

# **FEDERAL STANDARD 1037B**

03 June 1991

Superseding FEDERAL STANDARD 1037A, 26 June 1986

## **TELECOMMUNICATIONS: GLOSSARY OF TELECOMMUNICATION TERMS**

**Prepared By**

**National Communications System  
Office of Technology and Standards**

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**General Services Administration  
Office of Information Resources Management**

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## FOREWORD

This standard is issued by the General Services Administration pursuant to the Federal Property and Administrative Services Act of 1949, as amended.

This document provides Federal departments and agencies a comprehensive source of definitions of terms used in telecommunications and directly related fields by international, national, and U.S. Government telecommunications specialists.

The Paperwork Reduction Reauthorization Act of 1986, Public Law 99-500 [44 U.S.C. 3502(13)] expanded the definition of "automatic data processing equipment (ADPE)" to include, . . . any equipment or interconnected systems or subsystems of equipment that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information." This expansion in the scope of ADPE is implemented in the Federal Information Resources Management Regulation (FIRM), 41 CFR. To minimize confusion between the statutory definition of ADPE and the popular meaning of that term, GSA has established the term "Federal information processing (FIP) resources" to replace the term ADPE, as defined in Public Law 99-500. The new definitions of "FIP resources" are incorporated by reference to the FIRM.

The existence of multiple definitions for the same term in this standard reflects, in most instances, differences in meaning commonly assigned to these terms by practitioners in telecommunications and other, related disciplines. In some instances, however, the differences are not the result of interdisciplinary distinctions, but rather reflect variances in American and international usage or a need for further work in the various Government, national, and international standards-development groups to reach agreement on a common definition, or as a result of legislation. Source citations for some definitions (see the *Legends*) reflect the tracking of specialized glossaries for consistency.

The use of this standard by all Federal departments and agencies is *mandatory*.

Neither this nor any other glossary covering terms in a high-technology field such as telecommunications can be considered as complete and ageless. Periodic revisions will be made as required. The recommendations of Federal departments and agencies on improving the content or relevance of this document should be forwarded to the Office of the Manager, National Communications System, whose address is given in Section 5 of this standard.

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## Telecommunications: GLOSSARY OF TELECOMMUNICATION TERMS

1. **SCOPE.** The terms and accompanying definitions contained in this standard are drawn from authoritative non-Government sources such as the International Telecommunication Union, the International Organization for Standardization, the Telecommunications Industry Association, and the American National Standards Institute, as well as from numerous authoritative U.S. Government publications. The FTSC working group has rewritten many definitions as deemed necessary either to reflect technology advances or to make definitions which were phrased in specialized terminology more understandable to a broader audience.

1.1. **Applicability.** This standard incorporates and supersedes FED-STD-1037A, June 1986. Accordingly, all Federal departments and agencies shall use it as the authoritative source of definitions for terms used in the preparation of all telecommunications documentation. The use of this standard by all Federal departments and agencies is *mandatory*.

1.2. **Purpose.** The purpose of this standard is to improve the Federal acquisition process by providing Federal departments and agencies a comprehensive, authoritative source of definitions of terms used in telecommunications and directly related disciplines by national, international, and U.S. Government telecommunications specialists.

2. **REQUIREMENTS AND APPLICABLE DOCUMENTS.** The terms and definitions that constitute this standard, and that are to be applied to the applications cited in paragraph 3 below, are contained on page 1 through the end of this document. There are no other documents applicable to implementation of this standard. A list of acronyms and abbreviations follows the terms and definitions for the letter "Z".

### 3. **USE.**

a. All Federal departments and agencies shall use the terms and definitions contained herein. Only after determining that a term or definition is not included in this document may other sources be used. The *Legend* table on page xi is provided to assist users in determining the documentary source of the definitions where multiple definitions are included for a single term.

b. All terms are listed alphabetically. Terms containing numerals are alphabetized as though the numbers were spelled out; thus, "F1A-line weighting" will appear in the "F" portion of the alphabet between the terms "FOC" and "footprint," since it is pronounced "F-one- . . ." and "144-line weighting" will appear in the "O" portion of the alphabet, alphabetized as "one-forty-four line. . . ." For user convenience, exceptions to the rule are taken for entries comprising numerically sequential terms, e.g., "digital signal 0," . . . "digital signal 4," which are grouped numerically following the "digital signal" entry.

c. An abbreviation for the term name often appears in parentheses following the term name. In some cases, this abbreviation is properly an acronym, and is thus labeled. [As a general rule of thumb, an acronym is an abbreviation that constitutes a word that can be (or usually is) pronounced.] The list of abbreviations and acronyms appears at the end of this glossary.

d. Terms with more than one definition have numbered definitions. Generally, definition number "1" contains the most frequently used meaning of the term. Notes and cross-references are

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placed with the appropriate definition(s). Three types of cross-references are used: "*Synonym*," "*See*," and "*See also*":

(1) When terms are synonymous, the definition is placed under only one of the term names, generally the preferred name. Synonyms are listed for cross-reference purposes only. The other term name entries contain only a "*Synonym*" listing (and other cross-references, where appropriate); i.e., the definition for synonymous term names is not repeated. Terms labeled "*Colloquial synonym*" are in occasional informal use, but typically are semantically inexact, causing confusion, or may border on slang.

(2) "*See*" is used where an undefined term name is entered as a cross-reference only to direct the reader to a related term (or terms) that is (are) defined in the glossary.

(3) The "*See also*" cross-reference is used to identify term names that are related or contrasted, to amplify the reader's understanding of a family of terms.

e. Term names that are semantically incorrect, that have been replaced by recent advances in technology, and that have definitions that are no longer applicable, are designated as "*deprecated*." Reference is made to new terms or to new definitions, where applicable.

f. The telecommunications terms included in this glossary either are not sufficiently defined in a standard desk dictionary or are restated for clarity and convenience. Likewise, combinations of such words are included in this glossary where the usual desk-dictionary definitions, when used in combination, are either insufficient or vague.

4. **EFFECTIVE DATE.** The use of this approved standard by U.S. Government departments and agencies is mandatory, effective 180 days following the date of this standard.

5. **CHANGES.** When a Federal agency considers that this standard does not provide for its essential needs, a statement citing specific requirements shall be sent in duplicate to the General Services Administration, Policy and Regulation Division (KMP), Washington, DC 20405, in accordance with the provisions of the Federal Property Management Regulation 41 CFR 201-20.303. The General Services Administration will determine the appropriate action to be taken and will notify the agency.

Federal departments and agencies are encouraged to submit updates and corrections to this standard, which will be considered for the next revision of this standard. The General Services Administration has delegated the compilation of suggested changes to the National Communications System whose address is given below.

#### Preparing Activity:

Office of the Manager, National Communications System  
Office of Technology and Standards  
Washington, DC 20305-2010

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FED-STD-1037B was developed by a subcommittee of the Federal Telecommunication Standards Committee, the Working Group on FED-STD-1037A Revision. The U.S. Department of Commerce, National Telecommunications and Information Administration, Institute for Telecommunication Sciences (NTIA/ITS), 325 Broadway, Boulder, Colorado 80303-3328, supplied the chair and secretariat, technical, and editorial services for the subcommittee. The work of the subcommittee was reviewed by the National Communications Member Organizations, the Federal Telecommunication Standards Committee members, and representatives from the general public, industry, and other Federal agencies. The following Federal Agencies and Departments constituted the subcommittee.

Defense Communications Agency/Defense Communications Engineering Center  
Federal Aviation Administration Technical Center/ACD-350  
Joint Tactical Command, Control, and Communications Agency/ADW-S  
National Aeronautics and Space Administration/Headquarters Technology and Standards  
Naval Sea Systems Command/56ZC  
U.S. Air Force, Scott Air Force Base/1842 EEG/EEMST  
National Security Agency, Fort Meade  
U.S. Department of Agriculture/OIRM  
U.S. Department of Commerce/NTIA/Annapolis  
U.S. Department of Commerce/NTIA/ITS  
U.S. Department of Commerce/TMD  
U.S. Department of Interior/OIRM  
U.S. Department of Justice/JTS

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This document is available from the General Services Administration (GSA), acting as agent for the Superintendent of Documents. A copy for bidding and contracting purposes is available from GSA Business Centers. Copies are for sale at the GSA Specification Section, Room 6654, 7th and D Streets, S.W., Washington, D.C. 20407; telephone (202) 472-2205. Please call in advance for pickup service.

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**LEGEND (for labels appended to definitions)****LEGEND****MEANING**

(188)	Terms and definitions in direct support of the MIL-STD-188 series of standards and their associated military handbooks.
(JCS1-DOD)	Terms and definitions extracted verbatim from Joint Chiefs of Staff Publication No. 1-02 (1989), <i>Department of Defense Dictionary of Military and Associated Terms</i> , and established for use by all DoD Components, which will use the terms and definitions so designated without alteration unless a distinctly different context or application is intended.
(JCS1-NATO)	Terms and definitions extracted verbatim from Joint Chiefs of Staff Publication No. 1-02 (1989), and established for use by the member nations of the North Atlantic Treaty Organization.
(RR)	Terms and definitions extracted verbatim from the <i>International Radio Regulations</i> , Malaga-Torremolinos (Oct. 1984, rev. 1985).
(NTIA)	Terms and definitions extracted verbatim from the <i>NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management</i> (rev. Jan. 1989).
(FP)	Terms and definitions extracted verbatim from Federal Information Processing Standard Publication (FIPS PUB) 11-3 (when published), <i>American National Standard Dictionary for Information Systems</i> , which adopts ANSI X3N-1990 (with unchanged title).
(ISO)	FIPS PUB 11-3 terms and definitions adopted from the International Organization for Standardization.
(CFR-47)	Terms and definitions extracted verbatim from the <i>Code of Federal Regulations, Sec. 47, Telecommunications</i> (rev. Oct. 1, 1987, Oct. 1, 1988).

*Note 1:* Appreciation is proffered to the Telecommunications Industry Association for permission to include terms and definitions from ANSI/EIA/TIA-440A, *Fiber Optics Terminology* (1988). These entries are not source-cited herein because of extensive editorial rewriting by the FTSC working group in the interest of making the specialized terminology more understandable to a broad audience.

*Note 2:* The glossaries and dictionaries cited above contain more specialized terms and definitions than are appropriate for inclusion in this standard. The reader who is concerned with in-depth knowledge of such disciplines is directed to those documents.

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**a** Abbreviation for atto ( $10^{-18}$ ).  
See metric system.



**abandoned call** A call in which the caller disconnects or cancels the call after a connection has been made, but before the call is established. See also access phase, call, call processing, clearing, disconnect.

**abbreviated dialing** A service feature permitting the user to dial fewer digits to establish a call than are required under the nominal numbering plan. See also repertory dialer, service feature, speed calling.

**abort** 1. In data transmission, a function invoked by a primary or secondary sending station causing the recipient to discard (and ignore) all bit sequences transmitted by the sender since the preceding flag sequence. 2. To terminate, in a controlled manner, a processing activity in a computer system because it is impossible or undesirable for the activity to proceed. (FP) (ISO) See also disengagement attempt, flag sequence, lost call, unsuccessful call.

**absolute delay** The time interval or phase difference between transmission and reception of a signal. (188) See also delay distortion, delay equalizer, delay line, phase delay.

**absolute gain** 1. Of an antenna, for a given direction: the ratio, usually expressed in decibels, of the power that would be required at the input of an ideal isotropic radiator to the power actually supplied to the given antenna so that the radiation intensity in the far-field region in the given direction would be the same. If no direction is quoted, that corresponding to maximum radiation is assumed. (188) *Synonym* isotropic gain. 2. The ratio, usually expressed in decibels, between the signal level at the output of a device and its input under specified operating conditions; e.g., no-load gain, full-load gain, small-signal gain. (188) See also antenna, gain, level, loss.

**absolute temperature scale** See Kelvin temperature scale.

**absorption** In the transmission of electromagnetic or acoustic signals, the conversion of transmitted energy into heat or other forms of energy. (188) *Note 1:* Signal attenuation is a consequence of absorption. *Note 2:* In an optical fiber, intrinsic components of absorption consist of tails of ultraviolet and infrared bands. Extrinsic components include impurities and defects. See also absorption modulation, attenuation, ionospheric absorption, precipitation attenuation.

**absorption coefficient** The coefficient,  $b$ , in the exponent of the absorption equation that expresses Bouguer's law,  $F = F_0 \exp(-bx)$  where  $F$  is the electromagnetic field strength at the point  $x$  and  $F_0$  is the initial value of the field strength at  $x = 0$ .

**absorption index** 1. The ratio,  $K'$  of the electromagnetic radiation absorption constant to the refractive index given by  $K' = (K\lambda)/(4\pi n)$ , where  $K$  is the absorption coefficient,  $\lambda$  is the wavelength in vacuum, and  $n$  is the refractive index of the absorptive material. (188) 2. The functional relationship between the sun's angle (at any latitude and local time) and the ionospheric absorption. (188) See also radiation scattering, refractive index.

**absorption loss** The loss of power in a transmission circuit that results from the coupling to a neighboring circuit. See also adjacent channel interference.

**absorption modulation** Amplitude modulation of the output of a radio transmitter by means of a variable-impedance circuit that is caused to absorb carrier power in accordance with the modulating wave. See also absorption, amplitude modulation, carrier (crr), modulation.

**accept** In data transmission, the condition assumed by a primary or secondary station upon correct receipt of a frame for processing. See also acknowledge character, frame, primary station, secondary station.

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**acceptance** The condition that exists when a facility or system generally meets technical performance standards and security requirements.

**acceptance angle** In fiber optics, half the vertex angle of that cone within which optical power may be coupled into bound modes of an optical fiber. *Note:* Power may be coupled into leaky modes at angles exceeding the acceptance angle. (188) *See also* acceptance cone, bound mode, launch angle, launch numerical aperture, numerical aperture.

**acceptance cone** In fiber optics, that cone within which optical power may be coupled into the bound modes of an optical fiber. The acceptance cone is derived by rotating the acceptance angle (the maximum angle within which light will be coupled into a bound mode) about the fiber axis. (188) *See also* acceptance angle, bound mode, coupling, fiber optics, numerical aperture.

**acceptance pattern** 1. For an antenna, a distribution plot of the off-axis power relative to the on-axis power as a function of angle or position. (188) *Note:* This produces the equivalent of a horizontal antenna pattern. *See also* antenna lobe, directive gain, directivity pattern. 2. For an optical fiber or fiber bundle, a curve of total transmitted power plotted against the launch angle. *See also* acceptance cone.

**acceptance test** 1. A test of a system or functional unit, usually performed by the user on the user's premises after installation, with the participation of the vendor to ensure that the contractual requirements are met. (FP) (ISO) 2. Operating and testing of a communication system, subsystem, or component, to ensure that the specified performance characteristics have been met. (188) *See also* performance parameter, quality assurance, reliability, test and validation.

**acceptance trial** A trial carried out by nominated representatives of the eventual military users of the weapon or equipment to

determine if the specified performance and characteristics have been met. (JCS1-NATO)

**accepted interference** Interference at a higher level than that defined as permissible interference and which has been agreed upon between two or more administrations without prejudice to other administrations. (RR) *See also* interference, permissible interference.

**access** 1. The ability and means necessary to store data, retrieve data, or communicate with a system. (188) 2. To obtain the use of a resource. (FP) 3. In COMSEC, the capability and opportunity to gain detailed knowledge to alter information or material through authorized physical possession. *See also* attendant access loop, carrier sense multiple access, controlled access, direct access, disengagement attempt, dual access, dual-use access line, failure access, frequency-division multiple access, maximum access time, medium access control sublayer, multiple access, multiple homing, remote access, restricted access, serial access, service access point, special grade access line, time-division multiple access.

**access attempt** The process by which one or more users interact with a telecommunication system, to enable initiation of user information transfer. *Note:* An access attempt begins with an issuance of an access request by an access originator. An access attempt ends either in successful access or in access failure. *See also* abandoned call, access request, access time, called-party camp-on, calling-party camp-on, interface.

**access category** A class to which a user, program, or process in an automated information system may be assigned, based on the resources or groups of resources each user is authorized to use. *See also* classmark, user.

**access charge** A surcharge levied per the *Code of Federal Regulations*, Title 47, part 69, on each line or circuit that has the ability to access or be accessed by a public exchange network. *See also* tariff.

**access code** The preliminary digits that a user must dial to be connected to a particular outgoing trunk group or line. (188) *See also* code, NXX code.

**access contention** In ISDN applications, *synonymous with "contention."* *See* contention (def. #2).

**access control** 1. A technique used to define or restrict the rights of individuals or application programs to obtain data from, or place data onto, a storage device. (FP) 2. A service feature or technique used to permit or deny use of the components of a communication system. *See also* authenticate, classmark, controlled access, restricted access, service feature.

**access coupler** In fiber optics, a device placed between two fiber ends to allow signals to be extracted from, or injected into, one of the fibers. *See also* optical fiber coupler.

**access line** A transmission path between user terminal equipment and a switching center. *See also* line, local exchange loop, loop.

**access node** In packet switching, the switching concentration point for the transaction of a subscriber's traffic to and from a network backbone system. *Note:* Protocol conversion may occur at this point of entry. *See also* node.

**access originator** The functional entity responsible for initiating a particular access attempt. *Note:* An access attempt can be initiated by a source user, a destination user, or the telecommunication system. *See also* originating user, source user, user.

**access phase** In an information-transfer transaction, the phase during which an individual access attempt is made. *Note:* The access phase is the first phase of an information-transfer transaction. *See also* access request, disengagement phase, information-transfer phase, information-transfer transaction, phase (def. #2), successful disengagement.

**access point** 1. A class of junction points in a dedicated outside plant. They are semipermanent splice points at a junction between a branch feeder cable and distribution cables; points at which connections may be made for testing or using particular communication circuits. (188) 2. The point at which a user interfaces with a circuit or network. *See also* connection, demarcation point, outside plant, point of presence.

**access request** A control message issued by an access originator for the purpose of initiating an access attempt. *See also* access attempt, access phase.

**access time** 1. In a telecommunication system, the elapsed time between the start of an access attempt and successful access. *Note:* Access time values are measured only on access attempts that result in successful access. 2. In a computer, the time interval between the instant at which an instruction control unit initiates a call for data and the instant at which delivery of the data is completed. (188) 3. The time interval between the instant at which storage of data is requested and the instant at which storage is started. (188) 4. In magnetic disk devices, the time for the access arm to reach the desired track and the delay for the rotation of the disk to bring the required sector under the read-write mechanism. *See also* access attempt, call set-up time, maximum access time.

**accumulator** 1. A register in which one operand can be stored and subsequently replaced by the result of the store operation. (FP) (ISO) 2. A storage register. (188) 3. A storage battery. (188) *See also* buffer, register.

**accuracy** The degree of conformity of a measured or calculated value to its actual or specified value. *See also* precision.

**ACD** *Abbreviation for automatic call distributor.*

**ac-dc ringing** A type of telephone ringing that makes use of both ac and dc components--alternating current to operate a ringer and direct current to aid the relay action that stops

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the ringing when the called telephone is answered. *See also* ringdown.

**ACK** *Abbreviation for acknowledge character.*

**acknowledge character (ACK)** A transmission control character transmitted by the receiving station as an affirmative response to the sending station. (After FP) *Note:* An acknowledge character may also be used as an accuracy control character. *See also* accept, compelled signaling, control character, delivery confirmation, negative acknowledge character.

**acknowledgement** 1. A protocol data unit, or element thereof, between peer entities to indicate the status of data units that have been previously received. 2. A message from the addressee informing the originator that his communication has been received and understood. (JCSI-DoD) (JCSI-NATO)

**A-condition** For a start-stop teletypewriter system, *synonym* start signal.

**acoustic coupler** 1. A device for coupling electrical signals, by acoustical means, usually into and out of a telephone instrument. (188) 2. A terminal device used to link data terminals and radio sets with the telephone network. *Note:* The link is achieved through acoustic (sound) signals rather than through direct electrical connection. *See also* coupling, modem.

**acoustic noise** An undesired audible disturbance in the audio frequency range. (188) *See also* ambient noise level, interference, noise.

**acousto-optic effect** A variation of the refractive index of a material caused by acoustic energy, such as a wave or pulse. (188) *Note:* The acousto-optic effect is used in devices that modulate and deflect light. *See also* modulation.

**acousto-optics** The discipline involving the interactions between acoustic waves and light in a solid medium. (188) *Note:* Acoustic waves can be made to modulate, deflect, and focus light waves by causing a variation in the

refractive index of the medium. *See also* fiber optics.

**acquisition** 1. In satellite communications, the process of locking tracking equipment on a signal from a communications satellite. (188) 2. The process of achieving synchronization. 3. In servo systems, the process of entering the boundary conditions that will allow the loop to capture the signal and achieve lock-on. (188) *See also* phase-locked loop.

**acquisition time** 1. In a communication system, the amount of time required to attain synchronism. *See also* synchronization. 2. In satellite control communications, the time required for locking tracking equipment on a signal from a communications satellite. (188) *See also* satellite.

**active laser medium** The material within a laser, such as crystal, gas, glass, liquid, or semiconductor, that emits coherent radiation (or exhibits gain) as the result of stimulated electronic or molecular transitions to lower energy states. *Synonym* laser medium. *See also* laser, optical cavity.

**active network** A network that requires a source of power. *See also* network, passive network.

**active satellite** A satellite carrying a station intended to transmit or retransmit radiocommunication signals. (RR) (188) *See also* communications satellite, satellite.

**active sensor** 1. A measuring instrument that generates a signal, transmits it to a target, and receives a reflected signal from the target. *Note:* Information concerning the target is obtained by comparison of the received signal with the transmitted signal. 2. A measuring instrument in the Earth exploration-satellite service or in the space research service by means of which information is obtained by transmission and reception of radio waves. (RR) 3. A sensor that requires input energy from a source other than from that which is being sensed. *See also* passive sensor, sensor.

**activity factor** For a communication channel, the percentage of time during the busy hour that a signal is present in the channel in either direction. (188) *See also* channel, erlang, station message-detail recording.

**ACU** *Abbreviation for automatic calling unit.*

**A-D** *Abbreviation for analog-to-digital. See analog transmission.*

**Ada®** The official, high-level computer language of DoD for embedded-computer, real-time applications as defined in MIL-STD-1815. *Note:* Ada® is a registered trademark of the U.S. Government (Ada Joint Program Office). *See also* compile, high-level language.

**adaptive channel allocation** A method of multiplexing wherein the information-handling capacities of channels are not predetermined but are assigned on demand. *See also* adaptive routing, channel, multiplexing, spill forward.

**adaptive communication** Any communication system, or portion thereof, that automatically uses feedback information obtained from the system itself or from the signals carried by the system to modify dynamically one or more of the system operational parameters to improve system performance or to resist degradation. (188) *Note:* The modification of a system parameter may be discrete, as in hard-switched diversity reception, or may be continuous, as in a predetection combining algorithm. *See also* communications.

**adaptive differential pulse-code modulation (ADPCM)** A form of differential pulse-code modulation in which the prediction algorithm is adaptive to the incoming signal. *See also* differential pulse-code modulation, modulation, signal.

**adaptive equalization** Equalization that is accomplished automatically while signals (user or test traffic) are being transmitted, in order to adapt to changing transmission path characteristics. (188)

**adaptive predictive coding (APC)** A narrowband analog-to-digital conversion technique employing a one-level or multilevel sampling system in which the value of the signal at each sample time is adaptively predicted to be a linear function of the past values of the quantized signals. *Note:* APC is related to linear predictive coding (LPC) in that both use adaptive predictors. However, APC uses fewer prediction coefficients, thus requiring a higher bit rate than LPC. *See also* code, level, linear predictive coding, signal.

**adaptive routing** Routing that is automatically adjusted to compensate for network changes such as traffic patterns, channel availability, or equipment failures. *Note:* The experience used for adaptation comes from the traffic being carried. *See also* adaptive channel allocation, alternate routing, automatic route selection, directionalization, dynamically adaptive routing, line load control, time-assignment speech interpolation.

**adaptive system** A system that has a means of monitoring its own performance and a means of varying its own parameters, by closed-loop action, to improve its performance. (188)

**ADC** *Abbreviation for analog-to-digital converter.*

**ADCCP** *Abbreviation for Advanced Data Communication Control Procedure.*

**added bit** A bit delivered to the intended destination user in addition to intended user information bits and delivered overhead bits. *Synonym* extra bit. *See also* binary digit, character-count and bit-count integrity, deleted bit.

**added block** Any block, or other delimited bit group, delivered to the intended destination user in addition to intended user information bits and delivered overhead bits. *Synonym* extra block. *See also* binary digit, block, deleted block.



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**adder** A device whose output data are a representation of the sum of the numbers represented by its input data. (FP) (ISO)

**adder-subtractor** A device that acts as an adder or subtracter depending upon the control signal received; the adder-subtractor may be constructed so as to yield a sum and a difference at the same time. (FP) (ISO)

**add mode** In addition and subtraction operations, a mode in which the decimal marker is placed at a predetermined location with respect to the last digit entered. (FP) (ISO)

**add-on conference** An available service feature that allows an additional party to be added to an established call without attendant assistance. *Note:* A common implementation provides a progressive method that allows a calling party or a called party to add at least one additional party. *See also* computer conferencing, conference call, service feature.

**address** 1. In communications, the coded representation of the source or destination of a message. (188) 2. In data processing, a character or group of characters that identifies a register, a particular part of storage, or some other data source or destination. (188) 3. To assign to a device or item of data a label to identify its location. (188) 4. The part of a selection signal that indicates the destination of a call. 5. To refer to a device or data item by its address. (FP) (ISO) *See also* area code, en-bloc signaling.

**addressability** 1. In computer graphics, the number of addressable points on a display surface or in storage. (FP) (ISO) 2. In micrographics, the number of addressable points, within a specified film frame, written as follows: the number of addressable horizontal points by the number of addressable vertical points, for example, 3000 by 4000. (After FP)

**addressable point** In computer graphics, any point of a device that can be addressed. (FP) (ISO)

**address field** The portion of a message header that contains the destination address for the signal and the source of the signal. *Note:* In a communication network, the generally transmitted signal format contains a header, the data, and a trailer. *See also* data transmission, header, signal.

**address message sequencing** In common-channel signaling, a procedure for ensuring that addressed messages are processed in the correct order when the order in which they are received is incorrect. *See also* queue, routing indicator.

**address part** A part of an instruction that usually contains only an address or part of an address. (FP) (ISO) *See also* address.

**address pattern** A prescribed structure of data used to represent the destination(s) of a block, message, packet, or other formalized data structure. *See also* address, frame synchronization pattern.

**address separator** The character that separates the different addresses in a selection signal. *See also* character.

**ADH** *Abbreviation for automatic data handling.*

**adjacent-channel interference** Extraneous power from a signal in an adjacent channel. *Note:* Adjacent channel interference implies a specific condition caused by inadequate filtering (e.g., of unwanted modulation products in FM communication), tuning, or frequency control, in either the reference channel or the interfering channel, or both, as distinguished from crosstalk (def. #1), which results from undesired capacitive, inductive, or conductive coupling. (188) *See also* channel, co-channel interference, interference.

**adjunct service point (ASP)** An intelligent-network feature that resides at the intelligent peripheral equipment and responds to service logic interpreter requests for service processing. *See also* intelligent network.

**administration** 1. Any governmental department or service responsible for discharging the obligations undertaken in the convention of the International Telecommunication Union and the Regulations. (RR) 2. The management and execution of all military matters not included in tactics and strategy; primarily in the fields of logistics and personnel management. (JCSI-NATO) 3. Internal management of units. (JCSI-DoD) (JCSI-NATO) 4. The management and execution of all military matters not included in strategy and tactics. (JCSI-DoD)

**ADP** *Abbreviation for automatic data processing.*

**ADPCM** *Abbreviation for adaptive differential pulse-code modulation.*

**ADPE** *Abbreviation for automatic data processing equipment.*

**ADP system** *Synonym computer system.*

**Advanced Data Communication Control Procedure (ADCCP)** A bit-oriented Data-Link-Layer protocol used to provide point-to-point and point-to-multipoint transmission of a data frame with error control. *Note:* ADCCP closely resembles HDLC and SDLC. *See also* binary synchronous communications, frame, high-level data link control, link, synchronous data link control.

**advanced intelligent network (AIN)** A proposed intelligent-network (IN) architecture that includes both IN/1+ and IN/2 concepts. *See also* intelligent network.

**advanced television (ATV)** A family of television systems that are improvements over distribution-quality television. The family includes extended-definition television (EDTV), high-definition television (HDTV), and improved definition television (IDTV). *See also* extended-definition television, high-definition television, improved definition television.

**AECS** *Abbreviation for Aeronautical Emergency Communications System. See Aeronautical Emergency Communications System Plan.*

**aerial cable** A communications cable designed for installation on, or suspension from, a pole or other overhead structure. (188) *See also* cable, direct-buried cable, outside plant, underground cable.

**aeronautical Earth station** An Earth station in the fixed-satellite service, or, in some cases, in the aeronautical mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the aeronautical mobile-satellite service. (RR) *See also* Earth station, fixed-satellite service.

**Aeronautical Emergency Communications System (AECS) Plan** The AECS Plan provides for the operation of aeronautical communications stations, on a voluntary, organized basis, to provide the President and the Federal Government, as well as heads of state and local governments, or their designated representatives, and the aeronautical industry with an expeditious means of communications during an emergency situation. (CFR 47)

**aeronautical fixed service** A radiocommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient, and economical operation of air transport. (RR) *See also* aeronautical radionavigation service, mobile service.

**aeronautical fixed station** A station in the aeronautical fixed service. (RR)

**aeronautical mobile-satellite service** A mobile-satellite service in which mobile Earth stations are located on board aircraft; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. (RR) *See also* mobile Earth station, mobile service.

**aeronautical mobile service** A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which

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survival craft stations may participate; emergency position-indicating radiobeacon stations may also participate in this service on designated distress and emergency frequencies. (RR) *See also* aeronautical station, aircraft station, mobile Earth station, mobile service.

**aeronautical radionavigation-satellite service** A radionavigation-satellite service in which Earth stations are located on board aircraft. (RR)

**aeronautical radionavigation service** A radionavigation service intended for the benefit and for the safe operation of aircraft. (RR)

**aeronautical station** A land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea. (RR) *See also* aeronautical mobile service, aircraft station.

**AF** *Abbreviation for audio frequency.*

**AFNOR** *Acronym for Association Française Normal.* France's national standards-setting organization. *Note:* AFNOR provides the Secretariat for ISO TC97/SC1, Information Technology Vocabulary, which includes computers, communications information processing, and office machines.

**AGC** *Abbreviation for automatic gain control.*

**AI** *Abbreviation for artificial intelligence.*

**AIM** *Acronym for amplitude intensity modulation.*

**AIN** *Abbreviation for advanced intelligent network.*

**AIOD** *Abbreviation for automatic identified outward dialing.*

**AIOD leads** Terminal equipment leads used solely to transmit automatic identified outward dialing (AIOD) data from a PBX to the public switched telephone network or to switched service networks (e.g., EPSCS), so that a vendor can provide a detailed monthly bill identifying

long-distance usage by individual PBX stations, tie trunks, or the attendant. . . . (After CFR 47)

**airborne radio relay** 1. Airborne equipment used to relay radio transmission from selected originating transmitters. (JCS1-DoD) 2. A technique employing aircraft fitted with radio relay stations for the purpose of increasing the range, flexibility, or physical security of communications systems. (JCS1-NATO)

**air conditioning** In the DoD, synonym for the term "*environmental control*," which is the process of simultaneously controlling the temperature, relative humidity, air cleanliness, and air motion in a space to meet the requirements of the occupants, a process, or equipment. (188) *See also* critical areas.

**aircraft Earth station** A mobile Earth station in the aeronautical mobile-satellite service located on board an aircraft. (RR) *See also* mobile Earth station.

**aircraft station** A mobile station in the aeronautical mobile service, other than a survival craft station, located on board an aircraft. (RR) *See also* aeronautical mobile service, aeronautical station.

**air-ground radiotelephone service.** A public radio service between a base station and airborne mobile stations. (CFR 47)

**air portable** Denotes materiel that is suitable for transport by an aircraft loaded internally or externally, with no more than minor dismantling and reassembling within the capabilities of user units. This term must be qualified to show the extent of air portability. (JCS1-DoD) (JCS1-NATO)

**air sounding** Measuring atmospheric phenomena or determining atmospheric conditions, especially by means of apparatus carried by balloons, rockets, or satellites. *See also* ionosphere, virtual height.

**air terminal** The lightning rod or conductor placed on or above a building, structure, or external conductors for the purpose of



intercepting lightning. (188) *See also* facility grounding system, lightning down conductor, lightning protection subsystem.

**AIS** *Abbreviation for automated information system.*

**alarm center** A location that receives local and remote alarms. It is generally located within a technical control facility. (188)

**alarm indicator** A device that responds to a signal from an alarm sensor; e.g., a bell, lamp, horn, gong, buzzer, or a combination thereof.

**alarm sensor** 1. In communication systems, any device that can sense an abnormal condition within the system and provide, either locally or remotely, a signal indicating the presence of the abnormality. (188) *Note:* The signal may be in any desired form ranging from a simple contact closure (or opening) to a time-phased automatic shutdown and restart cycle. 2. In a physical security system, any of a group of approved devices used to indicate a change in the physical environment of a facility, or part thereof. (188) *Note:* Sensors may also be redundant or chained as when one sensor is used to protect the housing, cabling, or power of another. *See also* communications security, variation monitor.

**a-law** A non-North-American encoding methodology of sampling audio wave forms used in a 2048-kbps, 30-channel PCM system.

**ALE** *Abbreviation for automatic link establishment.*

**algorithm** A finite set of well-defined rules for the solution of a problem in a finite number of steps, for example, a complete specification of a sequence of arithmetic operations for evaluating  $\sin x$  to a given precision. (FP) (ISO)

**algorithmic language** An artificial language established for expressing a given class of algorithms. (FP) (ISO)

**aligned bundle** A bundle of optical fibers in which the relative spatial coordinates of each fiber are the same at the two ends of the bundle. (188) *Note:* Such a bundle may be used for the transmission of images. *Synonym* coherent bundle. *See also* fiber bundle, fiber optics.

**Allan variance** One half of the time average over the sum of the squares of the differences between successive readings of the frequency deviation sampled over the sampling period. *Note:* The Allan variance is conventionally expressed by  $\sigma_y^2(\tau)$ . The samples are taken with no dead-time between them. *Synonym* two-sample variance.

**allocation [of a frequency band]** Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned. (RR) (188) *See also* adaptive channel allocation, assigned frequency, authorized frequency, frequency.

**allotment [of a radio frequency or radio frequency channel]** Entry of a designated frequency channel in an agreed plan, adopted by a component conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions. (RR) *See also* adaptive channel allocation, assigned frequency, authorized frequency, assigned frequency band.

**all trunks busy (ATB)** An equipment condition in which all trunks (paths) in a given trunk group are busy. *Note:* All-trunks-busy registers do not indicate subsequent attempts to reach trunk groups. *See also* busy hour, erlang.

**alphabet** 1. An ordered set of all the letters used in a language, including letters with diacritical signs where appropriate, but not including punctuation marks. (FP) (ISO) 2. An ordered

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set of symbols used in a language; e.g., the Morse Code alphabet, the 128 ASCII (IA No. 5) characters. (188) *Note:* This definition includes punctuation marks, numeric digits, nonprinting control characters, and other symbols. *See also* alphanumeric, ASCII, character, character set, code, coded set, digit, digital alphabet, EBCDIC, language.

**alphabetic character set** A character set that contains letters and may contain control characters, special characters, and the space character, but not digits. (FP) (ISO)

**alphabetic code** A code according to which data are represented through the use of an alphabetic character set. (FP) (ISO)

**alphabetic string** 1. A string consisting solely of letters from the same alphabet. (FP) (ISO) 2. A character string consisting solely of letters and associated special characters from the same alphabet. (FP)

**alphabetic word** 1. A word consisting solely of letters from the same alphabet. (FP) (ISO) 2. A word that consists of letters and associated special characters, but not digits. (FP) *See also* word.

**alphabet translation** *See* alphabet transliteration.

**alphabet transliteration** That process whereby the characters in one alphabet are converted to characters in a different alphabet. (188) *See also* code, language.

**alphanumeric** 1. Pertaining to a character set that contains letters, digits, and, sometimes, other characters such as punctuation marks. (188) 2. A character set with unique bit configurations that comprise letters of the alphabet, digits of the decimal system, punctuation symbols, and sometimes special character symbols used in grammar, business, and science. *See also* alphabet (def. #2), character set, code, language.

**alphanumeric character set** A character set that contains both letters and digits, special characters, and the space character. (FP) (ISO)

**alphanumeric code** A code whose application results in a code set whose elements are taken from an alphanumeric character set. (FP) (ISO)

**alphanumeric data** Data represented by letters, digits, and sometimes by special characters and the space character. (FP) (ISO)

**alpha profile** *See* power-law index profile.

**alternate mark inversion (AMI) signal** A pseudoternary signal, representing binary digits, in which successive "marks" are of alternate polarity (positive and negative) but normally equal in amplitude and in which "spaces" are of zero amplitude. *See also* AMI violation, bipolar signal, modified AMI, paired disparity code, return-to-zero code.

**alternative** *Synonym* variant.

**alternate routing** The routing of a call or message over a substitute route when a primary route is unavailable for immediate use. (188) *See also* adaptive routing, call, dispersion (def. #1), dual access, dual homing, heuristic routing, multiple access, multiple homing, routing.

**altitude of the apogee or of the perigee** The altitude of the apogee or perigee above a specified reference surface serving to represent the surface of the Earth. (RR) *See also* apogee, perigee.

**ALU** *Abbreviation for* arithmetic and logic unit.

**AM** *Abbreviation for* amplitude modulation.

**AMA** *Abbreviation for* automatic message accounting.

**amateur-satellite service** A radiocommunication service using space stations on Earth satellites for the same purposes as those of the amateur service. (RR)

**amateur service** A radiocommunication service for the purpose of self-training, intercommunication and technical investigation carried out by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interests. (RR)

**amateur station** A station in the amateur service. (RR)

**ambient noise level** The level of acoustic noise existing in a room or other location, as measured with a sound level meter. *Note:* It is usually measured in decibels above a reference pressure level of 0.00002 pascal in SI units, or 0.0002 dyne per square centimeter in cgs units. (188) *Synonym* room noise level. *See also* acoustic noise, background noise, level, noise.

**AME** *Abbreviation for amplitude modulation equivalent. See compatible sideband transmission.*

**American National Standards Institute (ANSI)** The United States standards organization that establishes procedures for the development and coordination of voluntary American National Standards.

**American Standard Code for Information Interchange (ASCII)** *See* ASCII.

**AMI** *Abbreviation for alternate mark inversion. See alternate mark inversion signal.*

**AMI violation** A "mark" that has the same polarity as the previous "mark" in the transmission of alternate mark inversion (AMI) signals. *Note:* In some transmission protocols, AMI violations are deliberately introduced to aid synchronization or to signal a special event. *See also* alternate mark inversion signal, error, paired disparity code.

**amplitude distortion** Distortion occurring in a system, subsystem, or device when the output amplitude is not a linear function of the input amplitude under specified conditions. (188) *Note:* Amplitude distortion is measured with the system operating under steady-state

conditions with a sinusoidal input signal. When other frequencies are present, the term "amplitude" refers to that of the fundamental only. *See also* distortion, insertion-loss-vs.-frequency characteristic.

**amplitude equalizer** A corrective network that is designed to modify the amplitude characteristics of a circuit or system over a desired frequency range. (188) *Note:* Such devices may be fixed, manually adjustable, or automatic. *See also* amplitude-vs.-frequency distortion, equalization.

**amplitude frequency response** *Synonym* insertion-loss-vs.-frequency characteristic.

**amplitude hit** *See* hit (def. #1).

**amplitude intensity modulation (AIM)** *See* intensity modulation.

**amplitude keying** The process in which the magnitude of a signal is varied between a set of discrete values. (188) *See also* keying, modulation, signal.

**amplitude modulation (AM)** A form of modulation in which the amplitude of a carrier wave is varied in accordance with some characteristic of the modulating signal. (188) *Note:* Amplitude modulation implies the modulation of a coherent carrier wave by mixing it in a nonlinear device with the modulating signal, to produce discrete upper and lower sidebands, which are the sum and difference frequencies of the carrier and signal. The envelope of the resultant modulated wave is an analog of the modulating signal. The instantaneous value of the resultant modulated wave is the vector sum of the corresponding instantaneous values of the carrier wave, upper sideband, and lower sideband. Recovery of the modulating signal may be by direct detection or by heterodyning. *See also* absorption modulation, balanced modulator, carrier (cxr), intensity modulation, modulation, signal.

**amplitude modulation equivalent (AME)** *Synonym* compatible sideband transmission.

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**amplitude-vs.-frequency distortion** That distortion in a transmission system caused by the nonuniform attenuation, or gain, of the system with respect to frequency under specified operating conditions. (188) *Synonym* frequency distortion. *See also* amplitude equalizer, dispersion (def. #1), distortion, equalization, frequency, insertion-loss-vs.-frequency characteristic.

**AMPS** *Abbreviation for automatic message processing system.*

**AMTS** *Abbreviation for automated maritime telecommunications system.*

**analog computer** A device that performs operations on data that are represented, within the device, by continuous variables having some physical resemblance to the quantities being represented. *Note:* The earliest analog computers were purely mechanical devices with levers, cogs, cams, etc., representing the data or operator values. Modern analog computers typically employ electrical parameters such as voltage, resistance, or current to represent the quantities being manipulated. *See also* computer, digital computer.

**analog control** *Synonym* analog synchronization.

**analog data** Data represented by a physical quantity that is considered to be continuously variable and whose magnitude is made directly proportional to the data or to a suitable function of the data. (188) *See also* data, digital data.

**analog decoding** A process in which an analog signal is reconstructed from a digital signal that represents the original analog signal. (188) *See also* analog encoding, signal.

**analog encoding** Any process by which a digital signal or signals, that represent a sample or samples taken of an analog signal at a given instant or consecutive instants, are generated. (188) *See also* analog decoding, signal, uniform encoding.

**analog facsimile equipment** Facsimile equipment that employs analog techniques to encode the image detected by the scanner. The output signal is analog. *Note:* Examples of analog facsimile equipment are CCITT Group 1 and CCITT Group 2.

**analog signal** 1. A signal that makes use of electrical or physical analogies; i.e., varying voltages, frequencies, distances, etc., to produce a signal of a continuous (rather than of a pulsed or discrete) nature. (188) 2. A nominally continuous electrical signal that varies in some direct correlation to another signal impressed on a transducer. (188) *Note:* The electrical signal may vary its frequency, phase, or amplitude, for instance, in response to changes in phenomena or characteristics such as sound, light, heat, position, or pressure. *See also* digital signal, signal.

**analog synchronization** A synchronization control system in which the relationship between the actual phase error between clocks and the error signal device is a continuous function over a given range. *Synonym* analog control. *See also* synchronization.

**analog-to-digital (A-D) coder** *Synonym* analog-to-digital converter.

**analog-to-digital converter (ADC)** A device that converts an analog input signal to a digital output signal carrying equivalent information. (188) *Synonyms* analog-to-digital coder, analog-to-digital encoder, coder. *See also* digital-to-analog converter, digital voice transmission, digitizer.

**analog-to-digital (A-D) encoder** *Synonym* analog-to-digital converter.

**analog transmission** Transmission of a continuously varying signal as opposed to transmission of a discretely varying signal.

**angle modulation** Modulation in which the phase angle or frequency of a sine wave carrier is varied. (188) *See also* deviation ratio, digital phase modulation, frequency

**modulation, modulation, modulation index, phase deviation, phase modulation.**

**angle of deviation** In optics, the net angular deflection experienced by a light ray after one or more refractions or reflections. (188) *See also launch angle, reflection, refraction.*

**angle of incidence** The angle between an incident ray and the normal to a reflecting or refracting surface. (188) *See also critical angle, total internal reflection.*

**angstrom (Å)** A unit of length in optical measurement, where

- 1 Å =  $10^{-10}$  meters
- =  $10^{-4}$  micrometers
- =  $10^{-1}$  nanometers.

*Note:* The angstrom has been used historically in the field of optics, but it is not an SI (International System) unit.

**angular misalignment loss** In communications, the power loss caused by angular deviation from the optimum alignment of the axes of source to waveguide, waveguide to waveguide, or waveguide to detector. (188). *Note:* The waveguide may be an optical fiber. *See also coupling efficiency, extrinsic joint loss, gap loss, intrinsic joint loss, lateral offset loss.*

**ANI** *Abbreviation for automatic number identification.*

**anisochronous** Pertaining to transmission in which the time interval separating any two significant instants in sequential signals is not necessarily related to the time interval separating any other two significant instants. *Note:* Isochronous and anisochronous are characteristics, while synchronous and asynchronous are relationships. *See also heterochronous, homochronous, isochronous, mesochronous, plesiochronous.*

**anisochronous signal** A signal in which the interval separating two significant instants are not necessarily multiples of a unit interval. *Note:* Isochronous and anisochronous are characteristics, while synchronous and asynchronous are relationships. *See also*

*heterochronous, homochronous, isochronous, mesochronous, plesiochronous, signal.*

**anisochronous transmission** *See asynchronous transmission.*

**anisotropic** Pertaining to a material whose electrical or optical properties vary with the direction of propagation or with different polarizations of a traveling wave. *See also isotropic.*

**anomalous propagation (AP)** Abnormal propagation due to discontinuities in the propagation medium. *Note:* This results, in many instances, in the reception of signals well beyond the expected normal distance. (188) *See also ionosphere, propagation, sporadic E propagation.*

**ANSI** *Abbreviation for American National Standards Institute.*

**answer back** A signal or tone sent by a receiving equipment or data set to the sending station to indicate that it is ready to accept transmission, or acknowledging receipt of a transmission. *See also acknowledge character, call control signal.*

**answer signal** A supervisory signal, usually in the form of a closed loop, returned from the called telephone to the originating switch when the called party answers. *Note:* This signal stops the ringback signal from being returned to the caller. *See also call control signal, loop, signal.*

**antenna** Any structure or device used to collect or radiate electromagnetic waves. (188)

**antenna dissipative loss** A power loss resulting from changes in the measurable impedance of a practical antenna from a value theoretically calculated for a perfect antenna.

**antenna efficiency** In practical applications, the ratio of the total radiated power (total input power less antenna dissipative loss) to the total input power.



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**antenna electrical beam tilt** The shaping of the radiation pattern in the vertical plane of a transmitting antenna by electrical means so that maximum radiation occurs at an angle below the horizontal plane. (CFR 47)

**antenna gain** The ratio, usually expressed in decibels, of the power required at the input of a loss-free reference antenna to the power supplied to the input of the given antenna to produce, in a given direction, the same field strength, or the same irradiance, at the same distance. When not specified otherwise, the gain refers to the direction of maximum radiation. The gain may be considered for a specified polarization. Depending on the choice of the reference antenna, a distinction is made between:

--absolute or isotropic gain ( $G_i$ ), when the reference antenna is an isotropic antenna isolated in space;

--gain relative to a half-wave dipole ( $G_d$ ) when the reference antenna is a half-wave dipole isolated in space whose equatorial plane contains the given direction;

--gain relative to a short vertical antenna ( $G_r$ ), when the reference antenna is a linear conductor, much shorter than one quarter of the wavelength, normal to the surface of a perfectly conducting plane which contains the given direction. (After RR) (188) *Synonyms* gain of an antenna, power gain of an antenna. *See also* antenna, aperture-to-medium coupling loss, directive gain, Fraunhofer region, gain, mean power [of a radio transmitter].

**antenna gain-to-noise temperature ( $G/T$ )** A figure of merit, where  $G$  is the antenna gain in decibels at the receive frequency, and  $T$  is the equivalent noise temperature of the receiving system in kelvins. (188) *See also* antenna gain, noise.

**antenna height above average terrain** The average of antenna height above the terrain from 3.2 to 16 kilometers (2 to 10 miles) from the antenna for the eight cardinal radials. (188) *Note:* In general, a different antenna height will be determined for each direction from the antenna. The average of these various heights

is considered the antenna height above average terrain. (In some cases, fewer than eight directions may be used.) *See also* antenna.

**antenna lobe** A three-dimensional section of the radiation pattern of a directional antenna bounded by one or more cones of nulls (regions of diminished intensity). (188) *See also* fan-beam antenna, Fraunhofer region, main beam, main lobe, radiation pattern, side lobe.

**antenna matching** The process of adjusting impedance so that the input impedance of an antenna equals or approximates the characteristic impedance of its transmission line over a specified range of frequencies. (188) *Note:* The impedance of either the transmission line, or the antenna, or both, may be adjusted to effect the match. *See also* balun, impedance matching.

**antenna noise temperature** The temperature of a hypothetical passive resistor at the input of an ideal noise-free receiver that would generate the same output noise power per unit bandwidth as that at the antenna output at a specified frequency. (188) *Note:* Noise temperature of an antenna depends on its coupling to all noise sources in its environment as well as on noise generated within the antenna. *See also* noise.

**anti-interference** Pertaining to equipment, processes, or techniques used to reduce the effect of natural and man-made noise on radio communications.

**anti-jam** Pertaining to equipment, processes, or techniques used to reduce the effect of jamming on a desired signal. (188) *See also* electronic counter-counter measures, electronic warfare, frequency hopping, spread spectrum.

**anti-node** A point in a standing, i.e., stationary, wave at which the amplitude is a maximum, i.e., there is a crest. *Note:* The type of wave should be identified, such as a voltage wave or a current wave. *See also* node, standing wave ratio.

**antireflection coating** A thin, dielectric or metallic film (or several such films) applied to an optical surface to reduce its reflectance and thereby increase the transmittance. *Note:* The ideal value of the refractive index of a single-layer film is the square root of the product of the refractive indices on either side of the film, the ideal optical thickness being one quarter of a wavelength. *See also* dichroic filter, Fresnel reflection, reflectance, transmittance.

**anti-spoof** Measures to prevent an opponent's participation in a telecommunications network, or operation/control of a cryptographic or COMSEC system.

**AP** *Abbreviation for anomalous propagation.*

**APC** *Abbreviation for adaptive predictive coding.*

**APD** *Abbreviation for avalanche photodiode. Note: apd and a.p.d. are also used.*

**aperiodic antenna** An antenna designed to have an approximately constant input impedance over a wide range of frequencies; e.g., terminated rhombic antennas and wave antennas. *Synonym nonresonant antenna. See also antenna.*

**aperture** The portion of a plane surface near a directional antenna, normal to the direction of maximum radiation intensity, through which the major part of the radiation passes. (188) *See also* antenna, antenna gain, beamwidth.

**aperture distortion** In facsimile, the distortions in resolution, density, and shape of the recorded image caused by the shape and finite size of the scanning and recording apertures or spots. *See also* facsimile.

**aperture-to-medium coupling loss** The difference between the theoretical gain of a very large antenna (as used in beyond-the-horizon microwave links) and the gain that can be realized in operation. It is related to the ratio of the scatter angle to the antenna beamwidth. (188) *Note:* The "very large antennas" are referred to in wavelengths; thus,

this loss can apply to line-of-sight systems also. *See also* antenna, antenna gain, coupling, coupling loss, loss.

**apogee** The point on a satellite orbit that is most distant from the center of the gravitational field of the Earth. *See also* geostationary orbit, perigee, satellite.

**Application layer** *See* Open Systems Interconnection--Reference Model.

**applique** Circuit components added to an existing system to provide additional or alternate functions. (188) *Note:* Some carrier telephone equipment designed for ringdown manual operation can be modified with applique to allow for use between points having dial equipment. *See also* switching center.

**approved circuit** *Deprecated synonym for protected distribution system.*

**architecture** *See* telecommunication architecture.

**area code** *See* access code, code, country code, NXX code.

**argument 1.** An independent variable. (FP) (ISO)  
**2.** Any value of an independent variable: for example, a search key, or a number that identifies the location of a data item in a table. (FP) (ISO)

**arithmetic and logic unit (ALU)** A part of a computer that performs arithmetic, logic, and related operations. (FP) (ISO)

**arithmetic operation** An operation performed according to the rules of arithmetic.

**arithmetic overflow** *Synonym* overflow.

**arithmetic register** A register that holds the operands or the results of operations such as arithmetic operations, logic operations, and shifts. (FP)

**arithmetic shift** A shift, applied to the representation of a number in a fixed radix

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numeration system and in a fixed-point representation system, and in which only the characters representing the fixed-point part of the number are moved. An arithmetic shift is usually equivalent to multiplying the number by a positive or a negative integral power of the radix, except for the effect of any rounding; compare the logical shift with the arithmetic shift, especially in the case of floating-point representation. (FP) (ISO)

**arithmetic underflow** *Synonym* underflow.

**arithmetic unit** In a processor, the part that performs arithmetic operations; sometimes the unit performs both arithmetic and logic operations. (FP) (ISO)

**ARQ** *Abbreviation for automatic repeat-request.*

A system of error control for data transmission in which the receive terminal is arranged to detect a transmission error and automatically transmit a repeat-request (RQ) signal to the transmit terminal. The transmit terminal then retransmits the character, code block, or message until it is either correctly received or the error persists beyond a predetermined number of transmittals. (188) *Synonyms* error-detecting-and-feedback system, repeat-request system. *See also* block, block parity, character, cyclic redundancy check, echo check, error, error control, error correcting system.

**array** 1. An arrangement of elements in one or more dimensions. (FP) 2. In a programming language, an aggregate that consists of data objects with identical attributes, each of which may be uniquely referenced by subscription. (FP) (ISO)

**array processor** A processor capable of executing instructions in which the operands may be arrays rather than data elements. (FP) (ISO) *Synonym* vector processor.

**arrester** A device to protect an equipment, circuit, subsystem, or system from a voltage or current surge, such as may be produced by lightning or an electromagnetic pulse. (188)

*See also* air terminal, lightning down conductor, protector.

**ARS** *Abbreviation for automatic route selection.*

**artificial intelligence (AI)** The capability of a device to perform functions that are normally associated with human intelligence such as reasoning, learning, and self-improvement. (FP) *Note:* AI is the branch of computer science that attempts to approximate the results of human reasoning by organizing and manipulating factual and heuristic knowledge. Areas of AI activity include expert systems, natural language understanding, speech recognition, vision, and robotics.

**ARU** *Abbreviation for audio response unit.*

**ASCII** *Acronym for American Standard Code for Information Interchange.* The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), used for information interchange among data processing systems, data communications systems and associated equipment. (188) *Note:* The ASCII set consists of control characters and graphic characters, and is properly an alphabet and not a code. It is the U.S. implementation of International Alphabet No. 5 (IA No. 5) as specified in CCITT Recommendation V.3. *See also* alphabet, binary digit, bit pairing, code, data, EBCDIC.

**ASP** *Abbreviation for adjunct service point.*

**aspect ratio** In facsimile or television, the ratio of the width to the height of a picture, document, or scanning field. *See also* facsimile.

**assemble** To translate a computer program expressed in an assembly language into a machine language.

**assembler** A computer program that is used to assemble. (FP) (ISO) *Synonym* assembly program. *See also* compiler, translator.



**assembly** An item forming a portion of an equipment that can be provisioned and replaced as an entity and which normally incorporates replaceable parts or groups of parts. (JCS1-DoD) (JCS1-NATO) *See also* communications subsystem, component.

**assembly language** A computer-oriented language whose instructions are symbolic and usually in one-to-one correspondence with computer instructions and that may provide facilities such as the use of macro instructions. (FP) (ISO) (188) *Synonym* computer-dependent language. *See also* compile, computer language, computer-oriented language, high-level language, language, machine language.

**assembly phase** The logical subdivision of a run that includes the execution of an assembler. (FP) (ISO)

**assembly program** *Synonym* assembler.

**assembly time** The elapsed time taken for the execution of an assembler. (FP) (ISO) *See also* assembler, compiler.

**assigned frequency** 1. The center of the assigned frequency band assigned to a station. (RR) *See also* assigned frequency band. 2. The frequency of the center of the radiated bandwidth. (188) *Note:* The frequency of the rf carrier, whether suppressed or radiated, is usually given in parentheses following the assigned frequency, and is the frequency appearing in the dial settings of rf equipment intended for single sideband or independent sideband transmission. *See also* allocation [of a frequency band], authorized frequency, bandwidth, carrier (cxr), center frequency, frequency, frequency tolerance.

**assigned frequency band** The frequency band within which the emission of a station is authorized; the width of the band equals the necessary bandwidth plus twice the absolute value of the frequency tolerance. Where space stations are concerned, the assigned frequency band includes twice the maximum Doppler shift that may occur in relation to any point of

the Earth's surface. (RR) *See also* allocation [of a frequency band], allotment [of a radio frequency or radio frequency channel].

**assignment** [For NS/EP,] The designation of priority level(s). *See also* priority level.

**assignment [of a radio frequency or radio frequency channel]** Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions. (RR)

**associated common-channel signaling** A form of common-channel signaling in which the signaling channel is associated with a specific trunk group and terminates at the same pair of switches as the trunk group. (188) *Note:* The signal channel is usually transmitted by the same facilities as the trunk group. *See also* common-channel signaling, nonassociated common-channel signaling.

**associative storage** 1. A storage device whose storage locations are identified by their contents, or by a part of their contents, rather than by their names or positions. (FP) (ISO) *Synonym* content-addressable storage. 2. Storage that supplements another storage. (FP)

**asymmetrical modulator** *Synonym* unbalanced modulator.

**asynchronous communication system** A data communication system that employs asynchronous operation, such as a data communication system in which extra signal elements are appended to the data for the purpose of synchronizing individual data characters or blocks. (188) *Note:* The time spacing between successive data characters or blocks may be of arbitrary duration. *Synonym* start-stop system. *See also* asynchronous operation, block, character, communications.

**asynchronous network** *Synonym* nonsynchronous network.

**asynchronous operation** 1. A sequence of operations in which operations are executed out of time coincidence with any event. (188) 2.

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An operation that occurs without a regular or predictable time relationship to a specified event; e.g., the calling of an error diagnostic routine that may receive control at any time during the execution of a computer program. (FP) (ISO) (188) *Synonym* asynchronous working.

**asynchronous time-division multiplexing (ATDM)** Time-division multiplexing in which asynchronous transmission is used. *See also* multiplexing, synchronous TDM, time-division multiplexing.

**asynchronous transfer mode (ATM)** A data-transfer mode in which a multiplexing technique for fast packet switching in CCITT broadband ISDN is used. This technique inserts information in small, fixed-size cells (32-120 octets) that are multiplexed and switched in a slotted operation, based upon header content, over a virtual circuit established immediately upon a request for service.

**asynchronous transmission** Data transmission in which the instant that each character, or block of characters, starts is arbitrary; once started, the time of occurrence of each signal representing a bit within the character, or block, has the same relationship to significant instants of a fixed time frame. (188) *See also* block, character, intercharacter interval, isochronous, plesiochronous, synchronous transmission.

**asynchronous working** *Synonym* asynchronous operation.

**ATB** *Abbreviation for all trunks busy.*

**ATDM** *Abbreviation for asynchronous time-division multiplexing.*

**ATM** *Abbreviation for asynchronous transfer mode.*

**atmospheric duct** A layer in the lower atmosphere, occasionally of great horizontal extent, in which the vertical refractivity gradients are such that radio signals are guided

or focused within the duct and tend to follow the curvature of the earth with much less than normal attenuation. (188) *See also* ducting, hop, ionosphere, troposphere.

**atmospheric noise** Radio noise caused by natural atmospheric processes, primarily lightning discharges in thunderstorms. (188) *See also* interference, noise.

**atomic time** *See* International Atomic Time (TAI).

**attachment unit interface** In a local area network, the interface between the medium attachment unit and the data terminal equipment within a data station. (FP) (ISO)

**attack time** The time interval between the instant that a signal at the input of a device or circuit exceeds the activation threshold of the device or circuit, and the instant that the device or circuit reacts in a specified manner, or to a specified degree, to the input. *Note:* The term often implies a protective action such as that provided by a clipper (peak limiter) or compressor, but may be used to describe the action of a device such as a vox, where the action is not protective.

**attempt** *See* access attempt, disengagement attempt.

**attendant access loop** One of a group of switched circuits, which might be assigned to a specific telephone number, that provides a manual means for call completion and control. *See also* call, circuit, fixed loop, loop.

**attendant conference** A service feature that allows an attendant to establish a conference connection of three or more conferees. *See also* conference call, service feature.

**attendant position** Part of a switching system where an operator has the facilities to control or assist users in call completion and special services. (188) *See also* busy verification, call, switching center.

**attention signal** The attention signal to be used by AM, FM, and TV broadcast stations to actuate muted receivers for inter-station receipt of emergency cuing announcements and broadcasts involving a range of emergency contingencies posing a threat to the safety of life or property. (CFR 47)

**attenuation** Decrease in intensity of a signal, beam, or wave as a result of absorption of energy and of scattering out of the path of a detector, but not including the reduction due to geometric spreading; i.e., the inverse square of distance effect. (JCS1-DoD) (JCS1-NATO)  
*Note:* Attenuation is generally expressed in dB. However, "attenuation" is often used as a synonym for "attenuation coefficient," which is expressed in dB/km. *See also* absorption, attenuation coefficient, coupling loss, damping, differential mode attenuation, equilibrium mode power distribution, extrinsic joint loss, flat fading, insertion loss, intrinsic joint loss, leaky mode, macrobend loss, material scattering, microbend loss.

**attenuation coefficient** The rate of diminution of average power with respect to distance along a transmission path. *Synonym* attenuation rate. *See also* attenuation, attenuation constant, axial propagation constant.

**attenuation constant** For a particular propagation mode in an optical fiber, the real part of the axial propagation constant. *Note:* The attenuation coefficient for the mode power is twice the attenuation constant. *See also* attenuation coefficient, axial propagation constant, propagation constant.

**attenuation-limited operation** The condition prevailing when the received signal amplitude (rather than received-signal distortion) limits performance. (188) *See also* bandwidth-limited operation, dispersion-limited operation, distortion-limited operation, quantum-noise-limited operation.

**attenuation rate** *Synonym* attenuation coefficient.

**attenuator** 1. In electrical systems, a usually passive network for reducing the amplitude of a signal without appreciably distorting the waveform. *Note 1:* The term attenuator is normally reserved for such a network that is continuously or incrementally adjustable. An attenuator having a fixed value (fixed attenuator) is often called a pad, especially in telephony. *Note 2:* The impedances of the input and output ports of an attenuator (or pad) must normally be matched to the impedances of the signal source and load, respectively. 2. In optical systems, a passive device for reducing the amplitude of a signal without appreciably distorting the waveform.

**attribute** A property inherent in an entity or associated with that entity for database purposes. (FP)

**ATV** *Abbreviation for advanced television.*

**audible ringing tone** That tone received by the calling telephone indicating that the called telephone is being rung. *Synonym* ringback tone. *See also* ringback signal.

**audio frequency (AF)** The band of frequencies (approximately 30 hertz to 15 kilohertz) that can be heard by the normal human ear when transmitted as sound waves. (188) *See also* voice frequency.

**audio response unit (ARU)** A device that provides synthesized voice responses to dual-tone multifrequency signaling input. These devices process calls based on the caller's input, information received from a host data base, and information carried with the incoming call (e.g., time of day). *Note:* ARUs are used to increase the number of information calls handled and to provide consistent quality in information retrieval.

**audit** To conduct an independent review and examination of system records and activities in order to test the adequacy and effectiveness of data security and data integrity procedures, to ensure compliance with established policy and operational procedures, and to recommend any necessary changes. (FP)

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**audit review file** A file created by executing statements included in a program for the explicit purpose of providing data for auditing. (FP) (ISO)

**audit trail** 1. A record of both completed and attempted accesses and service. 2. Data in the form of a logical path linking a sequence of events, used to trace the transactions that have affected the contents of a record. (FP) (ISO) 3. A chronological record of system activities that is sufficient to enable the reconstruction, review, and examination of the sequence of environments and activities surrounding or leading to an operation, a procedure or an event in a transaction from its inception to final results. *Note:* Audit trail may apply to information in an automated information system, to the routing of messages in a communications system, or to material exchange transactions. *See also* automatic message accounting, call record, station message-detail recording, trace packet.

**authenticate** 1. To establish, usually by challenge and response, that a transmission attempt is authorized and valid. 2. To verify the identity of a user, device, or other entity in a computer system, or to verify the integrity of data that have been stored, transmitted, or otherwise exposed to possible unauthorized modification. 3. A challenge given by voice or electrical means to attest to the authenticity of a message or transmission. (JCSI-DoD) *See also* access control, fetch protection, password, recognition.

**authentication** 1. A security measure designed to protect a communications system against acceptance of a fraudulent transmission or simulation by establishing the validity of a transmission, message, or originator. (JCSI-DoD) 2. A means of identifying individuals and verifying their eligibility to receive specific categories of information. (JCSI-DoD) 3. Evidence by proper signature or seal that a document is genuine and official. (JCSI-DoD) (JCSI-NATO) 4. A security measure designed to protect a communication system against fraudulent transmissions. (JCSI-NATO) *See*

*also* authenticator, fetch protection, password, recognition.

**authenticator** 1. A symbol or group of symbols, or a series of bits, selected or derived in a prearranged manner and usually inserted at a predetermined point within a message or transmission for the purpose of attesting to the validity of the message or transmission. (JCSI-DoD) 2. A letter, numeral, or group of letters or numerals, or both attesting to the authenticity of a message or transmission. (JCSI-NATO)

**authorization** 1. The rights granted to a user to access, read, modify, insert, or delete certain data, or to execute certain programs. (FP) 2. The granting of access rights to a user, a program, or a process.

**authorized bandwidth** For the purposes of the *NTIA Manual*, the necessary bandwidth (bandwidth required for transmission and reception of intelligence); does not include allowance for transmitter drift or Doppler shift. (NTIA) *See also* bandwidth, necessary bandwidth.

**authorized frequency** A frequency that is allocated and assigned by a competent authority to a specific user for a specific purpose. (188) *See also* allocation [of a frequency band], assigned frequency, frequency, frequency assignment.

**authorized station** A station legitimately provided with all the current keys, procedures, and time information necessary to communicate with another station.

**AUTODIN** Acronym for automatic digital network.

**automated data medium** *Synonym* machine-readable medium.

**automated information system (AIS)** An assembly of computer hardware, software and/or firmware configured to communicate, compute, disseminate, process, store, and/or control data information.

**automated information systems security** Measures and controls that protect an automated information system against denial of service and unauthorized (accidental or intentional) disclosure, modification, or destruction of automated information systems and data. *Note:* Automated information systems security includes consideration of all hardware and/or software functions, characteristics and/or features; operational procedures, accountability procedures, and access controls at the central computer facility, remote computer, and terminal facilities; management constraints; physical structures and devices; and personnel and communications controls needed to provide an acceptable level of risk for the automated information system and for the data and information contained in the system. It includes the totality of security safeguards needed to provide an acceptable protection level for an automated information system and for data handled by an automated information system.

**automated maritime telecommunications system (AMTS)** An automatic, integrated and interconnected maritime communications system serving ship stations on specified inland and coastal waters of the United States. (CFR 47)

**automated radio** A radio with the capability for automatically controlled operation by electronic devices that requires little or no operator intervention.

**automated tactical command and control system** A command and control system or part thereof which manipulates the movement of information from source to user without intervention. *Note:* Automated execution of a decision without human intervention is not mandatory.

**automatic** Pertaining to a process or device that, under specified conditions, functions without intervention by a human operator. (FP) (ISO)

**automatic answering** A service feature in which the called terminal automatically responds to the calling signal and the call may be

established whether or not the called terminal is attended by a human operator. *See also* call, data terminal equipment, facility, service feature.

**automatic callback** A communications service feature that permits a user, when encountering a busy condition, to instruct the system to retain the called and calling numbers and to establish the call upon the availability of a clear circuit. *Note:* The feature may be implemented in the terminal, in the switching system, or shared between them. *Colloquial synonym* camp-on. *See also* automatic calling unit, call, card dialer, circuit, data terminal equipment, service feature.

**automatic call distributor (ACD)** A device that will distribute incoming calls to a specific group of terminals. *Note:* If the number of active calls is less than the number of terminals, the next call will be routed to the terminal that has been idle the longest time. If all terminals are busy, the incoming calls are held in a first-in first-out queue until a terminal becomes available. (188) *See also* call, proration.

**automatic calling** Calling in which the elements of the selection signal are entered into the data network contiguously at the full data signaling rate. The selection signal is generated by the data terminal equipment. *Note:* A limit may be imposed by the design criteria of the network to prevent more than a permitted number of unsuccessful call attempts to the same address within a specified period. (FP) (ISO)

**automatic calling unit (ACU)** A device that permits a computer or other business machine to originate calls automatically over the telecommunication network. *See also* automatic callback, call, card dialer.

**automatic data handling (ADH)** A generalization of automatic data processing to include the aspect of data transfer. (JCS1-DoD) (JCS1-NATO) *See also* data.

**automatic data processing (ADP)** 1. An interacting assembly of procedures, processes,



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methods, personnel, and equipment to perform automatically a series of data processing operations that result in a change in the semantic content of the data. (188) 2. Data processing by means of one or more devices that use common storage for all or part of a computer program, and also for all or part of the data necessary for execution of the program; that execute user-written or user-designated programs; that perform user-designated symbol manipulation, such as arithmetic operations, logic operations, or character-string manipulations; and that can execute programs that modify themselves during their execution. Automatic data processing may be performed by a stand-alone unit or by several connected units. (FP) 3. Data processing largely performed by automatic means. (JCSI-DoD) (JCSI-NATO) 4. That branch of science and technology concerned with methods and techniques relating to data processing largely performed by automatic means. (JCSI-DoD) (JCSI-NATO)

**automatic data processing equipment (ADPE)**  
... Any equipment or interconnected system or subsystems of equipment that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception, of data or information (i) by a Federal agency, or (ii) under a contract with a Federal agency which (I) requires the use of such equipment, or (II) requires the performance of a service or the furnishing of a product which is performed or produced making significant use of such equipment. Such term includes (i) computer, (ii) ancillary equipment, (iii) software, firmware, and similar procedures, (iv) services, including support services, and (v) related resources as defined by regulations issued by the Administrator for General Services. . . . (Public Law 99-500, Title VII, Sec. 822 (a) Section 111(a) of the *Federal Property and Administrative Services Act of 1949* (40 U.S.C. 759(a)) revised.) *See also paragraph #3 of the Foreword above.*

**automatic dialing** *See automatic calling unit.*

**Automatic Digital Network (AUTODIN)** A worldwide data communication network of the Defense Communications System. (188) *See also Automatic Secure Voice Communications Network, Automatic Voice Network, Federal Telecommunications System, Intercept tape storage.*

**automatic error correction** *See error-correcting code.*

**automatic exchange** A telephone system in which communication between users is effected by means of switches set in operation by the originating user's equipment without the aid of an attendant. *See also data switching exchange, exchange, switching center.*

**automatic function** A machine function or series of machine functions controlled by a program and carried out without assistance of an operator. (FP) (ISO)

**automatic gain control (AGC)** A process or means by which gain is automatically adjusted in a specified manner as a function of input level or another specified parameter. (188) *See also compressor, limiter circuit.*

**automatic identified outward dialing (AIOD)** A service feature of some switching or terminal devices to provide the user with an itemized statement of usage on directly dialed calls. *Note:* This capability is provided by automatic number identification (ANI) equipment installed in the exchange via a data link to the serving automatic message accounting (AMA)/ANI central exchange. *See also call, service feature.*

**automatic link establishment (ALE)** The capability of an HF radio station to make contact, or initiate a circuit, between itself and another specified radio station, without operator assistance and usually under processor control. *Note:* ALE techniques include automatic signaling, selective calling, and automatic handshaking. Other automatic techniques that are related to ALE are channel scanning and selection, link quality analysis (LQA), polling, sounding, message store and

forward, address protection, and anti-spoofing. *See also* controller.

**automatic message accounting (AMA)** A service feature that automatically records data of user-dialed calls. (188) *See also* audit trail, automatic number identification, call, call record, service feature.

**automatic message processing system (AMPS)** Any organized assembly of resources and methods used to collect, process, and distribute messages largely by automatic means. (JCS1-DoD)

**automatic number identification (ANI)** A service feature whereby the directory number or equipment number of a calling station is obtained automatically, for use in message accounting. *See also* automatic message accounting, call, service feature.

**automatic operation** The functioning of an apparatus, process, or system in a desired manner and at the proper time under control of mechanical or electronic devices that take the place of operators.

**automatic remote reprogramming and rekeying** The procedure by which distant equipment is reprogrammed or rekeyed electronically without specific actions by the receiving terminal.

**automatic repeat-request (ARQ)** *See* ARQ.

**automatic route selection (ARS)** Electronically or mechanically controlled selection and routing of outgoing calls without human intervention or assistance. *See also* adaptive routing, call, proration.

**Automatic Secure Voice Communications Network (AUTOSEVOCOM)** A worldwide, switched, secure voice network developed to fulfill DoD long-haul, secure voice requirements. (JCS1-DoD) (188) *See also* Automatic Digital Network, Automatic Voice Network, communications, Federal Telecommunications System.

**automatic sequential connection** A service feature provided by a data service to connect automatically, in a predetermined sequence, the terminals at each of a set of specified addresses to a single terminal at a specified address. *See also* data terminal equipment, proration.

**automatic signaling service** *Synonym* off-hook service.

**automatic switching system** A telephone system in which all the operations required to set up, supervise, and release connections required for calls are performed automatically in response to signals from a calling device. (188) *See also* call, switching center.

**Automatic Voice Network (AUTOVON)** The principal long-haul, unsecure voice communications network within the Defense Communications System. (JCS1-DoD) (188) *See also* Automatic Digital Network, Automatic Secure Voice Communications Network, communications.

**automation** 1. The implementation of processes by automatic means. (JCS1-DoD) (FP) (ISO) 2. The investigation, design, development, and application of methods of rendering processes automatic, self-moving, or self-controlling. (FP) 3. The conversion of a procedure, a process, or equipment to automatic operation. (JCS1-DoD)

**AUTOSEVOCOM** *Acronym for* Automatic Secure Voice Communications Network.

**AUTOVON** *Acronym for* Automatic Voice Network.

**auxiliary operation** An off-line operation performed by equipment not under control of the processing unit. (FP)

**auxiliary power** An alternate source of electric power, serving as backup for the primary power at the station main bus or prescribed sub-bus. (188) *Note:* An off-line unit provides electrical isolation between the primary power and the critical technical load; an on-line unit does not. A Class A power source is a primary

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power source; i.e., a source that assures an essentially continuous supply of power. Types of auxiliary power service include: Class B: a standby power plant to cover extended outages (days); Class C: a quick-start (10 to 60 seconds) unit to cover short-term outages (hours); Class D: an uninterruptible (no-break) unit using stored energy to provide continuous power within specified voltage and frequency tolerances. *See also* power, primary power, station battery.

**auxiliary storage** 1. Storage that is available to a processor only through input/output channels. (FP) 2. In a microcomputer, storage that is not memory; for example, storage on diskettes, on streaming tapes, or on magnetic tape cartridges. (FP)

**availability** The ratio of the total time a functional unit is capable of being used during a given interval to the length of the interval; e.g., if the unit is capable of being used for 100 hours in a week, the availability is 100/168. (188) *Note:* The conditions determining operability and committability must be specified. *See also* idle state, maintainability, mean time between failures, mean time between outages, mean time to repair, mean time to service restoral, reliability, unavailability.

**available line** 1. In voice or data communications, a circuit between two points that is ready for service, but idle. *See also* idle state, line. 2. In facsimile transmission, the portion of the scanning line that can be used specifically for picture signals. (188) *Synonym* useful line. *See also* facsimile, scanning line.

**available time** From the point of view of a user, the time during which a functional unit can be used. (FP) (ISO)

**avalanche photodiode (APD)** A photodiode designed to take advantage of avalanche multiplication of photocurrent. *Note:* As the reverse-bias voltage approaches the breakdown voltage, hole-electron pairs created by absorbed photons acquire sufficient energy to create additional hole-electron pairs when the

photons collide with ions; thus a multiplication (signal gain) is achieved. *See also* photodiode, PIN photodiode.

**avalanching** The process by which an electrical signal is multiplied within a device by electron impact ionization.

**average rate of transmission** *Synonym* effective speed of transmission.

**avoidance routing** The assignment of a circuit path to avoid certain critical or trouble-prone circuit nodes. *See also* alternate routing, directionalization, dynamically adaptive routing, line load control, route diversity.

**axial propagation constant** For an optical fiber, the propagation constant evaluated along the axis of a fiber (in the direction of transmission). *Note:* The real part of the axial propagation constant is the attenuation constant while the imaginary part is the phase constant. *Synonym* axial propagation wavenumber. *See also* attenuation, attenuation coefficient, attenuation constant, propagation constant.

**axial propagation wavenumber** *Synonym* axial propagation constant.

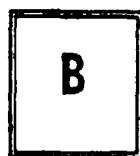
**axial ratio** Of a wave having elliptical polarization, the ratio of the major axis to the minor axis of the ellipse described by the tip of the electric field vector. *See also* elliptical polarization.

**axial ray** A light ray that travels along the optical axis. (188) *See also* geometric optics, meridional ray, paraxial ray, skew ray.

**axial slab interferometry** *Synonym* slab interferometry.



**b** *Abbreviation for bit. See binary digit.*



**B** *Abbreviation for bel.*

**backbone** The high-density connectivity portion of any communications network. (188) *See also network.*

**background noise** The total system noise in the absence of information transmission. (188) *See also ambient noise level, noise.*

**background processing** The [automatic] execution of lower priority computer programs when higher priority programs are not using the system resources. (FP) *See also batch processing.*

**backscattering** 1. Radio wave propagation in which the direction of the incident and scattered waves, resolved along a reference direction (usually horizontal) are oppositely directed. A signal received by backscattering is often referred to as "backscatter." (JCS1-DoD) (JCS1-NATO) (188) 2. In optics, the scattering of light into a direction generally opposite to the original one. *See also forward scatter, propagation, Rayleigh scattering, reflectance, reflection, scatter.*

**back-to-back connection** A connection between the output of a transmitting device and the input of an associated receiving device. (188) *Note:* When used for equipment measurements or testing purposes, this eliminates the effects of the transmission channel or medium. *See also loop-back (def. #2).*

**backup file** A copy of a file made for purposes of later reconstruction of the file, if necessary. (FP) (ISO) *Synonym* job-recovery control file.

**Backus Naur form (BNF)** A metalanguage used to specify or describe the syntax of a language in which each symbol, by itself, represents a set of strings of symbols. (FP)

**backward channel** 1. In data transmission, a secondary channel whose direction of transmission is constrained to be opposite to

that of the primary (or forward) channel. *Note:* The direction of transmission in the backward channel is restricted by the control interchange circuit that controls the direction of transmission in the primary channel. 2. The channel of a data circuit that passes data in a direction opposite to that of its associated forward channel. (188) *Note:* The backward channel is usually used for transmission of supervisory, acknowledgement, or error-control signals. The direction of flow of these signals is opposite to that in which information is being transferred. The bandwidth of this channel is usually less than that of the forward channel; i.e., the information channel. *See also backward signal, data transmission, forward channel, forward signal, information-bearer channel.*

**backward recovery** The reconstruction of an earlier version of a file by using a newer version of data recorded in a journal. (FP) (ISO)

**backward signal** A signal sent in the direction from the called to the calling station, or from the original communications sink to the original communications source. (188) *Note:* The backward signal is usually sent in the backward channel and usually consists of supervisory, acknowledgement, or error control signals. *See also backward channel, communications sink, communications source, forward channel, forward signal, signal.*

**backward supervision** The use of supervisory sequences from a secondary to a primary station. *See also control station, secondary station.*

**balance** To adjust the impedance of circuits and balance networks to achieve specified return loss objectives at junctions of two-wire and four-wire circuits. *See also balancing network.*

**balanced** Pertaining to electrical symmetry. (188)

**balanced code** 1. In PCM systems, a code constructed such that the spectrum resulting

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from the transmission of any code word has no dc component. (188) 2. A code whose digital sum variation is finite. *See also* code, pulse-code modulation.

**balanced line** A transmission line consisting of two conductors in the presence of ground, capable of being operated in such a way that when the voltages of the two conductors at all transverse planes are equal in magnitude and opposite in polarity with respect to ground, the currents in the two conductors are equal in magnitude and opposite in direction. (188) *Note:* A balanced line may be operated in an unbalanced condition. *Synonym* balanced signal pair. *See also* balance return loss, ground-return circuit, hybrid balance, line, line balance, longitudinal balance, metallic circuit, symmetrical pair, unbalanced line, unbalanced wire circuit.

**balanced modulator** A device used in amplitude modulation and so constructed that the carrier and any associated carrier noise is balanced out and the output contains the sidebands only. (188) *See also* amplitude modulation, sideband transmission, single-sideband suppressed carrier transmission.

**balanced signal pair** *Synonym* balanced line.

**balance return loss** A measure of the effectiveness with which a balancing network simulates the impedance of the two-wire circuit at a hybrid coil. More generally, a measure of the degree of balance between two impedances connected to two conjugate sides of a hybrid set, network, or junction. (188) *See also* balanced line, balancing network, hybrid balance, return loss.

**balancing network** 1. A circuit used to simulate the impedance of a uniform two-wire cable or open-wire circuit over a selected range of frequencies. 2. *Sometimes employed as a synonym for balun.* (188) *See also* balance return loss, balun, characteristic impedance, circuit, impedance matching.

**balun** *Acronym for balanced to unbalanced.* 1. A device used to couple a balanced device or

line and an unbalanced device or line. (188) 2. *Sometimes employed as a synonym for balancing network.* *See also* antenna, antenna matching, balancing network, Pawsey stub.

**band** 1. In communications, the frequency spectrum between two defined limits. (188) 2. A group of tracks on a magnetic drum or on one side of a magnetic disk. 3. A designator used by common carriers to define geographical areas. *See also* common carrier, frequency guard band.

**band-elimination filter** *Synonym* band-stop filter.

**bandpass filter** A device that passes all frequencies within its designed range(s) and bars passage to all frequencies not within the range(s). (188) *See also* band-stop filter, filter, frequency.

**bandpass limiter** A device that imposes hard limiting on a signal and contains a filter that suppresses the unwanted products (harmonics) of the limiting process. *See also* band-stop filter, filter.

**band-rejection filter** *Synonym* band-stop filter.

**band-stop filter** A device that bars passage of frequencies within its designed range(s), and allows passage of higher or lower frequencies, or both. (188) *Synonyms* band-elimination filter, band-rejection filter, band-suppression filter, notched filter. *See also* bandpass filter, bandpass limiter, filter, frequency.

**band-suppression filter** *Synonym* band-stop filter.

**bandwidth (BW)** 1. The difference between the limiting frequencies within which performance of a device, in respect to some characteristic, falls within specified limits. (188) 2. The difference between the limiting frequencies of a continuous frequency band. (188)

**bandwidth compression** Any technique to reduce the bandwidth needed to transmit a given amount of information in a given time,

or to reduce the time needed to transmit a given amount of information in a given bandwidth. (188) *Note:* The term implies reducing the normal bandwidth of an information-carrying signal by some means that does not reduce its information content. *See also* biternary transmission, data compression, necessary bandwidth.

**bandwidth-distance factor** In fiber optics, a figure of merit, usually expressed in megahertz-kilometer, used to express the signal-carrying capacity of an optical cable over various distances. (188) *Note:* This figure of merit implies that bandwidth and distance may be reciprocally related. Caution should be exercised because tradeoff is not necessarily linear and the operating points should be specified. *Synonym* bandwidth-distance product. *See also* bandwidth, fiber bandwidth.

**bandwidth-distance product** *Synonym* bandwidth-distance factor.

**bandwidth-limited operation** The condition prevailing when the system bandwidth, rather than the amplitude (or power) of the received signal, limits performance. (188) *Note:* The condition is reached when the system distorts the shape of the signal waveform beyond specified limits. For linear systems, bandwidth-limited operation is equivalent to distortion-limited operation. *See also* attenuation-limited operation, bandwidth, dispersion-limited operation, distortion-limited operation, linear element, quantum-noise-limited operation.

**bar code** A code representing characters by sets of parallel bars of varying thickness and separation that are read optically by transverse scanning. (FP) (ISO)

**base 1.** In the numeration system commonly used in scientific papers, the number that is raised to the power denoted by the exponent and then multiplied by the coefficient to determine the real number represented, for example, the number 6.25 in the expression  $2.7 \times 6.25^{1.5} = 42.1875$ . 2. A reference value. (FP) 3. A

number that is multiplied by itself as many times as indicated by an exponent. (FP)

**base address 1.** An address that is used as the origin in the calculation of addresses in the execution of a computer program. (FP) (ISO) 2. A given address from which an absolute address is derived by combination with a relative address. (FP)

**baseband 1.** The spectral band occupied by an unmodulated signal. (188) *Note:* Baseband transmission is usually characterized by being much lower in frequency than the signal that results if the baseband signal is used to modulate a carrier or subcarrier. 2. In facsimile, the frequency of a signal equal in width to that between zero frequency and maximum keying frequency. (188) *See also* baseband signaling, carrier (cxr), frequency, modulation, multiplex baseband, multiplexing.

**baseband local area network** A local area network in which information is encoded, multiplexed, and transmitted without modulation of carriers. *See also* local area network.

**baseband signaling** Transmission of a digital or analog signal at its original frequencies; i.e., a signal in its original form, not changed by modulation. *See also* baseband, modulation, signal.

**base station** A land station in the land mobile service. (RR) *See also* mobile service, mobile station.

**basic group** *See* group.

**basic mode link control** Control of data links by use of the control characters of the 7-bit character set for information processing interchange as given in ISO Standard 646-1983 and CCITT Recommendation V.3-1972. (FP) (ISO)

**basic rate interface (BRI)** A CCITT Integrated Services Digital Network (ISDN) multipurpose user's interface standard that denotes the capability of simultaneous voice and data

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services provided over two clear 64-kbps channels and one clear 16-kbps channel (2B+D) access arrangement to each subscriber's location. *See also Integrated Services Digital Network.*

**basic service** 1. A pure transmission capability over a communication path that is virtually transparent in terms of its interaction with customer-supplied information. 2. The offering of transmission capacity between two or more points suitable for a user's transmission needs and subject only to the technical parameters of fidelity and distortion criteria, or other conditioning. *See also enhanced service.*

**basic service element (BSE)** 1. An optional unbundled feature, generally associated with the basic serving arrangement (BSA), that an enhanced-service provider (ESP) may require or find useful in configuring an enhanced service. 2. A fundamental (basic) communication network service; an optional network capability associated with a BSA. *Note:* BSEs constitute optional capabilities to which the customer may subscribe or decline to subscribe. *See also unbundling.*

**basic serving arrangement (BSA)** 1. The fundamental tariffed switching and transmission (and other) services that an operating company must provide to an enhanced service provider (ESP) to connect with its customers through the company network. 2. In an open-network-architecture context, the fundamental underlying connection of an enhanced service provider (ESP) to and through the operating company's network. It includes an ESP access link, the features and functions associated with that access link at the central office serving the ESP and/or other offices, and the transport (dedicated or switched) within the network that completes the connection from the ESP to the central office serving its customers or to capabilities associated with the customer's complementary network services. *Note:* Each component may have a number of categories of network characteristics. Within these categories of network characteristics are alternatives from among which the customer

must choose. Examples of BSA components are ESP access link, transport and/or usage. *See also unbundling.*

**basic status** In data transmission, a secondary station's capability to send or receive a frame containing an information field.

**batch processing** 1. The processing of data or the accomplishment of jobs accumulated in advance in such a manner that the user cannot further influence the processing while it is in progress. (FP) (ISO) (188) 2. The processing of data accumulated over a period of time. (FP) 3. *Loosely*, the execution of computer programs serially. (FP) 4. Pertaining to the technique of executing a set of computer programs such that each is completed before the next program of the set is started. (FP) 5. Pertaining to the sequential input of computer programs or data. (FP) *See also background processing, remote batch processing.*

**baud (Bd)** 1. A unit of modulation rate. One baud corresponds to a rate of one unit interval per second, where the modulation rate is expressed as the reciprocal of the duration in seconds of the shortest unit interval. 2. A unit of signaling speed equal to the number of discrete signal conditions, variations, or events per second. (188) *Note:* If the duration of the unit interval is 20 milliseconds, the signaling speed is 50 baud. If the signal transmitted during each unit interval can take on any one of  $M$  discrete states, the bit rate is equal to the rate in baud times  $\log_2 M$ . The technique used to encode the allowable signal states may be any combination of amplitude, frequency, or phase modulation, but it cannot use a further time-division multiplexing technique to subdivide the unit intervals into multiple sub-intervals. In some signaling systems, non-information-carrying signals may be inserted to facilitate synchronization; e.g., in certain forms of binary modulation coding, there is a forced inversion of the signal state at the center of the bit interval. In these cases, the synchronization signals are included in the calculation of the rate in baud but not in the computation of bit rate. *See also bit rate, data signaling rate, unit interval.*

**Baudot code** A synchronous code for the transmission of data, developed about 1880, in which five equal-length bits represent one character. (188) *Note 1:* Baudot code has been replaced by the start-stop asynchronous International Alphabet No. 2 (IA No. 2). *Note 2:* IA No. 2 should not be identified as "Baudot code." *See also* code.

**BCC** *Abbreviation for block check character.*

**BCD** *Abbreviation for binary coded decimal.*

**B channel** The CCITT designation for a clear channel, 64-kbps service capability provided to a subscriber under the Integrated Services Digital Network offering. *Note:* The B channel is intended for transport of user information, as opposed to signaling information. *See also* Integrated Services Digital Network.

**BCI** *Abbreviation for bit-count integrity. See character-count and bit-count integrity.*

**Bd** *Abbreviation for baud.*

**beam diameter** The distance between two diametrically opposed points on a plane perpendicular to the beam axis at which the irradiance is a specified fraction of the beam's peak irradiance. (188) *Note:* The term is most commonly applied to beams that are circular or nearly circular in cross-section. *See also* antenna, beam divergence, beamwidth.

**beam divergence** 1. The increase in diameter with increase in distance along the beam axis from the appropriate aperture. 2. For beams that are circular or nearly circular in cross-section, the angle subtended by the far-field beam diameter. (188) 3. For beams that are not circular or nearly circular in cross-section, the far-field angle subtended by two diametrically opposed points in a plane perpendicular to the beam axis, at which points the power density is a specified fraction of the beam's peak power density. *Note:* Generally, for noncircular beams, only the maximum and minimum divergences (corresponding to the major and minor diameters of the far-field irradiance) need be specified. *See also* antenna,

**beam diameter, collimation, decollimation, diffraction limited, far-field region.**

**beamsplitter** A device for dividing an optical beam into two or more separate beams; often a partially reflecting mirror. *See also* optical fiber coupler.

**beam steering** Changing the direction of the major lobe of a radiation pattern. *See also* antenna.

**beamwidth** 1. For radio frequencies, the angle between the half-power points (3-dB points) of the main lobe of the antenna pattern when referenced to the peak power point of the antenna pattern. (188) *Note:* It is generally measured in the horizontal plane and expressed in degrees. 2. For fiber optics, *see* beam divergence. 3. The angle between the directions, on either side of the axis, at which the intensity of the radio frequency field drops to one-half the value it has on the axis. (JCS1-DoD) *See also* antenna, aperture, beam diameter, directive gain, directivity pattern.

**bearer channel** *See* B channel.

**bearer service** In ISDN applications, a telecommunications service allowing transmission of user-information signals between user-network interfaces. *See also* interface.

**beating** The phenomenon in which two or more periodic quantities having slightly different frequencies produce a resultant having periodic variations in amplitude. (188) *See also* heterodyne.

**bel (B)** The logarithm to the base 10 of a power ratio, expressed as  $B = \log_{10}(P_1/P_2)$ , where  $P_1$  and  $P_2$  are distinct powers. *Note:* The decibel, equal to one-tenth bel, is a more commonly used unit. *See also* dB.

**Bell Operating Company (BOC)** Any of the 22 operating companies that were divested from the AT&T company by court order. *Note:* Cincinnati Bell Telephone Co. and Southern



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- New England Bell Telephone Co. are not included.
- bend loss** *See* **macrobend loss, microbend loss**
- BER** *Abbreviation for bit error ratio.*
- BERT** *Acronym for bit error ratio tester.*
- BETRS** *Acronym for Basic Exchange Telecommunications Radio Service.* A service that can extend telephone service to rural areas by replacing the local loop with radio communications, sharing the UHF and VHF common carrier and private radio frequencies.
- BEX** *Abbreviation for broadband exchange.*
- bias** 1. A systemic deviation of a value from a reference value. (188) 2. The amount by which the average of a set of values departs from a reference value. (188) 3. An electrical, mechanical, magnetic, or other force field applied to a device to establish a reference level to operate the device. (188) 4. Effect on telegraph signals produced by the electrical characteristics of the terminal equipment. (188)
- bias distortion** Distortion affecting a two-condition (binary) coding in which all the significant intervals corresponding to one of the two significant conditions have uniformly longer or shorter durations than the corresponding theoretical durations. (188) *Note:* The magnitude of the distortion is expressed in percent of a perfect unit pulse length. *See also* **bias, cyclic distortion, distortion, end distortion, internal bias, marking bias, spacing bias.**
- biconical antenna** An antenna consisting of two conical conductors having a common axis and vertex. Excitation occurs at the common vertex. (188) *Note:* If one of the cones is flattened into a plane, the antenna is called a **discone**. *See also* **antenna.**
- BIH** *Abbreviation for International Time Bureau. See International Atomic Time (TAI).*
- bilateral control** *Synonym* **bilateral synchronization.**
- bilateral synchronization** A synchronization control system between exchanges A and B in which the clock at exchange A controls the received data at exchange B and the clock at exchange B controls the received data at exchange A. (188) *Note:* Normally implemented by deriving the receive timing from the incoming bit stream. *Synonym* **bilateral control. See also** **clock, double-ended synchronization, single-ended synchronization, synchronization.**
- billboard antenna** A broadside antenna array with flat reflectors. (188) *See also* **antenna.**
- binary** 1. Pertaining to a selection, choice, or condition that has two possible different values or states. (FP) (ISO) 2. Pertaining to a fixed radix numeration system that has a radix of two. (FP) (ISO)
- binary code** A code composed by selection and configuration of an entity that can assume either one of two possible states. (188) *See also* **binary digit, code.**
- binary-coded decimal (BCD)** A numbering system wherein each digit of a given decimal number is represented separately by a unique arrangement of binary digits (usually four). (188) *Note:* BCD sometimes refers only to the 4-bit representation of the decimal digits 0 through 9. *See also* **binary digit, binary notation, code.**
- binary-coded decimal code** *Synonym* **binary-coded decimal notation.**
- binary-coded decimal interchange code** *See* **binary-coded decimal notation.**
- binary-coded decimal (BCD) notation** A binary notation in which each of the decimal digits is represented by a binary numeral. (After FP) (After ISO) *Synonyms* **binary-coded decimal code, binary-coded decimal representation.**

**binary-coded decimal representation** *Synonym* binary-coded decimal notation.

**binary digit (bit)** 1. A character used to represent one of the two digits in the numeration system with a base of two, each digit representing one of two, and only two, possible states of a physical entity or system. 2. In binary notation either of the characters 0 or 1. (FP) (ISO) (188) 3. A unit of information equal to one binary decision or the designation of one of two possible and equally likely states of anything used to store or convey information. (188) *See also* byte, code element, digital signal, octet alignment.

**binary element** A constituent element of data that takes either of two values or states. (FP) (ISO)

**binary exponential backoff** *See* truncated binary exponential backoff.

**binary modulation** The process of varying a parameter of a carrier as a function of two finite and discrete states. (188) *See also* carrier (cxr), modulation.

**binary notation** 1. Any notation that uses two different characters, usually the binary digits 0 and 1. (After FP) (After ISO) *Note:* Data encoded in binary notation need not be in the form of a pure binary numeration system; e.g., Gray code. *Synonym* pure binary numeration system. 2. A scheme for representing numbers characterized by the arrangements of digits in sequence, with the understanding that successive digits are interpreted as coefficients of successive powers of base 2. (188) *See also* binary coded decimal, binary digit, code, Gray code.

**binary synchronous communication (bi-sync)** A character-oriented, data-link-layer protocol. *Note:* The bi-sync protocol is being phased out of most computer communication networks in favor of bit-oriented protocols such as SDLC, HDLC, and ADCCP. *See also* Advanced Data Communications Control Procedure, high-level data link control, synchronous data link control.

**bipolar signal** A signal having two polarities, both of which are not zero. (188) *Note 1:* It may have a two-state (NRZ) or a three-state (RZ) binary coding scheme. *Note 2:* It is usually symmetrical with respect to zero amplitude; e.g., +1, -1. *See also* alternate mark inversion signal, non-return-to-zero code, polar operation, return-to-zero code, signal.

**birefringence** *Literally, "double refraction."* In a transparent material, anisotropism of the refractive index, which varies as a function of orientation with respect to the incident ray, and also with the polarization of the incident ray. (188) *Note 1:* All crystals except those of cubic lattice structure exhibit some degree of anisotropy with regard to their physical properties, including refractive index. Other materials, such as glasses or plastics, become birefringent when subjected to mechanical strain. *Note 2:* Birefringent materials, including crystal, have the ability to refract an unpolarized incident ray into two separate, orthogonally polarized rays, which in the general case take different paths, depending on orientation with respect to the incident ray. The refracted rays are referred to as the "ordinary," or "O" ray, which obeys Snell's Law, and the "extraordinary," or "E" ray, which does not. *Synonym* double refraction. *See also* fiber optics, refraction.

**birefringent medium** *See* birefringence.

**B-ISDN** *Abbreviation for* broadband ISDN.

**bistable** Pertaining to a device capable of assuming either one of two stable states. (FP)

**bistable trigger circuit** A trigger circuit that has two stable states. (FP) (ISO) *Synonym* flip-flop.

**bi-sync** *Abbreviation for* binary synchronous communication.

**bit** *Acronym for* binary digit.

**bit-by-bit asynchronous operation** A mode of operation in which manual, semiautomatic, or



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automatic shifts in the data modulation rate are accomplished by gating or slewing the clock modulation rate. (188) *Note:* The equipment may, for example, be operated at 50 bps one moment and at 1200 bps the next moment. *See also* synchronous transmission.

**bit configuration** The order for encoding the bits of information that define a character. (FP) (ISO) *See also* binary digit.

**bit-count integrity (BCI)** *See* character-count and bit-count integrity.

**bit density** 1. A measure of the number of bits recorded per unit of length or area. (FP) (ISO) *Synonym* recording density. 2. The spacing along a magnetic medium of the bits that represent information. (FP) (ISO)

**biternary transmission** A method of digital transmission in which two binary pulse trains are combined for transmission over a channel in which the available bandwidth is sufficient only for transmission of one of the two pulse trains when in binary form. *See also* code, pulse, pulse train.

**bit error rate** *Deprecated term. See* bit error ratio.

**bit error ratio (BER)** The number of erroneous bits divided by the total number of bits transmitted, received, or processed over some stipulated period of time. (188) *Note:* Two examples of bit error ratio are: (a) transmission BER--the number of erroneous bits received divided by the total number of bits transmitted; and (b) information BER--the number of erroneous decoded (corrected) bits divided by the total number of decoded (corrected) bits. The BER is usually expressed as a number and a power of 10; e.g., 2.5 erroneous bits out of 100,000 bits transmitted would be 2.5 in  $10^5$  or  $2.5 \times 10^{-5}$ . *See also* binary digit, character-count and bit-count integrity, error, error budget, error burst, error control, error ratio, undetected error ratio.

**bit error ratio tester (BERT)** A testing device that compares a received data pattern with a

known transmitted pattern to determine the level of transmission quality.

**bit interval** *See* binary digit, character interval, unit interval.

**bit inversion** The changing of the state of a bit to the opposite state. (188) *See also* character-count and bit-count integrity.

**bit pairing** The practice of establishing, within a code set, a number of subsets that have an identical bit representation except for the state of a specified bit. (188) *Note:* In the International Alphabet No. 5 and the American Standard Code for Information Interchange (ASCII), the upper case letters are related to their respective lower case letters by the state of bit six. *See also* ASCII, binary digit.

**bit position** A character position in a word in a binary notation. (FP) (ISO)

**bit rate (BR)** In a bit stream, the number of bits occurring per unit time, usually expressed as bits per second. (188) *Note:* For M-ary operation, the bit rate is equal to  $\log_2 M$  times the rate (in baud), where M is the number of significant conditions in the signal. *See also* baud, binary digit, bits per second, data signaling rate, modulation rate, multiplex aggregate bit rate.

**bit robbing** The use of the least significant bit in a time slot or channel for conveying voice-related signaling or supervisory information.

**bit-sequence independence** A characteristic of some digital data transmission systems that impose no restrictions on, or modification of, the transmitted bit sequence. *Note:* This is in contrast to some protocols that reserve certain bit sequences for special meaning, e.g., the Flag sequence, 01111110, for HDLC, SDLC, and ADCCP protocols. *See also* binary digit, bit stream transmission.

**bit slip** The insertion or deletion of bits by a device to accommodate accumulated variations in the clock reference of the received waveform vs. the clock of the device. (188)

*See also* binary digit, character-count and bit-count integrity, clock, error.

**bits per inch (BPI)** The density of data, expressed in binary digits per inch of a storage medium.

**bits per second (bps)** The number of bits passing a designated point in a system per second. (188) *Note 1:* Values of data signaling rate in baud and in bits per second are numerically the same if, and only if: (a) all pulses (bits) are the same length; (b) all pulses (bits) are equal to the unit interval, the time element between the corresponding two significant instants of adjacent pulses; (c) binary operation is used. *Note 2:* In M-ary operation, bps equals  $\log_2 M$  times the rate (in baud), where M is the number of significant conditions in the signal. *See also* baud, binary digit, bit rate, data signaling rate, data transfer rate, modulation rate.

**bit-stepped** Control of digital equipment in which its operation is incremented one step at a time at the applicable bit rate. (188) *See also* character stepped.

**bit stream transmission** The transmission of characters at fixed time intervals without stop and start elements. *Note:* The bits that make up the characters follow each other in sequence without interruption. *See also* binary digit, bit-sequence independence, data stream.

**bit string** A delimited sequence of bits. *See also* binary digit, byte, packet, word.

**bit stuffing** A method used for synchronizing bit streams that do not necessarily have the same or rationally related bit rates, by adding noninformation ("stuffing") bits. The location of the "stuffing" bits is communicated to the receiving end of the link, where these extra bits are removed to return the stream(s) to its (their) original rate(s). (188) *Note:* Bit stuffing may be used to synchronize several channels before multiplexing or to rate-match two single channels to each other. *Synonym* positive justification. *See also* binary digit, de-stuffing, digital multiplexer, idle character,

interframe time fill, maximum stuffing rate, multiplexing, nominal bit stuffing rate, synchronization.

**bit stuffing rate** *See* nominal bit stuffing rate.

**bit synchronization** The process whereby the decision time is brought into alignment with the received bit (or basic signaling element). (188) *See also* binary digit, decision instant, frame synchronization, synchronization, synchronization bit.

**bit-synchronous operation** A mode of operation in which data circuit-terminating equipment, data terminal equipment, and transmitting circuits are all operated synchronously with a clock. (188) *Note 1:* Clock timing is delivered at twice the modulation rate, and one bit is transmitted or received during each clock cycle. *Note 2:* Bit-synchronous operation is sometimes erroneously referred to as "digital synchronization." *See also* binary digit, clock, data circuit-terminating equipment, data terminal equipment, synchronization, terminal.

**BIU** Abbreviation for bus interface unit. *See* network interface device.

**BLACK** A designation applied to all telecommunications circuits, components, systems, and equipment that handle only encrypted or unclassified signals and to telecommunications areas in which no classified signals occur. (188) *See also* BLACK signal, communications security, RED/BLACK concept, RED signal.

**blackbody** A totally absorbing body that does not reflect radiation. *Note:* In thermal equilibrium, a blackbody absorbs and radiates at the same rate; the radiation will just equal absorption when thermal equilibrium is maintained. *See also* emissivity.

**black facsimile transmission** 1. In facsimile systems using amplitude modulation, that form of transmission in which the maximum transmitted power corresponds to the maximum density of the subject copy. (188) 2. In facsimile systems using frequency modulation,

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that form of transmission in which the lowest transmitted frequency corresponds to the maximum density of the subject copy. (188) *See also* facsimile, white facsimile transmission.

**black recording** 1. In facsimile systems using amplitude modulation, that form of recording in which the maximum received power corresponds to the maximum density of the record medium. (188) 2. In a facsimile system using frequency modulation, that form of recording in which the lowest received frequency corresponds to the maximum density of the record medium. (188) *See also* facsimile.

**black signal** In facsimile, the signal resulting from the scanning of a maximum-density area of the subject copy. (188) *See also* facsimile, signal.

**BLACK signal** In cryptographic systems, a signal containing only unclassified or encrypted information. (188) *See also* communications security, RED signal.

**blanketing** The interference that is caused by the presence of an AM broadcast signal of one volt per meter (V/m) or greater strengths in the area adjacent to the antenna of the transmitting station. The 1 V/m contour is referred to as the blanket contour and the area within this contour is referred to as the "blanket area." (After CFR 47) *See also* white area.

**blanketing area** That area in the vicinity of a transmitting station where the signal of that station is so great that it interferes with reception of other stations. *Note:* This term is somewhat ambiguous unless the selectivity and quality of the receiver are specified. *See also* interference.

**blanking** [In graphic display,] The suppression of the display of one or more display elements or display segments. (FP) (ISO)

**blinking** An intentional periodic change in the intensity of one or more display elements or display segments. (FP) (ISO)

**block** 1. A group of bits or digits that are transmitted as a unit and that may be encoded for error-control purposes. (FP) (188) 2. A string of records, words, or characters, that for technical or logical purposes, are treated as a unit. (188) (FP) (ISO) *Note:* Blocks are separated by interblock gaps and each block may contain one or more records. 3. In programming languages, a subdivision of a program that serves to group related statements, delimit routines, specify storage allocation, delineate the applicability of labels, or segment parts of the program for other purposes. (FP)

**block character** *See* end-of-transmission-block character.

**block check** That part of the error control procedure that is used to determine whether a block of data is structured according to given rules. (188) *See also* block, block check character, block code, block parity, error control.

**block check character (BCC)** A character added at the end of a message or transmission block to facilitate error detection. *Note:* In longitudinal redundancy checking and cyclic redundancy checking, a block check character is transmitted by the sender after each message block. This block check character is compared with a second block check character computed by the receiver to determine if the transmission is error free. *See also* block check, block parity, character, cyclic redundancy check, error control.

**block code** An error detection and/or correction code in which the encoded block consists of  $N$  symbols, containing  $K$  information symbols ( $K < N$ ) and  $N - K$  redundant check symbols, such that most naturally occurring errors can be detected and/or corrected. *See also* block, block parity, convolutional code, error control, error-correcting code, forward error correction.

**block diagram** A diagram of a system, a computer, or a device in which the principal parts are represented by suitably annotated

geometrical figures to show both the basic functions of the parts and their functional relationships. (FP) (ISO)

**block-error probability** The ratio of the number of incorrectly received or missing blocks to the total number of blocks transmitted during a measurement period. (188) *See also* block-loss probability, incorrect block.

**blocking** 1. The formatting of data into blocks for purposes of transmission, storage, checking, or other functions. 2. Denying access to, or use of, a facility, system, or component. *See also* classmark, lost call, system blocking signal.

**blocking criterion** In telephone traffic engineering, a criterion that specifies the maximum number of calls or service demands that fail to receive immediate service. This value is normally expressed in a probabilistic notation (e.g., P.001).

**blocking factor** The number of records in a block; the number is computed by dividing the size of the block by the size of each record contained therein. (FP) (ISO) *Note:* Each record in the block must be the same size. *Synonym* grouping factor.

**blocking formulas** Specific probability distribution functions that closely approximate the call pattern of telephone users' probable behavior in failing to find idle facilities.

**block length** The number of records, words, or characters in a block. (FP) (ISO)

**block-loss probability** The ratio of the number of lost blocks to the total number of block transfer attempts during a specified period. (188) *See also* block error probability, block-misdelivery probability.

**block-misdelivery probability** The ratio of the number of misdelivered blocks to the total number of block transfer attempts during a specified period. (188) *See also* lost block, misdelivered block.

**block parity** The designation of one or more bits in a block as parity bits whose purpose is to ensure a designated parity, either odd or even. (188) *Note:* Used to assist in error detection or correction, or both. *See also* binary digit, block code, cyclic redundancy check, error control, error correcting code, error detecting code, parity, parity check.

**block transfer** The process, initiated by a single action, of transferring one or more blocks of data. (FP) (ISO)

**block transfer attempt** A coordinated sequence of user and telecommunication system activities undertaken to effect transfer of an individual block from a source user to a destination user. *Note:* A block transfer attempt begins when the first bit of the block crosses the functional interface between the source user and the telecommunication system. A block transfer attempt ends either in successful block transfer or in block transfer failure. *See also* block transfer time, interface, successful block transfer.

**block transfer efficiency** The average ratio of user information bits to total bits in successfully transferred blocks. *See also* overhead information, throughput.

**block transfer failure** Failure to deliver a block successfully. *Note:* Normally the principal block transfer failure outcomes are: lost block, misdelivered block, and added block. *See also* added block, deleted block, failure, incorrect block, lost block, successful block delivery, successful block transfer.

**block transfer rate** The number of successful block transfers during a performance measurement period divided by the duration of the period. (188) *See also* data transfer rate, data transfer time, error ratio, maximum block transfer time.

**block transfer time** The average value of the duration of a successful block transfer attempt. A block transfer attempt is successful if a) the transmitted block is delivered to the intended destination user within the maximum allowable

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performance period and b) the contents of the delivered block are correct. *See also* block, block transfer attempt, successful block transfer.

**BNF** *Abbreviation for* Backus Naur form.

**BOC** *Abbreviation for* Bell Operating Company.

**Boltzmann's constant (k)** The number that relates the average energy of a molecule to the absolute temperature of the environment; approximately equal to  $1.38 \times 10^{-23}$  joule/kelvin.

**bond** The electrical connection between two metallic surfaces established to provide a low resistance path between them. (188) *See also* direct bond, ground.

**bonding** 1. In electrical engineering, the process of connecting together metal parts so that they make low resistance electrical contact for direct current and lower frequency alternating currents. (JCS1-DoD) (JCS1-NATO) 2. The process of establishing the required degree of electrical continuity between two or more conductive surfaces that are to be joined. (188) *See also* direct bond, ground.

**Boolean function** A switching function in which the number of possible values of the function and each of its independent variables is two. (FP) (ISO)

**Boolean operation** 1. Any operation in which each of the operands and the result take one of two values. (FP) (ISO) 2. An operation that follows the rules of Boolean Algebra. (FP) (ISO)

**bootstrap** 1. A technique or device designed to bring about a desired state by means of its own action. (188) 2. That part of a computer program that may be used to establish another version of the computer program. (FP) 3. The automatic procedure whereby the basic operating system of a processor is reloaded following a complete shutdown or loss of memory. 4. A set of instructions that cause additional instructions to be loaded until the

complete computer program is in storage. (FP) (ISO) 5. To use a bootstrap. (FP) (ISO) *See also* computer.

**bound mode** In an optical fiber, a mode whose field decays monotonically in the transverse direction everywhere external to the core and which does not lose power to radiation. *Note:* Except in a single-mode fiber, the power in bound modes is predominantly contained in the core of the fiber. (188) *Synonyms* guided mode, trapped mode. *See also* acceptance angle, acceptance cone, cladding mode, guided ray, leaky mode, mode, normalized frequency, radiation mode.

**bound ray** *Synonym* guided ray.

**BPI** *Abbreviation for* bits per inch.

**bps** *Abbreviation for* bits per second.

**BR** *Abbreviation for* bit rate.

**branch** 1. In a computer program, a conditional jump or departure from the implicit or declared order in which instructions are being executed. (188) 2. To select a branch, as in definition #1. 3. A direct path joining two nodes of a network or graph. 4. In a power distribution system, a circuit from a distribution device (power panel) of a lower power handling capability than that of the input circuits to the device. (188) *See also* node.

**branching device** *See* optical fiber branching device.

**branching network** A network used for transmission or reception of signals over two or more channels. (188)

**branching repeater** A repeater with two or more outputs for each input. (188) *See also* repeater.

**breadboard** 1. An assembly of circuits or parts used to prove the feasibility of a device, circuit, system, or principle with little or no regard to the final configuration or packaging of the parts. (188) 2. To prepare a breadboard.



**break-out box** A testing device that permits a user to cross-connect and tie individual leads of an interface cable using jumper wires in order to monitor, switch, or patch the electrical output of the cable.

**Brewster's angle** For light incident on a plane boundary between two regions having different refractive indices, that angle of incidence at which the transmittance is unity for light that is polarized parallel to the plane defined by the direction of propagation and the normal to the surface. *Note:* Brewster's angle  $\Theta_B$ , for propagation from medium 1 to medium 2, is given by  $\Theta_B = \arctan(n_2/n_1)$ , where  $n_1$  and  $n_2$  are the refractive indices of the respective media. *See also* angle of incidence, reflectance, refractive index [of a medium].

**BRI** *Abbreviation for basic rate interface*

**brick** A station in the mobile service consisting of a hand-held radiotelephone unit licensed under a site authorization; each unit is capable of operation while being hand-carried by an individual.

**bridge** 1. A functional unit that interconnects two local area networks that use the same logical link control procedure, but may use different medium access control procedures. (FP) (ISO) *See also* gateway. 2. *See* hybrid coll. (188)

**bridged ringing** A signaling system in which ringers associated with a particular line are connected across that line.

**bridge lifter** A device that removes, either electrically or physically, bridged telephone pairs. (188) *Note:* Relays, saturable inductors, and semiconductors are used as bridge lifters.

**bridge transformer** *Synonym* hybrid coll.

**bridging connection** A parallel connection by means of which some of the signal energy in a circuit may be extracted, usually with negligible effect on the normal operation of the circuit. (188) *See also* branching network, circuit, monitor jack.

**bridging loss** The loss at a given frequency resulting from connecting an impedance across a transmission line. (188) *Note:* Expressed as the ratio (in decibels) of the signal power delivered to that part of the system following the bridging point before bridging, to the signal power delivered to that same part after the bridging. *See also* loss.

**brightness** An attribute of visual perception, in accordance with which a source appears to emit more or less light. *Note 1:* Usage should be restricted to nonquantitative reference to physiological sensations and perceptions of light. *Note 2:* "Brightness" was formerly used as a synonym for the photometric term "luminance" and (incorrectly) for the radiometric term "radiance." *See also* irradiance, radiance, radiant intensity.

**broadband** *Synonym* wideband.

**broadband exchange (BEX)** A switched communication system featuring interconnections having a bandwidth greater than voice bandwidth. *See also* bandwidth, group, switching center.

**broadband ISDN (B-ISDN)** A CCITT proposed Integrated Services Digital Network offering broadband capabilities including many of the following features or services: (a) from 150 to 600 Mbps interfaces, (b) using ATM (asynchronous transfer mode) to carry all services over a single, integrated, high-speed packet-switched net, (c) LAN interconnection, (d) the ability to connect LANs at different locations, (e) access to a remote, shared disk server, (f) voice/video/data teleconferencing from one's desk, (g) transport for programming services (e.g., cable TV), (h) single-user controlled access to remote video source, (i) voice/video telephone calls, and j) access to shop-at-home and other information services. *Note:* Techniques involved in the B-ISDN include code conversion, information compression, multipoint connections, multiple-connection calls. Current proposals use service-independent call structure that allows flexible arrangement and modular control of access and transport edges, the service

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components of a connection which can provide each user in a connection with independent control of its access features and serve as the basis of a simplified control structure for multipoint and multiconnection calls. Such a network might be expected to offer a variety of ancillary information processing functions. *See also* Integrated Services Digital Network.

**broadband system** *See* wideband.

**broadcasting-satellite service** A radiocommunication service in which signals transmitted or retransmitted by space stations are intended for direct reception by the general public. In the broadcasting-satellite service, the term "*direct reception*" shall encompass both individual reception and community reception. (RR) *See also* individual reception [in the broadcasting-satellite service].

**broadcasting service** A radiocommunication service in which the transmissions are intended for direct reception by the general public. This service may include sound transmissions, television transmissions or other types of transmissions. (RR)

**broadcasting station** A station in the broadcasting service. (RR)

**broadcast operation** The transmission of information so that it may be simultaneously received by stations that usually make no acknowledgement. (188) *See also* antenna, point-to-point transmission.

**browsing** The act of searching through automated information system storage to locate or acquire information without necessarily knowing of the existence or the format of the information being sought.

**BSA** *Abbreviation for basic serving arrangement.*

**BSE** *Abbreviation for basic service element.*

**buffer** 1. A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when

transferring data from one device to another. (FP) (188) *Note:* Buffers are used for many purposes such as: (a) interconnecting two digital circuits operating at different rates, (b) holding data for use at a later time, (c) allowing timing corrections to be made on a data stream, (d) collecting binary data bits into groups that can then be operated on as a unit, (e) delaying the transit time of a signal in order to allow other operations to occur. 2. To allocate and schedule the use of buffers. (188) 3. An isolating circuit used to prevent a driven circuit from influencing the driving circuit. (188) 4. In an optical fiber cable, a component used to encapsulate an optical fiber, thus providing mechanical isolation and/or protection from physical damage. (188) *Note:* Cable fabrication techniques vary, some resulting in firm contact between fiber and protective buffering, others resulting in a loose fit, permitting the fiber to slide in the buffer tube. Multiple buffer layers may be used for added fiber protection. *See also* data, elastic buffer, first-in first-out, optical fiber cable, queueing, queueing delay, queue traffic, variable length buffer.

**bug** 1. A concealed microphone or listening device or other audiosurveillance device. (JCS1-DoD) *See also* communications security. (188) 2. A mistake in a computer program. 3. To install means for audiosurveillance. (JCS1-DoD) 4. A semiautomatic telegraph key. 5. A mistake or malfunction. (FP) (188)

**building out** The process of adding a combination of inductance, capacitance, and resistance to a cable pair so that its electrical length may be increased by a desired amount to control impedance characteristics. (188) *Synonym* line buildout. *See also* balancing network, impedance matching.

**bulk encryption** Simultaneous encryption of all channels of a multichannel telecommunications trunk. (188) *See also* communications security, cryptology.

**bunched frame-alignment signal** A frame-alignment signal in which the signal elements occupy consecutive digit positions. *See also*



**distributed frame-alignment signal, frame, frame alignment, frame-alignment signal, signal.**

**bundle** A group of optical fibers or conductors, associated together and usually in a single sheath. (188) *See also* cable, fiber bundle, fiber optics.

**buried cable** *See* direct-buried cable.

**burst** 1. In data communication, a sequence of signals, noise, or interference counted as a unit in accordance with some specific criterion or measure. (FP) (188) *See also* burst transmission. 2. To separate continuous-form or multipart paper into discrete sheets. *See also* error burst.

**burst isochronous** *Deprecated synonym for isochronous burst transmission.*

**burst switching** In a packet-switched network, a switching capability in which each network switch extracts routing instructions from an incoming packet header to establish and maintain the appropriate switch connection for the duration of the packet, following which the connection is automatically released. *Note:* In concept, burst switching is similar to connectionless mode transmission, but it differs from the latter in that burst switching implies an intent to establish the switch connection in near real time so that only minimum buffering is required at the node switch. *See also* network, packet, packet switching.

**burst transmission** 1. A method of transmission that combines a very high data signaling rate with very short transmission times. (188) *Synonym* data burst. 2. A method of operating a data network by interrupting, at intervals, the data being transmitted. *Note:* The method enables communication between data terminal equipment and a data network operating at dissimilar data signaling rates.

**bus** One or more conductors or optical fibers that serve as a common connection for a related group of devices. (188)

**bus interface unit (BIU)** *See* network interface device.

**bus topology** A communication network topology in which nodes are connected serially, requiring all nodes except those at the ends of the bus to have the capability to transmit in, and receive from, two directions in order for all nodes to communicate with all other nodes on the bus; i.e., with intermediate nodes acting as repeaters or passive transparent nodes. *Note:* The failure of a single transmission line (channel) linking any two nodes will result in the isolation of a minimum of one node from the rest of the network. (188) *See also* ring network, star topology, tree topology.

**busy back** *Deprecated term. See* busy signal.

**busy hour** Any 60-minute period during which the traffic load in a given 24-hour period is a maximum. (188) *Note 1:* If the service time interval is less than 60 minutes, the busy hour is the 60-minute interval that contains the service time interval in the center. *Note 2:* In those cases where more than one busy hour occurs (saturation) in a 24-hour period, the busy hour or hours most applicable to the particular situation must be used. *Synonym* peak busy hour. *See also* all trunks busy, erlang, group busy hour, switch busy hour, traffic capacity, traffic intensity, traffic load.

**busy season** A 3-month, nonconsecutive period of time over a 1-year cycle with the highest busy hour traffic. *See also* busy hour.

**busy signal** In telephony, an audible or visual signal that indicates that the called number, or transmission path thereto, is unavailable. (188) *Synonym* busy tone. *See also* call, signal.

**busy test** In telephony, a test made to determine whether certain facilities which may be desired, such as a subscriber's line or a central office's trunk, are available for use.

**busy tone** *Synonym* busy signal.

**busy verification** In the public switched telephone network, a switching system service

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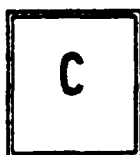
feature that permits an attendant to verify the busy or idle state of station lines and to break into the conversation. *Note:* An alternating tone of 440 Hz is applied to the line for 2 seconds, followed by a 0.5-second burst every 10 seconds to alert both parties that the attendant is connected to the circuit. *See also* attendant position, call.

**BW** *Abbreviation for bandwidth.*

**bypass** 1. *Broadly*, the use of any telecommunication facilities or services in circumvention of the local exchange carrier. *Note:* The alternative facilities or services may be either customer-provided or vendor-supplied. 2. *Generally*, an alternate circuit around some user equipment, group of equipments, or system element. (188) *Note:* Usually provided to allow system operation to continue when the bypassed portion is inoperable.

**byte** A sequence of N adjacent binary digits, usually treated as a unit, where N is a nonzero integral number. (188) *Note:* In pre-1970 literature, "byte" referred to a variable-length field. Since that time the usage has changed so that now it almost always refers to an 8-bit field. This usage predominates in computer and data transmission literature; when so used, the term is synonymous with "octet." *See also* binary digit, bit string, block, computer word, octet, octet alignment, word.

**cable** 1. An assembly of one or more conductors or optical fibers, or a combination of both, within an enveloping sheath. (188) 2. A message sent by cable, or by extension, any means of telegraphy.



**cable assembly** A cable that is connector terminated. *Note:* Generally a cable that has been terminated by a manufacturer and is ready for installation. *See also* cable.

**cable cutoff wavelength ( $\lambda_{cc}$ )** For a cabled single-mode optical fiber under specified length, bend, and deployment conditions, the wavelength at which the fiber's second order mode is attenuated a measurable amount when compared to a multimode reference fiber or to a tightly bent single-mode fiber. *See also* cutoff wavelength, fiber cutoff wavelength.

**cable television relay service (CARS) station** A fixed or mobile station used for the transmission of television and related audio signals, signals of standard and FM broadcast stations, signals of instructional television fixed stations, and cablecasting from the point of reception to a terminal point from which the signals are distributed to the public. (CFR 47)

**cache memory** A special buffer storage, smaller and faster than main storage, that is used to hold a copy of instructions and data in main storage that are likely to be needed next by the processor, and that have been obtained automatically from main storage. (FP) (ISO)

**call** 1. Any demand to set up a connection. 2. A unit of traffic measurement. (188) *See also* message. 3. In communications, the action performed by the calling party, or the operations necessary in making a call, or the effective use made of a connection between two stations.

**call abandoned** *See* abandoned call.

**call accepted signal** A call control signal sent by the called terminal to indicate that it accepts the incoming call. (After FP) *See also* call,

call control signal, data terminal equipment, signal.

**call attempts** All telephone calls attempting to reach an idle server at a switching center. *Note:* This accounting of call attempts is normally computed during a specific time frame and includes calls answered, calls overflowed, and calls abandoned.

**call collision** 1. Contention that occurs when a terminal and a DCE simultaneously transfer a call request and an incoming call specifying the same logical channel. *Note:* The DCE will proceed with the call request and cancel the incoming call. 2. That condition arising when a trunk or channel is seized at both ends simultaneously, thereby blocking a call. (188) *See also* blocking, call, clear collision, collision, data circuit-terminating equipment, data terminal equipment, head-on collision.

**call completion rate** The ratio of successfully completed calls to the total number of attempted calls. *Note:* This ratio is typically expressed as either a percentage or a decimal fraction.

**call control signal** Any one of the entire set of interactive signals necessary to establish, maintain, and release a call.

**call delay** The delay experienced when a call, arriving at an automatic switching device, finds no idle channel or facility available to process the call immediately.

**call detail recording (CDR)** A call data-collection feature for cost accounting assignment of service to a specific telephone extension or to a pool of like subscribers. *See also* automatic message accounting.

**call duration** The interval of time between the moment when a connection is established between the calling and called stations and the moment when either party terminates the call. *See also* call release time, call second, call set-up time.

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**called-line identification facility** A service feature provided by a network, which enables a calling terminal to be notified by the network of the address to which the call has been connected. *See also* calling-line identification facility, data terminal equipment, facility, service feature.

**called-line identification signal** A sequence of characters transmitted to the calling terminal to permit identification of the called line. *See also* call control signal, call receiver, character, data terminal equipment, signal, terminal.

**called party** *Synonym* call receiver.

**called-party camp-on** A communication system service feature that enables the system to complete an access attempt in spite of issuance of a user blocking signal. *Note:* Systems that provide this feature monitor the busy user until the user blocking signal ends, and then proceed to complete the requested access. This feature permits holding an incoming call until the called party is free. *See also* access attempt, call, calling-party camp-on, queue traffic, service feature.

**call forwarding** A service feature available in some switching systems where calls can be rerouted automatically from one line, i.e., station number, to another or to an attendant. *Note:* This feature may be implemented in many forms. *See also* service feature, switching center.

**call hold** A service feature, available in some switching systems, that permits a user to retain an existing call to accept or originate a second call using the same facilities. *See also* service feature.

**call identifier** A network utility that is an identifying name assigned by the originating network for each established or partially established virtual call and, when used in conjunction with the calling DTE address, uniquely identifies the virtual call over a period of time. *See also* data terminal equipment, virtual call.

**calling-line identification facility** A service feature, provided by a network, that enables a called terminal to be notified by the network of the address from which the call has originated. *See also* data terminal equipment, facility, incoming call identification, service feature.

**calling-line identification signal** A sequence of characters transmitted to the called terminal to permit identification of the calling line. *See also* call, call control signal, character, data terminal equipment, signal.

**calling party** *Synonym* call originator.

**calling-party camp-on** A service feature that enables the system to complete an access attempt in spite of temporary unavailability of system transmission or switching facilities required to establish the requested access. *Note:* Systems that provide this feature monitor the system facilities until the necessary facilities become available, and then proceed to complete the requested access. Such systems may or may not issue a system blocking signal to apprise the originating user of the access delay. *See also* access attempt, called party camp-on, queue traffic, service feature.

**calling sequence** A sequence of instructions together with any associated data necessary to perform a call. (FP) (ISO)

**calling signal** A call control signal transmitted over a circuit to indicate that a connection is desired. *See also* call control signal, signal.

**call intensity** *Synonym* traffic intensity.

**call-not-accepted signal** A call control signal sent by the called terminal to indicate that it does not accept the incoming call. (After FP) (After ISO) *See also* call control signal, data terminal equipment, signal.

**call originator** A person, equipment, or program that originates a call. (188) *Synonym* calling party. *See also* source user.

**call pickup** A service feature of some switching systems enabling a user, by dialing a

predetermined code, to answer incoming calls that are directed to another user in a preselected call group. *See also service feature.*

**call processing** The sequence of operations performed by a switching system from the acceptance of an incoming call through the final disposition of the call. *See also switching center.*

**call progress signal** A call control signal transmitted by the DCE to the calling terminal to report the progress of a call (positive call progress signal) or the reason why a connection could not be established (negative call progress signal). *See also call control signal, data circuit-terminating equipment, data terminal equipment, signal.*

**call progress tones** Audible signals returned to the station user by the switching equipment to indicate the status of a call, e.g., dial tones and busy signals. *See also call control signal.*

**call receiver** A person, equipment, or program to which a call is directed. *Synonym called party.*

**call record** All recorded data pertaining to a single call. (188) *See also audit trail, automatic message accounting.*

**call release time** In communication systems, the time interval from initiation of a clearing signal by a terminal until the free circuit condition appears on originating terminal equipment. (188) *See also call, call duration, call set-up time, disengagement time, terminal.*

**call restriction** A switching system service feature that prevents selected terminals from exercising one or more service features otherwise available from the switching system. (188) *See also classmark, class of service, service feature.*

**calls-barred facility** A service feature that permits a terminal either to make outgoing calls or to receive incoming calls, but not both.

(188) *See also classmark, data terminal equipment, facility, service feature.*

**call-second** A unit of communication traffic equivalent to one call of 1-second duration. (188) *Note:* One user making two 75-second calls or two users, each making one 75-second call, produce the same 150 call-seconds of traffic. Since a larger unit than the call-second is generally needed, the CCS (hundred-call-seconds) was introduced.

## RELATIONSHIPS

$3600 \text{ call-seconds} = 36 \text{ CCS} = 1 \text{ call hour.}$   $3600 \text{ call-seconds per hour} = 36 \text{ CCS per hour} = 1 \text{ call-hour per hour} = 1 \text{ erlang} = 1 \text{ traffic unit.}$  *See also call duration, connections per circuit hour, erlang, holding time, traffic intensity.*

**call set-up time** 1. The overall length of time required to establish a circuit-switched call between users. (188) 2. For data communication, the overall length of time required to establish a circuit-switched call between terminals; i.e., the time from the initiation of a call request to the beginning of the call message. *Note:* It is the summation of: (a) call request time--the time from initiation of a calling signal to the delivery to the caller of a proceed-to-select signal; (b) selection time--the time from the delivery of the proceed-to-select signal until all the selection signals have been transmitted; and (c) post selection time--the time from the end of the transmission of the selection signals until the delivery of the call-connected signal to the originating terminal. *See also access time, call, call duration, call release time, data terminal equipment.*

**call spill-over** In common-channel signaling, the effect on a traffic circuit of the arrival at a switching center of an abnormally delayed call control signal relating to a previous call, while a subsequent call is being set up on the circuit. (188) *See also call control signal, circuit, lockout.*

**call splitting** A switching system service feature that allows a switch attendant to talk privately

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in either direction on an established call. *See also cord circuit, service feature.*

**call transfer** A switching system service feature that allows the calling or called user to instruct the local switching equipment or switch attendant to transfer an existing call to another terminal. *Note:* This feature may be available on a call-by-call basis or on a semipermanent basis. *See also service feature.*

**call waiting** In telephony, a service feature that provides an indication to a terminal already engaged in an established call that one or more calls are awaiting connection. *See also call control signal, signal.*

**CAMA** *Acronym for Centralized Automatic Message Accounting.*

**camp-on** *Colloquial synonym for automatic callback.*

**CAN** *Abbreviation for cancel character.*

**cancel character (CAN)** 1. A control character used by some convention to indicate that the data with which it is associated are in error or are to be disregarded. (FP) 2. An accuracy control character used to indicate that the data with which it is associated are in error, are to be disregarded, or cannot be represented on a particular device. (FP) *See also control character.*

**capacitive coupling** The transfer of energy from one circuit to another by virtue of the mutual capacitance between the circuits. (188) *Note 1:* The coupling may be deliberate or inadvertent. *Note 2:* Capacitive coupling favors transfer of higher frequency components, whereas inductive coupling favors transfer of lower frequency components. *See also conducted coupling, coupling, inductive coupling.*

**capacity** *See channel capacity, traffic capacity.*

**capture effect** An effect associated with the reception of frequency-modulated signals in which, if two signals are received on or near the same frequency, only the stronger of the

two will appear in the output. (188) *Note 1:* The complete suppression of the weaker carrier occurs at the receiver limiter, where it is treated as noise and rejected. *Note 2:* Under conditions where both signals are fading randomly, the receiver may switch from one to the other. *Synonym FM capture effect. See also carrier (cxr), frequency modulation.*

**card dialer** An automatic dialer, combined with a terminal, that dials telephone numbers coded on a card. *See also automatic callback, automatic calling unit, repertory dialer, speed calling.*

**cardinal radials** Those eight radials at 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° of azimuth with respect to true north. (CFR 47)

**carrier** *Synonym common carrier.*

**carrier (cxr)** 1. A wave suitable for modulation by an information-bearing signal to be transmitted over a communication system. (188) 2. An unmodulated emission. (188) *Note:* The carrier is usually a sinusoidal wave or a recurring series of pulses. *Synonym carrier wave.* 3. Sometimes employed as a *synonym for carrier system.*

**carrier dropout** A short-duration loss of carrier signal. (188)

**carrier frequency** 1. The frequency of a carrier wave. (188) 2. The frequency of an unmodulated wave capable of being modulated or impressed with a second (information-carrying) signal. (188) *Note:* In frequency modulation, the carrier frequency is also referred to as the "center frequency." *See also carrier (cxr), modulation, spectrum designation of frequency.*

**carrier leak** The unwanted carrier remaining after carrier suppression in a suppressed carrier transmission system. (188) *See also carrier (cxr).*

**carrier level** The power of a carrier signal at a particular point in a system, expressed in



decibels in relation to some reference level. (188) *See also* carrier power, level.

**carrier multiplex** *See* frequency-division multiplexing.

**carrier noise level** The noise level resulting from undesired variations of a carrier in the absence of any intended modulation. (188) *Synonym* residual modulation. *See also* carrier (cxr), level, noise.

**carrier power [of a radio transmitter] (PC)** The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle taken under the condition of no modulation. (RR) (188) *Note:* Does not apply to pulse modulation or frequency-shift keying. *See also* carrier (cxr), carrier level, peak envelope power.

**carrier sense** In a local area network, an ongoing activity of a data station to detect whether another station is transmitting. (FP) (ISO) *See also* local area network.

**carrier sense multiple access (CSMA)** A network control feature wherein a transmitter checks for a clear access channel before transmitting. *See also* carrier, code-division multiple access, collision, local area network.

**carrier sense multiple access with collision avoidance (CSMA/CA)** A protocol that requires carrier sense and in which a data station that intends to transmit sends a jam signal; after waiting a sufficient time for all stations to pick up the jam signal, it sends a transmission frame; if while transmitting, it detects another station's jam signal, it stops transmitting for a designated time and then tries again. (FP) (ISO) *See also* local area network.

**carrier sense multiple access with collision detection (CSMA/CD)** A protocol that requires carrier sense and in which a transmitting data station that detects another signal while transmitting, stops sending, sends a jam signal, and then waits for a variable time before trying again. (FP) (ISO) *See also* local area network.

**carrier shift** 1. A method of keying a radio carrier for transmitting binary data or teletypewriter signals, which consists of shifting the carrier frequency in one direction for a marking signal and in the opposite direction for a spacing signal. (188) 2. In amplitude modulation, a condition resulting from imperfect modulation whereby the positive and negative excursions of the envelope pattern are unequal, thus effecting a change in the power associated with the carrier. There can be positive or negative carrier shift. (188) *See also* carrier (cxr), frequency, frequency-shift keying, modulation.

**carrier suppression** *See* suppressed carrier transmission.

**carrier synchronization** In a radio receiver, the generation of a reference carrier with a phase closely matching that of a received signal. *See also* carrier (cxr), phase-locked loop, synchronization.

**carrier system** A multichannel telecommunications arrangement wherein a number of individual data and/or voice circuits are multiplexed for transmission between nodes of a network with demultiplexing occurring as required. (188) *Note 1:* Many different forms of multiplexing are possible including time-division and frequency-division. *Note 2:* Multiple layers of multiplexing on the same carrier are also common. *Sometimes employed as a synonym for* carrier (cxr). *See also* channel, multiplexing, T-carrier.

**carrier-to-noise ratio (CNR)** In radio receivers, the ratio, expressed in decibels, of the level of the carrier to that of the noise in the receiver IF bandwidth before any nonlinear process such as amplitude limiting and detection takes place. (188) *See also* carrier (cxr), signal-to-noise ratio.

**carrier-to-receiver noise density (C/kT)** In satellite communications, the ratio, expressed in decibels, of the received carrier power (C) to the received noise power density (kT), where k is Boltzmann's constant and T is the receiver

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system noise temperature in kelvins. (188) *See also* carrier (cxr), signal-to-noise ratio.

carrier wave (cw) *Synonym* carrier (cxr).

CARS *Acronym for cable television relay service.*

CAS *Abbreviation for centralized attendant service.*

case shift 1. In data equipment, the change from letters to other characters, or vice versa. (188) 2. In typewriting or typesetting, the change from lower case letters to upper case letters, or vice versa.

Cassegrain antenna An antenna in which the feed radiator is mounted at or near the surface of a concave main reflector and is aimed at a convex secondary reflector slightly inside the focus of the main reflector. *Note 1:* Energy from the feed unit illuminates the secondary reflector which reflects it back to the main reflector, which then forms the desired forward beam. *Note 2:* This technique is adapted from optical telescope technology and allows the feed radiator to be more easily supported. *See also* antenna.

CATV *Abbreviation for community antenna television.*

cavity A volume defined by conductor-dielectric or dielectric-dielectric reflective boundaries, or a combination of both, and having dimensions designed to produce specific interference effects (constructive or destructive) when excited by an electromagnetic wave. *See also* optical cavity.

C-band *Colloquially*, a frequency band between 4 GHz and 6 GHz used in satellite communications.

CCH *Abbreviation for connections per circuit hour.*

CCIR *Abbreviation for International Radio Consultative Committee.*

CCIS *Abbreviation for common-channel interoffice signaling.*

CCITT *Abbreviation for International Telegraph and Telephone Consultative Committee.*

CCS *Abbreviation for hundred call-seconds.*

CCSA *Abbreviation for common control switching arrangement.*

CDF *Abbreviation for combined distribution frame.*

CDMA *Abbreviation for code-division multiple access.*

CDR *Abbreviation for call detail recording.*

C-E *Abbreviation for communications-electronics.*

CEI *Abbreviation for comparably efficient interconnection.*

cell 1. In cellular radio, the smallest geographic area defined for certain mobile communication systems. *Note:* Each cell has its own base station and a single controller interconnected with the public telephone network. 2. In OSI, a fixed-length block labeled at the Physical Layer of the Open Systems Interconnection Reference Model. 3. In computer systems, an addressable, internal hardware location. 4. In computer systems, a single location on a spreadsheet.

cellar *Synonym* last-in first-out.

cellular radio A mobile communication system based on a blend of radio transmission and telephone switching, which system permits telephone communication to and from mobile users within a defined area. *Note:* Large geographical areas are segmented into many smaller "cells," each of which has its own base station and a single controller interconnected with the public switched telephone network. The same frequencies are reused in noncontiguous cells since power output and signal direction are carefully controlled.

**CELP** *Acronym for code-excited linear prediction.*

**center frequency** 1. In frequency modulation, the rest frequency (frequency of the carrier before modulation). (188) 2. In facsimile, the frequency midway between the picture-black and picture-white frequencies. (188) *See also assigned frequency, carrier (cxr), carrier frequency, facsimile, frequency, modulation.*

**centralized attendant services (CAS)** A function of a centrally located attendant console that permits the control of a number of switches, some of which may be geographically remote.

**centralized automatic message accounting (CAMA)** An automatic message accounting system that serves more than one switch from a central location. *Note:* In certain cases, operator intervention may be required. *See also automatic message accounting.*

**centralized operation** Operation of a communication network in which transmission may occur between the control station and any tributary station, but not between tributary stations. *See also communications, distributed control, distributed switching, network, system signaling and supervision.*

**centralized ordering group (COG)** An organization provided by some communications service providers to coordinate services between the companies and vendors.

**central office (C.O.)** A common carrier switching office in which users' lines terminate. *Synonym local central office. See also end office, switching center.*

**central office connecting facility** *Synonym central office trunk.*

**central office trunk** 1. A trunk between central offices. (188) *Note:* It may be between major switches or between a major and a minor switch. 2. A trunk between public and private switches. *Synonym central office connecting facility. See also trunk.*

**central processing unit (CPU)** 1. The portion of a computer that includes circuits controlling the interpretation and execution of instructions. (188) 2. The portion of a computer that executes programmed instructions, performs arithmetic and logical functions on data, and controls input/output functions. *Synonym central processor. See also communications processor unit, computer, multiprocessing.*

**central processor** *Synonym central processing unit.*

**Centrex® (CTX) service** A service offered by Bell Operating Companies that provides functions and features comparable to those provided by a PBX or a PABX. *Note:* "Centrex® C.O." indicates that all equipment except the attendant's position and station equipment is located in the central office. "Centrex® C.U." indicates that all equipment, including the dial switching equipment, is located on the customer's premises.

**certification** The comprehensive evaluation of the technical and nontechnical security features of an automated information system and other safeguards, made in support of the accreditation process, that establishes the extent to which a particular design and implementation meets a specified set of security requirements.

**cesium clock** A clock containing a cesium standard as a frequency-determining element. (188) *See also cesium standard, coordinated clock, Coordinated Universal Time (UTC), DoD master clock, precise frequency, precise time, primary frequency standard, primary time standard, second.*

**cesium standard** A primary frequency standard in which a specified hyperfine transition of cesium-133 atoms is used to control the output frequency. (188) *Note:* Its accuracy is intrinsic and achieved without calibration. *See also cesium clock, Coordinated Universal Time (UTC), frequency, primary frequency standard, primary time standard, second.*

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**chad** The material separated from a punched tape or a punched card when forming a hole. (188) *See also* reperforator.

**chadless tape** 1. Punched tape that has been punched in such a way that chad is not formed. 2. A punched tape wherein only partial perforation is completed and the chad remains attached to the tape. (188) *Note:* This is a deliberate process and should not be confused with imperfect chadding. *See also* reperforator, tape relay.

**chad tape** Punched tape used in telegraphy/teletypewriter operation. The perforations, called "chad," are severed from the tape, making holes representing the characters. (188) *See also* reperforator, tape relay.

**channel** 1. A connection between initiating and terminating nodes of a circuit. (188) 2. A single path provided from a transmission medium either by physical separation, e.g., multipair cable, or by electrical separation, e.g., frequency- or time-division multiplexing. (188) 3. A single unidirectional or bidirectional path for transmitting or receiving, or both, of electrical or electromagnetic signals, usually in distinction from other parallel paths. (188) 4. Used in conjunction with a predetermined letter, number, or codeword to reference a specific radio frequency. (JCS1-DoD) (188) 5. A path along which signals can be sent; e.g., data channel, output channel. (188) 6. The portion of a storage medium that is accessible to a given reading or writing station; e.g., track, band. 7. In information theory, that part of a communications system that connects the message source with the message sink.

**channel-associated signaling** Signaling in which the signals necessary for the traffic carried by a single channel are transmitted in the channel itself or in a signaling channel permanently associated with it. (188) *See also* channel, common-channel signaling, in-band signaling, out-of-band signaling, signal.

**channel bank** The part of a carrier-multiplex terminal that performs the first step of

modulation. It multiplexes a group of channels into a higher frequency (analog) or higher rate (digital) band and, conversely, demultiplexes these aggregates back into individual channels. (188) *Note:* D1, D1A, D2, . . . Dn denote individual configurations of digital channel banks containing A-D converters. *See also* channel, common-channel signaling, group, multiplexing, wideband.

**channel capacity** A measure of the maximum possible bit rate through a channel, subject to specified constraints. (188) *See also* channel.

**channel gate** A device for connecting a channel to a highway, or a highway to a channel, at specified times. *See also* channel, highway.

**channelization** The concept of using a single high-capacity facility to create many relatively lower capacity channels by subdividing the high-capacity facility. (188) *See also* bandwidth, channel, frequency-division multiplexing, time-division multiplexing.

**channel noise level** 1. The ratio of the channel noise at any point in a transmission system to some arbitrary amount of circuit noise chosen as a reference. (188) *Note:* This ratio is usually expressed as one of the following: decibels above reference noise (dBrn); decibels above reference noise, C-message weighting (dBrnC); or adjusted decibels (dBa). Each ratio reflects a circuit noise reading of a specialized instrument designed to measure various interfering effects under specified conditions. 2. The noise power density spectrum in the frequency range of interest. (188) 3. The average noise power in the frequency range of interest. (188) *See also* channel, circuit noise level, dBa, dBa0, dBm(psoph), dBm0, dBm0p, dBrn, dBrnC, level, noise, signal-plus-noise-to-noise ratio, signal-to-noise ratio.

**channel packing** A technique for maximizing the use of voice frequency channels used for data transmission by multiplexing a number of lower data rate signals into a single higher speed data stream for transmission on a single voice frequency channel. (188) *See also* channel, digital multiplexer, multiplexing.

**channel reliability (CR)** The percentage of time a channel was available for use in a specific direction during a specified period of scheduled availability given by

$$CR = 100 \left[ 1 - \frac{TO}{TS} \right]$$

$$= 100 \frac{TA}{TS},$$

where TO is the channel total outage time, TS is the channel total scheduled time, TA is the channel total available time, and TS = TA + TO. (188) *See also* channel, circuit reliability.

**channel service unit (CSU)** A line bridging device that is the last signal regeneration point before a multiplexer or the data termination equipment. *Note:* Used to perform loop-back testing and may perform bit stuffing; provides a framing and formatting pattern compatible with the network.

**channel supergroup** *See* group.

**channel time slot** A time slot starting at a particular instant in a frame and allocated to a channel for transmitting a character, in-slot signal, or other data. (188) *Note:* Where appropriate, a modifier may be added; e.g., "telephone channel time slot." *See also* channel, digital multiplexer, multiplexing, time-division multiple access, time-division multiplexing.

**character** 1. A letter, digit, or other symbol that is used as part of the organization, control, or representation of data. (188) 2. One of the units of an alphabet. (188)

**character check** A method of error detection using the preset rules for the formulation of characters. (188) *See also* character, cyclic redundancy check, error control, parity.

**character-count and bit-count integrity** The preservation of the precise number of characters or bits that are originated per message or per unit time. (188) *Note:* Not to be confused with bit integrity or character

integrity, which require that the characters or bits delivered are, in fact, as they were originated. *See also* added bit, binary digit, bit error ratio, bit inversion, bit slip, character, deleted bit, digital error, error.

**character generator** A functional unit that converts the coded representation of a character into the graphic representation of the character for display. (FP) (ISO)

**character interval** The total number of unit intervals (including synchronizing, information, error checking, or control bits) required to transmit any given character in any given communication system. Extra signals that are not associated with individual characters are not included. *Note:* An example of an extra signal that is excluded in the above definition is any additional time added between the end of the stop element and the beginning of the next start element as a result of a speed change, buffering, etc. This additional time is defined as a part of the intercharacter interval. *See also* character, intercharacter interval, unit interval.

**characteristic distortion** In telegraphy, the distortion caused by transients that, as a result of previous modulation, are present in the transmission channel. (188) *Note:* Its effects are not consistent; its influence upon a given transition is to some degree dependent upon the remnants of transients affecting previous signal elements. *See also* cyclic distortion, distortion, end distortion.

**characteristic frequency** A frequency that can be easily identified and measured in a given emission. A carrier frequency may, for example, be designated as the characteristic frequency. (RR) (188) *See also* frequency, reference frequency.

**characteristic impedance ( $Z_0$ )** 1. The impedance of a circuit that, when connected to the output terminals of a uniform transmission line of arbitrary length, causes the line to appear infinitely long. *Note:* A line terminated in its characteristic impedance will have no standing waves, no reflections from the end, and a



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constant ratio of voltage to current at a given frequency at every point on the line. 2. For Maxwell's equations the impedance of a linear, homogeneous, isotropic, dielectric, and electric-charge-free propagation medium, given by the relation  $Z=(\mu/\epsilon)^{1/2}$  where  $\mu$  is the magnetic permeability and  $\epsilon$  is the electric permeativity of the medium. *See also* Impedance, Iterative Impedance.

**character recognition** The identification of characters by automatic means. (FP) (ISO)

**character set** 1. A finite set of different characters that is complete for a given purpose. (FP) (ISO) (188) *Note 1:* Examples are: each of the character sets in ISO Recommendation R646, 6- and 7-bit Coded Character Sets for Information Processing Interchange. *Note 2:* A character set may or may not include punctuation marks or other symbols. 2. An ordered set of unique representations called characters. (188) *Note:* Examples are: the 26 letters of the English alphabet, Boolean 0 and 1, and the 128 ASCII characters. *See also* alphabet, alphanumeric, binary digit, character, code, coded character set, coded set, digital alphabet, language.

**character stepped** A form of operational control of start-stop teletypewriter equipment in which a device is stepped one character at a time. (188) *Note:* The step interval is equal to or greater than the character interval at the applicable signaling rate. *See also* bit-stepped, character.

**check** A process for determining accuracy. (FP)

**check bit** A binary digit used for error detection, for example, a parity bit. (188) *See also* binary digit, error, error control, overhead information, parity check, redundancy check.

**check character** A single character, derived from and appended to a data item, that can be used to detect errors in processing or transmitting a data item. (188) *See also* character, overhead information, parity check.

**check digit** A single digit, derived from and appended to a data item, that can be used to detect errors in processing or transmitting a data item. (188) *See also* overhead information, parity check.

**checksum** 1. The sum of a group of data items that is stored with the group and is used for checking purposes; the data items are either numeric or may be treated as numeric for the purposes of calculating the checksum. (FP) (ISO) 2. An error detection technique, based on a summation operation performed on the bits to be checked.

**chemical vapor deposition (CVD) technique** In optical fiber manufacturing, a process in which deposits are produced by heterogeneous gas-solid and gas-liquid chemical reactions at the surface of a substrate. *Note:* The CVD method is often used in fabricating optical fiber preforms by causing gaseous materials to react and deposit glass oxides. The preform may be processed further in preparation for pulling into an optical fiber. *See also* preform.

**chirping** 1. A rapid change (as opposed to a long-term drift) of the wavelength of an electromagnetic wave. *Note:* Chirping is most often observed in pulsed operation of a source. 2. A pulse compression technique that uses (usually linear) frequency modulation during the pulse. *See also* frequency fluctuation, frequency instability.

**chromatic dispersion** A commonly used (but redundant) synonym for material dispersion. *See* dispersion.

**chromatic dispersion coefficient  $[D(\lambda)]$**  The derivative of the normalized group delay,  $\tau(\lambda)$ , of a fiber with respect to wavelength, that is,

$$D(\lambda) = \frac{d\tau(\lambda)}{d\lambda}$$

**chromatic dispersion slope  $[S(\lambda)]$**  The derivative of the chromatic dispersion coefficient,  $D(\lambda)$ , of a fiber with respect to wavelength, that is,



$$S(\lambda) = \frac{dD(\lambda)}{d\lambda}$$

*See also zero-dispersion wavelength.*

**cipher** Any cryptographic system in which arbitrary symbols or groups of symbols, represent units of plain text of regular length, usually single letters, or in which units of plain text are rearranged, or both, in accordance with certain predetermined rules. (JCS1-DoD)

**cipher text** Enciphered information. *See also cipher, plain text.*

**ciphony** The process of enciphering audio information, resulting in encrypted speech. *See also cryptographic information, cryptology, cryptomaterial.*

**circuit** 1. The complete path between two terminals over which one-way or two-way communications may be provided. (188) 2. An electronic path between two or more points, capable of providing a number of channels. (JCS1-DoD) 3. A number of conductors connected together for the purpose of carrying an electrical current. (JCS1-DoD) 4. An electronic closed-loop path among two or more points used for signal transfer. (188)

**circuit breaker** A protective device for opening and closing a circuit between separable contacts under both normal and abnormal conditions. (188) *Note:* Circuit breakers may be of many types and sizes, and are usually classified according to the medium in which the interruption takes place; e.g., oil (or other liquid), or air (or other gas). *See also circuit, disconnect switch, protector, switch (def. #1).*

**circuit noise level** At any point in a transmission system, the ratio of the circuit noise at that point to some arbitrary amount of circuit noise chosen as a reference. (188) *See also channel noise level, circuit, image rejection ratio, level, noise, signal-plus-noise-to-noise ratio.*

**circuit reliability (CR)** The percentage of time a circuit was available to the user during a specified period of availability, given by

$$CR = 100 \left[ 1 - \frac{TO}{TS} \right]$$

$$= 100 \frac{TA}{TS}$$

where TO is the circuit total outage time, TS is the circuit total scheduled time, TA is the circuit total available time, and TS = TA + TO. (188) *Synonym time availability. See also channel reliability, circuit.*

**circuitry** A complex of circuits describing interconnection within or between systems. (JCS1-DoD) *See also circuit.*

**circuit switching** A method of handling traffic through a switching center, either from local users or from other switching centers, whereby a connection is established between the calling and called stations until the connection is released by either the called or calling station. (188) *See also circuit, message switching, packet switching, switching system.*

**circuit transfer mode** In ISDN applications, a transfer mode by means of permanent allocation of channels or bandwidth between connections. *See also connection, transfer mode.*

**circular polarization** In electromagnetic wave propagation, polarization such that the tip of the electric field vector describes a circle in any fixed plane intersecting, and normal to, the direction of propagation. The magnitude of the electric field vector is constant. (188) *Note:* A circularly polarized wave may be resolved into two linearly polarized waves in phase quadrature with their planes of polarization at right angles to each other. *See also antenna, clockwise polarized wave, elliptical polarization.*

**circulator** 1. In networking, a passive junction of three or more ports in which the ports can be accessed in such an order that when power

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is fed into any port it is transferred to the next port, the first port being counted as following the last in order. (188) 2. In radar, a device that switches the antenna alternately between the transmitter and receiver.

**C/kT** *Abbreviation for carrier-to-receiver noise density.*

**cladding** 1. When referring to an optical fiber, a layer of material of lower refractive index, in intimate contact with a core material of higher refractive index. (188) 2. When referring to a metallic cable, a process of covering with a metal (usually achieved by pressure rolling, extruding, drawing, or swaging) until a bond is achieved. (188) *See also* cable, core, deeply depressed cladding fiber, depressed cladding fiber, doubly clad fiber, fiber optics, multimode optical fiber, normalized frequency, optical fiber, single-mode optical fiber, tolerance field.

**cladding center** For an optical fiber, the center of the circle that circumscribes the outer surface of the homogeneous cladding. *See also* cladding, tolerance field.

**cladding diameter** For an optical fiber, the outer diameter of the region of low refractive index surrounding the core. (188) *See also* cladding, core diameter, fiber optics, tolerance field.

**cladding mode** In an optical fiber, a transmission mode supported by the cladding; i.e., a mode in addition to the modes supported by the core material. (188) *See also* bound mode, leaky mode, mode, radiation mode.

**cladding mode stripper** A device for converting optical fiber cladding modes to radiation modes; as a result, the cladding modes are removed from the fiber. *Note:* Often a material such as the fiber coating or jacket having a refractive index equal to or greater than that of the fiber cladding will perform this function. *See also* cladding, cladding mode.

**cladding noncircularity** For an optical fiber, the percentage of deviation from a circle of the

cladding's cross-section. *Synonym* cladding ovality.

**cladding ovality** *Synonym* cladding noncircularity.

**cladding ray** In an optical fiber, a ray that is confined to the core and cladding by virtue of reflection from the outer surface of the cladding. *Note:* Cladding rays correspond to cladding modes in the terminology of mode descriptors. *See also* cladding mode, guided ray, leaky ray.

**C-language** A general-purpose, structured programming language, originally designed for and implemented on the UNIX™ operating system.

**CLASS** *Acronym for custom local area signaling services.*

**classmark** A designator used to describe the service feature privileges, restrictions, and circuit characteristics for lines or trunks accessing a switch; e.g., precedence level, conference privilege, security level, zone restriction. (188) *Synonym* class-of-service mark. *See also* blocking, call restriction, calls-barred facility, class of service, code restriction, controlled access, line load control, precedence, restricted access, service feature.

**class of emission** The set of characteristics of an emission, designated by standard symbols, e.g., type of modulation of the main carrier, modulating signal, type of information to be transmitted, and also if appropriate, any additional signal characteristics. (RR)

**class of office** A ranking assigned to each switching center in a communications network determined by the center's switching functions, interrelationships with other offices, and transmission requirements. *See also* office classification.

**class of service** 1. A designation assigned to describe the service treatment and privileges given to a particular terminal. (188) 2. A subgrouping of telephone users for the sake of

rate distinction. *Note:* This may distinguish between individual and party lines, between Government lines and others, between those permitted to make unrestricted international dialed calls and others, between business or residence and coin, between flat rate and message rate, and between restricted and extended area service. 3. A category of data transmission provided in a public data network in which the data signaling rate, the terminal operating mode, and the code structure (if any) are standardized. *Note:* This is defined within CCITT Recommendations X.1. *Synonym* user service class. *See also* call restriction, classmark.

**class-of-service mark** *Synonym* classmark.

**clear** To cause one or more storage locations to be in a prescribed state, usually that corresponding to a zero or that corresponding to the space character. (FP) (ISO)

**clear channel** A signal path that provides its full bandwidth for a user's service. *Note:* No control or signaling is performed on this path. *See also* bandwidth.

**clear collision** Contention that occurs when a DTE and a DCE simultaneously transfer a clear request packet and a clear indication packet specifying the same logical channel. *Note:* The DCE will consider that the clearing is completed and will not transfer a DCE clear confirmation packet. *See also* call collision, clear confirmation signal, collision, data circuit-terminating equipment, data terminal equipment.

**clear confirmation signal** A call control signal to acknowledge reception of the DTE clear request by the DCE or the reception of the DCE clear indication by the DTE. *See also* call control signal, clear collision, data circuit-terminating equipment, data terminal equipment, signal.

**clearing** 1. A sequence of events used to disconnect a call and return to the ready state. (188) 2. A procedure used to erase the sensitive information stored on a magnetic

medium. *Note:* Clearing creates a product which may be reused within, but not outside of, a secure facility. It does not produce a declassified product by itself, but is the first step in the declassification process. *See also* call, disengagement time.

**clear text** *Synonym* plain text.

**clipper** A circuit or device that limits the instantaneous output signal amplitude to a predetermined maximum value, regardless of the amplitude of the input signal. (188) *See also* companding, compandor, compressor, expander, limiter, peak limiting, vogad.

**clipping** 1. In telephony, the loss of the initial or final parts of a word, words, or a syllable, usually owing to the nonideal operation of voice-actuated devices. 2. Limiting of the instantaneous signal amplitudes to a predetermined maximum value. (188) 3. The removal of those parts of display elements that lie outside of a given boundary. (FP) (ISO)

**clock** 1. A reference source of timing information. (188) 2. A device providing signals used in a transmission system to control the timing of certain functions such as the duration of signal elements or the sampling rate. (188) 3. A device that generates periodic, accurately spaced signals used for such purposes as timing, regulation of the operations of a processor, or generation of interrupts. (FP) (ISO) *See also* coordinated clock, Coordinated Universal Time, DoD master clock, master clock, precise time, reference clock.

**clock difference** A measure of the separation between the respective time marks of two clocks. (188) *Note:* Clock differences must be reported as algebraic quantities measured on the same time scale. The date of the measurement should be given. Example: 1645 UT, 7 October 1992; UTC(USNO)-UTC(USAF Primary #1) =  $-0.9 \mu\text{s} \pm 0.2 \mu\text{s}$ . The local clock must be subtracted from the reference clock to get the proper sign.

**clock error** The difference between local clock time or value and a designated reference clock

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time or value. *Note:* Subtracting the clock difference from the local clock brings the local clock into agreement with the reference clock. *See also* error, local clock, reference clock.

**clock phase slew** The rate of relative phase change between a given clock signal and a stable reference signal. (188) *Note:* The two signals are generally at or near the same frequency or have an integral multiple frequency relationship. *See also* clock, phase.

**clock tolerance** The maximum permissible departure of a clock indication from a designated time reference such as Coordinated Universal Time (UTC).

**clock track** A track on which a pattern of signals is recorded to provide a timing reference. (FP) (ISO) *See also* track.

**clockwise polarized wave** An elliptically or circularly polarized electromagnetic wave in which the direction of rotation of the electric vector is clockwise as seen by an observer looking in the direction of propagation of the wave. (188) *See also* circular polarization, elliptical polarization.

**closed circuit** 1. In radio and television transmission, used to indicate that the programs are transmitted directly to specific users and not broadcast for general consumption. (188) 2. In telecommunications, a circuit dedicated to specific users. (188) *Note:* The circuit may be active or inactive at any given time. 3. A completed electrical circuit. *See also* circuit, dedicated circuit.

**closed-loop noise bandwidth** The integral, over all frequencies, of the absolute value of the closed-loop transfer function of a phase-locked loop. The closed-loop noise bandwidth when multiplied by the noise spectral density gives the output noise in a phase-locked loop. *See also* phase-locked loop.

**closed loop transfer function** A mathematical expression (algorithm) describing the net result of the effects of a closed (feedback) loop on the input signal to the circuits enclosed by the

loop. *Note:* It is measured at the output signal from the circuits enclosed by the loop. *See also* feedback, loop, regeneration.

**closed user group** A group of specified users of a data network that is assigned a facility that permits them to communicate with each other but precludes communications with all other users of the service or services. A user data terminal equipment may belong to more than one closed user group. (FP) (ISO) *See also* data, facility (defs. # 2 & 3).

**closed user group with outgoing access** A closed user group in which at least one member of the group has a facility that permits communication with one or more users external to the closed user group.

**C-message weighting** A noise weighting used in a noise measuring set to measure noise on a line that would be terminated by a 500-type or similar instrument. (188) *Note:* The meter is calibrated in dBrnC. *See also* flat weighting, F1A-line weighting, HA1-receiver weighting, message, 144-line weighting, 144-receiver weighting.

**CMRR** *Abbreviation for common-mode rejection ratio.*

**CNR** *Abbreviation for carrier-to-noise ratio, combat net radio.*

**CNS** *Abbreviation for complementary network services.*

**C.O.** *Abbreviation for central office.*

**COAM** *Acronym for customer owned and maintained equipment. Deprecated term. See customer premises equipment.*

**coast Earth station** An Earth station in the fixed-satellite service or, in some cases, in the maritime mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the maritime mobile-satellite service. (RR)

**coasting mode** In timing-dependent systems, a free-running operational timing mode in which continuous or periodic measurement of timing error is not available. *Note:* In some systems, operation in this mode can be enhanced for a period of time by using clock or timing error (or correction) information obtained during a prior tracking mode to estimate clock or timing corrections to be made in the free-running mode. *See also* tracking mode.

**coast station** A land station in the maritime mobile service. (RR)

**coax** *Acronym for coaxial cable.*

**coaxial cable (coax)** A cable consisting of a center conductor surrounded by an insulating material and a concentric outer conductor. (188) *Note:* Used primarily for wideband, video, or radio frequency service. *See also* cable.

**coaxial patch bay** *See* patch bay.

**COBOL** *Acronym for common business oriented language.* A programming language designed for business data processing. (After FP)

**co-channel interference** Interference resulting from two or more transmissions on the same channel (def. # 3). *See also* adjacent channel interference, interference.

**code** 1. A set of unambiguous rules specifying the manner in which data may be represented in a discrete form. *Note:* In the broadest sense, coding is a means of converting information into a form suitable for communications, processing, or encryption. (188) 2. Any system of communication in which arbitrary groups of symbols represent units of plain text of varying length. Codes may be used for brevity or for security. (JCS1-DoD) *Note:* Common categories are codes used to convert information into a form suitable for communications or encryption, brevity codes which reduce the length of time required to transmit information, codes used to describe the instructions which control the operation of a computer, cryptographic codes used to

convert plain text to meaningless combinations of letters or numbers and vice versa. 3. A cryptosystem in which the cryptographic equivalents (usually called "code groups") typically consisting of letters or digits (or both) in otherwise meaningless combinations are substituted for plain text elements which are primarily words, phrases, or sentences. (JCS1-DoD) 4. A set of rules that maps the elements of one set, the coded set, onto the elements of another set, the code element set. (FP) (ISO) *Synonym* coding scheme. 5. A set of items, such as abbreviations, that represent the members of another set. (FP) (ISO) 6. To represent data or a computer program in a symbolic form that can be accepted by a processor. (FP) (ISO) 7. To write a routine. (FP) (ISO)

**codec** *Acronym for coder-decoder.* 1. An assembly comprising an encoder and a decoder in the same equipment. (188) 2. A circuit that converts analog signals to digital code and vice versa. *See also* code, pulse-code modulation.

**code character** The representation of a discrete value or symbol in accordance with a code. (188) *See also* alphabet, character, code, digital alphabet.

**code conversion** 1. Conversion of character signals or groups of character signals in one code into corresponding signals or groups of signals in another code. (188) 2. A process for converting a code of some predetermined bit structure; e.g., 5, 7, or 14 bits per character interval, to a second code with the same or a different number of bits per character interval. No alphabetical significance is assumed in this process. *See also* binary digit, character, code, line code, pulse-code modulation, signal.

**coded character set** A set of unambiguous rules that establish a character set and the one-to-one relationships between the characters of the set and their coded representations. (188) *See also* character, character set, code, digital alphabet.



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**coded image** A representation of a display image in a form suitable for storage and processing. (FP) (ISO)

**code-division multiple access (CDMA)** A coding scheme in which digital information is encoded in an expanded bandwidth format. (188) *Note:* Several transmissions can occur simultaneously within the same bandwidth with the mutual interference reduced by the degree of orthogonality of the unique codes used in each transmission. It permits a high degree of energy dispersion in the emitted bandwidth. *See also* carrier sense multiple access, code, modulation, spread spectrum.

**coded set** A set of elements onto which another set of elements has been mapped according to a code, for example, the list of names of airports that is mapped onto a corresponding set of three-letter representations of airport names. (FP) (ISO) *See also* alphabet, character set, code, digital alphabet.

**code element** One of a set of parts, of which the characters in a given code may be composed. (188) *See also* binary digit, character, mark, space.

**code-excited linear prediction (CELP)** An analog-to-digital voice coding scheme. *See also* linear predictive coding.

**code group** A group of letters or numbers or both in a code system used to represent a plain text word, phrase, or sentence. (188) *See also* code, group (def. #4).

**code-independent data communication** A mode of data communication that uses a character-oriented protocol that does not depend on the character set or the code used by the data source. (FP) (ISO) *Synonym* code-transparent data communication. *See also* code, data, data communication, data transmission, transparency.

**coder** *Synonym* analog-to-digital converter.

**code restriction** A service feature wherein certain terminals are prevented from having

access to certain features of the network. *See also* classmark, restricted access, service feature.

**code-transparent data communication** *Synonym* code-independent data communication.

**code word** 1. A sequence of symbols conforming to the rules of generation of a language, such as an error-detection-or-correction code. (188) 2. A cryptonym used to identify sensitive intelligence data. (JCS1-DoD) (JCS1-NATO) (188) 3. A word which has been assigned a classification and a classified meaning to safeguard intentions and information regarding a classified plan or operation. (JCS1-DoD) (JCS1-NATO) *See also* code, word.

**coding scheme** *Synonym* code (def. #4).

**COG** *Abbreviation for* centralized ordering group.

**coherence area** In optical communications, the area in a plane perpendicular to the direction of propagation over which light may be considered highly coherent. (188) *Note:* Commonly, the area over which the degree of coherence exceeds 0.88. *See also* coherence length, coherence time, coherent, degree of coherence.

**coherence length** The propagation distance over which a light beam may be considered coherent. (188) *Note:* If the spectral width of the source is  $\Delta\lambda$  and the central wavelength is  $\lambda$ , the coherence length in a medium of refractive index  $n$  is approximately  $\lambda^2/(n\Delta\lambda)$ . *See also* coherence area, coherence time, degree of coherence, spectral width.

**coherence of frequency** *See* phase coherence.

**coherence of phase** *See* phase coherence.

**coherence time** For optical communications, the time over which a propagating light beam may be considered coherent. (188) *Note:* It is equal to coherence length divided by the phase velocity of light in a medium; approximately given by  $\lambda^2/c\Delta\lambda$ , where  $\lambda$  is the central wavelength,  $\Delta\lambda$  is the spectral width, and  $c$  is



the velocity of light in vacuum. In long-distance transmission systems, the coherence time may be degraded by other propagation factors. *See also* coherence area, coherence length, degree of coherence, monochromatic.

**coherent** Pertaining to a fixed phase relationship between corresponding points on an electromagnetic wave. (188) *Note:* A truly coherent wave would be perfectly coherent at all points in space. In practice, however, the region of high coherence may extend over only a finite distance. *See also* phase, phase coherence.

**coherent bundle** *Synonym* aligned bundle.

**coherent pulse operation** The method of pulse operation in which a fixed phase relationship of the carrier wave is maintained from one pulse to the next. (188) *See also* fixed reference modulation, phase.

**coherent radiation** *See* coherent.

**collimation** The process by which a divergent or convergent beam of electromagnetic radiation is converted into a beam with the minimum divergence or convergence possible for that system (ideally, a bundle of parallel rays). (188) *See also* beam divergence, decollimation.

**collimator** An optical device that renders diverging or converging light rays parallel. (188) *Note:* The degree of collimation (or parallelism) should be stated.

**collision** 1. In a data transmission system, the situation that occurs when two or more demands are made simultaneously on equipment that can handle only one at any given instant. (188) 2. In a computer, the situation that occurs when the same address is obtained for two different data items that are to be stored at that address. *See also* call collision, carrier sense multiple access, clear collision, data transmission.

**color-division multiplexing** *See* wavelength-division multiplexing

**combat-net radio (CNR)** A radio operating in a network, providing a half-duplex circuit employing a single radio frequency or a discrete set of radio frequencies (frequency hopping). (188) *Note:* These radios are primarily used for command and control of combat, combat support, and combat service support operations between and among ground, naval, and airborne forces. *See also* tactical communication.

**combinational logic element** A device having at least one output channel and one or more input channels, all characterized by discrete states, such that at any instant the state of each output channel is completely determined by the states of the input channels at the same instant.

**combined distribution frame (CDF)** A distribution frame that combines the functions of main and intermediate distribution frames. The frame contains both vertical and horizontal terminating blocks. The vertical blocks are used to terminate the permanent outside lines entering the station. Horizontal blocks are used to terminate inside plant equipment. This arrangement permits the association of any outside line with any desired terminal equipment. These connections are made with twisted pair wire, normally referred to as jumper wire, or with optical fiber cables, normally referred to as jumper cables. (188) *Note:* In technical control facilities, the vertical side may be used to terminate equipment as well as outside lines. The horizontal side is then used for jackfields and battery terminations. *See also* distribution frame, frame, intermediate distribution frame, main distribution frame, technical control facility.

**combiner** *See* maximal-ratio combiner, selective combiner.

**COMINT** *Acronym for* communications intelligence.

**comma-free code** A code constructed such that any partial code word, beginning at the start of a code word but terminating prior to the end of that code word, is not a valid code word. *Note 1:* The comma-free property permits the

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proper framing of transmitted code words, provided that (a) external synchronization is provided to identify the start of the first code word in a sequence of code words, and (b) no uncorrected errors occur in the symbol stream. *Note 2:* Huffman codes (variable length) are examples of comma-free codes. *Synonym prefix-free code. See also code, self-synchronizing code.*

**command** 1. An order for an action to take place. (FP) 2. A control signal. (FP) 3. That part of a computer instruction word that specifies the operation to be performed. 4. *Loosely*, a mathematical or logic operator. (FP) *See also command frame.*

**command and control (C<sup>2</sup>)** The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. (JCS1-DoD)

**command and control (C<sup>2</sup>) system** The facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the missions assigned. (JCS1-DoD)

**command, control and communications (C<sup>3</sup>)** The capabilities required by commanders to exercise command and control of their forces. (JCS Pub 18, *Operations Security*, Dec. 1982.)

**command frame** In data transmission, a frame, containing a command, transmitted by a primary station. *See also command, frame.*

**command net** A communications network which connects an echelon of command with some or all of its subordinate echelons for the purpose of command control. (JCS1-DoD) (JCS1-NATO) *See also network.*

**commercial carrier** *Synonym common carrier.*

**commonality** 1. A quality that applies to materiel or systems: (a) possessing like and interchangeable characteristics enabling each to be utilized, or operated and maintained by personnel trained on the others without additional specialized training; (b) having interchangeable repair parts and/or components; (c) applying to consumable items interchangeably equivalent without adjustment. (JCS1-DoD) 2. A term applied to equipment or systems that have the quality of one entity possessing like and interchangeable parts with another equipment or system entity. (188) *See also compatibility, interchangeability, interface, interoperability, transparency, transparent interface.*

**common battery** A battery that serves as a central source of energy for many similar circuits. (188) *Note 1:* In many telecommunication applications, a common battery is nominally -48 volts dc. *Note 2:* A telephone switch common battery supplies power to operate all directly connected simple instruments.

**common battery signaling** A system in which the signaling power of a telephone is supplied by the battery at the servicing switchboard. (188) *Note:* Switchboards may be manual or automatic, and "talking power" may be supplied by common or local battery.

**common carrier** 1. An organization that provides telecommunication facilities, services, or classes of service to the public for hire. (188) 2. Any person engaged as a common carrier for hire, in interstate or foreign communication by wire or radio or in interstate or foreign radio transmission of energy, except where reference is made to common carriers not subject to [this Act]; but a person engaged in radio broadcasting shall not, insofar as such person is so engaged, be deemed a common carrier. *Note:* "Person" means an individual, a corporation, a partnership, an association, a joint-stock company, a business trust, or any other organized group, or any receiver or trustee. (CFR 47) *Synonyms carrier,*

**commercial carrier.** *See also* divestiture, other common carrier, resale carrier, specialized common carrier.

**common-channel interoffice signaling (CCIS)** In multichannel switched networks, a method of transmitting all signaling information for a group of trunks by encoding it and transmitting it over a separate voice channel using time-division digital techniques. *See also* channel, signal.

**common-channel signaling** In a multichannel network, a signaling method using a separate channel for the control, accounting, and management of traffic. (188) *Note:* The same channels that are used for signaling (frequency bands or time slots) are not used for message traffic. *Synonym* separate channel supervisory signaling. *See also* channel, in-band signaling, out-of-band signaling, signal, Signaling System No. 7, signal transfer point.

**common control** An automatic switching arrangement in which the control equipment necessary for the establishment of connections is shared, being associated with a given call only during the period required to accomplish the control function. (188) *Note:* The same channels that are used for signaling (frequency bands or time slots) are not used for message traffic. *See also* switching system.

**common control switching arrangement (CCSA)** An arrangement in which switching for a private network is provided by one or more common control switching systems. *Note:* The switching systems may be shared by several private networks and also may be shared with the public telephone networks. *See also* switching system.

**common control system** An automatic switching system that makes use of common equipment to establish a connection. (188) *Note:* The common equipment then becomes available to establish other connections. *See also* common equipment, communications system.

**common equipment** Items used by more than one channel or equipment function. (188)

**common-mode interference** 1. Interference that appears between signal leads, or the terminals of a measuring circuit, and ground. (188) 2. A form of coherent interference that affects two or more elements of a network in a similar manner (i.e., highly coupled) as distinct from locally generated noise or interference that is statistically independent between pairs of network elements. *See also* differential mode interference, interference, mode.

**common-mode rejection ratio (CMRR)** The ratio of the common-mode interference voltage at the input of a circuit, to the corresponding interference voltage at the output. (188) *See also* interference, mode.

**common-mode voltage** 1. The voltage common to both input terminals of a device. (188) 2. In a differential amplifier, the unwanted part of the voltage between each input connection point and ground that is added to the voltage of each original signal. (FP) (ISO) *See also* mode (def. #1).

**common return** A return path that is common to two or more circuits and that serves to return currents to their source or to ground. (188) *See also* circuit, ground-return circuit, neutral, unbalanced wire circuit.

**common return offset** The dc common return potential difference of a line. (188) *See also* balanced, unbalanced line, unbalanced wire circuit.

**common trunk** In telephone systems having a grading arrangement, a trunk accessible to all groups of the grading. *See also* trunk.

**common user circuit** A circuit designated to furnish a communication service to a number of users. (188) *See also* circuit.

**common user network** A system of circuits or channels allocated to furnish communication paths between switching centers to provide communication service on a common basis to all connected stations or subscribers. It is sometimes described as a general purpose

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**network.** (JCS1-DoD) *See also* channel, circuit, network.

**communication deception** Use of devices, operations, and techniques with the intent of confusing or misleading the user of a communications link or a navigation system. (JCS1-DoD)

**communications** 1. A method or means of conveying information of any kind from one person or place to another. (JCS1-DoD) 2. A method or means of conveying information of any kind from one person or process to other person(s) or process(es) by a telecommunication medium. (188)

**communications center** 1. An agency charged with the responsibility for handling and controlling communications traffic. The center normally includes message center, transmitting, and receiving facilities. (JCS1-DoD) (JCS1-NATO) 2. A facility that serves as a node for a communication network(s). It is equipped for technical control and maintenance of the circuits originating, transiting, or terminating at the node. It may be provided with message center facilities and may serve as a gateway between networks. (188) *See also* information processing center.

**communications channel** *See* channel.

**communications-electronics (C-E)** The specialized field concerned with the use of electronic devices and systems for the acquisition or acceptance, processing, storage, display, analysis, protection, disposition, and transfer of information. (188) *Note:* It applies to and includes the wide range of responsibilities and actions relating to the electronic devices and systems that are used in the transfer of ideas and perceptions, to those electronic sensors and sensory systems that are used in the acquisition of information devoid of semantic influence, and to those electronic devices and systems that are intended to allow friendly forces to operate in a hostile environment and to deny to hostile forces the effective use of electromagnetic resources. *See also* communications.

**communications intelligence (COMINT)** Technical and intelligence information derived from foreign communications by other than the intended recipients. (JCS1-DoD)

**communications net** An organization of stations capable of direct communication on a common channel or frequency. (JCS1-DoD) (JCS1-NATO) *Synonym* net. *See also* communications, network.

**communications net operation** *See* net operation.

**communications network** An organization of stations capable of intercommunications but not necessarily on the same channel. (JCS1-DoD) *Synonym* net. *See also* communications, network.

**communications processor unit (CPU)** A computer unit embedded in a communications system, e.g., the message data processor of an AUTODIN Switching Center. (188) *Note:* "CPU" is also used as an abbreviation for "central processing unit" of a computer. *See also* central processing unit, communications, computer.

**communications satellite** An orbiting vehicle that relays signals between communications stations. There are two types: (a) active communications satellite--a satellite that receives, regenerates, and retransmits signals between stations; and (b) passive communications satellite--a satellite that reflects communications signals between stations. (JCS1-DoD) (JCS1-NATO) *See also* communications, satellite.

**communications security (COMSEC)** The protection resulting from all measures designed to deny unauthorized persons information of value which might be derived from the possession and study of telecommunications, or to mislead unauthorized persons in their interpretation of the results of such possession and study. Communications security includes: (a) cryptosecurity; (b) transmission security; (c) emission security; and (d) physical security of

communications security materials and information. (JCS1-DoD)

(a) **cryptosecurity:** The component of communications security which results from the provision of technically sound cryptosystems and their proper use. (JCS1-DoD)

(b) **transmission security:** The component of communications security which results from all measures designed to protect transmissions from interception and exploitation by means other than cryptanalysis. (JCS1-DoD)

(c) **emission security:** The component of communications security which results from all measures taken to deny unauthorized persons information of value that might be derived from intercept and analysis of compromising emanations from crypto-equipment and telecommunications systems. (JCS1-DoD)

(d) **physical security:** The component of communications security which results from all physical measures necessary to safeguard classified equipment, material, and documents from access thereto or observation thereof by unauthorized persons. (JCS1-DoD)

*See also* alarm sensor (def. #2), BLACK signal, bug, bulk encryption, communications, compromise, compromising emanations, controlled access, controlled area, cryptology, emission control, failure access, information systems security, limited protection, RED/BLACK concept, RED signal, vocoder.

**communications security equipment** Equipment designed to provide security to telecommunications by converting information to a form unintelligible to an unauthorized interceptor and by reconverting such information to its original form for authorized recipients, as well as equipment designed specifically to aid in, or as an essential element of, the conversion process. Communications security equipment is cryptoequipment, cryptoancillary equipment, cryptoproduction equipment, and authentication equipment. (JCS1-DoD) *See also* communications security.

**communications security material** All documents, devices, equipment, or apparatus, including cryptomaterial, used in establishing

or maintaining secure communications. (JCS1-DoD) *See also* communications security.

**communications sink** A device, e.g., a receiver, that receives information, control, or other signals from a communications source(s). (188) *See also* communications, destination user, source user, user.

**communications source** A device, e.g., a transmitter, that generates information, control, or other signals destined for a communications sink(s). (188) *See also* communications, destination user, source user, user.

**communications subsystem** A functional or operational assembly that is smaller than the larger assembly under consideration. (188) *Note:* In the DCS, a satellite link with one Earth terminal in CONUS and one in Europe is a subsystem of the DCS; the interconnect facilities at each Earth terminal are subsystems of the satellite link; and an optical fiber cable with its driver and receiver could be a subsystem of either of the interconnect facilities. *See also* assembly, communications, component, link.

**communications system** A collection of individual communication networks, transmission systems, relay stations, tributary stations, and terminal equipment capable of interconnection and interoperation to form an integral whole. (188) *Note:* These individual components must serve a common purpose, be technically compatible, employ common procedures, respond to some form of control, and, in general, operate in unison. *See also* common control system, communications, error-correcting system, error-detecting system, hybrid communication network, link, neutral direct current telegraph system, polarential telegraph system, protected distribution system, switching system, tactical communications system, wideband.

**communications system engineering** The translation of user requirements for the exchange of information into cost-effective and low-risk technical solutions in terms of equipment and subsystems. (188) *Note:* It



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encompasses the integration of these parts into a complete entity resulting in a minimum investment for the entire system life cycle required to satisfy the requirements of a majority of users of the communication system. *See also* communications, communications system.

**communications system survivability** *See* survivability.

**communications zone** Rear part of theater of operations (behind but contiguous to the combat zone), which contains the lines of communications, establishments for supply and evacuation, and other agencies required for the immediate support and maintenance of the field forces. (JCS1-DoD) (JCS1-NATO) *See also* communications.

**community antenna television (CATV)** A television distribution method whereby signals from distant stations are received, amplified, and then transmitted by (coaxial or fiber) cable or microwave links to subscribers. *Note 1:* In most countries CATV originated in areas where good reception of direct broadcast TV was not possible. Now CATV also provides a highly sophisticated cable distribution system to large metropolitan areas in direct and successful competition with direct broadcasting. *Note 2:* The abbreviation "CATV" originally applied to this technology. However, "CATV" is now typically used to mean "cable TV".

**community of interest** A grouping of users who generate a majority of their traffic in calls to each other. It may be related to a geographic area or to an administrative organization. *See also* call, closed user group.

**community reception** [in the broadcasting-satellite service] The reception of emissions from a space station in the broadcasting-satellite service by receiving equipment, which in some cases may be complex and have antennae larger than those used for individual reception, and intended for use:

--by a group of the general public at one location; or

--through a distribution system covering a limited area. (RR)

**compact** *Synonym* compress.

**compaction** *See* data compression.

**companding** An operation that compresses the dynamic range of signals before transmission and expands the dynamic range to the original value at the receiver. (188) *Note:* Companding allows signals to be transmitted over facilities that have a smaller dynamic range than the signals. This effectively reduces the noise and crosstalk levels at the receiver. *See also* clipper, compandor, compressor, expander.

**compandor** A device that incorporates a compressor and an expander, each of which may be used independently. (188) *See also* clipper, companding, compression ratio, compressor, expander, peak limiting, vogad.

**comparably efficient interconnection (CEI)** An equal-access concept developed by the FCC stating that, "... if a carrier offers an enhanced service, it should be required to offer network interconnection (or collocation) opportunities to others that are comparably efficient to the interconnection that its enhanced service enjoys. Accordingly, a carrier would be required to implement CEI only as it introduces new enhanced services." (FCC Report and Order June 16, 1986) *See also* unbundling.

**comparator** 1. In analog computing, a functional unit that compares two analog variables and indicates the result of that comparison. (FP) (ISO) 2. A device that compares two items of data and indicates the result of that comparison. (FP) (ISO) 3. A device for determining the dissimilarity of two items such as two pulse patterns or words. (FP)

**compartmentation** A method employed to segregate information of different desired accessibilities from each other. (188) *Note:* It may be used for communications security purposes.



**compatibility** 1. Capability of two or more items or components of equipment or material to exist or function in the same system or environment without mutual interference. (JCS1-DoD) (JCS1-NATO) (188) *See also* commonality, electromagnetic compatibility, fully intermateable connectors, interchangeability, interoperability, mobile service, mobile station, portability, transportability. 2. In computing, the ability to execute programs on different types of computers, without modification.

**compatible sideband transmission** That method of independent sideband transmission wherein the carrier is deliberately reinserted at a lower level after its normal suppression to permit reception by conventional AM receivers. (188) *Note:* The normal method of transmitting compatible SSB (AME) is the emission of the carrier plus the upper sideband. *Synonym* amplitude modulation equivalent. *See also* sideband transmission.

**compelled signaling** A signaling method in which the transmission of each signal in the forward direction is inhibited until an acknowledgement of the satisfactory receipt of the previous signal has been sent back from the receiver terminal. *See also* acknowledge character, error control, negative acknowledge character, packet switching, signal.

**compile** 1. To translate a computer program expressed in a high-level language into a program expressed in an intermediate language, assembly language, or a machine language. (FP) (ISO) 2. To prepare a machine language program from a computer program written in another programming language by making use of the overall logic structure of the program, or by generating more than one computer instruction for each symbolic statement, or both, as well as performing the function of an assembler. (FP) *See also* Ada®, assembly language, computer, computer language, computer-oriented language, high-level language, machine language, programmer.

**compiler** A computer program for compiling. (FP) (ISO) *Synonym* compiling program. *See also* compile.

**compiling program** *Synonym* compiler.

**complementary network services (CNS)** The means for an enhanced-service provider's customer to connect to the network and to the enhanced service provider. *Note:* Complementary network services usually consist of the customer's local service (e.g., business or residence line) and several associated service options, e.g., call-forwarding service. *See also* call forwarding.

**component** 1. An assembly, or part thereof, that is essential to the operation of some larger assembly. It is an immediate subdivision of the assembly to which it belongs. (188) *Note:* The proper usage of the term is dependent on the frame of reference. A radio receiver may be considered to be a component of a complete radio set (transmitter-receiver) if the radio set is part of a larger system. The same receiver could also be considered as a subsystem, in which case the IF amplifier section would be a component of the receiver but not of the radio set. Similarly, a resistor, capacitor, vacuum tube, transistor, or other item within the IF amplifier section is a component of that section. 2. A part or combination of parts, having a specified function, which can only be installed or replaced as a whole, and is also generally expendable. (JCS1-DoD) (JCS1-NATO) *See also* assembly, communications subsystem.

**composited circuit** A circuit that can be used simultaneously for telephony and dc telegraphy, or signaling; separation between the two being accomplished by frequency discrimination. *Synonym* voice-plus circuit. *See also* circuit, speech-plus-duplex operation, speech-plus signaling or telegraph.

**composite signaling (CX)** A signaling arrangement to provide means for direct current signaling and dial pulsing beyond the range of loop signaling methods. (188) *Note:* Composite signaling, like DX signaling, permits

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**duplex operation** in that it provides simultaneous two-way signaling. *Synonym* CX signaling. *See also* dial signaling, direct current signaling, pulse, signal.

**composite two-tone test signal** A test signal used for intermodulation distortion measurements. (188) *See also* intermodulation distortion, signal.

**compound signal** In ac signaling, a signal consisting of the simultaneous transmission of more than one frequency. *Note:* Dual-tone multifrequency signaling is an example of compound signaling. *See also* signal.

**compress** To reduce the space taken on a data medium by encoding or removing repetitive characters. (FP) (ISO) *Synonym* compact.

**compression** A process in which the dynamic range of a signal is reduced by controlling it as a function of the inverse relationship of its instantaneous value relative to a specified reference level. (188) *Note 1:* Input levels that are low relative to the reference level thus realize a relative increase, and levels that are high relative to the reference level thus realize a relative decrease. *Note 2:* Compression is usually accomplished by separate devices called compressors and is used for many purposes, such as: improving signal-to-noise ratios, preventing overload of succeeding elements of a system, or matching the dynamic ranges of two devices. *Note 3:* The amount of compression (expressed in decibels) may be a linear or nonlinear function of the signal level across the frequency band of interest and may be essentially instantaneous or have fixed or variable delay times. *Note 4:* Compression always introduces distortion, which is usually not objectionable, provided the compression is limited to a few decibels. 2. In facsimile systems, a process wherein the number of pels scanned on the original is larger than the number of encoded bits of picture information transmitted. (188) *See also* compander, compression ratio, compressor, expander, expansion, level, redundancy.

**compression ratio** 1. The ratio of the dynamic range of a compressor's input signals to the dynamic range of the compressor's output signals, usually expressed in decibels. *Note:* A 40-dB input range compressed to a 25-dB output range would exhibit 15 dB of compression. 2. In digital facsimile, the ratio of the total pels scanned for the original to the total encoded bits sent for picture information. 3. The ratio of the gain of a device at a low power level to the gain at some higher level, usually expressed in decibels. *See also* compandor, compression, expander, level.

**compressor** A device with a nonlinear gain characteristic that has a lower gain on higher input levels than it does on lower input levels. (188) *Note:* Usually used to allow signals with a greater dynamic amplitude range to be sent through devices and circuits with a more limited range. *See also* attack time, automatic gain control, clipper, companding, compandor, expander, limiter, peak limiting, voad.

**compromise** 1. The known or suspected exposure of clandestine personnel, installations, or other assets or of classified information or material, to an unauthorized person. (JCS1-DoD) 2. The disclosure of cryptographic information, or recovery of plain text of encrypted messages by unauthorized persons through cryptanalysis methods. 3. The disclosure of information or data to persons not authorized to receive it. 4. A violation of the security policy of an automated information system such that an unauthorized disclosure of sensitive information may have occurred. *See also* communications security.

**compromising emanations** Unintentional intelligence-bearing signals that, if intercepted and analyzed, disclose the information transmission received, handled, or otherwise processed by any information processing equipment. (188) *See also* communications security, RED/BLACK concept, TEMPEST.

**computer** 1. A device capable of accepting and processing information and supplying the results. It usually consists of input, output, storage, arithmetic, logic, and control units.

(188) **2.** A functional unit that can perform substantial computation, including numerous arithmetic operations or logic operations, without intervention by a human operator during a run. *Note 1:* This definition has been approved by the Customs Council to distinguish between a computer and other similar devices. *Note 2:* Computers have been loosely classified into microcomputers, minicomputers, and main-frame computers, based on their size. These distinctions are becoming less valid as the capabilities of even the smaller units have increased. Today's microcomputer can be much more versatile than last year's minicomputer and even more powerful than the main-frame computer of a few years ago. *See also* analog computer, assembly language, central processing unit, communications processor unit, compile, computer language, concentrator, digital computer, front-end processor, high-level language, machine language, multi-processing, overlay, programmer, software.

**computer conferencing** 1. The ability for multiple users/groups to access a common information base mediated by a controlling computer. 2. The interconnection of two or more computers working in a distributed manner on a common application process. (188)

**computer-dependent language** *Synonym* assembly language.

**computer graphics** 1. Methods and techniques for converting data to or from graphic displays via computers. (FP) (ISO) 2. That branch of science and technology that is concerned with methods and techniques for converting data to or from visual presentation using computers. (FP)

**computer language** A language that is used to program a computer. The language may be a high-level language, an assembly language, or a machine language. (188) *See also* assembly language, compile, high-level language, language, machine language.

**computer network** 1. A network of data processing nodes that are interconnected for the purpose of data communication. (FP) (ISO) 2. A complex consisting of two or more interconnected computers. (FP)

**computer-oriented language** A programming language whose words and syntax are designed for use on a specific computer or class of computers. (188) *Synonyms* low-level language, machine-oriented language. *See also* assembly language, compile, high-level language.

**computer program** A sequence of instructions suitable for processing by a computer. *Note:* Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution, as well as the execution of the program. The sequence of instructions may include statements and necessary declarations. (FP) (ISO) *See also* assembler, compiler.

**computer program origin** The address assigned to the initial storage location of a computer program in main storage. (FP)

**computer routine** *See* routine.

**computer science** The branch of science and technology that is concerned with methods and techniques relating to data processing performed by automatic means. (FP) (ISO)

**computer security** *See* automated information system security.

**computer system** A functional unit, consisting of one or more computers and associated software, that uses common storage for all or part of a program and also for all or part of the data necessary for the execution of the program; executes user-written or user-designated programs; performs user-designated data manipulation, including arithmetic operations and logic operations; and that may execute programs that modify themselves during their execution. *Note:* A computer system may be a stand-alone unit or may

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consist of several interconnected units. *Synonyms* ADP system, computing system.

**computer system fault tolerance** The ability of a computer system to continue to operate correctly even though one or more of its component parts are malfunctioning. The speed of performance, the throughput, or both may be diminished from normal until the faults are corrected. (FP) (ISO) *Synonym* computer system resilience.

**computer system resilience** *Synonym* computer system fault tolerance.

**computer word** In computing, a group of bits or characters treated by computer circuits as a unit. (188) *Synonym* machine word. *See also* binary digit, byte, character, word.

**computing system** *Synonym* computer system.

**COMSEC** *Acronym for communications security.*

**concatenation [of optical fibers]** The linking of optical fibers, end to end.

**concentrator** 1. In data transmission, a functional unit that permits a common path to handle more data sources than there are channels currently available within the path. *Note:* A concentrator usually provides communication capability between many low-speed, usually asynchronous, channels and one or more high-speed, usually synchronous channels. Usually different speeds, codes, and protocols can be accommodated on the low-speed side. The low-speed channels usually operate in contention and require buffering. 2. A device that connects a number of circuits, which are not all used at once, to a smaller group of circuits for economy. (188) *See also* channel, circuit, data compression, distributed switching, time-division multiplexing.

**concentricity error** For an optical fiber, when used in conjunction with a tolerance field to specify the core/cladding geometry, the distance between the center of the two concentric circles specifying the cladding

diameter and the center of the two concentric circles specifying the core diameter. *Synonyms* core-to-cladding concentricity, core-to-cladding eccentricity, core-to-cladding offset. *See also* cladding, cladding diameter, core, core diameter, tolerance field.

**conditioned circuit** A circuit that has conditioning equipment to obtain the desired characteristics for voice or data transmission. (188) *See also* conditioning equipment, equalization.

**conditioned diphase modulation** A method of modulation employing both diphase modulation and signal conditioning to eliminate the dc component of a signal, to enhance timing recovery, and to facilitate transmission over VF circuits or coaxial cable facilities. (188) *See also* modulation.

**conditioned loop** A loop that has conditioning equipment to obtain the desired line characteristics for voice or data transmission. (188) *See also* conditioning equipment, equalization, loop.

**conditioning equipment** 1. At junctions of circuits, equipment used to match transmission levels and impedances and also to provide equalization between facilities. (188) 2. Corrective networks used to equalize the insertion loss-vs.-frequency characteristic and the envelope delay distortion over a desired frequency range to improve data transmission. *See also* building out, conditioned circuit, conditioned loop, equalization.

**conducted coupling** Energy transfer by means of physical contact. (188) *Synonym* direct coupling. *See also* capacitive coupling, coupling, inductive coupling.

**conducted interference** 1. Interference resulting from noise or unwanted signals entering a device by direct coupling. (188) 2. An undesired voltage or current generated within a receiver, transmitter, or associated equipment, and appearing at the antenna terminals. (188) *See also* antenna, coupling, interference.

**conduction band** In solid-state physics, that property of a material wherein its energy states have one or more energy levels not completely filled, thus allowing electrons free motion, and allowing the material to carry an electric current.

**conference call** A service feature that allows a call to be established among three or more stations in such a manner that each of the stations is able to communicate with all the other stations. (188) *Synonym* multiple call. *See also* add-on conference, attendant conference, bridging connection, call, computer conferencing, group alerting and dispatching system, multiaddress calling facility, service feature, teleconference.

**conference operation** A type of operation that allows a call to be established among three or more stations in such a manner that each of the stations is able to communicate with all the other stations. (188) *Note:* In radio systems, the stations receive simultaneously, but must transmit one at a time. The common modes are "push-to-talk" (telephone) and "push-to-type" (telegraph, data transmission). *See also* computer conferencing, data conferencing repeater.

**configuration** The arrangement of communication or computer systems as defined by the nature, number, and the chief characteristics of its functional units. *Note 1:* The term may refer to a hardware or a software configuration. *Note 2:* The configuration determines what the system will do and how well it will do it.

**configuration management** The continuous control of changes made to a system's hardware, software, firmware, and documentation throughout the development and operational life of the system.

**confirmation signaling** In AUTOVON, a method of signaling on some intertoll trunks to ensure error-free transmission of dialed information. As each digit is sent over the trunk, confirmation is accomplished by

returning a unique digit-dependent signal from the far end. (188) *See also* signal.

**confirmation to receive** In facsimile, a signal from a CCITT Group 1, 2, or 3 facsimile receiver, indicating it is ready to receive picture signals. *See also* facsimile.

**conformance test** A test performed by an independent body to determine if a particular piece of equipment or system satisfies the criteria of a particular standard.

**connecting arrangement** In the public switched telephone networks, the equipment provided by a common carrier to accomplish electrical interconnection between customer-provided equipment and the facilities of the common carrier.

**connection** 1. A provision for a signal to propagate from one circuit, line, subassembly, or component to another. *See also* circuit, connector, cross-connection, splice. 2. An association established between functional units for conveying information. (FP) (ISO)

**connection-in-progress signal** A call control signal at the DCE/DTE interface that indicates to the DTE that the establishment of the data connection is in progress and that the ready-for-data signal will follow. *See also* call, call control signal, data circuit-terminating equipment, interface, signal.

**connectionless data transfer** *See* connectionless mode transmission.

**connectionless mode transmission** In packet data transmission, a mode of operation in which each packet is encoded with a header containing a destination address sufficient to permit the independent delivery of the packet without the aid of additional instructions. *Note:* A connectionless packet is frequently called a datagram. A connectionless service is inherently unreliable in the sense that the service provider usually cannot provide assurance against the loss, error insertion, misdelivery, duplication, or out-of-sequence delivery of a connectionless packet. However,



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it may be possible to protect against these anomalies by providing a reliable transmission service at a higher protocol layer, e.g., Transport Layer. *See also* datagram, Open Systems Interconnection--Reference Model, packet switching.

**connection-oriented data transfer protocol** A type of protocol for exchanging data in which a logical connection is established between end points. *See also* virtual circuit.

**connection-oriented mode transmission** In data transmission, an association in which the information transfer stage is preceded by a call establishment phase and followed by a call termination phase. In the information transfer phase, one or more packets are transmitted. The header of each information packet contains a sequence number and an identifier field that associates the packet with the previously established logical circuit. *Note:* Connection-oriented services are generally able to detect lost, errored, duplicated, or out-of-sequence packets. The CCITT X.25 protocols, which are widely implemented on packet-switched public data networks, represent an example of a connection-oriented set of protocols at layers 1, 2, and 3 of the OSI-Reference Model. *See also* Open Systems Interconnection-Reference Model, switching center, X.-series Recommendations.

**connections per circuit hour (CCH)** A unit of traffic measurement; i.e., the number of connections established at a switching point per hour. (188) *See also* call-second, erlang, traffic intensity.

**connector** 1. A demountable device for coupling an electrical or optical signal or power source, to a circuit or transmission medium. 2. A demountable device for concatenating transmission media, e.g., two optical fibers or two coaxial cables. *Note:* A connector is distinguished from a splice, which is a permanent joint. *See also* optical fiber connector, splice.

**connector-induced optical fiber loss** That part of connector insertion loss caused by fiber-end

contamination or structural changes to the optical fiber introduced by termination or handling within the connector. The loss is usually expressed in decibels (dB).

**connector insertion loss** *See* Insertion loss.

**conservation of radiance** A basic principle stating that no passive optical system can increase the quantity  $L/n^2$ , where  $L$  is the radiance of a beam and  $n$  is the local refractive index. (188) *Note:* Formerly called "conservation of brightness," or the "brightness theorem." *See also* fiber optics, radiance.

**content-addressable storage** *Synonym* associative storage.

**contention** 1. A condition that arises when two or more data stations attempt to transmit at the same time over a shared channel, or when two data stations attempt to transmit at the same time in two-way alternate communication. (FP) (ISO) *Note:* Contention can occur in data communications when no station is designated a master station. 2. Competition by users of a system for use of the same facility at the same time. (188) *See also* carrier sense multiple access, collision, data communication, link, master station.

**continuity check** A check made of a circuit to verify that a communication or power path exists. (188) *See also* circuit.

**continuously variable slope delta (CVSD) modulation** A type of delta modulation in which the size of the steps of the approximated signal is progressively increased or decreased as required to make the approximated signal closely match the input analog wave. (188) *See also* delta modulation, differential modulation, differential pulse-code modulation, modulation.

**continuous operation** 1. A condition wherein certain nodes, facilities, circuits, or equipment are in an operational state at all times. (188) *Note:* This usually requires a fully redundant configuration or at least an X out of Y degree of redundancy for compatible equipment,



where X is the number of spare components and Y is the number of operational components. 2. In data transmission, a type of operation in which the master station need not stop for a reply after transmitting each message or transmission block. *See also* cutover, degraded service state, down-time, dynamically adaptive routing, fail-safe operation, graceful degradation, operational service state, outage, redundancy (def. #2), survivability.

**continuous presence** In teleconferencing, the simultaneous presence of two or more video images. The images may appear on a single monitor in a split screen mode or on two separate monitors.

**continuous tone copy** In facsimile, an original or recorded copy that contains gray tones or densities between black and white, e.g., a photographic print. (188) *See also* facsimile, halftone.

**continuous wave (cw)** A wave of constant amplitude and constant frequency. (188) *See also* frequency, interrupted continuous wave.

**contouring** In digital facsimile, density step lines in received copy resulting from analog-to-digital conversion when the original image has observable gray shadings between the smallest density steps of the digital system. *See also* facsimile.

**contribution** In B-ISDN applications, the use of broadband transmission of audio or video information to the user for post-production processing and distribution. *See also* broadband ISDN, distribution, post-production processing.

**control character** A character whose occurrence in a particular context specifies a control function. A control character may be recorded for use in a subsequent action. A control character is not a graphic character but may have a graphic representation in some circumstances. (FP) (ISO) (188) *See also* acknowledge character, call control signal, character, data link escape character, end-of-selection character, end-of-text character,

end-of-transmission-block character, end-of-transmission character, enquiry character, idle character, negative acknowledge character, start-of-heading character, start-of-text character, stop signal.

**control function** *Synonym* control operation.

**controlled access** The process wherein access to the resources of an area or system is limited to authorized personnel, users, programs, processes, or other systems, and denied to all others. (188) *See also* access control, classmark, communications security, restricted access.

**controlled area** An area within which uncontrolled movement does not permit access to classified information and which is designed for the principal purpose of providing administrative control, safety, or a buffer area of security for limited access areas. (188) *See also* communications security.

**controller** In an automated radio, the device that commands the radio transmitter and receiver, and that performs processes, such as automatic link establishment, channel scanning and selection, link quality analysis, polling, sounding, message store and forward, address protection, and anti-spoofing. *See also* automatic link establishment.

**control of electromagnetic radiation** 1. Measures taken to minimize electromagnetic radiation emanating from a system or component, or to minimize electromagnetic interference. *Note:* Such measures are taken for purposes of security and/or the reduction of interference, especially on ships and aircraft. 2. A national operational plan to minimize the use of electromagnetic radiation in the United States and its possessions and the Panama Canal Zone in the event of attack or imminent threat thereof, as an aid to the navigation of hostile aircraft, guided missiles, or other devices. (JCS1-DoD) *See also* electronic warfare.

**control operation** An action that affects the recording, processing, transmission, or interpretation of data, e.g., starting or stopping

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a process, a carriage return, a font change, a rewind, or an end of transmission. *Synonym* control function.

**control station** In a data network, the station that selects the master station and supervises operational procedures such as polling, selecting, and recovery. *Note:* The control station has the overall responsibility for the orderly operation of the entire network. *See also* backward supervision, data communication, master station, network, primary station, secondary station, slave station, supervisory program, tributary station.

**conversational mode** A mode of communication similar to a conversation between two persons. *See also* duplex operation, Hamming code, interactive data transaction, push-to-talk operation.

**conversational service** Any two-way, interactive telecommunications service providing real-time, end-to-end information transfer.

**convolutional code** An error-correction code in which each  $m$ -bit information symbol to be encoded is transformed into an  $n$ -bit symbol ( $n > m$ ) where the transformation is a function of the last  $k$  information symbols, and  $k$  is referred to as the constraint length of the code. *Note:* Convolutional codes are often used to improve the performance of radio and satellite links. *See also* code, error control, error-correcting code, forward error correction, Hagelbarger code, Hamming code,

**coordinated clock** One of a set of clocks distributed over a spatial region, producing time scales that are synchronized to the time scale of a reference clock at a specified location. (188) *See also* cesium clock, clock, Coordinated Universal Time, DoD master clock, master clock, primary time standard, reference clock.

**coordinated time scale** A time scale synchronized within given tolerances to a reference time scale. (188) *See also* Coordinated Universal Time, DoD master

clock, Greenwich Mean Time, International Atomic Time (TAI), time, time scale.

**Coordinated Universal Time (UTC)** Time scale, based on the second (SI), as defined and recommended by the CCIR, and maintained by the Bureau International des Poids et Mesures (BIPM). For most practical purposes associated with the Radio Regulations, UTC is equivalent to mean solar time at the prime meridian (0° longitude), formerly expressed in GMT. *Note:* The full definition is contained in CCIR Recommendation 460-4. (After RR) (188) *Synonyms* World Time, Z time, Zulu Time. *See also* coordinated time scale, dating format, DoD master clock, Greenwich Mean Time, International Atomic Time, leap second, precise frequency, precise time, second, time scale, time standard.

**coordination area** The area associated with an Earth station outside of which a terrestrial station sharing the same frequency band neither causes nor is subject to interfering emissions greater than a permissible level. (RR) *See also* accepted interference, blanketing area, interference.

**coordination contour** The line enclosing the coordination area. (RR) *See also* blanketing.

**coordination distance** Distance on a given azimuth from an Earth station beyond which a terrestrial station sharing the same frequency band neither causes nor is subject to interfering emissions greater than a permissible level. (RR) *See also* accepted interference, blanketing, interference.

**cord circuit** A switchboard circuit, terminated in two plug-ended cords, used to establish connections manually between user lines or between trunks and user lines. A number of cord circuits are furnished as part of the manual switchboard position equipment. The cords may be referred to as front cord and rear cord or trunk cord and station cord. (188) *Note:* In modern cordless switchboards, the cord circuit is switch operated. *See also* call splitting, circuit, switchboard, switched loop.

**cord lamp** The lamp associated with a cord circuit that indicates supervisory conditions for the respective part of the connection.

**cordless switchboard** A telephone switchboard in which manually operated keys are used to make connections. (188) *See also* PBX.

**core** 1. The center region of an optical fiber through which light is transmitted. (188) *Note 1:* Strictly speaking, in certain cases a significant fraction of the energy in a bound mode does travel in the cladding. *Note 2:* The refractive index of the core must be higher than that of the cladding. *See also* cladding, core diameter, fiber optics, normalized frequency, optical fiber. 2. A piece of magnetic material, usually toroidal in shape, used for computer storage. 3. The material at the center of an electromechanical relay or coil winding. (188)

**core area** For an optical fiber, the cross-sectional area enclosed by the curve that connects all points nearest the axis on the periphery of the core where the refractive index of the core exceeds that of the homogeneous cladding by  $k$  times the difference between the maximum refractive index in the core and the refractive index of the homogeneous cladding, where  $k$  is a specified positive or negative constant with  $|k| < 1$ . *See also* cladding, core, homogeneous cladding, tolerance field.

**core diameter** 1. The diameter of the region of high refractive index surrounded by the cladding of an optical fiber. 2. In an optical fiber that is circular in cross-section, the diameter of the circle that best fits the outer limit of the core area. (188) *Note:* The center of this circle is the core center. *See also* cladding, cladding diameter, core, core area, fiber optics.

**core eccentricity** *See* ovality.

**core noncircularity** For an optical fiber, the percent that the shape of the core's cross-section deviates from a circle. Sometimes

referred to as "*core ovality*" (not to be confused with "*core eccentricity*").

**core storage** *See* magnetic core storage.

**core-to-cladding concentricity** *Synonym* concentricity error.

**core-to-cladding eccentricity** *Synonym* concentricity error.

**core-to-cladding offset** *Synonym* concentricity error.

**corner reflector** 1. A device, normally consisting of three metallic surfaces or screens perpendicular to one another, designed to act as a radar target or marker. (JCS1-DoD) (JCS1-NATO) 2. In radar interpretation, an object that, by means of multiple reflections from smooth surfaces, produces a radar return of greater magnitude than might be expected from the physical size of the object. (JCS1-DoD) (JCS1-NATO) 3. A reflector consisting of three mutually perpendicular intersecting conducting flat surfaces, which returns a reflected electromagnetic wave to its point of origin. (188) *Note:* Such reflectors are often used as radar targets. 4. A passive optical mirror, that consists of three mutually perpendicular flat, intersecting reflecting surfaces, which returns an incident light beam in the opposite direction. 5. A reflector consisting of two mutually intersecting conducting flat surfaces. *Note:* Such reflectors are often used in antennas.

**corner reflector antenna** An antenna consisting of a feed and a corner reflector (def. #5). (188)

**corrective maintenance** 1. Maintenance actions carried out to restore a defective item to a specified condition. (JCS1-NATO) 2. Tests, measurements, and adjustments made to remove or correct a fault. (188) *See also* maintenance, preventive maintenance.

**cosine emission law** *Synonym* Lambert's cosine law.

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**cosmic noise** Random noise originating outside the Earth's atmosphere. (188) *Note:* Its characteristics are similar to thermal noise. It is experienced at frequencies above about 15 MHz when highly directional antennas are pointed toward the sun or to certain other regions of the sky such as the center of the Milky Way Galaxy. *Synonym* galactic radio noise.

**Costas loop** A commonly used phase-locked loop technique for carrier phase recovery from suppressed-carrier modulation signal formats, e.g., double sideband suppressed carrier. *Note:* In its normal implementation, a local voltage-controlled oscillator provides quadrature outputs, one to each of two product detectors (phase detectors). The input signal is also applied to both of the product detectors (same phase to each), and the output of each phase detector is passed through a low-pass filter. The outputs of these low-pass filters are inputs to another phase detector, the output of which passes through a loop filter before being used to control the voltage-controlled oscillator. *See also* loop, phase-locked loop.

**country code** 1. In international direct telephone dialing, a 1-, 2-, or 3-digit number wherein the first digit designates the region and succeeding digit(s) designate(s) the country. 2. In international record carrier transmissions, the country code is a two or three alpha or numeric abbreviation of the country name following the geographical place name. *See also* access code, NXX code.

**coupled modes** 1. In fiber optics, a condition wherein energy is transferred among modes. (188) *Note:* The energy share of each mode does not differ after the equilibrium length has been reached. 2. In microwave transmission, a condition where energy is transferred from the fundamental mode to higher order modes. *Note:* Energy transferred to coupled modes is undesirable in usual microwave transmission in a waveguide. The frequency is kept low enough so that propagation in the waveguide is only in the fundamental mode. *See also* differential mode attenuation, fiber optics,

mode, multimode optical fiber, single-mode optical fiber.

**coupler** *See* directional coupler, optical fiber coupler.

**coupling** Any means by which energy is transferred from one conductive or dielectric medium (e.g., optical waveguide) to another, including fortuitous occurrences. *Note 1:* Types of electrical coupling include capacitive (electrostatic) coupling, inductive coupling, and conductive (hard wire) coupling. *Note 2:* Coupling may occur between optical fibers unless specific action is taken to prevent it. Coupling between fibers is very effectively prevented by the polymer overcoat, which also prevents the propagation of cladding modes, and provides some degree of physical protection. *See also* aperture-to-medium coupling loss, capacitive coupling, conducted coupling, conducted interference, cross coupling, cross modulation, crosstalk coupling, directional coupler, free-space coupling, interaction crosstalk, mode coupling, mode scrambler.

**coupling coefficient** A measure of the electrical coupling that exists between two circuits, equal to the ratio of the mutual impedance to the square root of the product of the self-impedances of the coupled circuits, all impedances being of the same kind. *See also* coupling.

**coupling efficiency** In fiber optics, the efficiency of optical power transfer between two optical components. (188) *Note:* Usually expressed as a percentage of the input or available power actually transferred.

**coupling loss** 1. The loss suffered when energy is transferred from one circuit to another, generally expressed in the same units as in the originating circuit, e.g., watts or dBm. (188) 2. In fiber optics, the power loss suffered when coupling light from one optical device to another. *See also* angular misalignment loss, aperture-to-medium coupling loss, coupling, extrinsic joint loss, insertion loss, intrinsic

**joint loss, lateral offset loss, path loss, transmission loss.**

**cover** 1. To convert the transmitted waveform into an unusable form by means of transmission security (TRANSEC) and cryptographic techniques. 2. To conceal or alter characteristic communications patterns to hide information that could be of value to an adversary. 3. The act of maintaining a continuous receiver watch with transmitter calibrated and available, but not necessarily available for immediate use. (JCS1-DoD) (JCS1-NATO) 4. Those measures necessary to give protection to a person, plan, operation, formation, or installation from the enemy intelligence effort and leakage of information. (JCS1-DoD) (JCS1-NATO)

**CPE** *Abbreviation for customer premises equipment.*

**cpi** *Abbreviation for characters per inch. The number of characters recorded on an inch of recording medium. (188)*

**cps** *Abbreviation for characters per second. Note: Formerly used as an abbreviation for "cycles per second;" however, "hertz" (Hz) is the preferred term in this context.*

**CPU** *Abbreviation for central processing unit, communications processor unit.*

**CR** *Abbreviation for channel reliability, circuit reliability.*

**CRC** *Abbreviation for cyclic redundancy check.*

**critical angle** In geometric optics, at a refractive boundary, the smallest angle of incidence at which total internal reflection occurs. (188) *Note 1: The angle of incidence is measured with respect to the normal at the refractive boundary. Note 2: The critical angle is given by  $\theta_c = \arcsin(n_1/n_2)$  where  $\theta_c$  is the critical angle,  $n_1$  is the refractive index of the less dense medium, and  $n_2$  is the refractive index of the denser medium. Note 3: The incident ray is in the denser medium. Note 4: If the incident ray is precisely at the critical angle, the refracted ray is tangent to the boundary at*

*the point of incidence. See also angle of incidence, fiber optics, total internal reflection.*

**critical areas** Operational areas that require specific environmental control because of the equipment contained therein. (188) *See also air conditioning.*

**critical frequency** 1. In radio propagation by way of the ionosphere, the limiting frequency below which a wave component is reflected by, and above which it penetrates through, an ionospheric layer. (188) 2. At vertical incidence, the limiting frequency below which a wave component is reflected by, and above which it penetrates through, an ionospheric layer. (188) *Note: The existence of the critical frequency is the result of electron limitation; i.e., the inadequacy of the existing number of free electrons to support reflection at higher frequencies. See also critical wavelength, cutoff frequency, frequency, ionosphere.*

**critical technical load** That part of the total technical power load required for synchronous communications and automatic switching equipment. (188) *See also load, technical load.*

**critical wavelength** The free-space wavelength that corresponds to the critical frequency. *Note: It is equal, in meters, to the speed of light ( $3 \times 10^8$  meters per second) divided by the critical frequency in hertz. See also critical frequency, ionosphere.*

**cross assembler** An assembler that can run symbolic-language input on one type of computer and produce machine-language output for another type of computer. (FP)

**crossbar switch** A switch having a plurality of vertical paths, a plurality of horizontal paths, and electromagnetically operated mechanical means for interconnecting any one of the vertical paths with any one of the horizontal paths. (188) *See also electronic switching system, step-by-step switching system, switch, switching center.*

**cross-connect** *Synonym cross-connection.*



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**cross-connection** Connections between terminal blocks on the two sides of a distribution frame, or between terminals on a terminal block. (188) *Note:* Connections between terminals on the same block are also called "straps." *Synonyms* cross-connect, jumper. *See also* connection.

**cross coupling** The coupling of a signal from one channel, circuit, or conductor to another, where it becomes an undesired signal. (188) *See also* circuit, coupling, interference.

**cross modulation** Intermodulation due to the modulation of the carrier of the desired signal by an undesired signal wave. (188) *See also* coupling, interference, modulation.

**cross-office trunk** A trunk whose terminations are within a single facility. (188) *See also* facility, trunk.

**crosspoint** A single element in an array of elements that comprise a switch. *Note:* It is a set of physical or logical contacts that operate together to extend the speech and signal channels in a switching network. *See also* switch, switching center.

**cross-polarized operation** The use of two transmitters operating on the same frequency, with one transmitter-receiver pair being vertically polarized and the other pair horizontally polarized (orthogonal polarization). (188) *See also* antenna, polarization diversity, space diversity.

**crosstalk (XT)** 1. Undesired capacitive, inductive, or conductive coupling from one circuit, part of a circuit, or channel, to another. 2. Any phenomenon by which a signal transmitted on one circuit or channel of a transmission system creates an undesired effect in another circuit or channel. (188) *See also* adjacent channel interference, channel, crosstalk coupling, far-end crosstalk, intelligible crosstalk, interaction crosstalk, interference, near-end crosstalk, susceptibility, unintelligible crosstalk.

**crosstalk coupling** The ratio of the power in a disturbing circuit to the induced power in the

disturbed circuit observed at definite points of the circuits under specified terminal conditions, expressed in decibels. (188) *Synonym* crosstalk coupling loss. *See also* circuit, coupling, crosstalk, interference, loss.

**crosstalk coupling loss** *Synonym* crosstalk coupling.

**cryptanalysis** 1. The steps and operations performed in converting encrypted messages into plain text without initial knowledge of the key employed in the encryption. (JCS1-DoD) 2. The study of encrypted texts. The steps or processes involved in converting encrypted text into plain text without initial knowledge of the key employed in the encryption. (JCS1-NATO) *See also* cryptography, cryptology.

**CRYPTO** A marking or designator identifying COMSEC keying material used to secure or authenticate telecommunications carrying classified or sensitive Government or Government-derived information, the loss of which could adversely affect the national security interest. *Note:* When written in all upper case letters, "CRYPTO" has the meaning stated above. When written in lower case as a prefix, "crypto" and "crypt" are abbreviations for "cryptographic." When "crypto" is combined with another word, the result is hyphenated if the root begins with a vowel. If the root word begins with a consonant, the result is written as a single word. *See also* cryptomaterial.

**cryptochannel** A complete system of cryptocommunications between two or more holders. The basic unit for naval cryptographic communication. It includes: (a) the cryptographic aids prescribed; (b) the holders thereof; (c) the indicators or other means of identification; (d) the area or areas in which effective; (e) the special purpose, if any, for which provided; and (f) pertinent notes as to distribution, usage, etc. A cryptochannel is analogous to a radio circuit. (JCS1-DoD) *See also* channel, cryptology.

**cryptographic information** All information significantly descriptive of cryptographic



techniques and processes or of cryptographic systems and equipment, or their functions and capabilities, and all cryptomaterial. (JCSI-DoD) *See also* ciphony, cryptology, cryptomaterial.

**cryptography** The principles, means, and methods for rendering plain information unintelligible and for restoring encrypted information to intelligible form. *See also* cryptanalysis, cryptology.

**crypto key** *Deprecated term. See* key.

**cryptologic** Of or pertaining to cryptology. (JCSI-DoD) *See also* cryptology.

**cryptology** The science that treats of hidden, disguised, or encrypted communications. It embraces communications security and communications intelligence. (JCSI-DoD) (188) *See also* bulk encryption, ciphony, communications security, cryptanalysis, cryptography, cryptologic, encode, encrypt, traffic flow security.

**cryptomaterial** 1. All material including documents, devices, equipment, and apparatus essential to the encryption, decryption, or authentication of telecommunications. When classified, it is designated CRYPTO and subject to special safeguards. (JCSI-DoD) 2. All material, including documents, devices, or equipment that contains crypto information and is essential to the encryption, decryption or authentication of telecommunications. (JCSI-NATO) *See also* ciphony, cryptographic information, cryptology.

**cryptosecurity** *See* communications security.

**crystal oscillator (XO)** An oscillator whose frequency is controlled by a piezoelectric crystal. *Note 1:* Because a piezoelectric crystal is subject to frequency variations with temperature, some means of temperature control is often required or specified. *Note 2:* Types of crystal oscillators include voltage controlled crystal oscillator (VCXO), temperature compensated crystal oscillator (TCXO), oven controlled crystal oscillator

(OCXO), temperature compensated-voltage controlled crystal oscillator (TCVCXO), oven controlled voltage controlled crystal oscillator (OCVCXO), microcomputer compensated crystal oscillator (MCXO), Rubidium-crystal oscillator (RbXO).

**CSMA** *Abbreviation for* carrier sense multiple access.

**CSMA/CA** *Abbreviation for* carrier sense multiple access with collision avoidance.

**CSMA/CD** *Abbreviation for* carrier sense multiple access with collision detection.

**CSU** *Abbreviation for* channel service unit, customer service unit.

**CTX** *Abbreviation for* Centrex®.

**cursor** A movable, visible mark used to indicate a position of interest on a display surface. (FP)

**curvature loss** *Synonym* macrobend loss.

**customer owned and maintained equipment (COAM)** *Deprecated term. See* customer premises equipment.

**customer premises equipment (CPE)** Terminal and associated equipment located at a subscriber's premises and connected with a carrier's communication channel(s) at the network interface at that subscriber's premises. *Note:* Excluded from CPE are over-voltage protection equipment, inside wiring, and pay telephones. *See also* embedded customer-premises equipment, new-customer premises equipment.

**customer-provided equipment** *Deprecated term. See* customer premises equipment.

**customer service unit (CSU)** A device that provides an accessing arrangement at a user location to either switched or point-to-point, data-conditioned circuits at a specifically established data signaling rate. *Note:* This device provides local loop equalization, transient protection, isolation, and central

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office loop-back testing capability. *See also* data service unit.

**custom local area signaling services (CLASS)** A generic term (like "WATS") describing several enhanced service offerings such as incoming-call identification, call trace, call blocking, automatic return of the most recent incoming call, call redial, and selective forwarding and programming to permit distinctive ringing for incoming calls. *See also* call forwarding, calling-line identification signal.

**cutback technique** A technique for measuring optical fiber attenuation or distortion by performing two transmission measurements. One is at the output end of the full length of the fiber. The other is within 1 to 3 meters of the input end. Without disturbing the source-to-fiber coupling, access to the short length output is accomplished by "cutting back" the test fiber. *See also* attenuation.

**cutoff attenuator** A waveguide of adjustable length, that varies the attenuation of signals passing through the waveguide.

**cutoff frequency** 1. The frequency above which, or below which, the output current in a circuit, such as a line or a filter, is reduced to a specified level. (188) 2. The frequency below which a radio wave fails to penetrate a layer of the ionosphere at the angle of incidence required for transmission between two specified points by reflection from the layer. (188) *See also* critical frequency, cutoff wavelength, frequency, ionosphere.

**cutoff mode** The highest order mode that will propagate in a given waveguide at a given frequency. (188) *See also* frequency, mode (def. #1).

**cutoff wavelength** In an optical fiber, the wavelength greater than which a particular waveguide mode ceases to be a bound mode. (188) *Note:* In a single-mode waveguide, concern is with the cutoff wavelength of the second-order mode. *See also* cable cutoff wavelength, cutoff frequency, fiber-cutoff

wavelength, fiber optics, frequency, mode (def. #1).

**cutover** The physical changing of circuits or lines from one configuration to another. (188) *See also* continuous operation.

**CVD** *Abbreviation for* chemical vapor deposition.

**CVSD** *Abbreviation for* continuously variable slope delta modulation.

**cw** *Abbreviation for* carrier wave, continuous wave.

**CX** *Abbreviation for* composite signaling.

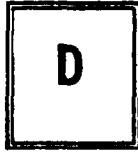
**cxr** *Abbreviation for* carrier.

**CX signaling** *Synonym* composite signaling.

**cyclic distortion** In telegraphy, distortion that is neither characteristic, bias, nor fortuitous, and which in general has a periodic character. (188) *Note:* Its causes are, for example, irregularities in the duration of contact time of the brushes of a transmitter distributor or interference by disturbing alternating currents. *See also* bias distortion, characteristic distortion, distortion, end distortion, fortuitous distortion.

**cyclic redundancy check (CRC)** A type of error-detecting scheme that uses parity bits generated by polynomial encoding and decoding algorithms to detect transit-generated errors. *Note:* Error correcting, when required, is usually accomplished through the use of an ARQ system. *See also* ARQ, block, block check character, character check, error control, error correcting code, error detecting system.

**D\*** (*Pronounced "D-Star"*) See specific detectivity.



**D-A** Abbreviation for digital-to-analog. See digital transmission system.

**DACS** Acronym for digital access and cross-connect systems.

**DAMA** Abbreviation for demand assignment multiple access.

**damping** 1. The progressive diminution with time of certain quantities characteristic of a phenomenon. 2. The progressive decay with time in the amplitude of the free oscillations in a circuit. (188)

**dark current** The external current that, under specified biasing conditions, flows in a photosensitive detector when there is no incident radiation. (188) See also photosensitive recording, quantum noise.

**data** Representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means. Any representations such as characters or analog quantities to which meaning is or might be assigned. (JCS1-DoD)

**data arrangement** In the public switched telephone networks, a single item or group of items present at the customer side of the network interface for data transmission purposes, including all equipment that may affect the characteristics of the interface. See also data, data circuit-terminating equipment, data terminal equipment, data transmission, interface.

**data attribute** A characteristic of a data element such as length, value, or method of representation. (FP)

**data bank** A set of data related to a given subject and organized in such a way that it can be consulted by users. (FP) (ISO)

**database** A set of data that is required for a specific purpose or is fundamental to a system, project, enterprise, or business. (188) *Note:* A database may consist of one or more data banks and be geographically distributed among several repositories.

**database management system (DBMS)** 1. A computer-based system used to establish, make available, and maintain the integrity of a database. (188) 2. An integrated set of computer programs that collectively provide all of the capabilities required for centralized management, organization, and control of access to a database that is shared by many users. (FP) (188) See also data dictionary, facility.

**data burst** *Synonym* burst transmission.

**data bus** A bus used to transfer data within or to and from a processing unit or storage device. See also bus.

**data circuit** A pair of associated transmit and receive channels that provides a means of two-way data communication. (188) See also circuit, data, data transmission.

**data circuit-terminating equipment (DCE)** In a data station, the equipment that provides signal conversion, coding, and other functions at the network end of the line between the data terminal equipment and the line, and that may be a separate or an integral part of the data terminal equipment or of the intermediate equipment. (FP) (ISO) (188) *Deprecated synonyms* data communications equipment, data set.

**data communication** The transfer of information between functional units by means of data transmission according to a protocol. (FP) (ISO) (188)

**data communication control character** See control character.

**data communication control procedure** A means used to control the orderly communication of information among stations in a data

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communication network. *See also* data, data transmission, serial access, serial transmission.

**data communications equipment** *Deprecated term. See* data circuit-terminating equipment.

**data compaction** *Synonym* data compression.

**data compression** 1. The process of reducing (a) bandwidth, (b) cost, and (c) time for the generation, transmission, and storage of data by employing techniques designed to remove data redundancy. 2. The use of techniques such as null suppression, bit mapping, and pattern substitution for purposes of reducing the amount of space required for storage of textual files and data records. (FP) (ISO) *Note:* Some data compaction methods employ fixed tolerance bands, variable tolerance bands, slope-keypoints, sample changes, curve patterns, curve fitting, floating-point coding, variable precision coding, frequency analysis, and probability analysis. (Simply squeezing noncompacted data into a smaller space, e.g., by transferring data on punched cards onto magnetic tape, is not considered data compression.) *Synonym* data compaction. *See also* concentrator, data, data transmission, redundancy.

**data concentrator** A functional unit that permits a common transmission medium to serve more data sources than there are channels currently available within the transmission medium. (FP) (ISO) *See also* concentrator, multiplexer.

**data conferencing repeater** A device that enables any one user of a group of users to transmit a message to all other users in that group. (188) *Synonym* technical control hubbing repeater. *See also* conference operation, data, data transmission, network.

**data contamination** *Synonym* data corruption.

**data corruption** The violation of data integrity. (FP) (ISO) (188) *Synonym* data contamination. *See also* data, data integrity, data transmission.

**data country code** A 3-digit numerical country identifier that is part of the 14-digit network terminal number plan. This prescribed numerical designation further constitutes a segment of the overall 14-digit X.121 numbering plan for a CCITT X.25 network.

**data dictionary** 1. A part of a database management system that provides a centralized repository of information about data, such as meaning, relationship to other data, origin, usage, and format. (188) 2. An inventory that describes, defines, and lists all of the data elements that are stored in a database (FP) (188) *See also* database management system.

**data directory** An inventory that specifies the source, location, ownership, usage, and destination of all of the data elements that are stored in a database. (FP)

**data element** 1. A named unit of data that, in some contexts, is considered indivisible and in other contexts may consist of data items. (FP) (ISO) 2. A named identifier of each of the entities and their attributes that are represented in a database. (FP) 3. A basic unit of information having a unique meaning and subcategories (data items) of distinct units or values. Examples of data elements are military personnel grade, sex, race, geographic location, and military unit. (JCS1-DoD)

**Data Encryption Standard (DES)** A cryptographic algorithm for the protection of unclassified computer data, issued as Federal Information Processing Standard Publication (FIPS PUB) 46-1. *Note:* The DES, which was promulgated by the National Institute of Standards and Technology (NIST)--formerly the National Bureau of Standards (NBS)--is intended for public and Government use.

**datagram** In packet switching, a self-contained packet, independent of other packets, that carries information sufficient for routing from the originating data terminal equipment to the destination data terminal equipment, without relying on earlier exchanges between the equipment and the network. (FP) (ISO) *Note:* Unlike virtual call service, there are no call

establishment or clearing procedures, and the network does not generally provide protection against loss, duplication, or misdelivery. *See also* connectionless mode transmission, data, data transmission, packet switching, virtual call capability.

**data integrity** 1. The state that exists when data are handled as intended and are not exposed to accidental or malicious modification, destruction, or disclosure. (FP) 2. The preservation of data for their intended use. (FP) 3. The property that data meet an *a priori* expectation of quality. *See also* data, data corruption, data security, data transmission.

**data interface capability** The designed capability of equipment to interface directly with equipment that conforms to other interfacing standards without the need for external modems.

**data item** 1. A named component of a data element; usually the smallest component. (FP) 2. A subunit of descriptive information or value classified under a data element. For example the data element "military personnel grade" contains data items such as sergeant, captain, and colonel. (JCS1-DoD)

**data link** 1. The means of connecting one location to another for the purpose of transmitting and receiving data. (JCS1-DoD) (JCS1-NATO) 2. The assembly of parts of two DTEs that are controlled by a link protocol, and that, together with the interconnecting data circuit, enables data to be transferred from a data source to a data sink. (188) *See also* data, data terminal equipment, data transmission, link, Open Systems Interconnection--Reference Model, tactical data information link.

**data link control** *See* Advanced Data Communications Control Procedures, binary synchronous communication, high-level data-link control, Open Systems Interconnection--Reference Model, synchronous data link control.

**data link escape character (DLE)** A transmission control character that changes the meaning of a limited number of contiguously following characters or coded representations. (FP) (ISO) *See also* character, control character.

**Data Link Layer** *See* Open Systems Interconnection--Reference Model.

**data mode** The state of a DCE when connected to a communication channel but not in a talk or dial mode. *See also* data, data circuit-terminating equipment, data transmission, mode.

**data network identification code (DNIC)** In the CCITT International X.121 format, the first four digits of the international data number; the set of digits that may comprise the three digits of the data country code (DCC) and the 1-digit network code (which is called the "network digit"). *See also* data country code.

**data numbering plan area (DNPA)** In the U.S. implementation of a CCITT X.25 network, the first three digits of a network terminal number (NTN). *Note:* The 10-digit NTN is the specific addressing information for an end-point terminal in an X.25 network.

**data phase** A phase of a data call during which data signals may be transferred between DTEs that are interconnected via the network. *See also* data terminal equipment, data transmission circuit, phase (def. #2).

**data processing** The systematic performance of operations upon data such as handling, merging, sorting, and computing. (FP) (ISO) (188) *Note:* The semantic content of the data may or may not be changed. *Synonym* information processing. *See also* automatic data processing, data.

**data scrambler** A device used in digital transmission systems to convert an input digital signal into a pseudorandom sequence free from long runs of marks, spaces, or other simple repetitive patterns. *Note:* This facilitates



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timing extraction and reduces the accumulation of jitter. *See also* randomizer, scrambler.

**data security** The protection of data from unauthorized (accidental or intentional) modification, destruction, disclosure, or delay. (188) *See also* communications security, data.

**data service unit (DSU)** 1. A device used for interconnecting data terminal equipment for the public telephone network. 2. A type of short-haul, synchronous-data line driver, normally installed at a user location, that connects a user's synchronous equipment over a 4-wire circuit at a preset transmission rate to a servicing dial-central-office. *Note:* This service can be for a point-to-point or multipoint operation in a digital data network. *See also* customer service unit.

**data set** *Deprecated term. See* data circuit-terminating equipment.

**data signaling rate (DSR)** 1. The aggregate of the number of bits per second in the transmission path of a data transmission system. (FP) (ISO) 2. A measure of signaling speed given by

$$DSR = \sum_{i=1}^m \frac{\log_2 n_i}{T_i},$$

where  $m$  is the number of parallel channels,  $T_i$  is the minimum interval between significant instants for the  $i$ -th channel expressed in seconds, and  $n_i$  is the number of significant conditions of the modulation in the  $i$ th channel. Data signaling rate is expressed in bits per second (bps). *Note 1:* For a single channel (serial transmission) it reduces to  $(1/T) \log_2 n$ ; with a two-condition modulation ( $n = 2$ ), it is  $1/T$ . *Note 2:* For a parallel transmission with equal minimum intervals and equal number of significant conditions on each channel, it is  $(m/T) \log_2 n$ ; in case of a two-condition modulation, this reduces to  $(m/T)$ . *Note 3:* DSR is occasionally expressed in baud, in which case, the factor  $\log_2 n$  in the above formula should be deleted. *Note 4:* In synchronous binary signaling, the data signaling rate in bits

per second is numerically the same as the modulation rate expressed in baud. Signal processors, such as four-phase modems, cannot change the data signaling rate, but the modulation rate depends on the line modulation scheme, according to Note 2. For example, in a 2400 bps 4-phase sending modem, the signaling rate is 2400 bps on the serial input side, but the modulation rate is only 1200 baud on the 4-phase output side. *See also* baud, binary digit, bit rate, bits per second, data, data transfer rate, data transmission, effective data transfer rate, effective speed of transmission, efficiency factor, maximum user signaling rate, multiplex aggregate bit rate.

**data signaling rate transparency** *See* transparency.

**data sink** *See* communications sink.

**data source** *See* communications source.

**data station** The data terminal equipment, the data circuit-terminating equipment, and any intermediate equipment. *Note:* The data terminating equipment may be connected directly to a data processing system or may be a part of the latter. (FP) (ISO) *See also* data, data circuit-terminating equipment, data terminal equipment, data transmission.

**data stream** A sequence of digitally encoded signals used to represent information for transmission. *See also* bit stream transmission, code, data, data transmission, serial transmission.

**data switching exchange (DSE)** The equipment installed at a single location to perform switching functions such as circuit switching, message switching, and packet switching. (FP) (ISO) *See also* automatic exchange, exchange, switching center, synchronous data network.

**data terminal equipment (DTE)** 1. Digital end instruments that convert the user information into data signals for transmission, or reconvert the received data signals into user information. (188) 2. The functional unit of a data station that serves as a data source or a data sink and



provides for the data communication control function to be performed in accordance with link protocol. *Note:* The DTE may consist of a single piece of equipment that provides all the required functions necessary to permit the user to intercommunicate, or it may be an interconnected subsystem of multiple pieces of equipment, to perform all the required functions.

**data transfer rate** The average number of bits, characters, or blocks per unit time passing between corresponding equipment in a data transmission system. (FP) (ISO) (188) *See also* binary digit, block, block transfer rate, character, data signaling rate, data transmission, effective data transfer rate, throughput.

**data transfer request signal** A call control signal transmitted by a DCE to a DTE to indicate that a distant DTE wants to exchange data. *See also* call, call control signal, data, data circuit-terminating equipment, data terminal equipment, data transmission, signal.

**data transfer time** The time that elapses between the initial offering of a unit of user data to a network by transmitting data terminal equipment and the complete delivery of that unit to receiving data terminal equipment. (188) *See also* block transfer rate, data, data transmission, throughput, transmission time, transmit flow control.

**data transmission** The conveying of data from one place for reception elsewhere by telecommunication means. (FP) (ISO) (188)

**data transmission circuit** The transmission media and intervening equipment used for the transfer of data between DTEs. (188) *Note 1:* A data transmission circuit includes any required signal conversion equipment. *Note 2:* A data transmission circuit may support the transfer of information in one direction only, in either direction alternately, or in both directions simultaneously. *See also* channel, circuit, data circuit, data phase, data terminal equipment, data transmission.

**data volatility** Pertaining to the rate of change in the values of stored data over a period of time. (FP)

**dating format** The format employed to express the time of an event. (188) *Note:* The time of an event on the UTC time scale is given in the following sequence: hour, day, month, year; e.g., 0917 UT, 30 August 1997. The hour is designated by the 24-hour system. *See also* Coordinated Universal Time (UTC).

**dB** *Abbreviation for decibel(s).* The standard unit for expressing transmission gain or loss and relative power ratios. (188) *Note:* The decibel is one-tenth of a bel, which is too large a unit for convenient use. Decibels, dB, is given by

$$dB = 10 \log \frac{P_1}{P_2} ,$$

where log is the base 10 logarithm and  $P_1$  and  $P_2$  are the distinct powers. Power ratios may be expressed in terms of voltage and impedance,  $E$  and  $Z$ , or current and impedance,  $I$  and  $Z$ . Thus,

$$\begin{aligned} dB &= 10 \log \frac{E_1^2/Z_1}{E_2^2/Z_2} \\ &= 10 \log \frac{I_1^2 Z_1}{I_2^2 Z_2} . \end{aligned}$$

If  $Z_1 = Z_2$ , these become

$$\begin{aligned} dB &= 20 \log \frac{E_1}{E_2} \\ &= 20 \log \frac{I_1}{I_2} . \end{aligned}$$

**dBa** Weighted noise power, in dB referred to 3.16 picowatts (-85 dBm), which is 0 dBa. (188) *Note:* The use of FIA-line or HAL-receiver weighting must be indicated in parentheses as

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required. A one-milliwatt, 1000-Hz tone will read +85 dBa, but the same power as white noise, randomly distributed over a 3-kHz band (nominally 300 to 3300 Hz), will read +82 dBa, due to the frequency weighting. *Synonym* **dB<sub>rn</sub>** adjusted. *See also* channel noise level, circuit noise level, dB, noise level, noise weighting.

**dBa(F1A)** Weighted noise power in dBa, measured by a noise measuring set with F1A-line weighting. (188) *Note:* F1A weighting is obsolete for DoD applications. *See also* dB, F1A-line weighting.

**dBa(HA1)** Weighted noise power in dBa, measured across the receiver of a 302-type or similar subscriber set, by a noise measuring set with HA1-receiver weighting. (188) *Note:* HA1 weighting is obsolete for DoD applications.

**dBa0** Noise power in dBa referred to or measured at a zero transmission level point (OTLP), also called a point of zero relative transmission level (0 dBr). (188) *Note:* It is preferred to convert noise readings from dBa to dBa0, as this makes it unnecessary to know or state the relative transmission level at the point of actual measurement. *See also* channel noise level, circuit noise level, dB, level, noise level.

**dBc** Decibels relative to the carrier power.

**dBm** Decibels referenced to one milliwatt. (188) *Note 1:* Employed in communication work as a measure of absolute power values. Zero dBm equals one milliwatt. *Note 2:* In DoD practice, unweighted measurement is normally understood, applicable to a certain bandwidth, which must be stated or implied. *Note 3:* In European practice, psophometric weighting may be implied, as indicated by context; equivalent to dBm0p, which is preferred. *See also* dB, dBmV, level, neper, signal level.

**dBm(psoph)** A unit of noise power in dBm, measured with psophometric weighting where

$$\begin{aligned} \text{dBm(psoph)} &= 10\log_{10}(\text{pWp}) - 90 \\ &= \text{dBa} - 84, \end{aligned}$$

where pWp is power in picowatts psophometrically weighted and dBa is the weighted noise power in dB referenced to 3.16 picowatts. *See also* channel noise level, circuit noise level, dB, noise level.

**DBMS** *Abbreviation for database management system.*

**dBmV** Decibels referenced to one millivolt across 75 ohms. (188) *Note:* This reference is not equivalent to dBm; it is, in fact,  $1.33 \times 10^{-5}$  milliwatts. *See also* dB, dBm.

**dBm0** Power in dBm referred to or measured at a zero transmission level point (OTLP). The OTLP is also called a point of zero relative transmission level (0 dBr0). (188) *Note:* Some international documents use dBm0 to mean noise power in dBm0p (psophometrically weighted dBm0). In DoD practice, dBm0 is not so used. *See also* dBm, level, zero transmission level point.

**dBm0p** Noise power in dBm0, measured by a psophometer or noise measuring set having psophometric weighting. (188) *See also* channel noise level, circuit noise level, dB, noise level, noise weighting.

**dBr** The power ratio, expressed in dB, between any point and a reference point selected as the zero relative transmission level point. (188) *Note:* Any power expressed in dBr does not specify the absolute power. It is a relative measurement only. *See also* dB, level, relative transmission level, transmission level, transmission level point, zero transmission level point.

**dB<sub>rn</sub>** Decibels above reference noise. *Note 1:* Weighted noise power in dB referred to 1.0 picowatt. Thus, 0dB<sub>rn</sub> = -90 dBm. Use of 144-line, 144-receiver, or C-message weighting, or flat weighting, must be indicated in parentheses as required. (188) *Note 2:* With C-message weighting, a one-milliwatt, 1000-

Hz tone will read +90 dBrn, but the same power as white noise, randomly distributed over a 3-kHz band will read approximately +88.5 dBrn (rounded off to +88 dBrn), due to the frequency weighting. *Note 3:* With 144 weightings, a one-milliwatt, 1000-Hz white noise tone will also read +90 dBrn, but the same 3-kHz power will only read +82 dBrn, due to the different frequency weighting. *See also* channel noise level, circuit noise level, dB, noise level, noise weighting.

**dBrn adjusted** *Synonym* dBa.

**dBrnC** Weighted noise power in dBrn, measured by a noise measuring set with C-message weighting. (188) *See also* circuit noise level, dB, level, noise level.

**dBrnC0** Noise power in dBrnC referred to or measured at a zero transmission level point (OTLP). (188) *See also* level, noise level, zero transmission level point.

**dBrn( $f_1$ - $f_2$ )** Flat noise power in dBrn, measured over the frequency band between frequencies  $f_1$  and  $f_2$ . (188) *See also* dB, flat weighting, frequency, noise level, noise weighting.

**dBrn(144-line)** Weighted noise power in dBrn, measured by a noise measuring set with 144-line weighting. (188) *See also* dB, noise level, noise weighting.

**dBW** Decibels referenced to one watt. (188) *See also* dB, rated output power.

**DCE** *Abbreviation for data circuit-terminating equipment.*

**DCE clear signal** A call control signal transmitted by the DCE to indicate that it is clearing a call. *See also* call, call control signal, data circuit-terminating equipment, signal.

**DCE waiting signal** A call control signal at the DCE/DTE interface that indicates that the DCE is waiting for another event in the call establishment procedure. *See also* call, call

control signal, data circuit-terminating equipment, data terminal equipment, signal.

**D channel** A component of the CCITT subscriber accessing standard under ISDN. Specifically, the D channel represents a 16-kbps segment of a 144-kbps, full-duplex subscriber service subdivided into a convention of 2B+D (two 64-kbps clear channels and one 16-kbps channel). The 64-kbps clear channels are used for voice and data service while the 16-kbps channel will predominately provide an out-of-band signaling capability. *See also* Integrated Services Digital Network.

**dc patch bay** A patch bay in which dc circuits are grouped. (188) *See also* patch bay.

**DCPSK** *Abbreviation for differentially coherent phase-shift keying.*

**DDD** *Abbreviation for direct distance dialing.*

**DDN** *Abbreviation for Defense Data Network.*

**dead sector** In facsimile, the elapsed time between the end of scanning of one line and the start of scanning of the following line. (188) *See also* facsimile, scanning (def. #2), scanning line length.

**debug** To detect, trace, and eliminate mistakes. (188)

**deception** *See* electronic deception.

**decibel (dB)** *See* dB.

**decipher** To convert enciphered text to the equivalent plain text by means of a cipher system. *Note:* This does not include solution by cryptanalysis. *See also* cipher, communications security, decode, decrypt.

**decision circuit** A circuit that measures the probable value of a signal element and makes an output signal decision based on the value of the input signal and a predetermined criterion or criteria. (188) *See also* circuit, gate, gating.

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**decision instant** In the reception of a digital signal, the instant at which a decision is made by a receiving device as to the probable value of a signal condition. (188) *Synonym* selection position. *See also* bit synchronization, significant instant.

**decode** 1. To convert data by reversing the effect of some previous encoding. (188) 2. To interpret a code. 3. To convert encoded text into its equivalent plain text by means of a code. (188) *Note:* This does not include solution by cryptanalysis. *See also* analog decoding, code, decipher, decrypt, encipher, encode.

**decollimation** In optics, that effect wherein a beam of parallel light rays is caused to diverge or converge from parallelism. (188) *Note:* Any of a large number of factors may cause this effect, e.g., refractive index inhomogeneities, occlusions, scattering, deflection, diffraction, reflection, refraction. *See also* beam divergence, collimation, diffraction, refraction, scattering.

**decrypt** To convert encrypted text into its equivalent plain text by means of a cryptosystem. (This does not include solution by cryptanalysis.) *Note:* The term decrypt covers the meanings of decipher and decode. (JCS1-DoD) *See also* decipher, decode, garble.

**dedicated circuit** A circuit designated for exclusive use by specified users. (188) *See also* circuit, closed circuit, hot line, leased circuit, off-hook service, point-to-point link.

**dedicated service** A communication network devoted to a single purpose or group of users, e.g., AUTOVON, FTS. (188) *Note:* It may be a subset of a larger network; e.g., AUTOVON, FTS.

**deemphasis** In FM transmission, the process of restoring (after detection) the amplitude-versus-frequency characteristics of the signal. (188) *See also* emphasis, preemphasis, preemphasis improvement.

**deeply depressed cladding fiber** An optical fiber construction, usually a single-mode fiber, that

has an outer cladding of approximately the same refractive index as the core, and an inner cladding of very low (depressed) refractive index material between them. *See also* cladding, depressed cladding fiber, doubly clad fiber, fiber optics, quadruply clad fiber, single-mode optical fiber.

**deep space** Space at distances from the Earth approximately equal to or greater than the distance between the Earth and the Moon. (RR)

**de facto standards** Standards, widely accepted and used, but lacking formal approval by a recognized standards organization.

**Defense Data Network (DDN)** The Department of Defense integrated packet switching network capable of worldwide multilevel secure and non-secure data transmission.

**definition** A figure of merit for image quality. (188) *Note:* For video-type displays, it is normally expressed in terms of the smallest resolvable element of the reproduced received image, e.g., lines per inch, pels per square inch. *See also* facsimile, resolution.

**degradation** In communications, that condition in which one or more of the established performance parameters fall outside predetermined limits, resulting in a lower quality of service. *See also* degraded service state.

**degraded service state** The condition wherein degradation prevails in a communication link. *Note:* For some applications, e.g., automatic switching to a nondegraded standby link, degradation must persist for a specified period of time before a degraded service state is considered to exist. (188) *See also* continuous operation, graceful degradation, outage.

**degree of coherence** A measure of the coherence of a light source. (188) *Note 1:* The magnitude of the degree of coherence is equal to the visibility,  $V$ , of the fringes of a two-beam interference test, as given by

$$V = \frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}},$$

where  $I_{\max}$  is the intensity at a maximum of the interference pattern, and  $I_{\min}$  is the intensity at a minimum. *Note 2:* Light is considered highly coherent when the degree of coherence exceeds 0.88, incoherent for very small values, and partially coherent for intermediate values. *See also coherence area, coherence length, coherence time.*

**degree of isochronous distortion** In data transmission, the ratio of (a) the absolute value of the maximum measured difference between the actual and the theoretical intervals separating any two significant instants of modulation (or demodulation) to (b) the unit interval. These instants are not necessarily consecutive. (188) *Note 1:* The degree of isochronous distortion is usually expressed as a percentage. *Note 2:* The result of the measurement should be completed by an indication of the period, usually limited, of the observation. For a prolonged modulation (or demodulation), it will be appropriate to consider the probability that an assigned value of the degree of distortion will be exceeded. *See also distortion, isochronous distortion.*

**degree of start-stop distortion** 1. In asynchronous data transmission, the ratio of (a) the absolute value of the maximum measured difference between the actual and theoretical intervals separating any significant instant of modulation (or demodulation) from the significant instant of the start element immediately preceding it to (b) the unit interval. 2. The highest absolute value of individual distortion affecting the significant instants of a start-stop modulation. *Note:* The degree of distortion of a start-stop modulation (or demodulation) is usually expressed as a percentage. Distinction can be made between the degree of late (or positive) distortion and the degree of early (or negative) distortion. *See also distortion, start-stop distortion.*

**dejitterizer** A device for reducing jitter in a digital signal, consisting essentially of an elastic buffer into which the signal is written and

from which it is read at a rate determined by the average rate of the incoming signal. *Note:* Such a device is largely ineffective in dealing with low-frequency impairments such as waiting-time jitter. *See also regeneration (def. #2), signal regeneration.*

**DEL** *Abbreviation for delete character.*

**delay** In radar, the electronic delay of the start of the time base used to select a particular segment of the total. (JCS1-DoD)

**delay distortion** The distortion of a waveform made up of two or more different frequencies, caused by the difference in arrival time of each frequency at the output of a transmission system. (188) *Synonyms phase distortion, time-delay distortion. See also absolute delay, distortion, group delay.*

**delayed delivery facility** A facility that employs storage within the data network whereby data destined for delivery to one or more addressees may be held for subsequent delivery at a later time. *See also store-and-forward.*

**delay encoding** A method of encoding binary data to form a two-level signal. A binary zero causes no change of signal level unless it is followed by another zero, in which case a transition takes place at the end of the first bit period. A binary "1" causes a transition from one level to the other in the middle of the bit period. *Note:* Used primarily for encoding of radio signals since the spectrum of the encoded signal contains less low frequency energy than an NRZ signal and less high frequency energy than a biphase signal. *See also modulation, non-return-to-zero code.*

**delay equalizer** A corrective network designed to make the phase delay or envelope delay of a circuit or system substantially constant over a desired frequency range. (188) *See also absolute delay, circuit, equalization, phase, phase delay.*

**delay line** 1. A transmission line, or equivalent device, designed to introduce delay. (188) 2. A sequential logic element or device with one



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input channel, in which the output channel state at a given instant,  $t$ , is the same as the input channel state at the instant,  $t-n$ , i.e., the input sequence undergoes a delay of  $n$  units. There may be additional taps yielding output channels with smaller values of  $n$ . (188) *See also* absolute delay.

**deleted bit** A bit not delivered to the intended destination. (188) *See also* added bit, binary digit, character-count and bit-count integrity, error.

**deleted block** A block not delivered to the intended destination. (188) *See also* added block, block, block transfer failure.

**delivered block** A successfully transferred block. *See also* binary digit, block.

**delivered overhead bit** A bit transferred to a destination user, but having its primary functional effect within the telecommunication system. *See also* binary digit, overhead information, user information.

**delivered overhead block** A successfully transferred block that contains no user information bits. *See also* block, overhead information, user information.

**delivery confirmation** Information returned to the originator indicating that a given unit of information has been delivered to the intended addressee(s). *See also* acknowledge character.

**Dellinger fade out** *See* flutter (def. #2).

**delta modulation (DM)** A technique for converting an analog signal to a digital signal. (188) *Note:* The technique approximates the analog signal with a series of straight-line segments. The approximated signal is compared to the original analog wave to determine an increase or decrease in relative amplitude. The decision process for establishing the state of successive binary digits is determined by this comparison. Only the change of information, an increase or decrease of the signal amplitude from the previous sample, is sent; thus, a no-change condition

remains at the same 0 or 1 state of the previous sample. There are several variations to the simple delta modulation system. *See also* continuously variable slope delta modulation, delta-sigma modulation, differential modulation, differential pulse-code modulation, pulse-code modulation, quantized feedback.

**delta-sigma modulation** A variant of delta modulation in which the integral of the input signal is encoded rather than the signal itself. (188) *Note:* This may be achieved by preceding a normal delta modulation encoder by an integrating network. *See also* delta modulation, modulation.

**demand assignment** An operational technique whereby various users share a communications channel on a real-time demand basis. That is, a user needing to communicate with another user of the network activates the required circuit. *Note:* Upon completion of the call, the circuit is deactivated and the capacity is available for other users. This service is analogous, in many ways, to an ordinary telephone switching network that provides common trunking for many users, on a demand basis, through a limited size trunk group. (188) *See also* time-division multiple access.

**demand assignment multiple access (DAMA)** A technique for allocating capacity based on either FDM or TDM modulating techniques. *Note:* Service is provided upon demand for access by the user. *See also* frequency-division multiplexing, time-division multiplexing.

**demand factor** The ratio of the maximum demand on a power system to the total connected load of the system. (188) *Note:* The maximum demand is usually the integrated-maximum-kW demand over a 15- or 30-minute interval, rather than the instantaneous or peak demand. *See also* demand load.

**demand load** 1. In general, the total power required by a facility. (188) *Note:* The demand load is the sum of the operational load (including any tactical load) and nonoperational demand loads. It is determined by applying the

proper demand factor to each of the connected loads and a diversity factor to the sum total. 2. At a communications center, the power required by all automatic switching, synchronous, and terminal equipment (operated simultaneously on-line or in standby), control and keying equipment, plus lighting, ventilation, and air conditioning equipment required to maintain full continuity of communications. (188) 3. The power required for ventilating equipment, shop lighting, and other support items that may be operated simultaneously with the technical load. (188) 4. The sum of the technical demand and nontechnical demand loads of an operating facility. (188) 5. At a receiver facility, the power required for all receivers and auxiliary equipment that may be operated on prime or spare antennas simultaneously, those in standby condition, multicouplers, control and keying equipment, plus lighting, ventilation, and air conditioning equipment required for full continuity of communications. (188) 6. At a transmitter facility, the power required for all transmitters and auxiliary equipment that may be operated on prime or spare antennas or dummy loads simultaneously, those in standby condition, control and keying equipment, plus lighting, ventilation, and air conditioning equipment required for full continuity of communications. (188) *See also demand factor, load.*

**demand service** In ISDN applications, a telecommunications service that establishes an immediate communication path in response to a user request made through user-network signaling.

**demarc** *Acronym for demarcation point.*

**demarcation point (demarc)** That point at which operational control or ownership changes from one organizational entity to another. *See also point of interface, point of presence.*

**democratically synchronized network** A mutually synchronized network in which all clocks in the network are of equal status and exert equal amounts of control on the others, the network operating clock pulse repetition

rate being the mean of the natural (uncontrolled) clock pulse repetition rates of the population of clocks. *See also frequency averaging, hierarchically synchronized network, master-slave timing, mutually synchronized network, mutual synchronization, oligarchically synchronized network.*

**demodulation** The process wherein a signal resulting from previous modulation is processed to derive a signal having substantially the characteristics of the original modulating signal. (188) *See also detection, modulation, restitution.*

**demultiplex (deMUX)** To separate two or more signals previously combined by compatible multiplexing equipment. (188) *See also multiplexing.*

**deMUX** *Acronym for demultiplexer.*

**density** In a facsimile system, a measure of the light transmission or reflection properties of an area, expressed by the logarithm of the ratio of incident to transmitted or reflected light flux. (188) *Note:* There are many types of density that will usually have different numerical values for a given material; e.g., diffuse density, double diffuse density, specular density. The relevant type of density depends upon the geometry of the optical system in which the material is used. *See also facsimile, optical density.*

**departure angle** The angle between the axis of the main lobe of an antenna pattern and the horizontal plane at the transmitting antenna. (188) *Synonym takeoff angle. See also radiation pattern.*

**depolarization** 1. In electromagnetic wave propagation, that condition wherein a polarized transmission being transmitted through a nonhomogeneous medium has its polarization reduced or randomized by the effects of the medium being traversed. (188) *See also polarization, polarization diversity.* 2. Prevention of polarization in an electric cell or battery. (188)

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**depressed cladding fiber** An optical fiber construction, usually single mode, that has double cladding, the outer cladding having an index of refraction intermediate between the core and the inner cladding. (188) *See also* cladding, deeply depressed cladding fiber, doubly clad fiber, fiber optics, single-mode optical fiber.

**deregulation** The reduction in tariff, market entry and exit, and facilities regulation of public telecommunication services.

**DES** *Abbreviation for Data Encryption Standard.*

**descrambler** The inverse of a scrambler, resulting in restoration of a signal to its original state, provided that no symbol errors have occurred. *See also* randomizer, scrambler.

**design margin** The additional performance capability above required standard basic system parameters that may be specified by a system designer to compensate for uncertainties. (188) *See also* fade margin, rf power margin.

**design objective (DO)** Any desired performance characteristic for communication circuits and equipment which is based on engineering judgment but, for a number of reasons, is not considered feasible to establish as a system standard at the time the standard is written. (188) *Note:* Examples of reasons for designating a performance characteristic as a DO rather than as a standard are: (a) it may be bordering on an advancement in the state of the art; (b) the requirement may not have been fully confirmed by measurement or experience with operating circuits; (c) it may not have been demonstrated that it can be met considering other constraints such as cost and size. A DO must be considered as guidance for DoD agencies in preparation of specifications for development or procurement of new equipment or systems and must be used if technically and economically practicable at the time such specifications are written. *See also* specification, standard.

**despun antenna** Of a rotating communications satellite, an antenna, the direction of whose main beam with respect to the satellite is continually adjusted so that it illuminates a given area on the surface of the Earth, i.e., the footprint does not move. *See also* satellite.

**destination user** A user to whom the source user information is to be delivered during a particular information transfer transaction. *See also* communications sink, communications source, data sink, data source, sink, source, source user.

**de-stuffing** The controlled deletion of stuffing bits from a stuffed digital signal, to recover the original signal. *Synonyms* negative justification, negative pulse stuffing. *See also* binary digit, bit stuffing, maximum stuffing rate, nominal bit stuffing rate.

**detection** 1. The recovery of information from an electrical or optical signal. 2. That process whereby a modulated signal is acted upon in such a manner as to restore the modulating signal to its original state. (188) 3. In radar, that process that separates a target echo from the background noise. 4. In surveillance, the determination and transmission by a surveillance system that an event has occurred. (JCS1-DoD) 5. The discovery by any means of the presence of a person, object, or phenomenon of potential military significance. (JCS1-NATO) *See also* demodulation, discriminator, identification friend or foe, modulation, recognition, restitution.

**detectivity** The reciprocal of noise equivalent power. *See also* noise equivalent power, signal-to-noise ratio.

**detector** 1. In a radio receiver, a circuit or device that recovers the signal of interest from the modulated wave. 2. In an optical communications receiver, a device that converts the received optical signal to another form. *Note:* Currently, this conversion is from optical to electrical power; however, optical-to-optical techniques are under development.

**detem** *Acronym for detector/emitter.* An opto-electronic transducer that combines the functions of an optical detector and an emitter within a single device or module.

**deterministic transfer mode** An asynchronous transfer mode in which the maximum information transfer capacity of a telecommunication service is provided throughout a call. *See also* asynchronous transfer mode, transfer mode.

**Deutsches Institut für Normung (DIN)** The Federal Republic of Germany's standards-setting organization equivalent to the American National Standards Institute (ANSI).

**deviation ratio** In a frequency modulation system, the ratio of the maximum frequency deviation of the carrier to the maximum modulating frequency of the system under specified conditions. (188) *See also* angle modulation, frequency, frequency deviation, frequency modulation, modulation index, phase modulation.

**D4** *See* channel bank.

**D-4** A framing standard for traditional time-division multiplexing that describes user channels multiplexed onto a trunk that has been segmented or framed into 24 bytes of 8 bits each. *Note:* The multiplexing function is performed in this framing structure by interleaving bits of consecutive bytes as they are presented from individual circuits into each D-4 frame. *See also* digital signal, time-division multiplexing, trunk.

**DFSK** *Abbreviation for double frequency-shift keying.*

**diad** *Synonym* dibit.

**diagnostic program** A computer program that recognizes, locates, and/or explains (a) a fault in equipment, networks, or systems, (b) a predefined error in input data, or (c) a syntax error in another computer program. (188)

**dial dictation access** A service feature available with some switching systems that permits dialing a special number to access centralized dictation equipment. *See also* service feature.

**dial mode** A manner of operating a DCE so that circuitry directly associated with call origination is connected to a communication channel. *See also* data circuit-terminating equipment.

**dial pulse** A direct-current pulse produced by a telephone instrument interrupting a steady current at a sequence and rate determined by an operator-selected digit and the operating characteristics of the instrument. (188) *See also* dial signaling, dial tone, multifrequency signaling, pulsing, rotary dial.

**dial pulsing** *Synonym* dial signaling.

**dial service assistance (DSA)** A service feature associated with the switching center equipment to provide operator services, such as information, intercepting, random conferencing, and precedence calling assistance. (188) *See also* service feature.

**dial signaling** A type of signaling in which dual-tone multifrequency (DTMF) signals or pulse trains are transmitted to a switching center. (188) *Note:* Keypad instruments may produce either DTMF signals or pulse trains. *Synonym* dial pulsing. *See also* composite signaling, direct current signaling, dual-tone multifrequency signaling, pulse, pulse train, pulsing, rotary dial, signal.

**dial switching equipment** Switching equipment actuated by electrical impulses generated by a dial or key pulsing arrangement. (CFR 47)

**dial through** A technique, applicable to access circuits, that permits an outgoing routine call to be dialed by the PBX user after the PBX attendant has established the initial connection. (188) *See also* service feature.

**dial tone** A tone employed in a dial telephone system to indicate to the calling party that the

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equipment is ready to receive dial or tone pulses. *See also* call control signal.

**dial-tone delay** The specific time that transpires between a subscriber's going off-hook and the receipt of dial tone from a servicing telephone central office.

**dial-up** 1. A switching system service feature that allows a user to initiate service on a previously arranged trunk or to transfer from an active trunk to a standby trunk without operator intervention. (188) 2. The service by which a computer terminal can use telephone systems to initiate and effect communications with a computer.

**diametral index of cooperation** In facsimile systems, the product of the drum diameter and the line advance in scanning lines per unit length. The unit of length must be the same as that used for expressing the drum diameter. (188) *Synonym* international index of cooperation. *See also* drum factor, facsimile, index of cooperation.

**dibit** A group of two bits. *Note:* The four possible states for a dibit are 00, 01, 10, and 11. (188) *Synonym* diad. *See also* binary digit.

**dichroic filter** An optical filter designed to transmit light selectively according to wavelength (most often, a high-pass or low-pass filter). *Note:* Commonly used as a beamsplitter. *See also* mode filter.

**dichroic mirror** A mirror designed to reflect light selectively according to wavelength. (188)

**DID** *Abbreviation for direct inward dialing.*

**dielectric** Any substance in which an electric field may be maintained with zero or near-zero power dissipation.

**dielectric filter** *See* interference filter.

**dielectric lens** A lens made of dielectric material that refracts radio waves in the same manner that an optical lens refracts light waves. (188)

**dielectric strength** 1. Of a material, the potential gradient at which the insulating property of the material ceases. 2. For a given configuration of dielectric material, the minimum voltage that produces a breakdown or rupture. (188) *Note:* The condition at which breakdown occurs is dependent on the rate of change of the voltage; therefore, such conditions should be specified.

**dielectric waveguide** A waveguide consisting of a dielectric material and the surrounding air or other materials with lower refractive index. *Note:* Not to be confused with a dielectric-filled metallic waveguide.

**differentially coherent phase-shift keying (DCPSK)** A method of encoding information in terms of phase changes, rather than absolute phases, and detected by comparing phases of adjacent bits. (188) *Note:* The carrier pulses used are of constant amplitude, angular frequency, and duration, but of different relative phase. In detection, a phase comparison is made of successive samples, and information is conveyed by the phase transitions between carrier and pulses rather than by the absolute phases of the pulses. *See also* keying, modulation, phase-shift keying.

**differential mode attenuation** In fiber optics, the variation in attenuation among the propagating modes of an optical fiber. (188) *See also* coupled modes, fiber optics, mode (def. #1).

**differential mode delay** In fiber optics, the variation in propagation delay that occurs because of the different group velocities of the modes in an optical fiber. (188) *Synonym* multimode group delay. *See also* fiber optics, mode (def. #1), multimode distortion.

**differential mode interference** 1. Interference that causes a change in potential of one side of a signal transmission path relative to the other side. (188) 2. Interference resulting from an interference current path coinciding with the signal path. (188) *See also* common-mode interference, interference, mode.



**differential modulation** A type of modulation in which the choice of the significant condition for any signal element is dependent on the choice for the previous signal element. (188) *Note:* Delta modulation is an example. *See also* continuously variable slope delta modulation, delta modulation, modulation, significant instant.

**differential phase-shift keying (DPSK)** A method of encoding information for digital transmission. *Note 1:* In DPSK, each signal element is encoded as a change in the phase of the carrier with respect to its previous phase angle. (188) *Note 2:* DPSK is a version of phase-shift keying in which the phase reference for each signaling element is the phase state of the preceding signaling element. *See also* double frequency-shift keying, frequency-shift keying, phase, phase deviation, phase modulation, phase shift, phase-shift keying.

**differential pulse-code modulation (DPCM)** A version of pulse-code modulation in which an analog signal is sampled, and the difference between the actual value of each sample and its predicted value (derived from the previous sample or samples) is quantized and is converted by encoding to a digital signal. *Note:* There are several variations on differential pulse-code modulation. *See also* adaptive differential pulse-code modulation, code, continuously variable slope delta modulation, delta modulation, modulation.

**differential quantum efficiency** In an optical source or detector, the slope of the curve relating output quanta to input quanta. (188) *See also* optoelectronic.

**diffraction** The deviation of a wavefront from the path predicted by geometric optics when a wavefront is restricted by an opening or an edge. (188) *Note:* Diffraction is usually most noticeable for openings of the order of a wavelength. However, diffraction may still be important for apertures many orders of magnitude larger than the wavelength. *See also* diffraction limited, far-field radiation

pattern, fiber optics, knife edge effect, propagation, refraction.

**diffraction grating** An array of fine, parallel, equally spaced reflecting or transmitting lines that mutually enhance the effects of diffraction at the edges of each so as to concentrate the diffracted light very close to a few directions depending on the spacing of the lines and the wavelength of the diffracted light. *Note:* The wavelength,  $\lambda$ , is given by  $\lambda = (S/N)(\sin i + \sin d)$ , where  $i$  is the angle of incidence,  $d$  is the angle of diffraction,  $S$  is the center-to-center distance between successive rulings, and  $N$  is the order of the spectrum. If there is a large number of narrow, close, equally spaced rulings upon a transparent or reflecting substrate, the grating will be capable of dispersing incident light into its wavelength components.

**diffraction limited** A beam of light is diffraction limited if: (a) the far-field beam divergence is equal to that predicted by diffraction theory, or (b) in focusing optics, the impulse response or resolution limit is equal to that predicted by diffraction theory. (188) *See also* beam divergence, diffraction, refraction.

**diffraction region** In radio transmission, the region beyond the radio horizon. (188)

**diffuse reflection** *See* reflection.

**digit** A symbol, numeral, or graphic character that represents an integer, e.g., one of the decimal characters "0" to "9," or one of the binary characters "0" or "1." (188) *Note:* In a given numeration system, the number of allowable different digits, including zero, is always equal to the radix (base). *See also* alphabet, binary digit, character, character set.

**digital** Characterized by discrete states.

**digital access and cross-connect systems (DACS)** A category of T-1 hardware architecture for private and public networks for centralized switching. This equipment employs D3/D4 framing for switching of DS-0 channels to other DS-0 channels. *See also* digital signal 0.

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**digital alphabet** A coded character set in which the characters of an alphabet have a one-to-one relationship with their digitally coded representations. (188) *See also* alphabet, character, character set, code, coded character set, coded set.

**digital circuit patch bay** A patching facility where low-level digital data circuits can be patched, monitored, and tested. (188) *Note:* This patch bay can be either "D" type (unbalanced) or "K" type (balanced). *See also* circuit, facility, level, patch bay.

**digital combining** A method of interfacing digital data signals, in either synchronous or asynchronous mode, without converting the data into a quasi-analog signal. (188) *See also* digital alphabet, diversity combiner, interface, multiplexing.

**digital computer** A device that performs operations on data that are represented by discrete values only. *Note:* Digital computers commonly employ electrical signals having two permissible states or levels, which represent the two possible characters (numerals) in the binary number system. *See also* analog computer, computer.

**digital data** 1. Data represented by discrete values or conditions, as opposed to analog data. (188) 2. A discrete representation of a quantized value of a variable, i.e., the representation of a number by digits, perhaps with special characters and the "space" character. *See also* analog data, data, data transmission.

**digital error** A single-digit inconsistency between the signal actually received and the signal that should have been received. (188) *See also* character-count and bit-count integrity, error, error control.

**digital facsimile equipment** Facsimile equipment that employs digital techniques to encode the image detected by the scanner. The output signal may be either digital or analog (188). *Note:* Examples of digital facsimile equipment are CCITT Group 3, CCITT Group

4, STANAG 5000 Type I and STANAG 5000 Type II.

**digital filter** A filter (usually linear), in discrete time, that is normally implemented through digital electronic computation. (188) *Note:* Digital filters differ from continuous time filters only in application. The parameters of digital filters are generally more stable than the parameters of commonly used analog (continuous) filters. Digital filters can be applied as optimal estimators. Commonly used forms are finite impulse response (FIR) and infinite impulse response (IIR). *See also* Kalman filter.

**digital frequency modulation** The transmission of digital data by frequency modulation of a carrier, as in binary frequency-shift keying. (188) *See also* angle modulation, carrier (cxr), differential phase-shift keying, frequency modulation, frequency-shift keying, modulation.

**digital milliwatt** A digital signal that is the coded representation of a 0-dBm, 1000-Hertz sine wave. (CFR 47)

**digital modulation** The process of varying one or more parameters of a carrier wave as a function of two or more finite and discrete states of a signal. (188) *See also* carrier (cxr), digital data, frequency-shift keying, modulation, phase-shift keying.

**digital multiplexer** A device for combining digital signals. (188) *Note:* Usually implemented by interleaving bits, in rotation, from several digital bit streams either with or without the addition of extra framing, control, or error detection bits. *See also* binary digit, bit stuffing, channel packing, frame, interleaving (def. #1), multiplexing.

**digital multiplex hierarchy** An ordered scheme for the combining of digital signals by the repeated application of digital multiplexing. (188) *Note 1:* Digital multiplexing schemes may be implemented in many different configurations depending upon the number of channels desired, the signaling system to be

used, and the bit rate allowed by the communication medium. *Note 2:* Some currently available multiplexers have been designated as D1-, DS-, or M-series, all of which operate at T-carrier rates. **CAUTION:** Extreme care must be exercised when selecting equipment for a specific system to ensure interoperability, because there are incompatibilities among manufacturers' designs (and various nations' standards). *See also* digital transmission group, digital transmission system, digroup, multiplex hierarchy, multiplexing.

**digital network** *See* integrated digital network.

**digital phase-locked loop** A phase-locked loop in which the reference signal, the controlled signal, or the controlling signal, or any combination of these, is in digital form. *See also* loop, phase, phase-locked loop.

**digital phase modulation** The process whereby the instantaneous phase of the modulated wave is shifted between a set of predetermined discrete values in accordance with the significant conditions of the modulating digital signal. *See also* angle modulation, differential phase-shift keying, frequency-shift keying, modulation, phase, phase-shift keying.

**digital primary patch bay** A patching facility that provides the first appearance of most local user digital circuits in the technical control facility (TCF). (188) *Note:* The digital primary patch bay provides patching, monitoring, and testing capabilities for both high-level and low-level digital circuits. *See also* circuit, D-type patch bay, facility, K-type patch bay, patch bay.

**digital selective calling (DSC)** A synchronous system developed by the International Radio Consultative Committee (CCIR), used to establish contact with a station or group of stations automatically by means of radio. The operational and technical characteristics of this system are contained in CCIR Recommendation 493. (CFR 47)

**digital signal (DS)** A signal characterized by discrete states. (188) *Note 1:* Usually, digital signals are binary signals. *Note 2:* Analog signals may be converted to digital signals by sampling and then quantizing. *See also* analog signal, binary digit, character, code (def #1), signal.

**digital signal 0 (DS0)** A basic digital signaling rate of 64 kbps, corresponding to the capacity of one voice-frequency-equivalent channel. *Note 1:* This rate forms the basis for the North American digital multiplex transmission hierarchy. *Note 2:* This channel may comprise twenty 2.4-kbps channels, or ten 4.8-kbps channels, or five 9.67-kbps channels, or one 56-kbps channel, or one 64-kbps clear channel.

**digital signal 1 (DS1)** A digital signaling rate of 1.544 Mbps, corresponding to the North American and Japanese T1 designator. *See also* T-carrier.

**digital signal 1C (DS1C)** A digital signaling rate of 3.152 Mbps, corresponding to the North American T1C designator. *See also* T-carrier.

**digital signal 2 (DS2)** A digital signaling rate of 6.312 Mbps, corresponding to the North American and Japanese T2 designator. *See also* T-carrier.

**digital signal 3 (DS3)** A digital signaling rate of 44.736 Mbps, corresponding to the North American T3 designator, and a rate of 32.064 Mbps, corresponding to the Japanese T3 designator. *See also* T-carrier.

**digital signal 4 (DS4)** A digital signal rate of 274.176 Mbps, corresponding to the European T4 designator; and a rate of 97.728 Mbps, corresponding to the Japanese T4 designator. *See also* T-carrier.

**digital speech interpolation (DSI)** In digital speech transmission, the use of periods of inactivity or constant signal to increase the transmission efficiency. *See also* time-assignment speech interpolation.

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**digital switch** Switching equipment designed, designated, or used to perform time-division multiplexed switching of digital signals. (188)

*Note 1:* When used with analog inputs, an A-D/D-A conversion is required. *Note 2:* Normal implementation is by interchanging time slots between input and output ports on a regular sequential basis under the direction of control systems. The control systems may be automatic, semiautomatic, or manual. *See also* circuit, digital-to-analog converter, digital transmission group, digital transmission system, digital voice transmission, digitize, digitizer, digit time slot, switching center.

**digital switching** A process in which digital signals are switched without converting them to or from analog signals. (188) *See also* digital switch, time-division switching.

**digital-to-analog (D-A) converter** 1. A device that converts a digital input signal to an analog output signal carrying equivalent information. (188) 2. A functional unit that converts data from a digital representation to an analog representation. (FP) (ISO) *See also* analog-to-digital converter, digital voice transmission, digitize.

**digital transmission group** A number of voice or data channels, or both, that are combined into a digital bit stream for transmission over various communication media. (188) *Note:* No specific number of channels is implied by this term. In general, however, the term implies no more channels than can be accommodated by a multiplexer whose output rate is not greater than about 24 voice channels. *See also* digital multiplex hierarchy, digroup, group, multiplexing, transmission.

**digital transmission system** A transmission system wherein all circuits carry information to one or more serial bit streams. *Note:* A-D/D-A conversion (if required) must be accomplished external to the system. All framing and system signaling and supervision are also included in the bit stream. (188) *See also* binary digit, circuit, digital multiplex hierarchy, frame, multiplexing, T-carrier.

**digital voice transmission** Transmission of analog voice signals that have been converted into digital signals, e.g., pulse-code modulation (PCM) of analog voice signals. (188) *See also* analog-to-digital converter, digital-to-analog converter.

**digitize** To convert an analog signal to a digital signal carrying equivalent information. (188) *See also* analog-to-digital converter, digital-to-analog converter.

**digitizer** 1. A device that converts an analog signal into a digital representation of that signal. (188) *Note:* Usually implemented by sampling the analog signal at a regular rate and encoding each sample into a numeric representation of the amplitude value of the sample. 2. A device that converts the position of a point on a surface into digital coordinate data. (188) *See also* analog-to-digital converter.

**digit time slot** In a digital data stream, a time interval that can be recognized and defined uniquely, and which is allocated to a single digit. (188) *See also* signaling time slot, time-division multiplexing, time slot (def. #2).

**digroup** A term designating the basic digital multiplexing grouping. *Note:* In the United States, this basic group is derived from 1.544 Mbps. In Europe, the basic group is commonly 2.048 Mbps. *See also* binary digit, digital multiplex hierarchy, digital transmission group, group, T-carrier.

**DIN** Abbreviation for Deutsches Institut für Normung.

**diode laser** *Synonym* injection laser diode.

**DIP** Abbreviation for dual in-line package. *See* dual in-line package switch.

**diplexer** A three-port frequency-dependent device that may be used as a separator or a combiner of signals. (188) *Note:* Duplex transmission through a diplexer is not possible. *See also* duplexer, duplex operation.

**diplex operation** Simultaneous one-way transmission or reception of two independent signals using a common element, such as a single antenna or channel; e.g., operation of two or more radio transmitters on different frequencies using one antenna. (188) *See also* **duplexer, duplex operation.**

**dipole antenna** Usually a straight, center-fed, one-half wavelength antenna. (188) *See also* **antenna, multi-element dipole antenna.**

**direct access** 1. The capability to obtain data from a storage device or to enter data into a storage device in a sequence independent of their relative positions, by means of addresses that indicate the physical location of the data. (FP) (ISO) 2. Pertaining to the organization and access method that must be used for a storage structure in which locations of records are determined by their keys, without reference to an index or to other records that may have been previously accessed. (FP) *See also* **browsing.**

**direct address** [In computing.] An address that designates the storage location of an item of data to be treated as an operand. (FP)

**direct bond** An electrical connection using continuous metal-to-metal contact between the members being joined. (188) *See also* **bond, bonding.**

**direct-buried cable** A communication cable manufactured or produced for the purpose of burial in direct contact with the earth. (188) *See also* **cable, underground cable.**

**direct call** A facility-handled call in which the network interprets the call request signal as an instruction to establish a previously designated connection. *See also* **call.**

**direct coupling** *Synonym* **conducted coupling.**

**direct current signaling (DX)** In telephony, a method whereby the signaling circuit E & M leads use the same cable pair(s) as the voice circuit and no filter is required to separate the control signals from the voice transmission.

(188) *Synonym* **DX signaling.** *See also* **composite signaling, dial signaling, E & M signaling, signal.**

**direct dialing service** A service feature that permits a user to place information concerning credit card calls, collect calls, and special billing calls into the public telephone network without operator assistance. *See also* **service feature.**

**direct distance dialing (DDD)** In the public telephone network, a service feature whereby a user may, without assistance from any network operating personnel, call any other user connected to the network outside the originator's local calling area. (188) *Note 1:* This method extends beyond the boundaries of the national public telephone network. *Note 2:* The method requires additional digits in the number dialed, over those required for use within the local area. *See also* **service feature.**

**direct inward dialing (DID)** 1. A service feature that allows inward-directed calls to a PBX to reach a specific PBX station without attendant assistance. 2. In a switching system, a service feature that permits incoming trunk calls to be forwarded directly to a user without attendant intervention. (188) *See also* **direct outward dialing, PBX, service feature.**

**directional antenna** An antenna in which the radiation pattern is not omnidirectional, i.e., a nonisotropic antenna. (188) *See also* **antenna, directive gain, directivity pattern, rhombic antenna.**

**directional coupler** A transmission coupling device for separately sampling (through a known coupling loss) either the forward (incident) or the backward (reflected) wave in a transmission line. (188) *Note 1:* A directional coupler may be used to sample either a forward or backward wave in a transmission line. A unidirectional coupler has available terminals or connections for sampling only one direction of transmission; a bidirectional coupler has available terminals for sampling both directions. *Note 2:* For optical fiber



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applications, *see* optical fiber branching device, optical fiber coupler, TEE coupler.

**directionalization** The temporary conversion of a portion or all of a two-way trunk group to one-way trunks favoring traffic flowing away from a congested switch. *Note:* Adjacent nodes must cooperate to accomplish this action. *See also* adaptive routing, avoidance routing, dynamically adaptive routing, line load control, minimize.

**direction finding** A procedure for obtaining bearings of radio frequency emitters by using a highly directional antenna and a display unit on an intercept receiver or ancillary equipment. (JCS1-DoD)

**direction of scanning** In a facsimile transmitting apparatus, the scanning of the plane (developed in the case of a drum transmitter) of the message surface along lines running from right to left commencing at the top so that scanning commences at the top right-hand corner of the surface and finishes at the bottom left-hand corner; this is equivalent to scanning over a right-hand helix on a drum. The orientation of the message on the scanning plane will depend upon its dimensions and is of no consequence. At the receiving apparatus, scanning takes place from right to left and top to bottom (in the above sense) for "positive" reception and from left to right and top to bottom (in the above sense) for "negative" reception. (188) *Note:* This is the CCITT Recommendation for phototelegraphic equipment. *See also* facsimile, scanning.

**directive gain** 1. The ratio of  $4\pi$  times the power delivered per unit solid angle (steradian) in a given direction to the power delivered to  $4\pi$  steradians. (188) *Note 1:* The directive gain is usually expressed in dB. (This yields the gain relative to an isotropic antenna.) *Note 2:* The power delivered to  $4\pi$  steradians is the total power delivered by the antenna. 2. Of an antenna, for a specified direction, the ratio in dB of the radiation intensity produced in the given direction to the average value of the radiation intensities in all directions in space. If the direction is not specified it can be

assumed to be that of maximum radiation. (188) *See also* antenna, antenna gain, beamwidth, effective radiated power, gain, main beam, mean power, power.

**directivity pattern** A diagram relating power density (or field strength) to direction relative to an antenna, at a constant, great distance from the antenna. (188) *Note:* Such diagrams usually refer to planes or the surface of a cone containing the antenna, and are usually normalized to the maximum value of the power density or field strength. *See also* antenna, beamwidth, main beam, radiation pattern.

**direct orbit** Of a satellite orbiting the Earth, an orbit in which the projection of the satellite on a plane through the (Earth's) equator revolves in the same direction as the rotation of the Earth. (188) *See also* equatorial orbit, geostationary orbit, inclined orbit, polar orbit, retrograde orbit, satellite, synchronous orbit.

**direct outward dialing (DOD)** 1. In a switching system, a service that allows outward calls from a PBX terminal without attendant assistance. 2. In a switching system, a service feature that permits outgoing trunk calls to be dialed directly without attendant assistance. (188) *See also* direct inward dialing, PBX, service feature.

**direct ray** A ray of electromagnetic radiation that follows the path of least possible propagation time between transmitting and receiving antennas. (188) *Note:* The least time path is not always the shortest distance path. *See also* antenna, ground wave, line-of-sight propagation, propagation, propagation mode, skip zone, sky wave.

**direct recording** That type of facsimile recording in which a visible record is produced, without subsequent processing, in response to the received signals. (188) *See also* electrochemical recording, electrolytic recording, electrostatic recording, facsimile.

**disabling tone** A selected tone transmitted over a communications path to control equipment. (188) *Note:* It is normally used to place an echo

suppressor in a nonoperative condition during data transmission over a telephone circuit. *See also* call, call control signal.

**disc** *See* diskette.

**DISC** *Abbreviation for* disconnect command.

**discone** *See* biconical antenna.

**disconnect** In telephony, the disassociation or release of a switched circuit between two stations. *See also* abandoned call, circuit, disconnect signal, disengagement attempt, disengagement phase, information-transfer transaction, successful disengagement.

**disconnect command (DISC)** In link-layer protocols such as HDLC, SDLC, and ADCCP, an unnumbered command used to terminate the operational mode previously set. *See also* LAP-B, network, Open Systems Interconnection--Reference Model, X.-series Recommendations.

**disconnect signal** In a switched telephone network, a signal transmitted from one end of a user line or trunk to indicate at the other end that the established connection should be disconnected. (188) *See also* call, call control signal, disconnect, disengagement attempt, information-transfer transaction, signal.

**disconnect switch** In a power system, a switch used for closing, opening, or changing the connections in a circuit or system or for purposes of isolation. *Note:* It has no interrupting rating and is intended to be operated only after the circuit has been opened by some other means, such as by a circuit breaker or variable transformer. (188) *See also* circuit breaker, operational load, station load.

**discriminator** A circuit that extracts the desired signal from an incoming frequency-modulated wave by changing frequency variations into amplitude variations. (188) *See also* detection, FM improvement factor, FM threshold effect.

**disengagement attempt** The process by which one or more users interact with a

telecommunication system in order to terminate an established access. *See also* disconnect, disconnect command, disconnect signal, information-transfer transaction, successful disengagement.

**disengagement denial** Disengagement failure due to excessive delay by the telecommunication system. *See also* disengagement failure, failure.

**disengagement-denial probability** The ratio of disengagement attempts that result in disengagement denial to the total disengagement attempts counted during a measurement period.

**disengagement failure** Failure of a disengagement attempt to return a communication system to the idle state, for a given user, within a specified maximum disengagement time. *See also* disengagement denial, disengagement request, failure, successful disengagement.

**disengagement originator** The functional entity responsible for initiating a particular disengagement attempt. *Note:* A disengagement attempt can be initiated by either the source user or the destination user; or, in the case of systems with preemption, by the communication system.

**disengagement phase** In an information transfer transaction, the phase during which successful disengagement occurs. *Note:* The disengagement phase is the third phase of an information transfer transaction. *See also* access phase, disconnect, information-transfer phase, information-transfer transaction, successful disengagement.

**disengagement request** A control or overhead signal issued by a disengagement originator for the purpose of initiating a disengagement attempt. *See also* disengagement failure, successful disengagement.

**disengagement time** 1. The average value of elapsed time between the start of a disengagement attempt for a particular source

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or destination user and the successful disengagement of that user. 2. Elapsed time between the start of a disengagement attempt and successful disengagement. *See also* call release time, clearing.

**diskette** A small magnetic disk enclosed in a jacket. (FP) (ISO)

**disk pack** An assembly of magnetic disks that can be removed as a whole from a disk drive together with a container from which the assembly must be separated when operating. (FP) (ISO)

**dispersion** In communications, any phenomenon in which electromagnetic wave propagation parameters are dependent upon wavelength. *Note 1:* In communication technology, the term is used to describe the process by which an electromagnetic signal propagating in a physical medium is degraded because the various wavelength components of the signal have different propagation characteristics within the physical medium. *Note 2:* In an optical fiber, there are several significant dispersion effects, such as material dispersion, profile dispersion, and waveguide dispersion, that degrade the signal. *Note 3:* In optical fiber communication; the incorrect terms "*multimode dispersion*" and "*intermodal dispersion*" should not be used as synonyms for the correct term "*multimode distortion*." *Note 4:* In classical optics, the term "*dispersion*" is used to denote the wavelength dependence of refractive index in matter, ( $dn/d\lambda$ , where  $n$  is the refractive index and  $\lambda$  is the wavelength) caused by interaction between the matter and light. The term "*dispersion*" as used in fiber optical communications, should not be confused with the term "*dispersion*" as used by optical lens designers. Three major types of dispersion--(a) material dispersion, (b) profile dispersion, and (c) waveguide dispersion--are considered below:

(a) **material dispersion** In optical fiber communication, the wavelength dependence of the velocity of propagation (of the optical signal) on the bulk material of which the fiber is made. *Note 1:* Because every optical signal

has a finite spectral width, material dispersion results in spreading of the signal. *Note 2:* Use of the redundant term "*chromatic dispersion*" is discouraged. *Note 3:* In pure silica, the basic material from which the most common telecommunication-grade fibers are made, material dispersion is minimum at wavelengths in the vicinity of 1.27  $\mu\text{m}$  (slightly longer in practical fibers). *See also* material dispersion coefficient.

(b) **profile dispersion** In an optical fiber, that dispersion attributable to the variation of refractive index contrast with wavelength. Profile dispersion is a function of the profile dispersion parameter. *See also* profile dispersion parameter, refractive index contrast, refractive index profile.

(c) **waveguide dispersion** Dispersion, of importance only in single-mode fibers, caused by the dependence of the phase and group velocities on core radius, numerical aperture, and wavelength. (188) *Note 1:* For circular waveguides, the dependence is on the ratio,  $a/\lambda$ , where  $a$  is core radius and  $\lambda$  is wavelength. *Note 2:* Practical single-mode fibers are designed so that material dispersion and waveguide dispersion cancel one another at the wavelength of interest.

*See also* distortion, intramodal distortion, material dispersion coefficient, multimode distortion, profile dispersion parameter.

**dispersion coefficient** *See* material dispersion coefficient.

**dispersion-limited operation** Operation of a communication circuit under specific conditions and limits wherein signal waveform degradation attributable to the dispersive effects of the communication medium is the dominant mechanism that limits circuit performance. *Note:* In optical fiber communication, the term is often confused with the term "*distortion-limited operation*." (188) *See also* attenuation-limited operation, bandwidth-limited operation, circuit, distortion-limited operation, fiber optics, multimode distortion, quantum-noise-limited operation.

**dispersion-shifted fiber 1.** An optical fiber that has its minimum-dispersion wavelength shifted, by the addition of dopants, to coincide with its minimum-loss wavelength. **2.** A single-mode optical fiber that has a nominal zero-dispersion wavelength of 1.55  $\mu\text{m}$  with applicability in the 1.5-to-1.6- $\mu\text{m}$  range, and has a dispersion coefficient that is a monotonically increasing function of wavelength. *Synonym* EIA Class IVb fiber. *See also* single-mode optical fiber.

**dispersion-unmodified fiber** *Synonym* dispersion-unshifted fiber.

**dispersion-unshifted fiber** A single-mode optical fiber that has a nominal zero-dispersion wavelength in the 1.3  $\mu\text{m}$  transmission window. *Synonyms* dispersion-unmodified fiber, EIA Class IVa fiber, nonshifted fiber. *See also* single-mode optical fiber.

**display device** An output unit that gives a visual representation of data.

**distortion** Any departure from a specified input-output signal relationship over a range of frequencies, amplitudes, or phase shifts, during a time interval. (188) *Note 1:* In a multimode optical fiber, the signal can suffer degradation from multimode distortion. In addition, several dispersive mechanisms can cause signal distortion in an optical fiber: waveguide dispersion, material dispersion, and profile dispersion. *Note 2:* In start-stop teletypewriter signaling, the shifting of the transition points of the signal pulses from their proper positions relative to the beginning of the start pulse. The magnitude of the distortion is expressed in percent of a perfect unit pulse length. *See also* dispersion, distortion-limited operation, end distortion, eye pattern, pulse, signal.

**distortion-limited operation** The condition prevailing when the distortion of a received signal, rather than its attenuated amplitude (or power), limits performance under stated operational conditions and limits. (188) *Note:* The condition is reached when the system distorts the shape of the waveform beyond specified limits. For linear systems, distortion-

limited operation is equivalent to bandwidth-limited operation. *See also* attenuation-limited operation, bandwidth-limited operation, dispersion-limited operation, multimode distortion, quantum-noise-limited operation.

**distributed control** Control of a network from multiple points. *Note:* Each point controls a portion of the network using local information or information transmitted over the network from distant points. *See also* centralized operation, distributed switching, hierarchical computer network, network architecture, routing table, system signaling and supervision.

**distributed frame-alignment signal** A frame-alignment signal in which the signal elements occupy digit positions that are not consecutive. *See also* bunched frame-alignment signal, frame, frame-alignment, frame-alignment signal, multiframe.

**distributed network** A network structure in which the network resources, such as switching equipment and processors, are distributed throughout the geographical area being served. (188) *Note:* Network control may be centralized or distributed. *See also* network, network architecture, network connectivity.

**distributed processing** A technique for implementing an integrated set of information processing functions within multiple, physically separated devices. (188) *See also* distributed network.

**distributed switching** A switching concept in which many processor-controlled switching units are distributed, usually close to user locations, and operate in conjunction with a host switch. (188) *Note:* Distributed switching usually provides for concentrations of users remote from the host switch and reduces the transmission facilities required between such concentrations and the host switch. *See also* centralized operation, concentrator, distributed control, spill forward, switching center, system signaling and supervision.

**distribution** In ISDN applications, the use of broadband transmission of audio or video

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information to the user, which does not apply post-production processing to the information. *See also* broadband ISDN, contribution, post-production processing.

**distribution frame** A structure with terminations for connecting the permanent wiring of a facility in such a manner that interconnection by cross-connections may be made readily. (188) *See also* combined distribution frame, group, group distribution frame, high frequency distribution frame, intermediate distribution frame, main distribution frame.

**distribution-quality television** Television conforming to the NTSC standard, the SECAM standard, the PAL standard, or the PAL-M standard. *Synonym [in CCITT usage]* existing-quality television. *See also* enhanced-quality television, high-definition television.

**distribution service** In ISDN applications, a telecommunications service that allows one-way flow of information from one point in the network to other points in the network with or without user individual presentation control.

**distribution substation** A substation that transforms electrical power for service to utilization equipment. (188)

**distribution voltage drop** The voltage drop between any two defined points of interest in a power distribution system. (188)

**diurnal phase shift** The phase shift of electromagnetic signals associated with daily changes in the ionosphere. (188) *Note 1:* The major changes usually occur during the period of time when sunrise or sunset is present at critical points along the path. *Note 2:* Significant phase shifts may occur on paths wherein a reflection area of the path is subject to a large tidal range. *Note 3:* In cable systems, significant phase shifts can be occasioned by diurnal temperature variance. *See also* fading, ionosphere, phase, phase interference fading.

**divergence** *See* beam divergence.

**diversity combiner** A circuit or device for combining two or more signals carrying the same information received via separate paths or channels with the objective of providing a single resultant signal that is superior in quality to any of the contributing signals. (188) *See also* digital combining, equal gain combiner, linear combiner, maximal-ratio combiner, post-detection combiner, predetection combining, selective combiner.

**diversity factor** The ratio of the sum of the individual maximum demands of the various parts of a power distribution system to the maximum demand of the whole system. *Note:* The diversity factor is always greater than unity. (188) *See also* load, load factor.

**diversity reception** That method of radio reception whereby, in order to minimize the effects of fading, a resultant signal is obtained by combining or selecting, or both, two or more independent sources of received-signal energy that carry the same modulation or information, but which may vary in their fading characteristics at any given instant. (188) *Note:* The amount of diversity improvement is directly dependent on the independence of the fading characteristics. *See also* dual diversity, frequency diversity, order of diversity, quadruple diversity, space diversity, tone diversity.

**divestiture** The court-ordered separation of the Bell Operating Telephone Companies from the American Telephone and Telegraph Company. *See also* common carrier, local access and transport area, network interface, other common carrier, resale carrier, specialized common carrier.

**D layer** *See* D region, ionosphere.

**DLE** *Abbreviation for* data link escape character.

**DM** *Abbreviation for* delta modulation.

**DO** *Abbreviation for* design objective.

**DOD** *Abbreviation for* direct outward dialing.



**DoD master clock** The U.S. Naval Observatory master clock, which has been designated as the DoD Master Clock to which DoD time and frequency measurements are referenced (traceable). (188) *Note:* This clock is one of two standard time references for the U.S. Government in accordance with Federal Standard 1002; the other standard time reference is the National Institute for Standards and Technology (NIST) master clock. *See also* cesium clock, clock, coordinated clock, coordinated time scale, Coordinated Universal Time, International Atomic Time, precise frequency, precise time, primary time standard, reference clock, remote clock, second, standard frequency and time signal service.

**domestic fixed public service** A fixed service, the stations of which are open to public correspondence, for radiocommunications originating and terminating solely at points all of which lie within [ . . . the entire United States and certain other geographic areas as specified in CFR 47].

**domestic public radio services** The land mobile and domestic fixed public services, the stations of which are open to public correspondence. (CFR 47)

**dominant mode** In a medium that can support more than one mode of operation, the mode that propagates with the minimum degradation (the mode of propagation with the lowest cutoff frequency). (188) *Note:* Designations for this mode are  $TE_{10}$  for rectangular waveguides and  $TE_{11}$  for circular waveguides. *See also* mode (def. #1), multimode distortion, waveguide.

**D1** *See* channel bank.

**double crucible method** A method of fabricating optical fiber by melting core and clad glasses into two suitably joined concentric crucibles and then drawing a fiber from the combined melted glass.

**double-current transmission** *Synonym* polar direct-current telegraph transmission.

**double-ended control** *Synonym* double-ended synchronization.

**double-ended synchronization** A synchronization control system between two exchanges, in which the phase error signals used to control the clock at one exchange are derived from comparison with the phase of the incoming digital signal and the phase of the internal clock at both exchanges. *Synonym* double-ended control. *See also* bilateral synchronization, clock, single-ended synchronization, synchronization, unilateral synchronization system.

**double frequency-shift keying (DFSK)** A multiplex system in which two telegraph signals are combined and transmitted simultaneously by a method of frequency shifting among four radio frequencies. (188) *See also* differential phase-shift keying, frequency-shift keying, keying, phase-shift keying.

**double modulation** A process in which a subcarrier is first modulated with an information-carrying wave, the resulting modulated subcarrier then being used to modulate another carrier having a higher frequency. (188) *See also* carrier (cxr), modulation.

**double refraction** *Synonym* birefringence.

**double-sideband reduced carrier transmission** That method of transmission in which frequencies produced by the process of amplitude modulation are symmetrically spaced above and below the carrier. The carrier level is reduced for transmission at a fixed level below that which is provided to the modulator. *Note:* Carrier is usually transmitted at a level suitable for use as a reference by the receiver except in those cases where it is reduced to the minimum practical level (suppressed carrier). *See also* double-sideband suppressed carrier transmission, double-sideband transmission, level, modulation, single-sideband suppressed carrier transmission, single-sideband transmission.

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**double-sideband suppressed carrier (DSB-SC) transmission** That method of transmission in which frequencies produced by the process of amplitude modulation are symmetrically spaced above and below the carrier frequency. The carrier level is reduced to the lowest practical level, ideally completely suppressed. (188)

*Note:* This is a special case of double-sideband reduced carrier. *See also* double-sideband reduced carrier transmission, level, modulation, sideband transmission, single-sideband suppressed carrier transmission, single-sideband transmission.

**double-sideband (DSB) transmission** That method of sideband transmission in which both sidebands are transmitted. (188) *See also* double-sideband reduced carrier transmission, independent-sideband transmission, sideband transmission, single-sideband suppressed carrier transmission, single-sideband transmission.

**doubly clad fiber** An optical fiber, usually single mode, that has a core surrounded by an inner cladding of lower refractive index, which is in turn surrounded by an outer cladding, which has a higher refractive index than the inner cladding. (188) *Note 1:* This is in contrast to an optical fiber having only one cladding surrounding the core. *Note 2:* This type of construction is often employed in single-mode fibers to reduce bending losses. *See also* cladding, deeply depressed cladding fiber, depressed cladding fiber, fiber optics, single-mode optical fiber.

**down-converter** A device for performing frequency translation in such a manner that the output frequencies are lower in the spectrum than the input frequencies. (188) *See also* erect position, frequency, frequency translation, inverted position, up-converter.

**downlink** That portion of a communication link used for transmission of signals from a satellite or airborne platform to a surface terminal. It is the converse of uplink. (188) *See also* Earth terminal complex, link, satellite, uplink.

**downtime** The time during which a functional unit is inoperable. (188) *See also* continuous operation, failure, fault, mean time between failures, mean time between outages, mean time to repair, mean time to service restoration, uptime.

**DPCM** *Abbreviation for differential pulse-code modulation.*

**DPSK** *Abbreviation for differential phase-shift keying.*

**D region** That portion of the ionosphere existing approximately 50 to 90 km above the surface of the Earth. (188) *Note:* Attenuation of radio waves, caused by ionospheric free-electron density generated by cosmic rays from the sun, is pronounced during daylight hours. At night the cosmic rays are gone, ionization ceases, and hence attenuation of radio waves ceases. *See also* ionosphere.

**drift** A comparatively long term change in any aspect of any system or equipment operational parameter. (188) *Note 1:* The term should be characterized when used, e.g., "diurnal frequency drift," "output level drift." *Note 2:* Drift is usually undesirable and unidirectional, but may be bidirectional, cyclic, or of such long term duration and low excursion rate as to be insignificant. *See also* frequency drift.

**drop** 1. That portion of a device that looks toward the internal station facilities, e.g., toward an AUTOVON 4-wire switch, toward a switchboard, or toward a switching center. (188) 2. The central office side of test jacks. (188) 3. A wire or cable from a pole or cable terminal to a building. (188) 4. To delete, intentionally or unintentionally, part of a signal for some reason, e.g., dropping bits. (188) *See also* local exchange loop, loop.

**drop and insert** That process wherein a part of the information carried in a transmission system is demodulated (dropped) at an intermediate point and different information is entered (inserted) for subsequent transmission in the same position, e.g., time, frequency, or phase, previously occupied by the terminated

information. (188) *Note:* Information not of interest at the drop-and-insert location is not demodulated. *See also* drop repeater, radio relay system.

**drop channel operation** A type of operation where one or more channels of a multichannel system are terminated (dropped) at any intermediate point between the end terminals of the system. *See also* channel, drop and insert, drop repeater, radio relay system.

**dropout** 1. In communication, a momentary loss of signal, usually due to the effect of noise, propagation anomalies, or system malfunction. (188) 2. A failure to read a binary character from data storage. *Note:* This failure is generally caused by defects in the storage media or failure in the read mechanism. 3. In magnetic tape, a recorded signal whose amplitude is less than a predetermined percentage of a reference signal. (188) *See also* character, failure, hit.

**drop repeater** A repeater that is provided with the necessary equipment for local termination (dropping) of one or more channels of a multichannel system. (188) *See also* channel, drop and insert, drop channel operation.

**drum factor** In facsimile systems, the ratio of drum length to drum diameter. Where drums are not used, it is the ratio of the equivalent dimensions. (188) *See also* diametral index of cooperation, facsimile, index of cooperation.

**drum speed** The angular speed of the facsimile transmitter or recorder drum, measured in revolutions per minute. (188) *See also* facsimile.

**DS** *Abbreviation for digital signal.*

**DSA** *Abbreviation for dial service assistance.*

**DSA board** A local dial office switchboard at which are handled assistance calls, intercepted calls, and calls from miscellaneous lines and trunks. It may also be employed for handling certain toll calls. (CFR 47)

**DSB** *Abbreviation for double sideband. See double-sideband transmission.*

**DSB board** A switchboard of a dial system for completing incoming calls received from manual offices. (CFR 47)

**DSB-SC** *Abbreviation for double-sideband suppressed carrier. See double-sideband suppressed carrier transmission.*

**DSC** *Abbreviation for digital selective calling.*

**DSE** *Abbreviation for data switching exchange.*

**DSI** *Abbreviation for digital speech interpolation.*

**DS0** *Abbreviation for digital signal 0.*

**DS1 . . . DS4** *Abbreviations for digital signal 1 . . . digital signal 4.*

**DS1C** *Abbreviation for digital signal 1C.*

**DSR** *Abbreviation for data signaling rate.*

**D-Star** *Synonym specific detectivity.*

**DSU** *Abbreviation for data service unit.*

**DTE** *Abbreviation for data terminal equipment.*

**DTE clear signal** A call control signal sent by the DTE to initiate clearing. *See also* call, call control signal, data terminal equipment, signal.

**DTE waiting signal** A call control signal sent by the DCE/DTE interface that indicates that the DTE is waiting for a call control signal from the DCE. *See also* call, call control signal, data circuit-terminating equipment, data terminal equipment, signal.

**D2** *See channel bank.*

**D3** *See channel bank.*

**DTMF** *Abbreviation for dual-tone multifrequency signaling.*

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**D-type patch bay** A patching facility designed for patching and monitoring of unbalanced data circuits at rates up to 1 Mbps. (188) *See also* K-type patch bay, MM patch bay, M patch bay, patch bay.

**dual access** 1. The connection of a user to two switching centers by separate access lines using a single message routing indicator or telephone number. 2. In satellite communications, the transmission of two carriers simultaneously through a single communication satellite repeater. (188) *See also* alternate routing, dual homing, multiple access, multiple homing, pulse-address multiple access, split homing.

**dual diversity** The simultaneous combining of, or selection from, two independently fading signals and their detection through the use of space, frequency, angle, time, or polarization characteristics. (188) *See also* diversity reception, frequency diversity, order of diversity, polarization diversity, quadruple diversity, space diversity, tone diversity.

**dual homing** The connection of a terminal so that it is served by either of two switching centers. *Note:* This service uses a single directory number or a single routing indicator. (188) *See also* alternate routing, dual access, multiple access, multiple homing.

**dual in-line package (DIP) switch** A subminiature switch compatible with standard integrated-circuit sockets.

**dual-tone multifrequency (DTMF) signaling** A telephone signaling method employing standard set combinations of two specific voice band frequencies, one from a group of four low frequencies and the other from a group of four relatively high frequencies. (188) *Note 1:* DTMF signals, unlike dial pulses, can pass through the entire connection to the called party, and therefore lend themselves to various schemes for remote control after the connection is set up. *Note 2:* Civil telephones using DTMF normally have 12 key combinations, the ten digits plus the symbols "\*" and "\*\*", the latter being reserved for special purposes. *Note 3:* The standard signals transmitted by switching

equipment used by the public exchange carriers are shown as follows:

Button or Digit	Frequencies (Hz)
1	697/1209
2	697/1336
3	697/1477
4	770/1209
5	770/1336
6	770/1477
7	852/1209
8	852/1336
9	852/1477
0	941/1336
*	941/1209
#	941/1477

*Note 4:* AUTOVON telephones have 16 combinations, the extra 4 being used for precedence. For AUTOVON, the signals transmitted are the same as those in Note 3, and there are an additional four keys:

Button or Key	Frequencies (Hz)
FO (Flash Override)	697/1633
F (Flash)	770/1633
I (Immediate)	852/1633
P (Priority)	941/1633

*See also* dial pulse, dial signaling, key pulsing, multifrequency signaling, signal.

**dual-use access line** A user access line normally used for voice communication, but which has special conditioning for use as a digital transmission circuit. (188)

**duct** See atmospheric duct.

**ducting** The propagation of radio waves within an atmospheric duct. (188) See also atmospheric duct, ionosphere, surface refractivity.

**dumb terminal** An ASCII, asynchronous-type terminal that does not employ a data transmission protocol and only sends or receives data one character at a time, sequentially.

**dummy load** A dissipative impedance-matched network used at the end of a transmission line to absorb all incident power, usually converted to heat. (188)

**duobinary signal** A pseudobinary-coded signal in which a "0" ("zero") bit is represented by a zero-level electric current or voltage; a "1" ("one") bit is represented by a positive-level current or voltage if the quantity of "0" bits since the last "1" bit is even, and by a negative-level current or voltage if the quantity of "0" bits since the last "1" bit is odd. (188) *Note 1:* Duobinary signals require less bandwidth than NRZ. *Note 2:* Duobinary signaling also permits the detection of some errors without the addition of error-checking bits. See also code, non-return-to-zero code, return-to-zero code, signal.

**duplex circuit** A circuit that permits simultaneous transmission in both directions. (188) *Synonym* full-duplex circuit. See also circuit, duplex operation, four-wire circuit, half-duplex circuit, half-duplex operation, simplex circuit, simplex operation.

**duplexer** A device that permits the simultaneous use of a transmitter and a receiver in connection with a common element such as an antenna system. (188) See also diplexer, diplex operation, duplex operation.

**duplex operation** An operating method in which transmission is permitted, simultaneously, in both directions of a telecommunication channel. (RR) (188) *Note 1:* This definition is not limited to radio transmission. *Note 2:* In

general, duplex operation and semi-duplex operation require two frequencies in radiocommunication; simplex operation may use either one or two. (RR) *Synonyms* full-duplex operation, two-way simultaneous operation. See also conversational mode, diplexer, diplex operation, duplexer, simplex circuit, simplex operation.

**duty cycle** 1. The ratio of the time duration of a phenomenon occurring in a stated interval to the time duration of the interval. (188) *Note:* Limiting conditions must be specified. 2. The ratio of the sum of all pulse durations to the total period during a specified period of continuous operation. 3. In a CVSD converter, the mean proportion of binary "1" digits at the algorithm output where each "1" indicates a run of a specified number of consecutive bits of the same polarity in a digital output signal. (188) See also continuously variable slope delta modulation, operating time.

**dwell time** That period of time during which a dynamic process is halted in order for another process to occur.

**DX signaling** *Synonym* direct current signaling.

**DX signaling unit** A duplex signaling unit that repeats "E" and "M" lead signals into a cable pair(s) via "A" and "B" leads. These signals are transmitted on the same cable pair(s) that transmit(s) the message. (188) See also E & M signaling, signal.

**dynamically adaptive routing** An algorithm, used for route determination in packet-switched networks, that automatically routes traffic around congested, damaged, or destroyed switches and trunks and allows the system to continue to function over the remaining portions of the network. See also adaptive routing, avoidance routing, communications, continuous operation, directionalization.

**dynamicizer** *Synonym* parallel-to-serial converter.



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**dynamic range** 1. In a transmission system, the ratio of the overload level to the noise level of the system, usually expressed in decibels. (188)  
2. The ratio of the specified maximum level of a parameter (e.g., power, voltage, frequency, or floating point number representation) to its minimum detectable or positive value, usually expressed in decibels. (188) *See also level.*

**dynamic variation** A short time variation outside of steady-state conditions in the characteristics of power delivered to communication equipment. (188)

**E & M signaling** In telephony, an arrangement that uses separate leads, called respectively the "E" lead and "M" lead, for signaling and supervisory purposes. *Note 1:*

The near end signals the far end by applying -48 vdc to the "M" lead, which results in a ground being applied to the far end's "E" lead. When -48 vdc is applied to the far end "M" lead, the near-end "E" lead is grounded. *Note 2:* The "E" originally stood for "ear," i.e., when the near-end "E" lead was grounded, the far end was calling and "wanted your ear." The "M" originally stood for "mouth," because when the near-end wanted to call (i.e., speak to) the far end, -48 vdc was applied to that lead. *See also circuit, direct current signaling, DX signaling unit, pulse-link repeater, signal.*



**Earth coverage (EC)** In satellite communications, the condition obtained when a beam is sufficiently wide to cover the surface of the Earth exposed to the satellite. (188) *See also footprint, satellite.*

**earth electrode subsystem** A network of electrically interconnected rods, plates, mats, or grids installed, or connected, for the purpose of establishing a low-resistance contact with earth. (188) *See also equipotential ground plane, facility grounding system, fault protection subsystem, ground potential, lightning protection subsystem, signal reference subsystem.*

**Earth exploration-satellite service** A radiocommunication service between Earth stations and one or more space stations, which may include links between space stations, in which:

- information relating to the characteristics of the Earth and its natural phenomena is obtained from active sensors or passive sensors on Earth satellites;
- similar information is collected from airborne or Earth-based platforms;
- such information may be distributed to Earth stations within the system concerned;
- platform interrogation may be included.

This service may also include feeder links necessary for its operation. (RR)

**earth ground** *See ground.*

**Earth station** A station located either on the Earth's surface or within the major portion of the Earth's atmosphere and intended for communication:

- with one or more space stations; or
- with one or more stations of the same kind by means of one or more reflecting satellites or other objects in space. (RR)

**Earth terminal** That portion of a satellite link that receives, processes, and transmits communications between the Earth and a satellite. (188) *Note:* Includes satellite terminals borne by aircraft. *See also Earth station, Earth terminal complex, facility, link, satellite.*

**Earth terminal complex** In satellite systems, the total assembly of equipment and facilities necessary to integrate an Earth terminal into a network. (188) *Note:* This includes the Earth terminal and its support requirements and any required interconnect facilities and their support requirements. It does not include other facilities at the site not necessary to establish and integrate the satellite link(s) with the network. *See also downlink, Earth terminal, facility, link, satellite.*

**EAS** *Abbreviation for extended area service.*

**eavesdropping** The unauthorized interception of information-bearing emanations through the use of methods other than wire-tapping.

**EBCDIC** *Acronym for extended binary coded decimal interchange code.* An 8-bit alphanumeric coded character set. *See also alphabet, ASCII, code.*

**E-bend** A smooth change in the direction of the axis of a waveguide, throughout which the axis remains in a plane parallel to the direction of electric E-field (transverse) polarization. (188) *Synonym E-plane bend. See also H-bend, macrobending, microbending, waveguide.*

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**EBS** *Abbreviation for Emergency Broadcast System.*

**EC** *Abbreviation for Earth coverage.*

**ECCM** *Abbreviation for electronic counter-countermeasures.*

**echo** 1. A wave that has been reflected or otherwise returned with sufficient magnitude and delay to be perceived. (188) *Note 1:* Echoes are frequently measured in decibels relative to the directly transmitted wave. *Note 2:* Echoes may be desirable (as in radar usage) or undesirable (as in telephone usage). *See also* echo attenuation, echo suppressor, feeder echo noise, forward echo, ghost, return loss. 2. In computing, to print or display characters (a) as they are entered from an input device, (b) as instructions are executed, or (c) as retransmitted characters are received from a remote terminal. 3. For an interactive computer graphics display, the immediate notification of the current value for a graphics parameter or operation as selected by the user.

**echo attenuation** In a communication circuit (4- or 2-wire) in which the two directions of transmission can be separated from each other, the attenuation of echo signals that return to the input of the circuit under consideration. *Note:* Echo attenuation is expressed as the ratio of the transmitted power to the received echo power in decibels. (188) *See also* attenuation, echo, echo suppressor, reflection loss, return loss.

**echo canceler** *See* echo suppressor.

**echo check** A check to determine the integrity of transmission of data, in which the received data are returned to the source for comparison with the originally transmitted data. *Synonym* loop check. *See also* ARQ, data transmission, feedback, information feedback.

**echoplex** An echo check applied to public switched network terminals operating in the duplex (two-way simultaneous) mode. *See also* network.

**echo return loss (ERL)** *See* return loss.

**echo suppressor** A device for connection to a two-way telephone circuit to attenuate echo signals in one direction caused by signals in the other direction. (188) *See also* echo, echo attenuation, return loss.

**ECM** *Abbreviation for electronic countermeasures.*

**EDTV** *Abbreviation for extended-definition television.*

**effective data transfer rate** The average number of bits, characters, or blocks per unit time transferred from a data source and accepted as valid by a data sink. (188) *Note:* It is expressed in bits, characters, or blocks per second, minute, or hour. *See also* data signaling rate, data transmission, effective speed of transmission, efficiency factor, throughput.

**effective Earth radius** The radius of a hypothetical Earth for which the distance to the radio horizon, assuming rectilinear propagation, is the same as that for the actual Earth with an assumed uniform vertical gradient of refractive index. (188) *Note:* For the standard atmosphere, the effective Earth radius is  $4/3$  that of the actual Earth radius. *See also* Fresnel zone, k-factor, path clearance, path profile, propagation path obstruction.

**effective height** 1. The height of the center of radiation of an antenna above the effective ground level. (188) 2. In low-frequency applications involving loaded or nonloaded vertical antennas, the moment of the current distribution in the vertical section divided by the input current. (188) *Note:* For an antenna with symmetrical current distribution, the center of radiation is the center of distribution. For an antenna with asymmetrical current distribution, the center of radiation is the center of current moments when viewed from directions near the direction of maximum radiation. *See also* antenna, antenna height above average terrain.

**effective input noise temperature** The source noise temperature in a two-port network or amplifier that will result in the same output noise power, when connected to a noise-free network or amplifier, as that of the actual network or amplifier connected to a noise-free source. (188) *Note:* If  $F$  is the noise figure numeric and  $290\text{ K}$  the standard noise temperature, then the effective noise temperature is given by  $T_n = 290(F-1)$ . See also noise, noise figure, thermal noise.

**effective mode volume** For an optical fiber, the square of the product of the diameter of the near-field pattern and the sine of the radiation angle of the far-field pattern. The diameter of the near-field radiation pattern is defined here as the full width at half maximum and the radiation angle at half maximum intensity. *Note:* Effective mode volume is proportional to the breadth of the relative distribution of power amongst the modes in a multimode fiber. It is not truly a spatial volume but rather an "optical volume" equal to the product of area and solid angle. See also mode volume, radiation pattern.

**effective monopole radiated power (e.m.r.p.)** The product of the power supplied to the antenna and its gain relative to a short vertical antenna in a given direction. (RR) See also effective radiated power.

**effective radiated power (e.r.p.)** [In a given direction,] The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction. (RR) (188) *Note 1:* If the direction is not specified, the direction of maximum gain is assumed. *Note 2:* Often written "ERP." See also antenna, directive gain, equivalent monopole radiated power, mean power.

**effective speed of transmission** The rate at which information is processed by a transmission facility, expressed as the average rate over a significant time interval. *Note:* This quantity is usually expressed as the average number of characters or bits per unit time. (188) *Synonym* average rate of transmission. See also data signaling rate,

data transmission, effective data transfer rate, efficiency factor, maximum user signaling rate, speed of service, throughput.

**efficiency factor** In data communications, the ratio of the time to transmit a text automatically and at a specified modulation rate, to the time actually required to receive the same text at a specified maximum error rate. (188) *Note 1:* All of the communication facilities are assumed to be in the normal condition of adjustment and operation. *Note 2:* Telegraph communications may have different temporal efficiency factors for the two directions of transmission. *Note 3:* The practical conditions of measurement should be specified; in particular, the duration. See also data signaling rate, data transmission, effective data transfer rate, effective speed of transmission, speed of service, throughput.

**EHF** *Abbreviation for extremely high frequency.*

**EIA Class IVa fiber** *Synonym* dispersion-unshifted fiber.

**EIA Class IVb fiber** *Synonym* dispersion-shifted fiber.

**EIA interface** Any of a number of equipment interfaces compliant with voluntary industry standards developed by the Electronic Industries Association (EIA) to define interface parameters. *Note 1:* Some of these standards have been adopted by the Federal Government as Federal standards. *Note 2:* The telecommunication-standards-developing bodies of the EIA are now part of the Telecommunications Industry Association (TIA), and the standards are designated EIA/TIA-XXX. See also interface.

**eight-hundred (800) service** *Synonym* Inward Wide-Area Telephone service.

**elastic buffer** A variable storage device having adjustable capacity and/or delay, in which a signal can be temporarily stored. See also buffer, first-in first-out, queue traffic, variable length buffer.

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**E layer** See E region, ionosphere.

**electrical length** 1. A length (e.g., a point-to-point measure of phase shift of a wave) expressed in wavelengths, radians, or degrees. (188) *Note:* When expressed in angular units, it is the length, in wavelengths, multiplied by  $2\pi$  to give radians, or by 360 to give degrees. 2. Of an antenna or transmission line, the effective length as it affects transmission performance; such as the radiation pattern of an antenna or the location of nodes in a transmission line. *Note:* The electrical length differs from the physical length because of distributed resistances and reactances in a physically realizable device. See also wavelength.

**electrically powered telephone** A telephone in which the operating power is obtained either from batteries located at the telephone (local battery) or from a telephone central office (common battery). See also soundpowered telephone.

**electrochemical recording** Facsimile recording by means of a chemical reaction brought about by the passage of a signal-controlled current through the sensitized portion of the record sheet. (188) See also direct recording, facsimile, recording.

**electrographic recording** See electrostatic recording.

**electroluminescence** Nonthermal conversion of electrical energy into light. *Note:* One example is the photon emission resulting from electron-hole recombination in a pn junction such as that in a light-emitting diode. See also injection laser diode, light-emitting diode.

**electrolytic recording** That type of electrochemical facsimile recording in which recording is made possible by the passage of a signal-controlled current through an electrolyte, thus causing metallic ions to be deposited forming the image. (188) See also direct recording, facsimile recorder.

**electromagnetic compatibility (EMC)** 1. The condition that prevails when telecommunication equipment is performing its individually designed function in a common electromagnetic environment without causing or suffering unacceptable degradation due to unintentional electromagnetic interference to or from other equipment in the same environment. (NTIA) 2. The ability of telecommunications equipment, subsystems, or systems to operate in their intended operational environments without suffering or causing unacceptable degradation because of electromagnetic radiation or response. Design compatibility is achieved by incorporation of engineering characteristics or features in all electromagnetic radiating and receiving equipment in order to eliminate or reject undesired signals and enhance operating compatibilities. Operational compatibility is achieved by the equipment flexibility to ensure interference-free operation. It involves the application of sound frequency management and clear concepts and doctrines to maximize operational effectiveness. (JCS1-DoD) 3. The capability of electrical and electronic systems, equipments, and devices to operate in their intended electromagnetic environment within a defined margin of safety, and at design levels of performance without suffering or causing unacceptable degradation as a result of electromagnetic interference. (JCS1-NATO) See also compatibility, electromagnetic interference, EMC analysis.

**electromagnetic emission control** The control of friendly electromagnetic emissions, e.g., radio, radar, and sonar transmissions, for the purpose of preventing or minimizing their use by unintended recipients. (188) See also electromagnetic interference, electronic warfare, emanations security, TEMPEST.

**electromagnetic environment (EME)** 1. The resulting product of the power and time distribution, in various frequency ranges, of the radiated or conducted electromagnetic emission levels that may be encountered by a military force, system, or platform when performing its assigned mission in its intended operational environment. It is the sum of



electromagnetic interference; electromagnetic pulse; hazards of electromagnetic radiation to personnel, ordnance, and volatile materials; and natural phenomena effects of lightning and p-static. (JCS1-DoD) (188) *Note:* The electromagnetic environment may also be expressed in terms of field strength. *See also* electronic reconnaissance, electronics intelligence, frequency, interference, precipitation static.

**electromagnetic hazards** *See* hazards of electromagnetic radiation to fuel, hazards of electromagnetic radiation to ordnance, hazards of electromagnetic radiation to personnel.

**electromagnetic interference (EMI)** 1. Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. It can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions and responses, intermodulation products, and the like. (JCS1-DoD) 2. Any electromagnetic disturbance, whether intentional or not, which interrupts, obstructs, or otherwise degrades or limits the effective performance of electronic or electrical equipment. (JCS1-NATO) *Synonym* radiofrequency interference. *See also* electromagnetic compatibility, electromagnetic emission control, electromagnetic vulnerability, electronic counter-countermeasures, electronic countermeasures, electronic reconnaissance, electronics intelligence, electronic warfare, interference, interference emission.

**electromagnetic interference (EMI) control** The control of radiated and conducted energy such that the emissions unnecessary for system, subsystem, or equipment operation are minimized or reduced. *Note:* Electromagnetic radiated and conducted emissions, regardless of their origin within the equipment, subsystem, or system are therefore controlled. Successful EMI control, along with susceptibility control, leads to electromagnetic compatibility. (188) *See also* electromagnetic interference, electronic counter-countermeasures, electronic countermeasures, electronics security,

electronic warfare, interference, interference emission.

**electromagnetic intrusion** The intentional insertion of electromagnetic energy into transmission paths in any manner, with the objective of deceiving operators or of causing confusion. (JCS1-DoD) *See also* electronic deception, electronic warfare, interference.

**electromagnetic pulse (EMP)** 1. The electromagnetic radiation from a nuclear explosion caused by Compton-recoil electrons and photoelectrons from photons scattered in the materials of the nuclear device or in a surrounding medium. The resulting electric and magnetic fields may couple with electrical/electronic systems to produce damaging current and voltage surges. May also be caused by nonnuclear means. (JCS1-DoD) 2. A broadband, high-intensity, short-duration burst of electromagnetic energy. (188) *Note:* In the case of nuclear detonations, the electromagnetic pulse signal consists of a continuous spectrum with most of its energy distributed throughout the lower frequencies of 3 Hz to 30 kHz. *See also* high-altitude electromagnetic pulse, pulse.

**electromagnetic radiation (EMR)** Radiation made up of oscillating electric and magnetic fields and propagated with the speed of light. Includes gamma radiation, X-rays, ultraviolet, visible, and infrared radiation, and radar and radio waves. (JCS1-DoD) *See also* far-field radiation pattern, far-field region, intermediate-field region, near-field region, radiation pattern, radiation scattering.

**electromagnetic radiation hazards (RADHAZ or EMR hazards)** Hazards caused by a transmitter/antenna installation that generates electromagnetic radiation in the vicinity of ordnance, personnel, or fueling operations in excess of established safe levels or increases the existing levels to a hazardous level; or a personnel, fueling, or ordnance installation located in an area that is illuminated by electromagnetic radiation at a level that is hazardous to the planned operations or occupancy. These hazards will exist when an

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**electromagnetic field of sufficient intensity** is generated to: (a) induce or otherwise couple currents and/or voltages of magnitudes large enough to initiate electroexplosive devices or other sensitive explosive components of weapon systems, ordnance, or explosive devices; (b) cause harmful or injurious effects to humans and wildlife; (c) create sparks having sufficient magnitude to ignite flammable mixtures of materials that must be handled in the affected area. (JCS1-DoD) *See also* electromagnetic vulnerability, electronic warfare, hazards of electromagnetic radiation to fuel, hazards of electromagnetic radiation to ordnance, hazards of electromagnetic radiation to personnel.

**electromagnetic spectrum** The range of frequencies of electromagnetic radiation from zero to infinity. It is divided into 26 alphabetically designated bands. (JCS1-DoD) *See also* frequency, spectrum designation of frequency.

**electromagnetic survivability** The ability of an equipment, subsystem, or system to resume functioning without evidence of degradation following temporary exposure to an adverse electromagnetic environment. *Note:* This implies that the system performance may be degraded during exposure to the adverse electromagnetic environment, but the system will not experience any damage, such as component burnout, which prevents it from operating when the adverse electromagnetic environment is removed. (188) *See also* survivability.

**electromagnetic vulnerability (EMV)** 1. The characteristics of a system that cause it to suffer a definite degradation (incapability to perform the designated mission) as a result of having been subjected to a certain level of electromagnetic environmental effects. (JCS1-DoD) (188) 2. The characteristics of a system that cause it to suffer degradation in performance of, or inability to perform, its specified task as a result of electromagnetic interference. (JCS1-NATO) *See also* electromagnetic interference, electromagnetic radiation hazards, electronic warfare.

**electromechanical recording** Recording by means of a signal-actuated mechanical device. (188) *See also* facsimile, recording.

**electronic counter-countermeasures (ECCM)** That division of electronic warfare involving actions taken to ensure friendly effective use of the electromagnetic spectrum despite the enemy's use of electronic warfare. (JCS1-DoD) *See also* anti-jam, electromagnetic interference, electromagnetic interference control, electronic warfare, frequency hopping.

**electronic countermeasures (ECM)** That division of electronic warfare involving actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum. (JCS1-DoD) *See also* electromagnetic interference, electromagnetic interference control, electronic jamming, electronic warfare, susceptibility.

**electronic deception** 1. The deliberate radiation, reradiation, alteration, suppression, absorption, denial, enhancement, or reflection of electromagnetic energy in a manner intended to convey misleading information and to deny valid information to an enemy or to enemy electronics-dependent weapons. Among the types of electronic deception are: (a) manipulative electronic deception--Actions to eliminate revealing or convey misleading, telltale indicators that may be used by hostile forces. (b) simulative electronic deception--Actions to represent friendly notional or actual capabilities to mislead hostile forces. (c) imitative electronic deception--The introduction of electromagnetic energy into enemy systems that imitates enemy emissions. (JCS1-DoD) 2. Deliberate activity designed to mislead an enemy in the interpretation or use of information received by his electronic systems. (JCS1-NATO) *See also* electromagnetic intrusion, electronic warfare.

**electronic emission security** Those measures taken to protect all transmissions from interception and electronic analysis. (188) *See also* electromagnetic interference control, electronics security, electronic warfare, emanations security, TEMPEST.

**electronic jamming** The deliberate radiation, reradiation, or reflection of electromagnetic energy for the purpose of disrupting enemy use of electronic devices, equipment, or systems. (JCS1-DoD) *See also* electronic countermeasures, electronic warfare, interference.

**electronic line of sight** The path traversed by electromagnetic waves that is not subject to reflection or refraction by the atmosphere. (JCS1-DoD) *See also* line-of-sight propagation.

**electronic line scanning** In facsimile, a method of scanning that provides motion of the scanning spot along the scanning line by electronic means. (188) *See also* facsimile, line.

**electronic mail** An electronic means for communicating information (primarily text) by a method of sending, storing, processing, and retrieving the information. This allows users to communicate under specified conditions. *Note:* Messages are held in storage until called for by the addressee. (188) *See also* data transmission, Integrated Services Digital Network, store-and-forward.

**electronic message system (EMS)** An electronic mail system incorporating the additional feature in which the central facility assumes active responsibility for delivering the message to the intended addressee(s) rather than the passive role of an electronic mail system, which merely delivers messages in response to a request by an addressee.

**electronic reconnaissance** The detection, identification, evaluation, and location of foreign electromagnetic radiations emanating from other than nuclear detonations or radioactive sources. (JCS1-DoD) *See also* electromagnetic environment, electromagnetic interference, electronic warfare, monitoring.

**electronics intelligence (ELINT)** Technical and intelligence information derived from foreign noncommunications electromagnetic radiations emanating from other than nuclear detonations

or radioactive sources. (JCS1-DoD) *See also* electromagnetic environment, electromagnetic interference, electronic warfare, intercept, interference.

**electronics security (ELSEC)** The protection resulting from all measures designed to deny unauthorized persons information of value that might be derived from their interception, and study of noncommunications electromagnetic radiations, e.g., radar. (JCS1-DoD)

**electronic switching system (ESS)** Any switching system whose major components use semiconductor devices. This includes semielectronic systems that have reed relays or crossbar matrices. (188) *See also* crossbar switch, switching system.

**electronic warfare (EW)** Military action involving the use of electromagnetic energy to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum and action to retain its effective use by friendly forces. (JCS1-NATO)

**electronic warfare support measures (ESM)** 1. That division of electronic warfare involving actions taken under direct control of an operational commander to search for, intercept, identify, and locate sources of radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic warfare support measures (ESM) provide a source of information required for immediate decisions involving electronic countermeasures (ECM), electronic counter-countermeasures (ECCM), avoidance, targeting, and other tactical employment of forces. Electronic warfare support measures data can be used to produce signals intelligence (SIGINT), both communications intelligence (COMINT) and electronics intelligence (ELINT). (JCS1-DoD) 2. That division of electronic warfare involving action taken to search for, intercept, identify, and locate radiated electromagnetic energy for the purpose of immediate threat recognition. It provides a source of information required for immediate decisions involving electronic countermeasures, electronic counter-countermeasures, and other tactical actions

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such as avoidance, targeting and homing. (JCSI-NATO) *See also* electronic warfare.

**electro-optical intelligence (ELECTRO-OPTINT)** Intelligence information other than signals intelligence derived from the optical monitoring of the electromagnetic spectrum from ultraviolet (0.01 micrometers) through the far infrared (1000 micrometers). (JCSI-DoD)

**electro-optic detector** *Deprecated term. See optoelectronic.*

**electro-optic effect** Any one of a number of phenomena in which an electromagnetic wave interacts with an electric field, or with matter under the influence of an electric field. (188) *Note 1:* Two of the most important electro-optic effects having application as modulation mechanisms in optical communication are the Kerr effect and Pockels effect, in which birefringence is induced (Kerr effect) or modified (Pockels effect) in a material. *Note 2:* The term "electro-optic" is often erroneously used as a synonym for "optoelectronic." *See also* magneto-optic effect, optoelectronic.

**ELECTRO-OPTINT** *Acronym for electro-optical intelligence.*

**electrophotographic recording** A method of recording using light to produce a change in electrostatic charge to form a photographic image. (188) *Note:* Subsequent processing is usually required to make the image visible. *See also* facsimile, recording.

**electrosensitive recording** A method of recording by means of impressing an electrical signal directly on the record medium. *See also* facsimile, recording.

**electrostatic recording** Recording by means of a signal-controlled electrostatic field. (188) *Note:* Subsequent processing is usually required to make the image visible. *See also* direct recording, facsimile, recording.

**electrothermal recording** That type of recording produced principally by signal-controlled

thermal action. (188) *See also* facsimile, recording.

**elemental area** In facsimile transmission systems, any segment of a scanning line of the subject copy, the dimension of which along the line is exactly equal to the nominal line width. (188) *Note:* Elemental area is not necessarily the same as the scanning spot. *See also* facsimile, picture element, pixel, scanning spot.

**elementary signaling element** *See* unit interval.

**ELF** *Abbreviation for extremely low frequency.*

**ELINT** *Acronym for electronics intelligence.*

**elliptical polarization** In electromagnetic wave propagation, polarization such that the tip of the electric field vector describes an ellipse in any fixed plane intersecting, and normal to, the direction of propagation. (188) *Note 1:* An elliptically polarized wave may be resolved into two linearly polarized waves in phase quadrature with their planes of polarization at right angles to each other. *Note 2:* Circular and linear polarization are special cases of elliptical polarization. *See also* axial ratio, polarization.

**ELSEC** *Acronym for electronics security.*

**emanations security (EMSEC)** The protection resulting from all measures designed to deny unauthorized persons information of value that might be derived from intercept and analysis of compromising emanations from other than crypto-equipment and telecommunications systems. *See also* electromagnetic emission control, electronic warfare, TEMPEST.

**embedded base equipment** All customer-premises equipment that had been provided by the Bell Operating Companies prior to January 1, 1984, that was ordered transferred from the BOCs to AT&T by court order.

**embedded customer-premises equipment** Telephone-company-provided premises equipment in use or in inventory of a regulated telephone utility as of December 31, 1982. *See*

*also* customer premises equipment, new-customer premises equipment.

**EMC** *Abbreviation for electromagnetic compatibility.*

**EMC analysis** The examination of an equipment, subsystem, system, or facility to determine its EMC status. (188) *Note:* This can be a projected analysis before construction or a real one after construction. *See also* electromagnetic compatibility.

**EMCON** *Abbreviation for emission control.*

**EME** *Abbreviation for electromagnetic environment.*

**emergency** A sudden, generally unexpected event, that does or could do harm to people, the environment, resources, property, or institutions. *Note:* Emergencies range from relatively local events to regional and national events and may be caused by natural or technological factors, human actions, or national security-related events.

**Emergency Broadcast System (EBS)** The EBS is composed of AM, FM, and TV broadcast stations; low-power TV stations; and non-Government industry entities operating on a voluntary, organized basis during emergencies at national, state, or operational (local) area levels. (CFR 47)

**emergency position-indicating radiobeacon station** A station in the mobile service the emissions of which are intended to facilitate search and rescue operations. (RR) *See also* mobile service.

**EMI** *Abbreviation for electromagnetic interference.*

**emission** 1. Electromagnetic energy propagated from a source by radiation or conduction. (188) *Note:* The energy thus propagated may be either desired or undesired and may occur anywhere in the electromagnetic spectrum. 2. Radiation produced, or the production of radiation, by a radio transmitting station. For

example, the energy radiated by the local oscillator of a radio receiver would not be an emission but a radiation. (RR) *See also* electromagnetic interference control, electronic emission security, frequency, harmful interference, interference emission, necessary bandwidth, out-of-band emission, radiation, rf bandwidth, spurious emission, spurious radiation.

**emission control (EMCON)** 1. The selective and controlled use of electromagnetic, acoustic, or other emitters to optimize command and control capabilities while minimizing, for operations security (OPSEC), detection by enemy sensors; to minimize mutual interference among friendly systems; and/or to execute a military deception plan. (JCS1-DoD) 2. Selective control of emitted electromagnetic or acoustic energy. The aim can be twofold--to minimize the enemy's detection of emissions and exploitation of the information so gained, or--to improve the performance of friendly sensors. (JCS1-NATO) *See also* communications security, electronic warfare, interference.

**emission security** *See* communications security.

**emissivity** The ratio of power radiated by a substance to the power radiated by a blackbody at the same temperature. (188) *Note:* Emissivity is a function of wavelength and temperature. Power and area units for both bodies must be the same or normalized. *See also* optical spectrum, radiance, radiant emittance.

**EMP** *Abbreviation for electromagnetic pulse.*

**emphasis** In FM transmission, the intentional alteration of the amplitude-versus-frequency characteristics of the signal to reduce adverse effects of noise in a communication system. (188) *Note:* The higher frequency signals are emphasized to produce a more equal modulation index for the transmitted frequency spectrum, and therefore a better signal-to-noise ratio for the entire frequency range. *See also* deemphasis, frequency, preemphasis.



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**EMR** *Abbreviation for electromagnetic radiation.*

**EMR hazards** *Abbreviation for electromagnetic radiation hazards*

**e.m.r.p.** *Abbreviation for effective monopole radiated power.*

**EMS** *Abbreviation for electronic message system.*

**EMSEC** *Acronym for emanations security.*

**emulate** To duplicate the functions of one system with a different system, so that the second system appears to behave like the first system. *Note:* For example, a computer emulates another, different computer by accepting the same data, executing the same programs, and achieving the same results. *Contrast with simulate.*

**EMV** *Abbreviation for electromagnetic vulnerability.*

**enabling signal** A signal that permits the occurrence of an event. (FP) (ISO) *See also signal.*

**en-bloc signaling** A method of signaling in which address digits are transmitted in one or more blocks, each block containing sufficient address information to enable switching centers to carry out progressive onward routing. *See also address, block, switching center.*

**encipher** To convert plain text into an unintelligible form by means of a cipher system. (JCS1-DoD) *See also cipher, decode, encode, encrypt.*

**encode** 1. To convert data by the use of a code, frequently one consisting of binary numbers, in such a manner that reconversion to the original form is possible. (188) 2. Conversion of plain text to equivalent cipher text by means of a code system. 3. To append redundant check symbols to a message for the purpose of generating an error detection and correction

code. *See also character, code, cryptology, decode, encipher, encrypt.*

**encoder** *See analog-to-digital converter.*

**encoding** *See analog encoding.*

**encoding law** The law defining the relative values of the quantum steps used in quantizing and encoding signals. *See also code, segmented encoding law.*

**encrypt** To convert plain text into unintelligible forms by means of a cryptosystem. *Note:* The term "*encrypt*" covers the meanings of "*encipher*" and "*encode*." (JCS1-DoD) *See also cryptology, encipher, encode, garble.*

**end distortion** In start-stop teletypewriter operations, the shifting of the end of all marking pulses except the stop pulse from their proper positions in relation to the beginning of the next start pulse. (188) *Note 1:* Shifting of the end of the stop pulse would constitute a deviation in character time and rate rather than being an end distortion. *Note 2:* Spacing end distortion is the termination of marking pulses before the proper time. *Note 3:* Marking end distortion is the continuation of marking pulses past the proper time. *Note 4:* Magnitude of the distortion is expressed in percent of a perfect unit pulse length. *See also bias distortion, characteristic distortion, cyclic distortion, distortion, start-stop distortion, teletypewriter signal distortion.*

**end finish** Surface condition at the optical fiber face.

**end instrument** A communication device that is connected to the terminals of a circuit. (188) *See also circuit, data terminal equipment, main station, terminal.*

**end office (E.O.)** A central office at which user lines and trunks are interconnected. (188) *See also central office, switching center, tandem center, trunk.*

**end-of-message function** In tape relay procedure, the letter and key functions,

including the end-of-message indicator, that constitute the last format line. (188) *See also* relay, reperforator, tape relay, torn-tape relay.

**end-of-selection character** The character that indicates the end of the selection signal. *See also* binary synchronous communication, character.

**end-of-text character (ETX)** A transmission control character used to terminate text. (FP) (ISO) *See also* binary synchronous communication, character.

**end-of-transmission-block character (ETB)** A transmission control character used to indicate the end of a transmission block of data when data are divided into such blocks for transmission purposes. (FP) (ISO) *See also* binary synchronous communication, block, character.

**end-of-transmission character (EOT)** A transmission control character used to indicate the conclusion of a transmission that may have included one or more texts and any associated message headings. (FP) (ISO) *Note:* Often used to initiate other functions such as releasing circuits, disconnecting terminals, or placing receive terminals in a standby condition. *See also* binary synchronous communication, character.

**end system (ES)** A system containing the application processes that are the ultimate sources and destinations of user oriented message flows. *Note:* The functions of an end system can be distributed among more than one processor/computer.

**end-to-end encryption** The encryption of information at its origin and decryption at its intended destination without any intermediate decryption. (188)

**end-to-end security** The safeguarding of information in a secure telecommunication system by cryptographic or protected distribution system means from point of origin to point of destination.

**endurability** The property of a system, subsystem, equipment, or process that enables it to continue to function within specified performance limits for an extended period of time, usually months, despite a potentially severe natural or man-made disturbance, e.g., nuclear attack, and a subsequent loss of external logistic or utility support. (188) *Note:* Endurability does not necessarily preclude temporary failures, but it does imply that the local capability exists to restore and maintain the entity to an acceptable performance level. *See also* fail-safe operation, graceful degradation, survivability.

**endurable operation** *See* **endurability**.

**end user** The ultimate consumer of a telecommunication service. *See also* destination user, source user.

**engineering channel** *Synonym* orderwire circuit.

**engineering orderwire (EOW)** A communication path for voice or data, or both, that is provided to facilitate the installation, maintenance, restoral, or deactivation of segments of a communication system by equipment operators, attendants, and controllers. (188) *See also* link orderwire, local orderwire, maintenance control circuit, orderwire circuit.

**enhanced-quality television** *Synonym [in CCITT usage] for* improved-definition television.

**enhanced service** Service, offered over commercial carrier transmission facilities used in interstate communications, that employs computer processing applications that act on the format, content, code, protocol, or similar aspects of the subscriber's transmitted information; provides the subscriber with additional, different, or restructured information; or involves subscriber interaction with stored information. (188) *See also* basic service.

**ENQ** *Abbreviation for* enquiry character.

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**enquiry character (ENQ)** A transmission control character used as a request for a response from the station with which a connection has been set up. *Note:* The response may include station identification, the type of equipment in service, and the status of the remote station. (FP) (ISO) *See also* binary synchronous communication, character.

**entrance facility** All facilities between the network interface on the customer's premises and the central office of a commercial carrier. *See also* facility, interface, network interface.

**envelope** The boundary of the family of curves obtained by varying a parameter of a wave. (188) *See also* modulation.

**envelope delay distortion** The distortion that results when the rate of change of phase shift with frequency over the bandwidth of interest is not constant. (188) *Note:* It is usually stated as one-half the difference between the delays of the two frequency extremes of the band of interest. *See also* distortion, ghost, group delay.

**environmental control** *See* air conditioning.

**E.O.** *Abbreviation for end office.*

**EOT** *Abbreviation for end of transmission character.*

**EOW** *Abbreviation for engineering orderwire.*

**E-plane bend** *Synonym* E-bend.

**equal gain combiner** A diversity combiner in which the signals on each channel are added together. *Note:* The channel gains are all equal and can be made to vary equally so that the resultant signal is approximately constant. (188) *See also* diversity combiner, gain, maximal-ratio combiner.

**equalization** The process of maintaining signal characteristics within specified limits by modifying circuit parameters. (188) *Note:* The equalization process may include modification of any circuit parameter, e.g., amplitude,

frequency, phase, timing, transport mechanisms, and relationships. *See also* amplitude equalizer, amplitude-vs.-frequency distortion, building out, conditioned circuit, conditioned loop, conditioning equipment, delay equalizer, loading (def. #1), phase, slope equalizer.

**equal level patch bay** An analog patching facility at which all nominal input and output voice frequency levels are uniform. (188) *Note:* This permits patching without making transmission level adjustments. *See also* circuit, facility, patch bay.

**equatorial orbit** An orbit with a 0° inclination angle, i.e., the orbital plane and the Earth's equatorial plane are coincident. (188) *See also* direct orbit, geostationary orbit, inclined orbit, polar orbit, retrograde orbit, satellite, synchronous orbit.

**equilibrium coupling length** *Synonym* equilibrium length.

**equilibrium length** For a specific excitation condition, the length of multimode optical fiber necessary to attain equilibrium mode power distribution. (188) *Note:* The term is sometimes used to refer to the longest such length, as would result from a worst-case, but undefined, excitation. *Synonyms* equilibrium coupling length, equilibrium mode distribution length. *See also* equilibrium mode power distribution, fiber optics, mode coupling.

**equilibrium mode distribution length** *Synonym* equilibrium length.

**equilibrium mode power distribution** In fiber optics, the condition in a multimode optical fiber in which the relative power distribution among the propagating modes is independent of length. (188) *Synonym* [in fiber optics] steady-state condition. *See also* equilibrium length, fiber optics, mode (def. #1).

**equilibrium mode simulator** For an optical fiber, a device or optical system used to create an approximation of the equilibrium mode power

distribution. *See also* equilibrium mode power distribution, mode filter.

**equipment side** That portion of a device that looks toward the in-station equipment. *See also* line side.

**equipotential ground plane** A mass or masses of conducting material which, when bonded together, offer a negligible impedance to current flow. (188) *Note:* Such planes may be in direct contact with the earth or may be physically isolated from the earth and suitably connected to it. *See also* earth electrode subsystem, facility grounding system, ground, ground plane.

**equivalent network** 1. A network that may replace another network without altering the performance of that portion of the system external to the network. 2. A theoretical representation of an actual network. (188) *See also* network.

**equivalent noise resistance** A quantitative representation in resistance units of the spectral density of a noise-voltage generator, given by  $R_n = (\pi W_n) / (k T_0)$ , where  $W_n$  is the spectral density,  $k$  is Boltzmann's constant,  $T_0$  is the standard noise temperature (290 K), and  $k T_0 = 4.00 \times 10^{-21}$  watt-seconds. *Note:* The equivalent noise resistance in terms of the mean-square noise-generator voltage,  $e^2$ , within a frequency increment,  $\Delta f$ , is given by  $R_n = e^2 / 4k T_0 \Delta f$ . *See also* frequency, noise.

**equivalent PCM noise** Through comparative tests, the amount of thermal noise power on an FDM or wire channel necessary to approximate the same judgment of speech quality created by quantizing noise in a PCM channel. (188) *Note:* Generally, 33.5 dBmC  $\pm$  2.5 dB is considered the approximate equivalent PCM noise of a 7-bit PCM system. *See also* frequency-division multiplexing, noise, pulse-code modulation.

**equivalent satellite link noise temperature** The noise temperature referred to the output of the receiving antenna of the Earth station corresponding to the radio-frequency noise

power which produces the total observed noise at the output of the satellite link excluding noise due to interference coming from satellite links using other satellites and from terrestrial systems. (RR) *See also* Earth station.

**erase** 1. To obliterate information from any storage medium, e.g., to clear or to overwrite. (188) 2. To remove all previous data from magnetic storage by changing it to a specified condition that may be an unmagnetized state or predetermined magnetized state. *See also* read-only storage, storage.

**erect position** In frequency-division multiplexing, a position of a translated channel in which an increasing signal frequency in the untranslated channel causes an increasing signal frequency in the translated channel. (188) *Synonym* upright position. *See also* down-converter, frequency-division multiplexing, frequency translation, inverted position, up-converter.

**E region** That region of the ionosphere existing between approximately 95 and 160 km above the surface of the Earth. It lies between the D and F regions. (188) *Synonyms* Heaviside layer, Kennelly-Heaviside layer. *See also* D-region (Note 2), ionosphere.

**ERL** Abbreviation for echo return loss. *See* return loss.

**erlang** An international, dimensionless unit of the average traffic intensity (occupancy) of a facility during a period of time, normally a busy hour. The number of erlangs is the ratio of the time during which a facility is occupied (continuously or cumulatively) to the time this facility is available for occupancy. (188) *Note 1:* The facility, such as a switch register, trunk, circuit, etc., is usually shared by many users. *Note 2:* Communications traffic measured in erlangs and offered to a group of shared facilities, such as a trunk group, is equal to the sum of the traffic intensity (in erlangs) of all individual sources, e.g., telephones, that share and are served exclusively by this group of facilities. *Note 3:* A single facility (register, trunk, circuit, etc.) cannot carry more than one

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erlang of traffic. *Synonym* traffic unit. *See also* traffic intensity, traffic load.

**e.r.p. [or ERP]** *Abbreviation for effective radiated power.*

**error** 1. The difference between a computed, estimated, or measured value and the true, specified, or theoretically correct value. (188)  
2. A malfunction that is not reproducible. (188)

**error budget** The allocation of a bit-error-ratio requirement to the segments of a circuit, e.g., trunking, switching, access lines, terminal devices, in a manner that permits the specified system end-to-end bit-error-ratio requirements to be satisfied for traffic transmitted over a postulated reference circuit. (188) *See also* binary digit, bit error ratio, error.

**error burst** A contiguous sequence of symbols, received over a data transmission channel, such that the first and last symbols are in error and there exists no contiguous subsequence of *M* correctly received symbols within the error burst. (188) *Note:* *M* is an integer parameter referred to as the guard band of the error burst. The last symbol in a burst and the first symbol in the following burst are accordingly separated by *M* correct bits or more. The number *M* should be specified when describing an error burst. *See also* binary digit, bit error ratio, burst, error, error control.

**error control** Any technique that will detect, or correct, the presence of errors. (188)

**error-correcting code** A code in which each telegraph or data signal conforms to specific rules of construction so that departures from this construction in the received signals can generally be automatically detected and corrected. If the number of errors is not greater than the maximum correctable threshold of the code, then all errors are corrected. (188) *Note 1:* Such codes require more signal elements than are necessary to convey the basic information. *Note 2:* The two main classes of error-correction codes are block codes and convolutional codes. *See also* block code, code, convolutional code, error control,

forward error correction, Hagelbarger code, Hamming code.

**error-correcting system** In digital data transmission, a system employing either forward error correction (FEC) or automatic repeat-request (ARQ) techniques such that most transmission errors are automatically removed from the data unit prior to delivery to the destination facility. (188) *See also* ARQ, code, communications system, error, error control, error correcting code, error-detecting code, forward error correction.

**error-detecting-and-feedback system** *Synonym* ARQ.

**error-detecting code** A code in which each telegraph or data signal conforms to specific rules of construction, so that departures from this construction in the received signals can be detected automatically. (188) *Note:* Such codes require more signal elements than are necessary to convey the basic information. *See also* block parity, code, error, error control, error-correcting code, error-correcting system.

**error-detecting system** A system employing an error-detecting code and so arranged that any signal detected as being in error is either deleted from the data delivered to the data sink, in some cases with an indication that such deletion has taken place, or delivered to the data sink together with an indication that the signal is in error. *See also* code, cyclic redundancy check, error, error control.

**error rate** *Deprecated term. See* error ratio.

**error ratio** The ratio of the number of bits, elements, characters, or blocks incorrectly received to the total number of bits, elements, characters, or blocks sent in a specified time interval. (188) *See also* binary digit, bit error ratio, block, block transfer rate, character, error.

**ES** *Abbreviation for end system.*

**ESC** *Abbreviation for escape character.*



**escape character (ESC)** In alphabet coding schemes, a specially designated character, the occurrence of which in the data signifies that one or more of the characters to follow are from a different character code, i.e., have meanings other than *normal*.

**ESM** *Abbreviation for electronic warfare support measure.*

**ESS** *Abbreviation for electronic switching system.*

**essential service** 1. A service provided by a telecommunications provider, such as an operating telephone company or a carrier, for delivery of priority dial tone. Generally, only up to 10 percent of the customers may request this type of service. 2. A service that is recommended for use in conjunction with NS/EP telecommunications services. *Note:* This service is often referred to as "critical service." *See also* NS/EP telecommunications.

**ETB** *Abbreviation for end-of-transmission-block character.*

**ETX** *Abbreviation for end-of-text character.*

**evanescent field** In a waveguide, a time-varying transverse electromagnetic field whose amplitude decreases monotonically as a function of transverse radial distance from the guide, but without an accompanying phase shift. (188) *Note:* In fiber optics, this field is a surface wave and may be used to provide coupling to another fiber. *See also* fiber optics, optical fiber.

**evanescent mode** A mode of the evanescent field. (188) *See also* evanescent field, fiber optics, mode (def. #1).

**even parity** *See* parity, parity check.

**EW** *Abbreviation for electronic warfare.*

**exalted-carrier reception** A method of receiving either amplitude- or phase-modulated signals in which the carrier is separated from the sidebands, filtered and amplified, and then

combined with the sidebands again at a higher level prior to demodulation. *Synonym* reconditioned carrier reception. (188) *See also* carrier (cxr), sideband transmission.

**exception condition** In data transmission, the condition assumed by a device when it receives a command that it cannot execute. *See also* data transmission.

**excess insertion loss** *Deprecated term. See* insertion loss. *Note:* The term was used to indicate that, in an optical-fiber coupler, the loss occasioned by dividing the input power among the ports is not the total insertion loss.

**exchange** A room or building equipped so that telephone lines terminating there may be interconnected as required. *Note:* The equipment may include manual or automatic switching equipment. (188) *See also* automatic exchange, data switching exchange, extended area service, facility, switching center, switching system, tandem center.

**exchange access** In the telephone networks, the provision of exchange services for the purpose of originating or terminating interexchange telecommunications. *Note:* Such services are provided by facilities in an exchange area for the transmission, switching, or routing of interexchange telecommunications originating or terminating within the exchange area.

**exchange area** A geographic area served by one or more central offices within which local telephone service is furnished under regulation. *See also* extended area service, foreign exchange service, local access and transport area.

**exchange facilities** Those facilities included within a local access and transport area. *See also* local access and transport area.

**executive program** *Synonym* supervisory program.

**existing-quality television** *Synonym* distribution-quality television.

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**expander** A device that restores the dynamic range of a compressed signal to its original dynamic range. (188) *See also* clipper, companding, compandor, compression, compression ratio, compressor, peak limiting, vogad.

**expansion** The restoration of the dynamic range of a compressed signal to its original dynamic range. *See also* compression.

**experimental station** A station utilizing radio waves in experiments with a view to the development of science or technique. This definition does not include amateur stations. (RR) *See also* amateur station.

**express orderwire** A permanently connected voice circuit between selected stations for technical control purposes. (188) *See also* circuit, orderwire circuit.

**extended area service (EAS)** An option whereby the telephone user can pay a higher flat rate to obtain wider geographical coverage without additional per-call charges. *See also* exchange, exchange area, flat rate service, postalized rate.

**extended binary coded decimal interchange code (EBCDIC)** *See* EBCDIC.

**extended-definition television (EDTV)** Television that includes improvements to the standard NTSC television system, which improvements are receiver-compatible with the NTSC standard, but modify the NTSC emission standards. *Note 1:* Such improvements may include (a) a wider aspect ratio, (b) higher picture definition than distribution-quality definition but lower than HDTV, and/or (c) any of the improvements used in improved-definition television. *Note 2:* When EDTV is transmitted in the 4:3 aspect ratio, it is referred to simply as "EDTV." When transmitted in a wider aspect ratio, it is referred to as "EDTV-Wide." *See also* advanced television, enhanced quality television, high-definition television, improved-definition television.

**extended superframe** A type of framing technique that provides both framing for D-4 format and on-line, real-time test capabilities for a circuit's operating condition without taking the circuit off-line.

**extension facility** A means of providing communication access to a user or group of users isolated from a central communications node. (188) *See also* facility, multiple access, mode, off-line, on-line, on-premises extension, terminal.

**extension terminal** A terminal that is added to an existing terminal sharing the same circuit and address (number, port). *See also* extension facility, mode.

**external timing reference** A timing reference obtained from a source external to the communications system such as one of the navigation systems, many of which are referenced to Coordinated Universal Time (UTC). *See also* Coordinated Universal Time, local clock, master clock, time.

**extinction ratio ( $r_e$ )** The ratio of the average received optical energy in logic "1" pulse to the average received optical energy in logic "0" pulse.

**extra bit** *Synonym* added bit.

**extra block** *Synonym* added block.

**extremely high frequency (EHF)** Frequencies from 30 GHz to 300 GHz. (188) *See also* frequency, spectrum designation of frequency.

**extremely low frequency (ELF)** Frequencies from 30 Hz to 300 Hz. (188) *See also* frequency, spectrum designation of frequency.

**extrinsic joint loss** For an optical fiber, that portion of a joint loss that is not intrinsic to the fibers, e.g., loss caused by end separation, angular misalignment, or lateral misalignment. *See also* angular misalignment loss, gap loss, intrinsic joint loss, lateral offset loss.

**eye pattern** An oscilloscope display in which a pseudorandom digital data signal from a receiver is repetitively sampled and applied to the vertical input, while the data rate is used to trigger the horizontal sweep. (188) *Note:* System performance information can be derived by analyzing the display. An open eye pattern corresponds to minimal signal distortion. Distortion of the signal waveform due to intersymbol interference and noise appears as closure of the eye pattern. *See also* distortion.

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**facet erosion** A phenomenon occurring in laser diodes in which degradation of the mirror reflectivity decreases the internal quantum efficiency and increases the threshold current. *See also* injection laser diode.



**facility** 1. A building or other structure, either fixed or transportable in nature, with its utilities, ground networks, and electrical supporting structures. *Note:* All wiring and cabling required to be provided are considered to be part of the facility. Any electrical and electronic equipment required to be supplied and installed are also part of the facility. (188) 2. A service provided by a telecommunication network or equipment for the benefit of the users or the operating administration. 3. A general term for the communication transmission pathway and associated equipment. 4. In a data protocol context, an additional item of information or a constraint encoded within the protocol data unit to provide the requested control. 5. A real property entity consisting of one or more of the following: a building, a structure, a utility system, pavement, and underlying land. (JCS1-DoD) *See also* technical control facility.

**facility grounding system** The electrically interconnected system of conductors and conductive elements that provides multiple current paths to the earth electrode subsystem. (188) *Note:* The facility grounding system consists of the earth electrode subsystem, the lightning protection subsystem, the signal reference subsystem, and the fault protection subsystem. *See also* air terminal, earth electrode subsystem, equipotential ground plane, facility, fault protection subsystem, ground, ground-return circuit, lightning down conductor, lightning protection subsystem, neutral ground, signal reference subsystem.

**facsimile (FAX)** 1. A form of telegraphy for the transmission of fixed images, with or without half-tones, with a view to their reproduction in a permanent form. In this definition the term telegraphy has the same general meaning as defined in the Convention.

(RR) 2. A system of telecommunication for the transmission of fixed images with a view to their reception in a permanent form. (JCS1-DoD) (JCS1-NATO) 3. The process, or the result of the process, by which fixed graphic material, including pictures or images, is scanned and the information converted into electrical signals that may be transmitted over a telecommunication system and used to record a copy of the original. (188) *Note 1:* Wirephoto and telephoto are facsimile via wire circuits; radiophoto is facsimile via radio. *Note 2:* Current facsimile systems are designated and defined as follows:

(a) **group 1 facsimile:** A mode of black/white facsimile operation as defined in CCITT Recommendation T.2, which uses double sideband modulation without any special measures to compress the bandwidth. *Note 1:* A 216 × 279 mm document (8½ × 11 inches) may be transmitted in approximately 6 minutes via a telephone-type circuit. Additional modes in this group may be designed to operate at a lower resolution suitable for the transmission of documents 216 × 279 mm in a time between 3 and 6 minutes. *Note 2:* The CCITT frequencies used are 1300 Hz for white and 2300 Hz for black. The North American standard is 1500 Hz for white and either 2300 or 2400 Hz for black.

(b) **group 2 facsimile:** A mode of black/white facsimile operation as defined in CCITT Recommendation T.3, which accomplishes bandwidth compression by using encoding and vestigial sideband, but excludes processing of the document signal to reduce redundancy. *Note:* A 216 × 279 mm document (8½ × 11 inches) may be transmitted in approximately 3 minutes using a 2100-Hz AM/PM/VSB, over a telephone-type circuit.

(c) **group 3 facsimile:** A mode of black/white facsimile operation as defined in CCITT Recommendation T.4, which incorporates means for reducing the redundant information in the document signal using a one-dimensional run-length coding scheme prior to the modulation process. *Note 1:* A 216 × 279 mm document (8½ × 11 inches) may be transmitted in approximately 1 minute or less over a telephone-type circuit with twice the group 2 horizontal resolution; vertical resolution may



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also be doubled. *Note 2:* Group 3 machines have integral digital modems. *Note 3:* An optional two-dimensional bandwidth compression scheme is also defined within the group 3 facsimile specification.

(d) **group 4 facsimile:** A mode of black/white facsimile operation as defined in CCITT Recommendations T.5 and T.6. *Note:* Uses bandwidth compression techniques to transmit an essentially error-free 216 x 279 mm (8½ x 11 inches) document at a nominal resolution of 8 lines/mm in less than 1 minute over a public data network voice-grade circuit.

**facsimile converter** 1. [Receiving,] A facsimile device that changes the type of modulation from frequency shift to amplitude. (188) 2. [Transmitting,] A facsimile device that changes the type of modulation from amplitude to frequency shift. (188)

**facsimile recorder** That part of the facsimile receiver that performs the final conversion of the facsimile picture signal to an image of the original subject copy on the record medium. (188) *See also* facsimile.

**facsimile signal level** The facsimile signal power or voltage measured at any point in a facsimile system. (188) *Note:* It is used to establish the operating levels in a facsimile system, and may be expressed in decibels with respect to some standard value such as 1 milliwatt. *See also* signal, zero transmission level point.

**facsimile transmission** *See* black facsimile transmission, facsimile, white facsimile transmission.

**fade margin** 1. A design allowance provided for system gain (or sensitivity) to accommodate expected fading, to ensure that the required grade of service will be maintained for the specified percentage of time. (188) 2. The amount by which a received signal level may be reduced without causing the system (or channel) output to fall below a specified threshold. (188) *See also* design margin, fading, rf power margin.

**fading** The variation, with time, of the intensity or relative phase, or both, of any or all frequency components of a received signal due to changes in the characteristics of the propagation path with time. (188) *See also* diurnal phase shift, fade margin, flat fading, frequency, phase interference fading, Rayleigh fading, selective fading.

**fading distribution** The probability that signal fading will exceed a certain value relative to a certain reference level. (188) *Note:* In the case of phase interference fading, the time distribution of the instantaneous field intensity approximates a Rayleigh distribution a large part of the time when at least several signal components of equal amplitude are involved. *See also* Rayleigh fading.

**fail** *See* failure, graceful degradation.

**fail safe** Of a device, the capability to fail without detriment to other devices or danger to personnel. (188)

**fail-safe operation** Any mode of operation designed to ensure that a failure of equipment, process, or system does not propagate beyond the immediate environs of the failing entity. (188) *See also* continuous operation, endurance, graceful degradation.

**failure** The temporary or permanent termination of the ability of an entity to perform its required function. (188) *Note:* Catastrophic failures are both sudden and complete. Degradation failures are both gradual and partial.

**failure access** An unauthorized and usually inadvertent access to data resulting from a hardware or software failure in an automated information system. *See also* communications security.

**fall time** The time required for a pulse amplitude to fall from a specified value (usually near the peak value) to a specified value (usually near the lowest value). (188) *Note:* Values of fall time are often specified

between the 90-percent and 10-percent values. *Synonym* pulse decay time. *See also* jitter.

**false clock** A condition where a phase-locked loop controlling a clock locks to a frequency other than the correct frequency. *Note 1:* The condition can occur when there is excessive phase shift, as a function of frequency, in the loop. *Note 2:* The condition often occurs where the false frequency is a harmonic of the correct frequency. *See also* false lock, phase-locked loop.

**false lock** A condition where a phase-locked loop locks to a frequency other than the correct one, or to an improper phase. *See also* false clock.

**fan-beam antenna** A directional antenna producing a main beam having a large ratio of major to minor dimension at any transverse cross-section. *See also* antenna, antenna lobe.

**Faraday effect** *See* magneto-optic effect.

**far-end crosstalk** Crosstalk that is propagated in a disturbed channel in the same direction as the propagation of a signal in the disturbing channel. *Note:* The terminals of the disturbed channel at which the far-end crosstalk is present and the energized terminals of the disturbing channel are usually remote from each other. (188) *See also* crosstalk, intelligible crosstalk, interference, near-end crosstalk.

**far field** *Synonym* far-field region.

**far-field diffraction pattern** The diffraction pattern of a source (such as an LED, ILD, or the output end of an optical fiber) observed at an infinite distance from the source. Theoretically, a far-field pattern exists at distances that are large compared with  $s^2/\lambda$ , where  $s$  is a characteristic dimension of the source and  $\lambda$  is the wavelength. Example: If the source is a uniformly illuminated circle, then  $s$  is the radius of the circle. *Note:* The far-field diffraction pattern of a source may be observed at infinity or (except for scale) in the focal plane of a well-corrected lens. The

far-field pattern of a diffracting screen illuminated by a point source may be observed in the image plane of the source. *Synonym* Fraunhofer diffraction pattern. *See also* diffraction, diffraction limited.

**far-field radiation pattern** 1. The field in a region at that distance from an antenna or source of electromagnetic radiation at which the electromagnetic field strength varies inversely as the distance from the antenna or source. Other contributions to the field strength, which vary inversely as the square or cube of the distance, are negligible. (188) 2. For optical fiber applications, *see* radiation pattern (def. #2). *See also* antenna, diffraction, electromagnetic radiation, intermediate-field region, near-field diffraction pattern.

**far-field region** The region of the field of a source where the angular field distribution is essentially independent of distance from the source. (188) *Note 1:* If the source has a maximum overall dimension  $D$  that is large compared to the wavelength, the far-field region is commonly taken to exist at distances greater than  $2D^2/\lambda$  from the source,  $\lambda$  being the wavelength. *Note 2:* For a beam focused at infinity, the far-field region is sometimes referred to as the Fraunhofer region. *Synonyms* far field, far zone, radiation field. *See also* beam divergence, electromagnetic radiation, Fraunhofer region, Fresnel region, intermediate-field region, near-field region, transition zone.

**far zone** *Synonym* far-field region.

**fast select** An optional user facility in the virtual call service of CCITT X.25 protocol that allows the inclusion of user data in the call request/connected and clear indication packets. An essential feature of the CCITT X.25 (1984) protocol. *See also* virtual call capability, X-series Recommendations.

**fault** 1. A defect that causes a reproducible or catastrophic malfunction. *Note:* A malfunction is considered reproducible if it occurs consistently under the same circumstances.

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2. In power systems, an unintentional short-circuit, or partial short-circuit, between energized conductors or between an energized conductor and ground. (188) 3. An accidental condition that causes a functional unit to fail to perform its required function. (FP) *See also* downtime, error, ground, preventive maintenance.

**fault protection subsystem** That part of a facility power distribution system that serves to provide a direct path from each power sink to the earth electrode subsystem. (188) *Note:* It is usually referred to as a "green wire." *See also* earth electrode subsystem, facility, facility grounding system, ground, lightning protection subsystem, neutral, neutral ground, signal reference subsystem.

**FAX** *Acronym for facsimile.*

**FC** *Abbreviation for functional component.*

**FCS** *Abbreviation for frame check sequence. See cyclic redundancy check.*

**FDDI** *Abbreviation for fiber distributed data interface.*

**FDDI-2** *See fiber distributed data interface.*

**FDHM** *See full width half maximum.*

**FDM** *Abbreviation for frequency-division multiplexing.*

**FDMA** *Abbreviation for frequency-division multiple access.*

**FEC** *Abbreviation for forward error correction.*

**Federal Telecommunications System (FTS)** A switched telecommunication network designed to provide analog and digital transmission for the Federal Government within and among the 50 states and Trust Territories of the United States. *See also* Automatic Digital Network, Automatic Secure Voice Communications Network, Automatic Voice Network, communications.

**feed** 1. To supply a signal to the input of a circuit, device, transmission line, antenna, or system. 2. A coupling device between an antenna and its transmission line. (188) *Note:* A feed may consist of a distribution network or a primary radiator. 3. A term used to describe the function of a device; e.g., feed horn, paper feed, line feed. (188)

**feedback** 1. The return of a portion of the output of an active device to the input. (188) *Note:* Positive feedback adds to the input, negative feedback subtracts from the input. 2. Information returned as a response to an originating source. *See also* closed loop transfer function, echo check, information feedback, lock-in frequency, regeneration.

**feeder echo noise** Distortion of a signal as a result of reflected waves in a transmission line that is many wavelengths long and mismatched at both generator and load ends. (188) *See also* echo, noise.

**feeder link** A radio link from an Earth station at a specified fixed point to a space station, or vice versa, conveying information for a space radio-communication service other than for the fixed-satellite service. (RR) *See also* Earth station.

**fetch protection** An automated information system-provided restriction to prevent a program from accessing data in another user's segment of storage. *See also* register, storage.

**FET photodetector** A photodetector employing photogeneration of carriers in the channel region of a field effect transistor structure to provide photodetection with current gain. *See also* photocurrent, photodiode.

**fiber** *See optical fiber.*

**fiber amplifier** One type of device that amplifies an optical signal directly, without the need to convert it to an electrical signal, amplify it electrically, and reconvert it to an optical signal. *Note 1:* This type of amplifier uses a doped fiber (e.g., a fiber doped with erbium), which bears the communication

signal, and which is optically pumped with a laser having a high-powered continuous output at an optical frequency slightly higher than that of the communication signal. The signal is intensified by Raman amplification. *Note 2:* Because neither optical-electrical conversion nor electrical amplification takes place, this type of amplifier is well suited for a wide variety of applications, both digital and analog. *Note 3:* Because this type of amplifier does not require extraordinary frequency (wavelength) control of the pumping laser, it is relatively simple. *Synonym* Raman amplifier.

**fiber axis** In an optical fiber, the line connecting the centers of the circles that circumscribe the core, as defined under "tolerance field." *Synonym* optical axis. *See also* tolerance field.

**fiber bandwidth** *See* bandwidth.

**fiber buffer** *See* buffer (def. #4).

**fiber bundle** An assembly of parallel unbuffered optical fibers, in intimate contact with one another and secured, usually with an epoxy or other adhesive in the interstices. *Note 1:* Each endface of the bundle is typically finished to a flat or other optical surface, usually at right angles to the axis of the bundle. *Note 2:* Such bundles are used to transmit optical power or images. *Note 3:* Bundles used to transmit images must maintain spatial coherence amongst the relative positions of the respective fibers at each end (aligned bundles). There is no requirement for this if the bundle is used to transmit optical power only. *Note 4:* Fiber bundles were employed in early, short-distance communication applications, but have become obsolete in modern telecommunications. *See also* aligned bundle, buffer, bundle, cable, fiber optics, optical fiber.

**fiber cutoff wavelength ( $\lambda_c$ )** For a short uncabled single-mode optical fiber with a specified radius of curvature, the wavelength at which presence of the fiber's second order mode introduces a measurable attenuation increase when compared to a fiber whose differential mode attenuation is not changing at

that wavelength. *Note:* Because a fiber's cutoff wavelength depends on length, bend, and cabling, a cabled fiber's cutoff wavelength is a more functional value for cutoff wavelength from a systems point of view. In general, the cable cutoff wavelength is lower than the fiber cutoff wavelength. *See also* cable cutoff wavelength, cutoff wavelength.

**fiber dispersion** *See* dispersion.

**fiber distributed data interface (FDDI)** An optical-fiber token-ring network (defined by four ANSI standards) with highly reliable data transfer, active link monitoring, station management, large-bandwidth capabilities (100 Mbps transmission rate), and survivability features. *Note 1:* The four standards are: ANSI X3T9.5 (Physical Media Dependent [PMD] specifications), ANSI X3T9.5 (addressing the PHY [physical] specifications), ANSI X3.139 (addressing the Media Access Control [MAC] parameters), and ANSI X3T9.5 (addressing Station Management [SMT] parameters). *Note 2:* FDDI-2, a second-generation FDDI network is under development.

**fiber optic** *Deprecated term. See entries under* optical fiber (e.g., optical fiber cable instead of fiber optic cable).

**fiber optics (FO)** The branch of optical technology concerned with the transmission of radiant power through fibers made of transparent materials such as glass (including fused silica) or plastic. (188) *Note 1:* Telecommunications applications of fiber optics employ flexible low-loss fibers, using a single fiber per information channel(s). *Note 2:* Various industrial and medical applications employ (typically high-loss) flexible fiber bundles in which individual fibers are spatially aligned, permitting optical relay of an image, such as in an endoscope. *Note 3:* Some specialized industrial applications employ rigid (fused) aligned fiber bundles for image transfer, such as in the fiber optics faceplate used on some high-speed oscilloscopes.

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**fiber pigtail** A short length of optical fiber, permanently fixed to a component, used to couple power between the component and the transmission fiber. (188) *See also* fiber optics, optical fiber.

**fidelity** The degree to which a system, or a portion of a system, accurately reproduces, at its output, the essential characteristics of the signal impressed upon its input. (188) *See also* linearity, precision.

**field** 1. The volume of influence of a physical phenomenon, expressed vectorially. 2. On a data medium or in storage, a specified area used for a particular class of data, e.g., a group of character positions used to enter or display wage rates on a screen. (FP) (ISO) 3. Defined logical data that are part of a record. (FP) 4. The elementary unit of a record that may contain a data item, a data aggregate, a pointer, or a link. (FP) *See also* address field, information field.

**field intensity** The irradiance of an electromagnetic beam under specified conditions. (188) *Note:* Usually specified in terms of power per unit area, e.g., watts per square meter, milliwatts per square centimeter. *See also* field strength, radio beam.

**field strength** The intensity of an electric, magnetic, or electromagnetic field at a given point. (188) *Note:* Normally used to refer to the rms value of the electric field, expressed in volts per meter, or of the magnetic field, expressed in amperes per meter. *Synonym* radio field intensity. *See also* field intensity, radio beam.

**field wire** A flexible insulated wire used in field telephone and telegraph systems. (188) *Note 1:* WD-1 and WF-16 are types of field wire. *Note 2:* Usually contains a strength member.

**FIFO** *Abbreviation for first-in first-out.*

**file** 1. The largest unit of storage structure that consists of a named collection of all occurrences in a database of records of a particular record type. (FP) 2. A set of related

records treated as a unit, for example, in stock control, a file could consist of a set of invoices. (FP) (ISO)

**file transfer, access, and management (FTAM)** An application's service and protocol based on the concept of virtual file store. This service/protocol allows remote access to various levels in a file structure and provides a comprehensive set of file management capabilities.

**fill** *See* bit stuffing.

**filled cable** A cable that has a nonhygroscopic material, usually a gel, inside the sheath. (188) *Note:* Used to prevent moisture from entering minor leaks in the sheath and migrating along the cable.

**filter** In electronics, a device which transmits only part of the incident energy and may thereby change the spectral distribution of energy: (a) high-pass filters transmit energy above a certain frequency; (b) low-pass filters transmit energy below a certain frequency; (c) bandpass filters transmit energy of a certain bandwidth; (d) band-stop filters transmit energy outside a specific frequency band. (JCS1-DoD) (JCS1-NATO)

**firmware** Software that is permanently stored in a hardware device which allows reading and executing the software, but not writing or modifying it. (188) *See also* hardware, hardware (def. #2), read-only storage, software.

**first-in first-out (FIFO)** A queueing discipline in which arriving entities leave in the same order in which they arrived. (188) *Note 1:* Service is offered first to the entity that has been in the file the longest. *Note 2:* Commonly used in message switching. *See also* buffer, elastic buffer, last-in first-out, queue traffic, variable length buffer.

**FISINT** *Acronym for foreign instrumentation signals intelligence.*

**fixed attenuator** *Synonym* pad.



**fixed loop** A service feature available in some switching systems that permits an attendant on an assisted call to retain connection through the attendant position for the duration of the call. *Note:* The attendant will normally receive a disconnect signal when the call has been terminated. *See also* attendant access loop, loop, service feature.

**fixed microwave auxiliary station** A fixed station used in connection with (a) the alignment of microwave transmitting and receiving antenna systems and equipment, (b) coordination of microwave radio survey operations, and (c) cue and contact control of television pickup station operations. (CFR 47)

**fixed-reference modulation** A type of modulation in which the choice of the significant condition for any signal element is based on a fixed reference. (188) *See also* coherent pulse operation, modulation.

**fixed-satellite service** A radiocommunication service between Earth stations as specified fixed points when one or more satellites are used; in some cases this service includes satellite-to-satellite links, which may also be effected in the inter-satellite service, the fixed-satellite service may also include feeder links for other space radiocommunication services. (RR) *See also* aeronautical service, Earth station.

**fixed service (FX)** A radiocommunication service between specified fixed points. (RR)

**fixed station** A station in the fixed service. (RR)

**fixed storage** *Synonym* read-only storage.

**flag** In data transmission, an indicator, such as a signal, symbol, character, or digit, used for identification. *Note:* An example is a word mark, a group mark, or letter that signals the occurrence of some condition or event such as the end of a word or block. *See also* block, character, word.

**flag sequence** 1. A sequence of bits used in a bit-oriented link protocol, e.g., ADCCP, SDLC, and HDLC, to delimit the beginning and end of a frame. *Note:* An 8-bit sequence is generally used as the flag sequence. 2. In data transmission, the sequence of bits employed to delimit the beginning and end of a frame. *Note:* In one standard data transmission system, the 8-bit sequence 01111110 is used as the flag sequence. *See also* abort, binary digit, data transmission, frame.

**flash** A signal generated by the momentary depression of the telephone switchhook or other device. *Note:* The flash is used to request additional services. *See also* dual-tone multifrequency signaling.

**FLASH message** A category of precedence reserved for initial enemy contact messages or operational combat messages of extreme urgency. Brevity is mandatory. (JCS1-DoD) *See also* precedence.

**flat fading** Fading in which all frequency components of the received radio signal decrease in the same proportion simultaneously. (188) *See also* attenuation, fading, selective fading.

**flat rate service** Telephone service in which a single payment permits an unlimited number of local calls to be made without further charge for a specified period of time. *See also* extended area service, measured-rate service, postalized rate, tariff.

**flat weighting** In a noise measuring set, an amplitude-frequency characteristic that is flat over a specified frequency range, which must be stated. (188) *Note:* Flat noise power may be expressed in dBrn ( $f_1$ - $f_2$ ), or in dBm ( $f_1$ - $f_2$ ). The terms "3-kHz flat weighting" and "15-kHz flat weighting" are also used for characteristics which are flat from 30 Hz to the upper frequency indicated. *See also* C-message weighting, dBrn( $f_1$ - $f_2$ ), F1A-line weighting, HA1-receiver weighting, 144-line weighting, 144-receiver weighting.

**F layer** *See* F region.

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**flexible disk** *Synonym* floppy disk.

**flip-flop** *Synonym* bistable trigger circuit.

**flood projection** In facsimile, the optical method of scanning in which the original is floodlighted and the scanning spot is defined by a masked portion of the illuminated area. *See also* facsimile.

**flood search routing** A routing method that employs an algorithm that determines the optimum route for traffic within a network, avoiding failed and congested links.

**floppy disk** A flexible magnetic disk enclosed in a container. (FP) *Synonym* flexible disk.

**flowchart** A graphical representation in which symbols are used to represent such things as operations, data, flow direction, and equipment, for the definition, analysis, or solution of a problem. (FP) (ISO) *Synonym* flow diagram.

**flow control** *See* transmit flow control.

**flow control procedure** The procedure for controlling the rate of transfer of data among elements of a network, e.g., between a DTE and a data switching exchange network, to prevent overload. *See also* data terminal equipment, data transmission, network.

**flow diagram** *Synonym* flowchart.

**flutter** 1. Rapid variations in received signal strength, such as may be caused by atmospheric variations, antenna movements in a high wind, or interaction with another signal. (188) 2. A phenomenon in radio propagation during which substantially all radio waves that are normally reflected by ionospheric layers in or above the E region suffer partial or complete absorption. (188) 3. In radio transmission, rapidly changing signal amplitude levels together with variable multipath time delays, caused by the reflection, and possible partial absorption, of the radio signal from aircraft flying through the beam or common scatter volume. (188) 4. The effect of the variation in the transmission characteristics

of a loaded telephone circuit caused by the action of telegraph direct currents on the loading coils. 5. In recording and reproducing, deviation of frequency that results, in general, from irregular motion during recording, duplication, or reproduction. *See also* distortion, phase interference fading, selective fading.

**flux** *Obsolete synonym* for radiant power.

**flywheel effect** That characteristic of an oscillator that enables it to sustain oscillations after removal of the control stimulus. (188) *Note:* This characteristic may be desirable (as in the case of phase-locked loops employed in synchronous system equipment) or undesirable (as in the case of a voltage-controlled oscillator). *Synonym* flywheeling.

**flywheeling** *Synonym* flywheel effect.

**FM** *Abbreviation* for frequency modulation.

**FM blanketing** That form of interference to the reception of other broadcast stations, which is caused by the presence of an FM broadcast signal of 115 dBu (562 mV/m) or greater signal strength in the area adjacent to the antenna of the transmitting station. The 115-dBu contour is referred to as the "blanketing area." (After CFR 47)

**FM broadcast translator** *See* translator (def. #3).

**FM capture effect** *Synonym* capture effect.

**FM capture ratio** *See* capture effect.

**FM improvement factor** The signal-to-noise ratio at the output of an FM receiver divided by the carrier-to-noise ratio at the input of the receiver. *Note:* This improvement is always obtained at the price of an increased bandwidth in the receiver and the transmission path. (188) *See also* bandwidth, discriminator, FM threshold effect, frequency modulation, signal-to-noise ratio.

**FM improvement threshold** The point in an FM receiver at which the peaks in the rf signal equal the peaks of the thermal noise generated in the receiver. (188) *Note:* A baseband signal-to-noise ratio of about 30 dB is typical at the improvement threshold, and this ratio improves 1 dB for each decibel of increase in the signal above the threshold. *See also* FM threshold effect, frequency modulation, signal-to-noise ratio, squelch.

**FM threshold effect** In an FM receiver, that effect produced when the desired-signal gain begins to limit the desired signal (and thus noise limiting/suppression). (188) *Note:* This effect occurs at (and above) the point at which the FM signal-to-noise improvement is measured. *See also* discriminator, FM improvement factor, FM improvement threshold, FM threshold extension, frequency modulation.

**FM threshold extension** A change in the value of the FM threshold of a receiver. *Note:* It may be obtained by decreasing the operational bandwidth, thus decreasing the received noise power and allowing the threshold of the desired signal to occur at a lower signal input level. *See also* bandwidth, FM threshold effect, frequency modulation, signal-to-noise ratio.

**FO** *Abbreviation for fiber optics.*

**F1A-line weighting** A noise weighting used in a noise measuring set to measure noise on a line that would be terminated by a 302-type or similar instrument. *Note 1:* The meter scale readings are in dBa(F1A). *Note 2:* F1A-line weighting is obsolete for new DoD applications. *See also* C-message weighting, flat weighting, 144-line weighting.

**footprint** In satellite communications, that portion of the Earth's surface over which a satellite antenna delivers a specified amount of signal power under specified conditions. (188) *Note:* The limiting case is somewhat less than one half the Earth's surface and depends on the altitude of the satellite. *See also* Earth coverage, satellite.

**foreign exchange (FX) service** A service in which a telephone in a given local exchange area, instead of being connected directly to the central office serving that exchange area, is connected, via a private line, to a central office in another (in telephone parlance, "foreign") exchange area. *Note:* To callers, it appears that the FX telephone is actually located in the caller's local exchange. *Synonym* long call. *See also* exchange area.

**foreign instrumentation signals intelligence (FISINT)** 1. Intelligence information derived from electromagnetic emissions associated with the testing and operational deployment of foreign aerospace, surface, and subsurface systems. (JCS1-DoD) 2. Technical information and intelligence information derived from the intercept of foreign instrumentation signals by other than the intended recipients. Foreign instrumentation signals intelligence is a category of signals intelligence. *Note:* Foreign instrumentation signals include but are not limited to signals from telemetry, beaconry, electronic interrogators, tracking/fusing/arming/firing command systems, and video data links. (JCS1-DoD)

**format** 1. Arrangement of bits or characters within a group, such as a word, message, or language. (188) *See also* packet format. 2. Shape, size, and general makeup of a document. (188)

**fortuitous conductor** Any conductor that may provide an unintended path for intelligible signals, e.g., water pipes, wire or cable, metal structural members. (188)

**fortuitous distortion** Distortion resulting from causes generally subject to random laws. (188) *See also* cyclic distortion, distortion.

**forward busying** That feature of a telecommunications system wherein supervisory signals are forwarded in advance of address signals in order to seize assets of the system before attempting to establish a call. (188) *See also* call, supervisory signals.

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**forward channel** The channel of a data circuit that transmits data from the originating user to the destination user. *Note:* The forward channel carries message traffic and some control information. *See also* backward channel, backward signal, channel, circuit, forward signal, information-bearer channel.

**forward echo** An echo propagating in the same direction as the original wave in a transmission line, and formed by energy reflected back from one irregularity and then onward again by a second. (188) *Note:* Forward echoes can occur at all irregularities in a length of cable, and, when they add systematically, can impair its performance as a transmission medium. *See also* echo, return loss.

**forward error correction (FEC)** A system of error control for data transmission wherein the receiving device has the capability to detect and correct any character or code block that contains fewer than a predetermined number of symbols in error. (188) *Note:* FEC is accomplished by adding bits to each transmitted character or code block using a predetermined algorithm. *See also* binary digit, block code, character, code, convolutional code, data transmission, error, error control, error-detecting code, information feedback.

**forward propagation ionospheric scatter (FPIS)**  
*Synonym* ionospheric scatter.

**forward scatter** 1. The deflection by reflection or refraction of an electromagnetic wave or signal in such a manner that a component of the wave is deflected in the direction of propagation of the incident wave or signal. 2. The component of an electromagnetic wave or signal that is deflected by reflection or refraction in the direction of propagation of the incident wave or signal. (188) 3. To deflect, by reflection or refraction, an electromagnetic wave or signal in such a manner that a component of the wave or signal is deflected in the direction of propagation of the incident wave or signal. (188) *Note:* The term "*scatter*" can be applied to reflection or refraction by relatively uniform media, but it is

usually taken to mean propagation in which the wavefront and direction are modified in a relatively disorderly fashion. *See also* backscattering, propagation.

**forward signal** A signal sent in the direction from the calling to the called station, i.e., from a data originating user to a destination user. *Note:* The forward signal is transmitted in the forward channel. *See also* backward channel, backward signal, data transmission, forward channel, signal.

**FOT** *Abbreviation for optimum traffic frequency.*

**four-wire circuit** A two-way circuit using two paths so arranged that the electrical signals are transmitted in one direction only by one path and in the other direction by the other path. (188) *See also* circuit, duplex circuit, duplex operation, four-wire terminating set, line adapter circuit, metallic circuit.

**four-wire repeater** A repeater, consisting of two amplifiers, used in a four-wire circuit. (188) *See also* repeater.

**four-wire terminating set** A set used to terminate the transmit and receive channels of a four-wire circuit and to interconnect four-wire and two-wire circuits. (188) *See also* circuit, four-wire circuit, hybrid set, line adapter circuit.

**fox message** The following standard test message, which includes all the alphanumerics on a teletypewriter and also function characteristics (space, figures shift, letters shift): "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG'S BACK 1234567890." (188)

**FPIS** *Abbreviation for forward propagation ionospheric scatter. See* ionospheric scatter.

**fractional frequency fluctuation** The deviation of the frequency of an oscillator from its nominal constant frequency, normalized to the nominal frequency.

**fractional offset** *Synonym* normalized offset.

**frame** 1. In data transmission, the sequence of contiguous bits bracketed by and including beginning and ending flag sequences. *Note 1:* A typical frame might consist of a specified number of bits between flags and contain an address field, a control field, and a frame check sequence. A frame may or may not include an information field. *Note 2:* Frames are normally associated with complex schemes and used with binary signaling. *Note 3:* Frames normally consist of a representation of the original signal presented for transmission together with other signal elements used for error detection and/or error control, or both, routing information, synchronization of information, and similar overhead functions not directly associated with the original signal. 2. In the multiplex structure of PCM systems, a set of consecutive digit time slots in which the position of each digit time slot can be identified by reference to a frame-alignment signal. (188) *Note:* The frame-alignment signal does not necessarily occur, in whole or in part, in each frame. 3. In a TDM system, a repetitive group of signals resulting from a single sampling of all channels, including any additional signals for synchronizing and other required system information. (188) *Note:* In-frame is the condition that exists when there is a channel-to-channel and bit-to-bit correspondence (exclusive of transmission errors) between all inputs of a time-division multiplexer and output of its associated demultiplexer. 4. In facsimile systems, a rectangular area, the width of which is the available line and the length of which is determined by the service requirements. (188) 5. In ISDN, a block of variable length, labeled at the Data Link Layer of the Open Systems Interconnection Reference Model.

**frame alignment** The extent to which the frame of the receiving equipment is correctly phased with respect to that of the received signal. *See also* bunched frame-alignment signal, distributed frame-alignment signal, frame, frame-alignment signal, frame slip, framing, framing bit.

**frame-alignment recovery time** *Synonym* reframing time.

**frame-alignment signal** In data transmission, the distinctive signal used to enable frame alignment to be accomplished. *See also* bunched frame-alignment signal, distributed frame-alignment signal, frame, frame alignment, multiframe, synchronous transmission.

**frame-alignment time slot** A time slot starting at a particular phase or instant in each frame and allocated to the transmission of a frame-alignment signal. (188) *See also* frame, synchronous transmission.

**frame check sequence (FCS)** *See* cyclic redundancy check.

**framed interface** An interface through which the information flow is partitioned into physical, periodic frames consisting of overhead information and an information payload. *See also* overhead information, payload.

**frame duration** 1. The sum of all the unit time intervals of a frame. (188) 2. The time from the start of one frame until the start of the next frame. *See also* frame, framing, framing bit, synchronous transmission.

**frame grabber** A device that can seize and record a single frame of video information out of a sequence of many frames.

**frame slip** 1. That condition under which a received digital signal loses frame synchronization. (188) 2. The dropping or repeating of a full frame by a transmission or switching facility without the loss of frame synchronization. (188) *See also* frame, frame alignment.

**frame synchronization** The process whereby a given digital channel (time slot) at the receiving end is aligned with the corresponding channel (time slot) of the transmitting end as it occurs in the received signal. (188) *Note:* Usually extra bits (frame synchronization bits) are



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inserted at regular intervals to indicate the beginning of a frame and for use in frame synchronization. *See also* binary digit, frame, synchronization, synchronization code.

**frame synchronization pattern** In digital communications, a prescribed recurring pattern of bits transmitted to enable the receiver to achieve frame synchronization. (188) *See also* binary digit, frame.

**framing** 1. In TDM reception, the process of adjusting the timing of the receiver to coincide with that of the received framing signals. (188) *See also* frame, frame alignment, frame duration, synchronous transmission, time-division multiplexing. 2. In video reception, the process of adjusting the timing of the receiver to coincide with the received video sync pulse. 3. In facsimile, the adjustment of the facsimile picture to a desired position in the direction of line progression. (188)

**framing bit** 1. A bit used for frame synchronization purposes. 2. A bit at a specific interval in a bit stream used in determining the beginning or end of a frame. (188) *Note:* Framing bits are non-information-carrying bits used to make possible the separation of characters in a bit stream into lines, paragraphs, pages, channels, etc. Framing in a digital signal is usually repetitive. *See also* binary digit, frame, frame alignment, frame duration.

**framing signal** *See* framing, framing bit.

**Fraunhofer diffraction pattern** *Synonym* far-field diffraction pattern.

**Fraunhofer region** The radiation field region for an antenna that is focused at infinity. *Note:* It begins beyond the Fresnel region at a distance approximately equal to twice the square of the antenna aperture divided by the wavelength. *See also* antenna, antenna gain, Fresnel region, intermediate-field region, near-field region.

**free-running capability** The capability of a normally synchronized oscillator to operate in the absence of a synchronizing signal.

**free space** A theoretical concept of space devoid of all matter. (188) *Note:* The term also implies remoteness from material objects that could influence the propagation of electromagnetic waves. *See also* free-space loss, line-of-sight propagation.

**free-space coupling** Energy transfer via electromagnetic fields not in a conductor. (188) *See also* free space, line-of-sight propagation.

**free-space loss** The signal attenuation that would result if all obstructing, scattering, or reflecting influences were sufficiently removed so as to have no effect on propagation. (188) *Note:* Free-space loss is primarily caused by beam divergence, i.e., signal energy spreading over larger areas at increased distances from the source. *See also* line-of-sight propagation, loss.

**freeze frame television** The technique of transmitting sequentially a series of video images. The transmission of the image is performed, typically, every 30 seconds from a processing unit's memory where the image is fixed prior to its transmission.

**F region** That region of the ionosphere existing between approximately 175 and 400 km above the surface of the Earth. (188) *Note 1:* The  $F_1$ -layer, about 175 to 250 km high, exists only during daylight hours. *Note 2:* The  $F_2$ -layer, about 250 to 400 km high, is the principal reflecting layer for HF communications. *See also* ionosphere.

**frequency** For a periodic function, the number of cycles or events per unit of time. *Note:* When the unit of time is 1 second, frequency is expressed (by definition) in hertz (Hz). (188)

**frequency accuracy** The degree of conformity to a specified value of a frequency. (188) *See also* frequency, frequency lock, frequency stability, precise frequency.

**frequency aging** The change in frequency with time caused by internal changes in an oscillator when external factors (e.g., environment, power supply) are kept constant. *See also* frequency drift.

**frequency allocation** *See* allocation [of a frequency band].

**frequency allotment** *See* allotment [of a radio frequency or radio frequency channel].

**frequency assignment** The process of authorizing a specific frequency, group of frequencies, or frequency band to be used at a certain location under specified conditions such as bandwidth, power, azimuth, duty cycle, or modulation. (188) *See also* allocation [of a frequency band], assigned frequency, authorized frequency, frequency.

**frequency assignment authority** The power granted an Administration or its designated/delegated leader or agency via treaty or law to specify frequencies or frequency bands of the electromagnetic spectrum for use in systems or equipment. *Note:* Primary authority is exercised for the United States by the National Telecommunications and Information Administration and the Federal Communications Commission for the Federal Government and the non-Government, respectively. Internationally this is done through the International Frequency Registration Board of the International Telecommunications Union.

**frequency averaging** A process by which network synchronization is achieved by use, at all nodes, of oscillators that adjust their frequencies to the average frequency of the digital bit streams received from connected nodes. *Note:* All oscillators are assigned equal weight in determining the ultimate network frequency. *See also* democratically synchronized network, frequency.

**frequency band** *See* spectrum designation of frequency.

**frequency-change signaling** A signaling method in which one or more particular frequencies correspond to each desired signaling condition of a code. *Note:* The transition from one set of frequencies to the other may be either a continuous or a discontinuous change in frequency or in phase. (188) *See also* code, frequency, signal.

**frequency coherence** *See* phase coherence

**frequency departure** An unintentional deviation from the nominal frequency value. *See also* error, frequency, frequency offset.

**frequency-derived channel** A channel derived by dividing an allocated or available bandwidth over a medium into two or more portions, each usable separately. (188) *Note:* A frequency-derived channel is continuously available and may be further divided on either a frequency or time basis. *See also* bandwidth, channel, frequency, frequency-division multiplexing, time-division multiplexing.

**frequency deviation** In frequency modulation, the difference between the maximum instantaneous frequency of the modulated wave and the carrier frequency. (188) *See also* carrier (cxr), deviation ratio, frequency, frequency modulation, frequency-shift keying.

**frequency displacement** The end-to-end shift in frequency that may result from independent frequency translation errors in a circuit. (188) *See also* error, frequency, frequency translation.

**frequency distortion** *Synonym* amplitude-vs.-frequency distortion.

**frequency diversity** Any method of diversity transmission and reception wherein the same information signal is transmitted and received simultaneously on two or more independently fading carrier frequencies. (188) *See also* carrier (cxr), diversity reception, dual diversity, frequency, time diversity.

**frequency-division multiple access (FDMA)** The use of frequency division to provide multiple

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and simultaneous transmissions to a single transponder. (188) *See also* frequency, multiplexing, time-division multiple access.

**frequency-division multiplexing (FDM)** A method of deriving two or more simultaneous, continuous channels from a transmission medium by assigning separate portions of the available frequency spectrum to each of the individual channels. (188) *Note:* In optical communications, one also encounters wavelength-division multiplexing (WDM), involving the use of several distinct optical sources (lasers), each having a distinct center frequency. *See also* carrier (cxf), channelization, frequency, inverted position, multiplex hierarchy, multiplexing, time-assignment speech interpolation, time-division multiplexing.

**frequency drift** An undesired progressive change in frequency with time. (188) *Note 1:* Causes of frequency drift include component aging and environmental changes. *Note 2:* Frequency drift may be in either direction and is not necessarily linear. *See also* drift, frequency, frequency aging, frequency instability, frequency lock, frequency offset, frequency stability, frequency tolerance, lock-in frequency.

**frequency exchange signaling** A frequency-change signaling method in which the change from one signaling condition to another is accompanied by decay in amplitude of one or more frequencies and by buildup in amplitude of one or more other frequencies. (188) *Synonym* two-source frequency keying. *See also* frequency, frequency-change signaling, frequency shift, frequency-shift keying, signal, two-tone keying.

**frequency fluctuation** A short-term variation, with respect to time, of the frequency of an oscillator. Frequency fluctuation,  $f(t)$ , is given by

$$f(t) = \frac{1}{2\pi} \frac{d^2 \theta(t)}{dt^2},$$

where  $\theta$  is the phase angle of the sinusoidal wave. *See also* chirping, frequency instability, frequency stability.

**frequency frogging** 1. The interchanging of the frequency allocations of carrier channels to prevent singing, reduce crosstalk, and to correct for a transmission line frequency-response slope. (188) *Note:* It is accomplished by having the modulators in a repeater translate a low-frequency group to a high-frequency group, and vice versa. Because of this frequency inversion process, a channel will appear in the low group for one repeater section and will then be translated to the high group for the next section. This results in nearly constant attenuation with frequency over two successive repeater sections, and eliminates the need for large slope equalization and adjustment. Also, singing and crosstalk are minimized because the high-level output of a repeater is at a different frequency from the low-level input to other repeaters. 2. Alternate use of two frequencies at repeater sites of line-of-sight microwave systems. (188) *See also* allocation [of a frequency band], carrier (cxf), channel, frequency.

**frequency guard band** An unused frequency band between two channels to provide a margin of safety against mutual interference. (188) *See also* band, channel, frequency, time guard band.

**frequency hopping** The repeated switching of frequencies during radio transmission according to a specified algorithm to avoid (or minimize) authorized interception or jamming of telecommunications.

**frequency-hopping spread spectrum** A signal structuring technique employing automatic switching of the transmitted frequency. Selection of the frequency to be transmitted is typically made in a pseudorandom manner from a set of frequencies covering a band wider than the information bandwidth. The intended receiver would frequency-hop in synchronization with the code of the transmitter in order to retrieve the desired information. (NTIA) (188) *Note:* In many

cases, used as an electronic counter-countermeasure (ECCM) technique. *See also* anti-jam, electronic counter-countermeasures, frequency, M-sequence, spread spectrum.

**frequency hour** One frequency used for one hour regardless of the number of transmitters over which it is simultaneously broadcast by a station during that hour. (CFR 47)

**frequency instability** The fluctuation (often by unknown causes) of the frequency of a circuit or device. *See also* chirping, frequency, frequency drift, frequency fluctuation, frequency offset, frequency stability, jitter, swim.

**frequency lock** That condition wherein a frequency-correcting closed (feedback) loop is maintaining its control of the output within the limits of one cycle. (188) *Note:* Frequency lock does not imply phase lock, but phase lock does not imply frequency lock. *See also* frequency, frequency accuracy, frequency drift, frequency stability, lock-in frequency, lock-in range.

**frequency modulation (FM)** The form of angle modulation in which the instantaneous frequency of a sine wave carrier is caused to depart from the carrier frequency by an amount proportional to the instantaneous value of the modulating signal. (188) *See also* angle modulation, carrier (cxr), deviation ratio, digital frequency modulation, frequency, frequency deviation, frequency-shift keying, modulation, modulation index, phase deviation, phase modulation, phase-shift keying.

**frequency offset** The difference between the frequency of a source and a reference frequency. (188) *See also* frequency, frequency departure, frequency drift, frequency instability, frequency stability, frequency tolerance, primary frequency standard.

**frequency response** *See* insertion-loss-vs.-frequency characteristic.

**frequency shift** 1. Any change in frequency. 2. Any change in the frequency of a radio transmitter or oscillator. (188) *Note:* Also called rf shift. 3. *See* frequency-shift telegraphy. 4. In facsimile, a frequency modulation system where one frequency represents picture black and another frequency represents picture white. Frequencies between these two limits may represent shades of gray. (188) 5. An intentional frequency change used for modulation purposes. (188) *See also* frequency, frequency assignment, frequency exchange signaling, frequency-shift keying, phase shift.

**frequency-shift keying (FSK)** A form of frequency modulation in which the modulating signal shifts the output frequency between predetermined values. (188) *Note 1:* Commonly, the instantaneous frequency is shifted between two discrete values termed the "mark" and "space" frequencies. This is a noncoherent form of FSK. *Note 2:* Coherent forms of FSK exist where there is no phase discontinuity in the output signal. *Synonyms* frequency-shift modulation, frequency-shift signaling. *See also* carrier shift, differential phase-shift keying, digital modulation, digital phase modulation, double frequency-shift keying, frequency, frequency deviation, frequency exchange signaling, frequency modulation, frequency shift, keying, multiple frequency-shift keying, phase-shift keying, two-tone keying.

**frequency-shift modulation** *Synonym* frequency-shift keying.

**frequency-shift signaling** *Synonym* frequency-shift keying.

**frequency-shift telegraphy** Telegraphy by frequency modulation in which the telegraph signal shifts the frequency of the carrier between predetermined values. (RR)

**frequency source** *See* frequency standard.

**frequency stability** A measure of the variations of the frequency of an oscillator from its mean frequency over a specified period of time.

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(188) *See also* error, frequency, frequency accuracy, frequency averaging, frequency drift, frequency fluctuation, frequency instability, frequency lock, frequency offset.

**frequency standard** A stable oscillator used for frequency calibration or reference. (188) *Note 1:* It usually generates a fundamental frequency with a high degree of accuracy, and harmonics of this fundamental are used to provide reference points. *Note 2:* Frequency standards in a network or facility are sometimes administratively designated as "primary" (or "secondary"). Care should be taken to prevent such a designation from being understood to mean that the standard is indeed a primary frequency standard meeting national criteria (unless it does). *See also* frequency, frequency stability, primary frequency standard.

**frequency synthesizer** A device for producing an additional frequency (or frequencies) that is (are) phase coherent to a reference frequency. (188) *Note:* The reference frequency may be from an internal source or (usually) from an external standard. *See also* frequency, phase coherence, station clock.

**frequency tolerance** The maximum permissible departure by the center frequency of the frequency band occupied by an emission from the assigned frequency or by the characteristic frequency of an emission from the reference frequency. [By international agreement,] frequency tolerance is expressed in parts per  $10^6$  or in hertz. (RR) (188) *Note:* This includes both the initial setting tolerance and excursions related to short- and long-term instability and aging. In the United States, frequency tolerance is expressed in parts per  $10^6$ , in hertz, or in percentages. *See also* assigned frequency, error, frequency, frequency drift, frequency offset.

**frequency translation** The transfer of signals occupying a definite frequency band, such as a channel or group of channels, from one position in the frequency spectrum to another, in such a way that the arithmetic frequency difference of signals within the band is

unaltered. (188) *See also* channel, down-converter, erect position, frequency, frequency displacement, inverted position, up-converter.

**Fresnel diffraction pattern** *Synonym* near-field diffraction pattern.

**Fresnel reflection** In optics, the reflection of a portion of incident light at a planar interface between two homogeneous media having different reflective indices. (188) *Note 1:* Fresnel reflection occurs at the air-glass interfaces at entrance and exit ends of an optical fiber. Resultant transmission losses (on the order of 4 percent per interface) can be virtually eliminated by use of antireflection coatings or index-matching materials. *Note 2:* Fresnel reflection depends upon the index difference and the angle of incidence; it is zero at Brewster's angle. In optical elements, a thin transparent film is sometimes used to give an additional Fresnel reflection that cancels the original one by interference. This is called an antireflection coating. *See also* antireflection coating, Brewster's angle, index-matching material, reflectance, reflection, refractive index [of a medium].

**Fresnel reflection method** In optical fiber communication, the method for measuring the index profile of an optical fiber by measuring the reflectance as a function of position on the end face. *See also* Fresnel reflection, index profile, reflectance.

**Fresnel reflective losses** For optical fiber communication, the losses incurred at the terminus interface that are due to refractive index differences. *See also* Fresnel reflection.

**Fresnel region** In radio communications, the region between the near field of an antenna and the Fraunhofer region. *Note:* The boundary between the two is generally considered to be at a radius equal to twice the square of antenna length divided by wavelength. *See also* antenna, effective Earth radius, Fraunhofer region, k-factor, near-field region, path clearance, path profile, path survey, propagation path obstruction.



**Fresnel zone** In radio communications, a cigar-shaped shell of circular cross-section surrounding the direct path between a transmitter and a receiver. For the first Fresnel zone, the distance from the transmitter to any point on this shell and on to the receiver is one half-wavelength longer than the direct path; for the second Fresnel zone, two half-wavelengths. (188) *See also* effective Earth radius, Fresnel reflection, k-factor, path clearance, path profile, path survey, propagation path obstruction.

**front-end noise temperature** A measure of the thermal noise generated in the first stage of a receiver. (188) *See also* noise.

**front-end processing** The transformation of information prior to a processing operation. *Note:* Front-end processing may include such service as serial-to-parallel conversion, packetizing, multiplexing and concentration, network access signaling/supervision, protocol conversion, error control, and diagnosis.

**front-end processor** A programmed-logic or stored-program device that interfaces data communication equipment with an input/output bus or memory of a data processing computer. *See also* computer.

**front-to-back ratio** A ratio of parameters used in connection with antennas, rectifiers, or other devices in which signal strength or resistance, or other parameters, in one direction is compared with that in the opposite direction. (188)

**FSK** *Abbreviation for frequency-shift keying.*

**FTAM** *Abbreviation for file transfer, access, and management.*

**FTS** *Abbreviation for Federal Telecommunications System.*

**full carrier single-sideband emission** A single-sideband emission without reduction [suppression] of the carrier. (RR) *See also* reduced carrier single-sideband emission, single-sideband emission.

**full-duplex circuit** *Synonym* duplex circuit.

**full-duplex operation** *Synonym* duplex operation.

**fully intermateable connectors** Connectors from one source that mate with complementary components from other sources without mechanical damage and with transmission properties maintained within specified limits. (188) *See also* compatibility.

**full width half maximum (FWHM)** A measure of the extent of a function given by the difference between the two extreme values of the independent variable at which the dependent variable is equal to half of its maximum value. *Note 1:* Commonly applied to the duration of pulse waveforms, the spectral extent of emission or absorption lines, and the angular or spatial extent of radiation patterns. *Note 2:* The term "*full duration half maximum*" is preferred when the independent variable is time.

**fully intermateable connectors** Connectors from one source that mate with complementary components from other sources without mechanical damage and with transmission properties maintained within specified limits. (188) *See also* compatibility.

**functional component (FC)** In intelligent networks, the elemental network call-processing actions, unique to the IN/2 architecture, that direct internal network resources to perform specific actions, e.g., to collect dialed digits. *See also* intelligent network.

**functional group** The functions performed by specific equipment, as in ISDN. *See also* Integrated Services Digital Network.

**functional signaling** In an ISDN, signaling that provides messages with unambiguous, defined meanings known to both the sender and receiver of the messages. *Note:* Signaling is generated by the terminal.

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**functional signaling link** A concept that describes a communications link with the transfer control functions associated therewith. *See also* link, signal.

**fundamental mode** The lowest order mode of an optical fiber. (188) *Note:* In optical fibers, the mode designated  $LP_{01}$  or  $HE_{11}$ . *See also* mode.

**fuse** An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it. (188) *See also* protector.

**fused quartz** Glass made by melting natural quartz crystals; not as pure as vitreous silica. *See also* vitreous silica.

**fused silica** *Synonym* vitreous silica. *See also* fused quartz.

**fusion splice** A splice accomplished by the application of localized heat sufficient to fuse or melt the ends of two lengths of optical fiber, forming a continuous, single fiber.

**FWHM** *Abbreviation for* full width half maximum.

**FX** *Abbreviation for* fixed service, foreign exchange service.

**gain** The ratio of output current, voltage, or power to input current, voltage, or power, respectively. (188) *Note 1:* Gain is usually expressed in decibels.

*Note 2:* Differences in power levels between points in a system may be expressed as gain. *Note 3:* Gain may be expressed as a positive or negative quantity; when a negative quantity, it is usually referred to as "loss." *See also* dB, loss.



**gain hlt** *See* hlt.

**gain of an antenna** *Synonym* antenna gain.

**galactic radio noise** *Synonym* cosmic noise.

**gap loss** In an optical-fiber system, a power loss, usually expressed in decibels, due to the longitudinal spacing at a light-source-to-fiber junction, at a fiber-to-fiber junction, or at a fiber-to-photodetector junction. (188) *Note:* For fiber-to-fiber coupling, it is commonly called "longitudinal offset loss."

**garble** An error in transmission, reception, encryption, or decryption that changes the text of a message or any portion thereof in such a manner that it is incorrect or undecryptable. (JCS1-DoD) *See also* decrypt, encrypt, error.

**gate** 1. A device having one output channel and one or more input channels, such that the output channel state is completely determined by the input channel states, except during switching transients. 2. One of many types of combinational logic elements having at least two inputs; e.g., AND, OR, NAND, and NOR. (188)

**gateway** In a communication network, one of the network nodes equipped for interfacing with a network using different protocols. (188) *Note:* It may contain devices such as protocol translators, impedance matching devices, rate converters, fault isolation, or signal translators as necessary to provide system interoperability. It also requires that mutually acceptable administrative procedures be established between the two networks. *See also* bridge,

communications, interface, internetworking, network, node.

**gating** 1. The process of selecting only those portions of a wave between specified time intervals or between specified amplitude limits. *See also* limiting, synchronizing. 2. The controlling of signals by means of combinational logic elements. (188) *See also* gate. 3. A process in which a predetermined set of conditions, when established, permits a second process to occur. (188) *See also* decision circuit, synchronizing.

**Gaussian beam** A beam of light whose electric field intensity distribution is Gaussian. *Note:* When such a beam is circular in cross-section, the intensity at distance  $r$  from the center,  $E(r)$ , is given by  $E(r) = E(0)\exp[-(r/w)^2]$  where  $E(0)$  is the electrical field strength at the beam center, i.e., at  $r = 0$ ; and  $w$  is the value of  $r$  at which the intensity is  $1/e$  of its value on the axis. *See also* beam diameter.

**Gaussian pulse** A pulse that has the waveform of a Gaussian distribution. (188) *Note:* In the time domain, the waveform,  $f(t)$ , is given by  $f(t) = A \exp[-(t/\sigma)^2]$ , where  $A$  is a constant, and  $\sigma$  is the pulse half duration at the  $1/e$  points. *See also* full width half maximum.

**GBH** *Abbreviation for* group busy hour.

**GCT** *Abbreviation for* Greenwich Civil Time.

**GDF** *Abbreviation for* group distribution frame.

**general communication** Two-way voice communication, through a base station, between (a) a common carrier land mobile or airborne station and a landline telephone station connected to a public message landline telephone system, or (b) two common carrier land mobile stations, or (c) two common carrier airborne stations, or (d) a common carrier land mobile station and a common carrier airborne station. (After CFR 47)

**general purpose network** *See* common user network.

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**geometric optics** The treatment of propagation of light as rays. *Note:* Rays are bent at the interface between two dissimilar media or may be curved in a medium in which the refractive index is a function of position. *See also* axial ray, meridional ray, optical axis, paraxial ray, physical optics, skew ray.

**geostationary orbit** An orbit that is circular, lies in the plane of the equator, and on which any point revolves about the Earth's polar axis in the same direction and with the same period as the Earth's rotation. (188) *Note:* An object in a geostationary orbit will remain above a fixed point on the Earth's equator at a distance of approximately 42,164 km from the center of the Earth. *See also* direct orbit, equatorial orbit, inclined orbit, periapsis, perigee, polar orbit, retrograde orbit, synchronous orbit.

**geostationary satellite** A geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator and which thus remains fixed relative to the Earth; by extension, a satellite that remains approximately fixed relative to the Earth. (RR)

**geostationary satellite orbit** The orbit in which a satellite must be placed to be a geostationary satellite. (RR)

**geosynchronous satellite** An earth satellite whose period of revolution is equal to the period of rotation of the Earth about its axis. (RR)

**ghost** A secondary image or signal resulting from echo, envelope delay distortion, or multipath reception. *See also* echo, envelope delay distortion, multipath.

**gigahertz (GHz)** A unit of frequency denoting  $10^9$  hertz. (188) *See also* frequency, metric system, spectrum designation of frequency.

**glare** *Deprecated term. See* call collision.

**GMT** *Abbreviation for* Greenwich Mean Time.

**GOS** *Abbreviation for* grade of service.

**GOSIP** *Acronym for* Government Open Systems Interconnection Profile.

**Government Open Systems Interconnection Profile (GOSIP)** A definition of Federal Government functional requirements for open systems computer network products. A common set of Open System Interconnection (OSI) data communication protocols that enables systems developed by different vendors to interoperate and enable the users of different applications on these systems to exchange information. *Note 1:* These OSI protocols were developed primarily by ISO and CCITT. *Note 2:* The GOSIP is a subset of the OSI protocols and is based on agreements reached by vendors and users of computer networks participating in the National Institute of Standards and Technology (NIST) Implementors Workshop. *Note 3:* The GOSIP is promulgated as FIPS Pub 146. *See also* Open Systems Interconnection.

**graceful degradation** A condition in which a system continues to operate, providing service in a degraded mode rather than failing completely or catastrophically. (188) *See also* continuous operation, degraded service state, endurance, fail-safe operation, failure.

**graded-index fiber** An optical fiber with a core refractive index that varies with radial distance from the fiber axis. Distinguished from a step-index fiber. (188) *Note:* This characteristic causes the light rays to be continually refocused by refraction within the core. *See also* optical fiber, refractive index, step-index fiber.

**graded-index profile** For an optical fiber, any refractive index profile in which the index in the core varies with radial distance from the axis of the fiber. Distinguished from a step-index profile. (188) *See also* dispersion, mode volume, multimode optical fiber, normalized frequency, optical fiber, parabolic profile, power-law index profile, profile parameter, refractive index, refractive index profile, step-index profile.

**grade of service (GOS)** The probability of a call being blocked or delayed more than a specified interval, expressed as a decimal fraction. (188) *Note:* Grade of service may be applied to the busy hour or to some other specified period or set of traffic conditions. Grade of service may be viewed independently from either end of the trunk and is not necessarily equal in each direction. *See also* call, quality of service, special grade of service.

**grandfathered systems** Systems (including, but not limited to, PBX and key telephone systems) directly connected to the public switched telephone network on June 1, 1978, that may remain connected thereto permanently without registration unless subsequently modified. Also included are systems that are of the same type as those connected to the public switched telephone network on July 1, 1978, which were added before January 1, 1980, and which may remain connected thereto permanently without registration unless subsequently modified. *See also* grandfathered terminal equipment.

**grandfathered terminal equipment** Terminal equipment (other than PBX and key telephone systems) and protective circuitry connected to the public switched telephone network before July 1, 1978, that may remain connected thereto for life without registration unless subsequently modified. *See also* grandfathered systems.

**graphics** The art or science of conveying information through the use of graphs, letters, lines, drawings, pictures, etc. (188) *Note:* Facsimile is one form of technology for electrically transporting intelligence in graphic form from one point to another. *See also* computer graphics, facsimile.

**Gray code** A special binary code used to minimize transmission errors, in which sequential decimal numbers are represented by binary expressions that differ only in one bit position.

Decimal	Binary	Gray
0	000	000
1	001	001
2	010	011
3	011	010
4	100	110
5	101	111
6	110	101
7	111	100

*See also* binary digit, error, error control.

**gray scale** An optical pattern consisting of discrete steps or shades of gray between black and white. (188) *See also* facsimile.

**great circle** A circle defined by the intersection of the surface of the Earth and any plane that passes through the center of the Earth. *Note:* The shortest distance, over the idealized surface of the Earth, between two points, lies along a great circle.

**Greenwich Civil Time (GCT)** *Synonym* Greenwich Mean Time; *obsolete term--see* Coordinated Universal Time.

**Greenwich Mean Time (GMT)** Mean solar time at the meridian of Greenwich, England; formerly used as a basis for standard time throughout the world. Normally expressed in 24-hour time. (188) *Note 1:* Also called "Zulu Time" and "World Time." *Note 2:* "Greenwich Mean Time" (GMT) is an obsolete term. Because the second is no longer defined in terms of astronomical phenomena, "Universal Time" (which is defined in terms of cesium-133 transitions) is the most accurate measure of



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time, and the primary term name for time is "Coordinated Universal Time," which is synonymous with "Zulu Time." *Synonyms* Greenwich Civil Time, Universal Time. *See also* Coordinated Universal Time.

**ground** 1. The electrical connection to earth through an earth electrode subsystem. This connection is extended throughout the facility via the facility ground system consisting of the signal reference subsystem, the fault protection subsystem, and the lightning protection subsystem. (188) 2. In an electrical circuit, a common return path, which may not necessarily be connected to earth ground. *See also* bond, bonding, earth electrode subsystem, equipotential ground plane, facility grounding system, fault, ground absorption, ground constants, ground plane, ground potential, ground-return circuit, ground start, ground wave.

**ground absorption** The loss of energy in transmission of radio waves due to dissipation in the ground. (188) *See also* ground constants.

**ground constants** The electrical constants of the earth, such as conductivity and dielectric constant. *Note:* These values vary with frequency, and also with local moisture content and chemical composition of the earth. (188) *See also* facility grounding system, ground, ground absorption, ground potential.

**ground loop** A potentially detrimental loop formed when two or more points in an electrical system that are nominally at ground potential are connected by a conducting path such that either or both points are at different ground potentials. (After IEEE)

**ground plane** The surface, existing or provided, that serves as the near-field reflection point for an antenna. (188) *See also* antenna, equipotential ground plane, image antenna.

**ground potential** The electrical potential of the earth with respect to another body or region. *Note:* The ground potential of the earth will vary with locality and also as a function of

certain phenomena such as meteorological disturbances. *See also* earth electrode subsystem, ground, ground constants.

**ground-return circuit** 1. A circuit in which the earth serves as one conductor. (188) 2. A circuit in which there is a common return path, whether or not connected to earth ground. *See also* circuit, common return, facility grounding system, ground, unbalanced line.

**ground start** A supervisory signal from a terminal to a switch in which one side of the line is temporarily grounded. (188) *See also* ground, loop start.

**ground wave** In radio transmission, a surface wave that propagates close to the surface of the Earth. *Note 1:* The Earth has one refractive index and the atmosphere has another, thus constituting an interface. These refractive indices are subject to spatial and temporal changes. *Note 2:* Ground waves do not include ionospheric and tropospheric waves. *See also* antenna, direct ray, sky wave.

**group** 1. In frequency-division multiplexing, a number of voice channels, either within a supergroup or separately, which in wideband systems is normally composed of up to 12 voice channels occupying the frequency band 60 kHz to 108 kHz. (188) *Note 1:* This is CCITT Basic Group B. *Note 2:* CCITT Basic Group A (carrier telephone systems) is an assembly of 12 channels, occupying upper sidebands in the 12-kHz to 60-kHz band. It is no longer mentioned in CCITT Recommendations. 2. A supergroup is normally 60 voice channels, or 5 groups of 12 voice channels each, occupying the frequency band 312 kHz to 552 kHz. (188) 3. A mastergroup is composed of 10 supergroups or 600 voice channels. (188) *Note 1:* The CCITT standard mastergroup contains 5 supergroups; U.S. commercial carriers use 10 supergroups. *Note 2:* The terms "supermastergroup" or "jumbo group" are sometimes used for 6 mastergroups. 4. A set of characters forming a unit for transmission or cryptographic treatment. (188)

**group alerting and dispatching system** A service feature that enables one controlling telephone to place a call to a specified number of telephones simultaneously, and have this call recorded. If any of the called lines is busy, the equipment camps on until it is free, then rings and plays the recorded message. *See also* conference call, multiaddress calling facility, service feature.

**group busy hour (GBH)** The busy hour offered to a given trunk group. *See also* busy hour, erlang, group, switch busy hour, traffic load.

**group delay** 1. The rate of change of the total phase shift with angular frequency,  $\omega = 2\pi f$ , through a device or transmission medium, where  $f$  is the frequency. *See also* delay distortion, envelope delay distortion. 2. In an optical fiber, in the strict sense, the transit time required for optical power, traveling at a given mode's group velocity, to travel a distance  $L$ . *Note:* For optical fiber dispersion measurement purposes, the quantity of interest is group delay per unit length, which is simply the inverse of the group velocity of a particular mode. The measured group delay of an optical signal through an optical fiber exhibits a wavelength dependence due to the various dispersion mechanisms present in the optical fiber. (188)

**group delay time** The time interval required for the crest of a group of waves to travel through a device or transmission facility where the component waves have slightly different individual frequencies. (188)

**group distribution frame (GDF)** In frequency-division multiplexing, a distribution frame that provides terminating and interconnecting facilities for the modulator output and demodulator input circuits of the channel transmitting equipment and modulator input and demodulator output circuits for the group translating equipment operating in the basic spectrum of 60 kHz to 108 kHz. (188) *See also* distribution frame, group.

**group index** In fiber optics, for a given mode propagating in a medium of refractive index  $n$ ,

the group index,  $N$ , is the velocity of light in vacuum,  $c$ , divided by the group velocity of the mode. (188) *Note:* For a plane wave of wavelength  $\lambda$ ,

$$N = n - \lambda \frac{dn}{d\lambda}$$

*See also* group velocity, phase velocity.

**grouping factor** *Synonym* blocking factor.

**group 1 . . . 4 facsimile** *See* facsimile.

**group patch bay** *See* patch bay.

**group velocity** 1. The velocity of propagation of an envelope produced when an electromagnetic wave is modulated by, or mixed with, other waves of different frequencies. (188) *Note:* The group velocity is the velocity of information propagation and, loosely, of energy propagation. 2. In optical fiber transmission, for a particular mode, the reciprocal of the rate of change of the phase constant with respect to angular frequency. *Note:* The group velocity equals the phase velocity if the phase constant is a linear function of the angular frequency,  $\omega = 2\pi f$ , where  $f$  is the frequency. 3. In optical-fiber transmission, the velocity of the modulated optical power. *See also* differential mode delay, group index, phase velocity.

**G/T** *Abbreviation for* antenna gain-to-noise temperature.

**guard band** *See* frequency guard band, time guard band.

**guided mode** *Synonym* bound mode.

**guided ray** In an optical fiber, a ray that is completely confined to the core. Specifically, a ray at radial position  $r$  having direction such that  $0 \leq \sin \theta(r) \leq [n^2(r) - n^2(a)]^{1/2}$ , where  $\theta(r)$  is the angle the ray makes with the fiber axis,  $n(r)$  is the refractive index at the radial distance  $r$  from the axis of the fiber, and  $n(a)$  is the refractive index at core radius,  $a$ , i.e., at the core-cladding interface. Guided rays

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correspond to bound (or guided) modes in the terminology of mode descriptors. (188) *Synonyms* bound ray, trapped ray. *See also* bound mode, fiber optics, guided wave, leaky ray.

**guided wave** A wave whose energy is concentrated near a boundary or between substantially parallel boundaries separating materials of different properties and whose direction of propagation is effectively parallel to these boundaries. (188) *See also* guided ray, waveguide.

**Hagelbarger code** A type of convolutional code designed to enable burst errors to be corrected provided that there are relatively long error-free intervals between the error bursts. *Note:* The principle of operation involves insertion of parity check bits spread out in time so that an error burst is not likely to affect more than one of the groups whose parity is checked. *See also* binary digit, code, convolutional code, error control, error-correcting code, group (def.#4).



**half-duplex (HD) circuit** A circuit that affords communication in either direction, but only in one direction at a time. (188) *Note:* If the transmission direction is reversed sufficiently rapidly, a half-duplex circuit can effectively simulate full-duplex operation. *See also* circuit, duplex circuit, duplex operation, simplex circuit, simplex operation.

**half-duplex (HD) operation** That mode of operation in which communication between two terminals occurs in either direction, but in only one direction at a time. (188) *Note:* Half-duplex operation may occur on a half-duplex circuit or on a duplex circuit, but it may not occur on a simplex circuit (def.#1). *Synonyms* one-way reversible operation, two-way alternate operation. *See also* circuit, duplex circuit, duplex operation, one-way communication, simplex circuit.

**halftone** Any photomechanical printing surface or the impression therefrom in which detail and tone values are represented by a series of evenly spaced dots in varying size and shape, varying in direct proportion to the intensity of tones they represent. (JCS1-DOD) (JCS1-NATO) *See also* continuous tone copy, facsimile.

**halftone characteristic** In facsimile systems, a relationship between the density of the recorded copy and the density of the original copy. (188) *Note:* The term may also be used to relate the amplitude of the facsimile signal to the density of the original copy or the record copy when only a portion of the system is

under consideration. In a frequency modulation system, an appropriate parameter is to be used instead of the amplitude. *See also* facsimile.

**Hamming code** An error-detecting and -correcting binary code used in data transmission that can detect all single and double bit errors and can correct all single bit errors. *Note:* Hamming codes must satisfy  $2^m \geq n+1$  and  $m = n-k$  where  $n$  is the number of bits in the block,  $k$  is the number of information bits in the block, and  $m$  is the number of check bits in the block. *See also* binary digit, block, code, convolutional code, error-correcting code, error-detecting code.

**Hamming distance** *Synonym* signal distance (def.#1).

**Hamming weight** The number of non-zero symbols in a symbol sequence. *Note:* For binary signaling, it is the number of "1" bits in the binary sequence. *See also* binary code, binary digit, Hamming code.

**handoff** 1. In a cellular radio system, the process of transferring a phone call in progress from one cell transmitter and frequency to another cell transmitter using a different frequency without interruption of the call. *See also* cellular radio. 2. In satellite communications, the process of transferring ground station control responsibility from one ground station to another without loss or interruption of service. (188)

**handshaking** 1. In data communication, a sequence of events governed by hardware or software, requiring mutual agreement of the state of the operational modes prior to change. 2. The process used to establish communications parameters between two stations. (188) *Note:* Handshaking follows the establishment of a circuit between the stations and precedes information transfer. It is used to agree upon such parameters as information transfer rate, alphabet, parity, interrupt procedure, and other protocol features. *See also* protocol.

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**hangover** *Synonym* tailing.

**HA1-receiver weighting** A noise weighting used in a noise measuring set to measure noise across the HA1-receiver of a 302-type or similar instrument. (188) *Note 1:* The meter scale readings are in dBa(HA1). *Note 2:* HA1 noise weighting is obsolete for new DoD applications. *See also* C-message weighting, flat weighting, 144-line weighting, 144-receiver weighting.

**hard clad silica (HCS) fiber** An optical fiber having a silica core and a hard polymeric plastic cladding intimately bonded to the core.

**hard copy** In computer graphics or telecommunications, a permanent reproduction of the data displayed or transmitted. The reproduction may be on any media suitable for direct use by a person. (188) *Note 1:* Teletypewriter pages, continuous printed tapes, facsimile pages, computer printouts, and radiophoto prints are all examples of hard copy. *Note 2:* Magnetic tapes or diskettes or nonprinted punched paper tapes are not hard copy.

**hardened** Pertaining to that condition of a facility with protective features that have been designed to allow the facility to withstand an explosion, a natural disaster, or ionizing radiation. (188)

**hard sectoring** The physical marking of sector boundaries on a magnetic disk. (FP) (ISO) *See also* soft sectoring.

**hardware** 1. Physical equipment as opposed to programs, procedures, rules, and associated documentation. (FP) (ISO) (188) 2. The generic term dealing with physical items as distinguished from its capability or function such as equipment, tools, implements, instruments, devices, sets, fittings, trimmings, assemblies, subassemblies, components, and parts. The term is often used in regard to the stage of development, as in the passage of a device or component from the design stage into the hardware stage as the finished object. (JCS1-DoD) 3. In data automation, the physical equipment or devices forming a

computer and peripheral components. (JCS1-DoD) *See also* firmware, software.

**hardwire** 1. To connect equipment or components permanently in contrast to using switches, plugs, or connectors. (188) 2. The wiring-in of fixed logic or read-only storage that cannot be altered by program changes. (188) *See also* firmware.

**harmful interference** 1. Any emission, radiation, or induction that endangers the functioning of a radionavigation service or of other safety services, or seriously degrades, obstructs, or repeatedly interrupts a radio communication service operating in accordance with approved standards, regulations, and procedures. (188) 2. Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with these [Radio] Regulations. (RR) *See also* accepted interference, interference.

**harmonic** Of a sinusoidal wave, an integral multiple of the frequency of the wave. *Note:* The first harmonic is the fundamental frequency itself; the second harmonic is twice the frequency of the fundamental; the third, three times the frequency of the fundamental, etc. *See also* overtone.

**harmonic distortion** The presence of frequencies at the output of a device, which are not present at the input, caused by nonlinearities within the device, and which are harmonically related to a single frequency applied to the input of the device. *Note:* The frequency of the first harmonic at the output (also known as the fundamental frequency) is the input frequency. (188) *See also* distortion, single-harmonic distortion, total harmonic distortion.

**hazards of electromagnetic radiation to fuel (HERF)** Potential for electromagnetic radiation to cause spark ignition of volatile combustibles, such as aircraft fuels. (188) *See also* radiation.



**hazards of electromagnetic radiation to ordnance (HERO)** Potential for electromagnetic radiation to affect adversely munitions or electroexplosive devices. (188) *See also radiation.*

**hazards of electromagnetic radiation to personnel (HERP)** Potential for electromagnetic radiation to produce harmful biological effects in humans. (188) *See also radiation.*

**H-bend** A smooth change in the direction of the axis of a waveguide, throughout which the axis remains in a plane parallel to the direction of magnetic H-field (transverse) polarization. (188) *Note:* Also called H-plane bend. *See also E-bend, waveguide.*

**HCS** *Abbreviation for hard clad silica.*

**HD** *Abbreviation for half duplex.*

**HDLC** *Abbreviation for high-level data link control.*

**HDTV** *Abbreviation for high-definition television.*

**head** A device that reads, writes, or erases data on a storage medium.

**head-end** 1. A central control device required within some LAN/MAN systems to provide such centralized functions as remodulation, retiming, message accountability, contention control, diagnostic control, and access to a gateway. 2. A central control device within CATV systems to provide such centralized functions as remodulation. *See also local area network.*

**header** The portion of a message that contains information that will guide the message to the correct destination. (188) *Note:* This information contains such things as the sender's and receiver's addresses, precedence level, routing instructions, and synchronization pulses. *See also address field, overhead information.*

**head-on collision** A condition that can occur on a data circuit when two or more nodes seize the circuit at approximately the same instant. *Note:* This condition may occur on other types of circuits. *See also call collision, lockout (def. #4).*

**Heaviside layer** *Synonym E region.*

**height gain** For a given propagation mode of an electromagnetic wave, the ratio of the field strength at a specified height to that at the Earth's surface. *See also gain.*

**helical antenna** An antenna that has the form of a helix. (188) *Note:* When the helix circumference is much smaller than one wavelength, the antenna radiates at right angles to the axis of the helix. When the helix circumference is one wavelength, maximum radiation is along the helix axis.

**HEMP** *Abbreviation for high-altitude electromagnetic pulse.*

**HE<sub>11</sub> mode** Designation for the fundamental hybrid mode of an optical fiber. *See also fundamental mode, mode.*

**HERF** *Abbreviation for hazards of electromagnetic radiation to fuel.*

**HERO** *Abbreviation for hazards of electromagnetic radiation to ordnance.*

**HERP** *Abbreviation for hazards of electromagnetic radiation to personnel.*

**hertz (Hz)** The frequency of a periodic phenomenon for which the period is one second. (188) *Note:* The SI unit for frequency, where one hertz corresponds to one cycle per second. *See also frequency, SI, spectrum designation of frequency.*

**heterochronous** A relationship between two signals such that their corresponding significant instants do not necessarily occur at the same time. (188) *Note:* Two signals having different nominal signaling rates and not stemming from the same clock or from homochronous clocks

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are usually heterochronous. *See also* anisochronous, homochronous, isochronous, mesochronous, plesiochronous.

**heterodyne** 1. To generate new frequencies by mixing two or more signals in a nonlinear device such as a vacuum tube, transistor, or diode mixer. (188) *Note:* A superheterodyne receiver converts any selected incoming frequency by heterodyne action to a common intermediate frequency where amplification and selectivity (filtering) are provided. 2. A frequency produced by mixing two or more signals in a nonlinear device. (188) *See also* beating, frequency, image frequency, intermodulation, intermodulation distortion.

**heterodyne repeater** A repeater for a radio system in which the received signals are converted to an intermediate frequency, amplified, and reconverted to a new frequency band for transmission over the next repeater section. (188) *Sometimes employed as a synonym for IF repeater. See also* frequency, repeater.

**heterogeneous multiplexing** Multiplexing in which all the information-bearer channels do not operate at the same data signaling rate. *See also* homogeneous multiplexing, multiplexing.

**heterojunction** A junction between semiconductors that differ in their doping level conductivities and also in their atomic or alloy compositions. *See also* homojunction.

**heuristic routing** A routing method in which time delay and other data extracted from incoming messages, over time and over differing routes, are used to determine the optimum routing for transmitting data back to the sources. *Note:* This allows a measure of routine optimization based on recent empirical knowledge of the state of the network. *See also* alternate routing, routing.

**hexadecimal** 1. Characterized by a selection, choice or condition that has sixteen possible different values or states. (FP) (ISO) *Synonym* sexadecimal. 2. In a fixed-radix numeration system, a radix of sixteen. (FP) (ISO)

**HF** *Abbreviation for high frequency.*

**HFDF** *Abbreviation for high frequency distribution frame.*

**hierarchical computer network** A computer network in which processing and control functions are performed at several levels by computers specially suited for the functions performed; e.g., industrial process control, inventory control, database control, or hospital automation. *See also* distributed control.

**hierarchically synchronized network** A mutually synchronized network in which some clocks exert more control than others, the network operating frequency being a weighted mean of the natural frequencies of the population of clocks. *See also* democratically synchronized network, master-slave timing, mutually synchronized network, mutual synchronization, oligarchically synchronized network.

**high-altitude electromagnetic pulse (HEMP)** An electromagnetic pulse produced at an altitude effectively above the sensible atmosphere (approximately 120 km). (188) *See also* electromagnetic pulse.

**high-definition television (HDTV)** Television that has approximately twice the horizontal and twice the vertical emitted resolution specified by the NTSC standard. HDTV employs a wide aspect ratio. *Note 1:* The total number of pixels is therefore more than four times that of NTSC. *Note 2:* HDTV may include any or all IDTV and EDTV improvements. *See also* advanced television, broadband ISDN, distribution-quality television, extended-definition television (EDTV), improved definition television (IDTV).

**higher frequency ground** *Deprecated term.* The interconnected metallic network intended to serve as a common reference for currents and voltages at frequencies above 30 kHz and, in some cases, above 300 kHz. (188) *See also* equipotential ground plane, facility grounding system, frequency, ground.

**high frequency (HF)** Frequencies from 3 MHz to 30 MHz. (188) *See also* frequency, spectrum designation of frequency.

**high frequency distribution frame (HFDF)** A distribution frame that provides terminating and interconnecting facilities for those combined supergroup modulator output and combined supergroup demodulator input circuits occupying the baseband spectrum. (188) *See also* distribution frame, frequency, group.

**high-level control** In data transmission, the conceptual level of control or processing logic existing in the hierarchical structure of a primary or secondary station, which level is above the Link Level and upon which the performance of Link Level functions is dependent or is controlled; e.g., device control, buffer allocation, or station management. *See also* level (def. #2), Open Systems Interconnection--Reference Model.

**high-level data link control (HDLC)** A link-level protocol used to provide reliable point-to-point transmission of a data packet. *Note:* A subset of HDLC, known as "LAP-B," is the layer-two protocol for CCITT Recommendation X.25. *See also* Advanced Data Communication Control Procedure, data, data transmission, level, link, Open Systems Interconnection--Reference Model, synchronous data link control, X.-series Recommendations.

**high-level language (HLL)** A computer programming language that does not reflect the structure of any one given computer or that of any one given class of computers. A statement in a high-level language must be interpreted and corresponding intermediate, assembly, or machine language statements compiled for use by a computer. (188) *Note:* Ada® is the DoD high-level language. FORTRAN, BASIC, C, and COBOL are common commercial high-level languages. *See also* Ada®, assembly language, compile, computer, computer language, computer-oriented language, language, level, machine language.

**high-pass filter** A filter that passes frequencies above a given frequency and attenuates all others. (188) *See also* filter, frequency.

**high-performance equipment** Equipment that has sufficiently exacting characteristics to permit its use in trunks or links; equipment designed primarily for use in global and tactical service where maximum performance and capabilities and minimum electromagnetic interference are necessary for operation in a variety of networks or for fixed point-to-point circuits. (188) *Note:* Requirements for global and tactical high-performance equipment may differ. *See also* low-performance equipment.

**high-usage trunk group** A group of trunks for which an alternate route has been provided to absorb the relatively high rate of overflow traffic. (188) *See also* group, overflow, routing.

**highway** 1. A digital serial-coded bit stream with time slots allotted to each call on a sequential basis. 2. A common path or a set of parallel paths over which signals from more than one channel pass with separation achieved by time division. *See also* channel gate, time-division multiplexing.

**hiss** Noise in the audio frequency range, having subjective characteristics analogous to prolonged sibilant sounds. (188) *Note:* Noise in which there are no pronounced low-frequency components may be considered as hiss. *See also* frequency, interference, noise.

**hit** 1. A transient disturbance to a communication medium. (188) *See also* dropout. 2. A match of data to a prescribed criterion.

**HLL** Abbreviation for high-level language.

**hold-in frequency range** A range of frequency differences between the local oscillator (or clock) and the reference frequency of a phase-locked loop for which the local oscillator (or clock) will slowly change frequency in a direction that will reduce the frequency difference and, if not interrupted, will

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eventually reach the lock-in frequency and achieve phase lock.

**holding time** The total length of time that a call makes use of a trunk or channel. (188) *Note:* Holding time is usually measured in call-seconds. *See also* call-second, channel, trunk.

**homochronous** The relationship between two signals such that their corresponding significant instants are displaced by a constant interval of time. (188) *See also* anisochronous, heterochronous, isochronous, mesochronous, plesiochronous.

**homogeneous cladding** In an optical fiber, a cladding in which the nominal refractive index is constant throughout. *Note:* An optical fiber may have several homogeneous claddings, each having a different refractive index. *See also* cladding, tolerance field.

**homogeneous multiplexing** Multiplexing in which all of the information-bearer channels operate at the same data signaling rate. *See also* heterogeneous multiplexing, multiplexing.

**homojunction** A junction between semiconductors that differ in their doping level conductivities but not in their atomic or alloy compositions. *See also* heterojunction.

**hop** The excursion of a radio wave from the Earth to the ionosphere and back to the Earth. (188) *Note:* The number of hops indicates the number of reflections from the ionosphere. *See also* atmospheric duct, ionosphere, skip distance.

**horizon angle** The angle, in a vertical plane, between a horizontal line extending from the center of an antenna and a line extending from the same point to the radio horizon. (188) *See also* antenna, k-factor, path profile, radio horizon.

**horizontal resolution** In facsimile, the number of picture elements per unit distance in the direction of scanning or recording. (188) *See also* facsimile.

**horn** 1. In radio transmitting practice, a waveguide section of increasing cross-sectional area used to radiate directly in the desired direction or to feed into a reflector that forms the desired beam. (188) *Note 1:* Such horns may have any of several expansion curves such as elliptical, conical, hyperbolic, or parabolic. *Note 2:* By a combination of designs controlling the horn dimensions, the spacing of the reflector, and the reflector shape and dimensions, a very wide range of beam patterns may be formed. 2. A portion of waveguide wherein at least one of the cross-sectional diameters is smoothly increased along the axis direction. (188) *Note:* Horns are used as direct radiators or as feed devices for reflective antennas. 3. In audio practice, a tube of increasing (often exponentially) cross-section for radiating or receiving acoustic waves. *Note:* The small or terminating end is normally provided with an impedance-matching device or cross-section as well as with the appropriate transducer. *See also* antenna, waveguide.

**horn gap switch** A switch provided with arcing horns, ordinarily used for disconnecting or breaking the charging current of overhead transmission and distribution lines. (188) *See also* switch.

**host** *Synonym* host computer.

**host computer** In a computer network, a computer that provides end users with services such as computation and database access and that usually performs network control functions. (FP) (ISO) *Synonym* host.

**hot line** A dedicated circuit linking only two terminals. (188) *Note 1:* In the DoD, hot lines do not require any dialing by the user. *Note 2:* Various priority services that require user dialing are not properly termed "hot lines." *See also* circuit, dedicated circuit, leased circuit, off-hook service, permanent virtual circuit, point-to-point link.

**house cable** *Deprecated term.* Communication cable within a building or a complex of buildings. *Note:* House cable owned before divestiture by the Bell System and after

divestiture by the Regional Bell Operating Companies will eventually be fully depreciated and will then belong to the customer. *See on-premises wiring.*

**housekeeping signals** *Synonym* service signals.

**hundred call-seconds (CCS)** *See* call-second.

**hunting** 1. In telephony, pertaining to the operation of a selector or other similar device to find and establish connection with an idle circuit of a chosen group. (188) *See also* group, rotary hunting. 2. Pertaining to the failure of a device to achieve a state of equilibrium, usually by alternately overshooting and undershooting the point of equilibrium. (188) *See also* failure.

**hybrid** 1. A device, circuit, apparatus, or system made up of two or more subassemblies, often employing different technologies, not heretofore combined, to satisfy a given requirement. *Note:* Examples include: (a) an electronic circuit having both vacuum tubes and transistors; (b) a mixture of thin-film and discrete integrated circuits; (c) a computer that has both analog and digital capability. (188) 2. A transformer or combination of transformers, or resistive network affording paths to three branches, circuits A, B, and C, so arranged that A can send to C, B can receive from C, but A and B are effectively isolated. (188) *See also* hybrid communication network, integrated optical circuit.

**hybrid balance** A measure of the degree of balance between two impedances connected to two conjugate sides of a hybrid set; it is given by the formula for return loss. (188) *See also* balanced, balanced line, impedance, return loss.

**hybrid cable** 1. A communication cable that contains two or more types of conductors that bear electrical signals, a mixture of signal-bearing electrical conductors and optical fibers, and/or two or more different types of optical fibers. 2. A communication cable containing signal-bearing media and electric power conductors.

**hybrid coil** A single transformer that has, effectively, three windings and which is designed to be connected to four branches of a circuit so as to make them conjugate in pairs. (188) *Synonym* bridge transformer. *See also* bridge, hybrid (def. #2), hybrid set.

**hybrid communication network** A communication system that uses a combination of trunks, loops, or links, some of which are capable of transmitting (and receiving) only analog or quasi-analog signals and some of which are capable of transmitting (and receiving) only digital signals. (188) *Synonym* hybrid system. *See also* communications, quasi-analog transmission.

**hybrid computer** A computer that processes both analog and digital data. (FP)

**hybrid connector** A connector containing contacts for more than one type of service such as electrical power, coaxial cables, optical fiber cables, and audio pairs (shielded and/or unshielded), which may contain active devices as well.

**hybrid coupler** 1. In antenna work, a hybrid junction forming a directional coupler. *Note:* The coupling factor is normally 3 dB. (188) 2. For optical fiber applications, *see* optical fiber coupler. *See also* coupling, fiber optics, hybrid junction, waveguide.

**hybrid interface structure** In ISDN, an interface structure using both labeled and positioned channels. *See also* labeled channel, positioned channel.

**hybrid junction** A waveguide or transmission line arrangement having four ports that, when terminated in their characteristic impedance, have the property that energy entering any one port is transferred (usually equally) to two of the remaining three ports. (188) *Note:* Widely used as a mixing or dividing device. *See also* matched junction, waveguide.

**hybrid mode** A mode possessing components of both electrical and magnetic field vectors in the direction of propagation. (188) *Note:* In fiber



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optics, such modes correspond to skew (nonmeridional) rays. *See also* mode, skew ray.

**hybrid set** Two or more transformers interconnected to form a network having four pairs of accessible terminals to which may be connected four impedances so that the branches containing them may be made interchangeable. (188) *See also* bridge, four-wire terminating set, hybrid coll, line adapter circuit.

**hybrid system** *Synonym* hybrid communication network.

**Hz** *Abbreviation for hertz.*

**ICI** *Abbreviation for incoming call identification.*

**ICW** *Abbreviation for interrupted continuous wave.*



**Identification, friend or foe (IFF)** A system using electromagnetic transmissions to which equipment carried by friendly forces automatically responds, for example, by emitting pulses, thereby distinguishing themselves from enemy forces. (JCS1-DoD) (JCS1-NATO) *Note:* It is a method of determining the friendly or unfriendly character of aircraft and ships by other aircraft or ships and by ground forces using electronic detection equipment and associated identification friend or foe units. *See also* electronic warfare, recognition.

**Identification friend or foe personal identifier** The discrete identification friend or foe code assigned to a particular aircraft, ship, or other vehicle for identification by electronic means. (JCS1-DoD) *See also* recognition.

**IDF** *Abbreviation for Intermediate distribution frame.*

**Idle-channel noise** Noise that is present in a communication channel when no signals are applied. *Note:* The conditions and terminations must be stated for the value to be significant. (188) *See also* channel, noise.

**Idle character** A control character that is sent when there is no information to be sent. *See also* bit stuffing, character.

**Idle-line termination** An electrical network that is switch controlled to maintain a desired impedance at a trunk or line terminal when that terminal is in the idle state. (188) *See also* line, terminal impedance.

**Idle state** The telecommunication service condition that exists whenever user messages are not being transmitted but the service is immediately available for use. *See also* availability, on-hook.

**IDN** *Abbreviation for integrated digital network.*

**IDTV** *Abbreviation for improved-definition television.*

**IF** *Abbreviation for intermediate frequency.*

**I/F** *Abbreviation for interface.*

**IFF** *Abbreviation for Identification, friend or foe.*

**IFRB** *Abbreviation for International Frequency Registration Board.*

**IF repeater** *See* heterodyne repeater.

**IFS** *Abbreviation for ionospheric forward scatter. See* ionospheric scatter.

**ILD** *Abbreviation for Injection laser diode.*

**ILS** *Abbreviation for instrument landing system.*

**IM** *Abbreviation for intensity modulation, intermodulation.*

**image antenna** A hypothetical, mirror-image antenna considered to be located as far below ground as the actual antenna is above ground. (188) *See also* antenna, ground plane.

**image frequency** In heterodyning, an undesired input frequency that is capable of producing the same output frequency (intermediate frequency) that the desired input frequency produces. (188) *Note:* The term implies the mirror-like symmetry of signal and image frequencies about the beating-oscillator frequency or the intermediate frequency, whichever is higher.

**image rejection ratio** In heterodyning, the ratio (usually expressed in decibels) of the output (intermediate-frequency) signal level produced by the desired input frequency, to that produced by the image frequency. (188) *Note:* When the ratio is measured, the input signal levels of the desired and image frequencies are equal. *See also* circuit noise level, frequency, image frequency.

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**imagery** Collectively, the representations of objects reproduced electronically or by optical means on film, electronic display devices, or other media. (JCS1-DoD) (JCS1-NATO)

**IMD** *Abbreviation for intermodulation distortion.*

**immediate message** A category of precedence reserved for messages relating to situations that gravely affect the security of national/allied forces or populace and that require immediate delivery to the addressee(s). (JCS1-DoD) *See also precedence.*

**IMP** *Abbreviation for interface message processor.*

**impedance** The total passive opposition offered to the flow of electric current. It consists of a combination of resistance, inductive reactance, and capacitive reactance. (188) *Note:* Impedance is usually a function of frequency.

**impedance matching** The connection of an additional impedance to an existing one in order to improve performance or to accomplish a specific effect. (188) *See also antenna matching, balancing network, building out, iterative impedance, loading, L-pad.*

**improved-definition television (IDTV)** Television that includes improvements to the standard NTSC television system, which improvements remain within the general parameters of NTSC television emission standards. *Note 1:* These improvements may be made at the transmitter and/or receiver and may include enhancements in parameters such as encoding, digital filtering, scan interpolation, interlaced scan lines, and ghost cancellation. *Note 2:* Such improvements must permit the signal to be transmitted and received in the historical 4:3 aspect ratio. *Synonym [in CCITT usage] enhanced-quality television.*

**improvement threshold** *See FM improvement threshold.*

**impulse** A surge of electrical energy, usually of short duration, of a nonrepetitive nature. (188) *Synonym surge. See also pulse.*

**impulse excitation** The production of an oscillatory current in a circuit by impressing a voltage for a relatively short period compared with the duration of the current produced. (188) *Synonym shock excitation.*

**impulse noise** Noise consisting of random occurrences of energy spikes, having random amplitude and bandwidths, whose presence in a data channel can be a prime cause of errors. (188) *See also noise, random noise.*

**impulse response** The amplitude-vs.-time output of a transmission facility or device in response to an impulse. (188) *See also impulse, random noise.*

**IN** *Abbreviation for intelligent network.*

**in-band noise power ratio** For multichannel equipment, the ratio of the mean noise power measured in any channel, with all channels loaded with white noise, to the mean noise power measured in the same channel, with all channels but the measured channel loaded with white noise. (188) *See also noise, white noise.*

**in-band signaling** Signaling that uses frequencies or time slots within the bandwidth of the information channel. (188) *See also bandwidth, channel, channel-associated signaling, common-channel signaling, frequency, out-of-band signaling, signal, single-frequency signaling.*

**inclination of an orbit [of an Earth satellite]** The angle determined by the plane containing the orbit and the plane of the Earth's equator. (RR)

**inclined orbit** Any nonequatorial orbit of a satellite. (188) *Note:* Inclined orbits may be circular or elliptical and may be synchronous or nonsynchronous. *See also direct orbit, equatorial orbit, geostationary orbit, geosynchronous satellite, polar orbit, retrograde orbit, satellite, synchronous orbit.*

**inclusion** Extraneous or foreign material, e.g., hydroxyl ions and metallic ion impurities, present within an optical fiber.

**Incoherent** In optics, characterized by a degree of coherence significantly less than 0.88. *See also coherent, degree of coherence.*

**incoming call identification (ICI)** A switching system feature that allows an attendant to identify visually the type of service or trunk group associated with a call directed to the attendant's position. *See also calling-line identification facility, service feature.*

**incorrect block** A block successfully delivered to the intended destination user, but having one or more incorrect bits, additions, or deletions, in the delivered block. *See also block, block-error probability, block transfer failure, error.*

**Independent clocks** A communication network timing subsystem using precise free-running clocks at the nodes for synchronization purposes. *Note:* Variable storage buffers installed to accommodate variations in transmission delay between nodes are made large enough to accommodate small time (phase) departures among the nodal clocks that control transmission. Traffic is occasionally interrupted to reset the buffers.

**Independent-sideband (ISB) transmission** That method of double-sideband transmission in which the information carried by each sideband is different. (188) *Note:* The carrier may be suppressed. *See also carrier (cxr), double-sideband transmission, sideband transmission.*

**index dip** In an optical fiber, a decrease in the refractive index at the center of the core, caused by certain manufacturing techniques. *Sometimes employed as a synonym for profile dip. See also refractive index profile.*

**indexing** *See interaction crosstalk.*

**index-matching material** In fiber optics, a material (liquid, gel, or cement) whose refractive index is nearly equal to the fiber core index. (188) *Note:* It is used to reduce Fresnel reflections from a fiber end face. *See also Fresnel reflection, mechanical splice, refractive index [of a medium].*

**index of cooperation** In facsimile, the product of the total line length in millimeters times the lines per millimeter divided by  $\pi$ . *Note:* For rotating devices, the index of cooperation is the product of the drum diameter times the number of lines per unit length. *See also diametral index of cooperation, drum factor, facsimile.*

**index of refraction** *Synonym refractive index [of a medium].*

**index profile** In an optical fiber, the refractive index as a function of radial distance from the optical axis. (188) *See also fiber optics, refractive index [of a medium].*

**indirect control** In digital data transmission, the use of a clock at a higher standard modulation rate, e.g., 4, 8, 128 times the modulation rate, rather than twice the data modulation rate, as is done in *direct* control. (188) *See also clock, modulation.*

**individual line** A user line, from a switching center, that serves a single user. *See also leased circuit, loop (def. #2).*

**individual reception [in the broadcasting-satellite service]** The reception of emissions from a space station in the broadcasting-satellite service by simple domestic installations and in particular those possessing small antennae. (RR) *See also broadcasting-satellite service, space station.*

**inductive coupling** The transfer of energy from one circuit to another by virtue of the mutual inductance between the circuits. (188) *Note 1:* The coupling may be deliberate and desired (as in an antenna coupler) or may be undesired (as in power line inductive coupling into telephone lines). *Note 2:* Capacitive coupling favors transfer of higher frequency components, whereas inductive coupling favors transfer of lower frequency components. *See also capacitive coupling, conducted coupling.*

**Industrial, scientific, and medical (ISM) applications [of radio frequency energy]** Operation of equipment or appliances designed

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to generate, and use locally, radio-frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of telecommunications. (RR)

**industry standard** An industry-developed document that establishes voluntary specifications for products, practices, or operations.

**information** 1. The meaning that a human assigns to data by means of the known conventions used in their representation. (JCSI-DoD) (188) 2. Data that have been processed and formulated by automated or manual means to satisfy a knowledge requirement for use by a decision maker. 3. In intelligence usage, unprocessed data of every description which may be used in the production of intelligence. (JCSI-NATO) 4. In intelligence usage, unevaluated material of every description that may be used in the production of intelligence. (JCSI-DoD)

**information-bearer channel** 1. A channel provided for data transmission, that is capable of carrying all the necessary information to permit communication, including user's data, synchronizing sequences, control signals, etc. *Note:* It may, therefore, operate at a greater signaling rate than that required solely for the user data. 2. A basic communication channel made available by the circuit provider with no enhanced or value-added services included other than the bandwidth transmission capability. (188) *See also* channel, circuit, communications.

**information bit** *See* user information bit.

**information feedback** The sending of data back to a source, usually for the purpose of checking the accuracy of transmission of data, the received data being returned to the sending end for comparison with the original data. *See also* echo check, feedback, forward error correction.

**information field** In data transmission, a field assigned to contain user information. *Note:*

The contents of the information field are not interpreted at the link level. *See also* data transmission, Open Systems Interconnection--Reference Model, user information bit.

**information processing** *Synonym* data processing.

**information processing center (IPC)** A facility staffed and equipped for processing and distributing information. (188) *Note:* An IPC may be geographically distributed.

**information security** The protection of information against unauthorized disclosure, transfer, modification, or destruction, whether accidental or intentional. (188) *See also* communications security.

**information source** *Synonym* source user.

**information system** A system, whether automated or manual, that comprises people, machines, and/or methods organized to collect, process, transmit, and disseminate data that represent user information. (188)

**information systems security (INFOSEC)** A composite of the means of protecting telecommunication systems and automated information systems and the information they process. *See also* automated information systems security, communications security.

**information transfer** The process of moving messages containing user information from a source to a sink. (188) *Note:* The information transfer rate may or may not be equal to the transmission modulation rate. *See also* information-bearer channel, information-transfer transaction, isochronous burst transmission.

**information-transfer phase** In an information-transfer transaction, the phase during which user information blocks are transferred from the source user to a destination user. *See also* access phase, disengagement phase, information-transfer transaction, phase, successful disengagement.



**information-transfer transaction** A coordinated sequence of user and telecommunication system activities whose ultimate purpose is to cause user information present at a source user to become present at a destination user. *Note:* An information-transfer transaction is typically divided into three consecutive phases: the access phase, the information-transfer phase, and the disengagement phase. *See also* access phase, disconnect, disconnect signal, disengagement attempt, disengagement phase, information transfer, information-transfer phase.

**INFOSEC** *Acronym for information systems security.*

**Infrared (IR)** The region of the electromagnetic spectrum bounded by the long-wavelength extreme of the visible spectrum (about 0.7  $\mu\text{m}$ ) and the shortest microwaves (about 0.1 mm). *See also* frequency, light, microwave.

**Injection fiber** *Synonym launching fiber.*

**Injection laser diode (ILD)** A laser employing a forward-biased semiconductor junction as the active medium. *Note:* Stimulated emission of coherent light occurs at a pn junction where electrons and holes are driven into the junction. (188) *Synonyms* diode laser, laser diode, semiconductor laser. *See also* active laser medium, chirping, laser, superradiance.

**Ink vapor recording** That type of recording in which vaporized ink particles are deposited directly upon the record sheet. (188) *See also* facsimile.

**Input** 1. Pertaining to a point in a device, process, or channel, which point accepts data.  
2. An input state, or a sequence of states. (FP) *See also* input data.

**Input data** 1. Data being received or to be received by a device or a computer program. (FP) 2. Data to be processed. (FP)

**Input-output channel** [For a computer,] A device that handles the transfer of data

between internal memory and peripheral equipment. (FP) (ISO)

**Input-output controller (IOC)** A functional unit that controls one or more input-output channels. (FP) (ISO) *Synonym* I/O controller.

**Input/output (I/O) device** A device that introduces data into or extracts data from a system. (188) *See also* terminal.

**Input protection** For analog input channels, protection against overvoltages that may be applied between any two input connectors or between any input connector and ground. (FP) (ISO)

**Insertion gain** The gain resulting from the insertion of a device in a transmission line, expressed as the ratio of the power delivered to that part of the line following the device to the power delivered to that same part before insertion. If more than one component is involved in the input or output, the particular component used must be specified. (188) *Note 1:* If the resulting number is negative, an "insertion loss" is indicated. *Note 2:* This ratio is usually expressed in decibels. *See also* dB, gain.

**Insertion loss** 1. The loss resulting from the insertion of a device in a transmission line, expressed as the reciprocal of the ratio of the power delivered to that part of the line following the device to the power delivered to that same part before insertion. If more than one component is involved in the input or output, the particular component used must be specified. *Note 1:* If the resulting number is negative, "insertion gain" is indicated. *Note 2:* This ratio is usually expressed in decibels.  
2. In an optical fiber system, the total optical power loss caused by insertion of an optical component, such as a connector, splice, or coupler. *See also* dB, loss.

**Insertion-loss-vs.-frequency characteristic** The amplitude transfer function characteristic of a system or component as a function of frequency. (188) *Note:* The amplitude response may be stated as actual gain, loss,

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amplification, or attenuation, or as a ratio of any one of these quantities, at a particular frequency, with respect to that at a specified reference frequency. *Synonym* amplitude frequency response. *See also* amplitude distortion, frequency, transfer function [of a device].

**inside plant** 1. With respect to wire and cable, all fixed ground cable plant extending inward from the main distribution frame (MDF), e.g., central office equipment, teletypewriters, and including the protectors and associated hardware on the telephone central office MDF. (188) 2. With respect to radio and radar, all fixed ground communications-electronics (C-E) equipment that is permanently located inside buildings. (188) *See also* facility, on-premises wiring, outside plant.

**inside wire** *See* on-premises wiring.

**in-slot signaling** Signaling performed in the associated channel time slot. *See also* bit robbing, channel time slot, out-slot signaling, signaling, signaling time slot.

**inspection lot** A collection of units of product from which a sample is to be drawn and inspected to determine conformance with acceptability criteria. *Note:* The inspection lot may differ from a collection of units designated as a lot for other purposes, e.g., production, shipment, etc.

**instant** A point in time, not necessarily with reference to a time scale. *Note:* An instant has no duration. (188)

**instruction** In a programming language, an expression that specifies one operation and identifies its operands, if any. (FP) (ISO) *See also* operand, operation.

**instrument landing system (ILS)** 1. A radionavigation system that provides aircraft with horizontal and vertical guidance just before and during landing and, at certain fixed points, indicates the distance to the reference point of landing. (RR) 2. A system of radio navigation intended to assist aircraft in landing

which provides lateral and vertical guidance, which may include indications of distance from the optimum point of landing. (JCS1-DoD) (JCS1-NATO)

**instrument landing system glide path** A system of vertical guidance embodied in the instrument landing system which indicates the vertical deviation of the aircraft from its optimum path of descent. (RR)

**instrument landing system localizer** A system of horizontal guidance embodied in the instrument landing system which indicates the horizontal deviation of the aircraft from its optimum path of descent along the axis of the runway. (RR)

**integrated digital network (IDN)** A network employing both digital transmission and digital switching. *See also* Integrated Services Digital Network.

**integrated optical circuit (IOC)** A circuit, or group of interconnected circuits, consisting of miniature solid-state optical components on semiconductor or dielectric substrates. *Note:* Examples of components in an IOC are light-emitting diodes, optical filters, photo detectors (active and passive), and thin-film optical waveguides. *See also* hybrid (def. #1).

**Integrated Services Digital Network (ISDN)** An integrated digital network in which the same time-division switches and digital transmission paths are used to establish connections for different services. *Note 1:* Such services include telephone, data, electronic mail, and facsimile. *Note 2:* How a connection is accomplished is often specified. For example, switched connection, nonswitched connection, exchange connection, ISDN connection. *See also* communications, electronic mail, integrated digital network.

**integrated station** A terminal device in which a telephone and one or more other devices, such as a video display unit, keyboard, or printer, are integrated into one unit and used over a single circuit.

**integrated system** A telecommunication system that transfers analog and digital traffic over the same switched network. (188) *See also* communications system, hybrid communication network, network.

**integrated voice data terminal (IVDT)** *See* integrated station.

**integrity** *See* data integrity, system integrity.

**intelligent network (IN)** A network that allows functionality to be distributed flexibly at a variety of nodes on and off the network and allows the architecture to be modified to control the services; [in North America] an advanced network concept that is envisioned to offer such things as (a) distributed call-processing capabilities across multiple network modules, (b) real-time authorization code verification, (c) one-number services, and (d) flexible private network services [including (1) reconfiguration by subscriber, (2) traffic analyses, (3) service restrictions, (4) routing control, and (5) data on call histories]. Levels of IN development are identified below:

--IN/1 A proposed intelligent network targeted toward services that allow increased customer control and that can be provided by centralized switching vehicles serving a large customer base.

--IN/1+ A proposed intelligent network targeted toward services that can be provided by centralized switching vehicles, e.g., access tandems, serving a large customer base.

--IN/2 A proposed, advanced intelligent-network concept that extends the distributed IN/1 architecture to accommodate the concept called "*service independence*." *Note:* Traditionally, service logic has been localized at individual switching systems. The IN/2 architecture provides flexibility in the placement of service logic, requiring the use of advanced techniques to manage the distribution of both network data and service logic across multiple IN/2 modules.

**intelligent peripheral (IP)** 1. Functional components that may be used most efficiently when accessed locally. 2. An intelligent-network feature that provides specialized

telecommunication capabilities required by IN/2 service logic programs. *See also* intelligent network

**intelligible crosstalk** 1. Crosstalk giving rise to intelligible signals. (188) 2. Crosstalk from which information can be derived. *See also* crosstalk, far-end crosstalk, interference, near-end crosstalk, unintelligible crosstalk.

**intelligibility** The capability of being understood; it does not imply the recognition of a particular voice. (188) *See also* recognition, signal-to-noise ratio.

**intensity** The square of the electric field strength of an electromagnetic wave. *Note:* Intensity is proportional to irradiance and may be used in place of the term "*irradiance*" when only relative values are important. *See also* irradiance, radiant intensity, radiometry.

**intensity modulation (IM)** In optical communication, a form of modulation in which the optical power output of a source is varied in accordance with some characteristic of the modulating signal. (188) *Note:* In intensity modulation, there are no discrete upper and lower sidebands in the usually understood sense of these terms, because present optical sources lack sufficient coherence to produce them. The envelope of the modulated optical signal is an analog of the modulating signal in the sense that the instantaneous power of the envelope is an analog of the characteristic of interest in the modulating signal. Recovery of the modulating signal is by direct detection, not heterodyning. *See also* amplitude modulation, fiber optics, modulation.

**interaction crosstalk** Crosstalk caused by coupling between carrier and noncarrier circuits; the crosstalk may, in turn, be coupled to another carrier circuit (in which case it is called "*indexing*"). (188) *See also* coupling, crosstalk.

**interactive data transaction** A single (one-way) message, transmitted via a data channel, to which a reply is required in order for work to proceed logically. *See also* data transmission.

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**Interactive service** In ISDN, a telecommunication service that provides for the bidirectional exchange of information between users or between users and hosts. *Note:* Interactive services are classified as the following types: conversational services, messaging services, and retrieval services. *See also* duplex operation.

**Interblock gap** An area on a data medium used to indicate the end of a block or physical record, e.g., a space between blocks on magnetic tape. (188) *See also* band, block, magnetic tape.

**Intercept** 1. To stop a telephone call directed to an improper, disconnected, or restricted telephone number, and to redirect that call to an operator or a recording. (188) 2. To gain possession of communications intended for others without their consent, and, ordinarily, without delaying or preventing the transmission. (188) *Note:* This may be an authorized or unauthorized action. 3. The acquisition of a transmitted signal with the intent of delaying or eliminating receipt of that signal by the intended destination user. (188) *See also* electronics intelligence, electronic warfare, monitoring (def. #2).

**Intercept tape storage** In AUTODIN, a method of providing temporary storage for message traffic destined for nonoperating or backlogged channels. (188) *See also* Automatic Digital Network.

**Interchangeability** A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves or of adjoining items, except for adjustment, and without selection for fit and performance. (JCS1-DoD) (JCS1-NATO) *See also* commonality, compatibility, interoperability.

**Interchangeable connectors** Connectors that share common installation geometry and have the same transmission performance. (188)

**Interchange circuit** A circuit between a DTE and a DCE for the purpose of exchanging data and signaling information. *Note:* Control signals, timing signals, common return functions, or other service features may be included in an interchange circuit. *See also* circuit, data circuit-terminating equipment, data terminal equipment.

**Intercharacter interval** In asynchronous transmission, that time period between the end of the stop signal of one character and the beginning of the start signal of the following character. (188) *Note:* This interval may be of any length. The signal sense of the intercharacter interval is always the same as the sense of the stop element, i.e., "1" or "mark." *See also* asynchronous transmission, character, character interval.

**intercom** 1. A telephone apparatus by means of which personnel can talk to each other within an aircraft, tank, ship, or activity. (JCS1-DoD) 2. A dedicated service within a specified user environment. (188)

**Interconnect facility** In communication systems, one or more communication links used to provide local area communication service between or among several locations which, taken as a whole, form a node in the network. (188) *Note 1:* The facility may include network control and administrative circuits as well as the primary traffic circuits. *Note 2:* The facility may use any desired medium available and may be redundant if required. *See also* facility, interconnection, link, local area network, network.

**interconnection** The linking together of interoperable systems. (JCS1-DoD) *See also* Interconnect facility, link (def. #2, 3, 4).

**Interexchange carrier (IXC)** Any service provider offering inter-LATA telecommunications services. *See also* local access and transport area.

**interface (I/F)** 1. A concept involving the definition of the interconnection between two equipment items or systems. The definition

includes the type, quantity, and function of the interconnecting circuits and the type, form, and content of signals to be interchanged via those circuits. Mechanical details of plugs, sockets, and pin numbers, etc., may be included within the context of the definition. (188) 2. A shared boundary, e.g., the boundary between two subsystems or two devices. (188) 3. A boundary or point common to two or more similar or dissimilar command and control systems, subsystems, or other entities against which or at which necessary information flow takes place. (JCSI-DoD) 4. A boundary or point common to two or more systems or other entities across which useful information flow takes place. (It is implied that useful information flow requires the definition of the interconnection of the systems which enables them to interoperate.) (188) 5. The process of interrelating two or more dissimilar circuits or systems. 6. The point of interconnection between user terminal equipment and commercial communication-service facilities.

**interface functionality** [In telephony,] The characteristic of interfaces that allows them to support transmission, switching, and signaling functions identical to those used in the enhanced services provided by the carrier. *Note:* As part of its comparably efficient interconnection (CEI) offering, the carrier must make available standardized hardware and software interfaces that are able to support transmission, switching, and signaling functions identical to those used in the enhanced services provided by the carrier.

**interface message processor (IMP)** A processor-controlled switch used in packet-switched networks to route packets to their proper destination. *See also* Interface, node, packet switching, switch.

**interface payload** In ISDN, that part of the bit stream through a framed interface used for telecommunication services and signaling. *See also* framed interface, payload.

**interface standard** Specifications of the functional, electrical, and physical characteristics necessary to allow the exchange

of information across an interface between different C<sup>3</sup> [Command, Control, and Communications] systems and information systems or equipment.

**interference** 1. In a signal transmission system, extraneous energy from natural or man-made sources that interferes with reception of desired signals. (188) *Note:* Interference is distinguished from noise by its usually narrower spectrum and singular (or limited number of) source(s), whereas noise is incoherent and generally wideband. 2. The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy. (RR) (188) *See also* accepted interference, blanketing, coordination area, electromagnetic interference, interference filter, permissible interference. 3. In optics, the interaction of two or more beams of coherent or partially coherent light. (188)

**interference emission** Emission that results in an electrical signal being propagated into and interfering with the proper operation of electrical or electronic equipment. *Note:* The frequency range of such interference may be taken to include the entire electromagnetic spectrum. (188) *See also* electromagnetic interference, electromagnetic interference control, interference.

**interference filter** An optical filter consisting of one or more thin layers of (usually) dielectric or metallic material, and selectively transmitting some wavelengths while reflecting others. *Note:* Such a filter is wavelength sensitive because of the interference effects that take place between the incident and reflected waves at the thin-film boundaries. *See also* dichroic filter, interference, optical filter.

**interferometer** An instrument that employs the principle of interference of electromagnetic



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waves for purposes of measurement. *See also* interference.

**interframe time fill** In data transmission, a sequence of bits transmitted between frames. *See also* frame, packet format.

**inter-LATA** Between local access and transport areas (LATAs). *See also* local access and transport area.

**interleaving** 1. The transmission of pulses from two or more digital sources in time-division sequence over a single path. (188) *See also* digital multiplexer, time-division multiplexing. 2. A data-communication technique, used in conjunction with error-correcting codes, to reduce the number of undetected error bursts. *Note:* In the interleaving process, code symbols are reordered before transmission in such a manner that any two successive code symbols are separated by I-1 symbols in the transmitted sequence, where I is called the degree of interleaving. Upon reception, the interleaved code symbols are reordered into their original sequence, thus effectively spreading or randomizing the errors (in time) to enable more complete correction by a random error-correcting code. (188) *See also* error control.

**intermediate distribution frame (IDF)** In a local central telephone or communications office, a frame whose primary purpose is to cross-connect the user line cable to the user line circuit. In a private exchange, the IDF is for similar purposes. (188) *Note:* Also used as a distribution point for multipair cables from the MDF or CDF to individual cables for equipment in areas remote from the frames. *See also* circuit, combined distribution frame, distribution frame, main distribution frame.

**intermediate field** *Synonym* intermediate-field region.

**intermediate-field region** The transition region, lying between the near-field region and the far-field region, in which the electric field strength of an electromagnetic wave developed by a transmitting antenna is significantly dependent upon the inverse distance, inverse

square of the distance, and the inverse cube of the distance from the antenna. (188) *Note:* The intermediate-field region is considered as any distance between 0.1 and 1.0 of the wavelength, for an antenna equivalent length that is small compared to this distance. *Synonyms* intermediate field, intermediate zone. *See also* electromagnetic radiation, far-field radiation pattern, far-field region, near-field region.

**intermediate frequency (IF)** A frequency to which a signal is shifted as an intermediate step in transmission or reception. (188)

**intermediate system** A system providing an OSI-RM Network Layer relay function (that is, a system that receives data from one correspondent Network entity and forwards it to another corresponding Network entity). *See also* Open Systems Interconnection--Reference Model.

**intermediate zone** *Synonym* intermediate-field region.

**intermodal dispersion** *Incorrect synonym for multimode distortion. See also* modal dispersion.

**intermodal distortion** *Synonym* multimode distortion.

**intermodulation (IM)** The production, in a nonlinear element of a system, of frequencies corresponding to the sum and difference frequencies of the fundamentals and integral multiples (harmonics) of the component frequencies that are transmitted through the element. (188) *See also* frequency, heterodyne, modulation.

**intermodulation distortion (IMD)** Nonlinear distortion characterized by the appearance of frequencies in the output, equal to the sum and difference frequencies of integral multiples (harmonics) of the component frequencies present in the input. (188) *Note:* Harmonic components also present in the output are usually not included as part of the intermodulation distortion. When harmonics

are included, a statement to that effect should be made. *See also* composite two-tone test signal, distortion, frequency, heterodyne.

**intermodulation noise** In a transmission path or device, that noise contingent upon modulation and demodulation and resulting from any nonlinear characteristics in the path or device. (188) *See also* noise.

**internal bias** That bias, either marking or spacing, that may occur within a start-stop teletypewriter receiving mechanism and that will have the same effect on the margin of operation as bias external to the receiver. (188) *See also* bias, bias distortion.

**internal memory** *Synonym* internal storage.

**internal storage** Storage that is accessible by a processor without the use of input-output channels. *Note:* It includes main storage, and may include other kinds of storage, such as cache memory and special registers, that can be accessed by the processor. (FP) (ISO) *Synonym* internal memory.

**International Atomic Time (TAI)** The time scale established by the International Time Bureau (BIH) on the basis of atomic clock data supplied by cooperating institutions. It differs from Coordinated Universal Time (UTC) by an integral number of seconds. (188) *See also* Coordinated Universal Time.

**International Index of cooperation** *Synonym* diametral index of cooperation.

**International Frequency Registration Board (IFRB)** A permanent organization of the International Telecommunication Union (ITU) that implements frequency assignment policy and maintains the Master International Frequency Register (MIFR).

**International Radio Consultative Committee (CCIR)** An organization of the ITU responsible for studying technical questions specifically related to radio communications.

**International System of Units (SI)** *See* metric system.

**International Telecommunication Union (ITU)** A civil international organization established to promote standardized telecommunication on a worldwide basis. (188) *Note:* The CCIR and CCITT are committees under the ITU. The ITU headquarters is located in Geneva, Switzerland. While older than the United Nations, it is recognized by the U.N. as the specialized agency for telecommunications.

**International Telegraph and Telephone Consultative Committee (CCITT)** An organization of the ITU whose function is to study technical, operating, and tariff questions relating to data, telegraphy, and telephony, and to issue Recommendations on these subjects.

**International Time Bureau (BIH)** *See* International Atomic Time.

**internet protocol (IP)** A DoD standard protocol designed for use in interconnected systems of packet-switched computer communication networks. *Note:* The internet protocol provides for transmitting blocks of data called datagrams from sources to destinations, where sources and destinations are hosts identified by fixed-length addresses. The internet protocol also provides for fragmentation and reassembly of long datagrams, if necessary, for transmission through small-packet networks. *See also* block, communications, protocol.

**internetwork connection** *See* gateway.

**internetworking** The process of interconnection of a number of individual networks to provide a path from one network to another network. *Note:* The networks involved may be of the same type, or they may be of different types; the important thing is that each network is distinct, with its own addresses, internal protocols, access methods, and administration. *See also* bridge, communications, gateway.

**Interoffice trunk** A direct trunk between central offices.

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**Interoperability** 1. The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together. (JCS1-DoD) (JCS1-NATO) 2. The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases. (JCS1-DoD) (188) 3. The ability to exchange data in a prescribed manner and the processing of such data to extract intelligible information which can be used to control/coordinate operations. (JCS Pub. 12, Vol. I, Change I, *Information Exchange Planning Guidance* [FOUO], May 1979) *See also* commonality, compatibility, interchangeability, mobile service, mobile station, portability, transportability.

**Interoperability standard** A document that establishes engineering and technical requirements that are necessary to be employed in the design of systems, units, or forces and to use the services so exchanged to enable them to operate effectively together.

**Interoperation** The use of interoperable systems, units, or forces. (JCS1-DoD)

**Interposition trunk** 1. A connection between two positions of a large switchboard so that a line on one position can be connected to a line on another position. 2. Connections terminated at test positions for testing and patching between testboards and patch bays within a technical control facility. (188) *See also* patch bay, tie trunk, trunk.

**Interpret** To translate and to execute each source language statement of a computer program before translating and executing the next statement. (FP) (ISO)

**Interrogation** 1. The process whereby a signal or combination of signals is intended to trigger a response. 2. The process whereby a station or device requests another station or device to

identify itself or to give its status. (188) *See also* master station.

**Interrupt** A suspension of a process, such as the execution of a computer program, caused by an event external to that process, and performed in such a way that the process can be resumed. (FP) (ISO) *Synonym* interruption.

**Interrupted continuous wave (ICW)** A modulation technique in which there is on-off keying of a continuous wave. (188) *See also* continuous wave, modulation.

**Interrupted isochronous transmission** *Synonym* isochronous burst transmission.

**Interruption** *Synonym* interrupt.

**Inter-satellite service** A radiocommunication service providing links between artificial Earth satellites. (RR)

**Interswitch trunk** A trunk between switching nodes. (188) *See also* trunk.

**Intersymbol interference** 1. Extraneous energy from the signal in one or more keying intervals that interferes with the reception of the signal in another keying interval, or the disturbance that results therefrom. (188) 2. In a digital transmission system, distortion of the received signal, which distortion results in the spreading and consequent overlap of individual pulses to the degree that the receiver cannot distinguish reliably between changes of state, thus compromising the integrity of the received data. *Note 1:* Intersymbol interference attributable to the statistical nature of quantum mechanisms represents the fundamental limit to receiver sensitivity. *Note 2:* Eye-pattern measurement is one method of analyzing intersymbol interference. *See also* attenuation-limited operation, bit error ratio, distortion, distortion-limited operation, eye pattern.

**Intertoll trunk** A channel between two toll offices.

**Intra-LATA** Within the boundaries of a local access and transport area (LATA). *See also* local access and transport area.

**Intramodal distortion** In an optical fiber, the distortion resulting from dispersion of group velocity of a propagating mode. *Note:* It is the only form of multimode distortion occurring in single-mode fibers. (188) *See also* dispersion, distortion, multimode distortion.

**Intraoffice trunk** Trunk connection within the same switching center. *See also* trunk.

**Intrinsic joint loss** That loss in optical power transmission, intrinsic to the optical fiber, caused by fiber parameters, e.g., dimensions, profile parameter, mode field diameter, mismatches when two nonidentical fibers are joined. *See also* extrinsic joint loss.

**Intrinsic noise** In a transmission path or device, that noise inherent to the path or device and not contingent upon modulation. (188) *See also* noise.

**Intrinsic quality factor (IQF)** A measure of the quality of a multimode fiber with regard to intrinsic splice loss. *Note:* The IQF can be used as an alternative to specifying requirements of core diameter, numerical aperture, concentricity error, and core noncircularity by requiring fibers to meet an average intrinsic splice loss. The IQF approach allows simultaneous parameter deviations to compensate for one another in terms of measured intrinsic splice loss.

**Inverted position** In frequency-division multiplexing, a position of a translated channel in which an increasing signal frequency in the untranslated channel causes a decreasing signal frequency in the translated channel. (188) *See also* down-converter, erect position, frequency-division multiplexing, frequency translation, up-converter.

**Inverter** 1. In electrical engineering, a device for converting direct current into alternating current. (JCS1-DoD) (JCS1-NATO) (188) 2. In computers, a device or circuit that inverts the

polarity of a signal or pulse. *Deprecated synonym* negation circuit.

**Inward Wide-Area Telephone Service (INWATS)** A service that allows users to receive calls from within specified rate areas without a charge to the calling party. *Synonym* Eight-hundred (800) service. *See also* call.

**INWATS** *Acronym for* Inward Wide-Area Telephone Service.

**I/O** *Abbreviation for* input/output.

**I/O controller** *Synonym* input-output controller.

**IOC** *Abbreviation for* input-output controller, integrated optical circuit.

**ion exchange technique** A method of fabricating a graded-index optical fiber by an ion exchange process. *See also* chemical vapor deposition technique, double crucible method, graded-index profile.

**ionosphere** 1. That part of the atmosphere in which reflection and/or refraction of electromagnetic waves occurs. (188) 2. That part of the atmosphere, extending from about 70 to 500 kilometers, in which ions and free electrons exist in sufficient quantities to reflect electromagnetic waves. (JCS1-DoD) *See also* D region, E region, F region.

**ionospheric absorption** Absorption occurring as a result of interaction between an electromagnetic wave and gas molecules in the ionosphere. (188) *See also* absorption, ionosphere.

**ionospheric disturbance** An increase in the ionization of the D region of the ionosphere, caused by solar activity, which results in greatly increased radio wave absorption. (188) *See also* ionosphere, sudden ionospheric disturbance.

**ionospheric forward scatter (IFS)** *Synonym* ionospheric scatter.

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**Ionospheric scatter** The propagation of radio waves by scattering as a result of irregularities or discontinuities in the ionization of the ionosphere. (RR) (188) *Synonyms* forward propagation ionospheric forward scatter, ionospheric scatter. *See also* backscattering, ionosphere, propagation, radiation scattering, scatter, tropospheric scatter.

**IP** *Abbreviation for intelligent peripheral, internet protocol.*

**IPC** *Abbreviation for information processing center.*

**IQF** *Abbreviation for intrinsic quality factor.*

**IR** *Abbreviation for infrared.*

**Irradiance** Radiant power incident per unit area upon a surface, usually expressed in watts per square meter. (188) *Colloquial synonym* power density. *See also* radiometry.

**ISB** *Abbreviation for independent sideband. See independent-sideband transmission.*

**ISDN** *Abbreviation for Integrated Services Digital Network.*

**ISM** *Abbreviation for industrial, scientific, and medical applications [of radio frequency energy].*

**isochronous** 1. That characteristic of a periodic signal in which the time interval separating any two corresponding transitions is equal to the unit interval or to a multiple of the unit interval. (188) 2. Pertaining to data transmission in which corresponding significant instants of two or more sequential signals have a constant phase relationship. *Note:* "Isochronous" and "anisochronous" are characteristics, while "synchronous" and "asynchronous" are relationships. *See also* anisochronous, asynchronous transmission, heterochronous, homochronous, isochronous burst transmission, isochronous distortion, isochronous modulation, isochronous signal, mesochronous, plesiochronous.

**isochronous burst transmission** A transmission process that may be used where the information-bearer channel rate is higher than the input data signaling rate. *Note 1:* The binary digits are transferred at the information-bearer channel rate, and the transfer is interrupted at intervals in order to produce the required average data signaling rate. *Note 2:* The interruption is always for an integral number of digit periods. (188) *Note 3:* The isochronous burst condition has particular application where envelopes are being transmitted and received by the data circuit-terminating equipment, but only the bytes contained within the envelopes are being transferred between data circuit-terminating equipment and the data terminal equipment. *Synonyms* burst isochronous (*deprecated*), interrupted isochronous transmission. *See also* information transfer, isochronous.

**isochronous distortion** The difference between the measured modulation rate and the theoretical modulation rate in a digital system. (188) *See also* degree of isochronous distortion, distortion, isochronous.

**isochronous modulation** Modulation (or demodulation) in which the time interval separating any two significant instants is theoretically equal to the unit interval or to a multiple of the unit interval. (188) *See also* isochronous, modulation, plesiochronous.

**isochronous signal** A signal in which the time interval separating any two significant instants is theoretically equal to the unit interval or to a multiple of the unit interval. (188) *Note 1:* In practice, variations in the time intervals are constrained within specified limits since there is no way of generating a constant unit interval of time. *Note 2:* "Isochronous" is a characteristic, while "synchronous" is a relationship. *See also* isochronous.

**isolator** In optical fiber systems, a device intended to prevent return reflections along a transmission path. *Note:* The Faraday isolator uses the magneto-optic effect.



**Isotropic** 1. Pertaining to a material whose properties, such as density, conductivity, permittivity, permeability, or composition, do not vary with distance or direction. 2. In communications-electronics work, describing a material whose electrical or optical properties are independent of direction of propagation and of polarization of a traveling wave. (188)  
*See also* anisotropic, birefringence.

**Isotropic antenna** A hypothetical antenna that radiates or receives equally in all directions. (188) *Note:* Isotropic antennas do not exist physically but represent convenient reference antennas for expressing directional properties of physical antennas. *See also* antenna.

**Isotropic gain** *Synonym* absolute gain (def. #1).

**Iterative impedance** At a pair of terminals of a four-terminal network, the impedance that will terminate the other pair of terminals in such a manner that the impedance measured at the first pair is equal to this terminating impedance. (188) *Note:* The iterative impedance of a uniform line is the same as its characteristic impedance. *See also* characteristic impedance, impedance, impedance matching.

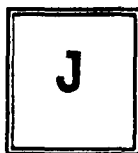
**ITU** *Abbreviation for International Telecommunication Union.*

**IVDT** *Abbreviation for integrated voice data terminal. See Integrated station.*

**IXC** *Abbreviation for interexchange carrier.*

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**jabber** In local area networks, transmission by a data station beyond the time interval allowed by the protocol. (FP) (ISO)



**jamming** See electronic countermeasures, electronic jamming, electronic warfare, interference, susceptibility.

**jam signal** A signal that carries a bit pattern sent by a data station to inform the other stations that they must not transmit. *Note 1:* In CSMA/CD networks, the jam signal indicates that a collision has occurred; in CSMA/CA networks, the signal indicates that the sending station intends to transmit. (FP) (ISO) *Note 2:* Not to be confused with "electronic jamming." See also carrier-sense multiple access with collision avoidance.

**jitter** Abrupt and spurious variations in a signal, such as in interval duration, in amplitude of successive cycles, or in the frequency or phase of successive pulses. (188) *Note 1:* When used qualitatively, the term must be identified as being time-, amplitude-, frequency-, or phase-related, and the form must be specified, e.g., pulse-delay-time jitter, pulse-duration jitter. When used quantitatively, a measure of the time- or amplitude-related variation must be included, e.g., average, rms, peak-to-peak. *Note 2:* The low-frequency cutoff for jitter is below 1 Hz. See also fall time, phase jitter, phase perturbation, swim, time jitter, wander.

**job** A unit of work that is defined by a user and that is to be accomplished by a computer. *Note:* This term is sometimes used to refer to a representation of a job; the representation may include a set of computer programs, files, and control statements to the operating system.

**job-recovery control file** *Synonym* backup file.

**Johnson noise** *Synonym* thermal noise.

**joint** For optical fibers, a splice or connector.

**joint multichannel trunking and switching system** That composite multichannel trunking and switching system formed from assets of the

Services, the Defense Communications System, other available systems, and/or assets controlled by the Joint Chiefs of Staff to provide an operationally responsive, survivable communication system, preferably in a mobile/transportable/recoverable configuration, for the joint force commander in an area of operations. (JCS1-DoD)

**Joint Tactical Information Distribution System (JTIDS)** An advanced information distribution system that provides secure integrated communication, navigation, and identification (ICNI) capability for application to military tactical operations.

**Joint Telecommunications Resources Board (JTRB)** The body required to be established by Section 2(b) (3) of Executive Order No. 12472 to assist the Director of the Office of Science and Technology Policy in the exercise of assigned nonwartime emergency telecommunications functions.

**journal** 1. A chronological record of data processing operations that may be used to reconstruct a previous or an updated version of a file. (FP) (ISO) *Synonym* log. 2. In database management systems, the record of all stored data items whose values are changed as a result of processing and manipulation of the data. (FP)

**joy stick** In computer graphics, a lever with at least two degrees of freedom that is used as an input unit, normally as a locator. (FP) (ISO)

**JTIDS** *Acronym for Joint Tactical Information Distribution System.*

**JTRB** *Abbreviation for Joint Telecommunications Resources Board.*

**Julian date** 1. The sequential day count, reckoned consecutively from the epoch beginning January 1, 4713 B.C. The Julian date on January 1, 1990, was 2,446,892. (188) 2. The true meaning of Julian date has been corrupted in modern times to refer also to an annual day numbering system in which days of the year are numbered in sequence, i.e., the

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first day of the year is 001, the second 002, the last day of the year is 365 (366 in leap years). (188) *Note:* To avoid ambiguity, "*day of year*" rather than "*Julian date*" should be used for this purpose. *See also* Coordinated Universal Time.

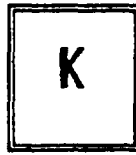
**jumper** *Synonym* cross-connection.

**junction point** *Synonym* node (def. #1).

**justification** *See* bit stuffing, de-stuffing, justify.

**justify** 1. To shift the contents of a register or a field so that the significant character at the specified end of the data is at a particular position. (FP) (ISO) 2. To align text horizontally or vertically so that the first and last characters of every line or the first and last line of the text are aligned with their corresponding margins. The last line of a paragraph is often not justified. (FP) (ISO)

**k** Abbreviation for kilo (SI prefix for  $10^3$ ). See metric system.



**K** 1. Abbreviation for kelvin(s). See Kelvin temperature scale.

2. When referring to data storage capacity,  $2^{10}$ , or 1024 in decimal notation.

**Kalman filter** A computational algorithm that processes measurements to deduce an optimum estimate of the past, present, or future state of a linear system by using a time sequence of measurements of the system behavior, plus a statistical model that characterizes the system and measurement errors, plus initial condition information. See also digital filter.

**KDC** Abbreviation for key distribution center.

**Kelvin (K) temperature scale** In the International System of Units (SI), the kelvin (K) is defined as the fraction  $1/273.16$  of the thermodynamic temperature of the triple point of water. *Note 1:* The temperature 0 K is called "absolute zero" (equivalent to  $-273.16^{\circ}\text{C}$  or  $-459.69^{\circ}\text{F}$ ). The degree Celsius is now defined as "an interval of one kelvin," rather than "one degree Kelvin." *Note 2:* Formerly called "absolute temperature scale." See also metric system.

**Kendall effect** A spurious pattern or other distortion in a facsimile record caused by unwanted modulation products arising from the transmission of a carrier signal, and appearing in the form of a rectified baseband that interferes with the lower sideband of the carrier. (188) *Note:* This occurs principally when the single-sideband width is greater than half the facsimile carrier frequency. See also facsimile.

**Kennelly-Heaviside layer** *Synonym* E region.

**kernel** A module of a program that forms a logical entity or performs a unit function. *Note:* The most vulnerable portion of code in a secure operating system is a special case of a kernel.

**key** Information (usually a sequence of random binary digits) used initially to set up and periodically to change the operations performed in a crypto-equipment for the purpose of encrypting or decrypting electronic signals, for determining electronic counter-countermeasures patterns (frequency hopping or spread spectrum) or for producing other keys. *Note:* "Key" has replaced the terms "variable," "key(ing) variable," and "cryptovariable."

**keyboard** An input device used to enter data by manual depression of keys, which causes the generation of the selected code element. (188)

**keyboard punch** *Synonym* keypunch.

**key distribution center (KDC)** A COMSEC facility that generates and distributes key in electrical form. (188) See also cryptology (def. #2).

**keying** The generating of signals by the interruption or modulation of a steady signal or carrier. (188)

**keying variable** *Deprecated synonym* for key.

**key management** The process by which key is generated, stored, protected, transferred, loaded, used, and destroyed.

**key pulsing** A system of sending telephone calling signals in which the digits are transmitted by operation of a pushbutton key set. (188) *Note:* The type of key pulsing commonly used by users and PBX operators is dual-tone multifrequency signaling. Each pushbutton causes generation of a unique pair of tones. In military systems, pushbuttons are also provided for additional signals, such as precedence. See also dual-tone multifrequency signaling, pulse, pulsing.

**keypunch** A keyboard-actuated punch that punches holes in a data medium. (FP) (ISO) *Synonym* keyboard punch.



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**key set** A multiline or multifunction user terminal device. (188) *See also* **key telephone system, PBX.**

**key telephone system (KTS)** Terminals and equipment in a local environment providing immediate access from all terminals to a variety of telephone services without attendant assistance. (188) *Note:* It may or may not interface with the public switched telephone network. *See also* **key set, PBX.**

**key variable** *Deprecated synonym for key.*

**k-factor** 1. In tropospheric radio propagation, the ratio between the effective and the actual Earth radius. (188) *Note:* For approximate calculations,  $k = 4/3$ . 2. In ionospheric radio propagation, a correction factor applied in calculations involving a curved layer; it is a function of distance and the real height of reflection. *See also* **effective Earth radius, Fresnel region, Fresnel zone, horizon angle, path clearance, path profile, path survey, propagation path obstruction.**

**knife-edge effect** In telecommunications, the transmission of radio signals into the line-of-sight shadow region caused by diffraction over an obstacle, e.g., a sharply defined mountain top. (188) *See also* **diffraction.**

**KTS** *Abbreviation for key telephone system.*

**K-type patch bay** A patching facility designed for patching and monitoring of balanced digital data circuits at rates up to 1 Mbps. (188) *See also* **digital primary patch bay, D-type patch bay, facility, patch bay.**

**label** 1. An identifier within or attached to a set of data elements. (FP) (ISO) 2. In communications, information within a message used to identify specific matters, such as the particular circuit to which the message is related. 3. In programming languages, an identifier that names a statement. (FP) 4. A data element that represents the sensitivity of the information. *Note:* For classified information, the label consists of the security level and the categories associated with the information.



**labeled channel** In ISDN, a time-ordered set of all block payloads with the same label. *See also* hybrid interface structure.

**labeled interface structure** In ISDN, an interface structure providing telecommunications services and signaling by means of labeled channels. *See also* interface, labeled channel, signaling.

**labeled multiplexing** In ISDN, multiplexing by concatenation of the blocks of the different labeled channels.

**labeled statistical channel** In ISDN, a labeled channel in which the block payloads or the duration of each successive block is random. *See also* block, labeled channel, payload.

**Lambertian radiator** *See* Lambert's cosine law.

**Lambertian reflector** *See* Lambert's cosine law.

**Lambertian source** An emitter that radiates according to Lambert's cosine law. *See also* Lambert's cosine law.

**Lambert's cosine law** The statement that the radiance of certain idealized surfaces--known as "Lambertian radiators," "Lambertian sources," or "Lambertian reflectors,"--is dependent upon the angle from which the surface is viewed, given by  $N = N_0 \cos A$ , where  $N$  is the radiant intensity,  $N_0$  is the radiance normal (perpendicular) to an emitting surface, and  $A$  is the angle between the

viewing direction and the normal to the surface. (188) *Note:* The radiant intensity of such a surface is maximum normal to the surface and decreases in proportion to the cosine of the angle from the normal. *Synonyms* cosine emission law, Lambert's emission law.

**Lambert's emission law** *Synonym* Lambert's cosine law.

**LAN** *Acronym for* local area network.

**land mobile-satellite service** A mobile-satellite service in which mobile Earth stations are located on land. (RR) *See also* Earth station.

**land mobile service** A mobile service between base stations and land mobile stations, or between land mobile stations. (RR)

**land mobile station** A mobile station in the land mobile service capable of surface movement within the geographical limits of a country or continent. (RR)

**landscape mode** 1. In facsimile, the mode for scanning lines across the longer dimension of a rectangular original. 2. In computer graphics, the orientation of a page in which the longer dimension is horizontal. *See also* portrait mode.

**land station** A station in the mobile service not intended to be used while in motion. (RR)

**language** A set of characters, conventions, and rules that is used for conveying information. (FP) (ISO) (188) *See also* alphabet.

**language processor** A program that performs such functions as translating, interpreting, and other tasks required for processing a specified programming language, for example, a FORTRAN processor, a COBOL processor. (FP) (ISO)

**LAP-B** The Data Link Layer protocol as specified by CCITT Recommendation X.25 (1989). *See also* high-level data link control.

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**laser** *Acronym for light amplification by stimulated emission of radiation.* A device that produces an intense, coherent, directional beam of optical radiation by stimulating electronic, ionic, or molecular transitions to higher energy levels so that when they return to lower energy levels they emit energy. *Note:* Laser radiation may be highly coherent temporally, or spatially, or both. (188) *See also* active laser medium, injection laser diode, optical cavity.

**laser chirp** The shift of the laser central wavelength during single pulse durations due to laser instability. *See also* chirping.

**laser diode** *Synonym* injection laser diode.

**laser intelligence (LASINT)** Technical and intelligence information derived from laser systems; a subcategory of electro-optical intelligence. (JCS1-DoD)

**laser medium** *Synonym* active laser medium.

**lasing threshold** The lowest excitation level at which a laser's output is dominated by stimulated emission rather than spontaneous emission. *See also* spontaneous emission, stimulated emission.

**LASINT** *Acronym for laser intelligence.*

**last-in, first-out (LIFO)** A queueing discipline in which arriving entities leave in the reverse order from which they arrived. *Note:* Service is offered to the entity that has been in the file the least time. *Synonyms* cellar, push-down file, spike file.

**LATA** *Acronym for local access and transport area.*

**lateral offset loss** In fiber optics, a power loss caused by transverse or lateral deviation from optimum alignment of source to optical fiber, fiber to fiber, or fiber to detector. (188) *Synonym* transverse offset loss.

**launch angle** 1. For an optical fiber or fiber bundle, the angle between the input radiation

vector, i.e., the chief input ray, and the axis of the fiber or fiber bundle. (188) *Note:* If the ends of the fibers are perpendicular to the axis of the fibers, the launch angle is equal to the incidence angle when the ray is external and the refraction angle when initially inside the fiber. 2. The beam divergence from any emitting surface, such as an LED laser, lens, prism, or optical fiber end. 3. The angle with the normal at which a light beam emerges from a surface. *See also* acceptance angle, angle of deviation, launch numerical aperture, optical fiber.

**launching fiber** A fiber used in conjunction with a source to excite the modes of another fiber in a particular fashion. *Note:* Launching fibers are most often used in test systems to improve the precision of measurements. *Synonym* injection fiber. *See also* mode, pigtail.

**launch numerical aperture (LNA)** The numerical aperture of an optical system used to couple (launch) power into an optical fiber. (188) *Note 1:* LNA may differ from the stated NA of a final focusing element if, for example, that element is underfilled or the focus is other than that for which the element is specified. *Note 2:* LNA is one of the parameters that determine the initial distribution of power among the modes of an optical fiber. *See also* acceptance angle, launch angle, numerical aperture.

**layer** 1. In radio-wave propagation, a stratum in the ionosphere in which the variation of free electron density with height attains a maximum value or has some other specified characteristic. *See also* ionosphere. 2. One of the units into which a telecommunication network architecture may be partitioned. *See also* Open Systems Interconnection--Reference Model.

**lay length** In helically wound (spun) cables, the longitudinal distance traversed by a cable component, e.g., a single wire or fiber buffer tube, in completing one revolution about the cable axis.

**LBO** *Abbreviation for line buildout. See building out.*

**LCD** *Abbreviation for liquid crystal display.*

**LDM** *Abbreviation for limited distance modem.*

**leaky mode** In an optical fiber, a mode whose field decays monotonically for a finite distance in the transverse direction but becomes oscillatory everywhere beyond that finite distance. *Note:* Leaky modes correspond to leaky rays in the terminology of geometric optics. Leaky modes experience attenuation, even if the waveguide is perfect in every respect. (188) *Synonym* tunneling mode. *See also* bound mode, cladding mode, fiber optics, leaky ray, mode, optical fiber, radiation mode.

**leaky ray** In an optical fiber, a ray for which geometric optics would predict total internal reflection at the core boundary, but which suffers loss by virtue of the curved core boundary. *Note:* Leaky rays correspond to leaky (or tunneling) modes in the terminology of mode descriptors. *Synonym* tunneling ray. *See also* bound mode, cladding ray, guided ray, leaky mode.

**leap second** An occasional adjustment of one second, added to, or subtracted from, Coordinated Universal Time (UTC) to bring it into approximate synchronism with UT-1, which is the time scale based on the rotation of the Earth. (188) *Note 1:* Adjustments, when required, are made at the end of June 30, or preferably, December 31, Universal Time, so that UTC never deviates from UT-1 by more than 0.9 second. *Note 2:* The last minute of the day on which an adjustment is made has 61 or 59 seconds. *See also* Coordinated Universal Time, International Atomic Time.

**leased circuit** Dedicated common-carrier facilities and channel equipment used in furnishing private line service from the telephone network for the exclusive use of a particular party or parties. *See also* dedicated circuit, hot line, individual line.

**LED** *Abbreviation for light-emitting diode.*

**left-hand [anti-clockwise] polarized wave** An elliptically or circularly polarized wave, in which the electric field vector, observed in the fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a left-hand (anti-clockwise) direction. (RR) *See also* circular polarization, right-hand [clockwise] polarized wave.

**leg** A connection from a specific node to an addressable entity, which may be another network node, such as a switching system, but will ordinarily be a termination to a user of the network. *See also* node.

**level 1.** The absolute or relative voltage, current, or power at a particular point in a circuit or system. (188) **2.** A tier or layer of a hierarchical system, e.g., the Link-Level protocol, high-level computer language. (188)

**level alignment** The adjustment of transmission levels of single links and of links in tandem to prevent overloading of transmission subsystems. (188) *See also* level, link, traffic load.

**LF** *Abbreviation for low frequency.*

**LIFO** *Acronym for last in, first out.*

**light** In a strict sense, the region of the electromagnetic spectrum that can be perceived by human vision, designated the visible spectrum and nominally covering the wavelength range of 0.4  $\mu\text{m}$  to 0.7  $\mu\text{m}$ . (188) *Note:* In the laser and optical communication fields, custom and practice have extended usage of the term to include the much broader portion of the electromagnetic spectrum that can be handled by the basic optical techniques used for the visible spectrum. This region has not been clearly defined, but, as employed by most workers in the field, may be considered to extend from the near-ultraviolet region of approximately 0.3  $\mu\text{m}$ , through the visible region, and into the mid-infrared region to 30  $\mu\text{m}$ . *See also* Infrared, optical spectrum, ultraviolet.

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**light current** *See* photocurrent.

**light-emitting diode (LED)** A pn-junction semiconductor device that emits incoherent optical radiation when biased in the forward direction. (188) *See also* electroluminescence, incoherent.

**lightguide** *Synonym* optical fiber.

**lightning down conductor** The conductor connecting the air terminal or overhead ground wire to the earth electrode subsystem. (188) *See also* air terminal, arrester, facility grounding system, fault protection subsystem, ground, lightning protection subsystem.

**lightning protection subsystem** All of the components used to protect a facility from the effects of lightning. (188) *Note:* It includes air terminals, lightning down conductors, the earth electrode subsystem, air gaps, arresters, and their interconnections. *See also* facility grounding system.

**light ray** The path of a point on a wavefront. The direction of the light ray is generally normal to the wavefront. *See also* geometric optics.

**limited distance modem (LDM)** A digital-to-analog signal converter normally used on privately owned circuits that conditions and strengthens a digital signal for use of higher baud rates over shorter distances.

**limited protection** A form of short-term communications security applied to the electromagnetic or acoustic transmission of unclassified information that warrants a degree of protection against simple analysis and easy exploitation but which does not warrant protection to the extent needed for security of classified information. (188) *See also* communications security, Data Encryption Standard.

**limited protection voice equipment** An equipment that provides limited protection for unclassified voice communications. (188) *See also* randomizer, scrambler.

**limiter** A device in which the voltage or some other characteristic of the output signal is automatically prevented from exceeding a specified value. (188) *See also* clipper, compressor, limiting, peak limiting.

**limiter circuit** A circuit of nonlinear elements that restricts the electrical excursion of a variable in accordance with specified criteria. (188) *See also* automatic gain control, circuit.

**limiting** A process by which a characteristic at the output of a device is prevented from exceeding a predetermined value. (188) *Note 1:* Hard limiting is a limiting action with negligible variation in output in the range where the output is limited (controlled) when subjected to a fairly wide variation of signal input. *Note 2:* Soft limiting is a limiting action with appreciable variation in output in the range where the output is limited (controlled) when subjected to a fairly wide variation of signal input. *See also* limiter, peak limiting.

**limits of interference** In radio transmission, the maximum permissible interference as specified in recommendations of the International Special Committee on Radio Interference or other recognized authority. (188) *See also* interference.

**line** 1. A medium for transferring electrical energy for communications from one point to another, e.g., a transmission line. (188) 2. *See* scanning line.

**line adapter circuit** A circuit that is used at the station end of a user access line and interfaces with a 4-wire telephone. (188) *See also* four-wire circuit, four-wire terminating set, hybrid set, two-wire circuit.

**linear analog control** *Synonym* linear analog synchronization.

**linear analog synchronization** A synchronization control system in which the functional relationships used to obtain synchronization are of simple proportionality.



*Synonym* linear analog control. *See also* synchronization.

**linear combiner** A diversity combiner that adds two or more receiver outputs. (188) *See also* diversity combiner, maximal-ratio combiner.

**linear element** A device for which the output, such as electric field, is linearly proportional to the input and no new wavelengths or modulation frequencies are generated.

**linearity** The property of a system in which, if input signals  $X$  and  $Y$  result in system output  $S(X)$  and  $S(Y)$  respectively, the input signal  $X+Y$  will result in the output  $S(X)+S(Y)$ , where  $S()$  is the system transfer function. *See also* fidelity, nonlinear distortion.

**linearly polarized (LP) mode** A mode for which the field components in the direction of propagation are small compared to components perpendicular to that direction. *Note:* The LP description is an approximation that is valid for a weakly guiding optical fiber, including typical telecommunication grade fibers. *See also* mode, weakly guiding fiber.

**linear optimization** *Synonym* linear programming.

**linear polarization** In electromagnetic wave propagation, polarization such that the tip of the electric field vector describes a straight line segment in any fixed plane intersecting, and normal to, the direction of propagation. *See also* elliptical polarization.

**linear predictive coding (LPC)** A method of digitally encoding analog signals, which method uses a single-level or multilevel sampling system in which the value of the signal at each sample time is predicted to be a linear function of the past values of the quantized signal. *Note:* LPC is related to adaptive predictive coding (APC) in that both use adaptive predictors. However, LPC uses more prediction coefficients to permit use of a lower information bit rate than APC, and thus requires a more complex processor. *See also* adaptive predictive coding, code, level.

**linear programming (LP)** In operations research, a procedure for locating the maximum or minimum of a linear function of variables that are subject to linear constraints. (FP) *Synonym* linear optimization.

**line balance** The degree of electrical similarity of the two conductors of a transmission line. (188) *Note:* Improved accuracy of balance reduces pickup of extraneous disturbances of all kinds, including crosstalk. *See also* balanced, balanced line.

**line bulldout (LBO)** *Synonym* building out.

**line code** A code chosen for use within a communication system for transmission purposes. (188) *Note:* It may differ from the code generated at a user terminal, and thus may require translation. *See also* code, code conversion, translator.

**line driver** A digital-signal amplifying device to enhance transmission reliability over an extended distance.

**line filter balance** A network designed to maintain phantom group balance when one side of the group is equipped with a carrier system. (188) *Note:* Since it must balance the phantom group for only voice frequencies, its configuration is usually quite simple compared with the filter that it balances. *See also* balanced line, filter, network, phantom group.

**line hit** *See* hit (def.#1).

**line load control** In telecommunication, a service feature permitting selective denial of call origination to certain lines when excessive demands for service are required of a switching center. (188) *See also* adaptive routing, avoidance routing, classmark, directionalization, loading, minimize, service feature, traffic load.

**line loop** *See* loop (def. #1).

**line-of-sight (LOS) propagation** Propagation of an electromagnetic wave in which the direct ray from the transmitter to the receiver is

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unobstructed. *Note:* The term "line-of-sight" is used mostly at or above VHF frequencies. *See also* direct ray, electronic line of sight, free-space loss, loss, propagation, radio horizon, shadow loss.

**line-route map** A map or overlay for signal communications operations that shows the actual routes and types of construction of wire circuits in the field. It also gives the locations of switchboards and telegraph stations. (JCS1-DoD) *See also* circuit.

**line side** The portion of a device toward the transmission path, e.g., channel, loop, or trunk. (188) *See also* equipment side, local side.

**line source** 1. In the spectral sense, an optical source that emits one or more spectrally narrow lines as opposed to a continuous spectrum. *See also* monochromatic. 2. In the geometric sense, an optical source whose active (emitting) area forms a spatially narrow line, e.g., an injection laser diode.

**line spectrum** In optics, an emission or absorption spectrum consisting of one or more narrow spectral lines, as opposed to a continuous spectrum. *See also* monochromatic, spectral line, spectral width.

**line speed** *See* modulation rate.

**line-to-line correlation** In facsimile, the correlation of image information from scanning line to scanning line. *Note:* This is a phenomenon that is useful for two-dimensional encoding. *See also* facsimile.

**line traffic coordinator (LTC)** The processor, in an AUTODIN switching center, designated to coordinate the line traffic. (188) *See also* loading.

**line verification** *See* busy verification.

**linewidth** *See* spectral width.

**link** 1. The communication facilities existing between adjacent nodes of a network. (188) 2. A portion of a circuit designed to be

connected in tandem with other portions. 3. A radio path between two points, called a radio link, which may be unidirectional, half-duplex, or (full) duplex. (188) 4. In communications, a general term used to indicate the existence of communications facilities between two points. (JCS1-DoD) (JCS1-NATO) 5. In computer programming, the part of a computer program, in some cases a single instruction or address, that passes control and parameters between separate portions of the computer program. *Note:* The term "link" should be defined or qualified when used. 6. A conceptual (or logical) circuit between two users of a packet-switched (or other) network permitting them to communicate, although different physical paths may be used.

**link encryption** The application of on-line crypto-operation to a link of a communications system so that all information passing over the link is encrypted in its entirety. (JCS1-DoD) *See also* bulk encryption, link, multiplex link encryption.

**Link Layer** *Deprecated term for Data Link Layer. See Open Systems Interconnection--Reference Model.*

**link level** In data transmission, the conceptual level of control or data processing logic existing in the hierarchical structure of a primary or secondary station that is responsible for maintaining control of the data link. *Note:* The link level functions provide an interface between the station high-level logic and the data link; these functions include transmit bit injection and receive bit extraction, address/control field interpretation, command response generation, transmission and interpretation, and frame check sequence computation and interpretation. *See also* data transmission, level, link.

**link orderwire** A voice and/or data communication circuit between adjacent communications facilities interconnected by a transmission link; specifically used for coordination and control of link activity. (188) *See also* circuit, engineering orderwire, facility, link, orderwire circuit.

**link protocol** A set of rules for data communication over a data link, which rules are specified in terms of a transmission code, a transmission mode, and control and recovery procedures. *See also* code, link, protocol.

**link quality analysis (LQA)** In a radio link, the overall process by which relative measurements of signal quality are performed. This signal quality is characterized by such parameter assessments as bit-error-ratio (BER), the ratio of signal-plus-noise-plus-distortion to noise-plus-distortion (SINAD), and multipath (MP). (188) *Note:* Such assessments are stored and/or exchanged between stations for use in making decisions about automatic link establishment (ALE). *See also* automatic link establishment, multipath, signal-plus-noise-plus-distortion to noise-plus-distortion ratio.

**liquid crystal display (LCD)** A display device that creates characters by means of the action of reflected light on patterns formed by a liquid that becomes opaque when it is energized. (FP)

**LLC** *Abbreviation for logical link control. See logical link control sublayer.*

**LNA** *Abbreviation for launch numerical aperture.*

**load** 1. The power consumed by a device or circuit in performing its function. (188) 2. A power-consuming device connected to a circuit. (188) 3. To enter data or programs into storage or working registers. (FP) (ISO) (188) 4. To insert data values into a database that previously contained no occurrences of data. (FP) (ISO) 5. To place a magnetic tape reel on a tape drive, or to place cards into the card hopper of a card punch or reader. (188)

**load capacity** In PCM, the level expressed in dBm0 of a sinusoidal signal, the positive and negative peaks of which coincide with the positive and negative virtual decision values of the encoder. *Synonym* overload point. *See also* pulse-code modulation.

**loader** A routine, commonly a computer program, that reads data into main storage. (FP) (ISO)

**load factor** The ratio of the average load over a designated period of time to the peak load occurring during that period. (188) *See also* diversity factor, load (def. #1).

**loading** 1. The insertion of impedance into a circuit to change its characteristics. (188) *See also* impedance matching. 2. In multichannel communications, the insertion of white noise or equivalent dummy traffic at a specified level, to simulate system traffic performance. (188) 3. In multichannel telephony systems, the loading imposed by the busy hour traffic (the equivalent mean power and the peak power) as a function of the number of voice channels; or the equivalent power of a multichannel complex or composite signal(s) referred to zero transmission level point (OTLP). *Note:* These loadings are a function of the number of channels and the specified voice channel mean power. (188) *See also* erlang, line load control, line traffic coordinator, loading characteristic, medium-power talker, system loading, traffic intensity.

**loading characteristic** In multichannel telephony systems, a plot, for the busy hour, of the equivalent mean power and the peak power as a function of the number of voice channels. (188) *Note:* The equivalent power of a multichannel signal referred to the zero transmission level point is a function of the number of channels and has for its basis a specified voice channel mean power. *See also* channel, loading, medium-power talker.

**loading coil** A coil that does not provide coupling with any other circuit, but is inserted in a circuit to increase its inductance. (188) *Note:* Loading coils inserted periodically in a pair of wires reduce the attenuation at the higher voice frequencies up to the cutoff frequency of the low-pass filter formed by the inductance of the coils and wires, and the capacitance between the wires. Above this frequency, the attenuation increases rapidly.

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**lobe** 1. *For antennas, see antenna lobe, main lobe, side lobe.* 2. A pair of channels between a data station and a lobe attaching unit, one channel for sending and one for receiving, as seen from the point of view of the attached data station. (FP) (ISO)

**local access and transport area (LATA)** Under the terms of the Modification of Final Judgment the geographical area within which a Bell Operating Company is permitted to provide exchange telecommunications and exchange access services after divestiture by AT&T. *See also* divestiture, exchange area, inter-LATA, intra-LATA.

**local area network (LAN)** A nonpublic data communication system, within a limited geographical area, designed to allow a number of independent devices to communicate with each other over a common transmission-interconnection topology. (188) *Note 1:* LANs are usually restricted to relatively small geographical areas, e.g., rooms, buildings, or clusters of buildings, and use fairly high data rates. *Note 2:* A LAN is not subject to public telecommunications regulations. *See also* bus topology, metropolitan area network, node (def. #1), ring network, star network, star topology, tree topology.

**local battery** 1. In telegraphy, the battery that actuates the telegraphic station recording instruments, as distinguished from the battery furnishing current to the line. (188) 2. In telephony, a system where each telephone set has its own individual source of power. (188)

**local call** 1. Any call using a single switching facility. (188) 2. Any call within a local charging area. *See also* call.

**local central office** *Synonym* central office.

**local clock** A clock located in close proximity to a particular communication station, node, or other facility with which it is associated. *Note:* The same clock might be a remote clock relative to some other station, node, or facility. *See also* clock, external timing reference.

**local exchange loop** Interconnection between customer premises and a public telephone central office. *See also* access line, drop, loop (def. #2).

**local line** *See* loop (def. #2).

**local loop** *Synonym* loop (def. #2).

**local measured service** *See* measured-rate service.

**local orderwire** A communication circuit between a technical control facility and selected terminal or repeater locations within the communications complex. (188) *Note:* In multichannel radio systems, the local orderwire is usually a handset connection at the radio location. *See also* engineering orderwire, orderwire circuit.

**local side** The portion of a device toward the station facilities. (188) *See also* line side.

**lock-in frequency** The minimum or maximum frequency that can be acquired and tracked by a closed loop system. *See also* feedback, frequency, frequency drift, frequency lock.

**lock-in range** The range of frequencies between the minimum and maximum lock-in frequencies. (188) *See also* frequency, frequency lock.

**lockout** 1. In a telephone circuit controlled by two voice-operated devices, the inability of one or both users to get through, either because of excessive local circuit noise or because of continuous speech from either or both users. (188) *See also* head-on collision. 2. In mobile communications, an arrangement of control circuits whereby only one receiver can feed the system at a time. (188) *Synonym* receiver lockout system. 3. In telephone systems, treatment of a user's line or trunk that is in trouble or in a permanent off-hook condition, by automatically disconnecting the line from the switching equipment. (188) 4. In public telephone systems, a process that denies an attendant or other users the ability to reenter an established connection. *See also* call spill-

over, head-on collision, not-ready condition.  
 5. An arrangement for restricting access to use of all, or part of, a computer system. (FP) (ISO) *Synonym* protection.

**log** *Synonym* journal (def. #1).

**logical circuit** *Synonym* virtual circuit.

**logical link control (LLC) sublayer** In a LAN/MAN system, that part of the OSI Data Link Layer that supports medium-independent data link functions, and uses the services of the medium access control sublayer to provide services to the network layer. *See also* link, Open Systems Interconnection--Reference Model.

**logical signaling channel** A logical channel that provides a signaling path within an information channel or a physical signaling channel. *See also* signaling path.

**logical topology** The connection configuration of a network that reflects the network's function, use, or implementation without reference to the physical interconnection of elements. *See also* physical topology.

**log-off** The procedure that is followed by a user in closing a session, i.e., a period of terminal operation.

**log-on** The procedure that is followed by a user in beginning a session, i.e., a period of terminal operation.

**log-periodic (LP) antenna** Any of a class of broadband, multielement unidirectional, narrow-beam antennas whose impedance and radiation characteristics repeat periodically as a logarithmic (exponential) function of the excitation frequency. *Note:* The length and spacing of the elements of such an antenna increase logarithmically from one end to the other. *Synonym* log-periodic array. (188)

**log-periodic (LP) array** *Synonym* log-periodic antenna.

**long call** *Synonym* foreign exchange.

**long distance call** Any telephone call, subject to charge, to a destination outside of the local service area of the calling station. *Note:* Also called "toll call" whether inter-LATA or intra-LATA.

**long-haul communications** 1. Communication that permits users to convey information on a national or worldwide basis. *Note:* Compared to tactical communications, long-haul communications are generally characterized by higher levels of users (including the National Command Authority), more stringent performance requirements (higher quality circuits), longer distances between users (up to global distances), higher traffic volume and density (larger sizing of switches and trunk cross-sections), and fixed or recoverable assets. Normally used in reference to the Defense Communications System. (188) *See also* communications. 2. In the public telephone network, a term describing circuits spanning considerable distances, generally applied to inter-LATA, interstate, or international communications. *See also* tactical communication.

**longitudinal balance** 1. The electrical symmetry of the two wires of a pair with respect to ground. (188) 2. The measure of the difference in impedance of the two sides of a circuit. *See also* balanced, balanced line.

**longitudinal offset loss** *See* gap loss.

**longitudinal redundancy check (LRC)** A system of error control based on the formation of a block check following preset rules. The check formation rule is applied in the same manner to each character. (188) *Note:* The combination of longitudinal and vertical redundancy check allows the detection and correction of single bit errors. *See also* block check, error control.

**longitudinal voltage** A voltage induced or appearing along the length of a transmission medium. *Note:* This voltage may also be called a "common-mode voltage" and is effectively eliminated by differential amplifiers or receivers that respond to voltage difference between the wires. Induced longitudinal



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voltage at low (power-line) frequencies can be greatly reduced by twisting parallel wires (called "*twisted wire pairs*").

**long-term stability** The relationship between oscillator frequency and time when the oscillator frequency is measured under constant environment, supply voltage, and load. This long-term frequency change is caused by changes in the oscillator's frequency determining elements. (188)

**long wavelength** In optical fiber communications, a term used to refer to optical radiation whose wavelength is greater than approximately 1  $\mu\text{m}$ .

**loop** 1. A communication channel from a switching center or an individual message distribution point to the user terminal. (188) *Synonym* subscriber line. 2. In telephone systems, a pair of wires from a central office to a subscriber's telephone. (188) *Synonyms* local loop, user's line. *See also* local exchange loop. 3. Go and return conductors of an electric circuit; a closed circuit. 4. A closed path under measurement in a resistance test. 5. A type of antenna used extensively in direction-finding equipment and in UHF reception. (188) 6. A sequence of instructions that may be executed iteratively while a certain condition prevails. In some implementations, no test is made to discover whether the condition prevails until the loop has been executed once. (FP) (ISO)

**loop-back** 1. A method of performing transmission tests of access lines from the serving switching center, a method that usually does not require the assistance of personnel at the served terminal. (188) 2. A method of testing between stations (not necessarily adjacent) wherein two lines are used, with the testing being done at one station and the two lines interconnected at the distant station. (188) *See also* back-to-back connection, loop (def. #2), loop test.

**loop check** *Synonym* echo check.

**loop filter** A filter located between the phase detector (or time discriminator) and the voltage

controlled oscillator (or phase shifter) of a phase-locked loop.

**loop gain** 1. The total usable power gain of a carrier terminal or two-wire repeater. The maximum usable gain is determined by and may not exceed the losses in the closed path. 2. The product of the gain values acting on a signal passing around a closed path, i.e., a loop. (188) *See also* gain, loop (def. #2).

**loop noise** The noise contribution of one (or both) loops of a circuit to the total circuit noise. (188) *Note:* The context of usage should show whether one or both loops are intended. *See also* loop (def. #2), noise.

**loop start** A supervisory signal given by a telephone or PBX in response to completing the loop path. *See also* ground start, loop.

**loop test** 1. *See* loop-back (def. #2). 2. A method of testing employed in fault isolation in a closed circuit or loop. (188) *See also* loop.

**loran** *Acronym for long range electronic navigation.* A long-range radio navigation position-fixing system using the time difference of reception of pulse-type transmissions from two or more fixed stations. (JCS1-DoD) (JCS1-NATO)

**loran station** A long-distance radio navigation land station transmitting synchronized pulses. Hyperbolic lines of position are determined by the measurement of the difference in the time of arrival of these pulses. (NTIA)

**LOS** *Abbreviation for line of sight.* *See* line-of-sight propagation.

**loss** 1. The amount of electrical or optical attenuation in a circuit, or the power consumed in a circuit component. (188) 2. The energy dissipated without accomplishing useful work, usually expressed in decibels. (188) *See also* attenuation, circuit, dB, power.

**lost block** A block not delivered to the user within a specified maximum end-to-end block transfer time. *See also* block, block-

**misdelivery probability, block transfer failure, error, misdelivered block.**

**lost call** A call that has not been completed for any reason other than cases where the called party (termination) is busy. (188) *See also* blocking, call, unsuccessful call.

**lower frequency ground** *Deprecated term.* A dedicated, single-point network intended to serve as a reference for voltages and currents, whether signal, control, or power, from dc to 30 kHz and, in some cases, to 300 kHz. Pulse and digital signals with rise and fall times greater than one microsecond are considered to be lower frequency signals. (188) *Note:* An obsolete concept for current military facilities since the introduction of the equipotential ground plane system of signal grounding. *See also* facility grounding system.

**lowest usable high frequency (LUF)** The lowest frequency in the HF band at which the received field intensity is sufficient to provide the required signal-to-noise ratio for a specified time period, e.g., 0100 to 0200 UTC, on 90 percent of the undisturbed days of the month. (188) *See also* frequency, ionosphere, maximum usable frequency.

**low frequency (LF)** Frequencies from 30 kHz to 300 kHz. (188) *See also* frequency, spectrum designation of frequency.

**low-level keying** *Synonym* low-level signaling.

**low-level language** *Synonym* computer-oriented language.

**low-level modulation** Modulation of a signal at a point in a system or device, such as a radio transmitter, where the power level is low compared with the output power. (188) *See also* modulation.

**low-level signaling** The use on signal lines of low levels of voltage that are between the limits of positive and negative 6 volts. (188) *Synonym* low-level keying. *See also* level, signal.

**low-pass filter** A filter network that passes all frequencies below a specified frequency with little or no loss, but strongly attenuates higher frequencies. (188) *See also* filter, frequency.

**low-performance equipment** 1. That equipment having insufficiently exacting characteristics to permit its use in trunks or links. (188) *Note:* Such equipment may be employed in loops whenever it meets loop performance requirements. 2. That tactical ground and airborne equipment whose size, weight, and complexity must be kept to a minimum and where the primary requirement is to operate in nets with similar minimum performance standards. (188) *See also* high-performance equipment.

**low-power communication device** A restricted radiation device, exclusive of those employing conducted or guided radio frequency techniques, used for the transmission of signs, signals (including control signals), writing, images and sounds or intelligence of any nature by radiation of electromagnetic energy. Examples: wireless microphone, phonograph oscillator, radio-controlled garage door opener, and radio-controlled models. (NTIA)

**L-pad** A pad consisting of two discrete components, one series component and one shunt component. *Note:* In schematic representation, the components resemble the upper-case letter "L," hence the name. (188) *See also* gain, impedance matching.

**LPC** *Abbreviation for linear predictive coding.*

**LP** *Abbreviation for linear programming.*

**LP mode** *Abbreviation for linearly polarized mode.*

**LP<sub>01</sub> mode** Designation of the fundamental LP mode. *See* fundamental mode.

**LQR** *Abbreviation for link quality analysis.*

**LRC** *Abbreviation for longitudinal redundancy check.*

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**LTC** *Abbreviation for line traffic coordinator.*

**LUF** *Acronym for lowest usable high frequency.*

**MAC** *Abbreviation for medium access control. See medium access control sublayer.*



**machine instruction** An instruction that can be executed by the processor of the computer for which it has been designed as part of the machine language. (FP) (ISO)

**machine language** A computer language composed of machine instructions that can be executed directly by a computer without further modification. (188) *See also assembly language, compile, computer, computer language, high-level language.*

**machine learning** The ability of a device to improve its performance based on its past performance. (FP)

**machine-oriented language** *Synonym computer-oriented language.*

**machine-readable medium** A medium that can convey data to a given sensing device. (FP) *Synonym automated data medium.*

**machine word** *Synonym computer word.*

**macrobending** In an optical fiber, all macroscopic deviations of the fiber's axis from a straight line; distinguished from microbending. (188) *See also macrobend loss, microbending, microbend loss.*

**macrobend loss** In an optical fiber, that loss attributable to macrobending. *Synonym curvature loss. See also macrobending, microbend loss.*

**magnetic card** A card with a magnetizable layer on which data can be stored. (FP) (ISO) (188) *See also band, magnetic tape.*

**magnetic circuit** 1. The complete closed path taken by magnetic flux. 2. A region of ferromagnetic material, such as the core of a transformer or solenoid, that contains essentially all of the magnetic flux.

**magnetic core storage** A storage device that uses magnetic properties of such materials as iron, iron oxide, or ferrite and in such shapes as wires, tapes, toroids, rods, or thin film.

**magnetic disk** A flat circular plate with a magnetizable surface layer on one or both sides of which data can be stored. (FP) (ISO)

**magnetic disk unit** A device that contains magnetic disks, a disk drive, one or more magnetic heads, and associated controls. (FP) (ISO)

**magnetic drum** A right circular cylinder with a magnetizable layer on which data can be stored. (FP) (ISO)

**magnetic drum unit** A device that contains a magnetic drum, the mechanism for moving it, magnetic heads, and associated controls. (FP) (ISO)

**magnetic storm** A perturbation of the Earth's magnetic field, caused by solar disturbances, usually lasting for a brief period (several days) and characterized by large deviations from the usual value of at least one component of the field. *See also sudden ionospheric disturbance.*

**magnetic tape** 1. A tape with a magnetizable layer on which data can be stored. (FP) (ISO) 2. A tape or ribbon of any material impregnated or coated with magnetic or other material on which information may be placed in the form of magnetically polarized spots. (JCS1-DoD) *See also band (def. #2), interblock gap, magnetic card, phase-encoded recording.*

**magneto-ionic double refraction** The combined effect of the Earth's magnetic field and atmospheric ionization, whereby a linearly polarized wave entering the ionosphere is split into two components called the ordinary wave and the extraordinary wave. *Note:* The component waves follow different paths, experience different attenuations, have different phase velocities, and, in general, are

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elliptically polarized in opposite senses. *See also* birefringence, ionosphere.

**magneto-optic** Pertaining to the interaction of an electromagnetic wave with a magnetic field or with matter under the influence of a magnetic field. (188) *Note:* The magneto-optic effect known as the "*Faraday effect*" is used to rotate the plane of polarization of a wave. *See also* Faraday effect, magneto-optic effect, polarization.

**magneto-optic effect** Any one of a number of phenomena in which an electromagnetic wave interacts with a magnetic field, or with matter under the influence of a magnetic field. (188) *Note:* The most important magneto-optic effect having application to optical communication is the Faraday effect, in which the plane of polarization is rotated under the influence of a magnetic field parallel to the direction of propagation. This effect may be used to modulate a lightwave. *See also* electro-optic effect.

**mailbox-type facility** *See* electronic mail.

**main beam** That portion of the directivity pattern of a directional antenna in which the radiation is at a maximum. (188) *Note:* The horizontal directivity pattern is usually specified, and the width of the main beam is usually specified as the angle encompassed between the points where the power has fallen 3 dB below maximum value. The vertical pattern is also of interest and may be similarly specified. *See also* antenna, antenna lobe, directive gain, directivity pattern, main lobe, side lobe.

**main distribution frame (MDF)** A distribution frame, on one part of which the permanent outside lines entering the facility terminate, and on another part of which the subscriber line multiple cabling, trunk multiple cabling, etc. terminate. It is used for cross-connecting any outside line with any desired terminal in such a multiple or with any other outside line. (188) *Note:* It usually carries the central office protective devices, and functions as a test point between a line and the office. In a private

exchange, the main distribution frame is used for similar purposes. The phrase "*outside line*" may include radio channels or circuits, as appropriate. Generally, a main distribution frame carries on the vertical side all outside lines and their protective devices, and on the horizontal side, all connections to central equipment that may be assigned to particular outside lines. As used in communication facilities other than telephone, all station lines and equipment terminate on the vertical side, and all patch fields on the horizontal side. *Synonym* main frame. *See also* circuit, combined distribution frame, distribution frame, intermediate distribution frame.

**main frame** *Synonym (in telephony)* main distribution frame.

**mainframe** A large computer, usually one to which other computers and/or terminals are connected to share its resources and computing power.

**main lobe** In an antenna radiation pattern, the lobe containing the maximum radiation intensity. (188) *See also* antenna, antenna lobe, main beam, side lobe.

**main station** A user's instrument, e.g., telephone set or terminal, with a distinct call number designation, connected to a local loop, used for originating calls, and on which incoming calls from the exchange are answered. *See also* call, end instrument, extension terminal, terminal.

**maintainability** 1. A characteristic of design and installation which is expressed as the probability that an item will be retained in or restored to a specified condition within a given period of time, when the maintenance is performed in accordance with prescribed procedures and resources. (188) 2. The ease with which maintenance of a functional unit can be performed in accordance with prescribed requirements. (FP) (ISO) *See also* availability, failure, mean time between failures, mean time to repair, mean time to service restoral.



**maintenance** 1. All action taken to retain materiel in or to restore it to a specified condition. It includes: inspection, testing, servicing, classification as to serviceability, repair, rebuilding, and reclamation. (JCS1-NATO) 2. All supply and repair action taken to keep a force in condition to carry out its mission. (JCS1-NATO) 3. The routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such condition that it may be continuously utilized, at its original or designed capacity and efficiency, for its intended purpose. (JCS1-NATO) 4. Any activity intended to restore or retain a functional unit in a state in which the unit can perform its required functions. Maintenance includes keeping a functional unit in a specified state by performing activities such as tests, measurements, replacements, adjustments, and repairs. (FP) (ISO) (188) *See also* corrective maintenance, preventive maintenance.

**maintenance control circuit (MCC)** A voice circuit used by maintenance personnel over microwave links for coordination. *Note:* This circuit is not available to operations or technical control personnel. (188) *See also* circuit, engineering orderwire, link, maintenance, orderwire circuit.

**major lobe** *See* main lobe.

**MAN** Acronym for metropolitan area network.

**management information system (MIS)** An organized assembly of resources and procedures required to collect, process, and distribute data for use in decision making. (188)

**Manchester encoding** A means by which data and clock signals can be combined into a single self-synchronizing data stream. Each encoded bit contains a transition at the midpoint of a bit period; the direction of transition determines whether the bit is a "0" or a "1." The first half is the true bit value; the second half is the complement of the true bit value. (188) *See also* alternate mark inversion signal.

**mandrel wrapping** A technique in which excess higher order modes launched into an optical fiber are filtered out by wrapping several turns of fiber around a mandrel approximately 1 cm in diameter.

**man-machine system** A system in which the functions of a human operator and a machine are integrated.

**marine utility station** A station in the maritime mobile service consisting of one or more hand-held radiotelephone units licensed under a single authorization. Each unit is capable of operation while being hand-carried by an individual. . . . (After CFR 47)

**maritime mobile-satellite service** A mobile-satellite service in which mobile Earth stations are located on board ships; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. (RR) *See also* Earth station.

**maritime mobile service** A mobile service between coast stations and ship stations, or between ship stations, or between associated on-board communication stations; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. (RR)

**maritime radionavigation-satellite service** A radionavigation-satellite service in which Earth stations are located on board ships. (RR) *See also* Earth station.

**maritime radionavigation service** A radionavigation service intended for the benefit and for the safe operation of ships. (RR)

**mark** 1. In binary communications, one of the two significant conditions of encoding. (188) *Synonyms* marking pulse, marking signal. *See also* space. 2. A symbol or symbols that indicate the beginning or the end of a field, of a word, or of a data item in a file, record, or block. (FP) (ISO) *See also* code element, marking bias, modulation, neutral operation, pulse, signal transition.

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**marker beacon** A transmitter in the aeronautical radionavigation service which radiates vertically a distinctive pattern for providing position information to aircraft. (RR)

**marking bias** The uniform lengthening of all marking signal pulses at the expense of all spacing pulses. (188) *See also* bias, bias distortion, mark, spacing bias.

**marking end distortion** *See* end distortion.

**marking pulse** *Synonym* mark.

**marking signal** *Synonym* mark.

**M-ary code** The generic name applied to all multilevel codes. (188) *Note:* A numeric digit may be substituted for "M" to indicate the specific number of quantization states. Thus an 8-ary code has eight distinct states and could convey three bits per code symbol. *See also* binary digit, code, level.

**M-ary signaling** The transmission of digital data such that each signaling symbol can take on any of M, rather than two, states. This multilevel (or multiple decision threshold) system implies three or more transmitted conditions. (188) *Synonym* multilevel modulation. *See also* level, modulation, signal.

**maser** *Acronym for microwave amplification by stimulated emission of radiation.* The general class of microwave amplifiers based on molecular interaction with electromagnetic radiation. *Note:* The nonelectric nature of the maser principle results in very low noise. *See also* laser.

**master clock** A device that generates periodic, accurately spaced signals that are used for such purposes as timing, regulation of the operations of a processor, or generation of interrupts. (FP) (ISO) *See also* clock, coordinated clock, Coordinated Universal Time, reference clock, slave clock.

**master frequency generator** In FDM, equipment used to provide system end-to-end carrier frequency synchronization and frequency

accuracy of tones over the system. (188) *Note:* The following types of oscillators are employed in the Defense Communications System FDM systems: Type 1 - master carrier oscillator as an integral part of the multiplexer set; Type 2 - submaster oscillator equipment or slave oscillator equipment as an integral part of the multiplexer set; Type 3 - external master oscillator equipment having extremely accurate and stable characteristics. *Synonym* master frequency oscillator. *See also* carrier (cxr), frequency, frequency-division multiplexing.

**master frequency oscillator** *Synonym* master frequency generator.

**mastergroup** *See* group.

**master-slave timing** In a communication system, a timing subsystem wherein one station or node supplies the timing reference for all other interconnected stations or nodes. *See also* democratically synchronized network, hierarchically synchronized network, mutual synchronization, oligarchically synchronized network, timing signal.

**master station** 1. In a data network, the station that has been designated by the control station to ensure data transfer to one or more slave stations. *Note:* A master station has control of one or more data links of the data communication network at a given instant. The assignment of master status to a given station is temporary and is controlled by the control station according to the procedures set forth in the operational protocol. Master status is normally conferred upon a station so that it may transmit a message, but a station need not have a message to send to be nominated as master. 2. In navigation systems employing precise time dissemination, a station whose clock is used to synchronize the clocks of subordinate stations. 3. In basic mode link control, the data station that has accepted an invitation to ensure a data transfer to one or more slave stations. At a given instant, there can be only one master station on a data link. (FP) (ISO) *See also* contention, control station, data communication, data transmission, interrogation, network, primary station,

**secondary station, slave station, tributary station.**

**matched junction** A waveguide component having four or more ports, and so arranged that if all ports except one are terminated in the correct impedance, there will be no reflection of energy from the junction. (188) *See also* hybrid junction.

**material absorption** *See* absorption.

**material dispersion** *See* dispersion.

**material dispersion coefficient [M( $\lambda$ )]** In an optical fiber, pulse broadening per unit length of fiber and per unit of spectral width, usually measured in picoseconds/(kilometer-nanometer). A measure of the change in group index ( $\Delta N$ ) as related to the change in wavelength, inversely proportional to the velocity of light in vacuum. M( $\lambda$ ) is expressed as

$$M(\lambda) = \frac{1}{c} \frac{dN}{d\lambda}$$

$$= -\frac{1}{c} \frac{d^2 n}{d\lambda^2},$$

where  $n$  is the refractive index of the material,  $N$  is the group index expressed as  $n - \lambda(dn/d\lambda)$ ,  $\lambda$  is the wavelength of interest, and  $c$  is the velocity of light in vacuum. *Note 1:* For many optical fiber materials,  $M$  equals zero at a specific wavelength  $\lambda_0$  between 1.2  $\mu\text{m}$  and 1.5  $\mu\text{m}$ . Below  $\lambda_0$ ,  $M$  is negative and increases with wavelength; it is positive above  $\lambda_0$ . *Note 2:* Pulse broadening caused by material dispersion in a unit length of optical fiber is given by the product of  $M$  and spectral width ( $\Delta\lambda$ ), except at  $\lambda = \lambda_0$ , where terms proportional to  $(\Delta\lambda)^2$  are important. (*See Note 1.*) *See also* dispersion, group index.

**material scattering** In an optical fiber, that part of the total scattering attributable to the properties of the materials used for fiber fabrication. *See also* Rayleigh scattering, scattering, waveguide scattering.

**maximal-ratio combiner** A diversity combiner in which the signals from each channel are added together; the gain of each channel is made proportional to the rms signal and inversely proportional to the mean square noise in that channel, with the same proportionality constant for all channels. (188) *Synonym* ratio-squared combiner. *See also* diversity combiner, equal gain combiner, post-detection combiner, predetection combining, selective combiner.

**maximum access time** Maximum allowable waiting time between initiation of an access attempt and successful access. *See also* access time.

**maximum block transfer time** Maximum allowable waiting time between initiation of a block transfer attempt and completion of a successful block transfer. *See also* block, block transfer rate, successful block transfer.

**maximum calling area** Geographic calling limits permitted to a particular access line based on requirements for the particular line. *Note:* Such restrictions are imposed for network control purposes. *See also* call.

**maximum disengagement time** Maximum allowable waiting time between initiation of a disengagement attempt and successful disengagement. *See also* disengagement time.

**maximum justification rate** *Synonym* maximum stuffing rate.

**maximum keying frequency** In facsimile systems, the frequency in hertz numerically equal to the spot speed divided by twice the X-dimension of the scanning spot. (188) *See also* facsimile, frequency.

**maximum modulating frequency** The highest picture frequency required for a given facsimile transmission system. (188) *Note:* The maximum modulating frequency and the maximum keying frequency are not necessarily equal. *See also* facsimile, frequency.

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**maximum stuffing rate** The maximum rate at which bits can be inserted or deleted. (188) *Synonym* maximum justification rate. *See also* binary digit, bit stuffing, de-stuffing, nominal bit stuffing, overhead bit.

**maximum usable frequency (MUF)** The upper limit of the frequencies that can be used at a specified time for radio transmission between two points and involving propagation by reflection from the regular ionized layers of the ionosphere. (188) *Note:* MUF is a median frequency applicable to 50 percent of the days of a month, as opposed to 90 percent cited for the lowest usable high frequency (LUF) and the optimum traffic frequency (FOT). *See also* frequency, lowest usable high frequency, optimum traffic frequency, spectrum designation of frequency.

**maximum user signaling rate** The maximum rate, in bits per second, at which binary information could be transferred (in a given direction) between users over the telecommunication system facilities dedicated to a particular information transfer transaction, under conditions of continuous transmission and no overhead information. For a single channel, signaling rate is expressed as  $SCSR = (1/T) \log_2 n$ , where SCSR is the single channel signaling rate in bits per second, T is the minimum time interval (in seconds) for which each level must be maintained, and n is the number of significant conditions of modulation of the channel. In the case where an individual end-to-end telecommunication service is provided by parallel channels, signaling rate is expressed as

$$PCSR = \sum_{i=1}^m \frac{\log_2 n_i}{T_i} ,$$

where PCSR is the total signaling rate for m channels, m is the number of parallel channels,  $T_i$  is the minimum interval between significant instants for the ith channel, and  $n_i$  is the number of significant conditions of modulation for the ith channel. In the case where an end-to-end telecommunication service is provided by tandem channels, the end-to-end signaling

rate is the lowest signaling rate among the component channels. *See also* channel, data signaling rate, effective speed of transmission, Shannon's law, signal, throughput.

**MCC** *Abbreviation for maintenance control circuit.*

**MCM** *Abbreviation for multicarrier modulation.*

**MDF** *Abbreviation for main distribution frame.*

**meaconing** 1. A system for receiving radio beacon signals and retransmitting them on the same frequency to confuse navigation and cause inaccurate bearings to be obtained by beacon users. 2. A system of receiving radio beacon signals and rebroadcasting them on the same frequency to confuse navigation. The meaconing stations cause inaccurate bearings to be obtained by aircraft or ground stations. (JCS1-DoD) (JCS1-NATO)

**mean power [of a radio transmitter]** The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions. (RR) (188) *Note:* Normally, a time of 0.1 second, during which the mean power is greatest, will be selected. *See also* antenna, directive gain, effective radiated power.

**mean time between failures (MTBF)** For a particular interval, the total functioning life of a population of an item divided by the total number of failures within the population during the measurement interval. The definition holds for time, cycles, kilometers, events, or other measure-of-life units. (188) *See also* availability, downtime, failure, maintainability, reliability.

**mean time between outages (MTBO)** The mean time between equipment failures that result in loss of system continuity or unacceptable degradation as expressed by  $MTBO = MTBF / (1 - FFAS)$ , where MTBF is the nonredundant mean time between failures and FFAS is the fraction of failures for which

the failed equipment is bypassed automatically. (188) *See also* availability, downtime, failure, reliability.

**mean time to repair (MTTR)** The total corrective maintenance time divided by the total number of corrective maintenance actions during a given period of time. (188) *See also* availability, downtime, maintainability, reliability.

**mean time to service restoral (MTSR)** The mean time to restore service following system failures that result in a service outage. *Note:* The time to restore includes all time from the occurrence of the failure until the restoral of service. (188) *See also* availability, downtime, failure, maintainability, reliability.

**measured-rate service** Telephone service for which charges are made in accordance with the use made of the line. *See also* call, flat rate service, postalized rate, tariff.

**measurement period** *See* performance measurement period.

**mechanically induced modulation** Optical signal modulation induced by mechanical means.

**mechanically intermateable connectors** Connectors that are mechanically mateable, without creating mechanical damage, and with no regard to attenuation properties. *See also* interchangeable connectors.

**mechanical splice** An optical-fiber splice accomplished by fixtures or materials, rather than by thermal fusion. *Note:* Index-matching material may be applied between two fiber ends. *See also* fusion splice, index-matching material, optical fiber splice.

**medium** 1. In telecommunications, the transmission path along which a signal is propagated, such as wire pair, coaxial cable, waveguide, optical fiber, or radio path. (188) *See also* circuit, communications, link, loop, transmission channel. 2. The material on which data are recorded, e.g., paper tape, punched card, magnetic tape or disk. (188)

**medium access control (MAC) sublayer** In a local area network, that part of the OSI Data Link Layer that supports topology-dependent functions and uses the services of the Physical Layer to provide services to the logical link control sublayer. *See also* layer (def. #2), link, Open Systems Interconnection--Reference Model.

**medium frequency (MF)** Frequencies from 300 kHz to 3000 kHz. (188) *See also* frequency, spectrum designation of frequency.

**medium interface connector (MIC)** In LAN/MAN systems, the connector at the interface point between the bus interface unit and the terminal, termed the medium interface point. *See also* interface, local area network, metropolitan area network.

**medium interface point (MIP)** In LAN/MAN systems, that location at which the standards for the interface parameters between a terminal and the bus interface unit are defined. *See also* interface, local area network, medium interface connector, metropolitan area network, network interface device.

**medium-power talker** The talker, within a log-normal distribution of talkers, whose volume lies at the medium power of all talkers determining the volume distribution at the point of interest. (188) *Note:* When the distribution follows a log-normal curve (values expressed in decibels), the mean and standard deviation can be used to compute the medium-power talker. The talker volume distribution follows a log-normal curve and the medium-power talker is uniquely determined by the average talker volume. The medium-power talker volume,  $V$ , is given by  $V = V_0 + 0.115\sigma^2$ , where  $V_0$  is the average of the talker volume distribution in volume units (vu), and  $\sigma$  is the standard deviation of the distribution. *See also* loading (def. #3), loading characteristic, power.

**megahertz (MHz)** A unit of frequency denoting one million ( $10^6$ ) Hz. (188) *See also* frequency, metric system.



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**memory** 1. All of the addressable storage space in a processing unit and other internal memory that is used to execute instructions. (FP) (ISO)  
2. Main storage, when used in reference to calculators, microcomputers, and some minicomputers. *See also* read-only storage, register.

**menu** A displayed list of options from which a user selects actions to be performed. (FP)

**meridional ray** In fiber optics, a ray that passes through the optical axis of an optical fiber (in contrast with a skew ray, which does not). *See also* axial ray, geometric optics, numerical aperture, optical axis, paraxial ray, skew ray.

**mesochronous** The relationship between two signals such that their corresponding significant instants occur at the same average rate. (188) *See also* anisochronous, heterochronous, homochronous, isochronous, plesiochronous.

**message** 1. Any thought or idea expressed briefly in a plain, coded, or secret language, prepared in a form suitable for transmission by any means of communication. (JCSI-NATO) *Note:* A message may be a one-unit message or a multiunit message. 2. [In telecommunications.] Record information expressed in plain or encrypted language and prepared in a format specified for intended transmission by a telecommunications system. (JCSI-DoD) 3. An arbitrary amount of information whose beginning and end are defined or implied. (FP) *See also* signal (def. #4), signal message.

**message alignment indicator** In a signal message, data transmitted between the user part and the message transfer part to identify the boundaries of the signal message. *See also* signal message.

**message broadcast** An electronic-mail conference capability using data terminals. *Note:* Control can be maintained by the user or by the network.

**message format** A predetermined or prescribed spatial or time-sequential arrangement of the

parts of a message that is recorded in or on a data storage medium. *Note:* Messages prepared for electrical transmission are usually composed on a printed blank form with spaces for each part of the message and for administrative entries.

**message handling systems (MHS)** The CCITT X.400 family of services and protocols that provides the functions for global electronic-mail transfer among local mail systems.

**message register leads** Terminal equipment leads at the interface used solely for receiving dc message register pulses from a central office at a PBX so that message unit information normally recorded at the central office only is also recorded at the PBX. . . . (After CFR 47)

**message service** Switched service furnished to the general public (as distinguished from private line service). Except as otherwise provided, this includes exchange switched services and all switched services provided by interexchange carriers and completed by a local telephone company's access services. . . . (After CFR 47) *Synonym* message toll service.

**message switching** A method of handling message traffic through a switching center, either from local users or from other switching centers, whereby the message traffic is stored and forwarded through the system. (188) *See also* circuit switching, packet switching, queue traffic, store-and-forward, switching center, switching system.

**message toll service** *Synonym* message service.

**message transfer part** That part of a common channel signaling system that transfers signal messages and performs necessary functions, e.g., error control and signaling link security, related to the transfer.

**message unit** A unit of measure for charging telephone calls, based on parameters such as the length of the call, the distance called, and/or the time of day. *See also* tariff.

**messaging service** In ISDN, an interactive telecommunications service that allows information transfer between users by means of store-and-forward, electronic mail, or message-handling functions.

**metallic circuit** A circuit in which metallic conductors are used and in which the ground or earth forms no part. (188) *See also* balanced line, circuit, four-wire circuit, two-wire circuit.

**metallic voltage** A potential difference between metallic conductors, as opposed to a potential difference between metallic conductor and ground. (After CFR 47) *See also* phantom circuit, virtual circuit.

**meteor burst communications** Communications by the propagation of radio signals reflected by ionized meteor trails. (CFR 47)

**meteorological aids service** A radiocommunication service used for meteorological, including hydrological, observations and exploration. (RR)

**meteorological-satellite service** An Earth exploration-satellite service for meteorological purposes. (RR)

**metric system** A decimal system of measures and weights based on the meter, the kilogram, and the second. (188) *Note:* The latest version of this system employs "SI Units," or the International System of Units, as follows:

Metric System (Units)		
Quantity	Base Units	Abbreviation
length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd
Supplementary Units		
plane angle	radian	rad
solid angle	steradian	sr
<p>Certain derived terms have also been standardized, e.g., the "hertz" (<math>2\pi</math> radians per second), formerly one cycle per second.</p> <p>Prefixes used with metric units are listed in the following table.</p>		

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PREFIXES USED WITH METRIC UNITS		
Unit	Abbrev.	Value
exa	E	$10^{18}$
peta	P	$10^{15}$
tera	T	$10^{12}$
giga	G	$10^9$
mega	M	$10^6$
kilo	k	$10^3$
hecto	h	$10^2$
deka	da	$10^1$
-	-	$10^0$
deci	d	$10^{-1}$
centi	c	$10^{-2}$
milli	m	$10^{-3}$
micro	$\mu$	$10^{-6}$
nano	n	$10^{-9}$
pico	p	$10^{-12}$
femto	f	$10^{-15}$
atto	a	$10^{-18}$
EXAMPLES		
Term	Abbrev.	Meaning
megahertz	MHz	$10^6$ hertz
picofarad	pF	$10^{-12}$ farads
nanosecond	ns	$10^{-9}$ seconds

**metropolitan area network (MAN)** A loosely defined term generally understood to describe a network covering an area larger than a local area network. (188) *Note:* It typically interconnects two or more local area networks, may operate at a higher speed, may cross administrative boundaries, and may use multiple access methods. *See also*

communications, local area network, medium interface connector, medium interface point, wide area network.

**MF** *Abbreviation for medium frequency.*

**MFD** *Abbreviation for mode field diameter.*

**MFJ** *Abbreviation for Modification of Final Judgment.*

**MFSK** *Abbreviation for multiple frequency-shift keying.*

**MHS** *Abbreviation for message handling systems.*

**MHz** *Abbreviation for megahertz*

**MIC** *Abbreviation for medium interface connector.*

**microbending** In an optical fiber, sharp curvatures involving local axial displacements of a few micrometers and spatial wavelengths of a few millimeters. (188) *Note:* Microbends can result from trauma during (or as a result of) fiber coating, cabling, packaging, and installation. Microbending can cause significant radiative loss and mode coupling. *See also* macrobending.

**microbend loss** In an optical fiber, that loss attributable to microbending. (188) *See also* macrobend loss.

**microcode** A sequence of microinstructions that is fixed in storage that is not program-addressable, and that performs specific processing functions. (FP)

**microcomputer** A computer system whose processing unit is a microprocessor. A basic microcomputer includes a microprocessor, storage, and an input/output facility which may or may not be on one chip. (FP) *See also* computer.

**microinstruction** An instruction that controls data flow and sequencing in a processor at a more fundamental level than machine

**instructions.** Individual machine instructions and perhaps other functions may be implemented by microprograms. (FP)

**microprocessor** A central processing unit implemented on a single chip. (188) *See also* computer.

**microprogram** A sequence of microinstructions that are in special storage where they can be dynamically accessed to perform various functions. (FP)

**microwave (mw)** A term loosely applied to those radio frequency wavelengths that are sufficiently short to exhibit some of the properties of light, e.g., they are easily concentrated into a beam. Commonly used for frequencies from about 1 GHz to 30 GHz. (188) *See also* frequency, spectrum designation of frequency.

**Mie scattering** Scattering of an electromagnetic wave by particles, i.e., refractive index inhomogeneities, that are large with respect to the wavelength, i.e., on the order of, or larger than the wavelength. *See also* Rayleigh scattering.

**mileage** In telecommunications, a specified distance used in tariff calculations. *Note:* It is locally defined and often refers to airline distance rather than actual route miles. *See also* measured-rate service, postalize, tariff.

**minicomputer** *See* computer.

**minimize** A condition wherein normal message and telephone traffic is drastically reduced in order that messages connected with an actual or simulated emergency shall not be delayed. (JCS1-DoD) *See also* directionalization, line load control, precedence.

**MIP** Abbreviation for medium interface point.

**MIS** Abbreviation for management information system.

**misalignment loss** *See* angular misalignment loss, gap loss, lateral offset loss.

**misdelivered block** A block received by a user other than the one intended by the message source. *See also* block, block-misdelivery probability, lost block.

**mission bit stream** The output or line rate, less any overhead generated by the device in question, in any particular part of the transmission scheme. (188) *See also* bit stream transmission, transmission.

**MM patch bay** A patching facility designed for patching and monitoring of digital data circuits at rates exceeding 3 Mbps. *See also* D-type patch bay, M-patch bay, patch bay.

**mobile Earth station** An Earth station in the mobile-satellite service intended to be used while in motion or during halts at unspecified points. (RR) *See also* Earth station.

**mobile-satellite service** A radiocommunication service:

- between mobile Earth stations and one or more space stations, or between space stations used by this service; or
- between mobile Earth stations by means of one or more space stations.

This service may also include feeder links necessary for its operation. (RR) *See also* Earth station.

**mobile service** A radiocommunication service between mobile and land stations, or between mobile stations. (RR) *See also* compatibility, interoperability, portability, transportability.

**mobile station** A station in the mobile service intended to be used while in motion or during halts at unspecified points. (RR) *See also* compatibility, interoperability, portability, transportability.

**modal dispersion** *Often erroneously used as a synonym for multimode distortion.*

**modal distortion** *Synonym multimode distortion.*

**modal distribution** 1. In an optical fiber operating at a single wavelength, the number of modes supported by the fiber, and their

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propagation time differences. (188) 2. In an optical fiber operating at multiple wavelengths simultaneously, the separation in wavelengths among the modes being supported by the fiber. (188) *See also* fiber optics, frequency, mode, mode volume, multimode optical fiber, single-mode optical fiber.

**modal loss** In an open waveguide, such as an optical fiber, a loss of energy on the part of an electromagnetic wave due to obstacles outside the waveguide, abrupt changes in direction of the waveguide, or other anomalies, that cause changes in the propagation mode of the wave in the waveguide. (188) *See also* fiber optics, loss, macrobend loss, microbend loss, mode (def. #1), speckle pattern.

**modal noise** Noise generated in an optical fiber system by the combination of mode-dependent optical losses and fluctuation in the distribution of optical energy among the guided modes or in the relative phases of the guided modes. (188) *Synonym* speckle noise. *See also* mode (def. #1), speckle pattern.

**mode** 1. The various possible patterns of standing waves of the electromagnetic field in a cavity or transmission line. (188) *Note 1:* Modes are characterized by their frequency and the spatial distribution of their polarization and field strength. *Note 2:* Any electromagnetic field distribution that satisfies Maxwell's equations and the boundary conditions is a mode. The field pattern of a mode depends on the frequency, refractive index, and cavity or waveguide geometry. 2. In statistics, the highest peak in a probability density function. 3. In data communications, different types of protocols used to transfer data from a switch to a switch, or from a switch to a terminal. (188) *Note:* In military switches, e.g., AUTODIN, modes I, II, III, IV, and V are used.

**mode coupling** In an optical fiber, the exchange of power among modes. (188) *Note:* The exchange of power may reach statistical equilibrium after propagation over a finite distance, designated the "equilibrium length." *See also* coupling, equilibrium length, mode

(def. #1), mode scrambler, multimode optical fiber.

**mode field diameter (MFD)** A measure of distribution of optical power intensity across the end face of a single-mode fiber.

**mode filter** A device used to select, reject, or attenuate a certain mode or modes. (188) *See also* dichroic filter, fiber optics, filter, mode (def. #1).

**mode [identification friend or foe]** The number or letter referring to the specific pulse spacing of the signals transmitted by an interrogator. (JCS1-DoD)

**modem** *Acronym for modulator-demodulator.* A device that modulates and demodulates signals. (188) *Note 1:* Modems are primarily used for converting digital signals into quasi-analog signals for transmission over analog communication channels and for reconvertng the quasi-analog signals into digital signals. *Note 2:* Many additional functions may be added to a modem to provide for customer service and control features. *Synonym* signal conversion equipment. *See also* acoustic coupler, data circuit-terminating equipment, input/output device, narrowband modem, peripheral equipment, quasi-analog signal, wideband modem.

**mode mixer** *Synonym* mode scrambler.

**mode partition noise** In an optical communication link, phase jitter caused by the combined effects of (laser) mode hopping in the optical source (which results in random wavelength changes) and intramodal distortion (the variation of propagation velocity, with wavelength, within a propagating mode in the fiber).

**modem patch** A method of electrically connecting paths of a circuit through employment of back-to-back modems. (188)

**mode scrambler** 1. A device for inducing mode coupling in an optical fiber. (188) 2. A device composed of one or more optical fibers in



which strong mode coupling occurs. *Note:* Frequently used to provide a mode distribution that is independent of source characteristics or that meets other specifications. *Synonym* mode mixer. *See also* coupling, fiber optics, mode (def. #1), mode coupling, multimode optical fiber.

**mode stripper** *See* cladding mode stripper.

**mode volume** The number of bound modes that an optical fiber is capable of supporting. (188) *Note:* The mode volume  $M$  is approximately given by  $V^2/2$  and  $(V^2/2)[g/(g + 2)]$  respectively for step-index and power-law profile fibers, where  $g$  is the profile parameter, and  $V$  is the normalized frequency greater than 5. *See also* effective mode volume, mode (def. #1), normalized frequency, power-law index profile, step-index profile.

**Modification of Final Judgment (MFJ)** The 1982 antitrust suit settlement agreement ("Consent Decree") entered into by the United States Department of Justice and the American Telephone and Telegraph Company (AT&T) that, after modification and upon approval of the United States District Court for the District of Columbia, required the divestiture of the Bell Operating Companies from AT&T.

**modified AMI** An AMI signal that does not strictly conform with alternate mark inversion but includes violations in accordance with a defined set of rules. *See also* alternate mark inversion signal, signal.

**modular jack** A device that conforms to the *Code of Federal Regulations*, Title 47, part 68, which defines size and configuration of all units that are permitted for connection to the public exchange facilities.

**modulation** A controlled variation of any property of a wave for the purpose of transferring information. (188)

**modulation factor** In amplitude modulation, the ratio of the peak variation actually used, to the maximum design variation in a given type of modulation. (188) *Note:* In conventional

amplitude modulation, the maximum design variation is considered that for which the instantaneous amplitude of the modulated signal reaches zero. When zero is reached, the modulation is considered 100 percent. *See also* amplitude modulation, modulation, modulation index, percentage modulation, unbalanced modulator.

**modulation index** In angle modulation, the ratio of the frequency deviation of the modulated signal to the frequency of a sinusoidal modulating signal. (188) *Note:* The modulation index is numerically equal to the phase deviation in radians. *See also* angle modulation, deviation ratio, frequency modulation, modulation, modulation factor, phase deviation, phase modulation.

**modulation rate** The reciprocal of the measure of the shortest nominal time interval between successive significant instants of the modulated signal. (188) *See also* baud, bit rate, bits per second, data signaling rate, modulation.

**modulation suppression** In the reception of an amplitude-modulated signal, an apparent reduction in the depth of modulation of a wanted signal, caused by the presence, at the detector, of a stronger unwanted signal. (188) *See also* amplitude modulation, signal-to-noise ratio, suppressed carrier transmission.

**modulator** A device that imposes a signal on a carrier. (188) *See also* modulation.

**modulator-demodulator (modem)** *See* modem.

**modular** Pertaining to the design concept in which interchangeable units are employed to create a functional end product. (188)

**monitor** 1. Software or hardware that scrutinizes and then displays, records, supervises, controls, or verifies the operations of a system. *Note:* Possible uses of monitors are to indicate significant departures from the norm, or to determine levels of utilization of particular functional units. 2. *Synonym* visual display unit.

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**monitoring** 1. The act of listening, carrying out surveillance on, and/or recording the emissions of one's own or allied forces for the purpose of maintaining and improving procedural standards and security, or for reference, as applicable. (JCS1-DoD) (JCS1-NATO) 2. The act of listening, carrying out surveillance on, and/or recording of enemy emissions for intelligence purposes. (JCS1-DoD) (JCS1-NATO) *See also* electronic reconnaissance, intercept. 3. The act of detecting the presence of signals, such as electromagnetic radiation, sound, and visual signals, and the measurement thereof with appropriate measuring instruments. 4. The act of detecting the presence of radiation and the measurement thereof with radiation measuring instruments. *Synonym* radiological monitoring. (JCS1-DoD) (JCS1-NATO)

**monitor jack** A jack (or key) that provides access to communication circuits for the purpose of observing the signal conditions on the circuit without interrupting the service provided by that circuit. (188) *See also* bridging connection, circuit.

**monitor key** *See* monitor jack.

**monochromatic** In optics, consisting of a single wavelength or color. *Note:* In practice, radiation is never perfectly monochromatic but, at best, displays a narrow band of wavelengths. *See also* coherent, line source, spectral width.

**monochromator** In optics, an instrument for isolating narrow portions of the spectrum.

**monomode optical fiber** *Synonym* single-mode optical fiber.

**mouse** A hand-held computer input device that generates the coordinates of a position indicator and is operated by being moved on a flat surface.

**M-patch bay** A patching facility designed for patching and monitoring of digital data circuits at rates from 1 Mbps to 3 Mbps. (188) *See also* D-type patch bay, MM patch bay, patch bay.

**M-sequence** A binary sequence that can be generated with a linear shift register and having the property that, if the shift register is set to any nonzero state and subsequently cycled, a pseudorandom binary sequence of  $2^M - 1$  bits will be generated (where  $M$  is the number of stages, i.e., the length or number of bit positions in the register) before the shift register returns to its original state and the output sequence repeats. *Note:* The register may be used to control the sequence of frequencies for a frequency-hopping spread spectrum transmission. *See also* register, shift register.

**MTBF** *Abbreviation for mean time between failures.*

**MTBO** *Abbreviation for mean time between outages.*

**MTSR** *Abbreviation for mean time to service restoral.*

**MTTR** *Abbreviation for mean time to repair.*

**mudbox** An unsheltered item of equipment that is sufficiently rugged to withstand adverse environments. It is expected to operate when exposed on the ground.

**MUF** *Abbreviation for maximum usable frequency.*

**muldem** *Acronym for multiplexer/demultiplexer.*

**multiaddress calling facility** A system service feature that permits a user to nominate more than one addressee for the same data. *Note:* The network may accomplish this sequentially or simultaneously. *See also* call, conference call, group alerting and dispatching system, selective calling, service feature.

**multicarrier modulation (MCM)** A technique of transmitting data by dividing the data into several interleaved bit streams and using these to modulate several carriers. *Note:* MCM is a form of frequency division multiplexing.

**multi-element dipole antenna** An arrangement of a number of dipole antennas. (188) *Note:* By varying the arrangement and the way they are driven, various directional patterns may be obtained. *See also* antenna, dipole antenna.

**multifiber cable assembly** *See* cable assembly.

**multifiber joint** An optical splice or connector designed to mate two multifiber cables, providing simultaneous optical alignment of all individual fibers.

**multiframe** In PCM systems, a set of consecutive frames in which the position of each frame can be identified by reference to a multiframe alignment signal. (188) *Note:* The multiframe alignment signal does not necessarily occur, in whole or in part, in each multiframe. *See also* distributed frame-alignment signal, frame, frame-alignment signal, pulse-code modulation, signal.

**multifrequency pulsing** *Synonym* multifrequency signaling.

**multifrequency signaling** A signaling method using combinations of two-out-of-six ("MF 2/6") or two-out-of-eight ("MF 2/8") voice-band frequencies to indicate telephone address digits, precedence ranks, and line or trunk busy. "MF 2/6" uses frequencies of 700, 900, 1100, 1300, 1500, and 1700 Hz; "MF 2/8" and DTMF use 697, 770, 852, 941, 1209, 1336, 1447, and 1633 Hz. (188) *Synonym* multifrequency pulsing. *See also* dual-tone multifrequency signaling, frequency.

**multilayer filter** *See* interference filter.

**multilevel modulation** *Synonym* M-ary signaling.

**multilink operation** In packet-switched networks, the simultaneous use of multiple links for the transmission of different segments of the same message unit. *Note:* Use of multilink operation is intended to increase the effective rate of message transmission and requires special procedures for multiplexing/demultiplexing control.

**multimode distortion** In an optical fiber, a result of different values of the group delay for each individual mode at a single wavelength. (188) *Note:* The term "multimode dispersion" is often used as a synonym; such usage, however, is discouraged since the mechanism is not dispersive in nature. *Synonyms* intermodal distortion, modal distortion. *See also* coherence area, coherence length, coherence time, distortion, distortion-limited operation, fiber optics, mode (def. #1).

**multimode group delay** *Synonym* differential mode delay.

**multimode optical fiber** An optical fiber that will allow more than one bound mode to propagate. (188) *Note:* The fiber may be either graded index or step index. *See also* cladding mode, coupled modes, fiber optics, modal distribution, modal noise, mode, mode scrambler, mode volume, optical fiber, single-mode optical fiber.

**multipath** The propagation phenomenon that results in radio signals reaching the receiving antenna by two or more paths. (188) *Note 1:* Multipath effects range from constructive reinforcement to destructive cancellation of the signal. *Note 2:* In facsimile and television transmission, multipath causes jitter and ghosting. *See also* propagation, Rayleigh fading.

**multiple** A system of wiring so arranged that a circuit, a line, or a group of lines is accessible at a number of points. (188) *Synonym* multipoint. *See also* circuit.

**multiple access** 1. The connection of a user or subscriber end-instrument to two or more switching centers by separate access lines using a single-message routing indicator or telephone number. 2. In satellite communications, the capability of a communication satellite to function as a portion of a communication link between more than one pair of satellite terminals simultaneously. (188) *Note:* Three types of multiple access are presently employed with communication satellites: code-division, frequency-division, and time-division. *See*

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*also* alternate routing, dual access, dual homing, extension facility, multiple homing, pulse-address multiple access, satellite.

**multiple call** *Synonym* conference call.

**multiple frequency-shift keying (MFSK)** A form of frequency-shift keying in which multiple codes are used in the transmission of digital signals. (188) *Note:* The coding systems may use multiple frequencies transmitted concurrently or sequentially. *See also* frequency, frequency-shift keying, keying.

**multiple homing** 1. In telephony, the connection of a terminal facility so that it can be served by one or several switching centers. (188) *Note:* This service may use a single directory number. 2. In telephony, the connection of a terminal facility to more than one switching center by separate access lines. *Note:* Separate directory numbers are applicable to each accessed switching center. (188) *See also* alternate routing, dual homing, multiple access, split homing.

**multiple spot scanning** In facsimile systems, the method in which scanning is carried on simultaneously by two or more scanning spots, each one analyzing its fraction of the total scanned area of the subject copy. (188) *See also* facsimile, scanning (def. #2).

**multiplex (MUX)** *See* multiplexing.

**multiplex aggregate bit rate** The bit rate in a time-division multiplexer that is equal to the sum of the input channel data signaling rates available to the user plus the rate of the overhead bits required. (188) *See also* binary digit, bit rate, channel, data signaling rate, time-division multiplexing.

**multiplex baseband** In frequency-division multiplexing, the frequency band occupied by the aggregate of the signals in the line interconnecting the multiplexing and radio or line equipment. (188) *See also* baseband, multiplexing.

**multiplexer (MUX)** A device for the combining of two or more channels. (188) *See also* channel, multiplexing.

**multiplexer/demultiplexer (muldem)** A device that combines the functions of multiplexing and demultiplexing of digital signals. *Note:* This term is applicable to a purely digital multiplexer/demultiplexer, as opposed to the term "*modem*," which applies to a modulator/demodulator.

**multiplex hierarchy** In frequency-division multiplexing, the rank of frequency bands occupied: 12 channels = 1 group, 5 groups (60 channels) = 1 supergroup, 5 supergroups (300 channels) = 1 mastergroup (CCITT standard), 10 supergroups (600 channels) = 1 mastergroup (U.S. standard), 6 U.S. mastergroups = 1 jumbo group. (188) *See also* digital multiplex hierarchy, frequency-division multiplexing, group, multiplexing, time-division multiplexing.

**multiplexing (MUXing)** The combining of two or more information channels onto a common transmission medium. (188)

**multiplex link encryption** Encryption in which a single cryptographic device is used to encrypt all of the data in a multiplexed link. (188) *See also* cryptology, link (def. #1), link encryption, multiplexing.

**multipoint** *Synonym* multiple.

**multipoint access** The condition in which more than one terminal is supported by a single network termination. *See also* network termination, terminal.

**multipoint circuit** A circuit providing transmission capability among three or more separate points. (188) *See also* broadcast operation, circuit.

**multipoint distribution service** A one-way domestic public radio service rendered on microwave frequencies from a fixed station transmitting (usually in an omnidirectional

pattern) to multiple receiving facilities located at fixed points. (CFR 47)

**multipoint grounding system** A system of equipment bonded together and also bonded to the facility ground at the nearest location of the facility ground to the equipment. (188) *See also* earth electrode subsystem, facility grounding system, ground.

**multipoint link** A data communication link connecting three or more terminals. *See also* link (def. #1).

**multiprocessing** 1. A mode of operation that provides for parallel processing by two or more processors of a multiprocessor. (FP) (ISO) 2. The simultaneous execution of two or more computer programs or sequences of instructions by a computer. (FP) 3. *Loosely*, parallel processing. (FP) *See also* central processing unit, computer, distributed control, multiprogramming, on-line computer system, time-sharing.

**multiprocessor** A computer that has two or more processors that have common access to a main storage. (FP) (ISO)

**multiprogramming** A mode of operation that provides for the interleaved execution of two or more computer programs by a single processor. (FP) (ISO) (188) *See also* multiprocessing, time-sharing.

**multi-satellite link** A radio link between a transmitting Earth station and a receiving Earth station through two or more satellites, without any intermediate Earth station. A multi-satellite link comprises one uplink, one or more satellite-to-satellite links, and one downlink. (RR)

**multitasking** A mode of operation that provides for concurrent performance or interleaved execution of two or more tasks. (FP) (ISO)

**mutually synchronized network** A network-synchronizing arrangement in which each clock in the network exerts a degree of control on all others. *See also* democratically synchronized

network, hierarchically synchronized network, master-slave timing, mutual synchronization, oligarchically synchronized network, synchronization.

**mutual synchronization** A timing subsystem not employing directed control, by which the frequency of the clock at a particular node is controlled by some weighted average of the timing on all signals received from neighboring nodes. *See also* democratically synchronized network, hierarchically synchronized network, master-slave timing, mutually synchronized network, oligarchically synchronized network, synchronization.

**MUX** *Abbreviation for multiplex, multiplexer. See multiplexing.*

**mw** *Abbreviation for microwave.*



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**NA** Abbreviation for numerical aperture.



**nailed-up circuit** 1. A circuit semipermanently established through a circuit-switching facility for point-to-point connectivity. 2. *Deprecated synonym for permanent virtual circuit.*

**NAK** Acronym for negative-acknowledge character.

**narrative traffic** Messages normally prepared in accordance with standardized procedures for transmission via optical character recognition equipment or teletypewriter. (188) *Note:* In contrast to data pattern traffic, narrative messages contain additional message format lines. *See also* record traffic.

**narrowband modem** A modem whose modulated output signal has an essential frequency spectrum that is limited to that which can be wholly contained within, and faithfully transmitted through, a voice channel with a nominal 4-kHz bandwidth. (188) *Note:* High frequency (HF) modems are limited to operation over a voice channel with a nominal 3 kHz bandwidth. *See also* channel, modem, narrowband radio voice frequency, wideband modem.

**narrowband radio voice frequency (NBRVF)** In narrowband radio, the nominal 3-kHz bandwidth allocated for single channel radio that provides a transmission path for analog and quasi-analog signals. (188)

**narrowband signal** Any analog signal or analog representation of a digital signal whose essential spectral content is limited to that which can be contained within a voice channel of nominal 4-kHz bandwidth. (188) *Note:* Narrowband radio uses a voice channel with a nominal 3-kHz bandwidth. *See also* bandwidth, channel, narrowband radio voice frequency, signal, wideband.

**National Command Authorities (NCA)** The President and the Secretary of Defense or their

duly deputized alternates or successors. (JCS1-DoD)

**National Communications System (NCS)** 1. The organization established by Section 1(a) of Executive Order No. 12472 to assist the President, the National Security Council, the Director of the Office of Science and Technology Policy, and the Director of the Office of Management and Budget, in the discharge of their national security emergency preparedness telecommunications functions. The NCS consists of both the telecommunications assets of the entities represented on the NCS Committee of Principals and an administrative structure consisting of the Executive Agent, the NCS Committee of Principals, and the Manager. 2. The telecommunications system that results from the technical and operational integration of the separate telecommunications systems of the several executive branch departments and agencies having a significant telecommunications capability. (JCS1-DoD)

**National Coordinating Center (NCC)** The joint telecommunications industry-Federal Government operation established by the National Communications System to assist in the initiation, coordination, restoration, and reconstitution of NS/EP telecommunication services or facilities.

**National Electric Code® (NEC)** A standard governing the use of electrical wire, cable, and fixtures installed in buildings; developed by the NEC Committee of the American National Standards Institute (ANSI), sponsored by the National Fire Protection Association (NFPA), identified by the description ANSI/NFPA 70-1990. (188)

**national security /or emergency preparedness telecommunications** *See* NS/EP telecommunications.

**natural frequency** Of an antenna, the lowest frequency at which the antenna resonates without the addition of any inductance or capacitance. (188) *See also* antenna, antenna matching, frequency.

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**nautical mile (nmi)** 1. A measure of distance equal to one minute of arc on the Earth's surface. The United States has adopted the international nautical mile equal to 1,852 meters or 6,076.11549 feet. (JCS1-DoD) 2. The fundamental unit of distance used in navigation; the International Nautical Mile equals 1,852 m (6,076.1 ft or 1.15 statute mi). (188) *Note:* Frequently confused with the geographical mile, which is equal to 1 min of arc on the Earth's equator (6087.15 ft). The DoD and the U.S. Department of Commerce adopted the International Nautical Mile in 1954. *See also* statute mile.

**NBH** *Abbreviation for network busy hour. See busy hour.*

**NBRVF** *Abbreviation for narrowband radio voice frequency.*

**NCA** *Abbreviation for National Command Authority.*

**NCC** *Abbreviation for National Coordinating Center.*

**NCS** *Abbreviation for National Communications System.*

**near-end crosstalk** Crosstalk that is propagated in a disturbed channel in the direction opposite to the direction of propagation of the current in the disturbing channel. *Note:* The terminals of the disturbed channel, at which the near-end crosstalk is present, and the energized terminal of the disturbing channel, are usually near each other. (188) *See also* crosstalk, far-end crosstalk, intelligible crosstalk, interference.

**near field** *Synonym near-field region (def. #1).*

**near-field diffraction pattern** The diffraction pattern of an electromagnetic wave, which pattern is observed close to a source or aperture, as distinguished from a far-field diffraction pattern. *Note:* The pattern in the output plane is called the near-field radiation pattern. *Synonym* Fresnel diffraction pattern.

*See also* diffraction, far-field diffraction pattern, far-field region.

**near-field region** 1. The close-in region of the field of an antenna between the close-in refractive field region and the far-field region wherein the angular field distribution is dependent upon distance from the antenna. (188) *Note:* If the antenna has a maximum overall dimension that is not large compared to the wavelength, this field region may not exist. For an antenna focused at infinity, the radiating near field is referred to as the "Fresnel region." *Synonyms* near field, near zone. *See also* antenna, electromagnetic radiation, far-field diffraction pattern, far-field radiation pattern, Fraunhofer region, Fresnel region, intermediate-field region, transition zone. 2. In optical fiber communications, the region close to a source or aperture. The diffraction pattern in this region typically differs significantly from that observed at infinity and varies with distance from the source. *See also* far-field diffraction pattern.

**near-field scanning** The technique for measuring the index profile of an optical fiber by illuminating the entrance face with an extended source and measuring the point-by-point radiance of the exit face. *See also* refracted ray method.

**near real time** Delay caused by automated processing and display between the occurrence of an event and reception of the data at some other location. (JCS1-DoD) *See also* real time.

**near zone** *Synonym near-field region (def. #1).*

**NEC** *Abbreviation for National Electric Code®.*

**necessary bandwidth** For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions. (RR) (188) *Note:* Emissions useful for the adequate functioning of the receiving equipment, e.g., the emission corresponding to

the carrier of reduced carrier systems, must be included in the necessary bandwidth. (188) (See Annex J of *NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management* for formulas used to calculate necessary bandwidth.) See also bandwidth, bandwidth compression, carrier (cxr), frequency, nominal bandwidth, occupied bandwidth, spurious emission, spurious response, suppressed carrier transmission.

**negation circuit** *Deprecated synonym for inverter.*

**negative-acknowledge character (NAK)** A transmission control character sent by a station as a negative response to the station with which the connection has been set up. (FP) (188) *Note 1:* In binary synchronous communication protocol, used to indicate that an error was detected in the previously received block and that the receiver is ready to accept retransmission of the erroneous block. *Note 2:* In multipoint systems, used as the not-ready reply to a poll. See also acknowledge character, character, compelled signaling, control character.

**negative feedback** See feedback (def. #1).

**negative justification** *Synonym de-stuffing.*

**negative pulse stuffing** *Synonym de-stuffing.*

**N-entity** An active element in the n-th layer of the Open Systems Interconnection--Reference Model that interacts directly with elements (entities) of the layer immediately above or below the n-th layer. It is defined by a unique set of rules (syntax) and information formats (data/control), and it performs a defined set of functions. See also Open Systems Interconnection--Reference Model, protocol.

**NEP** *Abbreviation for noise equivalent power.*

**neper (Np)** A unit for expressing transmission gain or loss and relative ratios. Like the decibel, it is a dimensionless unit, and ITU (CCITT and CCIR) Recommendations recognize both units. The value in nepers, Np,

is given by  $Np = \ln(X_1/X_2)$ , where  $X_1$  and  $X_2$  are the test value and the reference value, respectively, and  $\ln$  is the natural, base e, logarithm. (188) *Note 1:* One neper (Np) = 8.686 dB, where  $8.686 = 20/\ln 10$ . *Note 2:* Nepers are usually used to express voltage or current ratios, whereas decibels are normally used to express power ratios. See also dB.

**net** *Synonyms communications net, communications network.*

**net gain** The overall gain of a transmission circuit. (188) *Note 1:* It is measured by applying a test signal of some convenient power at the beginning (input) of a circuit and measuring the power delivered at the other end (output). If the ratio of these powers (output/input), expressed in decibels, is positive, it is the net gain of the circuit under observation; if negative, it is the negative net gain, also called the "net loss". *Note 2:* The test signal must be chosen so that its power (level) is within the normal operating range of the circuit being tested. See also circuit, dB, gain, standard test signal, standard test tone, transmission level.

**net loss** The overall loss of a transmission circuit. (188) *Note 1:* It is measured by applying a test signal of some convenient power at the beginning of a circuit and measuring the power delivered at the other end. The ratio of these powers, expressed in decibels, is the net loss of the circuit under observation. *Note 2:* The test signal must be chosen so that its power (level) is within the normal operating range of the circuit being tested. See also circuit, dB, loss, net loss variation, standard test signal, standard test tone, transmission level, transmission loss.

**net loss variation** The maximum change in net loss occurring in a specified portion of a communication system during a specified period. (188) See also loss, net loss.

**net operation** The operation of an organization of stations capable of direct communication on a common channel or frequency. *Note:* Nets (netted operations) are ordered conferences

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whose participants have common information needs or similar functions to perform. Nets are characterized by adherence to standard formats. They are responsive to a common supervisor, called the "net controller" or "net control station," whose functions include permitting access to the net and maintaining circuit discipline. *See also* communications net, polling.

**net radio interface (NRI)** An interface between single-channel radio users and switched communication systems. (188) *See also* communications system, interface, radio and wire integration.

**network** 1. An interconnection of three or more communicating entities and (usually) one or more nodes. *See also* bus topology, ring network, star network, tree topology. 2. A combination of passive or active electronic components that serves a given purpose.

**network architecture** 1. The design principles, physical configuration, functional organization, operational procedures, and data formats used as the basis for the design, construction, modification, and operation of a communications network. (188) *See also* Open Systems Interconnection--Reference Model. 2. The structure of an existing communication network including the facilities, operational structure and procedures, and the data formats. (188) *See also* centralized operation, distributed control, distributed network, distributed switching, network connectivity.

**network busy hour (NBH)** *See* busy hour.

**network connectivity** The topological description of a network, which specifies the interconnection of the transmission nodes in terms of circuit termination locations and quantities. (188) *See also* distributed network, network, network architecture, node.

**network interface** 1. The point of interconnection between a user terminal and a private or public network. 2. The point of interconnection between the public switched network and a privately owned terminal. (188)

*Note: Code of Federal Regulations, Title 47, part 68, stipulates the interface parameters.* 3. The point of interconnection between one network and another network (or portion thereof). (188) *See also* divestiture, entrance facility, gateway, interface, network, network terminating interface, registered jack, service termination point.

**network interface device (NID)** 1. A device that performs functions such as code and protocol conversion, and buffering required for communications to and from a network. 2. A device used primarily within a local area network to allow a number of independent devices, with varying protocols, to communicate with each other. This communication is accomplished by converting each device protocol into a common transmission protocol. *Note:* The transmission protocol may be chosen to accommodate, directly without interface conversion, some of the devices used within the network. *Synonym* network interface unit. *See also* local area network, medium interface point, network.

**network interface unit (NIU)** *Synonym* network interface device.

**network inward-dialing (NID)** A service feature of an automatically switched telephone network that allows a calling user to dial directly to an extension number at the called user facility without operator intervention. (188) *See also* network, network outward-dialing, service feature.

**Network Layer** *See* Open Systems Interconnection--Reference Model.

**network outward-dialing (NOD)** A service feature of an automatically switched telephone network that allows a calling user to dial directly all network user numbers without operator intervention. (188) *See also* network interface device, network inward-dialing, service feature.

**network terminal number (NTN)** In the CCITT International X.121 format, the sets of digits that comprise the complete address of the data



terminal end point. *Note:* For an NTN that is not part of a national integrated numbering format, the NTN is the 10 digits of the CCITT X.25 14-digit address that follow the Data Network Identification Code (DNIC). When part of a national integrated numbering format, the NTN is the 11 digits of the CCITT X.25 14-digit address that follow the DNIC.

**network terminating interface (NTI)** 1. The point where the network service provider's responsibilities for service begin or end. 2. The interface between a DCE and its connected DTE. *See also* customer premises equipment, entrance facility, interface, network interface, plant.

**network termination** Network equipment providing functions necessary for network operation of ISDN access protocols. *Note:* Network termination provides functions essential for transmission services. *See also* Integrated Services Digital Network, protocol, terminal.

**network topology** The specific physical (real) or logical (virtual) arrangement of the elements of a network. *Note:* Two networks have the same topology if the connecting configuration is the same, although the networks may differ in physical interconnections, distance between nodes, transmission rates, and signal types. *Synonym* topology. *See also* bus topology, logical topology, physical topology, ring network, star topology, tree topology.

**network utility** An internetwork administrative signaling mechanism in the call control procedure between packet switching public data networks.

**neutral** The ac power system conductor that is intentionally grounded on the supply side of the service disconnect. (188) *Note:* It is the low potential (white) side of a single phase ac circuit or the low potential fourth wire of a three-phase Wye distribution system. The neutral provides a current return path for ac power currents whereas the safety ground (green) conductor should not, except during fault conditions. *See also* common return,

facility grounding system, fault protection subsystem, ground, neutral ground.

**neutral direct current telegraph system** A telegraph system employing current during marking intervals and no current during spacing intervals for transmission of signals over the line. (188) *Note 1:* "Neutral" here means that direction of current flow is immaterial. *Note 2:* In polar telegraph systems, the signal alternates between positive and negative voltages and, thus, the current flows reverse on the line during transitions between marks and spaces. *Synonyms* single-current system, single-current transmission system, single-Morse system. *See also* communications system.

**neutral ground** An intentional ground applied to the neutral conductor or neutral point of a circuit, transformer, machine, apparatus, or system. (188) *See also* facility grounding system, fault protection subsystem, ground, neutral.

**neutral operation** A method of teletypewriter operation in which marking signals are formed by current pulses of one polarity, either positive or negative, and spacing signals are formed by reducing the current to zero or nearly zero. (188) *See also* mark, polar operation, space.

**neutral relay** A relay in which the movement of the armature does not depend upon the direction of the current in the circuit controlling the armature. (188) *See also* polar operation, relay (def. #2).

**new-customer premises equipment** All customer premises equipment not in service or in the inventory of a regulated telephone utility as of December 31, 1982. *See also* customer premises equipment, embedded customer-premises equipment.

**NF** *Abbreviation for noise figure.*

**N-function** A defined action performed by an N-entity. It may be either a single action (primitive function) or a set of actions. *See*

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- also* Open Systems Interconnection--Reference Model.
- nibble** Half a byte. *See also* byte.
- NID** Acronym for network interface device, network inward-dialing.
- NIU** Abbreviation for network interface unit. *See* network interface device.
- nmi** Abbreviation for nautical mile.
- NOD** Acronym for network outward-dialing.
- nodal clock** The principal clock or alternate clock located at a particular node that provides the timing reference for all major functions at that node.
- nodal point** Synonym node (def. #1).
- node** 1. In network topology, a terminal of any branch of a network or an interconnection common to two or more branches of a network. (188) Synonyms junction point, nodal point. *See also* branch (def. #3), communications, extension facility, extension terminal, interface message processor, network. 2. In a switched network, one of the switches forming the network backbone. 3. A technical control facility (TCF). (188) 4. A point in a standing or stationary wave at which the amplitude is a minimum. (188) *In this sense, synonym* null (def. #2). *See also* anti-node, standing wave ratio.
- noise** 1. An undesired disturbance within the frequency band of interest; the summation of unwanted or disturbing energy introduced into a communications system from man-made and natural sources. (188) 2. A disturbance that affects a signal and that may distort the information carried by the signal. (FP) (ISO) 3. Random variations of one or more characteristics of any entity such as voltage, current, or data. (FP) 4. A random signal of known statistical properties of amplitude, distribution, and spectral density. (FP) 5. *Loosely*, any disturbance tending to interfere with the normal operation of a device or system. (FP)
- noise current** In optical communication, an rms component of the optical detector electrical output current which is determined with the signal power removed. *See also* noise voltage.
- noise equivalent power (NEP)** At a given data-signaling rate or modulation frequency, operating wavelength, and effective noise bandwidth, the radiant power that produces a signal-to-noise ratio of unity at the output of a given optical detector. (188) *Note 1:* Some manufacturers and authors define NEP as the minimum detectable power per square root bandwidth. When defined this way, NEP has the units of watts/(hertz)<sup>1/2</sup>. Therefore, the term is a misnomer, because the units of power are watts. *Note 2:* Some manufacturers define NEP as the radiant power that produces a signal-to-dark-current noise ratio of unity. This is misleading when dark-current noise does not dominate, as is often true in optical fiber systems. *See also* detectivity, noise, signal-to-noise ratio, specific detectivity.
- noise factor** Synonym noise figure.
- noise figure (NF)** The ratio of the output noise power of a device to the portion thereof attributable to thermal noise in the input termination at standard noise temperature (usually 290 K). (188) *Note:* The noise figure is thus the ratio of actual output noise to that which would remain if the device itself did not introduce noise. In heterodyne systems, output noise power includes spurious contributions from image-frequency transformation, but the portion attributable to thermal noise in the input termination at standard noise temperature includes only that which appears in the output via the principal frequency transformation of the system and excludes that which appears via the image frequency transformation. Synonym noise factor. *See also* effective input noise temperature, noise, thermal noise.
- noise level** The volume of noise power, measured in decibels, referred to a baseline. (188) *See also* dBa, dBa0, dBm(psoph),

**dBm0P, dBrnC, dBrnC0, dBrn( $f_1$ - $f_2$ ), dBrn(144-line), noise, signal-to-noise ratio.**

**noise power** 1. The power generated by a random electromagnetic process. (188) 2. In the acceptance testing of radio transmitters, the mean power supplied to the antenna transmission line by a radio transmitter when loaded with noise having a Gaussian amplitude-vs.-frequency distribution. (188) *See also* noise, pink noise, white noise.

**noise suppression** The process of automatically reducing the noise output of a receiver during periods when no carrier is being received. (188)

**noise voltage** In optical communication, an rms component of the optical detector electrical output voltage which is incoherent with the signal radiant power. *Note:* This value is usually determined with the signal power removed. *See also* noise current.

**noise weighting** A specific amplitude-vs.-frequency characteristic that permits a measuring set to give numerical readings that approximate the interfering effects to any listener using a particular class of telephone instrument. (188) *Note 1:* Noise weighting measurements are made in lines terminated either by the measuring set or the class of instrument. *Note 2:* The noise weightings generally used were established by agencies concerned with public telephone service, and are based on characteristics of specific commercial telephone instruments, representing successive stages of technological development. The coding of commercial apparatus appears in the nomenclature of certain weightings. The same weighting nomenclature and units are used in military versions of commercial noise measuring sets. *See also* dBa, dBm0p, dBrn, dBrnC, dBrn( $f_1$ - $f_2$ ), dBrn(144-line), psophometric voltage, weighting network.

**nominal bandwidth** The widest band of frequencies, inclusive of guard bands, assigned to a channel. (188) *Note:* Not to be confused with the terms "necessary bandwidth," "occupied bandwidth," or "rf bandwidth." *See also* bandwidth, frequency.

**nominal bit stuffing rate** The rate at which stuffing bits are inserted (or deleted) when both the input and output bit rates are at their nominal values. (188) *See also* binary digit, bit stuffing, de-stuffing, maximum stuffing rate.

**nominal linewidth** In facsimile systems, the average separation between centers of adjacent scanning or recording lines. (188) *See also* facsimile.

**nominal value** An assigned, specified, or intended value of any quantity with uncertainty in its realization.

**nonassociated common-channel signaling** A form of common-channel signaling where the signaling channel serves one or more trunk groups, at least one of which terminates at a point other than the signal transfer point at which the signaling channel terminates. (188) *See also* associated common-channel signaling, common-channel signaling, signal transfer point.

**nonblocking switch** 1. A switch designed in such a manner that there are enough paths across it that an originated call can always reach an idle line without encountering a busy condition on the way. (188) 2. A switching network (system) in which any idle outlet can always be reached from any given inlet under all traffic conditions. (188) *See also* idle state, switching center.

**noncentralized operation** A control discipline for multipoint data communication links in which transmission may be between tributary stations or between the control station and tributary station(s). *See also* communications, link.

**noncritical technical load** That part of the technical load not required for synchronous operation. (188) *See also* load, technical load.

**nonerasable storage** *Synonym* read-only memory.

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**nonlinear distortion** Distortion caused by a deviation from a linear relationship between specified input and output parameters of a system or component. (188) *See also* distortion, linearity.

**nonlinear scattering** Direct conversion of a photon from one wavelength to one or more other wavelengths. In an optical fiber, nonlinear scattering is usually not important below the threshold irradiance for stimulated nonlinear scattering. *Note:* Examples are Raman and Brillouin scattering. *See also* photon.

**nonloaded cable** *See* nonloaded line.

**nonloaded line** Transmission line (cable) that has no intentionally added inductance.

**nonoperational load** Administrative, support, and housing power requirements. (188) *Synonym* utility load.

**nonresonant antenna** *Synonym* aperiodic antenna.

**non-return-to-zero, change-on-ones (NRZ1)** A method of encoding, i.e., data representation, in which "ones" are represented by a change in condition and "zeros" are represented by no change. (188) *See also* code, return-to-zero code.

**non-return-to-zero (NRZ) code** A code form having two states, termed "zero" and "one," and no neutral or rest condition. (188) *Note 1: Contrast with Manchester encoding and return-to-zero code. Note 2: For a given data transmission (bit) rate, the non-return-to-zero code requires only one-half the bandwidth required by the Manchester code. See also* bipolar signal, code, duobinary signal, Manchester encoding, non-return-to-zero change-on-ones, return-to-zero code.

**nonshifted fiber** *Synonym* dispersion-unshifted fiber.

**nonsynchronous data transmission channel** A data channel in which no separate timing

information is transferred between the DTE and the DCE. (188) *See also* channel, clock, network.

**nonsynchronous network** A network in which the clocks do not need to be synchronous or mesochronous. (188) *Synonym* asynchronous network. *See also* clock, network.

**nonsynchronous system** *See* asynchronous transmission.

**nonsynchronous transmission** *See* asynchronous transmission.

**nontechnical load** That part of the total operational load used for general lighting, air conditioning, ventilating equipment, etc., for normal operation. (188) *See also* air conditioning, operational load, plant.

**normalized frequency (V)** 1. In fiber optics, a dimensionless quantity,  $V$ , given by  $V = (2\pi a/\lambda)(n_1^2 - n_2^2)^{1/2}$ , where  $a$  is the fiber core radius,  $\lambda$  is the wavelength in vacuum, and  $n_1$  and  $n_2$  are the maximum refractive indices in the core and homogeneous cladding, respectively. *Note:* In a fiber having a power-law profile, the approximate number of bound modes is  $(V^2/2)[g/(g+2)]$ , where  $g$  is the profile diameter. For single-mode operation,  $V \leq 2.405$ . *Synonym* V number. 2. The ratio between an actual frequency and its nominal value. (188) *See also* bound mode, core, frequency, mode volume, parabolic profile, power-law index profile.

**normalized offset** The offset divided by the nominal value. *Synonyms* fractional offset, relative offset.

**notched filter** *Synonym* band-stop filter.

**notched noise** Noise in which a narrow band of frequencies has been removed. (188) *Note:* Normally used for testing devices or circuits. *See also* noise.

**not-ready condition** A steady-state condition at the DTE/DCE interface, which denotes that the DCE is not ready to accept a call request

signal or that the DTE is not ready to accept an incoming call. (188) *See also* call restriction, data circuit-terminating equipment, data terminal equipment, data transfer request signal, on-hook, on-hook signal.

**Np** *Abbreviation for neper.*

**NRI** *Abbreviation for net radio interface.*

**NRZ** *Abbreviation for non-return-to-zero. See non-return-to-zero code.*

**NRZI** *Abbreviation for non-return-to-zero, change-on-ones.*

**NS/EP telecommunications** Telecommunications services that are used to maintain a state of readiness or to respond to and manage any event or crisis (local, national, or international) that causes or could cause injury or harm to the population, damage to or loss of property, or degrade or threaten the national security /or emergency preparedness posture of the United States. *See also* priority level, priority level assignment, private NS/EP telecommunications services, restoration, service identification, service user, Telecommunications Service Priority service, Telecommunications Service Priority system.

**NTI** *Abbreviation for network terminating interface.*

**NTN** *Abbreviation for network terminal number.*

**NTSC standard** *Abbreviation for National Television Standards Committee standard. The North American standard for the generation, transmission, and reception of television communication wherein the 525-line picture is the standard. Note 1:* The picture information is transmitted in AM and the sound information is transmitted in FM. Compatible with CCIR Standard M. *Note 2:* This standard is used also in Central America, a number of South American countries, and some Asian countries, including Japan. *See also* PAL, PAL-M, SECAM, teleconference, television.

**nuclear hardness** A quantitative description of the physical attributes of a system or component that will allow survivability in a given nuclear weapon environment. *Note:* Hardness is measured by physical quantities such as overpressure, peak velocities, energy absorbed, and electrical stress. Hardness is achieved through design specifications and is verified by one or more test and analysis techniques.

**null 1.** A dummy letter, letter symbol, or code group inserted in an encrypted message to delay or prevent its solution, or to complete encrypted groups for transmission or transmission security purposes. **2. Synonym node** (def. #4). **3.** Of an antenna radiation pattern, a specific direction in which the radiated power of a transmitting antenna (or response sensitivity of a receiving antenna) approaches zero in relation to the radiated power in the main beam (or desired direction). *Note:* Often the null has a narrow directivity (angle) compared to that of the main beam, and this can be used for desirable purposes such as radio navigation or prevention of interfering signals in a given direction.

**numerical aperture (NA)** **1.** The sine of the vertex angle of the largest cone of meridional rays that can enter or leave an optical system or element, multiplied by the refractive index of the medium in which the vertex of the cone is located. The NA is generally measured with respect to an object or image point and will vary as that point is moved. **2.** For an optical fiber in which the refractive index decreases monotonically from  $n_1$  on the axis to  $n_2$  in the cladding, the numerical aperture is given by  $NA = (n_1^2 - n_2^2)^{1/2}$ . (188) **3. Colloquially,** the sine of the radiation or acceptance angle of an optical fiber, multiplied by the refractive index of the material in contact with the exit or entrance face. This usage is approximate and imprecise, but is often encountered. *See also* acceptance angle, fiber optics, launch numerical aperture, meridional ray, radiation angle, radiation pattern.

**NXX code** In the North American direct distance dialing numbering plan, a central



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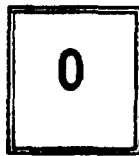
office code of three digits that designates a particular central office or a given 10,000-line unit of subscriber lines; "N" is any number from 2 to 9, and "X" is any number from 0 to 9. *See also* access code, code.

**Nyquist interval** The maximum time interval between regularly spaced samples of a signal that will permit the signal waveform to be completely determined. (188) *Note 1:* It is equal to the reciprocal of twice the bandwidth of the sampled signal. *Note 2:* In practice, when analog signals are sampled for the purpose of digital transmission or other processing, the sampling rate must be more frequent than that defined by Nyquist's theorem, because of quantization error introduced by the digitizing process. The required sampling rate is determined by the accuracy of the digitizing process. *See also* bandwidth, sampling rate, signal sampling.

**Nyquist rate** The reciprocal of the Nyquist interval. *Note:* This is the minimum sampling rate given by Nyquist's theorem. *See also* sampling rate.

**Nyquist's theorem** A theorem, developed by H. Nyquist, which states that an analog signal waveform may be uniquely reconstructed, with no error, from samples taken at equal time intervals. The sampling rate must be equal to, or greater than, twice the highest frequency component in the analog signal. *See also* Nyquist interval, Nyquist rate, sampling rate, signal sampling.

**OCC** *Abbreviation for other common carrier.*



**occupancy** The amount of time that a circuit or switching facility is in use. *Note:* Normally expressed as a percentage, occupancy represents the actual usage versus the maximum amount of time available during a 1-hour period. *Synonym usage.*

**occupied bandwidth** The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage,  $B/2$ , of the total mean power of a given emission. Unless otherwise specified by the CCIR for the appropriate class of emission, the value of  $B/2$  should be taken as 0.5%. (RR) (188) *Note 1:* The percentage of the total power outside the occupied bandwidth is represented by  $B$ . *Note 2:* In some cases, e.g., multichannel frequency-division multiplexing systems, use of the 0.5 percent limits may lead to certain difficulties in the practical application of the definition of occupied and necessary bandwidth; in such cases, a different percentage may prove useful. *See also* bandwidth, frequency, necessary bandwidth, nominal bandwidth, rf bandwidth.

**OCR** *Abbreviation for optical character reader, optical character recognition.*

**octet** A byte of eight binary digits usually operated upon as an entity. (188) *See also* binary digit, byte.

**octet alignment** The configuration of a field composed of an integral number of octets. If the field is not divisible by eight, bits (usually zeros) are added to either the first octet (left justification) or the last octet (right justification). *See also* binary digit, byte.

**OD** *Abbreviation for optical density.*

**odd-even check** *Synonym* parity check.

**odd parity** *See* parity, parity check.

**off-hook** 1. In telephone operations, the condition existing when the receiver or handset is removed from its switch. (188) *See also* dial tone. 2. One of two possible signaling states; e.g., tone or no tone, ground connection or battery connection. (188) 3. The active state (closed loop) of a subscriber or PBX user loop. (188) 4. An operating state of a data arrangement in which the communication link is enabled for voice and data communication or network signaling. *See also* on-hook, open circuit (def. #2).

**off-hook service** The automatic establishment of a connection between specified users as a result of lifting the handset off the hook. (188) *Synonym* automatic signaling service. *See also* dedicated circuit, hot line, permanent signal, permanent virtual circuit.

**off-hook signal** In telephone switching, a signal indicating seizure, request for service, or a busy condition. (188) *See also* call, call control signal, dial tone, seizure signal, signal.

**office classification** Prior to divestiture, those numbers that were assigned to offices according to their hierarchical function in the U.S. public switched telephone network. The following class numbers are used:

- Class 1: Regional Center (RC)
- Class 2: Sectional Center (SC)
- Class 3: Primary Center (PC)
- Class 4: Toll Center (TC) if operators present, otherwise Toll Point (TP)
- Class 5: End Office (EO) [local central office]

*Note:* Any one center handles traffic from one to two or more centers lower in the hierarchy. Since divestiture, these designations have become less firm. *See also* central office, network, switching center.

**off-line** That condition wherein devices or subsystems are not connected into, do not form a part of, and are not subject to the same controls as an operational system. These devices may, however, be operated

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independently. (188) *See also* extension facility, node (def. #1).

**off-line recovery** The process of recovering nonprotected message traffic by use of an off-line processor or central processing unit. (188) *See also* monitoring.

**off-line storage** Storage that is not under the control of a processing unit. (FP)

**off-net calling** That process wherein telephone calls that originate or pass through private switching systems in transmission networks are extended to stations in the commercial telephone system. (188) *See also* call.

**off-premises extension (OPX)** An extension telephone, PBX station, or key system station located on property that is not contiguous with that on which the main telephone, PBX, or key system is located. *See also* extension facility, on-premises extension.

**off-the-shelf** Pertaining to equipment already manufactured and available for delivery from stock. (188)

**off-the-shelf item** An item that has been developed and produced to military or commercial standards and specifications, is readily available for delivery from an industrial source, and may be procured without change to satisfy a military requirement. (JCS1-DoD) *Note:* The same definition applies to civil-sector procurement.

**oligarchically synchronized network** A synchronized network in which the timing of all clocks is controlled by a selected few clocks. *See also* democratically synchronized network, hierarchically synchronized network, master-slave timing, mutually synchronized network, mutual synchronization.

**Omega** A global radio navigation system that provides position information by measuring phase difference between signals radiated by a network of eight transmitting stations deployed worldwide. (188) *Note:* The transmitted signals time-share transmission on frequencies

of 10.2, 11.05, 11.33, and 13.6 kHz. Since the transmissions are coordinated with UTC (USNO), they also provide time reference.

**omnidirectional antenna** An antenna whose pattern is nondirectional in azimuth. (188) *Note:* The vertical pattern may be of any shape. *See also* antenna, antenna lobe.

**omnidirectional range station** A radionavigation land station in the aeronautical radionavigation service providing direct indication of the bearing (omni-bearing) of that station from an aircraft. (NTIA)

**ONA** *Abbreviation for open network architecture.*

**on-board communication station** A low-powered mobile station in the maritime mobile service intended for use for internal communications on board a ship, or between a ship and its lifeboats and life rafts during lifeboat drills or operations, or for communication within a group of vessels being towed or pushed, as well as for line handling and mooring instructions. (RR) *See also* mobile station.

**144-line weighting** In telephone systems, a noise weighting used in a noise measuring set to measure noise on a line that would be terminated by an instrument with a No. 144-receiver, or a similar instrument. (188) *Note:* The meter scale readings are in dBrn(144-line). *See also* C-message weighting, flat weighting, F1A-line weighting, HA1-receiver weighting.

**144-receiver weighting** In telephone systems, a noise weighting used in a noise measuring set to measure noise across the receiver of an instrument equipped with a No. 144-receiver. (188) *Note:* The meter scale readings are in dBrn(144-receiver). *See also* C-message weighting, flat weighting, HA1-receiver weighting.

**one-way communication** A mode of communication such that information is always transferred in one preassigned direction only and not necessarily constrained to one

transmission path, e.g., broadcast stations, one-way intercom systems, and wireline news services.

**one-way-only channel** A channel capable of operation in only one direction, which is fixed and cannot be reversed. (188) *Synonym* unidirectional channel. *See also* channel, simplex circuit, simplex operation.

**one-way operation** *Synonym* simplex operation (def. #1).

**one-way reversible operation** *Synonym* half-duplex operation.

**one-way trunk** A trunk between two switching centers, or between switching centers and subscriber stations, over which traffic may be originated from one preassigned location only. (188) *Note 1:* The traffic may consist of two-way communications; the expression "one way" refers only to the constraint on the location that may originate a call. *Note 2:* At the originating end, the one-way trunk is known as an "outgoing trunk"; at the other end, it is known as an "incoming trunk". *See also* trunk.

**on-hook** 1. In telephone operation, the condition existing when the receiver or handset is resting on the switch. (188) 2. One of two possible signaling states, e.g., tone or no tone, ground connection or battery connection. (188) 3. The idle state (open loop) of a subscriber or PBX line loop. (188) 4. An operating state of a data arrangement in which the communication link is disabled; the data arrangement presents a defined, high impedance to the network, and usually is configured to be sensitive to ring signals. *See also* idle state, not-ready condition, off-hook.

**on-hook signal** In telephone switching, a signal indicating a disconnect, unanswered call, or an idle condition. (188) *See also* call, call control signal, idle state, not-ready condition, signal.

**on-line** That condition wherein devices or subsystems are connected into, form a part of, and are subject to the same controls as an

operational system. (188) *See also* extension facility, on-premises extension.

**on-line computer system** A computer system that is a part of, or embedded in, a larger entity and that functions within that entity to obtain inputs and provide outputs. *Note:* Generally, an on-line computer interacts in real or near real time with its system and its users. *See also* multiprocessing, time-sharing.

**on-premises extension** An extension telephone, PBX station, or key system station located on property that is contiguous with that on which the main telephone, PBX, or key system is located. *See also* extension facility, off-premises extension, on-line.

**on-premises wiring** Customer-owned metallic or optical-fiber communications transmission lines, installed within or between buildings. *Note:* On-premises wiring comprises horizontal wiring and backbone wiring, and extends from the external network interface to the user work station areas. It includes the total communications wiring to transport current or future data, voice, LAN, and image information.

**open circuit** 1. In electrical engineering, a loop or path that contains an infinite impedance. 2. In communications, a circuit available for use. (188) *See also* circuit, off-hook.

**open network architecture (ONA)** In the context of the FCC's Computer Inquiry III, the overall design of a communication carrier's basic network facilities and services to permit all users of the basic network to interconnect to specific basic network functions and interfaces on an unbundled, equal-access basis. *Note:* The ONA concept consists of three integral components: (a) basic serving arrangements (BSAs), (b) basic service elements (BSEs), and (c) complementary network services.

**open system** A system whose characteristics comply with specified, publicly maintained, readily available standards and that therefore can be connected to other systems that comply

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with these same standards. (After FP) (After ISO)

**Open Systems Interconnection (OSI)** A logical structure for network operations standardized within the ISO; a seven-layer network architecture being used for the definition of network protocol standards to enable any OSI-compliant computer or device to communicate with any other OSI-compliant computer or device for a meaningful exchange of information.

**Open Systems Interconnection (OSI) architecture** Network architecture that adheres to that particular set of ISO standards that relates to Open Systems Architecture.

**Open Systems Interconnection (OSI)--Protocol Specifications** The lowest level of abstraction within the OSI standards scheme. Each OSI-Protocol Specification operates at a single layer. Each defines the primitive operations and permissible responses required to exchange information between peer processes in communicating systems to carry out all or a subset of the services defined within the OSI-Service Definitions for that layer.

**Open Systems Interconnection--Reference Model (OSI-RM)** An abstract description of the digital communications between application processes running in distinct systems. The model employs a hierarchical structure of seven layers. Each layer performs value-added service at the request of the adjacent higher layer and, in turn, requests more basic services from the adjacent lower layer:

(a) **Physical Layer:** Layer 1, the lowest of seven hierarchical layers. The Physical layer performs services requested by the Data Link Layer. The major functions and services performed by the physical layer are: (a) establishment and termination of a connection to a communications medium; (b) participation in the process whereby the communication resources are effectively shared among multiple users, e.g., contention resolution and flow control; and, (c) conversion between the representation of digital data in user equipment and the corresponding signals transmitted over a communications channel.

(b) **Data Link Layer:** Layer 2. This layer responds to service requests from the Network Layer and issues service requests to the Physical Layer. The Data Link Layer provides the functional and procedural means to transfer data between network entities and to detect and possibly correct errors that may occur in the Physical Layer. *Note:* Examples of data link protocols are HDLC and ADCCP for point-to-point or packet-switched networks and LLC for local area networks.

(c) **Network Layer:** Layer 3. This layer responds to service requests from the Transport Layer and issues service requests to the Data Link Layer. The Network Layer provides the functional and procedural means of transferring variable length data sequences from a source to a destination via one or more networks while maintaining the quality of service requested by the Transport Layer. The Network Layer performs network routing, flow control, segmentation/desegmentation, and error control functions.

(d) **Transport Layer:** Layer 4. This layer responds to service requests from the Session Layer and issues service requests to the Network Layer. The purpose of the Transport Layer is to provide transparent transfer of data between end users, thus relieving the upper layers from any concern with providing reliable and cost-effective data transfer.

(e) **Session Layer:** Layer 5. This layer responds to service requests from the Presentation Layer and issues service requests to the Transport Layer. The Session Layer provides the mechanism for managing the dialogue between end-user application processes. It provides for either duplex or half-duplex operation and establishes checkpointing, adjournment, termination, and restart procedures.

(f) **Presentation Layer:** Layer 6. This layer responds to service requests from the Application Layer and issues service requests to the Session Layer. The Presentation Layer relieves the Application Layer of concern regarding syntactical differences in data representation within the end-user systems. *Note:* An example of a presentation service would be the conversion of an EBCDIC-coded text file to an ASCII-coded file.



**(g) Application Layer: Layer 7.** The highest layer. This layer interfaces directly to and performs common application services for the application processes; it also issues requests to the Presentation Layer. The common application services provide semantic conversion between associated application processes. *Note:* Examples of common application services of general interest include the virtual file, virtual terminal, and job transfer and manipulation protocols.

**Open Systems Interconnection (OSI)--Service Definitions** The next lower level of abstraction below that of the OSI--Reference Model. The OSI--Service Definitions for each layer define the layer's abstract interface and the facilities provided to the user of the service independent of the mechanism used to accomplish the service.

**Open Systems Interconnection (OSI)--Systems Management Functions in the Application Layer** related to the management of various OSI resources and their status across all layers of the OSI architecture.

**open wire** Conductors that typically are separately supported with insulators on poles or towers above the surface of the Earth. (188) *Note 1:* Open wire conductors may be insulated or uninsulated. *Note 2:* Open wire may be used in both communication applications and power applications. *See also* twin cable, two-wire circuit.

**operand** An entity on which an operation is performed. (FP) (ISO) *See also* operation.

**operating system** An integrated collection of routines that service the sequencing and processing of programs by a computer. *Note:* Operating systems provide a central control to users and programs, performing input, output, accounting, resource allocation, storage assignment, and other system-related functions. (188)

**operating time** 1. The time interval from the occurrence of a specified input condition to a system and the completion of a specified

operation. 2. In telephone or computer systems, the elapsed time between the request for service from a user and the final release by either user of all facilities. (188) *See also* duty cycle, operational service state, reliability.

**operation** 1. The method, act, process, or effect of using a device or system. (188) 2. A well-defined action that, when applied to any permissible combination of known entities, produces a new entity, e.g., the process of addition in arithmetic--in adding 5 and 3 to obtain 8, the numbers 5 and 3 are the operands, the number 8 is the result, and the plus sign is the operator indicating that the operation performed is addition. (FP) (ISO) 3. A program step, usually specified by the operation part of an instruction, that is undertaken or executed by a computer, e.g., addition, multiplication, extraction, comparison, shift, transfer. (FP) *See also* instruction, operand.

**operational load** The total power requirements for communication facilities. (188) *See also* disconnect switch, load, nontechnical load, technical load.

**operational research** *Synonym* operations research.

**operational service period** A performance measurement period, or succession of performance measurement periods, during which a telecommunication service remains in an operational service state. (188) *Note:* An operational service period begins at the beginning of the performance measurement period in which the telecommunications service enters the operational service state, and ends at the beginning of the performance measurement period in which the telecommunications service leaves the operational service state. *See also* continuous operation, outage duration, performance measurement period.

**operational service state** A telecommunications service condition defined to exist (*a posteriori*) during any performance measurement period over which the calculated values of specified supported performance parameters are equal to

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or better than their associated outage thresholds. (188) *See also* operating time, outage, performance parameter.

**operations analysis** *Synonym* operations research.

**operations research** 1. The design of models for complex problems concerning the optimal allocation of available resources and the application of mathematical methods for solving those problems. (FP) (ISO) 2. The analytical study of military problems undertaken to provide responsible commanders and staff agencies with a scientific basis for decision on action to improve military operations. (JCS1-DoD) *Synonyms* operational research, operations analysis.

**operations security (OPSEC)** A process of analyzing friendly actions attendant to military operations and other activities to (a) identify those actions that can be observed by adversary intelligence systems; (b) determine indicators hostile intelligence systems might obtain that could be interpreted or pieced together to derive critical information in time to be useful to adversaries; (c) select and execute measures that eliminate or reduce to an acceptable level the vulnerabilities of friendly actions to adversary exploitation. (JCS1-DoD)

**operations security (OPSEC) assessment** A process of analyzing information and indicator sources associated with operations and other activities to evaluate and improve the effectiveness of an organization in protecting its critical information from adversaries. *Note:* Operations security techniques include: (a) identifying critical information that must be protected. (b) identifying indicators of information that can be observed or obtained by adversaries that could be interpreted or pieced together to derive critical information in time to be useful to adversaries, and (c) selecting and recommending measures that eliminate or reduce the vulnerabilities of friendly actions or information to adversary exploitation. *See also* operations security, operations security survey.

**operations security (OPSEC) survey** A thorough on-site examination of an operation or activity to determine if there are vulnerabilities that would permit adversaries' exploitation of critical information during the planning, preparation, execution, and post-execution phases of any operation or activity. *See also* operations security, operations security assessment.

**OPSEC** *Acronym for* operations security.

**optical attenuator** In optical communications, a device used to reduce the intensity of the optical signal. *Note:* In some optical attenuators used in optical fiber systems, the amount of attenuation depends on the modal distribution of the optical signal.

**optical axis** 1. In a lens element, the straight line that passes through the centers of curvature of the lens surfaces. In an optical system, the line formed by the coinciding principal axes of the series of optical elements. (JCS1-DoD) (JCS1-NATO) 2. For an optical fiber, *synonym* fiber axis. *See also* bandwidth, fiber optics, optical fiber.

**optical beamsplitter** *See* beamsplitter.

**optical blank** A casting consisting of an optical material molded into the desired geometry for grinding; polishing; or, in the case of some optical fiber manufacturing processes, drawing to the final optical/mechanical specifications. *See also* preform.

**optical branching device** *See* optical fiber branching device.

**optical cable** *Synonym* optical fiber cable.

**optical cable assembly** *See* cable assembly.

**optical cavity** A region bounded by two or more reflecting surfaces, referred to as mirrors, or cavity mirrors, whose elements are aligned to provide multiple reflections of lightwaves. *Note:* The resonator in a laser is an optical cavity. *In this sense, synonym* resonant cavity. *See also* active laser medium, laser.

- optical character reader (OCR)** A device employed for optical character recognition.
- optical character recognition (OCR)** The machine identification of printed characters through use of light-sensitive devices. (188) *See also* character.
- optical combiner** A passive device in which power from several input fibers is distributed among a smaller number (one or more) of output fibers. (188) *See also* fiber optics, star coupler.
- optical conductor** *Deprecated synonym for optical fiber.*
- optical connector** *See optical fiber connector.*
- optical coupler** *See optical fiber coupler.*
- optical density (OD)** A measure of the transmittance of an optical element expressed by  $\log_{10}(1/T)$  where T is transmittance. The analogous term  $\log_{10}(1/R)$  is called the reflection density. (188) *Note:* The higher the optical density, the lower the transmittance. Optical density times 10 is equal to transmission loss expressed in decibels, e.g., an optical density of 0.3 corresponds to a transmission loss of 3 dB. *See also* transmission loss, transmittance.
- optical detector** A transducer that generates an output signal when irradiated with optical power. (188) *See also* optoelectronic.
- optical dispersion** *See dispersion.*
- optical fiber** Any filament or fiber, made of dielectric materials, that guides light, whether or not it is used to transmit signals. (188) *Synonyms* lightguide, optical conductor (*deprecated*). *See also* cladding, cladding mode, fiber optics, multimode optical fiber, optical fiber cable, single-mode optical fiber.
- optical fiber branching device** A device possessing three or more ports which acts to share light among its ports in a predetermined fashion without any modification, manipulation, or amplification of the input signal. *Note:* Types include: unidirectional, bidirectional, symmetrical and asymmetrical branching devices. *Synonym* passive optical fiber branching device. *See also* optical fiber coupler (def. #1).
- optical fiber cable** A fiber, multiple fibers, or fiber bundle in a structure fabricated to meet optical, mechanical and environmental specifications. *Synonym* optical cable. *See also* cable assembly.
- optical fiber connector** A device whose purpose is to transfer optical power between two optical fibers or bundles, and that is designed to be connected and disconnected repeatedly. *Note:* This term may be abbreviated to "connector" when used in documents that discuss only optical fiber connectors. *See also* multifiber joint, optical fiber coupler.
- optical fiber coupler** 1. A device whose purpose is to distribute optical power among two or more ports. *See also* optical fiber branching device, star coupler, tee coupler. 2. A device whose purpose is to couple power between a fiber and a source or detector.
- optical fiber link** A communication link that transmits signals by means of modulated light propagated in an optical fiber. (188) *See also* fiber optics, link (def. #1), optical repeater.
- optical fiber preform** *See preform.*
- optical fiber ribbon** A cable of optical fibers laminated in a flat plastic strip. (188) *See also* optical fiber cable.
- optical fiber splice** A permanent joint whose purpose is to couple optical power between two fibers. *See also* fusion splice, joint, mechanical splice.
- optical fiber waveguide** *See optical fiber.*
- optical filter** An element that selectively transmits or blocks a range of wavelengths.

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**optical interface** Within an optical fiber communications link, any point at which an optical signal is passed from one equipment or medium to another without conversion to an electrical signal.

**optical isolator** A short length of optical fiber inserted into a communication system to provide electrical isolation between two or more parts of the system. (188) *Note:* Often used to provide nonmetallic entry and/or exit from secure areas. *Synonym* opto-isolator. *See also* fiber optics, optoelectronic.

**optical junction** Any physical interface in a fiber optic system. (188) *Note:* Source to fiber, fiber to fiber, fiber to detector, beam to prism (or lens), fiber to lens, lens to fiber, are examples of optical junctions. *See also* fiber optics, interface, optical fiber connector, optical fiber coupler, optical fiber splice.

**optical line code** Sequences of optical pulses suitably structured to permit information transfer over the optical link.

**optical link** Any optical transmission channel designed to connect two end terminals or to be connected in series with other channels. (188) *Note:* Sometimes terminal hardware, e.g., transmitter/receiver modules, is considered part of an optical link. *See also* fiber optics, link (def. #1), optical transmitter.

**optically active material** A material that can rotate the polarization of light that passes through it. (188) *Note:* An optically active material exhibits different refractive indices for left and right circular polarizations (circular birefringence). *See also* birefringence.

**optical path length** In a medium of constant refractive index,  $n$ , the product of the geometric distance and the refractive index. If  $n$  is a function of position, optical path length is the integral of  $nds$ , where  $ds$  is an element of length along the path. (188) *Note:* Optical path length is proportional to the phase shift a light wave undergoes along a path. *See also* optical thickness.

**optical power** *Colloquial synonym for radiant power.*

**optical receiver** A device that detects an optical signal, converts it to an electrical signal, and processes the electrical signal, as required for use by the terminal electronics. (188) *See also* fiber optics.

**optical repeater** In an optical communication system, an optoelectronic device or module that receives an optical signal, amplifies it (or, in the case of a digital signal, reshapes, retimes, or otherwise reconstructs it), and retransmits it as an optical signal. (188) *See also* fiber optics.

**optical source** A device that provides optical power, usually by converting other forms of power to optical power. *See also* source efficiency.

**optical spectrum** Generally, the electromagnetic spectrum within the wavelength region extending from the vacuum ultraviolet at 1 nm to the far infrared at 0.1 mm. *Note:* The term was originally applied to that region of the electromagnetic spectrum visible to the normal human eye, but is now considered to include all wavelengths between the shortest wavelengths of radio and the longest of X-rays. *See also* emissivity, infrared, light.

**optical splitter** *See* beamsplitter.

**optical system power margin** *See* system power margin.

**optical thickness** 1. The product of the physical thickness of an isotropic optical element and its refractive index. 2. The total optical path length (the physical thickness) through an optical element. (188) *See also* optical path length.

**optical time domain reflectometer (OTDR)** A measurement device used to characterize an optical fiber wherein an optical pulse is transmitted through the fiber and the resulting light that is scattered and reflected back to the input is measured as a function of time. *Note:* Useful in estimating the attenuation coefficient

as a function of distance, identifying defects and other localized losses, and measuring fiber length. *See also* fiber optics.

**optical transmittance** *See* transmittance.

**optical transmitter** A device that accepts an electrical signal as its input, processes this signal, and uses it to modulate an optoelectronic device, such as an LED or an injection laser diode, to produce an optical signal capable of being transmitted via an optical transmission medium. (188) *See also* fiber optics, optical link.

**optical waveguide** 1. Any structure having the ability to guide the flow of optical energy along a path parallel to its axis and, at the same time, to contain the energy within, or adjacent to, its surface. (188) 2. In optical communications, generally a fiber designed to transmit optical signals. *See also* optical fiber.

**optimum traffic frequency (FOT)** The highest frequency that is predicted to be available for skywave transmission over a particular path at a particular hour for 90 percent of the days of the month. (188) *Note:* The FOT is normally just below the value of the maximum usable frequency (MUF). *See also* frequency.

**optoelectronic** Pertaining to any device that functions as an electrical-to-optical or optical-to-electrical transducer, or an instrument that employs such a device in its operation. (188) *Note 1:* Photodiodes, LEDs, injection laser diodes, and integrated optical circuit (IOC) elements are examples of optoelectronic devices commonly used in optical fiber communications. *Note 2:* "Electro-optical" is often erroneously used as a synonym. *See also* electro-optic effect, optical detector, optical source.

**optoelectronic device** *See* optoelectronic.

**opto-isolator** *Synonym* optical isolator.

**OPX** *Abbreviation for* off-premises extension.

**orbit** The path, relative to a specified frame of reference, described by the center of mass of a satellite or other object in space subjected primarily to natural forces, mainly the force of gravity. (RR)

**order of diversity** The number of independently fading propagation paths or frequencies, or both, used in diversity reception. (188) *See also* diversity reception, dual diversity, quadruple diversity.

**orderwire circuit** A voice or data circuit used by technical control and maintenance personnel for coordination and control action relative to activation, deactivation, change, rerouting, reporting, and maintenance of communication systems and services. (188) *Synonyms* engineering channel, service channel. *See also* circuit, engineering orderwire, express orderwire, link orderwire, local orderwire, maintenance control circuit, supervisory signals.

**orderwire multiplex** A multiplex carrier set specifically designed for the purpose of carrying orderwire traffic, as opposed to one designed for carrying mission traffic. (188) *See also* multiplexing, orderwire circuit.

**originating user** The user who initiates a particular information transfer transaction. *Note:* The originating user may be either the source user or the destination user. *See also* access originator, communications source.

**originator** *See* access originator, disengagement originator.

**originator-to-recipient speed of service** *Synonym* speed of service (def. #1).

**orthogonal multiplex** A method of combining two or more digital signals whose pulses are mutually independent, thus avoiding intersymbol interference. (188) *See also* intersymbol interference, multiplexing.

**orthomode transducer** A device forming part of an antenna feed and serving to combine or separate orthogonally polarized signals.



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**oscillator** An electronic circuit designed to produce an ideally stable alternating voltage or current.

**OSI** *Abbreviation for Open Systems Interconnection.*

**OSI-RM** *Abbreviation for Open Systems Interconnection--Reference Model.*

**OTDR** *Abbreviation for optical time-domain reflectometer.*

**other common carrier (OCC)** A specialized common carrier, domestic and/or international record carrier, or domestic satellite carrier engaged in providing services authorized by the Federal Communications Commission. *See also* common carrier, divestiture, resale carrier, specialized common carrier.

**outage** A telecommunication service condition wherein a user is completely deprived of service due to any cause within the communication system. (188) *Note:* For a particular system, "outage" may be defined in terms of minimum acceptable performance. *See also* continuous operation, degraded service state, failure, operational service state, performance measurement period, performance parameter.

**outage duration** That period of time between the onset of an outage and the restoration of service. (188) *See also* downtime, mean time to service restoral, operational service period.

**outage probability** The probability that the outage state will occur within a specified time period. *See also* outage ratio, performance measurement period.

**outage ratio** The sum of all the outage durations divided by the time period of measurement. *See also* performance measurement period.

**outage state** *See* outage.

**outage threshold** *See* system operational threshold.

**out-of-band emission** Emission on a frequency or frequencies immediately outside the necessary bandwidth, which results from the modulation process, but excluding spurious emission. (RR) *See also* emission.

**out-of-band signaling** 1. The transmission of signaling via a different channel (either FDM or TDM) from that used for the primary information transfer. (188) 2. Signals using a portion of the channel bandwidth provided by the medium such as the carrier channel, but denied to the speech or intelligence path by filters. *Note:* This results in a reduction of the effective available bandwidth. *See also* bandwidth, channel, channel-associated signaling, common-channel signaling, frequency, in-band signaling, retrieval, signal.

**out-of-frame-alignment time** The time during which frame alignment is effectively lost. (188) *Note:* The out-of-frame-alignment time includes the time to detect loss of frame alignment and the alignment recovery time. *See also* frame.

**outputting** The process of transmitting digital address information over a trunk from one switching center or switchboard to another. (188) *See also* pulse, pulse train, pulsing, system signaling and supervision.

**output** 1. Information retrieved from a functional unit or from a network, usually after some processing. (FP) 2. An output state, or sequence of states. (FP) (ISO) 3. Pertaining to a device, process, or channel involved in the production of data by a computer or by any of its components. (FP) (ISO)

**output angle** *Synonym* radiation angle.

**output rating** 1. The power available at the output terminals of a transmitter when connected to the normal load or its equivalent. (188) 2. Under specified ambient conditions, the power that can be delivered by a device over a long period of time without overheating. (188) *See also* peak power output, power, rated output power.

**outside plant** 1. In telephony, all cable, poles, ducts, conduits, wire, repeaters, load coils, and other equipment located between the main distribution frame of the switching entity and the entrance to another switching entity or a premises serving the user's equipment. 2. For the DoD, that portion of intrabase communication systems extending from the main distribution frame outward to a user's end instrument or to the terminal connections for these instruments. (188) *See also* access point, aerial cable, direct-buried cable, facility, inside plant, underground cable.

**out-slot signaling** Signaling performed in digit time slots that are not within the channel time slot. *See also* bit robbing, channel time slot, in-slot signaling, signaling, signaling time slot.

**outward dialing** *See* network outward-dialing.

**ovality** A term used to specify or define the deviation of the cross-section (of the core or cladding) of an optical fiber from perfect circularity. *Note 1:* The cross-section is assumed, to a first approximation, to be elliptical. The ovality is then defined as  $2(a-b)/(a+b)$ , where  $a$  is the major axis length and  $b$  is the minor axis length. The above fraction is often multiplied by 100, to express ovality as a percentage. *Note 2:* Ovality may also be defined or specified by the use of a tolerance field consisting of two concentric circles, within which the cross-section boundary must lie. *See also* concentricity error, tolerance field.

**overflow** 1. Generally, the generation of potential traffic beyond the capacity of a system or subsystem. (188) 2. A count of telephone call attempts made on busy groups of trunks or access lines. *See also* high-usage trunk group, traffic overflow. 3. Traffic handled by overflow equipment. 4. Traffic that exceeds the capacity of the switching equipment and is therefore lost. (188) 5. Excess traffic on a particular route, which is offered to another (alternate) route. (188) 6. A condition existing within a digital computer resulting from an attempt to calculate a value that exceeds the numbering capacity of the

machine. (188) *Synonym* arithmetic overflow. *See also* underflow.

**overhead bit** Any bit other than a user information bit. (188) *See also* binary digit, front-end processing, maximum stuffing rate, overhead information, service bit, user information bit.

**overhead communications** *See* overhead bit.

**overhead information** Digital information transferred across the functional interface separating a user and a telecommunication system (or between functional entities within a telecommunication system) for the purpose of directing or controlling the transfer of user information and/or the detection and correction of errors. (188) *Note:* Overhead information originated by the user is not considered as system overhead information. Overhead information generated within the system and not delivered to the user is considered as system overhead information. Thus, user throughput is reduced by both overheads while system throughput is only reduced by system overhead. *See also* block transfer efficiency, check bit, check character, check digit, delivered overhead bit, delivered overhead block, header, overhead bit, service bit.

**overlay** 1. One of several segments of a computer program that, during execution, occupy the same area of main storage, one segment at a time. (FP) (ISO) 2. To load an overlay. (FP) (188) *See also* computer, patching (def. #2).

**overload point** *Synonym* load capacity.

**overmodulation** 1. The condition that prevails when the instantaneous level of the modulating signal exceeds the value necessary to produce 100 percent of modulation of the carrier, resulting in distortion of the output signal, and of the recovered modulating signal. 2. A condition in which the mean level of the modulation signal is such that the peak value of the signal exceeds the value necessary to produce 100 percent modulation, resulting in

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distortion of the output signal. (188) *See also* distortion, modulation, percentage modulation.

**override** That condition wherein an active circuit is entered or seized for use by a third party. (188) *See also* precedence, seizing.

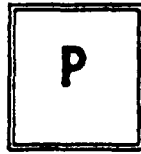
**overshoot** 1. In an amplifier, the increased amplitude of a portion of a nonsinusoidal wave due to the particular characteristics of the circuit. (188) *Note:* Overshoot is valuable in decreasing the response time of a signal, but it causes distortion of that signal. *See also* response time. 2. The result of an unusual atmospheric condition that causes microwave signals to be received where they are not intended. *See also* ducting.

**over-the-horizon radar** A radar system that makes use of the atmospheric reflection and refraction phenomena to extend its range of detection beyond line of sight. Over-the-horizon radars may be either forward scatter or backscatter systems. (JCS1-DoD)

**overtime period** 1. Conversation time, on a charged telephone call, that is greater than the initial period. *Note:* Generally, the time after the first minute. 2. Pertaining to the occupancy time of WATS circuits in excess of the time contracted for in each period. *See also* tariff.

**overtone** Of a sinusoidal wave, an integral multiple of the frequency of the wave, other than the fundamental itself. *Note 1:* The first overtone is twice the frequency of the fundamental, and thus corresponds to the second harmonic; the second overtone is three times the frequency of the fundamental, and thus corresponds to the third harmonic, etc. *Note 2:* Use of this term is generally confined to acoustic waves, especially in applications related to music. *See also* harmonic.

**PABX** *Abbreviation for private automatic branch exchange. Note: Use of the term "PBX" is more common than "PABX," regardless of automation.*



**packet** In data communication, a sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole. The data, control signals, and possibly error control information, are arranged in a specific format. (FP) (ISO) (188) *See also* binary digit, burst switching, format, packet switching, protocol, protocol data unit.

**packet assembler/disassembler (PAD)** A functional unit that enables data terminal equipment not equipped for packet switching to access a packet-switched network. (FP) (ISO)

**packet format** The structure of data and control of information in a packet. (188) *Note: The size and content of the various fields are defined by a set of rules that are used to make up a packet. See also* format (def. #1), protocol.

**packet-mode terminal** Data terminal equipment that can control, format, transmit, and receive packets. (FP) (ISO) (188) *See also* mode (def. #3), packet switching, terminal.

**packet-switched data transmission service** A service that provides the transmission of data in the form of packets. (188) *Note: This service may or may not provide for the assembly and disassembly of data packets. See also* data, data transmission.

**packet switching** The process of routing and transferring data by means of addressed packets so that a channel is occupied during the transmission of the packet only, and upon completion of the transmission the channel is made available for the transfer of other traffic. (FP) (ISO) (188) *See also* channel, circuit switching, compelled signaling, connectionless mode transmission, data, interface message processor, message switching, packet, packet

mode terminal, packet-switching network, public switched network, switching system.

**packet-switching network** A network designed to carry data in the form of packets. *Note: The packet format, internal to the network, may require conversion at a gateway. (188) See also* burst switching, data, packet, packet switching.

**packet transfer mode** A method of information transfer, by means of packet transmission and packet switching, that permits dynamic sharing of network resources among many connections. *See also* connection.

**packing fraction** In a fiber bundle, the ratio of the aggregate fiber cross-sectional core area to the total cross-sectional area. (188) *See also* core, fiber optics.

**packing fraction loss** The optical power loss, usually expressed in decibels, due to the packing fraction's being less than unity. (188) *See also* fiber optics.

**pad** An arrangement of fixed resistors used to reduce the strength of any signal a desired fixed amount without introducing appreciable distortion. (188) *Note: The corresponding adjustable arrangement is called an "attenuator." Synonym* fixed attenuator. *See also* attenuation, L-pad, network.

**PAD** *Acronym for packet assembler/disassembler.*

**pager** A mobile receiver for paging communications, also known as a "beeper." (CFR 47)

**paging** A one-way communications service from a base station to mobile or fixed receivers that provide signaling or information transfer by such means as tone, tone-voice, tactile, optical readout, etc. (CFR 47)

**paired cable** A cable made up of one or more separately insulated twisted-wire pairs, none of which is arranged with others to form quads.

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(188) *See also* cable, quadded cable, shielded pair.

**paired disparity code** A code in which some or all of the characters are represented by two sets of digits of opposite disparity that are used in sequence so as to minimize the total disparity of a longer sequence, e.g., an alternate mark inversion signal. (188) *See also* alternate mark inversion signal.

**pair-gain system** A subscriber transmission system that serves a number of subscribers with a smaller number of wire pairs using concentration, multiplexing, or both. (188) *See also* concentrator (def. #2), multiplexing.

**PAL** *Acronym for phase alternation by line.* A television signal standard (625 lines, 50 hertz, 220 volts primary power) used in the United Kingdom, much of the rest of western Europe, several South American countries, some Middle East and Asian countries, several African countries, Australia, New Zealand, and other Pacific island countries. *See also* NTSC, PAL-M, SECAM.

**PAL-M** A modified version of the phase-alternation-by-line (PAL) television signal standard (525 lines, 50 hertz, 220 volts primary power), used in Brazil. *See also* NTSC, PAL, SECAM.

**PAM** *Abbreviation for pulse-amplitude modulation.*

**PAMA** *Abbreviation for pulse-address multiple access.*

**p/a r** *Abbreviation for peak-to-average ratio.*

**parabolic antenna** An antenna consisting of a parabolic reflector and a radiating or receiving element at or near its focus. (188) *Note:* If the reflector is in the shape of a paraboloid, it is called a paraboloidal reflector; cylindrical paraboloids and partial paraboloids are also used. *See also* antenna.

**parabolic profile** In an optical fiber, a power-law index profile with the profile

parameter,  $g$ , equal to 2. *Synonym* quadratic profile. *See also* graded-index profile, multimode optical fiber, power-law index profile, profile parameter.

**parallel computer** A computer that has multiple arithmetic units or logic units that are used to accomplish parallel operations or parallel processing. (FP) (ISO)

**parallel processing** Pertaining to the concurrent or simultaneous execution of two or more processes in a single unit. (FP) (ISO)

**parallel-to-serial converter** A digital device that converts a group of simultaneous inputs, often constituting a byte or other defined block of data, into corresponding time-sequenced signal elements. *Synonyms* dynamicizer, serializer. *See also* serial-to-parallel converter.

**parallel transmission** The simultaneous transmission of the signal elements of a group representing a character or other data item. (FP) (188) *See also* serial transmission.

**parasitic element** Of an antenna, a directive element that is not connected to a radio transmitter or receiver either directly or via a feeder, but is coupled to the driven element only by the fields. (188) *Synonym* passive element. *See also* antenna, reflective array antenna.

**paraxial ray** In optical systems, a ray that is close to and nearly parallel with the optical axis. (188) *See also* axial ray, light ray.

**parity** In binary-coded systems, the oddness or evenness of the number of ones in a finite binary stream. (188) *Note:* By the addition of one extra bit, a bit stream can be forced to a specified parity state. This is often used as a simple error-detection check, and will detect (but not correct) the occurrences of any single bit error in the field. *See also* block parity.

**parity check** A check that tests whether the number of ones or zeros in an array of binary digits is odd or even. (188) *Note:* Odd parity is standard for synchronous transmission and



even parity for asynchronous transmission. *Synonym* odd-even check. *See also* block parity, check bit, check digit, code, error control.

**par meter** A display meter of the peak-to-average ratio (p/a r) measurement technique developed as a quick means of identifying degraded telephone channels. (188) *Note:* The measurement is very sensitive to envelope delay distortion and is also useful for idle channel noise, nonlinear distortion, and amplitude distortion measurements. *See also* grade of service.

**part 68** The section of Title 47 of the *Code of Federal Regulations* governing the direct connection of telecommunications equipment and premises wiring with the public switched telephone network and certain private line services; e.g., foreign exchange lines (customer premises end), the station end of off-premises stations associated with PBX and Centrex® services, trunk-to-station tie lines (trunk end only), and switched service network station lines (common control switching arrangements); and the direct connection of all PBX (or similar) systems to private line services for tie trunk type interfaces, off-premises station lines, automatic identified outward dialing and message registration. *Note:* These rules provide the technical and procedural standards under which direct electrical connection of customer-provided telephone equipment, systems, and protective apparatus may be made to the nationwide network without causing harm and without a requirement for protective circuit arrangements in the service provider's network.

**passband** The portion of spectrum, between limiting frequencies, that is transmitted with minimum relative loss or maximum relative gain. (188) *Note 1:* The limiting frequencies are defined as those at which the relative intensity or power decreases to a specified normalized fraction (often -3 dB) of the maximum intensity or power. *Note 2:* The difference in hertz is called the bandwidth. *Note 3:* The term applies to all types of equipment and circuits.

**passive communications satellite** *See* communications satellite.

**passive element** *Synonym* parasitic element.

**passive network** A network that does not include a power source. (188) *See also* active network, network.

**passive optical fiber branching device** *Synonym* optical fiber branching device.

**passive repeater** An unpowered device used to route a microwave beam over or around an obstruction. (188) *Note:* For example, two parabolic antennas connected back-to-back, or a flat reflector used as a mirror.

**passive satellite** *See* active satellite.

**passive sensor** A measuring instrument in the Earth-exploration satellite service or in the space research service by means of which information is obtained by reception of radio waves of natural origin. (RR) *See also* active sensor, sensor.

**passive station** On a multipoint connection or a point-to-point connection using basic mode link control, any tributary station waiting to be polled or selected. (FP) (ISO) *See also* node, terminal.

**password** 1. In data communications, a word, character, or combination thereof, that permits access to otherwise inaccessible data, information, or facilities. (188) *See also* log-on. 2. A secret word or distinctive sound used to reply to a challenge. (JCS1-DoD) (JCS1-NATO) 3. A protected, private character string that is used to authenticate an identity. *See also* authenticate, character, communications security.

**password length equation** An equation that determines an appropriate password length,  $M$ , which provides an acceptable probability,  $P$ , that a password will be guessed in its lifetime. *Note:* The password length is given by  $M = (\log S)/(\log N)$  where  $S$  is the size of the password space and  $N$  is the number of

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characters available. The password space is given by  $S = LR/P$ , where  $L$  is the maximum lifetime of a password and  $R$  is the number of guesses per unit of time. *See also* password length parameter.

**password length parameter** A basic parameter affecting the password length needed to provide a given degree of security. *Note 1:* Password length parameters are related by the expression  $P = LR/S$ , where  $P$  is the probability that a password can be guessed in its lifetime,  $L$  is the maximum lifetime a password can be used to log into a system,  $R$  is the number of guesses per unit of time, and  $S$  is the number of unique algorithm-generated passwords (the password space). *Note 2:* The degree of password security is determined by the probability that a password can be guessed in its lifetime.

**patch** 1. To connect communication circuits together temporarily by means of a cord (cable) known as a patch cord. (188) *See also* circuit, connection (def. #1), patch bay, patching. 2. To make a temporary or expedient modification of a program in order to locate and correct an error. (FP) (ISO) 3. To modify an object program without recompiling the source program. (FP)

**patch and test facility (PTF)** An organizational element of a station or terminal facility that functions as a supporting activity under the technical supervision of a designated technical control facility (TCF). (188) *Note:* It performs functions such as quality control checks and tests on equipment, links, and circuits; troubleshooting; activation, changing, and deactivation of circuits; technical coordination; and reporting. *See also* circuit, facility, technical control facility.

**patch bay** An assembly of hardware so arranged that a number of circuits, usually of the same or similar type, appear on jacks for monitoring, interconnecting, and testing purposes. (188) *Note 1:* Patch bays are used at many locations, such as technical control facilities, patch and test facilities, and at telephone exchanges. *Note 2:* Patch bays are often used for special

purposes, such as dc, VF, group, coaxial, equal-level, and digital data circuits. *See also* circuit, dc patch bay, digital circuit patch bay, digital primary patch bay, D-type patch bay, equal level patch bay, interposition trunk, K-type patch bay, MM patch bay, M-patch bay, patch, patch panel, secure voice cord board, voice frequency primary patch bay.

**patching** 1. The temporary connection of circuits by means of cords with plugs inserted into appropriate jacks, or by electronic means. (188) *See also* circuit (def. #1), connection, overlay, patch. 2. The insertion of a program patch in a computer program, routine, or subroutine.

**patch panel** One segment of a patch bay. (188) *See also* patch bay.

**path attenuation** *Synonym* path loss.

**path clearance** In microwave line-of-sight communications, the perpendicular distance from the radio-beam axis to obstructions such as trees, buildings, or terrain. (188) *Note:* The required path clearance is usually expressed, for a particular k-factor, as some fraction of the first Fresnel zone radius. *See also* effective Earth radius, Fresnel zone, k-factor, path profile, path survey, propagation path obstruction.

**path intermodulation noise** Noise in a transmission path, which noise is contingent upon modulation; it results from any nonlinear characteristic of the path. (188) *See also* intermodulation, modulation, noise.

**path loss** In a communication system, the attenuation undergone by an electromagnetic wave in transit between a transmitter and a receiver, usually expressed in decibels. (188) *Note:* Path loss may be due to many effects such as free-space loss, refraction, reflection, aperture-medium coupling loss, and absorption. *Synonym* path attenuation. *See also* loss, shadow loss, transmission loss.

**path profile** A graphic representation of the physical features of a propagation path in the

vertical plane containing both endpoints of the path, showing the surface of the Earth and including trees, buildings, and other features that may obstruct the radio signal. (188) *Note:* Profiles are drawn either with an effective Earth radius simulated by a parabolic arc, in which case the ray paths are drawn as straight lines, or with a "flat Earth"--in which case the ray paths are drawn as parabolic arcs. *See also* effective Earth radius, Fresnel zone, horizon angle, k-factor, path clearance, propagation path obstruction, smooth Earth.

**path survey** The assembling of pertinent geographical and environmental data required to design a radio communication system. (188) *See also* Fresnel zone, k-factor, path clearance, path profile.

**Pawsey stub** A device for connecting an unbalanced coaxial feeder to a balanced antenna. *See also* balun, feed (def. #3).

**PAX** *Abbreviation for private automatic exchange. See private automatic branch exchange.*

**payload** From the perspective of a network service provider: of a data field, block, or stream, being processed or transported, the part that represents information useful to the user, as opposed to system overhead information. *Note:* Payload includes user information and may include such additional information as user-requested network management and accounting information.

**payload module** The portion of the information payload containing one or more entire channels.

**PBX** *Abbreviation for private branch exchange.*

1. A private telecommunication exchange that usually includes access to the public switched network. 2. A switch serving a selected group of users and subordinate to a higher level military establishment switch. (188) 3. A private telephone switchboard that provides dial service on a subscriber's premises and serves only those stations with local and trunked communications. (188) *Note 1:* A PBX operates with only a manual switchboard;

a private automatic exchange (PAX) does not have a switchboard, a private automatic branch exchange (PABX) may or may not have a switchboard. *Note 2:* Use of the term "PBX" is more common than "PABX," regardless of automation. *See also* key set, key telephone system.

**PBX tie trunk** *See* tie trunk.

**PBX trunk** *See* trunk.

**PC** *Abbreviation for carrier power [of a radio transmitter].*

**PCB** *Abbreviation for power circuit breaker.*

**PCM** *Abbreviation for pulse-code modulation.*

**PCM multiplex equipment** Equipment for digitizing two or more analog signals and combining the resultant bit streams into a single aggregate signal by a combination of pulse-code modulation and time-division multiplexing. (188) *See also* channel, code, multiplexing, pulse-code modulation.

**PCS** *Abbreviation for plastic clad silica. See plastic clad silica fiber.*

**PDM** *Abbreviation for pulse-duration modulation.*

**PDN** *Abbreviation for public data network.*

**PDS** *Abbreviation for protected distribution system.*

**PDU** *Abbreviation for protocol data unit.*

**PE** *Abbreviation for phase-encoded.*

**peak busy hour** *Synonym* busy hour.

**peak emission wavelength** Of an optical emitter, the spectral line having the greatest power.

**peak envelope power [of a radio transmitter] (pX, PX)** The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of

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the modulation envelope taken under normal operating conditions. (RR) (188)

**peak limiting** A process in which the absolute instantaneous value of a signal parameter is prevented from exceeding a specified value. (188) *See also* attack time, clipper, compandor, compressor, expander, limiter, limiting, pulse-code modulation.

**peak power output** The output power averaged over that cycle of an electromagnetic wave having the maximum peak value that can occur under any combination of signals transmitted. (188) *See also* output rating, peak envelope power [of a radio transmitter], rated output power.

**peak signal level** An expression of the maximum instantaneous signal power or voltage as measured at any point in a transmission path. (188) *See also* level, signal.

**peak-to-average ratio (p/a r)** The ratio of the instantaneous peak value (amplitude) of a signal to its time-averaged value. (188) *Note:* Peak-to-average ratio can be determined for voltage, current, power, or other parameters. *See also* output rating.

**peak-to-peak value** The algebraic difference between the extreme values of a varying quantity. (188) *See also* output rating.

**peak wavelength** The wavelength at which the radiant intensity of an optical source is maximum. *See also* spectral line, spectral width.

**peg count** A count of the attempts to seize, or actual seizures of, various types of telephone trunks, access lines, or switching equipment, during a specified period of time. (188) *See also* seizing, traffic usage recorder.

**pel** 1. The smallest discrete scanning line sample of a facsimile system, which sample contains only black/white information (no gray shading information is used). *See also* facsimile. 2. The smallest area of a television (TV) picture capable of being delineated by an

electrical signal passed through the TV system.

3. The smallest element that can be distinguished vertically and horizontally within a black and white image telemetry scene. (188) *See also* elemental area, facsimile, pixel, scanning.

**penetration** 1. The passage through a partition or wall of an equipment or enclosure by a wire, cable, or other conductive object. (188)

2. The successful act of bypassing the security mechanisms of a cryptographic or automated information system.

**PEP** *Formerly, an abbreviation for peak envelope power; however, either "PX" or "pX" is the preferred abbreviation. Note: See power.*

**percentage modulation** 1. In angle modulation, the fraction of a specified reference modulation, expressed in percent. (188) 2. In amplitude modulation, the modulation factor expressed in percent. (188) *Note:* It is sometimes convenient to express percentage modulation in decibels below 100 percent modulation. *See also* modulation, modulation factor, overmodulation.

**percent break** In telephone dialing, the ratio of the open circuit time to the sum of the open and closed circuit times allotted to a single dial pulse cycle, expressed as a percentage. (188) *See also* dial signaling.

**performance measurement period** The time period over which values of the performance parameters are measured. (188) *Note:* The duration of a performance measurement period is determined by required confidence limits and may vary as a function of the observed parameter values. A user's time is divided into a succession of consecutive performance measurement periods to enable measurement of user information transfer reliability. *See also* acceptance test, operational service period, outage, outage probability.

**performance parameter** A quantity whose numerical values characterize a particular aspect of telecommunication system performance. (188) *See also* acceptance test,

**communications, operational service state, outage, system operational threshold.**

**periapsis** In satellite systems, the point on a satellite's orbit at which it is closest to the center of the primary body about which it is orbiting. (188) *Note:* Where Earth-based satellite systems are concerned, the term is synonymous with perigee. *See also* geostationary orbit, satellite.

**perigee** The point at which a satellite orbit is the least distance from the center of the gravitational field of the Earth. *See also* altitude of the apogee or perigee, apogee, geostationary orbit, satellite.

**perimeter protection system** A field disturbance sensor which uses buried leaky cables installed around a facility to detect any unauthorized entry or exit. (RR)

**period [of a satellite]** The time elapsing between two consecutive passages of a satellite through a characteristic point on its orbit. (RR)

**periods processing** The processing of various levels of sensitive information at distinctly different times. *Note:* Under periods processing, the system must be purged of all information from one processing period before transitioning to the next when there are different users with differing authorizations. (188) *See also* communications security.

**peripheral device** *See* peripheral equipment.

**peripheral equipment** In a data processing system, any equipment, distinct from the central processing unit, that may provide the system with additional capabilities. *Note:* Such equipment is often off-line until needed for a specific purpose and may, in some cases, be shared among several users. *See also* keyboard, modem, terminal.

**periscope antenna** An antenna configuration wherein the transmitting antenna is oriented to produce a vertical radiation pattern, and a flat or parabolically curved reflector, mounted above the transmitting antenna, is used to

direct the beam in a horizontal path toward the receiving antenna. (188) *Note:* This configuration allows increased terrain clearance without long transmission lines while permitting the active equipment to be located at or near ground level for ease of maintenance. *See also* antenna.

**permanent bond** A bond not expected to require disassembly for operational or maintenance purposes. (188) *See also* connection.

**permanent signal (PS)** An extended off-hook condition not followed by dialing. *See also* off-hook.

**permanent storage** A storage device that is nonerasable. (FP) (ISO) *See also* read-only storage.

**permanent virtual circuit (PVC)** A virtual circuit that is used to establish a long-term association between two DTEs. The long-term association is identical to the data transfer phase of a virtual call. *Note:* Permanent virtual circuits eliminate the need for repeated call set-up and clearing. *Deprecated synonym* nailed-up circuit. *See also* circuit, hot line, off-hook service, virtual call capability, virtual circuit.

**permissible interference** Observed or predicted interference which complies with quantitative interference and sharing criteria contained in these [Radio] Regulations or in CCIR Recommendations or in special agreements as provided for in these Regulations. (RR) *See also* accepted interference, interference.

**phantom circuit** A circuit derived from two suitably arranged pairs of wires, called side circuits, with each pair of wires being a circuit in itself and at the same time acting as one conductor of the phantom. (188) *See also* circuit, side circuit.

**phantom group** Three circuits that are derived from simplexing two physical circuits to form a phantom circuit. (188) *See also* circuit, line filter balance.



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**phase** 1. In periodic phenomena, any possible distinguishable state of the phenomena. (188) *Note:* It can be identified through the time of its occurrence, elapsed from a specified reference to be called correctly "*phase time*," but frequently abbreviated to "*phase*." If the phenomenon is sinusoidal, the phase can be identified either by angle or by time, both measured from an assigned reference, depending on the dimensions assigned to the reference period. 2. That period of time during which a specified function occurs in a sequential list of functions. (188)

**phase angle** The measure of the relative position of points, from a chosen instant or position, on a periodic wave in time or space. *Note:* The value of the phase angle is obtained by multiplying a fraction (the difference between the two points in terms of an abscissa divided by the period of the function) of the period by  $360^\circ$  or by  $2\pi$  radians. Phase angle is expressed in degrees, radians, or wavelengths; or time, if the frequency is known.

**phase bandwidth** Of a network or device, the width of the continuous frequency range over which the phase/frequency characteristic does not depart from linearity by more than a stated amount. (188) *See also* bandwidth, frequency, phase.

**phase coherence** The state in which two signals have a common frequency and maintain a fixed phase relationship. (188) *See also* coherent, frequency, frequency synthesizer, phase (def. #1).

**phase coherent** *See* phase coherence.

**phase constant** The imaginary part of the axial propagation constant for a particular mode, usually expressed in radians per unit length. (188) *See also* axial propagation constant, mode (def. #1), phase (def. #1).

**phased array** An arrangement of antennas (of any type) in which the signal feeding each antenna is varied in such a way that radiation is reinforced in a desired direction and suppressed in undesired directions. (188) *Note:*

Rapid scanning in azimuth or elevation can be accomplished with such arrays. *See also* antenna, reflective array antenna.

**phase delay** In the transfer of a single-frequency wave from one point to another in a system, the time delay of the part of the wave that identifies its phase. (188) *Note:* The phase delay is synonymous with transit time and may be expressed in any convenient unit; e.g., seconds, degrees, radians, or wavelength units. *See also* absolute delay, coherent, delay equalizer, phase (def. #1).

**phase departure** An unintentional deviation from the nominal phase value. *See also* coherent, error, phase (def. #1), phase jump.

**phase detector** A circuit or instrument that detects the difference in phase between corresponding points on two signals. (188) *See also* phase (def. #1).

**phase deviation** In phase modulation, the peak difference between the instantaneous angle of the modulated wave and the angle of the carrier. (188) *Note:* In the case of a sinusoidal modulating function, the value of the phase deviation, expressed in radians, is equal to the modulation index. *See also* angle modulation, carrier (cxr), differential phase-shift keying, frequency modulation, modulation index, phase (def. #1), phase difference, phase-frequency distortion, phase inversion, phase modulation, phase shift.

**phase diagram** A graphic representation of the phase relationships between two or more waveforms. *Note:* It may be represented as a vector diagram or as an amplitude-vs.-time diagram. *See also* coherent, phase (def. #1), phase deviation, phase modulation.

**phase difference** The time or the angle by which one wave leads or lags another. (188) *See also* coherent, phase (def. #1), phase deviation, phase modulation.

**phase distortion** *Synonym* delay distortion.

**phase-encoded (PE) recording** A method of recording on magnetic tape in which a "1" data bit is a flux reversal to the polarity of the interblock gap, and the "0" data bit is a flux reversal to the polarity opposite to that of the interblock gap (when reading in the forward direction). (188) *See also* code, magnetic tape, phase (def. #1), phase flux reversal.

**phase equalizer** *See* delay equalizer.

**phase flux reversal** In magnetic tape phase-encoded recording, a flux reversal written at the nominal midpoint between successive "1" bits or between successive "0" bits to establish proper polarity. (188) *See also* phase (def. #1), phase-encoded recording.

**phase-frequency distortion** That form of distortion occurring under either or both of the following conditions: (a) the phase-frequency characteristic is not linear over the frequency range of interest; (b) the zero-frequency intercept of the phase-frequency characteristic is not zero or an integral multiple of  $2\pi$  radians. (188) *See also* error, frequency, phase (def. #1), phase deviation, phase modulation.

**phase hit** *See* hit.

**phase instability** The fluctuation of the phase of a wave relative to a reference. *Note:* The fluctuation is often from unknown causes. *See also* phase departure, phase deviation, phase jitter, phase perturbation.

**phase interference fading** The variation in signal amplitude produced by the interaction of two or more components with different relative phases. (188) *See also* diurnal phase shift, fading, flutter (def. #1), interference, ionosphere, phase (def. #1).

**phase inversion** Production of a phase difference of  $180^\circ$ . (188) *See also* phase (def. #1), phase perturbation.

**phase jitter** A form of phase perturbation that results in the intermittent shortening or lengthening of signals. (188) *See also* jitter, phase (def. #1), phase perturbation.

**phase jump** A sudden phase change in a signal. (188) *See also* phase (def. #1), phase departure.

**phase-locked loop (PLL)** 1. An electronic servo system that controls an oscillator so that it maintains a constant phase angle relative to a reference signal source. 2. A circuit for synchronizing a variable local oscillator with the phase of a transmitted signal. (188) *Note:* Widely used in space communication for coherent carrier tracking and threshold extension, bit synchronization, and symbol synchronization. *See also* acquisition, carrier synchronization, Costas loop, digital phase-locked loop, false clock, loop, phase (def. #1).

**phase modulation (pm)** A form of angle modulation in which the phase angle of a carrier is caused to depart from its reference value by an amount proportional to the instantaneous value of the modulating function. (188) *See also* angle modulation, carrier (cxr), deviation ratio, differential phase-shift keying, frequency modulation, modulation index, phase (def. #1), phase deviation, phase difference, phase-frequency distortion.

**phase noise** Rapid, short-term, random fluctuations in the phase of a wave, caused by time-domain instabilities in an oscillator. *Note:* Phase noise,  $\mathcal{L}(f)$  in decibels relative to carrier power (dBc) on a 1-Hz bandwidth, is given by  $\mathcal{L}(f) = 10\log[0.5(S_p(f))]$  where  $S_p(f)$  is the spectral density of phase fluctuations.

**phase nonlinearity** Lack of direct proportionality of phase shift to frequency over the frequency range of interest. *See also* frequency, phase (def. #1).

**phase offset** An intentional algebraic phase (time) difference between two periodic signals. (188) *See also* phase (def. #1), phase deviation, phase difference.

**phase perturbation** An undesired phenomenon, from causes known or unknown, that results in a relative shifting (often quite rapid) in the phase of a signal. (188) *Note 1:* The shifting in phase may appear to be random, cyclic, or

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both. *Note 2:* The amount of phase perturbation may be expressed in degrees, with any cyclic component expressed in hertz. *See also* error, jitter, phase (def. #1), phase jitter.

**phase quadrature** *Synonym* quadrature.

**phase shift** The change in phase of a periodic signal with respect to a reference. (188) *See also* differential phase-shift keying, frequency shift, phase (def. #1), phase deviation, phase-shift keying.

**phase-shift keying (PSK)** A method of modulation used for digital transmission wherein the phase of the carrier is discretely varied in relation to a reference phase, or the phase of the previous signal element, in accordance with the data to be transmitted. (188) *Note 1:* In PSK systems designed so that the carrier can assume only two different phase angles, each change of phase (signal element) carries one bit of information; i.e., the bit rate equals the modulation rate. *Note 2:* If the number of recognizable phase angles is increased to 4, then 2 bits of information can be encoded into each signal element; likewise, 8 phase angles can encode 3 bits in each signal element, e.g., unit interval. *See also* carrier (cxr), differentially coherent phase-shift keying, differential phase-shift keying, digital modulation, digital phase modulation, double frequency-shift keying, frequency modulation, frequency-shift keying, keying, modulation, phase (def. #1), phase shift, quadrature phase-shift keying.

**phase velocity** The velocity of propagation of a uniform plane wave, given by the product of the wavelength and the frequency divided by the refractive index of the medium in which the wave is propagating. (188) *Note 1:* In free space, the refractive index may be considered as unity. *Note 2:* In free space, the group velocity and phase velocity are identical. *See also* axial propagation constant, coherence time, group index, group velocity, phase (def. #1).

**phasing** In facsimile transmission, the adjustment of picture position along the

scanning line. (188) *Note:* An out-of-phase condition results in a split image at the recorder. *See also* facsimile.

**phonetic alphabet** A list of standard words used to identify letters in a message transmitted by radio or telephone. The following are the authorized words, listed in order, for each letter in the alphabet: Alpha, Bravo, Charlie, Delta, Echo, Foxtrot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whiskey, X-ray, Yankee, Zulu. (JCS1-DoD) *See also* alphabet.

**photoconductivity** The conductivity increase exhibited by some nonmetallic materials, resulting from the free carriers generated when photon energy is absorbed in electronic transitions. *See also* photoelectric effect.

**photocurrent** The current that flows through a photosensitive device (such as a photodiode) as the result of exposure to radiant power. *Note:* Internal gain, such as that in an avalanche photodiode, may enhance or increase the current flow but is a distinct mechanism. *See also* dark current, photodiode.

**photodiode** A diode designed to produce photocurrent by absorbing light. *Note:* Photodiodes are used for the detection of optical power and for the conversion of optical power to electrical power. *See also* avalanche photodiode, photocurrent, PIN photodiode.

**photoelectric effect** 1. External photoelectric effect: The emission of electrons from the irradiated surface of a material. *Synonym* photoemissive effect. 2. Internal photoelectric effect: *See* photoconductivity.

**photoemissive effect** *Synonym* photoelectric effect (def. #1).

**photon** A discrete packet of electromagnetic energy. The energy of a photon is  $h\nu$  where  $h$  is Planck's constant and  $\nu$  is the optical frequency. *See also* nonlinear scattering, Planck's constant.

**photon noise** Noise attributed to the discrete (particulate) nature of light. (188) *See also* dark current, quantum noise, shot noise, thermal noise.

**photosensitive recording** Facsimile recording by the exposure of a photosensitive surface to a signal-controlled light beam or spot. (188) *See also* dark current, facsimile, recording.

**photovoltaic effect** The production of a voltage difference across a pn junction resulting from the absorption of photon energy. The voltage difference is caused by the internal drift of holes and electrons. *See also* photon.

**physical frame** *See* frame.

**Physical Layer** *See* Open Systems Interconnection--Reference Model.

**physical optics** The branch of optics that treats light propagation as a wave phenomenon rather than a ray phenomenon, as in geometric optics. *See also* geometric optics.

**physical security** *See* communications security.

**physical signaling sublayer (PLS)** In a LAN or MAN system, that portion of the OSI Physical Layer that interfaces with the medium access control sublayer and performs bit symbol encoding and transmission, bit symbol reception and decoding, and optional isolation functions. *See also* local area network, metropolitan area network.

**physical topology** The physical interconnection of elements (e.g., paths, switches, concentrators) of a network. *See also* logical topology, network topology.

**picture element** *See* pel, pixel.

**picture frequencies** In facsimile systems, the frequencies that result solely from scanning a subject copy. (188) *Note:* This does not include frequencies that are part of a modulated carrier signal. *See also* facsimile, frequency.

**piece-wise linear encoding** *Synonym* segmented encoding law.

**pigtail** A short length of optical fiber or electrical conductor, permanently fixed to a component, used to couple power between it and the transmission medium. *See also* launching fiber.

**pilot** A signal, usually a single frequency, transmitted over a system for supervisory, control, equalization, synchronization, or reference purposes. (188) *Note:* Sometimes it is necessary to employ several independent pilot frequencies. Most radio relay systems use radio or continuity pilots of their own but transmit also the pilot frequencies belonging to the carrier frequency multiplex system. *See also* carrier (cxr), frequency, signal, synchronizing pilot.

**pilot-make-busy (PMB) circuit** A circuit arrangement by which trunks provided over a carrier system are made busy to the switching equipment in the event of carrier system failure, or during a fade of the radio system. (188) *See also* circuit, failure.

**pilot tone** *See* pilot.

**pink noise** In acoustics, noise in which there is equal power per octave. *See also* noise, white noise.

**PIN photodiode** A diode with a large intrinsic region sandwiched between p- and n-doped semiconducting regions. Photons absorbed in this region create electron-hole pairs that are then separated by an electric field, thus generating an electric current in a load circuit.

**piston** In a waveguide, a longitudinally movable metallic plane surface that reflects essentially all the incident energy. *Synonym* plunger.

**pixel** The smallest discrete scanning line sample of a facsimile system, which sample contains gray scale information. (188) *See also* elemental area, facsimile, gray scale, pel, scanning.

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**PLA** *Abbreviation for programmable logic array.*

**plain text** Unencrypted information in textual form. (188) *Note:* "Plain text" includes voice. *Synonym* clear text. *See also* cipher text, cryptology.

**planar array** A radio antenna in which all of the elements, both active and parasitic, are in a single plane. (188) *Note 1:* It provides a large aperture and may be used for directional beam control by varying the relative phases among the elements. *Note 2:* It may be used with a reflective screen behind the active plane. *See also* antenna.

**Planck's constant** The number  $h$  that relates the energy  $E$  of a photon with the frequency  $\nu$  of the associated wave through the relation  $E = h\nu$ , where  $h = 6.626 \times 10^{-34}$  joule-second. *See also* photon.

**plane wave** 1. A wave whose surfaces of constant phase are infinite parallel planes normal to the direction of propagation. (188) 2. An electromagnetic wave that predominates in the far-field region of an antenna, and with a wavefront that is essentially in a flat plane. (188) *Note:* In free space, the characteristic impedance of a plane wave is 377 ohms. *See also* antenna, far-field radiation pattern.

**plant** A general term (usually divided into outside plant and inside plant) for all facilities and equipment used in providing telecommunication services. *See also* network terminating interface, nontechnical load.

**plastic clad silica (PCS) fiber** An optical fiber having a silica core and plastic cladding, usually a soft silicone material.

**plenum** Within a building, a space created by building components, designed for the movement of environmental air; e.g., a space above a suspended ceiling or below an access floor. *Note:* Communication and power cables are often pulled through a plenum to reach power poles or columns in open office space layouts.

**plesiochronous** That relationship between two signals such that their corresponding significant instants occur at nominally the same rate, any variations being constrained within a specified limit. (188) *Note:* There is no limit to the phase difference that can accumulate between corresponding significant instants over a long period of time. *See also* anisochronous, asynchronous transmission, heterochronous, homochronous, isochronous, isochronous modulation, mesochronous, synchronous.

**PLL** *Abbreviation for phase-locked loop.*

**PL/1** A programming language that is designed for use in a wide range of commercial and scientific computer applications. (FP)

**plotter** An output unit that presents data in the form of a two-dimensional graphic representation. (FP) (ISO)

**PLS** *Abbreviation for physical signaling sublayer.*

**plunger** *Synonym* piston.

**pm** *Abbreviation for phase modulation.*

**PM** *Abbreviation for preventive maintenance.*

**PMB** *Abbreviation for pilot-make-busy. See pilot-make-busy circuit.*

**POI** *Abbreviation for point of interface.*

**point of interface (POI)** The physical telecommunication interface between the local access and transport area (LATA) access, and inter-LATA functions. This point establishes the technical interface, the test points, and the points of operational responsibility. *See also* local access and transport area.

**point of presence (POP)** A physical layer within a local access and transport area (LATA) at which an inter-LATA carrier establishes itself for the purpose of obtaining LATA access and to which the local exchange company provides access services. *See also* local access and transport area.



**point-to-point link** A data communication link connecting only two stations. (188) *See also* dedicated circuit, hot line, link.

**point-to-point transmission** Transmission between two designated stations. (188) *See also* broadcast operation, dedicated circuit, hot line, leased circuit.

**polar direct-current telegraph transmission** A form of binary telegraph transmission in which positive and negative direct currents denote the significant conditions. (188) *Synonym* double-current transmission. *See also* direct current signaling, telegraph.

**polarential telegraph system** A direct-current telegraph system employing polar transmission in one direction and a form of differential duplex transmission in the other. (188) *Note:* Two types of polarential systems, known as types A and B, are in use. In half-duplex operation of a type A polarential system, the direct-current balance is independent of line resistance. In half-duplex operation of a type B polarential system, the direct current is substantially independent of the line leakage. Type A is better for cable loops where leakage is negligible but resistance varies with temperature. Type B is better for open wire where variable line leakage is frequent. *See also* communications system, half-duplex operation.

**polarization** That property of an electromagnetic wave describing the time-varying direction and amplitude of the electric field vector; specifically, the figure traced as a function of time by the projection of the extremity of the vector onto a fixed plane in space, which plane is perpendicular to the direction of propagation. (188) *Note:* In general, the figure is elliptical and it is traced in a clockwise or counterclockwise sense, as viewed in the direction of propagation. The commonly referenced circular and linear polarizations are obtained when the ellipse becomes a circle or a straight line, respectively. Clockwise-sense rotation of the electric vector is designated right-hand polarization, and counterclockwise-sense rotation is designated

left-hand polarization. *See also* depolarization, diversity reception, elliptical polarization, magneto-optic.

**polarization diversity** Any method of diversity transmission and reception wherein the same information signal is transmitted and received simultaneously on orthogonally polarized waves with fade-independent propagation characteristics. (188) *See also* depolarization, diversity reception, dual diversity.

**polar operation** A system whereby marking signals are formed by current or voltage pulses of one polarity and spacing signals by current or voltage pulses of equal magnitude but opposite polarity (bipolar signal). (188) *See also* bipolar signal, neutral operation, pulse.

**polar orbit** An orbit for which the angle of inclination is 90°. (188) *Note:* A satellite in polar orbit will pass over both the north and south geographic poles each orbit. *See also* direct orbit, equatorial orbit, geostationary orbit, inclined orbit, retrograde orbit, satellite, synchronous orbit.

**polar relay** A relay in which the direction of movement of the armature depends on the direction of the current flow. (188) *See also* neutral relay, relay (def. #2).

**polling** 1. A network control system in which a designated control station invites its tributary stations to transmit in any sequence specified by the control station. 2. In multipoint communication, or in point-to-point communication, the process whereby stations are invited one at a time to transmit. 3. Interrogation of devices for purposes such as avoiding contention, determining operational status, or determining readiness to send or receive data. (FP) *See also* network, response (def. #1).

**POP** *Acronym for point of presence.*

**port** 1. A place of access to a device or network where energy may be supplied or withdrawn or where the device or network variables may be observed or measured. (188) 2. In a

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communication network, a point at which signals can enter or leave the network en route to or from another network. *See also* data circuit-terminating equipment, input/output device, terminal.

**portability** 1. The ability to transfer data from one system to another without being required to recreate or reenter data descriptions or to modify significantly the application being transported. (FP) 2. The ability of software or of a system to run on more than one type or size of computer under more than one operating system. (After FP) *See also* compatibility, interoperability, mobile service, mobile station, transportability.

**portable operating system interface for computer environments (POSIX)** A Federal information processing standard providing a vendor-independent interface between an operating system and an application program. The standard specifies operating system interfaces and source code level functions based on the UNIX<sup>TM</sup> system documentation. *Note 1:* Operating systems other than UNIX<sup>TM</sup> will subsequently be incorporated in this standard. *Note 2:* IEEE Standard 1003.1-1988 was adopted by reference and published as FIPS Pub-151.

**portable station** A station capable of transmitting and/or receiving while in motion or during brief halts at unspecified locations. *Note:* Usually carried by a person, but may be conveyed by a vehicle.

**port operations service** A maritime mobile service in or near a port, between coast stations and ship stations, or between ship stations, in which messages are restricted to those relating to the operational handling, the movement and the safety of ships and, in emergency, to the safety of persons. Messages which are of a public correspondence nature shall be excluded from this service. (RR)

**portrait mode** 1. In facsimile, the mode of scanning lines across the shorter dimension of a rectangular original. (188) *Note:* CCITT Group 1, 2, and 3 facsimile machines use

portrait mode. 2. In computer graphics, the orientation of a page in which the shorter dimension is horizontal. *See also* landscape mode.

**port station** A coast station in the port operations service. (RR)

**positioned channel** A channel occupying dedicated bit positions in an ISDN framed data stream, e.g., B, H, and D channels, in ISDN user interfaces.

**positioned interface structure** Within a framed interface, a structure in which positioned channels provide all services and signaling. *See also* broadband ISDN, framed interface, positioned channel.

**positioning time** *Synonym* seek time.

**positive feedback** *Synonym* regeneration (def. #1).

**positive justification** *Synonym* bit stuffing.

**POSIX** *Acronym for portable operating system interface for computer environments.*

**postalize** To structure rates or prices so that they are not distance sensitive, but depend on other factors (such as duration of a call, etc.). *See also* extended area service, flat rate service, measured-rate service.

**postalized rate** A rate, for a transmission service, which is not dependent upon distance. *Note:* When referring to an international transmission service, the rate is the same regardless of the location within the country originating the message. *See also* extended area service, flat rate service, measured-rate service.

**post-detection combiner** A circuit or device for combining two or more signals after demodulation. (188) *See also* diversity combiner, maximal-ratio combiner.

**post-development review** *Synonym* system follow-up.

**post-implementation review** *Synonym* system follow-up.

**post-production processing** In B-ISDN applications, processing of audio and video information after contribution and prior to final use. *See also* broadband ISDN, contribution, distribution.

**power** 1. The rate of transfer or absorption of energy per unit time in a system. (188) *In the optical regime, synonym* radiant power. 2. Whenever the power of a radio transmitter etc. is referred to, it shall be expressed in one of the following forms, according to the class of emission, using the arbitrary symbols indicated: --peak envelope power (PX or pX); --mean power (PY or pY); --carrier power (PZ or pZ). For different classes of emission, the relationships between peak envelope power, mean power and carrier power, under the conditions of normal operation and of no modulation, are contained in CCIR Recommendations which may be used as a guide. For use in formulae, the symbol *p* denotes power expressed in watts and the symbol *P* denotes power expressed in decibels relative to a reference level. (RR)

**power circuit breaker (PCB)** 1. The primary switch used to apply and remove power from equipment. (188) 2. A circuit breaker for use on ac circuits rated in excess of 1500 volts. (188) *See also* protector.

**power density** *Colloquial synonym* for irradiance.

**power gain of an antenna** *Synonym* antenna gain.

**power-law index profile** For optical fibers, a class of graded-index profiles characterized by

$$n(r) = n_1 \left[ 1 - 2\Delta \left( \frac{r}{a} \right)^g \right]^{\frac{1}{2}}, r \leq a$$

$$n(r) = n_2 = n_1 (1 - 2\Delta)^{\frac{1}{2}}, r \geq a, \text{ where}$$

$$\Delta = \frac{n_1^2 - n_2^2}{2n_1^2},$$

*n(r)* is the refractive index as a function of radius, *n*<sub>1</sub> is the refractive index on axis, *n*<sub>2</sub> is the refractive index of the homogeneous cladding, *a* is the core radius, and *g* is a parameter that defines the shape of the profile. *Note 1:* *α* is often used in place of *g*. Hence, this is sometimes called an alpha profile. *Note 2:* For this class of profiles, multimode distortion is smallest when *g* takes a particular value depending on the material used. For most materials, this optimum value is approximately 2. When *g* increases without limit, the profile tends to a step-index profile. *See also* graded-index profile, mode volume, profile parameter, step-index profile.

**power level** At any point in a transmission system, the ratio of the power at that point to some arbitrary amount of power chosen as a reference. *Note:* This ratio is usually expressed either in decibels referred to one milliwatt, dBm, or in decibels referred to one watt, dBW. (188) *See also* dB, level, power.

**power margin** *See* system power margin.

**PPM** *Abbreviation* for pulse-position modulation.

**precedence** A designation assigned to a message by the originator to indicate to communications personnel the relative order of handling and to the addressee the order in which the message is to be noted. (JCS1-DoD) (JCS1-NATO) *Note:* Current order of precedence for military messages is, in descending order. FLASH, IMMEDIATE, PRIORITY, ROUTINE. *See*

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*also* classmark, FLASH message, immediate message, minimize, override, preemption, priority message, routine message, seizing, special grade of service.

**precipitation attenuation** The loss of energy by an electromagnetic wave because of scattering, refraction, and/or absorption during its passage through a volume of the atmosphere containing precipitation such as rain, snow, hail, or sleet. *See also* attenuation, loss, path loss, transmission loss.

**precipitation static** A type of radio interference, caused by the impact of charged particles against an antenna, experienced in a receiver during snowstorms, rainstorms, and dust storms. (188) *See also* electromagnetic environment, noise.

**precise frequency** 1. A frequency that is maintained to the known accuracy of an accepted reference frequency standard. (188) *Note:* Current accuracy among international standards is approximately 1 part in  $10^{13}$  2. A frequency requirement accurate to within one part in  $10^9$ . (JCS1-DoD) *See also* Coordinated Universal Time, DoD master clock, frequency, frequency accuracy, primary time standard, reference frequency, standard frequency and time signal service.

**precise time** 1. A time mark, the position of which (or a time interval, the duration of which) is known accurately with reference to an accepted reference time standard. (188) *Note:* Current accuracy among international standards is approximately 1 part in  $10^{13}$  2. A time requirement accurate to within 10 milliseconds. (JCS1-DoD) *See also* clock, Coordinated Universal Time, DoD master clock, primary time standard, reference frequency, standard frequency and time signal service.

**precision** 1. The degree of mutual agreement among a series of individual measurements, values, or results; often, but not necessarily, expressed by the standard deviation. *Note 1:* With respect to a set of independent devices of the same design, it is the ability of these

devices, to produce the same value or result. *Note 2:* With respect to a single device, put into operation repeatedly without adjustments, it is the ability to produce the same value or result. *Synonym* reproducibility. *See also* accuracy. 2. In computer science, a measure of the ability to distinguish between nearly equal values. (188) 3. The degree of discrimination with which a quantity is stated; for example, a three-digit numeral to the base 10 discriminates among 1000 possibilities. *See also* accuracy, fidelity, resolution.

**predetection combining** A technique used to obtain an improved signal from multiple radio receivers involved in diversity reception. (188) *Note:* This process requires that all incoming diversity signals be brought into approximate phase coincidence before combining. *See also* diversity combiner, maximal-ratio combiner, selective combiner.

**preemphasis** A process in a system designed to increase the magnitude of some frequency components with respect to the magnitude of others in order to reduce adverse effects, such as distortion, in subsequent parts of the system. (188) *See also* deemphasis, emphasis, frequency, noise, signal-to-noise ratio.

**preemphasis improvement** The improvement in the signal-to-noise ratio of the high-frequency end of the baseband resulting from passing the modulating signal (at the transmitter) through a preemphasis network, which increases the magnitude of the higher signal frequencies, and then passing the output of the discriminator through a deemphasis network to restore the original signal power distribution. *See also* deemphasis, emphasis, frequency, noise, signal-to-noise ratio.

**preemphasis network** A network inserted in a system in order to increase the magnitude of one range of frequencies with respect to another. (188) *Note:* Preemphasis is usually employed in FM or pm transmitters to equalize the modulating signal drive power in terms of deviation ratio. The receiver demodulation process includes a reciprocal network called

deemphasis to restore the original signal power distribution. *See also* frequency.

**preemption** The seizure, usually automatic, of military system facilities that are being used to serve a lower precedence call in order to serve immediately a higher precedence call. (188) *See also* call, precedence, seizing.

**prefix-free code** *Synonym* comma-free code.

**preform** A glass structure from which an optical fiber may be drawn. *See also* chemical vapor deposition technique, ion exchange technique, optical blank.

**premises wiring** *See* on-premises wiring.

**Presentation Layer** *See* Open Systems Interconnection--Reference Model.

**press-to-talk operation** *Synonym* push-to-talk operation.

**press-to-type operation** *Synonym* push-to-type operation.

**preventive maintenance (PM)** 1. The care and servicing by personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects. (JCS1-DoD) 2. Systematic and/or prescribed maintenance intended to reduce the probability of failure. (JCS1-NATO) 3. Maintenance, including tests, measurements, adjustments, and parts replacement, performed specifically to prevent faults from occurring. (188) *See also* corrective maintenance, fault, maintenance.

**PRF** *Abbreviation for* pulse repetition frequency.

**PRI** *Abbreviation for* primary rate interface.

**primary channel** 1. The channel that is designated as a prime transmission channel and is used as the first choice in restoring priority

circuits. (188) 2. In a data communication network, a transmission channel having the highest signaling rate capability of all the channels sharing a common interface. *Note:* A primary channel may support the transfer of information in one direction only, either direction alternately, or both directions simultaneously. *See also* channel, secondary channel.

**primary coating** For an optical fiber, the material in intimate contact with the cladding surface, applied to preserve the integrity of that surface and to strip cladding modes. *See also* cladding.

**primary distribution system** A system of alternating current distribution for supplying the primaries of distribution transformers from the generating station or substation distribution buses. (188) *See also* facility (def. #1), primary power.

**primary frequency standard** A frequency source that meets national standards for accuracy and operates without need for calibration; e.g., cesium beam clocks. *See also* cesium clock, cesium standard, DoD master clock, frequency offset, frequency standard, standard frequency and time signal service.

**primary group** *See* group.

**primary power** A reliable source of power normally serving the station main bus. (188) *Note:* The source may be a Government-owned generating plant or a utility system. A Class A primary power source is one providing an assurance of essentially continuous supply. *See also* auxiliary power, power, primary distribution system, primary substation, station battery.

**primary radar** A radiodetermination system based on the comparison of reference signals with radio signals reflected from the position to be determined. (RR) *See also* radar.

**primary rate interface (PRI)** An ISDN network interface standard (designated in North America) with a network channelization of



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**23B+D.** All circuit-switched B channels operate at 64 kbps; the D channel operates at 64 kbps. This combination results in a DSI (T1) interface at the network boundary. *See also* Integrated Services Digital Network.

**primary service area** [T]he service area of a broadcast station in which the groundwave is not subject to objectionable interference or objectionable fading. (CFR 47)

**primary station** In a data communication network, the station responsible for unbalanced control of a data link. *Note:* The primary station generates commands and interprets responses, and is responsible for initialization of data and control information interchange, organization and control of data flow, retransmission control, and all recovery functions at the link level. *See also* control station, data communication, link, master station, network, secondary station, slave station, tributary station.

**primary substation** Equipment that switches or modifies voltage, frequency, or other characteristics of primary power. (188) *See also* primary power.

**primary time standard** A time standard that operates according to the adopted definition of the second, without calibration. (188) *See also* cesium clock, cesium standard, coordinated clock, Coordinated Universal Time, DoD master clock, precise frequency, precise time, reference clock, reference frequency, standard frequency and time signal service.

**principal clock** That member of a set of redundant clocks that is selected for normal use. (188) *Note 1:* It may or may not be selected because of superior clock quality or other properties that make it a unique member of the set. *Note 2:* The term "primary clock" should be avoided because of the possibility of confusion with "primary frequency standard." *See also* clock, Coordinated Universal Time, reference frequency.

**priority level** The level that may be assigned to an NS/EP telecommunications service

specifying the order in which provisioning or restoration of the service is to occur relative to other NS/EP and/or non-NS/EP telecommunication services. Priority levels authorized are designated (highest to lowest) "E," "1," "2," "3," "4," and "5" for provisioning and "1," "2," "3," "4," and "5" for restoration. *See also* NS/EP telecommunications.

**priority level assignment** The priority level(s) designated for the provisioning and/or restoration of a particular NS/EP telecommunications service. *See also* NS/EP telecommunications.

**priority message** A category or precedence reserved for messages that require expeditious action by the addressee(s) and/or furnish essential information for the conduct of operations in progress when routine precedence will not suffice. (JCS1-DoD) *See also* precedence, seizing.

**privacy** 1. The protection afforded to information transmitted in a communications system or network to conceal it from persons within the system or network. *Synonym* segregation. 2. Short-term protection afforded those unclassified communications that require safeguarding, within existing laws, from unauthorized persons; e.g., radio communications of law enforcement personnel. 3. The protection afforded by a communication system against unauthorized disclosure of the information in the system. (188) *Note:* The required protection may be accomplished by communication security measures, by directives to operating personnel, or other means. The limited protection afforded certain voice and data transmissions by various commercial crypto-equipment is sufficient to deter a casual listener, but could not withstand a technically competent cryptanalytic attack. *See also* authenticate, communications.

**private automatic branch exchange (PABX)** An automatic PBX. (188) *Note:* Use of the term "PBX" is more common than "PABX," regardless of automation.

**private automatic exchange (PAX)** *See* private automatic branch exchange.

**private branch exchange (PBX)** *See* PBX.

**private exchange (PX)** A private telecommunication switch that usually includes access to the public switched network. *See also* PBX, private automatic branch exchange.

**private line** *See* leased circuit.

**private NS/EP telecommunications services** Non-common-carrier telecommunications services, including private line, virtual private line, and private switched network services. *See also* public switched NS/EP telecommunications services.

**probability** *See* block-loss probability, block-misdelivery probability, disengagement-denial probability, outage probability, service probability, statistical multiplexing.

**procedure-oriented language** A problem-oriented language that facilitates the expression of a procedure as explicit algorithms; for example, FORTRAN, ALGOL, COBOL, PL/1. (FP)

**process computer system** A computer system, with a process interface system, that monitors or controls a technical process. (FP) *See also* process interface system.

**process control** Automatic control of a process, in which a computer system is used to regulate the usually continuous operations or processes. (FP) (ISO)

**process control equipment** Equipment that measures the variables of a technical process, directs the process according to control signals from the process computer system, and provides appropriate signal transformation, for example, equipment such as actuators, sensors, and transducers. (FP) (ISO) *See also* process computer system.

**process control system** A computer system, process control equipment, and possibly a

process interface system. The process interface system may be part of a special-purpose computer. (FP) (ISO) *See also* process interface system.

**processing** *See* automatic data processing, batch processing, data processing, multiprocessing, remote batch processing.

**processing unit** A functional unit that consists of one or more processors and their internal storage. (FP) (ISO)

**process interface system** A functional unit that adapts process control equipment to the computer system in a process computer system. (FP) (ISO)

**processor** In a computer, a functional unit that interprets and executes instructions. *Note:* A processor consists of at least an instruction control unit and an arithmetic unit. (FP) (ISO) *See also* central processing unit.

**procurement** The process of obtaining personnel, services, supplies, and equipment. (JCS1-DoD)

**procurement lead time** The interval in months between the initiation of procurement action and receipt into the supply system of the production model (excludes prototypes) purchased as the result of such actions, and is composed of two elements, production lead time and administrative lead time. (JCS1-DoD)

**profile** *See* graded-index profile, index profile, parabolic profile, power-law index profile.

**profile dip** *See* index dip.

**profile dispersion** *See* dispersion.

**profile dispersion parameter (P)** For an optical fiber,

$$P(\lambda) = \frac{n_1 \lambda}{N_1 \Delta} \frac{d\Delta}{d\lambda}$$

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where  $n_1$  is the refractive index of the core,  $N_1$  is the group index of the core,  $n_1(1-2\Delta)^{1/2}$  is the refractive index of the homogeneous cladding, and  $\Delta$  is the refractive index contrast. Sometimes it is defined with the factor (-2) in the numerator. *See also* dispersion.

**profile parameter (g)** For an optical fiber, the shape-defining parameter,  $g$ , for a power-law index profile. *See also* power-law index profile, refractive index profile.

**program** 1. A plan or routine for solving a problem on a computer. 2. A sequence of instructions used by a computer to do a particular job or solve a given problem. 3. To design, write, and test programs. (FP) (ISO) *See also* computer.

**programmable** Pertaining to a device that can accept instructions that alter its basic functions. (FP)

**programmable logic array (PLA)** An array of gates whose interconnections can be programmed to perform a specific logical function. (FP)

**programmable read-only memory (PROM)** A storage device that, after being written once, becomes a read-only memory. (FP) (ISO) *See also* read-only memory.

**programmer** 1. That part of digital apparatus having the function of controlling the timing and sequencing of operations. (188) 2. A person who prepares sequences of instructions for a computer. (188) *See also* compile, computer, computer language.

**programming language** An artificial language that is used to generate or to express programs.

**programming system** One or more programming languages and the software necessary for using these languages with particular automatic data processing equipment. (FP)

**program origin** *See* computer program origin.

**program patch** *See* patch (def. #2, #3).

**PROM** *Acronym for* programmable read-only memory.

**propagation** The directed motion of waves. *See also* anomalous propagation, backscattering, diffraction, direct ray, forward scatter, ionospheric scatter, line-of-sight propagation, multipath, refraction, scatter, sporadic E propagation, tropospheric scatter.

**propagation constant** For an electromagnetic field mode varying sinusoidally with time at a given frequency, the logarithmic rate of change, with respect to distance in a given direction, of the complex amplitude of any field component. *Note:* The propagation constant,  $\lambda$ , is a complex quantity given by  $\lambda = \alpha + i\beta$ , where  $\alpha$ , the real part, is the attenuation constant and  $\beta$ , the imaginary part, is the phase constant. *See also* attenuation constant, axial propagation constant, phase constant.

**propagation mode** 1. The manner in which radio signals travel from a transmitting antenna to a receiving antenna, such as ground wave, sky wave, direct wave, ground reflection, or scatter. (188) 2. One of the electric and magnetic field configurations in which energy propagates in a waveguide or along a transmission line. *See also* mode (def. #1), transmission.

**propagation path obstruction** A man-made or natural physical feature that lies near enough to a radio path to cause a measurable effect on path loss, exclusive of reflection effects. (188) *Note:* An obstruction may lie to the side, or even above the path, although usually it will lie below the path. Ridges, cliffs, buildings, and trees are examples of obstructions. If the clearance from the nearest anticipated path position, over the expected range of Earth radius  $k$ -factor, exceeds 0.6 of the first Fresnel zone radius, the feature is not normally considered an obstruction. *See also* effective Earth radius, Fresnel zone,  $k$ -factor, path clearance, path profile.

**propagation time delay** The time required for a signal to travel from one point to another. (188) *See also* block transfer time, transmission (def. #1), transmission time.

**proprietary standard** Documentation by a commercial entity specifying equipment, practices, or operations unique to that commercial entity.

**proration** 1. The distribution or allocation of parameters, such as noise power, proportionally among a number of tandem connected items, such as equipment, links, or trunks, in order to balance the performance of communications circuits. (188) 2. In a telephone switching center, the distribution or allocation of equipment or components proportionally among a number of functions, to provide a requisite grade of service. (188) *See also* automatic call distributor, automatic route selection, automatic sequential connection, circuit, distributed switching, grade of service.

**protected distribution system (PDS)** A wireline or fiber-optics telecommunication system which includes adequate acoustic, electrical, electromagnetic, and physical safeguards to permit its use for the unencrypted transmission of classified information. *Note:* A complete protected distribution system includes the subscriber and terminal equipment and the interconnecting lines. *Deprecated synonym* approved circuit.

**protection** *Synonym* lockout (def. #5).

**protection ratio** The minimum value of the wanted-to-unwanted signal ratio, usually expressed in decibels, at the receiver input determined under specified conditions such that a specified reception quality of the wanted signal is achieved at the receiver output. (RR)

**protector** A device used to protect telecommunications facilities and equipment from abnormally high voltage or current. (188) *Note 1:* A protector may contain arresters. *Note 2:* Protectors may operate on short or long time-base phenomena, or both, and should

be specified. *See also* air terminal, arrester, circuit breaker, fuse, power circuit breaker.

**protocol** 1. [In general,] A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. (188) (FP) (ISO) *Note:* Protocols may govern portions of a network, types of service, or administrative procedures. For example, a data link protocol is the specification of methods whereby data communication over a data link is performed in terms of the particular transmission mode, control procedures, and recovery procedures. *See also* communications, handshaking, link (def. #1), link protocol, N-entity, network, packet, packet format. 2. In layered communication system architecture, a formal set of procedures that are adopted to facilitate functional interoperability within the layered hierarchy. *See also* Open Systems Interconnection--Protocol Specifications, Open Systems Interconnection--Reference Model.

**protocol data unit (PDU)** Information that is delivered as a unit between peer entities of a network and may contain control information, address information, or data. *See also* Open Systems Interconnection--Reference Model.

**prototype** 1. A pre-production, functioning specimen(s) that is the first of its type, typically used for the evaluation of design, performance, and/or production potential. 2. A model suitable for evaluation of design, performance, and production potential. (JCS1-DoD)

**provisioning** The act of supplying telecommunications service to a user, including all associated transmission, wiring, and equipment. In NS/EP telecommunication services, "provisioning" and "initiation" are synonymous and include altering the state of an existing priority service or capability. *See also* NS/EP telecommunications.

**PS** *Abbreviation for* permanent signal.

**pseudorandom noise** Noise that satisfies one or more of the standard tests for statistical

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randomness. (188) *Note:* Although it seems to lack any definite pattern, the pseudorandom sequence of pulses will repeat after a very long time interval. *See also* noise, white noise.

**pseudorandom number sequence** An ordered set of numbers that has been determined by some defined arithmetic process but is effectively a random number sequence for the purpose for which it is required. (FP) (ISO) *Note:* Although it seems to lack any definite pattern, this sequence of numbers will repeat after a very long time interval. *See also* random number, spread spectrum.

**PSK** *Abbreviation for phase-shift keying.*

**PSN** *Abbreviation for public switched network.*

**psophometer** An instrument arranged to give visual indication corresponding to the aural effect of disturbing voltages of various frequencies. *Note:* A psophometer usually incorporates a weighting network, the characteristics of which differ according to the type of circuit under consideration; e.g., high-quality music or commercial speech circuits. *See also* dBm(psoph), noise.

**psophometrically weighted dBm** *See* dBm(psoph), dBm0p.

**psophometric voltage** Circuit noise voltage measured in a line with a psophometer that includes a CCIF-1951 weighting network. *Note 1:* Do not confuse with "psophometric emf," conceived as the emf in a generator (or line) with 600 ohms internal resistance, and hence, for practical purposes, numerically double the corresponding psophometric voltage. *Note 2:* Psophometric voltage readings,  $v$  (in millivolts), are commonly converted to dBm(psoph) by  $\text{dBm(psoph)} = 20 \log_{10} v - 57.78$ . *See also* noise weighting.

**psophometric weighting** A noise weighting established by the International Consultative Committee for Telephony (CCIF, now CCITT), designated as CCIF-1951 weighting, for use in a noise measuring set or psophometer. (188) *Note:* The shape of this characteristic is

virtually identical to that of F1A weighting. The psophometer is, however, calibrated with a tone of 800 Hz, 0 dBm, so that the corresponding voltage across 600 ohms produces a reading of 0.775 V. This introduces a 1-dBm adjustment in the formulas for conversion with dBa. *See also* dBm(psoph), dBr, noise.

**PSTN** *Abbreviation for public switched telephone network.*

**PTF** *Abbreviation for patch and test facility.*

**PTM** *Abbreviation for pulse-time modulation.*

**PTT** Postal, telegraph, and telephone organization, usually a governmental department, which acts as its nation's common carrier. (188) *See also* common carrier, divestiture.

**public correspondence** Any telecommunication which the offices and stations must, by reason of their being at the disposal of the public, accept for transmission. (RR)

**public data network (PDN)** A network established and operated by a telecommunication administration, or a recognized private operating agency, for the specific purpose of providing data transmission services for the public. (188) *See also* communications, data transmission, public data transmission service, public switched network, public switched telephone network.

**public data transmission service** A data transmission service that is established and operated by a telecommunication administration, or a recognized private operating agency, and uses a public data network. *Note:* The service may include circuit-switched, packet-switched, and leased-circuit data transmission. *See also* data transmission, public data network.

**public switched network (PSN)** Any common carrier network that provides circuit switching among public users. (188) *Note:* The term is usually applied to the public switched



telephone network, but it could be applied more generally to other switched networks, e.g., public data networks and packet-switched public data networks. *See also* circuit, communications, packet switching, public data network, public switched telephone network.

**public switched NS/EP telecommunications services** Those NS/EP telecommunications services utilizing public switched networks. Such services may include both interexchange and intraexchange network facilities (e.g., switching systems, interoffice trunks, and subscriber loops). *See also* private NS/EP telecommunications services.

**public switched telephone network (PSTN)** The domestic telecommunications network commonly accessed by ordinary telephones, key telephone systems, private branch exchange trunks, and data arrangements. *Note:* Completion of the circuit between the calling and called parties in this network requires network signaling in the form of dial pulses or multifrequency signals. *See also* circuit, communications, public data network, public switched network, telephony.

**public utility commission (PUC)** A generic term for any state regulatory body charged with regulating intrastate utilities, including telecommunications. *Note:* In some states this function is performed by public service commissions or state corporation commissions.

**PUC** *Abbreviation for public utility commission.*

**pull-in frequency range** The maximum frequency difference between the local oscillator (or clock) and the reference frequency of a phase-locked loop over which the local oscillator can be locked.

**pulsating direct current** Current that is changing in value at regular or irregular intervals but has the same direction at all times. (188)

**pulse** A transition in the magnitude of a quantity, short in relation to the time span of interest. (188)

**pulse-address multiple access (PAMA)** The ability of a communication satellite to receive signals from several Earth terminals simultaneously and to amplify, translate, and relay the signals back to Earth, based on the addressing of each station by an assignment of a unique combination of time and frequency slots. (188) *Note:* This ability may be restricted by allowing only some of the terminals access to the satellite at any given time. *See also* dual access, multiple access.

**pulse amplitude** The magnitude of a pulse, measured with respect to a specified reference value. (188) *Note:* For a specific designation, adjectives such as "average," "instantaneous," "peak," "root-mean-square," etc., should be used to indicate the particular meaning intended. *See also* pulse.

**pulse-amplitude modulation (PAM)** That form of modulation in which the amplitude of the pulse carrier is varied in accordance with some characteristic of the modulating signal. (188) *See also* carrier (cxr), modulation, pulse.

**pulse broadening** An increase in pulse duration. *Note:* Pulse broadening may be specified by the impulse response, the root-mean-square pulse broadening, or the full-duration-half-maximum pulse broadening. *See also* full width half maximum, impulse response, root-mean-square pulse broadening.

**pulse-code modulation (PCM)** That form of modulation in which the modulating signal is sequentially sampled, quantized, and coded into a binary form for transmission over a digital link. (188) *See also* balanced code, code conversion, equivalent PCM noise, frame, load capacity, modulation, multiframe, PCM multiplex equipment, peak limiting, signal sample.

**pulse decay time** *Synonym* fall time.

**pulse distortion** *See* distortion.

**pulse duration** 1. The time interval between the points on the leading and trailing edges at which the instantaneous value bears a specified

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relation to the peak pulse amplitude. 2. The time between a specified reference point on the first transition of a pulse waveform and a similarly specified point on the last transition. *Note:* The time between the 10%, 50%, or 1/e points is commonly used, as in the rms pulse duration. (188) 3. In radar, measurement of pulse transmission time in microseconds; that is, the time the radar's transmitter is energized during each cycle. (JCS1-DoD) *Deprecated synonyms* pulse length, pulse width. *See also* frequency, pulse, root-mean-square pulse duration.

**pulse-duration modulation (PDM)** That form of modulation in which the duration of the pulse is varied in accordance with some characteristic of the modulating signal. (188) *Deprecated synonyms* pulse-length modulation, pulse-width modulation. *See also* modulation, pulse, pulse-time modulation.

**pulse duty factor** The ratio of the pulse duration to the pulse period of a periodic pulse train. (188) *See also* duty cycle, pulse.

**pulse length** *Deprecated synonym for* pulse duration.

**pulse-length modulation** *Deprecated synonym for* pulse-duration modulation.

**pulse-link repeater** In E & M signaling, a device that interfaces the signal paths of concatenated trunk circuits. *Note 1:* Such a device responds to a ground on the "E" lead of one trunk by applying -48Vdc to the "M" lead of the connecting trunk, and vice versa. *Note 2:* This function is a built-in, switch-selectable option in some commercially available carrier channel units. (188) *See also* circuit, E & M signaling, link.

**pulse period** The reciprocal of the pulse repetition rate.

**pulse-position modulation (PPM)** That form of modulation in which the positions in time of the pulses are varied, in accordance with some characteristic of the modulating signals, without modifying the pulse width. (188) *See*

*also* modulation, pulse, pulse-time modulation.

**pulse repetition frequency (PRF)** In radar, the number of pulses that occur each second. Not to be confused with transmission frequency which is determined by the rate at which cycles are repeated within the transmitted pulse. (JCS1-DoD) *See also* frequency, pulse, pulse repetition rate.

**pulse repetition rate** The number of pulses per unit time. (FP) *See also* pulse repetition frequency.

**pulse rise time** *See* rise time.

**pulse string** *Synonym* pulse train.

**pulse stuffing** *See* bit stuffing.

**pulse-time modulation (PTM)** Those forms of modulation in which the time of occurrence of some characteristic of the pulsed carrier is varied with respect to some characteristic of the modulating signal. (188) *Note:* This includes pulse-position modulation and pulse-duration modulation. *See also* modulation, pulse, pulse-duration modulation, pulse-position modulation.

**pulse train** A series of pulses having similar characteristics. (FP) (ISO) *Synonym* pulse string. *See also* pulse.

**pulse width** *Deprecated synonym for* pulse duration.

**pulse-width modulation (PWM)** *Deprecated synonym* pulse-duration modulation.

**pulsing** In telephony, the transmission of address information to a switching office by means of digital pulses. *Note:* Pulsing methods include multifrequency, rotary, and reverive pulsing. *See also* dial pulse, dial signaling, pulse, pulse-address multiple access.

**pump frequency** The frequency of an oscillator used to provide the sustaining power to devices

such as parametric amplifiers or lasers. (188)  
*See also* laser, power.

**PX** *Abbreviation for private exchange, peak envelope power [of a radio transmitter].*

**pure binary numeration system** *Synonym* binary notation.

**push-down file** *Synonym* last-in, first-out.

**push-to-talk operation** In telephone or two-way radio systems, that method of communication over a speech circuit in which the talker is required to keep a switch operated while talking. *Note:* In radio, it is used where the same frequency is employed by both transmitters. (188) *Synonym* press-to-talk operation. *See also* circuit, conversational mode, half-duplex circuit.

**push-to-type operation** In telegraph or data transmission systems, that method of communication in which the operator at a station must keep a switch operated in order to send messages. *Note 1:* It is used in radio systems where the same frequency is employed for transmission and reception. (188) *Note 2:* This is a derivative form of transmission and may be used in simplex, half-duplex, or duplex operation. *Synonym* press-to-type operation. *See also* half-duplex circuit.

**PVC** *Abbreviation for permanent virtual circuit.*

**pW** *Abbreviation for picowatt. A unit of power equal to  $10^{-12}$  W (-90 dBm). (188) Note:* It is commonly used for both weighted and unweighted noise measurements. Context must be observed.

**PWM** *Abbreviation for pulse-width modulation. See* pulse-duration modulation.

**pWp** *Abbreviation for picowatt, psophometrically weighted. See* noise weighting.

**pWp0** *Abbreviation for picowatt, psophometrically weighted, referred to a zero transmission level point. See* noise weighting.

**pX** *Abbreviation for peak envelope power [of a radio transmitter].*

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**QA** *Abbreviation for quality assurance.*

**QAM** *Abbreviation for quadrature amplitude modulation.*

**QC** *Abbreviation for quality control.*

**QOS** *Abbreviation for quality of service.*

**QPSK** *Abbreviation for quadrature phase-shift keying.*

**quad** A group of four wires composed of two pairs twisted together. *Note:* The pairs have a fairly long length of twist and the quad a fairly short length of twist. (188) *See also* four-wire circuit.

**quadded cable** A cable formed of multiples of quads, paired and separately insulated, and twisted together within an overall jacket. (188) *See also* cable, paired cable, spiral-four cable.

**quadratic profile** *Synonym* parabolic profile.

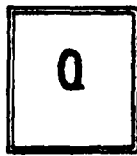
**quadrature** Separated in phase by  $90^\circ$  ( $\pi/2$  radians). (188) *Synonym* phase quadrature. *See also* phase.

**quadrature amplitude modulation (QAM)** Quadrature modulation in which some form of amplitude modulation is used for both inputs. (188) *See also* modulation, quadrature modulation.

**quadrature modulation** Modulation of two carrier components  $90^\circ$  apart in phase by separate modulating functions. (188) *See also* modulation, quadrature amplitude modulation.

**quadrature phase-shift keying (QPSK)** PSK using four phase states. (188) *Synonyms* quadriphase, quaternary phase-shift keying. *See also* keying, modulation, phase, phase-shift keying.

**quadriphase** *Synonym* quadrature phase-shift keying.



**quadruple diversity** The simultaneous combining of, or selecting from, four independently fading signals. *Note:* Diversity may be accomplished through the use of space, frequency, angle, time, or polarization characteristics or combinations thereof. (188) *See also* diversity reception, dual diversity, order of diversity.

**quadruply clad fiber** An optical fiber construction (usually single mode) that has four claddings over the core. *Note:* The core has a relatively very high refractive index, with claddings of very low, high, low, and medium refractive indices. (188) *See also* cladding, deeply depressed cladding fiber, fiber optics, optical fiber.

**quality assurance (QA)** 1. All actions that are taken to ensure that delivered products or services meet performance requirements and adhere to standards and procedures. (188) 2. The planned systematic activities necessary to ensure that a component, module, or system conforms to established technical requirements. (FP) (ISO) (188) 3. The policy, procedures, and systematic actions established in an enterprise for the purpose of providing and maintaining some degree of confidence in data integrity and accuracy throughout the life cycle of the data, which includes input, update, manipulation, and output. (FP) (188) *See also* acceptance test, test and validation.

**quality control (QC)** A management function whereby control of the quality of raw materials, assemblies, produced materiel, and services is exercised for the purpose of preventing production of defective materiel or providing faulty services. (188) *See also* grade of service.

**quality of service (QOS)** 1. The quality specification of a communication channel or system. (188) *Note:* It may be stated in terms of signal-to-noise ratio, bit error ratio, message throughput rate, or call blocking probability. 2. A subjective rating of telephone communication quality, in which listeners judge a transmission as excellent, good, fair,



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poor, or unsatisfactory. *See also* call, grade of service.

**quantization** A process in which the continuous range of values of a signal is divided into nonoverlapping (but not necessarily equal) subranges, a discrete value being uniquely assigned to each subrange. *Note:* When sampling, e.g., to achieve pulse-code modulation, if the sampled signal value falls within a given subrange, the sample is assigned the corresponding discrete value. (188) *See also* a-law, quantization level, signal, uniform encoding.

**quantization level** In the quantization process, the discrete value assigned to a particular subrange. (188) *See also* a-law, level, quantization, uniform encoding.

**quantized feedback** In a digital feedback loop, the digital signal that is fed back. (188) *Note 1:* Several forms of analog-to-digital converters contain a quantized feedback loop following the basic A-D converter. *Note 2:* The feedback signal is often processed before introducing it to the loop. *See also* delta modulation, feedback, loop.

**quantizing distortion** The distortion resulting from the quantization process. (188) *See also* distortion.

**quantizing levels** In coded digital transmission, the number of discrete signal levels transmitted as the result of signal digitization. (188) *See also* digital-to-analog converter, digitize, digitizer, level.

**quantizing noise** An undesirable random signal caused by the error of approximation in a quantizing process. (188) *Note:* It is dependent on the particular quantization process used and the statistical characteristics of the quantized signal. *See also* noise.

**quantum efficiency** In an optical source or detector, the ratio of output quanta to input quanta. *Note:* Input and output quanta need not both be photons. (188)

**quantum noise** Noise attributable to the discrete and probabilistic nature of physical phenomena and their interactions. *See also* photon noise, thermal noise.

**quantum-noise-limited operation** Operation wherein the minimum detectable signal is limited by quantum noise. (188) *See also* attenuation-limited operation, bandwidth-limited operation, dispersion-limited operation, distortion-limited operation, shot noise.

**quartz clock** A clock containing a quartz oscillator that determines the accuracy and precision of the clock.

**quartz oscillator** An oscillator whose frequency is stabilized by use of a quartz crystal. *Note:* The piezoelectric property of a crystal results in a nearly constant frequency, depending upon the crystal's size, shape, and mode of excitation.

**quasi-analog signal** A digital signal that has been converted to a form suitable for transmission over a specified analog channel. (188) *Note:* The specification of the analog channel should include frequency range, frequency bandwidth, signal-to-noise ratio, and envelope delay distortion. When this form of signaling is used to convey message traffic over dial-up telephone systems, it is often referred to as voice-data. A modem may be used for the conversion process. *See also* modem, signal.

**quasi-analog transmission** A transmission method in which a modulator, used to modulate one or more voice-frequency carriers, is used to make a digital signal suitable for transmission over an analog voice circuit, and a demodulator is used to recover the digital signal at the other end of the circuit. (188) *See also* hybrid communication network, modem.

**quaternary phase-shift keying** *Synonym* quadrature phase-shift keying.

**quaternary signal** A digital signal having four significant conditions. *See also* signal.

**queue** A collection of items, such as telephone calls, that is arranged in sequence. (188) *Note:* Queues are used to store events occurring at random times and to service them according to a prescribed discipline that may be fixed or adaptive. *See also* buffer, queue traffic.

**queueing** The process of entering elements into or removing elements from a queue. (188) *See also* buffer, queue traffic.

**queueing delay** 1. In an automatically switched telephone network, the time period that occurs between the completion of the calling party signaling and the arrival of a ringing signal at the called instrument. (188) *Note:* It may be due to delays (queues) at the originating switch, any intermediate switches, or the called-party servicing switch. 2. In a data network, the sum of all the delays introduced by the network between the originator's request for service and the establishment of a circuit to the called data terminal equipment. 3. In a packet-switched network, the sum of all of the delays encountered by a packet between the time of introduction into the network and the time of delivery to the addressee. (188) *See also* buffer.

**queue traffic** 1. In a store-and-forward switching center, the outgoing messages awaiting transmission at the outgoing line position. (188) 2. A series of calls waiting for service. (188) *See also* buffer, called-party camp-on, calling-party camp-on, first-in first-out, message switching, queueing, selective calling.

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**raceway** A linear enclosure channel used to hold and protect wires, cables, or bus bars. (188)  
*See also* bus.



**rack** A frame upon which one or more units of equipment are mounted. (188)  
*Note:* DoD racks are always vertical.

**racon** A radionavigation system transmitting, automatically or in response to a predetermined received signal, a pulsed radio signal with specific characteristics. (CFR 47) *See also* radar beacon.

**rad** 1. *Abbreviation for radian(s)*, 2. A measure of radiation energy: 0.01 joules of absorbed radiation energy per kilogram of material (irrespective of type of radiation).

**radar** *Acronym for radio detection and ranging.*  
1. A radio detection device that provides information on range, azimuth, and/or elevation of objects. (JCS1-DoD) 2. A radiodetermination system based on the comparison of reference signals with radio signals reflected, or retransmitted, from the position to be determined. (RR) *See also* primary radar, secondary radar.

**radar beacon (racon)** 1. A transmitter-receiver associated with a fixed navigational mark which, when triggered by a radar, automatically returns a distinctive signal which can appear on the display of the triggering radar, providing range, bearing, and identification information. (RR) 2. A receiver-transmitter combination which sends out a coded signal when triggered by the proper type of pulse, enabling determination of range and bearing information by the interrogating station or aircraft. (JCS1-DoD) *See also* racon.

**radar intelligence (RADINT)** Intelligence information derived from data collected by radar. (JCS1-DoD)

**RADHAZ** *Acronym for electromagnetic radiation hazards.*

**radian (rad)** Metric unit of measurement for plane angles. *See* metric system.

**radiance** Radiant power, in a given direction, per unit solid angle per unit of projected area of the source, as viewed from the given direction. *Note:* Radiance is usually expressed in watts per steradian per square meter. (188) *See also* conservation of radiance, emissivity, irradiance, radiant energy, radiant intensity, radiometry, spectral radiance.

**radiant emittance** Radiant power emitted into a full sphere ( $4\pi$  steradians) by a unit area of a source, expressed in watts per square meter. (188) *Synonym* radiant exitance. *See also* emissivity, radiation mode, radiometry, spectral radiance, spectral width.

**radiant energy** Energy that is transferred via electromagnetic waves; i.e., the time integral of radiant power, usually expressed in joules. (188) *See also* radiance.

**radiant exitance** *Synonym* radiant emittance.

**radiant flux** *Deprecated synonym for radiant power.*

**radiant intensity** Radiant power per unit solid angle, usually expressed in watts per steradian. (188) *See also* radiance, radiometry.

**radiant power** The time rate of flow of radiant energy, expressed in watts. *Note:* The prefix is often dropped, and the term "power" is used. *Colloquial synonyms* flux, optical power, power, radiant flux. *See also* radiance, radiometry.

**radiation** 1. In radio communication, the emission of energy in the form of electromagnetic waves. (188) 2. The outward flow of energy from any source in the form of radio waves. (RR) *See also* antenna, hazards of electromagnetic radiation to fuel, hazards of electromagnetic radiation to ordnance, hazards of electromagnetic radiation to personnel, radiation pattern, radiation scattering, spurious radiation, thermal radiation.

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**radiation angle** In fiber optics, half the vertex angle of the cone of light emitted at the exit face of a fiber. (188) *Note:* The cone is usually defined by the angle at which the far-field irradiance has decreased to a specified fraction of its maximum value or as the cone within which can be found a specified fraction of the total radiated power at any point in the far field. *Synonym* output angle. *See also* acceptance angle, far-field region, numerical aperture.

**radiation efficiency** The ratio of the power radiated to the total power supplied to the radiator at a given frequency. (188) *See also* antenna, radiant emittance.

**radiation field** *Synonym* far-field region.

**radiation-hardened fiber** An optical fiber made with core and cladding materials that are designed to recover their intrinsic value of attenuation coefficient, within an acceptable time period, after exposure to a radiation pulse.

**radiation mode** For an optical fiber, any mode that is not a bound mode; a leaky or radiation mode of the fiber. (188) *Note:* In an optical fiber, a mode whose fields are transversely oscillatory everywhere external to the waveguide, and which exists even at the limit of zero wavelength. Specifically, a mode for which  $\beta \leq [n^2(a)k^2 - (\ell/a)^2]^{1/2}$ , where  $\beta$  is the imaginary part (phase term) of the axial propagation constant, integer  $\ell$  is the azimuthal index of the mode,  $n(a)$  is the refractive index, where  $a$  is the core radius, and  $k$  is the free-space wavenumber,  $2\pi/\lambda$ , where  $\lambda$  is the wavelength. Radiation modes correspond to refracted rays in the terminology of geometric optics. *Synonym* unbound mode. *See also* bound mode, cladding mode, fiber optics, leaky mode, mode (def #1), optical fiber, refracted ray.

**radiation pattern** 1. The variation of the field intensity of an antenna as an angular function with respect to the axis. (188) *Note:* The pattern is normally represented graphically for the far-field conditions in either horizontal or vertical planes. *See also* antenna, departure

angle, directivity pattern, far-field radiation pattern, radio beam, reflective array antenna.

2. In fiber optics, the relative power distribution as a function of position or angle. (188) *Note 1:* Near-field radiation pattern describes the radiant emittance ( $\text{W}\cdot\text{m}^{-2}$ ) as a function of position in the plane of the exit face of an optical fiber. *Note 2:* Far-field radiation pattern describes the irradiance as a function of angle in the far-field region of the exit face of an optical fiber. *Note 3:* Radiation pattern may be a function of the length of the fiber, the manner in which it is excited, and the wavelength. *See also* fiber optics, numerical aperture, radiation mode.

**radiation resistance** The resistance that, if inserted in place of an antenna, would consume the same amount of power that is radiated by the antenna. (188) *See also* antenna, antenna matching, dummy load.

**radiation scattering** The diversion of radiation (thermal, electromagnetic, or nuclear) from its original path as a result of interaction or collisions with atoms, molecules, or larger particles in the atmosphere or other media between the source of radiation (e.g., a nuclear explosion) and a point some distance away. As a result of scattering, radiation (especially gamma rays and neutrons) will be received at such a point from many directions instead of only from the direction of the source. (JCS1-DoD) (JCS1-NATO) *See also* absorption index, electromagnetic radiation, ionospheric scatter, radiation, scatter.

**RADINT** Acronym for radar intelligence.

**radio** 1. A general term applied to the use of radio waves. (RR) 2. A method of communicating over a distance by modulating electromagnetic waves and radiating these waves. (188) *See also* combat-net radio, radio waves or Hertzian waves.

**radio altimeter** 1. Radionavigation equipment, on board an aircraft or spacecraft, used to determine the height of the aircraft or the spacecraft above the Earth's surface or another surface. (RR) 2. An instrument which displays



**the distance between an aircraft datum and the surface vertically below as determined by a reflected radio/radar transmission.** (JCS1-DoD) (JCS1-NATO)

**radio and wire integration (RWI)** The combining of wire circuits with radio facilities. (JCS1-DoD) *See also* net radio interface.

**radio astronomy** Astronomy based on the reception of radio waves of cosmic origin. (RR)

**radio astronomy station** A station in the radio astronomy service. (RR) *Note:* This is always a receiving station.

**radio baseband** *See* baseband.

**radiobeacon station** A station in the radionavigation service the emissions of which are intended to enable a mobile station to determine its bearing or direction in relation to the radiobeacon station. (RR)

**radio beam** A radiation pattern from a directional antenna, such that the energy of the transmitted electromagnetic wave is confined to a small angle in at least one dimension. (188) *See also* antenna, antenna lobe, beamwidth, field intensity, field strength, radiation pattern.

**radio channel** An assigned band of frequencies sufficient for radio communication. (188) *Note:* The width of a channel depends upon the type of transmission and the frequency tolerance. A channel is normally assigned for a specified type of service by a specified transmitter. *See also* assigned frequency, channel, frequency.

**radio common carrier (RCC)** A common carrier engaged in the provision of Public Mobile Service, which is not also in the business of providing landline local exchange telephone service. These carriers were formerly called "miscellaneous common carriers." (CFR 47) *See also* common carrier, radio.

**radiocommunication** Telecommunication by means of radio waves. (RR)

**radiocommunication service** A service as defined in this Section of the [Radio] Regulations involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes. In these regulations, unless otherwise stated, any radiocommunication service relates to terrestrial radiocommunication. (RR) *See also* space radiocommunication.

**radio deception** The employment of radio to deceive the enemy. Radio deception includes sending false dispatches, using deceptive headings, employing enemy call signs, etc. (JCS1-DoD) *See also* electronic countermeasures, electronic warfare.

**radio detection** The detection of the presence of an object by radio-location without precise determination of its position. (JCS1-DoD) (JCS1-NATO) *See also* monitoring.

**radio detection and ranging** *See* radar.

**radio determination** The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to those parameters, by means of the propagation properties of radio waves. (RR)

**radio determination-satellite service** A radiocommunication service for the purpose of radiodetermination involving the use of one or more space stations. (RR)

**radio determination station** A station in the radiodetermination service. (RR)

**radio direction finding (RDF)** 1. Radio location in which only the direction of a station is determined by means of its emissions. (JCS1-DoD) (JCS1-NATO) *See also* monitoring, radio fix. 2. Radiodetermination using the reception of radio waves for the purpose of determining the direction of a station or object. (RR)

**radio direction-finding station** A radiodetermination station using radio direction finding. (RR)

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**radio fadeout** *See* flutter.

**radio field intensity** *Synonym* field strength.

**radio fix** 1. The locating of a radio transmitter by bearings taken from two or more direction finding stations, the site of the transmitter being at the point of intersection. (JCS1-DoD) (JCS1-NATO) 2. The location of a ship or aircraft by determining the direction of radio signals coming to the ship or aircraft from two or more sending stations, the locations of which are known. (JCS1-DoD) (JCS1-NATO) *See also* monitoring, radio direction finding, radionavigation.

**radio frequency (rf)** Those frequencies of the electromagnetic spectrum normally associated with radio wave propagation. (188) *For designation of subdivisions, see spectrum designation of frequency. See also* frequency.

**radio frequency interference (RFI)** *Synonym* electromagnetic interference.

**radio guard** A ship, aircraft, or radio station designated to listen for and record transmissions, and to handle traffic on a designated frequency for a certain unit or units. (JCS1-DoD) *See also* monitoring, traffic.

**radio horizon** The locus of the points at which direct rays from an antenna become tangential to the Earth's surface. (188) *Note 1:* On a spherical surface, the horizon is a circle. *Note 2:* The distance to the horizon is affected by atmospheric refraction. *See also* horizon angle, line-of-sight propagation, smooth Earth.

**radiolocation** Radiodetermination used for purposes other than those of radionavigation. (RR) *See also* radionavigation.

**radiolocation land station** A station in the radiolocation service not intended to be used while in motion. (RR)

**radiolocation mobile station** A station in the radiolocation service intended to be used while

in motion or during halts at unspecified points. (RR)

**radiolocation service** A radiodetermination service for the purpose of radiolocation. (RR)

**radiological monitoring** *Synonym* monitoring.

**radiometry** The science of radiation measurement. *The basic quantities of radiometry are listed on the next page.*

**radionavigation** 1. Radio-location intended for the determination of position or direction or for obstruction warning in navigation. (JCS1-DoD) (JCS1-NATO) *See also* radio fix. 2. Radiodetermination used for the purposes of navigation, including obstruction warning. (RR) *See also* radiolocation.

**radionavigation land station** A station in the radionavigation service not intended to be used while in motion. (RR)

**radionavigation mobile station** A station in the radionavigation service intended to be used while in motion or during halts at unspecified points. (RR)

**radionavigation-satellite service** A radio determination-satellite service used for the purpose of radionavigation. This service may also include feeder links necessary for its operation. (RR)

**radio net** 1. An organization of radio stations that is capable of direct communication on a common frequency. (188) 2. An organization of radio stations broadcasting common programming over different frequencies at different locations (not necessarily simultaneously). *See also* network.

**radio recognition** The determination by radio means of the friendly or enemy character, or the individuality, of another. (JCS1-DoD) (JCS1-NATO) *See also* identification friend or foe.

**radio recognition and identification** *See* identification friend or foe.

RADIOMETRIC TERMS			
TERM	SYMBOL	QUANTITY	UNIT
radiant energy	Q	energy	joule (J)
radiant power <i>Synonym optical power</i>	$\phi$	power	watt (W)
irradiance	E	power incident per unit area (irrespective of angle)	$\text{W}\cdot\text{m}^{-2}$
spectral irradiance	$E_{\lambda}$	irradiance per unit wavelength interval at a given wavelength	$\text{W}\cdot\text{m}^{-2}\cdot\text{nm}^{-1}$
radiant emittance <i>Synonym radiant exitance</i>	W	power emitted (into a full sphere) per unit area	$\text{W}\cdot\text{m}^{-2}$
radiant intensity	I	power per unit solid angle	$\text{W}\cdot\text{sr}^{-1}$
radiance	L	power per unit angle per unit projected area	$\text{W}\cdot\text{sr}^{-1}\cdot\text{m}^{-2}$
spectral radiance	$L_{\lambda}$	radiance per unit wavelength interval at a given wavelength	$\text{W}\cdot\text{sr}^{-1}\cdot\text{m}^{-2}\cdot\text{nm}^{-1}$

**radio relay system** A point-to-point radio transmission system in which the signals are received, amplified, and retransmitted by one or more intermediate radio stations. (188) *See also drop and insert, drop channel operation, link.*

**radiosonde** An automatic radio transmitter in the meteorological aids service usually carried on an aircraft, free balloon, kite, or parachute, and which transmits meteorological data. (RR)

**radiotelegram** A telegram, originating in or intended for a mobile station or a mobile Earth station transmitted on all or part of its route over the radiocommunication channels of the mobile service or of the mobile-satellite service. (RR)

**radio telegraphy** The transmission of telegraphic codes by means of radio. (JCS1-DoD) (JCS1-NATO) *See also code, telegraph.*

**radiotelemetry** Telemetry by means of radio waves. (RR)

**radiotelephone call** A telephone call, originating in or intended for a mobile station or a mobile Earth station, transmitted on all or part of its route over the radiocommunication channels of the mobile service or of the mobile-satellite service. (RR)

**radio telephony** The transmission of speech by means of modulated radio waves. (JCS1-DoD) (JCS1-NATO)

**radio teletypewriter (RTTY)** A teletypewriter employed in a communication system using radio circuits. *Note:* Such systems are spoken of as RATT systems. (188) *See also teletypewriter.*

**radiotelex call** A telex call, originating in or intended for a mobile station or a mobile Earth station, transmitted on all or part of its route

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over the radiocommunication channels of the mobile service or the mobile-satellite service. (RR) *See also* Telex®.

**radio waves or Hertzian waves** Electromagnetic waves of frequencies arbitrarily lower than 3000 GHz, propagated in space without artificial guide. (RR)

**radio-wire integration** *See* radio and wire integration.

**RAM** *Acronym for random access memory.*

**Raman amplifier** *synonym* fiber amplifier.

**random access memory (RAM)** High-speed read/write memory with an access time that is essentially the same for all storage locations. (FP) *See also* read-only memory, volatile storage.

**randomizer** 1. A device used to invert the sense of pseudorandomly selected bits of a bit stream to avoid long sequences of bits of the same sense. (188) *Note:* The same selection pattern must be used on the receive terminal in order to restore the original bit stream. 2. An analog or digital source of unpredictable, unbiased, and usually independent bits. *Note:* Randomizers can be used for several different functions, including key generation or to provide a starting state for a key generator. *See also* binary digit, data scrambler, descrambler, limited protection voice equipment, scrambler.

**random noise** Noise consisting of a large number of transient disturbances with a statistically random time distribution. (188) *Note:* Thermal noise is an example of random noise. *See also* impulse noise, noise.

**random number** 1. A number selected from a known set of numbers in such a way that each number in the set has the same probability of occurrence. (FP) (ISO) 2. A number obtained by chance. (FP) 3. One of a sequence of numbers considered appropriate for satisfying certain statistical tests or believed to be free from conditions that might bias the result of a

calculation. (FP) *See also* pseudorandom number sequence.

**range designation of data signaling rates (DSRs)** A method of referring to a range, or band, of data signaling rates. *Note:* The designator is a two- or three-letter abbreviation for the name. Each range is one decade wide. The range limits for each decade have coefficients of 3. Thus, the logarithmic midrange value of each range (decade) is close to 1 times a power of ten. Each range is designated by number that is the power of ten of the midrange value. For example, the logarithmic midrange value of the 30-300 Gbps EHR (Extremely High Data Signaling Rate) is  $10^{11}$ . Therefore the numerical designator for this range is 11. The data signaling rate (DSR) describes the rate at which data pass through a point, for example, in bits, characters, words, or other data unit per unit time. It is not the speed at which lightwaves propagate in an optical fiber, such as in meters per second. *See also* data signaling rate, spectrum designation of frequency.

**raster** A predetermined pattern of scanning lines within a display space; e.g., the pattern followed by an electron beam scanning the screen of a television camera or receiver. (188) *See also* scanning.

**raster scanning** That type of scanning in which the motion of the scanning spot follows a raster. (188) *See also* scanning.

**rated output power** That power available at a specified output of a device under specified conditions of operation. (188) *Note:* This power may be further described; e.g., maximum rated output power, average rated output power. *See also* dBW, output rating, peak envelope power [of a radio transmitter], peak power output.

**ratio-squared combiner** *Synonym* maximal-ratio combiner.

**ray** *See* light ray.

**Rayleigh distribution** A mathematical statement of the frequency distribution of random variables, for the case where two orthogonal variables are independent and normally distributed with the same variance. (188)

**Rayleigh fading** Phase-interference fading, due to multipath, which is approximated by the Rayleigh distribution. (188) *See also* fading, fading distribution, multipath.

**Rayleigh scattering** Scattering caused by inhomogeneities within a medium that result in refractive-index fluctuations (within that same medium) whose dimensions are small with respect to wavelength. *Note:* The strength of the scattered field is inversely proportional to the fourth power of the wavelength of interest. (188) *See also* material scattering, Mie scattering, scatter, waveguide scattering.

**RBOC** *Acronym for Regional Bell Operating Company.*

**RC** *Abbreviation for reflection coefficient.*

**RCC** *Abbreviation for radio common carrier.*

**RDF** *Abbreviation for radio direction finding.*

**read head** A magnetic head capable of reading only. (FP) (ISO)

**reading** The acquisition or interpretation of data from a storage device, from a data medium, or from another source. (FP) (ISO)

**read-only memory (ROM)** A memory in which data, under normal conditions, can only be read. (FP) (ISO) *Synonym* nonerasable storage. *See also* random access memory.

**read-only storage** A storage device whose contents cannot be modified, except by a particular user, or when operating under particular conditions, for example, a storage device in which writing is prevented by a lockout. (188) (FP) *Synonym* fixed storage. *See also* erase, firmware, permanent storage, reading, storage.

**read/write opening** *Synonym* read/write slot.

**read/write slot** An opening in the jacket of a diskette to allow access to the read/write heads. *Synonym* read/write opening.

**real time** 1. The actual time during which a physical process occurs. (188) 2. Pertaining to the performance of a computation during the actual time that the related physical process occurs, in order that results of the computation can be used in guiding the physical process. 3. The absence of delay, except for the time required for the transmission by electromagnetic energy, between the occurrence of an event or the transmission of data, and the knowledge of the event, or reception of the data at some other location. (JCS1-DoD). *See also* absolute delay, near real time, transmission.

**reasonableness check** A test to determine whether a value conforms to specified criteria. *Note:* This can be used to eliminate questionable data points from subsequent processing. *Synonym* wild-point detection.

**received noise power** 1. The calculated or measured noise power, within the bandwidth being used, at the receive end of a circuit, channel, link, or system. (188) 2. The absolute power of the noise measured or calculated at a receive point. (188) *Note:* The related bandwidth and the noise weighting must also be specified. 3. The value of noise power from all sources measured at the line terminals of a listener telephone set. (188) *Note:* Either flat weighting or some other specific amplitude-frequency characteristic or noise weighting characteristic must be associated with the measurement. *See also* bandwidth, noise, noise power.

**received signal level (RSL)** The voltage or power (within a specified signal bandwidth) at the receiver input terminal, relative to an established reference. (188) *Note:* The RSL is often expressed in decibels with respect to 1 mW (0 dBm). *See also* level, signal.



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**receive only (RO)** Pertaining to a device or a mode of operation capable of receiving messages, but not of transmitting messages. (188)

**receiver attack-time delay** The time interval from the application of a step input rf signal (at a level equal to the receiver sensitivity) to the receiver input, until the receiver output amplitude reaches 90 percent of its steady-state value. *Note:* This time delay includes the time for the receiver to break squelch, if applicable. (188) *See also* receiver release-time delay.

**receiver lockout system** *Synonym* lockout (def. #2).

**receiver release-time delay** The time interval from removal of rf energy at the receiver input until the receiver output is squelched. (188) *See also* receiver attack-time delay.

**recognition** 1. The determination by any means of the individuality of persons, or of objects, such as aircraft, ships, or tanks, or of phenomena such as communications-electronics patterns. (JCS1-DoD) (188) 2. In ground combat operations, the determination that an object is similar within a category of something already known; e.g., tank, truck, man. (JCS1-DoD) 3. The determination of the nature of a detected person, object, or phenomenon, and possibly its class or type. This may include the determination of an individual within a particular class or type. (JCS1-NATO) *See also* authenticate, identification friend or foe, identification friend or foe personal identifier, intelligibility.

**reconditioned carrier reception** *Synonym* exalted-carrier reception.

**reconstructed sample** An analog sample generated at the output of a decoder when a specified character signal is applied at its input. (188) *Note:* The amplitude of this sample is proportional to the value of the corresponding encoded sample. *See also* digital-to-analog converter.

**record** A set of related data elements treated as a unit. (188) *See also* file.

**record communication** A telecommunication process that produces a hard copy record of the transmission, such as teletypewriter and facsimile. (188) *See also* communications, facsimile, hard copy, teletypewriter.

**recorded copy** In facsimile, a visible image of the original in record form. (188) *See also* facsimile, hard copy.

**recorder warning tone** A one-half second burst of 1400 Hz applied to a telephone line every 15 seconds to indicate to the called party that the calling party is recording the conversation. *Note:* This tone is required by law to be generated as an integral part of any recording device used for the purpose and is required to be not under the control of the calling party. The tone is recorded together with the conversation. *See also* busy verification.

**record information** All forms (e.g., narrative, graphic, data, computer memory) of information registered in either temporary or permanent form so that it can be retrieved, reproduced, or preserved. (JCS1-DoD) *See also* hard copy.

**recording** 1. The process of converting electrical signals to a recoverable form on a preservable medium. (188) 2. In facsimile systems, the process of converting the electrical signals to an image on a preservable medium. (188)

**recording density** *Synonym* bit density (def. #1).

**record medium** 1. The physical medium on which information is stored in recoverable form. (188) 2. In facsimile transmission, the physical medium on which the recorder forms an image of the subject copy. (188) *Note:* The record medium and the record sheet may be identical. *Synonym* record sheet. *See also* facsimile, hard copy.

**record sheet** *Synonym* record medium.

**record traffic** 1. Traffic that is recorded, in permanent or quasipermanent form, by the originator, the addressee, or both. (188) 2. Traffic that is permanently or semipermanently recorded in response to administrative procedures or public law. *See also* hard copy, narrative traffic.

**recovery** In a database management system, the procedures and capabilities available for reconstruction of the contents of a database to a state that prevailed before the detection of processing errors and before the occurrence of a hardware or software failure that resulted in the destruction of some or all of the stored data.

**recovery procedure** 1. The actions necessary to restore an automated information system's data files and computational capability after a system failure. 2. In data communications, a process whereby a data station attempts to resolve conflicting or erroneous conditions arising during the transfer of data. *See also* clear collision, error.

**RED/BLACK concept** The separation of electrical and electronic circuits, components, equipment, and systems that handle classified plain text (RED) information in electrical signal form from those that handle encrypted or unclassified (BLACK) information in the same form. (188) *See also* compromising emanations, TEMPEST.

**RED signal** In cryptographic systems, a signal containing classified information that has NOT been encrypted. *See also* BLACK, BLACK signal.

**reduced carrier single-sideband emission** A single-sideband emission in which the degree of carrier suppression enables the carrier to be reconstituted and to be used for demodulation. (RR) (188) *See also* full carrier single-sideband emission, single-sideband emission, suppressed carrier transmission.

**reduced carrier transmission** A form of transmission in which the signal has been amplitude modulated and in which the degree

of carrier suppression enables the carrier to be reconstituted and to be used for demodulation. (188) *See also* reduced carrier single-sideband emission.

**redundancy** 1. In the transmission of data, the excess of transmitted message symbols over that required to convey the essential information in a noise-free circuit. *Note:* Redundancy may be introduced intentionally (as in the case of error detection/correction codes) or inadvertently (such as by oversampling a band-limited signal, inefficient formats, etc.). 2. In a communication system, surplus capability usually provided to improve the reliability and quality of service. (188) *See also* continuous operation, data, data compression, frequency diversity, space diversity.

**redundancy check** 1. A method of verifying that any redundant hardware or software in a communication system is in an operational condition. (188) 2. A check that uses one or more extra binary digits or characters attached to data for the detection of errors. (FP) (ISO) (188) *See also* operational service state, performance parameter.

**redundant code** A code using more signal elements than necessary to represent the intrinsic information. (188) *Note:* The redundancy may be used for error-control purposes. *See also* error control, redundancy.

**reference black level** [In television,] The level corresponding to the specified maximum excursion of the luminance signal in the black direction. (CFR 47)

**reference circuit** A hypothetical circuit of specified length and configuration with a defined transmission characteristic, primarily used as a reference for measuring the performance of other circuits and as a guide for planning and engineering of circuits and networks. (188) *Note:* Normally, several types of reference circuits are defined, with different configurations, because communications are required over a wide range of distances. A group of related reference circuits is also called a reference system. *See also* circuit.

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**reference clock** 1. A clock with which another clock is compared. (188) 2. A clock, usually of high stability and accuracy, used to govern a network of mutually synchronized clocks of lower stability. *Note:* The failure of a reference clock does not necessarily cause loss of synchronism. *See also* clock, coordinated clock, Coordinated Universal Time (UTC), DoD master clock, master clock, precise time.

**reference configuration** In ISDN, a combination and arrangement of functional groups and reference points that reflect possible network topology. *See also* functional group, reference point, topology.

**reference frequency** 1. A standard fixed frequency from which operational frequencies may be derived or with which they may be compared. (188) *Note:* The reference frequency may be used to specify an assigned frequency or fix a characteristic or carrier frequency. 2. A frequency having a fixed and specific position with respect to the assigned frequency. The displacement of this frequency with respect to the assigned frequency has the same absolute value and sign that the displacement of the characteristic frequency has with respect to the center of the frequency band occupied by the emission. (RR) *See also* assigned frequency, carrier (cxr), characteristic frequency, frequency, precise frequency, precise time, primary time standard, principal clock, syntonization.

**reference noise** The magnitude of circuit noise chosen as a reference for measurement. (188) *Note:* Many different levels with a number of different weightings are in current use, and care must be taken to ensure that the proper parameters are stated. *See also* dBa, dBa(F1A), dBa(HA1), dBa0, dBm(psoph), dBm0, dBm0p, dBrn, dBrnC, dBrnC0, dBrn(f<sub>1</sub>-f<sub>2</sub>), dBrn(144-line), noise, noise weighting.

**reference point** In ISDN, a logical point between two, nonoverlapping functional groups. *Note:* When equipment is placed at a reference point, that reference point is designated an interface.

*See also* functional group, Integrated Services Digital Network (ISDN).

**reference surface** That surface of an optical fiber that is used to contact the transverse-alignment elements of a component such as a connector. *Note 1:* For various fiber types, the reference surface might be the fiber core, cladding, or buffer layer surface. *Note 2:* In certain cases the reference surface may not be an integral part of the fiber. *See also* optical fiber connector.

**reference transmission level point** *See* relative transmission level, transmission level point.

**reference white level** [In television,] The level corresponding to the specified maximum excursion of the luminance signal in the white direction. (CFR 47)

**reflectance** The ratio of reflected power to incident power, generally expressed in decibels or percent. *Note:* Reflection from a smooth surface is termed specular, whereas reflection from a rough surface is termed diffuse. (188) *See also* reflection.

**reflecting loss** *See* reflection loss.

**reflection** 1. The abrupt change in direction of a wave front at an interface between two dissimilar media so that the wave front returns into the medium from which it originated. 2. Energy diverted back from the interface of two media. The reflection may be specular (i.e., direct) or diffuse according to the nature of the contact surfaces. (JCS1-DoD) (JCS1-NATO) *See also* critical angle, reflectance, reflectivity, total internal reflection.

**reflection coefficient (RC)** 1. The ratio between the amplitude of the reflected wave and the amplitude of the incident wave. (188) *Note:* For large smooth surfaces, the reflection coefficient may be near unity. At near grazing incidence, even rough surfaces may reflect relatively well. 2. At any specified place in a transmission line between a power source and sink, the complex ratio of the electric field strength associated with the reflected wave to

that associated with the incident wave. The modulus (or magnitude) is given by

$$RC = \frac{|Z_2 - Z_1|}{|Z_1 + Z_2|} \\ = \frac{SWR - 1}{SWR + 1},$$

where  $Z_1$  is the impedance toward the source,  $Z_2$  is the impedance toward the load, the vertical bars designate absolute magnitude, and SWR is the standing wave ratio. (188) *See also* reflection loss, refractive index [of a medium], refractive index contrast, refractive index profile, return loss, standing wave ratio.

**reflection loss** 1. The ratio, usually expressed in decibels, of the incident power to the reflected power at any discontinuity or impedance mismatch. (188) *Note:* When the two waves have opposite phases and appropriate magnitudes, a "reflection gain" may be obtained, i.e., a negative loss. 2. The reflection loss for a given frequency at the junction of a source of power and a load is given by

$$20 \log_{10} \frac{|Z_1 + Z_2|}{\sqrt{4Z_1 Z_2}},$$

where the reflection loss is in decibels, the vertical bars designate absolute magnitude, and  $Z_1$  and  $Z_2$  are the impedances of the source of power and the load, respectively. (188) 3. In an optical fiber, the loss that takes place at any discontinuity of refractive index, especially at an air-glass interface such as a fiber endface, where a fraction of the optical signal is reflected back toward the source. *Note:* This reflection phenomenon is also called "Fresnel reflection loss." At normal incidence, the fraction of reflected power is expressed by the formula

$$r = \frac{(n_1 - n_2)^2}{(n_1 + n_2)^2},$$

where  $r$  is the fraction of incident power that is reflected,  $n_1$  is the medium having the lower index of refraction, and  $n_2$  is the medium having the higher index of refraction. The reflection loss in decibels then becomes  $10 \log_{10} r$ . *See also* echo attenuation, Fresnel reflection loss, loss, path loss, reflection coefficient, return loss, scattering loss, standing wave ratio.

**reflection method** *See* Fresnel reflection method.

**reflective array antenna** An antenna wherein the active (driven) elements are situated at a predetermined distance from a surface designed to reflect the incident energy from the active antenna in a desired direction. (188) *Note 1:* Usually descriptive of an antenna with many active elements working in conjunction with an electrically large reflection surface to produce a unidirectional beam. *Note 2:* Such antennas may be used as a gain-producing device or alternatively for reduction of radiation/reception in unwanted directions. *Note 3:* The antenna may contain parasitic elements as well as driven elements. *See also* antenna, parasitic element, phased array, radiation pattern, reflector.

**reflectivity** The reflectance of the surface of a material so thick that the reflectance does not change with increasing thickness; the intrinsic reflectance of the surface, irrespective of other parameters such as the reflectance of the rear surface. *Note:* No longer in common usage. *See also* reflectance.

**refracted near-field scanning method** *See* refracted ray method.

**refracted ray** In an optical fiber, a ray that is refracted from the core into the cladding. Specifically a ray having direction such that

$$\frac{n^2(r) - n^2(a)}{1 - \left(\frac{r}{a}\right)^2 \cos^2 \phi(r)} \leq \sin^2 \theta(r),$$

where  $r$  is the radial distance from the center of the fiber,  $\phi(r)$  is the azimuthal angle of

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projection of the ray at  $r$  on the transverse plane,  $\Theta(r)$  is the angle the ray makes with the fiber axis,  $n(r)$  is the refractive index at  $r$ ,  $n(a)$  is the refractive index at the core radius, and  $a$  is the core radius. Refracted rays correspond to radiation modes in the terminology of mode descriptors. *See also* cladding ray, guided ray, leaky ray, radiation mode.

**refracted ray method** The technique for measuring the index profile of an optical fiber by scanning the entrance face with the vertex of a high numerical aperture cone and measuring the change in power of refracted (unguided) rays. *Synonym* refracted near-field scanning method. *See also* refracted ray, refraction.

**refraction** The changing of direction of a wavefront in passing through a boundary between two dissimilar media, or in a medium whose refractive index is a continuous function of position (graded-index medium). *See also* angle of deviation, refractive index [of a medium], wavefront.

**refractive index ( $n$ ) [of a medium]** The ratio of the velocity of propagation in vacuum to the phase velocity in the medium. (188) *Synonym* index of refraction.

**refractive index contrast** In an optical fiber, a measure of the relative difference in refractive index of the core and cladding. (188) *Note:* Refractive index contrast,  $\Delta$ , is given by  $\Delta = (n_1^2 - n_2^2) / 2n_1^2$ , where  $n_1$  is the maximum refractive index in the core and  $n_2$  is the refractive index of the homogeneous cladding.

**refractive index profile** The description of the value of the refractive index, as a function of distance from the optical axis along an optical fiber diameter. (188) *See also* graded-index profile, parabolic profile, power-law index profile, profile dispersion parameter, profile parameter, step-index profile.

**reframing time** The time that elapses between the instant at which a valid frame-alignment signal is available at the receiving data terminal equipment and the instant at which frame

alignment is established. *Note:* The reframing time includes the time required for replicated verification of the validity of the frame-alignment signal. *Synonym* frame-alignment recovery time. *See also* frame.

**refresh** The process of repeatedly producing a display image on a display surface so that the image remains visible. (FP) (ISO)

**regeneration** 1. The gain that results from coupling the output of an amplifier to its input. (188) *Synonym* positive feedback. 2. The action of a regenerative repeater in which digital signals are amplified, reshaped, retimed, and retransmitted. (188) 3. In a storage device whose information storing state may deteriorate, the process of restoring the device to its latest undeteriorated state. (188) *See also* closed loop transfer function, deJitterizer, feedback, signal regeneration.

**regenerative repeater** A repeater, designed for digital transmission, in which digital signals are amplified, reshaped, retimed, and retransmitted. (188) *Synonym* regenerator. *See also* optical repeater, pulse, repeater.

**regenerator** *Synonym* regenerative repeater.

**Regional Bell Operating Companies (RBOCs)** The seven holding companies, formed from the divestiture action of the American Telephone and Telegraph company, into which the Bell System's local telephone companies were assigned.

**regional center** *See* office classification.

**register** A temporary-memory device used to receive, hold, and transfer data (usually a computer word) to be operated upon by a processing unit. (188) *Note:* Computers typically contain a variety of registers. General-purpose registers perform such functions as accumulating arithmetic results. Other registers hold the instruction being executed, the address of a storage location, or data being retrieved from or sent to storage. *See also* buffer, fetch protection, M-sequence,



**read-only storage, permanent storage, random-access memory, shift register, storage.**

**registered jack (RJ)** Any of the RJ series of jacks, described in the *Code of Federal Regulations*, Title 47, part 68, used to provide interface to the public telephone network. *See also* connection, interface (def. #1), network.

**registration** 1. The accurate positioning of an entity relative to a reference. (188) 2. *See* registration program.

**registration program** The Federal Communications Commission program and associated directives intended to assure that all connected terminal equipment and protective circuitry will not harm the public switched telephone network or certain private line services. *Note 1:* The program requires the registering of terminal equipment and protective circuitry in accordance with Subpart C of part 68, Title 47 of the *Code of Federal Regulations*. This includes the assignment of identification numbers to the equipment and the testing of the equipment. *Note 2:* The registration program contains no requirement that accepted terminal equipment be compatible with, or function with, the network. (188) *See also* part 68.

**relative error** The ratio of an absolute error to the true, specified, or theoretically correct value of the quantity that is in error. (FP) (ISO)

**relative offset** *Synonym* normalized offset.

**relative transmission level** The ratio of the signal power, at a given point in a transmission system, to a reference signal power. (188) *Note:* The ratio is usually determined by applying a standard test tone at zero transmission level point (or adjusted test tone power at any other point) and measuring the gain or loss to the location of interest. A distinction should be made between the standard test tone power and the expected median power of the actual signal required as the basis for the design of transmission systems. *See also* dBr, level, standard test tone,

transmission, transmission level, transmission level point, zero transmission level point.

**relay** 1. An intermediate station passing information between terminals or other relay stations. *See also* radio relay. 2. An electromechanical device that enables a part in one circuit to control electrical currents or voltages in other circuits. (188) *See also* neutral relay, polar relay, relay configuration, repeater.

**relay configuration** An operating configuration in which a circuit is established between two stations via an intermediate relay station. Two links are used simultaneously and the channel connections at the relay station are accomplished completely within the station. (188) *See also* circuit (def. #1), relay (def. #1).

**released loop** *Synonym* switched loop.

**release time** 1. The time after the end of an enabling signal (as in a vogad or echo suppressor) during which suppression continues. (188) *See also* vogad. 2. The time interval between de-energization of a relay coil and the end of the contact closure. (188)

**reliability** 1. The ability of an item to perform a required function under stated conditions for a specified period of time. (JCS1-NATO) 2. The probability that a functional unit will perform its required function for a specified interval under stated conditions. (188) *See also* acceptance test, availability, maintainability, mean time between failures, mean time between outages, mean time to repair, mean time to service restoral.

**remote access** 1. Pertaining to communication with a data processing facility through a data link. (FP) 2. A PABX service feature that allows a user at a remote location to access PABX features by telephone; e.g., WATS lines. *Note:* Individual authorization codes are usually required. *See also* access, PABX, remote control equipment, service feature, Wide Area Telephone Service.

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**remote access data processing** Data processing in which some input/output functions are performed by devices that are connected to a computer system by means of data communication. (FP) (ISO)

**remote batch entry** Submission of batches of data through an input unit that has access to a computer through a data link. (FP) (ISO)

**remote batch processing** Batch processing in which input-output units have access to a computer through a data link. (FP) (ISO)

**remote call forwarding** A service feature that allows calls coming to a remote call-forwarding number to be automatically forwarded to any answering location that the called customer wishes. *Note:* Customers may have a remote-forwarding telephone number in a central switching office without having any other local telephone service in that office.

**remote clock** A clock located remotely from a particular communications station, node, or other facility with which it is associated, or located remotely from another clock with which it is to be compared. *See also* clock, DoD master clock, master clock.

**remote control equipment** Devices used to perform monitoring, controlling, and/or supervisory functions, at a distance. (188) *See also* access point, remote access.

**remote job entry (RJE)** In computer operations, that mode of operation that allows input of a job to a computer from a remote site and receipt of the output at a remote site via a communications link. *See also* remote access.

**remote orderwire** An extension of a local orderwire to a point convenient for personnel to perform required monitoring functions. (188) *See also* orderwire circuit.

**remote trunk arrangement (RTA)** Arrangement that permits the extension of TSPS functions to remote locations. (CFR 47)

**REN** Acronym for ringer equivalency number.

**reorder tone** A unique tone received by the calling station when switching paths, trunks, or other communications equipment or facilities (except the called terminal) are not available for use during a call attempt.

**repair** The restoration of an item to serviceable condition through correction of a specific failure or unserviceable condition. (JCS1-DoD)

**repeater** A device that amplifies an input signal or, in the case of pulses, amplifies, reshapes, retimes, or performs a combination of any of these functions on an input signal for retransmission. (188) *Note:* It may be either one-way or two-way type. *See also* regenerative repeater.

**repeating coil** A voice-frequency transformer characterized by a closed core, a pair of identical balanced primary (line) windings, a pair of identical but not necessarily balanced secondary (drop) windings, and a low transmission loss at voice frequencies. (188) *Note:* It permits transfer of voice currents from one winding to another by magnetic induction, matches line and drop impedances, and prevents direct conduction between the line and the drop. *See also* balanced, drop repeater.

**repeat-request (RQ) system** *Synonym* ARQ.

**reperforator** In teletypewriter systems, a device used to punch a tape in accordance with arriving signals, permitting reproduction of the signals for retransmission. (188) *See also* chad, chadless tape, chad tape, tape relay, torn-tape relay.

**repertory dialer** A telephone set that stores a group of numbers frequently called by a customer and transmits the dialing information to the central office by a single action. (188) *See also* call, card dialer, speed calling.

**reproducibility** *Synonym* precision.

- request** *See* access request, ARQ, data transfer request signal, disengagement request, request data transfer.
- request data transfer** A signal sent by the DTE to the DCE to request the establishment of a data connection. *See also* call control signal, data, data circuit-terminating equipment, data terminal equipment, signal.
- reradiation** 1. Radiation, at the same or different wavelength(s), of energy received from an incident wave. (188) 2. Undesirable radiation of signals generated locally in a radio receiver, causing interference or revealing the location of the receiver. *See also* interference.
- rerouting** Recommencement of route selection from the first point of routing control, when congestion is encountered at some intermediate switching point in the connection that it is desired to establish. *See also* clear collision.
- resale carrier** A company that redistributes the services of a commercial carrier and retails the services to the public. *See also* common carrier, divestiture, other common carrier, specialized common carrier.
- resale service** In FCC deliberations and rulings, the right of a buyer of basic telecommunication services, such as private lines, foreign exchanges, or WATS, to resell and/or share with others the unused capacity.
- reserved circuit service** In ISDN applications, a telecommunications service that establishes a communication path at a preset time (requested by the user) in response to a user-network signaling request.
- reserved word** In programming languages, a keyword whose definition is fixed by the programming language and which cannot be changed by the user. *Note:* In Ada® and COBOL all keywords are reserved words, while FORTRAN has no reserved words. (FP) (ISO)
- reset mode** The parameters initially programmed for basic operation. (188)
- resident** Pertaining to computer programs that remain on a particular storage device. (FP) (ISO)
- residual error rate** *Synonym* undetected error rate.
- residual error ratio** 1. The ratio of the number of bits, unit elements, characters, or blocks incorrectly received but undetected or uncorrected by the error-control equipment, to the total number of bits, unit elements, characters or blocks. (After CCITT) 2. The error ratio that remains after attempts at correction are made. (FP)
- residual modulation** *Synonym* carrier noise level.
- resolution** 1. The minimum difference between two discrete values that can be distinguished by a measuring device. (188) *Note:* High resolution does not necessarily imply high accuracy. 2. The degree of precision to which a quantity can be measured or determined. (188) 3. A measurement of the smallest detail that can be distinguished by a sensor system under specific conditions. (JCS1-DoD) (JCS1-NATO) *See also* accuracy, definition, precision, resolving power.
- resolving power** A measure of the ability of a lens or optical system to form separate and distinct images of two objects with small angular separation. (188) *Note:* Because of diffraction at the aperture, no optical system can form a perfect image of a point, but produces instead a small disk of light (Airy disk) surrounded by alternately dark and bright concentric rings. *See also* resolution.
- resonant cavity** *See* optical cavity.
- respond opportunity** In data transmission, the link level logical control condition during which a given secondary station may transmit a response. *See also* transmit flow control.
- response** 1. A reply to a query. (188) 2. In data transmission, the content of the control field of a response frame advising the primary station

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concerning the processing by the secondary station of one or more command frames.  
**3.** The effect of an active or passive device upon an input signal. *See also* polling, response time.

**response frame** In data transmission, all frames that may be transmitted by a secondary station. *See also* frame, secondary station.

**response time** 1. The time a system takes to react to a given input. (188) *Note:* If a message is keyed into a terminal by an operator and the reply from the computer, when it comes, is typed at the same terminal, response time may be defined as the time interval between the operator pressing the last key and the terminal typing the first letter of the reply. 2. In a data system, the elapsed time between the end of transmission of an enquiry message and the beginning of the receipt of a response message, measured at the enquiry originating station. 3. The time a functional unit takes to react to a given input. (188) *See also* overshoot, turnaround time.

**responsivity** The ratio of an optical detector's electrical output to its optical input. (188) *Note 1:* Generally expressed in amperes per watt, or volts per watt, of incident radiant power. *Note 2:* The value will change with the wavelength of the incident radiation. *Deprecated synonym* sensitivity.

**restart** The resumption of the execution of a computer program using the data recorded at a checkpoint. (FP) (ISO) *See also* checkpoint.

**restitution** A series of significant conditions determined by the decisions taken according to the products of the demodulation process. (188) *See also* demodulation, detection.

**restoration** Any or all actions taken to repair and restore one or more telecommunication services that have experienced a degraded quality of service or a service outage for any reason, including a damaged or impaired telecommunication facility. (188) *Note:* Such repair or returning to service may be done by patching, routing, substitution of component

parts or pathways, or other means, as determined necessary by a service vendor.

**restoration priority** *See* TSP service.

**restricted access** A class of service in which users may be denied access to one or more of the system features or operating levels. (188) *See also* access control, classmark, code restriction, controlled access, service feature.

**restricted service** *See* restricted access.

**restriction** *See* restricted access.

**retiming** Adjustment of the intervals between corresponding significant instants of a digital signal in reference to a timing signal. (188)

**retrace** The difference between the frequency at a specified time after oscillator turn-on and the frequency immediately prior to oscillator turn-off, when an oscillator, operating in a stable condition at a specified test temperature, is turned off for a specified time period, maintained at the specified test temperature, and again turned on.

**retrieval** 1. In common-channel signaling, the procedure for guarding against the loss of signaling information when a signaling link fails and changeover is initiated. *Note:* Retrieval involves the retransmission of lost or mutilated messages. 2. In information processing, the act or process of recovering data or information from storage. (FP) *See also* common-channel signaling, link, out-of-band signaling.

**retrieval function** In a data manipulation language, a capability to select and to locate stored records with specified characteristics and to transfer these records to a work area for any required further processing by an application program. (FP)

**retrieval service** In ISDN applications, an interactive telecommunications service allowing access to and retrieval of stored information (a database).

**retrograde orbit** Of a satellite orbiting the Earth, an orbit in which the projection of the satellite's position on the (Earth's) equatorial plane revolves in the direction opposite that of the rotation of the Earth. *See also* equatorial orbit, geostationary orbit, inclined orbit, polar orbit, synchronous orbit.

**return loss** The ratio, at the junction of a transmission line and a terminating impedance, of the amplitude of the reflected wave to the amplitude of the incident wave, expressed in decibels. (188) *Note:* More broadly, the return loss is a measure of the dissimilarity between two impedances, being equal to the number of decibels that corresponds to the scalar value of the reciprocal of the reflection coefficient, RC, and hence is expressed by

$$\left| \frac{Z_1 + Z_2}{Z_2 - Z_1} \right|,$$

where  $Z_1$  is the impedance toward the source and  $Z_2$  is the impedance toward the load. *See also* balance return loss, echo, echo attenuation, echo suppressor, forward echo, loss, reflection coefficient, reflection loss.

**return-to-zero (RZ) code** A code form having two information states called "zero" and "one" in which the signal returns to a rest state during a portion of the bit period. (188) *See also* alternate mark inversion signal, bipolar signal, code, duobinary signal.

**reverse-battery signaling** A type of loop signaling in which battery and ground are reversed on the tip and ring of the loop to give an "off-hook" signal when the called party answers. (188) *Note:* Some systems employ reverse battery, either for a short period or until the call is finished, to indicate that it is a toll call. This is used in connection with some PBXs to provide toll diversion in the PBX. *See also* off-hook signal, on-hook signal, signal.

**revertive pulsing** In telephone networks, a means of controlling distant switching selections by pulsing, in which the near end receives signals from the far end.

**rf** *Abbreviation for radio frequency.*

**rf bandwidth** The difference between the highest and the lowest emission frequencies in the region of the carrier or principal carrier frequency. (188) *Note:* In practice, the region of the carrier or principal carrier frequency beyond which the amplitude of any frequency resulting from modulation by signal, subcarrier, or both frequencies, and their distortion products is less than 5 percent (-26 dB) of the rated peak output amplitude of: (a) the carrier or a single-tone sideband, whichever is greater, for single-channel emission; or (b) any subcarrier or a single-tone sideband thereof, whichever is greater, for multiplex emission. *See also* bandwidth, frequency, nominal bandwidth, occupied bandwidth.

**RFI** *Abbreviation for radio frequency interference. See electromagnetic interference.*

**rf power margin** An extra amount of transmitter power that may be specified by a designer because of uncertainties in the empirical components of the prediction method, the terrain characteristics, atmospheric variability, and equipment performance parameters. (188) *See also* design margin, fade margin.

**rf tight** Offering a high degree of electromagnetic shielding effectiveness. (188) *See also* shield, shielding effectiveness, TEMPEST.

**rhombic antenna** An antenna composed of wire radiators describing the sides of a rhombus. (188) *Note:* It is usually terminated and unidirectional; when unterminated, it is bidirectional. *See also* antenna.

**RI** *Abbreviation for routing indicator.*

**right-hand [clockwise] polarized wave** An elliptically or circularly polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a right-hand



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or clockwise direction. (RR) *See also* circular polarization, left-hand [anti-clockwise] polarized wave.

**ring** 1. In telephony, a signal of specific duration and character that indicates to a user (customer, subscriber) that a calling party is engaged in an access attempt. (188) *See also* access attempt, circuit. 2. *See* ring network. (188)

**ring around** The improper routing of a call back through a switching center already involved in attempting to complete the same call. (188) *See also* alternate routing, routing.

**ringback signal** 1. In telephony, a signal, usually consisting of an audio tone interrupted at a slow rate, provided to a caller to indicate that the called-party instrument is receiving a ringing signal. (188) *Note:* This signal may be generated by the called-party servicing switch or by the calling-party switch. 2. A ringing signal returned to a caller to indicate that one of the types of delayed automatic calling is now ringing the called party. (188) *See also* call, call control signal.

**ringback tone** *Synonym* audible ringing tone.

**ringdown** 1. In telephone switching, that method of signaling an operator in which telephone ringing current is sent over the line to operate a lamp and the drop of a self-locking relay. (188) 2. The type of signaling employed in manual operation, as differentiated from dial signaling. Ringdown signaling uses a continuous or pulsing ac signal transmitted over the line and can also apply when no switchboard is involved, as well as from a switchboard to the user. (188) *Note:* The term "ringdown" originated in magneto telephone operation, where cranking the magneto of a telephone set would "ring" its bell and cause a lever to fall "down" at the central switchboard.

**ringdown circuit** A circuit on which the signaling is manually activated. (188)

**ringdown signaling** The application of a signal to a line for the purpose of operating a line

signal lamp or supervisory signal lamp at a switchboard or ringing a user's instrument. (188) *See also* ringdown, signal.

**ringer equivalency number (REN)** A number determined in accordance with the *Code of Federal Regulations*, Title 47, part 68, which represents the ringer loading effect on a line. *See also* loading.

**ring latency** In a token-ring network, the time measured in bits at the data transmission rate, required for a signal to propagate once around the ring. *Note:* Ring latency includes the signal propagation delay through the ring medium, including drop cables, plus the sum of propagation delays through each data station connected to the token-ring network. (FP) (ISO) (188) *See also* token-ring network.

**ring network** A network in which every node has exactly two branches connected to it. (FP) (ISO) (188) *See also* bus topology, local area network, node (def. #1), slotted ring network, star network, star topology, token-ring network, tree topology.

**ring topology** *See* ring network.

**ring transit time** *See* round-trip delay time.

**R interface** For a basic rate access in an ISDN environment, the interfacing specifications covering pre-ISDN standards (e.g., EIA-232C). *See also* Integrated Services Digital Network, S interface, T interface, U interface.

**ripple voltage** 1. The alternating component of dc voltage that is residually retained from the rectification or generation of dc power from an alternating source or rectification process. (188) 2. The alternating component of dc voltage that is coupled into a circuit from a source of interference.

**rise time** In the approximation of a step function, the time required for a signal to change from a specified low value to a specified high value. Typically, these values are 10% and 90% of the step height. (FP) (ISO) (188) *See also* fall time, pulse.

**RJ** *Abbreviation for registered jack.*

**RJE** *Abbreviation for remote job entry.*

**rms** *Abbreviation for root-mean-square.*

**rms pulse duration** *See root-mean-square (rms) pulse duration.*

**RO** *Abbreviation for receive only.*

**ROM** *Acronym for read-only memory.*

**roofing filter** A low-pass filter used to reduce unwanted higher frequencies. (188) *See also filter.*

**room noise level** *Synonym ambient noise level.*

**root** The highest level of a hierarchy. (FP)

**root-mean-square (rms) deviation** A single quantity,  $\sigma_{rms}$ , characterizing a function,  $f(x)$ , given by

$$\sigma_{rms} = \left[ \frac{1}{M_0} \int_{-\infty}^{\infty} (x - M_1)^2 f(x) dx \right]^{\frac{1}{2}}, \text{ where}$$

$$M_0 = \int_{-\infty}^{\infty} f(x) dx, \text{ and}$$

$$M_1 = \frac{1}{M_0} \int_{-\infty}^{\infty} x f(x) dx.$$

*Note:* The term "rms deviation" is also used in probability and statistics, where the normalization,  $M_0$ , is unity. Here, the term is used in a more general sense. *See also impulse response, root-mean-square pulse broadening, root-mean-square pulse duration, spectral width.*

**root-mean-square (rms) pulse broadening** The temporal rms deviation of the impulse response of a system. *See also root-mean-square deviation, root-mean-square pulse duration.*

**root-mean-square (rms) pulse duration** A special case of root-mean-square deviation where the independent variable is time and  $f(t)$  is pulse waveform. *See also root-mean-square deviation.*

**rotary dial** A type of calling device (incorporated within a telephone set) that, when wound up and released, generates dc pulses required for establishing a connection in a telephone system. *See also dial pulse, dial signaling, dual-tone multifrequency signaling.*

**rotary hunting** Historically, hunting wherein all the numbers in the hunt group are selected sequentially. (188) *Note:* In modern electronic switching, the numbers are not necessarily sequential. *See also hunting.*

**rotary switching** In telephone systems, an electro-mechanical switching method whereby the selecting mechanism consists of a rotating element using several groups of wipers, brushes, and contacts. (188) *See also switching system.*

**rotational delay** *Synonym search time.*

**rotational position sensing** [In magnetic media,] A technique used to locate a given sector, a desired track, and a specific record by continuous comparison of the read/write head position with appropriate synchronization signals. (FP) (ISO)

**round-trip delay time** 1. The elapsed time for transit of a signal over a closed circuit. (188) *Note:* Significant in systems that require two-way interactive communication such as voice telephony or ACK/NAK data systems where the round-trip time directly affects the throughput rate. It may range from a very few microseconds for a short LOS radio system to many seconds for a multiple-link circuit with one or more satellite links involved. This includes the node delays as well as the media transit time. 2. In radar systems, the time required for a transmitted pulse to reach a target and the echo to return to the receiver. (188) *See also circuit, turnaround time.*

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**route diversity** The allocation of circuits between two points with no geographic points of commonality. (188) *See also* **alternate routing**, **avoidance routing**.

**routine** A [computer] program, called by another program, that may have some general or frequent use. (FP) (ISO)

**routine message** A category of precedence to be used for all types of messages that justify transmission by rapid means unless of sufficient urgency to require a higher precedence. (JCS1-DoD) *See also* **precedence**.

**routing** The process of determining and prescribing the path or method to be used for establishing telephone connections or forwarding messages. *See also* **alternate routing**, **heuristic routing**, **high-usage trunk group**, **ring around**, **spill forward**.

**routing indicator (RI)** A group of letters assigned to indicate: (a) the geographic location of a station; (b) a fixed headquarters of a command, activity, or unit at a geographic location; and (c) the general location of a tape relay or tributary station to facilitate the routing of traffic over the tape relay networks. (JCS1-DoD) *See also* **alternate routing**, **character**.

**routing table** A matrix associated with a network control protocol, which gives the hierarchy of link routing at each node. *See also* **distributed control**, **queue traffic**.

**RQ** *Abbreviation for repeat-request. See ARQ.*

**RSL** *Abbreviation for received signal level.*

**RTA** *Abbreviation for remote trunk arrangement.*

**RTTY** *Abbreviation for radio teletypewriter.*

**rubidium clock** A clock containing a quartz oscillator stabilized by a rubidium standard.

**rubidium standard** A frequency standard in which a specified hyperfine transition of

rubidium-87 atoms is used to control the output frequency. *Note:* A rubidium standard consists of a gas cell, which has an inherent long-term instability. This, as a consequence, relegates the rubidium standard to status as a secondary standard. *See also* **primary frequency standard**.

**run** 1. The execution of one or more [computer] jobs or programs. 2. A performance of one or more [computer] programs. (FP) (ISO)

**run-length encoding** A redundancy-reduction technique for facsimile in which a run of consecutive picture elements having the same state (gray scale or color) is encoded into a single codeword. (188) *See also* **code**, **facsimile**.

**rural radio service** A public radio service rendered by fixed stations on frequencies below 1000 MHz used to provide (a) public message communication service between a central office and subscribers located in rural areas to which it is impracticable to extend service via landlines, or (b) public communication service between landline central offices and different exchange areas which it is impracticable to interconnect by any other means, or (c) private line telephone, telegraph, or facsimile service between two or more points to which it is impracticable to extend service via landline. (After CFR 47)

**rural subscriber station** A fixed station in the rural radio service used by a subscriber for communication within a central office station.

**RWI** *Abbreviation for radio and wire integration.*

**RZ** *Abbreviation for return-to-zero. See return-to-zero code.*

**s** Abbreviation for second.

**safety service** Any radiocommunication service used permanently or temporarily for the safeguarding of human life and property. (RR)



**sampling** See signal sampling.

**sampling frequency** See sampling rate.

**sampling rate** The number of samples taken per unit time; the rate at which signals are sampled for subsequent use, such as modulation, coding, quantization, or any combination of these functions. *Note:* The sampling rate is sometimes improperly referred to as the sampling frequency. (188) See also Nyquist rate, signal sampling.

**satellite** A body which revolves around another body of preponderant mass and which has a motion primarily and permanently determined by the force of attraction of that other body. (RR) (188) See also Earth station.

**satellite Earth terminal** That portion of a satellite link that receives, processes, and transmits communications between Earth and a satellite. (188) See also link, satellite.

**satellite emergency position-indicating radiobeacon** An Earth station in the mobile-satellite service the emissions of which are intended to facilitate search and rescue operations. (RR)

**satellite link** A radio link between a transmitting Earth station and a receiving Earth station through one satellite. A satellite link comprises one uplink and one downlink. (RR)

**satellite network** A satellite system or a part of a satellite system, consisting of only one satellite and the cooperating Earth stations. (RR)

**satellite operation** See satellite PBX.

**satellite PBX** A PBX or Centrex® System that is not equipped with attendant positions, and is associated with an attended main PBX or Centrex® System. *Note:* The main attendant provides attendant functions for the satellite system. See also Centrex® service, PBX.

**satellite relay** An active or passive satellite repeater that relays signals between two Earth terminals. (188)

**satellite system** A space system using one or more artificial Earth satellites. (RR)

**saturation** 1. In a communication system, that condition wherein a component of the system has just reached its maximum traffic handling capacity. *Note:* This equates to one erlang per circuit. See also busy hour, erlang, traffic load. 2. That point at which the output of a linear device deviates significantly from being a linear function of the input when the input signal is increased. (188) *Note:* Some forms of modulation require that all amplifiers operate below saturation.

**scan** 1. To examine sequentially, part by part. (FP) 2. To examine every reference or every entry in a file routinely as part of a retrieval scheme. (FP) (ISO) 3. In electromagnetic or acoustic search, one complete rotation of an antenna. It may determine a time base. (JCS1-NATO) 4. [In ELINT,] The motion of an electronic beam through space searching for a target. Scanning is produced by the motion of the antenna or by lobe switching. (JCS1-DoD)

**scanner** A device that examines a spatial pattern, one part after another, and generates analog or digital signals corresponding to the pattern. *Note:* Scanners are often used in mark sensing, pattern recognition, or character recognition. (FP) (ISO) (188) See also facsimile, scanning, simple scanning.

**scanning** 1. In telecommunication systems, periodic examination of the traffic activity to determine whether further processing is required. 2. In television, facsimile, and picture transmission, the process of analyzing successively the colors and densities of the

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subject copy according to the elements of a predetermined pattern. (188) 3. The process of tuning a device through a predetermined range of frequencies in prescribed increments and times (regular or random). (188)

**scanning line** The path traversed by a scanning spot during a single line sweep.

**scanning line frequency** In facsimile, the frequency at which a fixed line perpendicular to the direction of scanning is crossed by a scanning spot. (188) *Note:* This is equivalent to drum speed in some mechanical systems. *See also* facsimile, frequency, scanning, stroke speed.

**scanning line length** In facsimile systems, the total length of a scanning line, equal to the spot speed divided by the scanning line frequency. (188) *Note:* This is generally greater than the length of the available line. *See also* dead sector, facsimile, scanning, spot speed.

**scanning pitch** The distance between the centers of consecutive scanning lines. *See also* facsimile, scanning.

**scanning rate** In facsimile and television systems, the rate of displacement of the scanning spot along the scanning line. (188) *See also* facsimile, scanning.

**scanning spot** In facsimile systems, the area on the subject copy covered instantaneously by the pickup system of the scanner. (188) *See also* elemental area, facsimile, raster scanning, scanning.

**scan-stop lockup** In automatic link establishment radios, the undesired condition where the normal process of: (a) scanning radio channels, (b) stopping on the desired channel, and/or (c) returning to scan, is terminated by the equipment.

**scatter** The process whereby the direction, frequency, or polarization of waves is changed when the waves encounter one or more discontinuities in the medium, which have lengths on the order of a wavelength. (188)

*Note:* The term is frequently used to imply a disordered change in the incident energy.

**scattering** The change produced by scatter.

**scattering loss** That part of the transmission (power) loss that is due to scattering within the medium or due to roughness of the reflecting surface. (188) *See also* loss, reflection loss, scatter, transmission loss.

**SCC** *Abbreviation for specialized common carrier.*

**schematic** A diagram that details the electrical elements of a circuit or system. *See also* circuit, system.

**scintillation** In electromagnetic wave propagation, a random fluctuation of the received field strength about its mean value, the deviations usually being relatively small. (188) *Note:* The effects of this phenomenon become more significant as the frequency of the propagating wave increases. *See also* field intensity, field strength.

**scrambler** A device that transposes or inverts signals or otherwise encodes a message at the transmitter to make it unintelligible at a receiver not equipped with an appropriately set descrambling device. (188) *Note:* Scramblers normally use a fixed algorithm or mechanism. They provide a measure of communications privacy that is inadequate for classified traffic. *See also* data scrambler, descrambler, limited protection voice equipment, mode scrambler, randomizer.

**screen** 1. To examine entities within a telecommunication system to determine suitability for further processing. 2. A nonferrous metallic mesh used to provide electromagnetic shielding. (188) 3. To reduce undesired electromagnetic signals and noise by enclosing devices in electrostatic or electromagnetic shields. (188) 4. The viewing surface of a cathode ray tube. *See also* filter, shield, shielding effectiveness.



**scroll** In a display device, the ability to move the display window of the screen either vertically or horizontally to view the contents of a document in memory. *Note:* Scrolling may be continuous or in steps. (188).

**SDLC** *Abbreviation for synchronous data link control.*

**search time** The time interval required for a direct-access magnetic storage device to locate a particular data element, record or file. *Synonym* rotational delay.

**SECAM** *Acronym for système électronique couleur avec memoire.* A television signal standard (625 lines, 50 hertz, 220 volts primary power) used in France, eastern European countries, the USSR and some African countries. *See also* NTSC standard, PAL, PAL-M.

**second (s)** In the International System of Units (SI), the time interval equal to 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the atom of cesium-133. (188) *See also* cesium clock, cesium standard, Coordinated Universal Time, DoD master clock, International Atomic Time.

**secondary channel** A data transmission channel having a lower signaling rate capacity than the primary channel in a system in which two channels share a common interface. *See also* channel, primary channel.

**secondary radar** A radiodetermination system based on the comparison of reference signals with radio signals retransmitted from the position to be determined. (RR) *See also* primary radar, radar.

**secondary radiation** Particles (such as photons, Compton recoil electrons, delta rays, secondary cosmic rays, and secondary electrons) that are produced by the action of primary radiation on matter. (188)

**secondary service area** [T]he service area of a broadcast station served by the skywave and

not subject to objectionable interference and in which the signal is subject to intermittent variations in strength. (CFR 47)

**secondary station** In a data communication network, the station responsible for performing unbalanced link-level operations, as instructed by the primary station. *Note:* A secondary station interprets received commands and generates responses. *See also* backward supervision, control station, data communication, link, master station, primary station, slave station, tributary station.

**secondary time standard** A time standard that requires periodic calibration of the device against a primary time standard. *See also* primary time standard.

**SECORD** *Acronym for secure voice cord board.*

**SECTEL** *Acronym for secure telephone.* *See* secure telephone unit.

**sector** A predetermined, addressable angular part of a track or a band on a magnetic drum or magnetic disk.

**secure communications** Telecommunications which are effectively secured against hostile exploitation by COMSEC equipment and/or protected distribution systems.

**secure telephone unit (STU)** A U.S. Government-approved telecommunication terminal designed to protect the transmission of sensitive or classified information in the voice, data, and facsimile modes.

**secure voice cord board (SECORD)** A desk-mounted patch panel that provides the capability for controlling 16 wideband (50 kbps) or narrowband (2400 bps) user lines and 5 narrowband trunks to AUTOVON or other DCS narrowband facilities. (188) *See also* patch bay, wideband.

**security** 1. The condition achieved when designated information, materiel, personnel, activities and installations are protected against espionage, sabotage, subversion and terrorism,

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as well as against loss or unauthorized disclosure. The term is also applied to those measures necessary to achieve this condition and to the organizations responsible for those measures. (JCS1-NATO) 2. Measures taken by a military unit, an activity, or installation to protect itself against all acts designed to, or which may, impair its effectiveness. (JCS1-DoD) 3. A condition that results from the establishment and maintenance of protective measures that ensure a state of inviolability from hostile acts or influences. (JCS1-DoD) 4. With respect to classified matter, it is the condition that prevents unauthorized persons from having access to official information that is safeguarded in the interests of national security. (JCS1-DoD) *See also* AUTOSEVOCOM, communications, communications security, data security, electronics security, signal security, traffic-flow security.

**seek** To position selectively the access mechanism of a direct access [storage] device. (FP)

**seek time** The time required for the access arm of a direct-access storage device to be positioned on the appropriate track. (FP) (ISO) *Synonym* positioning time.

**segmented encoding law** An encoding law in which an approximation to a smooth law is obtained by a number of linear segments. *Synonym* piece-wise linear encoding. *See also* code, encoding law.

**segregation** *Synonym* privacy (def. #1).

**seizing** A condition in which various parts of a communication system are temporarily dedicated to a specific use, generally in response to a user request for service. (188) *Note:* The parts of the system seized may be automatically connected or may require that an operator intervene; e.g., a long-distance call may be established by automatic means (direct distance dialing) or by an operator. *See also* dedicated circuit, override, peg count, precedence, preemption.

**seizure signal** In telephone systems, a signal used by the calling end of a trunk or line to indicate a request for service. (188) *See also* access request, call control signal, off-hook signal, signal.

**selection position** *Synonym* decision instant.

**selective calling** The ability of a transmitting station to specify which of several stations on the same line is to receive a message. *See also* call, conference call, multiaddress calling facility, queue traffic, selective ringing.

**selective combiner** A circuit or device for selecting one of two or more diversity signals in which only the signal having the most desirable characteristics is selected and used. (188) *Note:* The selection process may be designed to operate on signal amplitude, signal-to-noise ratio, transition characteristics, or other signal characteristics. *See also* diversity combiner, maximal-ratio combiner, predetection combining.

**selective fading** Fading in which the components of the received radio signal fluctuate independently. (188) *See also* fading, flat fading, flutter.

**selective jamming** *See* electronic warfare.

**selective ringing** A system designed with the capability of ringing only the desired user on a multiparty line. (188) *See also* selective calling.

**selectivity** A measure of the ability of a receiver to discriminate between a wanted signal on one frequency and unwanted signals on other frequencies. (188) *See also* discriminator, frequency.

**self-delineating block** A block in which a bit pattern or a flag identifies the block endpoints. *See also* block.

**self-synchronizing code** A code constructed such that the symbol stream formed by a portion of one code word or the overlapped portion of any two adjacent code words is not a

valid code word. (188) *Note:* The self-synchronizing property permits the proper framing of transmitted code words provided that no uncorrected errors occur in the symbol stream. External synchronization is not required. The HDLC and ADCCP frames represent self-synchronizing code words. *See also* code, comma-free code.

**semiautomated tactical command and control system** A machine-aided command and control system wherein human intervention is required in varying degrees to operate the system.

**semiautomatic switching system** A telephone system in which operators receive call instructions orally from users and complete them by automatic equipment. (188) *See also* PBX.

**semiconductor laser** *Synonym* injection laser diode.

**semiduplex operation** 1. A method which is simplex operation at one end of the circuit and duplex operation at the other. *RR Footnote:* In general, duplex operation and semiduplex operation require two frequencies in radiocommunication; simplex operation may use either one or two. (RR) 2. A special mode of operation of a communications network wherein a base station operates in a duplex mode with a group of remote stations operating in a half-duplex mode. (188) *CAUTION:* The terms "*half-duplex*" and "*simplex*" are used differently in wire and radio communications. The user should verify the nature of the services intended. *See also* duplex operation, simplex operation.

**sender** A device that accepts address information from a register or routing information from a translator, and then transmits the proper routing digits to a trunk or to local equipment. *Note:* Sender and register functions are often combined in a single unit. (188) *See also* address.

**sending-end crossfire** In teletypewriter (TTY) systems, the interfering current in a channel

from one or more adjacent TTY channels transmitting from the end at which the crossfire is measured. (188) *See also* interference, teletypewriter.

**sensitivity** In a communications system receiver or similar device, the minimum input signal required to produce a specified output signal having a specified signal-to-noise ratio, or other specified criteria. (188) *Note 1:* This signal input may be expressed as power in dBm or as field strength in microvolts per meter, with input network impedance stipulated. *Note 2:* Sometimes improperly used as a *synonym* for *responsivity*. *See also* discriminator, *responsivity*, *signal-to-noise ratio*, *spectral responsivity*.

**sensor** 1. A device that responds to a physical stimulus (such as heat, light, sound, pressure, magnetism, or a particular motion) and produces a resulting signal. 2. An equipment which detects, and may indicate, and/or record objects and activities by means of energy or particles emitted, reflected, or modified by objects. (JCS1-DoD) (JCS1-NATO) *See also* active sensor, passive sensor.

**sentinel** *See* flag.

**separate channel supervisory signaling** *Synonym* common-channel signaling.

**septet** A byte composed of seven binary elements. (FP) (ISO) *Synonym* seven-bit byte.

**sequence** An arrangement of items according to a specified set of rules, for example, items arranged alphabetically, numerically, or chronologically. (FP) *See also* automatic sequential connection, bit-sequence independence, flag sequence.

**sequential access** *Synonym* serial access.

**sequential logic element** A device that has at least one output channel and one or more input channels, all characterized by discrete states, such that the state of each output channel is determined by the previous states of the input channels. (FP)

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**sequential transmission** *Synonym serial transmission.*

**serial** 1. Pertaining to a process in which all events occur one after the other; for example, the serial transmission of the bits of a character according to the CCITT V.25 protocol. (FP) (ISO) 2. Pertaining to the sequential or consecutive occurrence of two or more related activities in a single device or channel. (FP) 3. Pertaining to the sequential processing of the individual parts of a whole, such as the bits of a character or the characters of a word, using the same facilities for successive parts. (FP) *See also parallel processing.* 4. An element or a group of elements within a series which is given a numerical or alphabetical designation for convenience in planning, scheduling, and control. (JCS1-DoD) (JCS1-NATO)

**serial access** 1. Pertaining to the sequential or consecutive transmission of data to or from storage. (188) 2. That process wherein data are obtained from a storage device or are entered into a storage device in such a way that the process depends on the location of those data and on a reference to data previously accessed. *Synonym sequential access. See also access, data communication control procedure.*

**serial digital computer** A digital computer in which the digits are handled serially. *Note:* The bits that comprise a digit may be handled either serially or in parallel.

**serializer** *Synonym parallel-to-serial converter.*

**serial-to-parallel converter** A digital device that accepts a single time sequence of signal elements and distributes them among multiple parallel outputs. (188) *Synonym staticizer. See also parallel-to-serial converter.*

**serial transmission** The sequential transmission of the signal elements of a group representing a character or other entity of data. (FP) (ISO) *Synonym sequential transmission. See also data communication control procedure, data stream, parallel transmission.*

**series T junction** A three-port waveguide junction that has an equivalent circuit in which the impedance of the branch waveguide is predominantly in series with the impedance of the main waveguide at the junction.

**service** *See telecommunication service.*

**service access point** 1. Any physical point at which a circuit may be accessed. (188) 2. An entry point to an OSI protocol layer to provide a designated service. *See also Open Systems Interconnection--Reference Model.*

**service bit** An overhead bit that is not a check bit, such as a bit used for a request for repetition or for a numbering sequence. (188) *See also binary digit, check bit, front-end processing, overhead bit, overhead information.*

**service channel** *Synonym orderwire circuit.*

**service feature** A function that may be added (or specified initially) to an equipment to provide a service to the user in addition to the basic function of the equipment. (188) *Note:* Modern telephone switches may be obtained with a wide variety of functions, such as call forwarding and call waiting.

**service identification** The information uniquely identifying an NS/EP telecommunications service to the service vendor and/or service user. *See also NS/EP telecommunications.*

**service probability** The probability of obtaining a specified (or higher) quality of service during a given period of time. (188) *See also grade of service, outage probability.*

**service program** *Synonym utility program.*

**service routine** *Synonym utility routine.*

**service signals** Signals that enable data systems equipment to function correctly, and possibly to provide ancillary facilities. *Synonym housekeeping signals. See also signal.*

**service termination point** The last point of service rendered by a commercial carrier under applicable tariffs. *See also* customer premises equipment, network interface, network terminating interface.

**service user** Any individual or organization (including a service vendor) supported by a telecommunications service for which a priority level has been requested or assigned. *See also* priority level.

**Session Layer** *See* Open Systems Interconnection--Reference Model.

**set 1.** A finite or infinite number of objects, entities, or concepts, that have a given property or properties in common. (FP) (ISO) **2.** To put all or part of a device into a specified state.

**seven-bit byte** *Synonym* septet.

**sexadecimal** *Synonym* hexadecimal.

**sextet** A byte composed of six binary elements. (FP) (ISO) *Synonym* six-bit byte.

**S-F** *Abbreviation for store-and-forward.*

**SF** *Abbreviation for single-frequency. See single-frequency signaling.*

**shadow loss 1.** The attenuation caused to a radio signal by obstructions in the propagation path. (188) *See also* line-of-sight propagation, path loss. **2.** In a reflector antenna, the relative reduction in the effective aperture of the antenna owing to the masking effect of antenna parts, such as the feed obstructing the radiation from the reflector. (188)

**shannon** The unit of information derived from the occurrence of one of two equiprobable, mutually exclusive, and exhaustive events. *Note:* A transmitted bit may, with perfect formatting and source coding, contain one shannon of information; in general, the information content of a bit will be less than a shannon.

**Shannon's law** A statement defining the theoretical maximum rate at which error-free digits can be transmitted over a bandwidth-limited channel in the presence of noise. The law is usually expressed in the form  $C = W \log_2(1 + S/N)$  where  $C$  is the channel capacity in bits per second,  $W$  is the bandwidth in hertz, and  $S/N$  is the signal-to-noise ratio. (188) *Note:* Error-correction coding can improve the communications performance relative to uncoded transmission, but no practical error correction coding system exists that can closely approach the theoretical performance limit given by Shannon's law. *See also* erlang, loading, maximum user signaling rate, throughput.

**shaping network** A network inserted in a circuit for improving or modifying the wave shape of the signals. (188).

**sheath miles** The actual length of cable in route miles. (CFR 47)

**shell** In a computer environment, an operating system's command interpreter; the part of the operating system that reads an input and performs the appropriate operation.

**SHF** *Abbreviation for super high frequency. See spectrum designation of frequency.*

**shield** A housing, screen, sheath, or cover that substantially reduces the coupling of electric and magnetic fields into or out of circuits or prevents the accidental contact of objects or persons with parts or components operating at hazardous voltage levels. (188) *See also* screen.

**shielded pair** A two-wire transmission line surrounded by a sheath of conductive material that protects it from the effects of external fields and confines fields produced within the line. (188) *See also* paired cable, quadded cable.

**shielding effectiveness** A measure of the reduction or attenuation in the electromagnetic or electrostatic field strength at the point in space caused by the insertion of a shield



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between the source and that point. (188) *See also* screen, shield.

**shift** 1. The movement of some or all of the characters of a word by the same number of character positions in the direction of a specified end of a word. (FP) (ISO) 2. In radar, the ability to move the origin of a radial display away from the center of the cathode ray tube. (JCS1-DoD) (JCS1-NATO)

**shift register** 1. A register in which shifts are performed. (FP) (ISO) 2. A storage device in which a serially ordered set of data may be moved, as a unit, into a discrete number of storage locations. (188) *Note 1:* Shift registers may be configured so that the stored data may be moved in more than one direction. *Note 2:* Shift registers may be configured so that data may be entered (stored) from multiple inputs. *Note 3:* Shift registers may be grouped into arrays of two or more dimensions in order to perform more complex data operations. *See also* data, M-sequence, register, shift.

**ship Earth station** A mobile Earth station in the maritime mobile-satellite service located on board ship. (RR) *See also* maritime mobile service.

**ship movement service** A safety service in the maritime mobile service other than a port operations service, between coast stations and ship stations, or between ship stations, in which messages are restricted to those relating to the movement of ships. Messages which are of a public correspondence nature shall be excluded from this service. (RR)

**ship's emergency transmitter** A ship's transmitter to be used exclusively on a distress frequency for distress, urgency or safety purposes. (RR)

**ship station** A mobile station in the maritime mobile service located on board a vessel which is not permanently moored, other than a survival craft station. (RR)

**shock excitation** *Synonym* impulse excitation.

**short haul toll traffic** A general term applied to message toll traffic between nearby points. In common usage, this term is ordinarily applied to message toll traffic between points less than 20 to 50 miles apart. (CFR 47)

**short wavelength** In optical fiber communication, a term used to refer to optical radiation whose wavelength is generally less than 1  $\mu\text{m}$ .

**shot noise** The noise caused by the fluctuation in the current of charge carriers passing through a surface at statistically independent times. (188) *Note:* There is often a (minor) inconsistency in referring to shot noise in an optical system: many authors refer to shot noise loosely when speaking of the mean square shot noise current (amperes<sup>2</sup>) rather than noise power (watts). *See also* quantum noise.

**SI** *Abbreviation for International System of Units. See* metric system.

**SID** *Abbreviation for sudden ionospheric disturbance.*

**sideband** Frequencies, distributed above and below a carrier, containing energy resulting from amplitude modulation. (188) *Note:* The frequencies above the carrier are called "*upper sidebands*" and those below the carrier are called "*lower sidebands*." *See also* amplitude modulation, sideband transmission, single-sideband suppressed carrier transmission.

**sideband transmission** That method of transmission in which frequencies produced by amplitude modulation occur above and below the carrier frequency. The frequencies above the carrier are called "*upper sidebands*" and those below the carrier are called "*lower sidebands*." (188) *See also* amplitude modulation, carrier (cxr), compatible sideband transmission, double-sideband suppressed carrier transmission, double-sideband transmission, frequency, independent-sideband transmission, modulation, reduced carrier transmission, sideband, single-sideband suppressed carrier transmission, single-

**sideband transmission, suppressed carrier transmission, vestigial sideband transmission.**

**side circuit** Either of the two circuits employed for the derivation of a phantom circuit. (188) *See also* circuit, phantom circuit.

**side lobe** In a directional antenna radiation pattern, a radiation lobe in any direction other than that of the main lobe. (188) *See also* antenna, antenna lobe, main beam, main lobe.

**sidetone** The sound of the speaker's own voice (and background noise) as heard in the speaker's telephone receiver. (188) *Note:* The volume is usually suppressed. *Synonym* telephone sidetone. *See also* feedback.

**SIGINT** Acronym for signals intelligence.

**signal** 1. Detectable transmitted energy that can be used to carry information. (188) 2. A time-dependent variation of a characteristic of a physical phenomenon, used to convey information. 3. As applied to electronics, any transmitted electrical impulse. (JCS1-DoD) (JCS1-NATO) 4. Operationally, a type of message, the text of which consists of one or more letters, words, characters, signal flags, visual displays, or special sounds, with prearranged meanings and which is conveyed or transmitted by visual, acoustical, or electrical means. (JCS1-DoD) (JCS1-NATO)

**signal center** A combination of signal communication facilities operated by the Army in the field and consisting of a communications center, telephone switching central and appropriate means of signal communications. (JCS1-DoD) *See also* communications, communications center.

**signal contrast** In facsimile, the ratio, expressed in decibels, of the level of the white signal to the level of the black signal. (188) *See also* facsimile, signal-to-noise ratio.

**signal conversion equipment** *Synonym* modem.

**signal converter** *See* analog-to-digital converter, parallel-to-serial converter, serial-to-parallel converter.

**signal distance** 1. The number of digit positions in which the corresponding digits of two binary words of the same length are different. (FP) *Synonym* Hamming distance. 2. A measure of the difference between a given signal and a reference signal. *Note:* For analog signals, often the root mean square difference between the given and reference signals over a symbol period.

**signal distortion** *See* distortion.

**signal droop** The distortion of an otherwise essentially flat-topped rectangular pulse characterized by a decline of the pulse top.

**signal frequency shift** *See* frequency shift.

**signaling** 1. In a telecommunications network, the information exchange concerning establishment and control of a connection and management of the network, in contrast to user information transfer. (188) 2. The use of signals for communication.

**signaling path** In a transmission system, a path provided for system control, synchronization, checking, signaling, and service signals used in system management and operations rather than for the data, messages, or calls of the users. (188) *Note:* The signaling path may also carry power for various system needs. *See also* orderwire circuit, signal.

**signaling rate** *See* data signaling rate.

**Signaling System No. 7** A common-channel signaling system defined by the CCITT in the 1988 Blue Book, in Recommendations Q.771 through Q.774. *Note:* This signaling system is a prerequisite for implementation of the Integrated Services Digital Network (ISDN). *See also* common-channel signaling, Integrated Services Digital Network.

**signaling time slot** A time slot starting at a particular phase or instant in each frame and

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allocated to the transmission of supervisory and control data. (188) *See also* data, digit time slot, frame, signal.

**signal intelligence** *See* signals intelligence.

**signal level** A measure of the power of a signal at a specified point in a communications system. (188) *See also* dBm, level, signal, transmission level point.

**signal message** In data communication, an assembly of signaling information pertaining to a call, including the associated message alignment and service indications, that is transferred via the message transfer part. *See also* message, message alignment indicator, signal.

**signal-plus-noise-plus-distortion to noise-plus-distortion ratio (SINAD)** The ratio, expressed in decibels, of (a) the recovered audio power (original modulating audio signal plus noise plus distortion) from a modulated radio frequency carrier, to (b) any residual audio power (noise plus distortion) remaining after the original modulating audio signal is removed. (188)

**signal-plus-noise-to-noise ratio ((S+N)/N)** The ratio of the amplitude of the desired signal plus the noise to the amplitude of the noise at a given point, usually expressed in decibels. (188) *See also* channel noise level, noise, signal.

**signal reference subsystem** That portion of a facility grounding system that serves to provide a reference plane(s) for all of the signal paths in the facility. (188) *Note:* Every effort should be made to keep all fault currents, lightning discharge currents, or power distribution system currents removed from these planes. *See also* earth electrode subsystem, facility grounding system, fault protection subsystem, signal.

**signal regeneration** Signal transformation that restores a signal so that it conforms to its original characteristics. (FP) (ISO) (188) *See also* de jitterizer regeneration, signal.

**signal return** A current-carrying path between a load and the signal source. It is the low side of the closed loop energy transfer circuit between a source-load pair. (188) *See also* loop-back, ringback signal.

**signal sample** The value of a particular characteristic of a signal at a chosen instant. (188) *See also* pulse-code modulation, signal, significant instant.

**signal sampling** The process of obtaining a sequence of instantaneous values of a particular signal characteristic, usually at regular time intervals. (188) *See also* sampling rate, signal.

**signal security** A generic term that includes both communications security and electronic security. (JCSI-DoD) *See also* electronic warfare, TEMPEST.

**signals intelligence (SIGINT)** A category of intelligence information comprising, either individually or in combination, all communications intelligence, electronics intelligence, and foreign instrumentation signals intelligence, however transmitted. (JCSI-DoD) *See also* electronics intelligence, electronic warfare.

**signal-to-crosstalk ratio** At a specified point in a circuit, the ratio in decibels of the power of the wanted signal to the power of the unwanted signal. (188) *See also* circuit, crosstalk, signal, signal-to-noise ratio.

**signal-to-noise ratio (SNR)** The ratio of the amplitude of the desired signal to the amplitude of noise signals at a given point in time. (JCSI-DoD) *Note:* Usually expressed in decibels, and in terms of peak values for impulse noise and root-mean-square values for random noise. Both the signal and noise should be defined to avoid ambiguity; e.g., peak-signal to peak-noise ratio. *See also* carrier-to-noise ratio, carrier-to-receiver noise density, channel noise level, detectivity, FM improvement factor, FM improvement threshold, FM threshold extension, intelligibility, modulation suppression, noise,

**noise level, preemphasis, preemphasis improvement, sensitivity, signal.**

**signal transfer point (STP)** In a common-channel signaling network, a switching center providing for the transfer from one signaling link to another. *See also* common-channel signaling, link (def. #1), nonassociated common-channel signaling, signal, switching center.

**signal transition** In teletypewriter systems, the change from one signaling condition to another; e.g., the change from "mark" to "space" or from "space" to "mark." (188) *See also* mark, signal, space.

**significant condition** *See* significant instant.

**significant digit** In a numeral, a digit that is needed for a given purpose; in particular, a digit that must be kept to preserve a given accuracy or a given precision. (FP) (ISO)

**significant instant** In a time-plot of a signal, such as a time-plot of a pulsed electromagnetic wave, an instant at which a particular type of a usually repetitive event occurs, such as a transition to another significant condition, such as a different electric field strength, power level, polarization, frequency, or phase in a modulated wave. (188) *Note:* The significant conditions are those recognized by an appropriate device. Each of the significant instants is determined at the moment the appropriate device assumes a condition or state usable for performing a specific function, such as recording, processing, or gating. *See also* decision instant, significant interval, start-stop distortion.

**significant interval** The time interval between two consecutive significant instants. (188)

**silent monitoring** To listen, unnoticed, to a telephone conversation. *Note:* Federal statutes limit silent monitoring.

**silent zone** *Synonym* skip zone.

**simple buffering** A technique for assigning buffer storage for the duration of the execution of a computer program. (FP) (ISO) *See also* buffer (def. #1).

**simple scanning** In facsimile transmission, scanning using only one spot at a time. (188) *See also* facsimile, scanner, scanning (def. #2).

**simplex circuit** 1. A circuit that provides transmission in one direction only. (188) 2. *Deprecated definition:* A circuit using ground return and affording communication in either direction, but in only one direction at a time. *Special note:* The above two definitions are contradictory; however, both are in common use. The user is cautioned to verify the nature of the service specified by this term. *See also* circuit, duplex circuit, duplex operation, half-duplex circuit, half-duplex operation, one-way-only channel, simplex operation.

**simplex operation** 1. Operating method in which transmission occurs in only one preassigned direction. *Synonym* one-way operation. (188) 2. *Deprecated definition:* A mode of operation in which communications between two terminals takes place in either direction, but only one direction at a time. *Note:* This type of operation may occur only on simplex circuits as defined in simplex circuit (def. #2) above. 3. Operating method in which transmission is made possible alternately in each direction of a telecommunication channel, for example by means of manual control. *Note:* In general, duplex operation and semiduplex operation require two frequencies in radiocommunication; simplex operation may use either one or two. (RR) *CAUTION:* These three definitions are contradictory; however, all are in common use--the first two are used in telephony; the last one, in radio. The user is cautioned to verify the nature of the service specified by this term. *See also* duplex circuit, duplex operation, half-duplex circuit, half-duplex operation, one-way communication, one-way-only channel, phantom circuit, simplex circuit, simplex signaling.

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**simplex signaling (SX)** Signaling using two conductors for a single channel; a center tapped coil or its equivalent is used at both ends for this purpose. (188) *Note:* The arrangement may be a one-way signaling scheme suitable for intra-office use, or the simplex legs may be connected to (full) duplex signaling circuits that then function like CX signaling with E & M lead control. *See also* signal, simplex operation.

**simulate** To represent certain features of the behavior of a physical or abstract system by the behavior of another system, for example, to use delay lines to represent the propagation delay and phase shift of an actual transmission path. (After FP) *Note:* The simulator imitates one or more of the operations and functions of the unit it simulates. It is not, however, a complete functional equivalent. For example, a cockpit simulator imitates flight parameters, but does not fly. *Contrast with* emulate.

**SINAD** Acronym for signal-plus-noise-plus-distortion to noise-plus-distortion ratio.

**singing** An undesired self-sustained audio oscillation in a circuit. *Note:* Singing is usually caused by feedback, excessive gain, or unbalance of a hybrid termination, or by some combination of these. (188) *See also* circuit, singing margin, singing point, unbalanced line.

**singing margin** The difference in power levels between the singing point and the operating gain of a system or component. (188)

**singing point** The threshold point at which additional gain in the system will cause self-oscillation. (188) *See also* singing.

**single-current system** *Synonym* neutral direct current telegraph system.

**single-current transmission system** *Synonym* neutral direct current telegraph system.

**single-ended control** *Synonym* single-ended synchronization.

**single-ended synchronization** A synchronization control method used between two locations in which phase error signals used to control the clock at one location are derived from a comparison of the phase of the incoming signals and the phase of the internal clock of the same location. *Synonym* single-ended control. *See also* bilateral synchronization, clock, double-ended synchronization, synchronization, unilateral synchronization system.

**single-frequency (SF) signaling** In telephone communications, a method of conveying dialing or supervisory signals, or both, with one or more specified single frequencies. (188) *Note:* The DCS transmits dc signaling pulses or supervisory signals, or both, over carrier channels or cable pairs on a 4-wire basis using a 2600-Hz signal tone. The conversion into tones, or vice versa, is done by SF signal units. *See also* frequency, in-band signaling, signal.

**single-harmonic distortion** The ratio of the power of any single harmonic frequency signal to the power of the fundamental frequency signal. *Note:* This ratio is measured at the output of a device under specified conditions and is expressed in decibels. (188) *See also* distortion, frequency, harmonic distortion, total harmonic distortion.

**single-mode optical fiber** An optical fiber in which only the lowest order bound mode (which may consist of a pair of orthogonally polarized fields) can propagate at the wavelength of interest. *Note 1:* In step-index guides, this occurs when the normalized frequency,  $V$ , is less than 2.405. For power-law profiles, single-mode operation occurs for normalized frequency,  $V$ , less than approximately  $2.405 [(g+2)/g]^{1/2}$ , where  $g$  is the profile parameter. *Note 2:* In practice, the orthogonal polarizations may not be associated with degenerate modes. *Synonym* monomode optical fiber. *See also* bound mode, multimode optical fiber, normalized frequency, power-law index profile, profile parameter, step-index fiber.



**single-mode optical waveguide** *See* single-mode optical fiber.

**single-Morse system** *Synonym* neutral direct current telegraph system.

**single-polarized antenna** An antenna intended to radiate or receive radio waves with only one polarization. Usually, the desired sense of polarization is maintained only for certain directions or within the major portion of the antenna's beam. (188) *See also* antenna.

**single-sideband (SSB) emission** An amplitude-modulated emission with one sideband only. (RR) (188) *See also* carrier (cxr), double-sideband reduced carrier transmission, double-sideband suppressed carrier transmission, double-sideband transmission, full carrier single-sideband emission, reduced carrier single-sideband emission, sideband transmission, suppressed carrier single-sideband emission.

**single-sideband (SSB) equipment reference level** The power of one of two equal tones that, when used together to modulate a transmitter, cause it to develop its full rated peak power output. (188) *See also* level, reference circuit, sideband transmission, standard test tone.

**single-sideband (SSB) noise power ratio** The ratio of the power, measured at the output, in the notch bandwidth, with the notch in, to the power in the notch bandwidth, with the notch out, again measured at the output, with the notch applied to an input sufficient to maintain the total system mean noise power output constant. (188) *See also* noise.

**single-sideband suppressed carrier (SSB-SC) transmission** That method of single-sideband transmission in which the carrier is suppressed. (188) *Note:* In SSB-SC the carrier power level is suppressed to the point where it is insufficient to demodulate the signal.

**single-sideband (SSB) transmission** That method of sideband transmission in which only one sideband is transmitted. (188) *Note:* The carrier may be suppressed.

**sink** 1. An absorber of power. *See also* load (def. # 2). 2. In communications, that part of a system in which messages are considered to be received. (188) *See also* communications sink, data circuit-terminating equipment, data terminal equipment, destination user, source, source user.

**S interface** For basic rate access in an ISDN environment, the S interface denotes a user-to-network interface reference point characterized by a four-wire, 144-kbps (2B+D) user rate. *Note 1:* As a universal interface between ISDN terminals or terminal adapters and the network channel termination, the S interface allows a variety of terminal types and subscriber networks (e.g., PBXs, LANs, and controllers) to be connected to this type of network. *Note 2:* At the S interface, there are 4000 frames of 48 bits each, per second, for 192 kbps. The user's portion is 36 bits per frame, or 144 kbps. *See also* Integrated Services Digital Network, R interface, T interface, U interface.

**six-bit byte** *Synonym* sextet.

**skew** 1. In parallel transmission, the difference in arrival time of bits transmitted at the same time. (188) 2. For data recorded on multichannel magnetic tape, the difference in time of reading bits recorded as a single line. (188) 3. In facsimile systems, the angular deviation of the received frame from rectangularity due to asynchronism between scanner and recorder. *Note:* Skew is expressed numerically as the tangent of the angle of deviation. (188) 4. In facsimile, deviation of the angle of the scanning line or recording line to the perpendicular of the paper path. *See also* facsimile.

**skew ray** In a multimode optical fiber, any bound ray that in propagating does not intersect the fiber axis (in contrast with a meridional ray). (188) *Note:* In a straight, ideal fiber, a skew ray traverses a helical path along the fiber, not crossing the fiber axis. A skew ray is not confined to the meridian plane. *See also* axial ray, geometric optics, hybrid mode, meridional ray, paraxial ray.

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**skip distance** The minimum distance between the transmitting station and the point of return to the Earth of the transmitted wave reflected from the ionosphere. (188) *See also* hop, ionosphere, skip zone.

**skip zone** A ring-shaped region within the transmission range wherein signals from a transmitter are not received. It is the area between the farthest points reached by the ground wave and nearest points at which the reflected sky waves come back to Earth. (188) *Synonyms* silent zone, zone of silence. *See also* direct ray, ionosphere, skip distance.

**sky wave** A radio wave that travels upward in space from the antenna. (188) *Note:* It may or may not be returned to Earth from the ionosphere. *See also* direct ray, ionosphere, surface wave.

**slab interferometry** The method of measuring the index profile of an optical fiber by preparing a thin sample that has its faces perpendicular to the axis of the fiber, and measuring its index profile by interferometry. *Synonyms* axial slab interferometry, slice interferometry. *See also* interferometer.

**slant range** The line of sight distance between two points, not at the same level relative to a specific datum. (JCS1-DoD) (JCS1-NATO) (188) *See also* antenna, horizon angle, line-of-sight propagation.

**slave clock** A clock that is coordinated with a master clock. *Note:* Such coordination is usually achieved by phase locking the slave clock to a signal received from the master clock. Optionally, the propagation time delay of the signal from the master clock to the slave clock may be removed (double-endedness) to put the clocks in synchronism; i.e., to cause their time markers to occur simultaneously. *See also* master clock.

**slave station** 1. In a data network, the station that is selected and controlled by a master station. *Note:* The slave station can usually only call, or be called by, a master station.  
2. In navigation systems employing precise time

dissemination, a station whose clock is synchronized by a master station. *See also* control station, master station, primary station, secondary station, tributary station.

**slice interferometry** *Synonym* slab interferometry.

**slip** A time or positional displacement that causes the loss of, or the extraneous insertion of, one or more symbols in a sequence of transmitted symbols. *Note:* Slips are generally caused by the lack of adequate synchronization between the two clocks controlling the transmission of, and the reception of, the communication signal. *See also* clock.

**slip-free operation** Operation of a communication system with sufficient phase locking to avoid overflowing or emptying storage buffers. (188) *See also* phase.

**slope** In a transmission line, the rate of change, with respect to frequency, of attenuation of a transmission line over the frequency spectrum. (188) *Note:* Normally, for metallic lines, attenuation is greater at high frequencies than at low frequencies. *See also* attenuation, frequency.

**slope equalizer** A device or circuit used to achieve a specified slope in a metallic transmission line. (188) *See also* attenuation, equalization.

**slot antenna** A radiating element formed by a slot in a conducting surface or in the wall of a waveguide. (188) *See also* antenna.

**slotted-ring network** A ring network that allows unidirectional data transmission between data stations by transferring data in predefined slots in the transmission stream over one transmission medium such that the data return to the originating station. (FP) (ISO) *See also* ring network.

**slot time** In carrier sense multiple access networks with collision detection, a protocol that requires carrier sense and in which a transmitting data station that detects another

signal while transmitting, stops sending, sends a jam signal, and then waits for a variable length of time before trying again. (FP) (ISO) *See also* carrier sense multiple access with collision detection.

**SMDR** *Abbreviation for station message-detail recording.*

**smooth Earth** Idealized surfaces, such as water surfaces or very level terrain, having radio horizons that are not formed by prominent ridges or mountains but are determined solely as a function of antenna height above ground and the effective Earth radius. (188) *See also* path profile, radio horizon.

**sneak current** In a communication circuit, an unwanted, steady current, slightly higher than normal, that presents no immediate danger, but, if not dealt with, could cause improper operation or, eventually, damage. (188)

**SNR** *Abbreviation for signal-to-noise ratio.*

**soft copy** A nonpermanent display image, for example, a cathode ray tube display. (FP) (ISO) *See also* hard copy.

**soft sectoring** The identification of sector boundaries on a magnetic disk by using recorded information. (FP) (ISO) *See also* hard sectoring.

**software** A set of computer programs, procedures, and associated documentation concerned with the operation of a data processing system; e.g., compilers, library routines, manuals, circuit diagrams. (JCS1-DoD) *See also* computer, firmware, hardware.

**SOH** *Abbreviation for start-of-heading character.*

**solid-state scanning** In facsimile, scanning in which all or a part of the scanning process is performed by electronic commutation of a solid-state array of photosensitive elements. (188) *See also* facsimile, scanning.

**soliton** An optical pulse having a shape, spectral content, and power level designed to take advantage of nonlinear effects in an optical fiber waveguide, for the purpose of essentially negating dispersion over long distances.

**SONET** *Acronym for synchronous optical network.* An interface standard for synchronous 2.46-Gbps optical-fiber transmission, developed by the Exchange Carriers Standards Association. *Note:* SONET is built on a data rate of 51.840 Mbps, called OC1 (optical carrier 1). The SONET hierarchy builds on multiples of OC1, up to and including OC48, for an equivalent bandwidth of 2.48832 Gbps.

**sounding** *See* air sounding.

**sound-powered telephone** A telephone in which the operating power is derived from the speech input only. (188) *See also* electrically powered telephone.

**source** In communications, that part of a system from which messages are considered to originate. (188) *See also* data terminal equipment, destination user, optical source, sink, source user.

**source efficiency** In optical systems, the ratio of emitted optical power of a source to the input electrical power. (188) *See also* optical source.

**source language** [In computer technology,] A language from which statements are translated. (FP)

**source user** The user providing the information to be transferred to a destination user during a particular information transfer transaction. *Synonym* information source. *See also* access originator, call originator, communications source, destination user, sink, source.

**space** In binary modulation, the significant condition of modulation that is not specified as the "mark." (188) *Synonyms* spacing pulse, spacing signal. *See also* code element, mark

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- (def. #1), modulation, neutral operation, signal transition.
- spacecraft** A man-made vehicle which is intended to go beyond the major portion of the Earth's atmosphere. (RR)
- space diversity** A method of transmission or reception, or both, employed to minimize the effects of fading by the simultaneous use of two or more antennas located a number of wavelengths apart. (188) *See also* antenna, cross-polarized operation, diversity reception, dual diversity.
- space-division switching** In telephony, a method whereby single transmission-path routing determination is accomplished in a switch using a physically separated set of matrix contacts or cross-points. (188) *See also* switching system.
- space operation service** A radiocommunication service concerned exclusively with the operation of spacecraft, in particular, space tracking, space telemetry, and space telecommand. These functions will normally be provided within the service in which the space station is operating. (RR)
- space radiocommunication** Any radiocommunication involving the use of one or more space stations or the use of one or more reflecting satellites or other objects in space. (RR) *See also* radiocommunication service.
- space research service** A radiocommunication service in which spacecraft or other objects in space are used for scientific or technological research purposes. (RR)
- space station** A station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere. (RR) *See also* terminal.
- space subsystem** In satellite communications, that portion of the satellite link that is in orbit. (188)
- space system** Any group of cooperating Earth stations and/or space stations employing space radiocommunication for specific purposes. (RR) *See also* Earth station, space station.
- space telecommand** The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate functions of equipment on a space object, including the space station. (RR)
- space telemetry** The use of telemetry for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft. (RR) *See also* telemetry.
- space tracking** Determination of the orbit, velocity, or instantaneous position of an object in space by means of radiodetermination, excluding primary radar, for the purpose of following the movement of the object. (RR) *See also* radiodetermination.
- spacing bias** The uniform lengthening of all spacing signal pulses at the expense of all marking signal pulses. (188) *See also* bias, bias distortion, marking bias.
- spacing end distortion** *See* end distortion.
- spacing pulse** *Synonym* space.
- spacing signal** *Synonym* space.
- spare** An individual part, subassembly, or assembly supplied for the maintenance or repair of systems or equipment. (JCS1-NATO)
- spatial coherence** *See* coherent.
- spatially coherent radiation** *See* coherent.
- special grade access line** An AUTOVON access line specially conditioned, usually by providing amplitude and delay equalization, to give it characteristics suitable for handling special services; e.g., lower signaling rates of 600 to 2400 bits per second. (188) *See also* Automatic Voice Network, equalization, line (def. #1).

**special grade of service** In the AUTOVON, a communication service offering that uses specially conditioned interswitch trunks and access lines to provide the required transmission capability for secure voice, data, and facsimile. (188) *See also* Automatic Voice Network, classmark, grade of service, precedence.

**specialized common carrier (SCC)** A common carrier offering a limited type of service or serving a limited market. *See also* common carrier, divestiture, other common carrier, resale carrier.

**special purpose computer** A computer that is designed to operate upon a restricted class of problems. (FP)

**special service** A radiocommunication service, not otherwise defined in this Section of the [Radio] Regulations, carried on exclusively for specific needs of general utility, and not open to public correspondence. (RR)

**specification** A document intended primarily for use in procurement, which clearly and accurately describes the essential technical requirements for items, materials, or services, including the procedures by which it will be determined that the requirements have been met. Specifications for items and materials may also contain preservation, packaging, packing, and marking requirements. (188) *See also* design objective.

**specific detectivity** A figure of merit often used to characterize detector performance, defined as the reciprocal of noise equivalent power (NEP), normalized to unit area and unit bandwidth. Specific detectivity is given by  $D^* = (A\Delta f)^{1/2}/NEP$ , where  $A$  is the area of the photosensitive region of the detector and  $\Delta f$  is the effective noise bandwidth. *See also* detectivity, noise equivalent power.

**speckle noise** *Synonym* modal noise.

**speckle pattern** In optics, a power intensity pattern produced by the mutual interference of partially coherent beams that are subject to

minute temporal and spatial fluctuations. (188) *Note:* In a multimode fiber, a speckle pattern results from a superposition of mode field patterns. If the relative modal group velocities change with time, the speckle pattern will also change with time. If, in addition, differential mode attenuation is experienced, modal noise results. *See also* fiber optics, modal noise, mode (def. #1), multimode optical fiber.

**spectral irradiance** Irradiance per unit wavelength interval at a given wavelength, usually expressed in watts per unit area per unit wavelength interval. (188) *See also* fiber optics, irradiance, radiometry.

**spectral line** A narrow range of emitted or absorbed wavelengths. *See also* line source, line spectrum, monochromatic, spectral width.

**spectral loss curve** In fiber optics, a plot that shows attenuation as a function of wavelength of light propagation in a fiber. (188) *Note:* Spectral loss curves should be normalized before meaningful comparison can be made. *See also* fiber optics.

**spectral purity** The degree to which a signal is coherent. *See also* coherent.

**spectral radiance** Radiance per unit wavelength interval at a given wavelength, expressed in watts per steradian per unit area per wavelength interval. (188) *See also* radiance, radiant emittance, radiometry.

**spectral responsivity** The ratio of an optical detector's electrical output to its optical input, as a function of optical wavelength. *See also* responsivity.

**spectral width** The wavelength interval in which a spectral quantity is a specified fraction of its maximum value. (188) *Note 1:* One method of specifying the spectral width is the full width at half maximum (FWHM), specifically the difference between the wavelengths at which the magnitude drops to one-half of its maximum value. This method may be difficult to apply when the spectrum has a complex shape. *Note 2:* Another method of specifying



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spectral width is a special case of root-mean-square deviation where the independent variable is wavelength,  $\lambda$ , and  $f(\lambda)$  is a suitable radiometric quantity. See also root-mean-square deviation. Note 3: The relative spectral width  $(\Delta\lambda)/\lambda$  is frequently used where  $\Delta\lambda$  is obtained according to Note 1 or Note 2. See also coherence length, dispersion, line spectrum.

spectral window A wavelength region of relatively high transmittance, surrounded by regions of low transmittance. (188) *Synonym* transmission window.

spectrum See optical spectrum.

spectrum designation of frequency A method of referring to a range or band of communication frequencies. (188) In American practice the designator is a two- or three-letter abbreviation for the name. In ITU practice, the designator is numeric. These ranges or bands are:

FREQUENCY RANGE	TYPICAL AMERICAN DESIGNATOR	ITU FREQUENCY BAND DESIGNATOR*
30 - 300 Hz	ELF (Extremely Low Frequency)	2"
300 - 3000 Hz	ULF (Ultra Low Frequency)	3"
3 - 30 kHz	VLF (Very Low Frequency)	4
30 - 300 kHz	LF (Low Frequency)	5
300 - 3000 kHz	MF (Medium Frequency)	6
3 - 30 MHz	HF (High Frequency)	7
30 - 300 MHz	VHF (Very High Frequency)	8
300 - 3000 MHz	UHF (Ultra High Frequency)	9
3 - 30 GHz	SHF (Super High Frequency)	10
30 - 300 GHz	EHF (Extremely High Frequency)	11
300 - 3000 GHz	THF*** (Tremendously High Frequency)	12

\*The eight microwave frequency bands designated by the letters C, L, S, X, K, Q, V, and W, representing the frequency ranges from 225 MHz to 100 GHz, used to describe radar bands, have no official status and are deprecated.

"An extrapolation; not designated by the ITU as part of the radio spectrum.

\*\*\*The term "THF" is not in the *Radio Regulations*.

Entries 13-21, in the table below, are extensions to the above table, based upon extrapolations of ANSI/IEEE 100-1988, to include optical frequencies and beyond.

FREQUENCY RANGE	ITU FREQUENCY BAND DESIGNATOR
3-30 THz	13
30-300 THz	14
300-3000 THz	15
3-30 PHz	16
30-300 PHz	17
300-3000 PHz	18
3-30 EHz	19
30-300 EHz	20
300-3000 EHz	21

THz = Terahertz ( $10^{12}$  hertz)

PHz = Petahertz ( $10^{15}$  hertz)

EHz = Exahertz ( $10^{18}$  hertz)

**spectrum signature** The pattern of radio signal frequencies, amplitudes, and phases, which characterizes the output of a particular device, and tends to distinguish it from other devices. (188) *See also* characteristic frequency, frequency.

**specular reflection** *See* reflection.

**speech digit signaling** Signaling in which digit time slots used primarily for encoded speech are periodically used for signaling (as, optionally, in ISDN). *See also* Integrated Services Digital Network, signaling (def. #1).

**speech-plus-duplex operation** The method of operation in which speech and telegraphy (duplex or simplex) are transmitted simultaneously over the same circuit, being kept from mutual interference by use of filters. (188) *See also* circuit, composited circuit.

**speech-plus signaling or telegraph** An arrangement of equipment that permits the use of part of a speech band for transmission of signaling or telegraph signals. (188) *See also* circuit, composited circuit, signal.

**speech power** *See* volume unit.

**speed calling** A service feature that enables a switch or station to store certain telephone numbers and dial them automatically when a short (1-, 2-, or 3-digit) code is entered. (188) *See also* abbreviated dialing, card dialer, repertory dialer, service feature.

**speed dialing** Dialing at a speed greater than the normal ten pulses per second. (188) *See also* abbreviated dialing, pulse, pulsing.

**speed of service** 1. [User] The time elapsed from release by the originator to the receipt by the addressee. (188) *Synonym* originator-to-recipient speed of service. 2. [System] The time elapsed from entry of a message into a communications system until receipt at the terminating communications facility (communications addressee). (188) *See also* effective speed of transmission, efficiency factor, throughput.

**spike file** *Synonym* last-in, first-out.

**spill forward** In automatic switching, the transfer of full control on a call to the succeeding office by sending forward the complete telephone address of the called party. (188) *See also* adaptive channel allocation, distributed switching, routing.

**spill-forward feature** A service feature, in the operation of an intermediate office, that, acting on incoming trunk service treatment indications, assumes routing control of the call from the originating office. (188) *Note:* This increases the chances of completion by offering the call to more trunk groups than are available in the originating office. *See also* routing, service feature.

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**spiral-four cable** A quadded cable with four conductors. (188) *Synonym* star quadded cable. *See also* cable, quadded cable.

**splice** 1. To join, permanently, physical media that conduct or transmit power or a communication signal. 2. A device that so joins conducting or transmitting media. 3. The completed joint. *See also* connector, fusion splice, optical fiber splice.

**splice loss** In optical fiber systems, any loss of optical power at a splice. *Note:* A practical splice, of physically realizable fibers, has losses attributable to a number of mechanisms, some of which are intrinsic to the fibers, and some of which are intrinsic to the method or device being used to join them. *See also* insertion loss.

**split homing** The connection of a terminal facility to more than one switching center by separate access lines, each having separate directory numbers. (188) *See also* access, dual homing, multiple homing.

**splitter** *See* beamsplitter.

**(S+N)/N** *Abbreviation for signal-plus-noise-to-noise ratio.*

**spontaneous emission** Radiation emitted when the internal energy of a quantum mechanical system drops from an excited level to a lower level without regard to the simultaneous presence of similar radiation. *Note:* Examples of spontaneous emission include: (a) radiation from an LED, and (b) radiation from an injection laser below the lasing threshold. *See also* injection laser diode, light-emitting diode, stimulated emission, superradiance.

**spoofing** 1. In COMSEC applications, the interception, alteration, and retransmission of a cipher signal or data in such a way as to mislead the receiver. 2. In automated-information-systems applications, an attempt to gain access to an automated information system by posing as an authorized user. (After INFOSEC)

**spooling** The use of auxiliary storage as buffer storage to reduce processing delays when transferring data between peripheral equipment and the processors of a computer. *Note:* The term is derived from the expression simultaneous peripheral operation on line. (FP) (ISO)

**sporadic E** *Synonym* sporadic E propagation.

**sporadic E propagation** Radio wave propagation by means of returns from irregular ionization appearing at heights of about 90 km to 120 km. (188) *Note:* The maximum frequency returned from this layer can be much greater than that from the normal E layer. Close to the equator it is essentially a daytime phenomenon, but in the auroral zone it is most prevalent at night. *Synonym* sporadic E. *See also* anomalous propagation, ionosphere, propagation.

**spot jamming** The jamming of a specific channel or frequency. (JCS1-DoD) (JCS1-NATO) *See also* electronic warfare.

**spot projection** The optical method of scanning in which the scanning spot size is determined by the illuminated area of a spot which moves across the subject copy. (188) *See also* facsimile, scanning.

**spot speed** In facsimile systems, the speed of the scanning or recording spot along the available line. (188) *Note:* This is generally measured on the subject copy or on the record sheet. *See also* facsimile, signal, synchronizing.

**spread spectrum** 1. A telecommunications technique in which a signal is transmitted in a bandwidth considerably greater than the frequency content of the original information. (188) (After INFOSEC) 2. A signal structuring technique that employs direct sequence, frequency hopping or a hybrid of these, which can be used for multiple access and/or multiple functions. This technique decreases the potential interference to other receivers while achieving privacy and increasing the immunity of spread spectrum receivers to noise and interference. Spread spectrum generally makes use of a sequential noise-like signal structure to

**spread** the normally narrowband information signal over a relatively wide band of frequencies. The receiver correlates the signals to retrieve the original information signal. (NTIA) (188) *See also* anti-jam, frequency hopping, pseudorandom number sequence.

**spurious emission** Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions. (RR) (188) *See also* bandwidth, emission, frequency, necessary bandwidth, spurious response, stray current, susceptibility.

**spurious radiation** 1. Any unintentional emission. (188) 2. *See* spurious emission. *See also* frequency, radiation.

**spurious response** A response in the receiver IF bandpass produced by an undesired emission where the fundamental or harmonic of the undesired signal mixes with the fundamental or harmonic of the receiver local oscillator. (188) *See also* bandwidth, error, intermediate frequency, spurious emission.

**squelch** A circuit function that acts to suppress the audio output of a receiver. (NTIA) (188) *Note:* The squelch function is activated in the absence of sufficiently strong desired input signals in order to exclude undesired input signals at or near the same frequency that are received at a lower power level. *See also* circuit, FM improvement threshold, noise suppression.

**sr** Abbreviation for steradian.

**SSB** Abbreviation for single sideband. *See* single sideband emission.

**SSB-SC** Abbreviation for single-sideband suppressed carrier. *See* single-sideband suppressed carrier transmission.

**stability** The invariability of a specified property of a substance, device, or apparatus with time, or under the influence of typically extrinsic factors.

**stagger** In facsimile systems, periodic error in the position of the recorded spot along the recorded line. (188) *See also* facsimile.

**standard** 1. Guideline documentation that reflects agreements on products, practices, or operations by nationally or internationally recognized industrial, professional, trade associations or governmental bodies. *Note:* This concept applies to formal, approved standards, as contrasted to de facto standards and proprietary standards, which are exceptions to this concept. *See also* de facto standards, proprietary standard. 2. A document that establishes engineering and technical requirements for processes, procedures, practices, and methods that have been adopted as standard. 3. An exact value, a physical entity, or an abstract concept, established and defined by authority, custom, or common consent to serve as a reference, model, or rule in measuring quantities or qualities, establishing practices or procedures, or evaluating results. A fixed quantity or quality. (JCS1-DoD) (JCS1-NATO)

**standard frequency and time signal-satellite service** A radiocommunication service using space stations on Earth satellites for the same purpose as those of the standard frequency and time signal service. This service may also include feeder links necessary for its operation. (RR) *See also* standard time and frequency signal service.

**standard frequency and time signal service** A radiocommunication service for scientific, technical and other purposes, providing the transmission of specified frequencies, time signals, or both, of stated high precision, intended for general reception. (RR)

**standard frequency and time signal station** A station in the standard frequency and time signal service. (RR)

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**standard optical source** A reference optical source to which emitting and detecting devices are compared for calibration purposes. (188) *Note:* In the United States, standard optical sources must be traceable to the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards (NBS). *See also* reference frequency.

**standard telegraph level (STL)** The power per individual telegraph channel required to yield the standard composite data level. For example, for a composite data level of -13 dBm at 0 dBm transmission level point (TLP), the STL would be -25.0 dBm for a 16-channel VFCT terminal computed from  $STL = -(13 + 10\log_{10}n)$ , where  $n$  is the number of telegraph channels and the STL is in dBm. (188) *See also* level.

**standard test signal** A single-frequency signal with standardized level generally used for testing the peak power transmission capability and for measuring the total harmonic distortion of circuits or parts of a circuit. (188) *Note:* For standardized test signal levels and frequencies, see MIL-STD-188-100 for DoD use, and the *Code of Federal Regulations*, Title 47, part 68 for other Government agencies. *See also* circuit, frequency, level, reference frequency, total harmonic distortion, transmission level.

**standard test tone** A single-frequency signal with a standardized level generally used for level alignment of single links and of links in tandem. (188) *Note:* For standardized test signal levels and frequencies, see MIL-STD-188-100 for DoD use, and the *Code of Federal Regulations*, Title 47, part 68 for other Government agencies. *See also* frequency, level, relative transmission level, transmission level.

**standard time and frequency signal (STFS) service** *See* standard frequency and time signal service *Note:* In the United States, standard time and frequency signals are broadcast by the U.S. Naval Observatory and the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards

(NBS). *See also* Coordinated Universal Time, DoD master clock, frequency, precise frequency, precise time, primary frequency standard, primary time standard, signal, standard frequency and time signal service.

**standing wave ratio (SWR)** The ratio of the amplitude of a standing wave at an anti-node to the amplitude at a node. (188) *Note:* The standing wave ratio, SWR, in a uniform transmission line is given by  $SWR = (1 + RC)/(1 - RC)$  where  $RC$  is the reflection coefficient. *See also* anti-node, node, reflection coefficient, reflection loss.

**star coupler** A passive device in which power from one or several input optical fibers is distributed amongst a larger number of output optical fibers. *See also* optical combiner, tee coupler.

**star network** A radial (starlike) configuration of communication-network nodes such that there is a direct path between each node and a central node that serves as a central distribution node. (188) *See also* bus topology, node (def. #1), ring network, tree topology.

**star quadded cable** *Synonym* spiral-four cable.

**starting frame delimiter** A specified bit pattern that indicates the start of a transmission frame. (FP) (ISO) *See also* flag sequence.

**start-of-heading character (SOH)** A transmission control character used as the first character of a message heading. (FP) (ISO) *See also* character, control character.

**start-of-text character (STX)** A transmission control character that precedes a text and may be used to terminate the message heading. (FP) (ISO) *See also* character, control character.

**star topology** A communication network topology in which peripheral nodes are connected to a central node, which rebroadcasts all transmissions, received from any peripheral node, to all peripheral nodes on the network, including the originating node. *Note 1:* All peripheral nodes may thus communicate with



all others by transmitting to, and receiving from, the central node only. *Note 2:* The failure of a transmission line (channel) linking any peripheral node to the central node will result in the isolation of that peripheral node from all others. *Note 3:* If the star's central node is passive, the originating node must be able to tolerate the reception of an echo of its own transmission, delayed by the two-way transmission time (i.e., to and from the central node, plus any delay generated in the central node). An active star (star network having an active central node) may have means to prevent echo-related problems. (188) *See also* bus topology, local area network, node (def. #1), ring network, star network, tree topology.

**start pulse** *See* A-condition, start signal.

**start-record signal** In facsimile systems, a signal used for starting the process of converting the electrical signal to an image on the record sheet. (188) *See also* facsimile, signal.

**start signal** 1. In start-stop transmission, a signal at the beginning of a character that prepares the receiving device for the reception of the code elements. *Note:* A start signal is limited to one signal element generally having the duration of a unit interval. (FP) (ISO) (188) 2. A signal to a receiving mechanism to get ready to receive data or to perform a function. (FP) *Synonym* A-condition. *See also* control character, start-stop transmission, stop signal.

**start-stop character** A character including one start signal at the beginning and one or two stop signals at the end. (FP) (ISO)

**start-stop distortion** The ratio of the maximum difference, irrespective of sign, between the actual and the theoretical intervals that separate any significant instant of modulation (or demodulation) from the significant instant of the start element immediately preceding it, to the unit interval. (188) *See also* decision instant, degree of start-stop distortion, distortion, end distortion, significant instant.

**start-stop margin** In start-stop modulation, the maximum amount of overall start-stop

distortion that is compatible with the correct translation by the start-stop equipment of all the character signals that appear singly, that appear at the maximum allowable speed, or that appear at the standard modulation rate. (188) *See also* distortion.

**start-stop modulation** A method of modulation in which the time of occurrence of the bits within each character, or block of characters, relates to a fixed time frame, but the start of each character, or block of characters, is not related to this fixed time frame. (188) *See also* asynchronous communication system, binary digit, modulation.

**start-stop system** *Synonym* asynchronous communication system.

**start-stop transmission** 1. A form of asynchronous operation used in digital communications, which employs a start pulse and a stop pulse for each symbol. (188) 2. Signaling in which each group of code elements corresponding to an alphanumeric signal is preceded by a start signal that serves to prepare the receiving mechanism for the reception and registration of a character, and is followed by a stop signal that serves to bring the receiving mechanism to rest in preparation for the reception of the next character. (188) *See also* asynchronous operation, asynchronous transmission, code, pulse.

**start-stop TTY distortion** *Synonym* teletypewriter signal distortion.

**statement** 1. In [computer] programming languages, a language construct that represents a set of declarations or a step in a sequence of actions. (FP) 2. In computer programming, a symbol string or other arrangement of symbols. (FP) 3. In computer programming, a meaningful expression or generalized instruction represented in a source language. 4. *Deprecated synonym* instruction.

**staticizer** *Synonym* serial-to-parallel converter.

**station** 1. One or more transmitters or receivers or a combination of transmitters and receivers,

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including the accessory equipment necessary at one location, for carrying on radio communication service. Each station will be classified by the service in which it operates permanently or temporarily. (JCS1-DoD)

2. One or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service. Each station shall be classified by the service in which it operates permanently or temporarily. (RR) *Note:* The use of the term is not limited to radio applications.

**stationary satellite** *See* geostationary orbit.

**station battery** Within a facility, a separate battery power source that provides for all significant requirements for dc input power associated with the facility. (188) *Note:* Such a capability is often centrally located. The batteries may power radio and telephone equipment as well as provide emergency lighting and controls for equipment. *See also* auxiliary power, facility (def. #1), primary power.

**station clock** The principal clock or alternate clock located at a particular station providing the timing reference for all major functions at that station. (188) *Note:* A station clock may also be used to provide timing or frequency signals to other equipment. *See also* clock, frequency synthesizer.

**station equipment** *See* customer premises equipment.

**station load** The total power requirements of the integrated station facilities. (188) *See also* disconnect switch, load (def. #1), power, technical load.

**station message-detail recording (SMDR)** Computer-generated records of all calls originated and/or received by a switching system. *See also* activity factor, audit trail.

**statistical multiplexing** Multiplexing in which channels are established on a statistical basis; e.g., connections are made according to probability of need. *See also* channel, multiplexing.

**statistical time-division multiplexing** Time-division multiplexing in which connections to communication circuits are made on a statistical basis. *See also* circuit, multiplexing.

**statute mile** A unit of distance equal to 1.609 km, 0.869 nmi, or 5280 ft. (188) *See also* nautical mile.

**steady-state condition** 1. In a communication circuit, a condition in which some specified characteristic of a condition, such as value, rate, periodicity, or amplitude, exhibits only negligible change over an arbitrarily long period of time. 2. In an electrical circuit, a condition, occurring after all initial transients or fluctuating conditions have damped out, in which currents, voltages, or fields remain essentially constant or oscillate uniformly without changes in characteristics such as amplitude, frequency, or wave shape. (188) *See also* circuit. 3. In fiber optics, synonym for equilibrium mode power distribution.

**step-by-step (SXS) switching system** An automatic dial-telephone system in which calls go through the switching equipment by a succession of switches that move a step at a time, from stage to stage, each step being made in response to the dialing of a number. (188) *See also* crossbar switch, electronic switching system, switching center.

**step-index fiber** An optical fiber with a core having a uniform refractive index. (188) *See also* fiber optics, graded-index fiber, step-index profile.

**step-index profile** For an optical fiber, a refractive index profile characterized by a uniform refractive index within the core and a sharp decrease in refractive index at the core-cladding interface. (188) *Note:* This corresponds to a power-law index profile with profile parameter approaching infinity. *See*

*also* critical angle, graded-index profile, multimode optical fiber, normalized frequency, refractive index [of a medium].

**steradian (sr)** Metric unit of solid angle. *See* metric system.

**stereophonic crosstalk** An undesired signal occurring in the main channel from modulation of the stereophonic channel or that occurring in the stereophonic channel from modulation of the main channel. (CFR 47)

**stereophonic sound subcarrier** A subcarrier within the FM broadcast baseband used for transmitting signals for stereophonic sound reception of the main broadcast program service. (CFR 47)

**stereophonic sound subchannel** The band of frequencies from 23 kHz to 99 kHz containing sound subcarriers and their associated sidebands. (CFR 47)

**STFS** *Abbreviation for standard time and frequency signal. See standard time and frequency signal service.*

**stimulated emission** Radiation emitted when the internal energy of a quantum mechanical system drops from an excited level to a lower level when induced by the presence of radiant energy at the same frequency. *Note:* An example is the radiation from an injection laser diode above lasing threshold. *See also* injection laser diode, spontaneous emission.

**STL** *Abbreviation for standard telegraph level, studio-to-transmitter link.*

**stop element** *See* stop signal.

**stop-record signal** In facsimile systems, a signal used for stopping the process of converting the electrical signal to an image on the record sheet. (188) *See also* facsimile, signal.

**stop signal** 1. In start-stop transmission, a signal at the end of a character that prepares the receiving device for the reception of a subsequent character. A stop signal is usually

limited to one signal element having any duration equal to or greater than a specified minimum value. (FP) (ISO) (188) 2. A signal to a receiving mechanism to wait for the next signal. (FP) *See also* control character, overhead bit, start signal.

**storage** 1. The retention of data in any form, usually for the purpose of orderly retrieval and documentation. (JCS1-DoD) 2. A device consisting of electronic, electrostatic, electrical, hardware or other elements into which data may be entered, and from which data may be obtained, as desired. (JCS1-DoD) *See also* erase, fetch protection, read-only storage, register.

**storage cell** 1. [In information processing,] An addressable storage unit. (FP) 2. [In information processing,] The smallest subdivision of storage into which a unit of data has been or can be entered, in which it is or can be stored, and from which it can be retrieved. (FP) *Synonym* storage element.

**storage element** *Synonym* storage cell.

**storage register** *See* register.

**store-and-forward (S-F)** Applied to communication systems in which messages are received at intermediate routing points and recorded (stored). They are then transmitted (forwarded) to a further routing point or to the ultimate recipient. (188) *See also* electronic mail, message switching.

**stored-program computer** A computer controlled by internally stored instructions, that can synthesize and store instructions, and that can subsequently execute those instructions. (FP)

**STP** *Abbreviation for signal transfer point.*

**strap** *See* cross-connection.

**stray current** Current through a path other than the intended path. (188) *See also* spurious emission.

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**streamer** *Synonym* streaming tape drive.

**streaming tape drive** A magnetic tape unit especially designed to make a nonstop dump or restore magnetic disks without stopping at interblock gaps. (FP) (ISO) *Synonym* streamer.

**streaming tape recording** A method of recording on magnetic tape that maintains continuous tape motion without the requirement to start and stop within the interrecord gap. (FP)

**stressed environment** In radio communication, an environment that is under the influence of an extrinsic factor or factors that degrade communication integrity. *Note 1:* A stressed environment exists when (a) the benign communications medium is perturbed by natural or man-made events, such as an intentional burst, (b) the received signal is degraded by addition of natural or man-made interference such as jamming signals or co-channel interference, or (c) an interfering signal can reconfigure the network. *Note 2:* In a stressed environment, where an adversary threatens successful communications, the radio signals may be encrypted in an effort to deny the adversary an intelligible message, traffic flow information, network information, or automatic link establishment control information.

**string** A sequence of elements of the same type, such as characters, considered as a whole. (FP) (ISO)

**stroke** A straight line or arc that is used as a segment of a graphic character. (FP)

**stroke edge** In character recognition, the line of discontinuity between a side of a stroke and the background, obtained by averaging, over the length of the stroke, the irregularities resulting from the printing and detecting processes. (FP)

**stroke speed** In facsimile systems, the number of times per minute that a fixed line perpendicular to the direction of scanning is crossed in one direction by a scanning or recording spot. (188) *Note:* In most

conventional mechanical systems, this is equivalent to drum speed. In systems in which the picture signal is used while scanning in both directions, the stroke speed is twice the above figure. *See also* facsimile, scanning line frequency.

**stroke width** In character recognition, the distance measured perpendicularly to the stroke centerline between the two stroke edges. (FP)

**structured programming** A technique for organizing and coding [computer] programs in which a hierarchy of modules is used, each having a single entry and a single exit point, and in which control is passed downward through the structure without unconditional branches to higher levels of the structure. Three types of control flow are used: sequential, test, and iteration. (FP)

**STU** *Acronym* for secure telephone unit.

**studio-to-transmitter link (STL)** Any communication link used for the transmission of broadcast program material from a studio to the transmitter. *Note:* This may be a microwave radio or conventional landline link.

**stuffing** *See* bit stuffing, de-stuffing.

**stunt box** A device that controls the nonprinting functions of a printer at a terminal.

**STX** *Abbreviation* for start-of-text character.

**SUB** *Acronym* for substitute character.

**subcarrier** A carrier that is applied as modulation on another carrier. (188) *See also* carrier (cxr), frequency.

**sublayer** A subdivision of a layer in the Open Systems Interconnection--Reference Model. *See also* Open Systems Interconnection--Reference Model.

**subnetwork** A collection of equipment and physical transmission media that forms an autonomous whole and that can be used to

interconnect systems for purposes of communication.

**subroutine** A set of computer instructions to carry out a predefined function or computation. *Note:* "Open" subroutines are integrated into the main program. "Closed" subroutines are arranged so that program control is shifted to them for execution of their task(s) and then returned to the main program.

**subscriber line** *Synonym* loop (def. #1).

**substitute character (SUB)** A control character that is used in the place of a character that is recognized to be invalid or in error or that cannot be represented on a given device. (FP) (ISO)

**subvoice-grade channel** A channel with a bandwidth narrower than that of a voice-grade channel. *Note:* Such a channel is often a subchannel of a voice-grade line. *See also* bandwidth, voice grade.

**successful block delivery** The transfer of a nonduplicate user information block between the source user and intended destination user. *Note:* Successfully delivered blocks include incorrect blocks in addition to successfully transferred (correct) blocks. *See also* block, block transfer failure.

**successful block transfer** The transfer of a correct, nonduplicate, user information block between the source user and intended destination user. *Note:* Successful block transfer occurs at the moment when the last bit of the transferred block crosses the functional interface between the telecommunication system and the intended destination user. Successful block transfer can only occur within a defined maximum block transfer time after initiation of a block transfer attempt. *See also* block, block transfer attempt, block transfer failure, block transfer time, maximum block transfer time.

**successful disengagement** The termination of user information transfer between a source user and a destination user in response to a

disengagement request. *Note:* Successful disengagement occurs at the earliest moment at which either user is able to initiate a new information transfer transaction. *See also* access phase, disconnect, disengagement attempt, disengagement failure, disengagement phase, disengagement request, information-transfer phase.

**sudden ionospheric disturbance (SID)** Abnormally high ionization densities in the D region caused by an occasional sudden outburst of ultraviolet light on the Sun (solar flare). *Note:* This results in a sudden increase in radio-wave absorption, which is most severe in the upper MF and lower HF frequencies. (188) *See also* ionosphere, ionospheric disturbance, magnetic storm.

**sum check** *Synonym* summation check.

**summation check** A check based on the formation of the sum of the digits of a numeral. The sum of the individual digits is usually compared with a previously computed value. (FP) (ISO) *Synonym* sum check.

**superencryption** The process of encrypting encrypted information. *Note:* This process occurs when a message encrypted off-line is transmitted over a secured circuit or when information encrypted by the originator is multiplexed onto a communications trunk, which is then bulk encrypted.

**supergroup** *See* group, multiplex hierarchy.

**super high frequency (SHF)** *See* spectrum designation of frequency.

**superluminescent LED** An emitter based on stimulated emission with amplification but insufficient feedback for oscillation to build up. *See also* light-emitting diode, spontaneous emission, stimulated emission.

**superradiance** Amplification of spontaneously emitted radiation in a gain medium, characterized by moderate line narrowing and moderate directionality. *Note:* This process is generally distinguished from lasing action by



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the absence of positive feedback, and hence the absence of well-defined modes of oscillation. *See also* laser, spontaneous emission, stimulated emission.

**supervisor** *Synonym* supervisory program.

**supervisory control** The use of characters or signals to automatically actuate equipment or indicators. *See also* character, signal, supervisory signals.

**supervisory program** 1. A program, usually part of an operating system, that controls the execution of other routines and regulates work scheduling, input-output operations, error actions, and similar functions. (188) *See also* control station. 2. A computer program that allocates computer component space and schedules computer events by task queueing and system interrupts. *Note:* Control of the system is returned to the supervisory program frequently enough to ensure that demands on the system are met. 3. A computer program, usually part of an operating system, that controls the execution of other computer programs and regulates the flow of work in a data processing system. (FP) (ISO) *Synonyms* executive program, supervisor.

**supervisory routine** A routine that allocates computer component space and schedules computer events by task queueing and system interrupts. *Note:* Control of the system is returned to the supervisory program frequently enough to ensure that demands on the system are met.

**supervisory signals** Signals used to indicate (or, in modern usage, to indicate and to control) the various operating states of the circuits or circuit combinations involved in a particular connection. (188) *See also* forward busying, orderwire circuit, signal, supervisory control.

**suppressed carrier single-sideband emission** A single-sideband emission in which the carrier is virtually suppressed and not intended to be used for demodulation. (RR) *See also* single-sideband emission.

**suppressed carrier transmission** A form of amplitude modulation transmission where the carrier is reduced to a minimum level. The carrier is not intended to be used for demodulation. (188) *Note:* This is a special case of reduced carrier transmission. *See also* carrier (cxr), double-sideband suppressed carrier transmission, modulation suppression, reduced carrier transmission, sideband transmission, single-sideband suppressed carrier transmission, single-sideband transmission, transmission.

**surface refractivity** The value of refractivity (refractive index) of the Earth's atmosphere, calculated from observations of pressure, temperature, and humidity at the Earth's surface. (188) *Note:* The gradient of refractivity refers to the difference in refractivity over a given height, as between the surface and 100 m, surface and 1 km, etc. *See also* ducting, refractive index [of a medium].

**surface wave** A wave that is guided along the interface between two different media or by a refractive index gradient. (188) *Note 1:* The field components of the wave diminish with distance from the interface. *Note 2:* Optical energy is not converted from the surface wave field to another form of energy and the wave does not have a component directed normal to the interface surface. *Note 3:* In optical fiber transmission, evanescent waves are surface waves. *Note 4:* In radio transmission, ground waves are surface waves that propagate close to the surface of the Earth, the Earth having one refractive index and the atmosphere another, thus constituting an interface surface. *See also* ground wave, refractive index [of a medium], sky wave.

**surge** *Synonym* impulse.

**survey** *See* path survey.

**survivability** A property of a system, subsystem, equipment, process, or procedure that provides a defined degree of assurance that the named entity will continue to function during and after a natural or man-made disturbance; e.g., nuclear attack. (188) *Note:* This term must be

qualified by specifying the range of conditions over which the entity will survive, the minimum acceptable level or post-disturbance functionality, and the maximum acceptable outage duration. *See also* communications system, continuous operation, electromagnetic survivability, endurability.

**survivable operation** *See* survivability.

**survival craft station** A mobile station in the maritime mobile service or the aeronautical mobile service intended solely for survival purposes and located on any lifeboat, life raft or other survival equipment. (RR) *See also* maritime mobile service.

**susceptibility** 1. The vulnerability of a target audience to particular forms of psychological operations approach. (JCS1-DoD) (JCS1-NATO) 2. In electronic warfare, the degree to which electronic equipment is affected by electromagnetic energy radiated by an enemy's equipment, such as jamming transmitters. (188) *See also* electronic counter-countermeasures, electronic jamming, electronic warfare.

**susceptiveness** In telephone systems, the tendency of circuits to pick up noise and low frequency induction from power systems. *Note:* It depends on telephone circuit balance, transpositions, wiring spacing, and isolation from ground. (188) *See also* crosstalk, spurious emission.

**sweep acquisition** A technique whereby the frequency of the local oscillator is slowly swept past the reference in order to assure that the pull-in range is reached. *See also* pull-in frequency range.

**swim** Slow, graceful, undesired movements of display elements, groups, or images about their mean position on a display surface, such as that of a monitor. *Note:* Swim can be followed by the human eye, whereas jitter usually appears as a blur. *See also* drift, jitter, wander.

**switch** 1. A mechanical, electro-mechanical, or electronic device for making, breaking, or

changing the connections in or among circuits. (188) 2. To transfer a connection from one circuit to another. 3. *Colloquial synonym* switching center. (188) 4. In a computer program, a conditional instruction and a flag that is interrogated by the instruction. (FP) (ISO) 5. In a computer program, a parameter that controls branching and that is bound prior to the branch point being reached. (FP) *Synonym* switchpoint. 6. A device or programming technique for making a selection, such as a toggle, a conditional jump. (FP)

**switchboard** Equipment with which switching operations are performed manually. (188) *See also* cord circuit, PBX.

**switch busy hour** The busy hour for a single switch. (188) *See also* busy hour, erlang, group busy hour, traffic load.

**switched circuit** In a communication network, a circuit that may be temporarily established at the request of one or more of the connected stations. (188) *See also* circuit, switching system.

**switched loop** In telephony, a circuit that automatically releases connection from a console or switchboard, once connection has been made, to the appropriate terminal. *Note:* Loop buttons or jacks are used to answer incoming listed directory number calls, dial "0" internal calls, transfer requests, and intercepted calls. The attendant can handle only one call at a time. *Synonym* released loop. *See also* cord circuit, loop.

**switching center** In a communication system, an installation (facility) in which switching equipment is used to interconnect communication circuits on a circuit-, message-, or packet-switching basis. (188) *Synonyms* [in telephony] switching exchange, switching facility. *Colloquial synonym* switch. *See also* central office, data switching exchange, digital switching, end office, packet switching, step-by-step switching system, switching system.

**switching exchange** *Synonym* switching center.

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**switching facility** *Synonym* switching center.

**switching system** A communication system consisting of switching centers and their interconnecting media. (188) *See also* communications system, switching center.

**switchpoint** *Synonym* switch (def. #5).

**SWR** *Abbreviation for* standing wave ratio.

**SX** *Abbreviation for* simplex signaling.

**SXS** *Abbreviation for* step-by-step switching system.

**syllable** A character string or a bit string in a word. (FP)

**symbolic language** A computer programming language used to express addresses and instructions with symbols convenient to humans rather than to machines.

**symbolic logic** The discipline in which valid arguments and operations are dealt with using an artificial language designed to avoid the ambiguities and logical inadequacies of natural languages. (FP) (ISO)

**symmetrical channel** A channel in which the send and receive directions of transmission have the same data signaling rate. *See also* channel, data signaling rate.

**symmetrical pair** A balanced transmission line in a multipair cable having equal conductor resistances per unit length, equal impedances from each conductor to earth, and equal impedances to other lines. (188) *See also* balanced line.

**SYN** *Acronym for* synchronous idle character.

**synchronism** The state of being synchronous. *See also* synchronous network.

**synchronization** The process of attaining synchronism. (188) *See also* acquisition time, analog synchronization, bilateral synchronization, bit-synchronous operation,

carrier synchronization, double-ended synchronization, frame synchronization, linear analog synchronization, mutually synchronized network, single-ended synchronization, synchronization code, synchronous data link control, synchronous data network, unilateral synchronization system.

**synchronization bit** A binary digit used to achieve or maintain synchronism. (188) *Note:* The term "synchronization bit" is usually applied to digital data streams, whereas the term "synchronization pulse" is usually applied to analog signals. *See also* binary digit, bit synchronization, character, digit, timing signal.

**synchronization code** In digital systems, a sequence of digital symbols introduced into a transmission signal to achieve or maintain synchronism. *See also* frame synchronization, synchronization, synchronous data network.

**synchronization pulse** A pulse used to achieve or maintain synchronism. *Note:* The term "synchronization pulse" is usually applied to analog signals, whereas the term "synchronization bit" is usually applied to digital data streams. *See also* pulse, timing signal.

**synchronized network** *See* democratically synchronized network, hierarchically synchronized network, master-slave timing, mutually synchronized network, oligarchically synchronized network.

**synchronizing** 1. Achieving and maintaining synchronism. *See also* gating (def. #1). 2. In facsimile, achieving and maintaining predetermined speed relations between the scanning spot and the recording spot within each scanning line. (188) *See also* facsimile.

**synchronizing pilot** In FDM, a reference frequency used for achieving and maintaining syntonization of the oscillators of a carrier system or for comparing the frequencies or phases of the currents generated by those oscillators. (188) *See also* carrier (cxr),

**frequency-division multiplexing, pilot, timing signal.**

**synchronous** Pertaining to two or more processes that depend upon the simultaneous occurrence of specific events such as a common timing signal. (188) *Note:* "Isochronous" and "anisochronous" are characteristics, while "synchronous" and "asynchronous" are relationships. *See also* asynchronous transmission, bit-by-bit asynchronous operation, frame-alignment time slot, frame duration, framing.

**synchronous data link control (SDLC)** A bit-oriented protocol for the control of synchronous transmission over data links in a data network. *See also* Advanced Data Communication Control Procedure, binary synchronous communication, data, data transmission, link, network, synchronization.

**synchronous data network** A data network in which synchronism is achieved and maintained between data circuit-terminating equipment (DCE) and the data switching exchange (DSE), and between DSEs. (188) *Note:* The data signaling rates are controlled by timing equipment within the network. *See also* data circuit-terminating equipment, data switching exchange, link (def. #1), synchronization, synchronization code.

**synchronous idle character (SYN)** A transmission control character used in synchronous transmission systems to provide a signal from which synchronism or synchronous correction may be achieved between data terminal equipment, particularly when no other character is being transmitted. (FP) (ISO)

**synchronous network** A network in which clocks are controlled so as to run, ideally, at identical rates, or at the same mean rate with limited but constant relative phase displacement. (188) *Note:* Ideally, the clocks are synchronous, but they may be mesochronous in practice. By common usage, such mesochronous networks are frequently described as synchronous. *See also* clock, data transmission, synchronism.

**synchronous orbit** An orbit, any point on which has a period equal to the average rotational period of the Earth. (188) *Note:* If the orbit is also circular and equatorial, it is called a stationary (geostationary) orbit. *See also* direct orbit, equatorial orbit, geostationary orbit, inclined orbit, polar orbit, retrograde orbit, satellite.

**synchronous satellite** A satellite in a synchronous orbit. (188) *See also* geostationary orbit, satellite.

**synchronous TDM** A multiplexing scheme in which timing is obtained from a clock that in turn controls both the multiplexer and the channel source. (188) *See also* asynchronous time-division multiplexing, time-division multiplexing.

**synchronous transfer mode** A proposed transport level, a time-division multiplex-and-switching technique to be used across the user's network interface for a broadband ISDN. *See also* Integrated Services Digital Network.

**synchronous transmission** Data transmission in which the time of occurrence of each signal representing a bit is related to a fixed time base. (FP) (ISO) (188) *Note:* "Isochronous" and "anisochronous" are characteristics, while "synchronous" and "asynchronous" are relationships. *See also* asynchronous transmission, bit-by-bit asynchronous operation, frame-alignment time slot, frame duration, framing.

**syntax** 1. The relationships among characters or groups of characters, independent of their meanings or the manner of their interpretation and use. (FP) 2. The structure of expressions in a language. (FP) 3. The rules governing the structure of a language. (FP) 4. The relationship among symbols. (FP)

**syntonization** The process of setting the frequency of one oscillator equal to that of another. *See also* reference frequency.

**SYSGEN** Acronym for system generation.

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**system** 1. Any organized assembly of resources and procedures united and regulated by interaction or interdependence to accomplish a set of specific functions. (JCSI-DoD) 2. A collection of personnel, equipment, and methods organized to accomplish a set of specific functions. (188)

**system analysis** A systematic investigation of a real or planned system to determine the functions of the system and how they relate to each other and to any other system. (FP) (ISO)  
*Synonym* systems analysis.

**system blocking signal** A control (overhead) message generated within a telecommunication system to indicate temporary unavailability of system resources required to complete a requested access. *See also* blocking, signal.

**systems design** 1. A process of defining the hardware and software architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. (FP) (ISO) 2. The preparation of an assembly of methods, procedures, or techniques united by regulated interaction to form an organized whole. (JCSI-DoD) (JCSI-NATO)

**system documentation** The collection of documents that describes the requirements, capabilities, limitations, design, operation, and maintenance of an information processing system. (FP) (ISO)

**system failure transfer** The ability to transfer central office trunks or interoffice trunking to predetermined stations (in the event of catastrophic failure) to allow incoming and outgoing calls to be completed.

**system follow-up** The study of the effects of a system after it has reached a stabilized state of operational use. (FP) (ISO) *Synonyms* post-development review, post-implementation review.

**system generation (SYSGEN)** The process of selecting optional parts of an operating system and of creating a particular operating system

tailored to the requirements of a data processing installation. (FP) (ISO)

**system integration** The progressive linking and testing of system components to merge their functional and technical characteristics into a comprehensive, interoperable system. *Note:* Integration of data systems allows data existing on disparate systems to be shared or accessed across functional or system boundaries.

**system integrity** 1. That condition of a system wherein its mandated operational and technical parameters are within the prescribed limits. (188) 2. The quality of an automated information system when it performs its intended function in an unimpaired manner, free from deliberate or inadvertent unauthorized manipulation of the system.

**system life cycle** The course of developmental changes through which a system passes from its conception to the termination of its use; for example, the phases and activities associated with the analysis, acquisition, design, development, test, integration, operation, maintenance, and modification of a system. (FP)

**system loading** In an FDM transmission system, the absolute power level, referred to a zero transmission level point, of the composite signal (speech, data, and signaling) transmitted in one direction. (188) *See also* level (def. #1), loading, transmission level point.

**system operational threshold** A defined value, for a supported performance parameter, which value establishes the minimum operational service performance level for the parameter. (188) *Note:* A measured parameter value worse than the associated outage threshold indicates that the telecommunication service is in an outage state. *See also* performance parameter.

**system overhead information** *See* overhead information.

**system power margin** The difference between available power and the power needed to overcome system losses and still satisfy the



minimum input power requirements of the receiver. *Note:* System power margin includes the effects of component aging.

**systems analysis** *Synonym system analysis.*

**system signaling and supervision** In transmission systems, any scheme used to provide such functions as system control, addressing, routing, error detection and correction, level control, priority, traffic control, message accountability, and/or other required overhead information. (188) *CAUTION:* In any given digital system, the system signaling scheme must be compatible throughout the system. *See also* centralized operation, circuit, distributed control, distributed switching, network architecture, outpulsing.

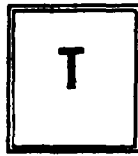
**system software** Application-independent software that supports the running of application software. (FP) (ISO)

**system support** The continued provision of services and material necessary for the use and improvement of a system after the system has been adopted. (FP) (ISO)

**system test time** That part of operating time during which the functional unit is tested for proper operation. Since a functional unit may consist of a computer and its operating system, system test time in some cases includes the time for testing computer programs belonging to the operating system. (FP) (ISO)

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**T** *Abbreviation for* **tera** ( $10^{12}$ ).  
*See* **metric system**.



**Tactical Automatic Digital Switching System (TADSS)** A transportable store-and-forward, message-switching system designed for rapid deployment in support of tactical forces. (188) *See also* **switching system**.

**tactical command and control (C<sup>2</sup>) systems** The equipment, communication, procedures, and personnel essential to a commander for planning, directing, coordinating, and controlling tactical operations of assigned forces pursuant to the missions assigned.

**tactical communication** A method or means of conveying information of any kind, especially orders and decisions from one command, person, or place to another within the tactical forces, normally by means of electronic equipment (including communications security equipment) organic to the tactical forces. (188) *Note:* Excluded from this definition are communications provided to tactical forces by DCS, to nontactical forces by DCS, to tactical forces by nontactical military commands, and to tactical forces by civil organizations. *See also* **combat-net radio**, **communications**, **communications security**, **long-haul communications**, **tactical load**, **TRI-TAC equipment**.

**tactical communication system** A system configured by various types of fixed-size, self-contained assemblages, such as radio terminals and repeaters; switching, transmission, and terminal equipment; and interconnect and control facilities, that are used within or in support of tactical forces and are designed to meet the requirements of changing tactical situations. (188) *Note:* The system provides securable voice and data communications among mobile users to facilitate command and control within, and in support of, tactical forces. Based on different requirements of the multichannel trunking networks, a distinction is made between: (a) tactical systems requiring extremely short facility-installation times (on the order of hours), necessitated by relocation

requirements that are sometimes frequent, and (b) other tactical telecommunication systems. *See also* **communications system**, **TRI-TAC equipment**.

**tactical data information link (TADIL)** A Joint-Chiefs-of-Staff-approved standardized communication link suitable for transmission of digital information. A TADIL is characterized by its standardized message formats and transmission characteristics. (188)

**tactical data information link--A (TADIL--A)** A netted link in which one unit acts as a net control station and interrogates each unit by roll call. Once interrogated, that unit transmits its data to the net. This means that each unit receives all the information transmitted. This is a direct transfer of data and no relaying is involved. (JCSI-DoD) (188)

**tactical data information link--B (TADIL--B)** A point-to-point data link between two units which provides for simultaneous transmission and reception of data (duplex). (JCSI-DoD) (188)

**tactical load** That part of the operational load required by the host service consisting of weapons, detection, command control systems, and related functions. (188) *See also* **load (def. #1)**, **operational load**, **tactical communication**.

**TADIL** *Acronym for* **tactical data information link**.

**TADSS** *Acronym for* **Tactical Automatic Digital Switching System**.

**tag** *See* **flag**, **label**.

**TAI** *Abbreviation for* **International Atomic Time**.

**tail circuit** A leased or privately owned communication line from the end of a major transmission link, such as a microwave link, satellite link, or LAN, to the end-user location. *Note:* Under definition #1 of "circuit" as defined in this glossary, a tail circuit is only a

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- part of the overall circuit. *See also* circuit, loop.
- tailing** In facsimile systems, the excessive prolongation of the decay of the signal. (188) *Synonym* hangover. *See also* facsimile, underlap.
- takeoff angle** *Synonym* departure angle.
- tandem** Pertaining to an arrangement or sequencing of networks, circuits, or links, wherein the output terminals of one network, circuit, or link are connected directly to the input terminals of another network, circuit, or link, e.g., links connected sequentially by microwave relays. (188) *See also* concatenation [of optical fibers], link (def. #1).
- tandem center** In a communication system, an installation in which switching equipment connects trunks to trunks, but does not connect any customer loops. (188) *See also* end office, exchange, extension facility, switching center, tandem tie trunk network, trunk.
- tandem office** A central office unit used primarily as an intermediate switching point for traffic between central offices.
- tandem tie trunk network (TTTN)** An arrangement that permits sequential connection of tie trunks between PBX/Centrex® locations by using tandem operation. Tandem operation permits two or more dial tie trunks to be connected together at a tandem center location to form a through connection. *See also* switching center, tandem center, trunk.
- tap** In fiber optics, a device for extracting a portion of the optical signal from an optical fiber.
- tapered fiber** An optical fiber whose transverse dimensions vary monotonically with length.
- tape relay** A method of retransmitting TTY traffic from one channel to another, in which messages arriving on an incoming channel are recorded in the form of perforated tape, this tape then being either fed directly and automatically into an outgoing channel, or manually transferred to an automatic transmitter for transmission on an outgoing channel. (188) *See also* chadless tape, chad tape, reperforator, torn-tape relay.
- tariff** The published schedule of rates or charges for a specific unit of equipment, facility, or type of service such as might be provided by a telecommunication common carrier. *See also* access charge, common carrier, measured-rate service, message unit, mileage, overtime period.
- TASI** *Acronym for time-assignment speech interpolation.*
- tasking** *See* multitasking.

**T-carrier** Generic designator for any of several digitally multiplexed telecommunications carrier systems. *Note 1:* The designators for T-carrier in the North American digital hierarchy correspond to the designators for the digital signal (DS) level hierarchy. *Note 2:* T-carrier systems were originally designed to transmit digitized voice signals. Current applications also include digital data transmission. (188) *Note 3:* The tables below lists the designators and rates for current T-Carrier systems. *Note 4:* If an "F" precedes the "T", an optical fiber cable system is indicated at the same rates.

NORTH AMERICAN HIERARCHY	
DESIGNATOR (DS LEVEL)	RATE Mbps Channels
T1 (DS 1)	1.544 24 ch
T1C	3.152
T2 (DS 2)	6.312 96 ch
T3 (DS 3)	44.736 672 ch
T4 (DS 4)	274.176 4032 ch

*Note 5:* The North American and Japanese hierarchies are based on multiplexing 24 voice-frequency channels and multiples thereof, whereas the European hierarchy is based on multiplexing 30 voice-frequency channels and multiples thereof. See also carrier system, digital signal, digital transmission system, digroup.

**TCB** Abbreviation for trusted computing base.

**TCF** Abbreviation for technical control facility.

**TCP** Abbreviation for transmission control protocol.

**TCS** Abbreviation for trusted computer system.

JAPANESE HIERARCHY	
DS LEVEL	RATE mbps CHANNELS
DS 1	1.544 24 ch
DS 2	6.312 96 ch
DS 3	32.064 480 ch
DS 4	97.728 1440 ch
DS 5	400.352 5760 ch

EUROPEAN HIERARCHY (CEPT)	
DS LEVEL	RATE mbps CHANNELS
DS 1	2.048 30 ch
DS 2	8.448 120 ch
DS 3	34.368 480 ch
DS 4	139.268 1920 ch
DS 5	565.148 7680 ch

**TCU** Abbreviation for teletypewriter control unit.

**TDM** Abbreviation for time-division multiplexing.

**TDMA** Abbreviation for time-division multiple access.



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**technical control facility (TCF)** A physical plant, or a designated and specially configured part thereof, containing the equipment necessary for ensuring fast, reliable, and secure exchange of information. This facility typically includes distribution frames and associated panels, jacks, and switches; and monitoring, test, conditioning, and orderwire equipment. This facility allows telecommunications systems control personnel to exercise essential operational control over communication paths and facilities, make quality analyses of communications and communication channels, monitor operations and maintenance functions, recognize and correct deteriorating conditions, restore disrupted communications, provide requested on-call circuitry, and take or direct such actions as may be required and practical. (188) *See also* communications center, facility, patch and test facility.

**technical control hubbing repeater** *Synonym* data conferencing repeater.

**technical load** The portion of the operational load required for communications, tactical operations, and ancillary equipment including necessary lighting, air conditioning, or ventilation required for full continuity of communications. (188) *See also* critical technical load, load, noncritical technical load, operational load, station load.

**TED** *Abbreviation for* trunk encryption device.

**tee coupler** A passive coupler having three ports. *See also* star coupler.

**TEK** *Abbreviation for* traffic encryption key.

**teleaction service** In ISDN applications, a telecommunication service using very short messages with very low data transmission rates between the user and the network.

**telecommand** The use of telecommunication for the transmission of signals to initiate, modify or terminate functions of equipment at a distance. (RR)

**telecommunication** 1. Any transmission, emission, or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems. (RR) 2. Any transmission, emission, or reception of signs, signals, writings, images, sounds, or information of any nature by wire, radio, visual, or other electromagnetic systems. (JCSI-DoD) (JCSI-NATO) *See also* automatic data processing, communications.

**telecommunication architecture** Within a telecommunication system, the overall plan governing the capabilities of functional elements and their interaction, including configuration, integration, standardization, life-cycle management, and definition of protocol specifications, among these elements.

**telecommunication facilities** The aggregate of equipment, such as telephones, teletypewriters, facsimile equipment, cables, and switches, used for various modes of transmission, such as digital data, audio signals, and video signals.

**telecommunication service** 1. Any service provided by a telecommunication provider. 2. A specified set of user-information transfer capabilities provided to a group of users by a telecommunication system. (188) *Note:* The telecommunication service user is responsible for the information content of the message. The telecommunication service provider has the responsibility for the acceptance, transmission, and delivery of the message. *See also* telecommunication system operator.

**telecommunications security** *See* communications security.

**Telecommunications Service Priority (TSP) service** A regulated service provided by a telecommunications provider, such as an operating telephone company or a carrier, for NS/EP telecommunications. *Note:* This service replaced Restoration Priority (RP) service effective September 1990. *See also* NS/EP telecommunications.

**Telecommunications Service Priority (TSP) system** A system that provides a means for

telecommunications users to obtain priority treatment from service providers for the NS/EP telecommunications requirements. *Note:* This system replaced the Restoration Priority (RP) system effective September 1990. *See also* NS/EP telecommunications.

**Telecommunications Service Priority (TSP) system user** Any individual, organization, or activity that interacts with the NS/EP TSP System.

**telecommunication system** *See* communications system.

**telecommunication system operator** The organization responsible for providing telecommunication service to users.

**teleconference** A conference between persons remote from one another but linked by a telecommunications system. (JCS1-DoD) (JCS1-NATO) *Note:* The conference is supported by audio and/or video communication equipment that enables the live exchange of information among remotely located persons and machines.

**telegram** Written matter intended to be transmitted by telegraphy for delivery to the addressee. This term also includes radio telegrams unless otherwise specified. In this definition the term "*telegraphy*" has the same general meaning as defined in the [1979 General Worldwide Administrative Radio Conference] Convention. (RR)

**telegraph** A system of telecommunication using coded signals. (188) *See also* code, polar direct-current telegraph transmission, radio telegraphy, voice-frequency telegraph.

**telegraphy** A form of telecommunication which is concerned in any process providing transmission and reproduction at a distance of documentary matter, such as written or printed matter or fixed images, or the reproduction at a distance of any kind of information in such a form. For the purposes of the *Radio Regulations*, unless otherwise specified therein, telegraphy shall mean a form of

telecommunication for the transmission of written matter by the use of a signal code. (RR)

**telemetry** The use of telecommunication for automatically indicating or recording measurements at a distance from the measuring instrument. (RR) *See also* space telemetry.

**telephone exchange** *See* exchange, switching center.

**telephone frequency** *See* audio frequency, voice frequency.

**telephone sidetone** *Synonym* sidetone.

**telephony** A form of telecommunication set up for the transmission of speech or, in some cases, other sounds. (RR) *See also* message, public switched telephone network.

**teleprinter** *See* teletypewriter.

**teleprocessing** The combining of telecommunications and computer operations interacting in the automatic processing, reception, and transmission of data and/or information. (JCS1-DoD) (188)

**teleservice** *See* telecommunication service.

**teletex** An international store-and-forward, error-free communication service defined by the CCITT with a recommended user data rate of 2400 bits per second over the general switched telephone network. *Note:* Teletex is expected to replace international Telex®. The communications protocol used for teletex is being enhanced as the basis for the CCITT group 4 facsimile service.

**teletext** A type of communications service in which a user can access a remote database and receive the requested data on the user's video display. *Note:* The database information is returned to the user's video display over a common carrier channel. *See also* viewdata.

**teletypewriter (TTY)** A printing telegraph instrument having a signal-actuated mechanism

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for automatically printing received messages. *Note 1:* It may have a keyboard similar to that of a typewriter for sending messages. (188) *Note 2:* The term "teleprinter" may be applied to a receive-only unit having no keyboard. Radio circuits carrying TTY traffic are sometimes referred to as "RTTY" or "RATT." *See also* radio teletypewriter, sending-end crossfire.

**teletypewriter control unit (TCU)** A device that serves as the control and coordination unit between teletypewriter devices and a message switching center when employing controlled teletypewriter operations. (188)

**teletypewriter exchange service (TWX®)** A switched teletypewriter service in which suitably arranged teletypewriter stations are provided with lines to a central office for access to other such stations. *Note:* TWX® and Telex® are commercial teletypewriter exchange services.

**teletypewriter signal distortion** The shifting of signal-pulse transitions from their proper positions relative to the beginning of the start pulse. The magnitude of the distortion is expressed in percent of a perfect unit pulse length. (188) *Synonym* start-stop TTY distortion. *See also* cyclic distortion, distortion, end distortion, marking bias, signal, spacing bias.

**television (TV)** A form of telecommunication for the transmission of transient images of fixed or moving objects. (RR) *Note:* The picture signal is generally accompanied by the sound signal, and follows the NTSC standard in North America. *See also* NTSC standard.

**television broadcast translator** *See also* translator (def. #3).

**Telex®** A communication service involving teletypewriters connected through automatic exchanges.

**TEM** *Abbreviation for transverse electromagnetic. See transverse electromagnetic mode.*

**TE** *Abbreviation for transverse electric. See transverse electric mode.*

**temperature** *See* antenna gain-to-noise temperature, antenna noise temperature, effective input noise temperature, front-end noise temperature, Kelvin temperature scale.

**TEMPEST** An unclassified short name referring to the investigation, study, and control of compromising emanations from electrical and electronic equipment. *Often used as a synonym for compromising emanations, as in "TEMPEST test" or "TEMPEST inspection." Also used as a verb meaning "to insulate against compromising emanations."* (188) *See also* compromising emanations, electromagnetic emission control, electronic emission security, electronics security, electronic warfare, emanations security, RED/BLACK concept.

**temporal coherence** *See* coherent.

**temporally coherent radiation** *See* coherent.

**terahertz (THz)** A unit denoting one trillion ( $10^{12}$ ) hertz. (188) *See also* frequency, metric system, spectrum designation of frequency.

**terminal** Any device capable of sending, receiving, or sending and receiving information over a communication channel. (188) *See also* bit synchronous operation, called-line identification facility, call release time, data circuit-terminating equipment, data terminal equipment, end instrument, input/output device, main station, packet mode terminal, passive station, peripheral equipment, port.

**terminal adapter** An interfacing device employed at the "R" reference point in an ISDN environment that allows connection of a non-ISDN terminal at the physical layer to communicate with an ISDN network. Typically, this adapter will support standard RJ-11 telephone connection plugs for voice and RS-232C, V.35 and RS-449 interfaces for data. *See also* Integrated Services Digital Network.

**terminal impedance** 1. The impedance as measured at the unloaded output terminals of transmission equipment or a line that is otherwise in normal operating condition. (188) 2. The ratio of voltage to current at the output terminals of a device, including the connected load. *See also* idle line termination, impedance.

**terminus** A device used to terminate an optical fiber, providing a means to locate and contain an optical fiber within a connector.

**terrestrial radiocommunication** Any radiocommunication other than space radiocommunication or radio astronomy. (RR)

**terrestrial station** A station effecting terrestrial radiocommunication. In these [Radio] Regulations, unless otherwise stated, any station is a terrestrial station. (RR)

**test and validation** Physical measurements taken to verify conclusions obtained from mathematical modeling and analysis or taken for the purpose of developing mathematical models. (188) *See also* acceptance test, quality assurance.

**test antenna** An antenna of known performance characteristics used in determining transmission characteristics of equipment and associated propagation paths. (188) *See also* antenna.

**test center** *See* patch and test facility, technical control facility.

**test point** That point within an equipment or equipment string that provides electrical access to signals for the purpose of fault isolation. (188) *See also* fault.

**test tone** A tone sent at a predetermined level and frequency through a transmission system to facilitate measurement and/or alignment of the gains and/or losses of devices in the transmission circuit. (188) *See also* standard test signal, standard test tone.

**text processing** *Synonym* word processing.

**T4 carrier** *See* T-carrier.

**TGM** *Abbreviation for* trunk group multiplexer.

**THD** *Abbreviation for* total harmonic distortion.

**thermal noise** The noise generated by thermal agitation of electrons in a conductor. The noise power,  $P$ , in watts, is given by  $P = kT\Delta f$  where  $k$  is Boltzmann's constant in joules per kelvin,  $T$  is the conductor temperature in kelvins, and  $\Delta f$  is the bandwidth in hertz. (188) *Note 1:* Thermal noise power, per hertz, is equal throughout the frequency spectrum, depending only on  $k$  and  $T$ . *Note 2:* For the general case, the above definition may be held to apply to charge carriers in any type of conducting medium. *Synonym* Johnson noise. *See also* bandwidth, effective input noise temperature, noise, noise figure, thermal radiation.

**thermal radiation** 1. The heat and light produced by a nuclear explosion. (JCS1-DoD) (JCS1-NATO) 2. Electromagnetic radiations emitted from a heat or light source as a consequence of its temperature; it consists essentially of ultraviolet, visible, and infrared radiations. (JCS1-DoD) *See also* radiation, thermal noise.

**THF** *Abbreviation for* tremendously high frequency. *See* spectrum designation of frequency.

**thin film waveguide** A transparent dielectric film, bounded by lower index materials, capable of guiding light. *See also* optical fiber, optical waveguide.

**threat** Any circumstance or event with the potential to cause harm to a telecommunication system or automated information system in the form of destruction, disclosure, modification of data, and/or denial of service.

**three-bit byte** *Synonym* triplet.

**three-way calling** A switching system service feature permitting a user to add a third party line without the assistance of an attendant. *See also* call, conference call, multiple.

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**threshold** 1. The minimum value of a signal that can be detected by the system or sensor under consideration. (188) 2. A value used to denote predetermined levels, such as those pertaining to volume of message storage, i.e., in-transit storage or queue storage, used in a message switching center. (188) 3. The minimum value of the parameter used to activate a device. (188) 4. The minimum value a stimulus may have to create a desired effect. *See also* FM improvement threshold, outage, system operational threshold.

**threshold current** In a laser, the driving current corresponding to lasing threshold. *See also* lasing threshold.

**threshold extension** *See* FM threshold extension.

**threshold frequency** In optoelectronics, the frequency of incident radiant energy below which there is no photoemissive effect. (188) *See also* frequency, frequency tolerance.

**through group** A group of 12 voice-frequency channels transmitted through a repeater as a unit without frequency translation. (188) *See also* frequency, group, through-group equipment.

**through-group equipment** In carrier telephone transmission, equipment that accepts the signal from a group receiver output and attenuates it to the proper signal level for insertion, without frequency translation, at the input of a group transmitter. (188) *See also* group.

**throughput** 1. The number of bits, characters, or blocks that can pass through a data communication system (or portion of that system) when the system (or portion of the system measured) is working at saturation. The throughput will vary greatly from its theoretical maximum. (188) *Note:* The throughput is expressed in data units per period of time; e.g., in AUTODIN, as blocks per second. 2. A measure of the amount of work performed by a system over a period of time, e.g., the number of jobs per day. *See also* binary digit, block, block transfer efficiency,

block transfer rate, data communication, data transfer rate, effective data transfer rate, effective speed of transmission, efficiency factor, maximum user signaling rate, Nyquist rate, Shannon's law, speed of service.

**through supergroup** A group of 60 voice-frequency channels transmitted through a repeater as a unit without frequency translation. (188) *See also* frequency, group.

**through-supergroup equipment** In carrier telephone transmission, equipment that accepts the multiplexed signal from a supergroup receiver output, amplifies it without frequency translation, and provides the proper signal level to the input of a supergroup transmitter equipment. (188) *See also* group.

**THz** *Abbreviation for terahertz. See* metric system.

**TIA** *Abbreviation for Telecommunications Industry Association. See* EIA interface.

**TIE** *Acronym for time interval error.*

**tie line** *See* tie trunk.

**tie trunk** A telephone line directly connecting either two private branch exchanges or two private exchanges. *See also* interposition trunk, trunk.

**time** 1. An epoch, i.e., the designation of an instant on a selected time scale, astronomical or atomic. It is used in the sense of time of day. (JCS1-DoD) (188) 2. *See* time scale. (188) *See also* coordinated time scale, Coordinated Universal Time, International Atomic Time, precise time, primary time standard, real time, standard time and frequency signal service.

**time ambiguity** A situation where more than one different time or time measurement can be obtained under the stated conditions.

**time-assignment speech interpolation (TASI)** A technique used on certain long FDM links to improve voice-transmission efficiency by switching an additional user onto a channel



temporarily idled because the original user has stopped speaking; when the first user resumes speaking, that user will, in turn, be switched to any channel that happens to be idle. (188) *See also* adaptive routing, digital speech interpolation, frequency-division multiplexing, link.

**time availability** *Synonym* circuit reliability.

**time block** An arbitrary grouping of several consecutive hours of a day, usually for a particular season, during which it is assumed that propagation data are statistically homogeneous. (188)

**time code** A format used to convey time (or timing) information. (188) *See also* code, Coordinated Universal Time.

**time code ambiguity** The shortest interval between successive repetitions of the same time code value. *Note:* In a time code having year-of-century as the most slowly changing field, the time code ambiguity would be 100 years; for a digital clock displaying hours and minutes up to a maximum of 11:59, it would be 12 hours. *See also* time code resolution.

**time code resolution** The time interval between two successive time code states. It is determined by the most rapidly changing symbol position within the time code. *Note:* For a digital clock displaying hours and minutes, it would be 1 minute. *See also* time code ambiguity.

**time-delay distortion** *Synonym* delay distortion.

**time-derived channel** *See* time-division multiplexing.

**time diversity** A method of transmission wherein a signal representing the same information is sent over the same channel at different times. (188) *Note:* Often used over systems subject to burst error conditions and with the time spacing adjusted to be longer than an error burst. *See also* frequency diversity, space diversity.

**time division** *See* time-division multiplexing.

**time-division multiple access (TDMA)** A communication technique that uses a common channel (multipoint or broadcast) for communication among multiple users by allocating unique time slots to the different users. (188) *Note:* Used extensively in satellite systems, local area networks, physical security systems, and combat-net radio systems. *See also* channel time slot, frequency-division multiple access, multiplexing.

**time-division multiplexing (TDM)** A method of deriving two or more apparently simultaneous channels from a given frequency spectrum of a transmission medium connecting two or more points by assigning discrete time intervals in sequence to each of the individual channels. During a given time interval the entire available frequency spectrum can be used by the channel to which it is assigned. (188) *Note:* In general, time-division multiplexing systems use pulse transmission. The multiplex pulse train may be considered to be the interleaved pulse trains of the individual channels. The individual channel pulses may be modulated either in an analog or a digital manner. *See also* asynchronous time-division multiplexing, channelization, concentrator, digit time slot, frequency-derived channel, frequency-division multiplexing, highway, multiplex aggregate bit rate, multiplex hierarchy, multiplexing, synchronous TDM, time-sharing.

**time-division switching** A switching method for TDM channels. It requires the shifting of data from one time slot to another in the TDM frame. (188) *See also* digital switching, switching system, time-division multiplexing.

**time guard band** A time interval left vacant on a channel to provide a margin of safety against intersymbol interference in the time domain between sequential operations, such as detection, integration, differentiation, transmission, encoding, decoding, or switching. (188) *See also* band, frequency guard band, time-division multiplexing.

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**time instability** The fluctuation of the time interval error caused by the instability of a real clock.

**time interval error (TIE)** After a time period following perfect synchronization between a real clock and an ideal uniform time scale, the time difference between that clock and the time scale.

**time jitter** Short-term variation or instability in the duration of a specified interval. (188) *See also jitter.*

**time marker** A reference signal, often repeated periodically, enabling the correlation of specific events with a time scale. *Note:* Time markers are used in some systems for establishing synchronization.

**time of occurrence** The date (instant) of an event, with reference to a particular time scale. (188) *See also Coordinated Universal Time, time scale.*

**time-out** 1. A network parameter related to an enforced event designed to occur at the conclusion of a predetermined elapsed time. (188) 2. An event that occurs at the end of a predetermined period of time that began at the occurrence of another specified event. The time out can be prevented by an appropriate signal. (FP) (ISO) (188) *See also call control signal.*

**time scale** 1. A time-measuring system used to relate the times of occurrence of events. (188) 2. Time coordinates placed on the abscissa (x-axis) of Cartesian graphs used for depicting waveforms and similar phenomena. *Note:* Time scales are graduated in seconds, multiples of a second (minute, hour, day, year), and submultiples of a second (millisecond, nanosecond, picosecond, etc.). (188) *See also coordinated time scale, Coordinated Universal Time, International Atomic Time, time of occurrence.*

**time scale factor** A multiplier used to transform the real time of a problem or event into computer time.

**time-sharing** 1. A mode of operation that provides for the interleaving of two or more independent processes on one functional unit. (188) 2. Pertaining to the interleaved use of time on a computing system that enables two or more users to execute computer programs concurrently. *See also multiprocessing, multiprogramming, on-line computer system.*

**time slot** 1. Period of time during which certain activities are governed by specific regulations. (JCS1-DoD) (JCS1-NATO) 2. Any time interval that can be recognized and defined uniquely. (188) *See also digit time slot.*

**time standard** A stable device that emits signals at equal intervals such that their count may be used as a clock. *See also clock, Coordinated Universal Time, DoD master clock, master-slave timing, primary time standard.*

**time tick** A time mark output of a clock system.

**timing extraction** *Synonym timing recovery.*

**timing recovery** The derivation of a timing signal from a received signal. (188) *Synonym timing extraction. See also signal.*

**timing signal** 1. The output of a clock. (188) 2. A signal used to synchronize interconnected equipment. (188) *See also clock, master-slave timing, signal, synchronization bit, synchronization pulse, synchronizing pilot.*

**timing tracking accuracy** A measure of the ability of a timing synchronization system to minimize the clock difference between a master clock and any slaved clock. *See also clock, clock difference, synchronization.*

**T interface** For basic rate access in an ISDN environment, a user network interface reference point, characterized by a four-wire, 144-kbps (2B+D) user rate. *Note:* This interface accommodates the link access and transport layer function in the ISDN architecture. Physically, this device is located at the user's premises and is distance sensitive to the servicing network terminating equipment. Functionally, the T interface is

analogous to the Channel Service Units (CSUs) and the Data Service Units (DSUs). *See also* Integrated Services Digital Network, R interface, S interface.

**T junction** *See* series T junction.

**TLP** *Abbreviation for* transmission level point.

**TM** *Abbreviation for* transverse magnetic. *See* transverse magnetic mode.

**token** In certain local-area-network protocols, a group of bits that serves as a symbol of authority, is passed among data stations, and is used to indicate the station that is temporarily in control of the transmission medium. *See also* token-ring network.

**token-bus network** A bus network in which a token passing procedure is used. (FP) (ISO) *See also* bus topology, local area network, token.

**token passing** A network access procedure in which a token passes from station to station and the only station allowed to transmit information is the station with the token. *See also* local area network, ring network, token.

**token-ring network** A ring network that allows unidirectional data transmission between data stations by a token-passing procedure over one transmission medium such that the transmitted data return to the transmitting station. (FP)

**tolerance** The permissible range of variation of some characteristic from its nominal value.

**tolerance field** *For optical fibers:* 1. In general, the region between two curves (frequently two circles) used to specify the tolerance on component size. 2. When used to specify fiber cladding size, the annular region between the two concentric circles of diameter  $D + \Delta D$  and  $D - \Delta D$ . The first (larger) is the smallest circle that circumscribes the outer surface of the homogeneous cladding; the second (smaller) circle is the largest circle that fits within the outer surface of the homogeneous cladding. 3. When used to specify the core size, the

annular region between the two concentric circles of diameter  $d + \Delta d$  and  $d - \Delta d$ . The first (larger) is the smallest circle that circumscribes the core area; the second (smaller) circle is the largest circle that fits within the core area. *Note:* The circles of definition #2 need not be concentric with the circles of definition #3. *See also* cladding, concentricity error, core, homogeneous cladding.

**toll call** *See* long distance call.

**toll diversion** A system service feature by which users are denied the ability to place toll calls without the assistance of an attendant. *Note:* Toll diversion affects the entire switching system, instead of discriminating between individual extensions. *See also* call, call restriction, calls-barred facility, restricted access, service feature.

**toll office** A central office used primarily for supervising and switching toll traffic.

**toll restriction** *See* classmark.

**toll switching trunk** A trunk connecting one or more end offices to a toll center as the first stage of concentration for intertoll traffic. (188) *Note:* Operator assistance or participation may be an optional function. In U.S. common carrier telephony service, a toll center designated "Class 4C" is an office where assistance in completing incoming calls is provided in addition to other traffic; a toll center designated "Class 4P" is an office where operators handle only outbound calls, or where switching is performed without operator assistance. *See also* switching system.

**T1 carrier** *See* T-carrier.

**T1C carrier** *See* T-carrier.

**T2 carrier** *See* T-carrier.

**T3 carrier** *See* T-carrier.

**T4 carrier** *See* T-carrier.

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**tone diversity** A method of voice frequency telegraph (VFTG) transmission wherein two channels of a 16-channel VFTG carry the same information. (188) *Note:* This is commonly achieved by twinning the channels of a 16-channel VFTG to provide 8 channels with dual diversity. *See also* diversity reception, dual diversity.

**tone signaling** *See* dual-tone multifrequency signaling.

**tool** In some computer languages, a small program executed as a shell command. *Note:* In other computer languages, such as BASIC, it is called a "utility."

**topology** *Synonym* network topology.

**torn-tape relay** An antiquated tape relay system in which the perforated tape is manually transferred by an operator to the appropriate outgoing transmitter. (188) *See also* reperforator, tape relay.

**total channel noise** The sum of random noise and intermodulation noise plus crosstalk. (188) *Note:* Impulse noise is not included because different techniques are required for its measurement. *See also* channel, channel noise level, noise.

**total harmonic distortion (THD)** The ratio of the sum of the powers of all harmonic frequency signals (other than the fundamental) to the power of the fundamental frequency signal. *Note:* This ratio is measured at the output of a device under specified conditions and is expressed in decibels. (188) *See also* distortion, frequency, harmonic distortion, single-harmonic distortion, standard test signal.

**total internal reflection** The reflection that occurs when light strikes an interface at an angle of incidence (with respect to the normal) greater than the critical angle. (188) *See also* angle of incidence, critical angle, fiber optics, leaky mode, reflection coefficient.

**total line length** In facsimile, the spot speed divided by the scanning line frequency. *Note:* This may be greater than the length of the available line. *See also* facsimile, spot speed.

**touch-sensitive** Pertaining to a device that allows a user to interact with a computer system by touching an area on the surface of the device with a finger, pencil, or other object; for example, a touch-sensitive keypad or screen. (FP)

**trace packet** In a packet-switching network, a unique packet that causes a report of each stage of its progress to be sent to the network control center from each visited system element. *See also* audit trail.

**trace program** A computer program that performs a check on another computer program by exhibiting the sequence in which the instructions are executed and usually the results of executing the instructions. (FP)

**track** On a data medium, a path associated with a single read/write head as data move past the head. (FP) (ISO)

**track density** The number of tracks per unit length, measured in a direction perpendicular to the tracks. (FP) (ISO) *See also* track.

**tracking error** The deviation of a dependent variable with respect to a reference function.

**tracking mode** An operational mode during which a system is operating within specified movement limits relative to a reference. (188) *See also* coasting mode, frequency tolerance.

**tracking phase** *See* tracking mode.

**traffic** 1. The information moved over a communication channel. (188) 2. A quantitative measurement of the total messages and their length, expressed in CCS or other units, during a specified period of time. (188) *See also* busy hour, call-second, communications, erlang, narrative traffic, record traffic.

**traffic capacity** The maximum traffic per unit of time that a given telecommunication system, subsystem, or device can carry under specified conditions. (188) *See also* busy hour, call-second, communications, erlang, traffic load.

**traffic encryption key (TEK)** Key used to encrypt plain text or to superencrypt previously encrypted text and/or to decrypt cipher text.

**traffic engineering** The determination of the numbers and kinds of circuits and quantities of related terminating and switching equipment required to meet anticipated traffic loads throughout a communication system. (188) *See also* design margin, design objective, operational load, via net loss.

**traffic-flow security** 1. Measures used to conceal the presence of valid messages in an on-line cryptosystem or secure communication system. *Note:* Encryption of sending and receiving addresses and causing the circuit to appear busy at all times by sending dummy traffic are two methods of traffic-flow security. A more common method is to send a continuous encrypted signal, irrespective of whether traffic is being transmitted. 2. The protection resulting from features, inherent in some cryptoequipment, which conceal the presence of valid messages on a communications circuit; normally achieved by causing the circuit to appear busy at all times. (JCS1-DoD) *See also* cryptology, electronic warfare.

**traffic intensity** A measure of the average occupancy of a facility during a period of time, normally a busy hour, measured in traffic units (erlangs) and defined as the ratio of the time during which a facility is occupied (continuously or cumulatively) to the time this facility is available for occupancy. (188) *Note:* A traffic intensity of one traffic unit (one erlang) means continuous occupancy of a facility during the time period under consideration, regardless of whether or not information is transmitted. *Synonym* call intensity. *See also* busy hour, call-second, erlang, traffic load.

**traffic load** The total traffic carried by a trunk or trunk group during a specified time interval. (188) *See also* busy hour, connections per circuit hour, erlang, group busy hour, level alignment, line load control, saturation, switch busy hour, traffic capacity, traffic intensity.

**traffic monitor** A switch service feature that provides basic data on the amount and type of traffic handled by the system. (188) *See also* monitoring, service feature, station message-detail recording, switch (def. #1), traffic load, traffic usage recorder.

**traffic overflow** 1. That condition wherein the traffic offered to a portion of a communication system exceeds its capacity and the excess may be blocked or may be provided with alternate routing. (188) 2. The excess traffic itself. (188) *See also* alternate routing, overflow.

**traffic register** *See* register.

**traffic service position system (TSPS)** A stored program electronic system associated with one or more toll switching systems which provides centralized traffic service position functions for several local offices at one location. (CFR 47 pt. 67, Appendix.)

**traffic unit** *Synonym* erlang.

**traffic usage recorder** A device for measuring and recording the amount of telephone traffic carried by a group, or several groups, of switches or trunks. (188) *See also* monitoring, peg count, traffic monitor.

**transceiver** A device that performs, within one chassis, both telecommunication transmitting and receiving functions. (188)

**transducer** A device for converting energy from one form to another. (FP) *See also* interface, optoelectronic.

**transfer** To send information from one location and to receive it at another.

**transfer characteristics** Those intrinsic parameters of a system, subsystem, or



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equipment which, when applied to the input of the system, subsystem, or equipment, will fully describe its output.

**transfer function [of a device]** 1. A mathematical statement expressing the transfer characteristics of a system, subsystem, or equipment. 2. The relationship between the input and the output in terms of the transfer characteristics. *See also* insertion-loss-vs-frequency characteristic, transfer characteristics.

**transfer mode** A method of transmission, multiplexing, and switching used in an ISDN.

**transfer rate** *See* data transfer rate.

**transient** *See* dynamic variation.

**transit delay** In ISDN, the elapsed time between the moment that the first bit of a unit of data (such as a frame) passes a given point and the moment that bit passes another given point plus, the transmission time of that data unit. *See also* frame.

**transition zone** The zone between the far end of the near-field region and the near end of the far-field region. (188) *Note:* The transition is gradual. *See also* far-field region, near-field region.

**transit network identification** A network service feature that specifies the sequence of networks used to establish or partially establish a virtual circuit.

**translating program** *Synonym* translator (def. #2).

**translator** 1. A device that converts information from one system of representation into equivalent information in another system of representation. (188) *Note:* In telephone equipment, it is the device that converts dialed digits into call-routing information. *See also* transponder. 2. A computer program that translates from one language into another language and in particular from one programming language into another

programming language. (FP) (ISO) *Synonym* translating program. *See also* address translator. 3. In FM and TV broadcasting, a repeater station that receives a primary station's signal, amplifies it, shifts it in frequency, and rebroadcasts it.

**transliterate** To convert the characters of one alphabet to the corresponding characters of another alphabet. (FP)

**transmission** 1. The dispatching, for reception elsewhere, of a signal, message, or other form of information, e.g., telegraphy, telephony, or facsimile, by means of wire, optical fiber, or radio. (188) 2. The transfer of electrical power from one location to another over conductors. (188)

**transmission block** A group of bits or characters transmitted as a unit, usually with an encoding procedure for error control purposes. (FP) (ISO) *See also* binary digit, character.

**transmission channel** All of the transmission facilities between the input (to the channel) from an initiating node and the output (from the channel) to a terminating node. (188) *Note 1:* In telephony, transmission channels may be of various bandwidths; e.g., nominal 3-kHz, nominal 4-kHz, or nominal 48-kHz (group). *Note 2:* "Transmission channel" is not to be confused with the more general term "channel." *See also* bandwidth, channel, information-bearer channel.

**transmission coefficient** 1. The ratio of the transmitted field strength to the incident field strength when an electromagnetic wave is incident upon an interface surface between media with two different refractive indices. 2. In a transmission line, the ratio of the complex amplitude of the transmitted wave to that of the incident wave at a discontinuity in the line. 3. A number indicating the probable performance of a portion of a transmission circuit. *Note:* The value of the transmission coefficient is inversely related to the quality of the link or circuit. (188) *See also* path loss, reflection coefficient, transmission loss.

**transmission control character** *See* control character.

**transmission control protocol (TCP)** A highly reliable, DoD standard host-to-host protocol used over packet-switched computer communication networks. *Note:* It corresponds closely to OSI--RM layer 4 (Transport Layer). *See also* control character, Open Systems Interconnection--Reference Model, protocol.

**transmission frame** A data structure, beginning and ending with delimiters, that consists of fields predetermined by a protocol for the transmission of user data and control data. (FP) (ISO)

**transmission level** At any point in a transmission system, the power (usually expressed in dBm) that should be measured at that point when a standard test signal (often 0 dBm at 1000 Hz) is transmitted at some point chosen as a reference point. (188) *Note:* The transmission level of a point is a function of system design and is a measure of the design (or nominal) gain, at 1000 Hz, of the system between the chosen reference point (known as the zero transmission level point or OTLP) and the test point in question. Absolute measurements of the power of test signals at any point are influenced by the expected level as well as by any deviations of the system from its desired gain. *See also* dBr, level (def. #1), net gain, net loss, relative transmission level, standard test signal, standard test tone.

**transmission level point (TLP)** A point in a transmission system at which the ratio, in decibels, of the power of the test signal at that point to the power of the test signal at a reference point is specified. (188) *Note:* A OTLP is an arbitrarily established point in a communication circuit to which all relative levels at other points in the circuit are referred. Very often the measured power level at a point, expressed in decibels relative to a reference, is so closely associated with the point (place) in the circuit that the power level and the point are used interchangeably. A point where a reading of -16 dBm is expected would be a

"-16 TL point," sometimes abbreviated "-16 TLP." *See also* dBr, level (def. #1), relative transmission level, system loading, zero transmission level point.

**transmission loss** The decrease in power during transmission from one point to another, usually expressed in decibels. (188) *See also* attenuation, net loss, optical density, path loss, reflection, scattering loss, transmittance.

**transmission security** *See* communications security.

**transmission security key (TSK)** A key that is used in the control of transmission security processes such as frequency hopping and spread spectrum. *See also* key.

**transmission time** In facsimile, the elapsed time between the start of picture signals and the detection of the end-of-message signal by the receiver for a single document. *See also* facsimile.

**transmission window** *Synonym* spectral window.

**transmissivity** In optics, the transmittance of a unit length of material, at a given wavelength, excluding the reflectances at the surfaces of the material. *Note:* The term is no longer in common use. *See also* transmittance.

**transmit-after-receive time delay** The time interval from removal of rf energy at the local receiver input until the local transmitter is automatically keyed on and the transmitted rf signal amplitude has increased to 90 percent of its steady-state value. (188) *Note:* HF transceiver equipment is normally not designed with an interlock between receiver squelch and transmitter on-off key. The transmitter can be keyed on at any time, independent of whether or not a signal is being received at the receiver input. *See also* transmitter attack-time delay.

**transmit flow control** In data communication systems, a device function that controls the rate at which data may be transmitted from one terminal so that it is equal to the rate at which it can be received by another terminal. *Note 1:*

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This function may apply between a DTE and the adjacent data switching exchange or between two DTEs. In the latter case, the transmission rate may be controlled due to network or remote DTE requirements. *Note 2:* This function can operate independently in the two directions of data transfer, thus permitting the transfer rates in one direction to be different from the transfer rates in the other direction. *See also* control character, data terminal equipment, data transfer time, data transmission, respond opportunity.

**transmittance** The ratio of transmitted power to incident power. (188) *Note:* In optics, frequently expressed as optical density or percent; in communications applications, generally expressed in decibels. Formerly called "transmission." *See also* optical density.

**transmitter attack-time delay** The time interval from keying-on a transmitter until the transmitted rf signal amplitude has increased to a specified level, usually 90 percent of its key-on steady-state value. *Note:* This delay excludes any necessary time for automatic antenna tuning. (188) *See also* transmit-after-receive time delay.

**transmitter central wavelength range** ( $\lambda_{\text{max}}$  -  $\lambda_{\text{min}}$ ) In optical communication, the total allowed range of transmitter central wavelengths caused by the combined worst-case variations due to manufacturing, temperature, aging, and any other significant factors.

**transmitter power output rating** The power output of a radio transmitter under stated conditions of operation and measurement. (188) *Note:* Power output ratings may be made against a number of criteria, e.g., peak envelope power, peak power, mean power, carrier power, noise power, or stated intermodulation level. *See also* output rating.

**transmitter release-time delay** The time interval from keying-off a transmitter until the transmitted rf signal amplitude has decreased to a specified value, usually 10 percent of its key-

on steady-state value. (188) *See also* transmitter attack-time delay.

**transmultiplexer** Equipment that transforms signals derived from frequency-division multiplex equipment, such as group or supergroups, to time-division-multiplexed signals having the same structure as those derived from PCM multiplex equipment, such as primary or secondary PCM multiplex signals, and vice versa. (188) *See also* frequency, frequency-division multiplexing, pulse-code modulation.

**transparency** 1. The property of an entity that allows another entity to pass through it without altering either or both of the entities. 2. In telecommunication networks, the property that allows the end-to-end transmission of signals without changing their form or information content. (188) *See also* code-independent data communication, commonality, communications, compatibility, Integrated Services Digital Network, interoperability. 3. That quality of a data communication system or device that uses a bit-oriented link protocol that does not depend on the bit sequence structure used by the data source. 4. An image fixed on a clear base by means of a photographic printing, chemical, or other process, especially adaptable for viewing by transmitted light. (JCS1-DoD) (JCS1-NATO)

**transparent interface** An interface that facilitates the capability to connect and operate a system, subsystem, or equipment with another system, subsystem, or equipment, without modification of their characteristics or operational procedures on either side of the interface. (188) *See also* commonality, interface, interoperability, mechanically intermateable connectors.

**transparent network** *See* transparency (def. #2).

**transponder** 1. An automatic device that receives, amplifies, and retransmits a signal on a different frequency. (188) 2. An automatic device that transmits a predetermined message in response to a predefined received signal. (188) *Note:* Used in identification-friend-or-

foe systems and air-traffic-control systems. *See also* identification friend or foe. 3. A receiver-transmitter that will generate a reply signal upon proper interrogation. (JCS1-DoD) (JCS1-NATO)

**transportability** 1. The quality of equipment, devices, systems, and associated hardware that permits its being moved from one location to another to interconnect with locally available equivalents. *Note:* The quality involves elements such as standardized plugs and transmission media. *See also* compatibility, interoperability. 2. The capability of material to be moved by towing, self-propulsion, or carrier via any means, such as railways, highways, waterways, pipelines, oceans, and airways. (JCS1-DoD) *See also* mobile service, mobile station, portability.

**transportable station** A station that is transferred to various fixed locations but is not intended to be used while in motion. (NTIA)

**Transport Layer** *See* Open System Interconnection--Reference Model.

**transposition** 1. In data transmission, a transmission defect in which, during one character period, one or more signal elements are changed from one significant condition to the other, and an equal number of elements are changed in the opposite sense. (188) *See also* code, translator. 2. In outside plant construction, an interchange of positions of the several conductors of a circuit between successive lengths; this interchange is normally used to reduce inductive interference on communication circuits. (188)

**transverse electric (TE) mode** A mode whose electric field vector is normal to the direction of propagation. *Note:* In an optical fiber, TE and TM modes correspond to meridional rays. *See also* meridional ray, mode.

**transverse electromagnetic (TEM) mode** A mode whose electric and magnetic field vectors are both normal to the direction of propagation. *Note:* A TEM mode may not exist in a

waveguide. Only a TE or TM mode may so exist. *See also* mode.

**transverse interferometry** The method used to measure the index profile of an optical fiber by placing it in an interferometer and illuminating the fiber transversely to its axis. Generally, a computer is required to interpret the interference pattern. *See also* interferometer.

**transverse magnetic (TM) mode** A mode whose magnetic field vector is normal to the direction of propagation. *Note:* In a planar dielectric waveguide (as within an injection laser diode), the field direction is parallel to the core-cladding interface. In an optical fiber, TE and TM modes correspond to meridional rays. *See also* meridional ray, mode (def. #1).

**transverse offset loss** *Synonym* lateral offset loss.

**transverse propagation constant** In fiber optics, the propagation constant in a direction perpendicular to the fiber axis. *Note:* The transverse propagation constant for a given mode can vary with the transverse coordinates. *See also* propagation constant.

**transverse scattering** The method for measuring the index profile of an optical fiber or preform by illuminating the fiber or preform coherently and transversely to its axis, and examining the far-field irradiance pattern. *Note:* A computer is required to interpret the pattern of the scattered light. *See also* scattering.

**trapped mode** *Synonym* bound mode.

**trapped ray** *Synonym* guided ray.

**tree network** *See* tree topology.

**tree search** In a tree structure, a search in which it is possible to decide, at each step, which part of the tree may be rejected without a further search. (FP) (ISO)

**tree structure** A hierarchical organization in which each node is considered to be an ancestor of all lower level nodes to which it is

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connected; the root, or base node, is an ancestor of all other nodes. (FP)

**tree topology** A communication network topology which, from a purely topologic viewpoint, resembles a star network in that individual peripheral nodes are required to transmit to and receive from one other node only, toward a central node, and are not required to act as repeaters or regenerators. The function of the central node, however, may be distributed. (188) *Note 1:* As in the conventional star network, individual nodes may thus still be isolated from the network by a single-point failure of a transmission path to the node. *Note 2:* A single-point failure of a transmission path within the distributed node will result in partitioning two or more stations from the rest of the network. *See also* bus topology, local area network, network topology, node (def. #1), ring network, star network, star topology.

**tremendously high frequency (THF)** Frequencies from 300 GHz to 3000 GHz. (188) *See also* frequency, spectrum designation of frequency.

**tributary office** A local office, located outside the exchange in which a toll center is located, that has a different rate center from its toll center. (After CFR 47)

**tributary station** 1. In a data network, a station other than the control station. 2. On a multipoint connection or a point-to-point connection using basic mode link control, any data station other than the control station. (FP) (ISO) *See also* control station, data communication, master station, primary station, secondary station, slave station.

**trim effect** The degradation of crystal oscillator frequency-temperature stability and marked frequency offset as a result of frequency adjustment which produces a rotation or distortion, or both, of the initial frequency-temperature characteristic.

**triple precision** Characterized by the use of three computer words to represent a number in accordance with required precision. (FP) (ISO)

**triplet** A byte composed of three bits. *Synonym* three-bit byte.

**TRI-TAC Acronym for tri-services tactical.** *See* tactical communication.

**TRI-TAC equipment** Equipment designed to accommodate the transition from the manual and analog systems currently being used to fully automated digital systems, and to provide message switching, circuit switching for voice communications, secure voice terminals, digital facsimile systems, and a user's digital voice terminal.

**troposcatter** *Synonym* tropospheric scatter.

**troposphere** 1. The lower layers of atmosphere, in which the change of temperature with height is relatively large. It is the region where clouds form, convection is active, and mixing is continuous and more or less complete. (JCS1-DoD) (JCS1-NATO) 2. The layer of the Earth's atmosphere, between the surface and the stratosphere, in which about 80 percent of the total mass of air is located and in which temperature normally decreases with altitude. (188) *Note:* The thickness of the troposphere varies with season and latitude; it is usually 16 km to 18 km over tropical regions and 10 km or less over the poles. *See also* atmospheric duct, ionosphere.

**tropospheric duct** *See* atmospheric duct.

**tropospheric scatter** 1. The propagation of radio waves by scattering as a result of irregularities or discontinuities in the physical properties of the troposphere. (RR) 2. The propagation of electromagnetic waves by scattering as a result of irregularities or discontinuities in the physical properties of the troposphere. (JCS1-DoD) (JCS1-NATO) 3. A method of transhorizon communications using frequencies from approximately 350 MHz to approximately 8400 MHz. (188) *Note:* The propagation mechanism is still not fully understood, though



it includes several distinguishable but changeable mechanisms such as propagation by means of random reflections and scattering from irregularities in the dielectric gradient density of the troposphere, smooth-Earth diffraction, and diffraction over isolated obstacles (knife-edge diffraction). *Synonym* troposcatter. *See also* backscattering, ionospheric scatter, propagation, scatter.

**tropospheric wave** A radio wave that is propagated by reflection from a place of abrupt change in the dielectric constant or its gradient in the troposphere. (188) *Note:* In some cases, the ground wave may be so altered that new components appear to arise from reflection in regions of rapidly changing dielectric constant. When these components are distinguishable from the other components, they are called "tropospheric waves." *See also* ground wave, sky wave.

**truncated binary exponential backoff** In carrier sense multiple access with collision avoidance networks and in carrier sense multiple access with collision detection networks, the algorithm used to schedule retransmission after a collision such that the retransmission is delayed by an amount of time derived from the slot time and the number of attempts to retransmit. (FP) (ISO) *See also* carrier sense multiple access with collision avoidance, carrier sense multiple access with collision detection.

**truncation** [In data processing,] The deletion or omission of a leading or a trailing portion of a string in accordance with specified criteria. (FP)

**truncation error** In the representation of a number, the error introduced when one or more digits are dropped.

**trunk 1.** A single transmission channel between two points that are switching centers or nodes, or both. (188) **2.** [A] circuit between switchboards or other switching equipment, as distinguished from circuits which extend between central office switching equipment and information origination/termination equipment. (CFR 47) *See also* central office

**trunk, channel** (defs. #1, #3, #5), **circuit** (def. #2), **common trunk**, **cross-office trunk**, **interposition trunk**, **interswitch trunk**, **intraoffice trunk**, **one-way trunk**, **tandem center**, **tandem tie trunk network**, **transmission channel**.

**trunk answer from any station** A switching system service feature that allows a user to dial a special code and answer an incoming call when the feature is activated. *See also* service feature.

**trunk encryption device (TED)** A bulk encryption device used to provide secure communication over a wideband digital transmission link. (188) *Note:* It is usually located between the output of a trunk group multiplexer and a wideband radio or cable facility. *See also* bulk encryption, link encryption.

**trunk group** Two or more trunks of the same type between the same two points. (188) *See also* group.

**trunk group multiplexer (TGM)** A time-division multiplexer whose function is to combine individual digital trunk groups into a higher rate bit stream for transmission over wideband digital communication links. *See also* group, link, multiplexing.

**trunk hunting** *See* hunting (def. #1).

**trusted computer system (TCS)** An automated information system, including all of the hardware, firmware, and software that, by virtue of having undergone sufficient benchmark validation and testing, as well as acceptance and user testing, can be expected to meet the user's requirements for reliability, security, and operational effectiveness with specified performance characteristics. *Note:* Such a system is primarily intended for simultaneously processing various levels of sensitive and classified information without danger of compromise. (188) *See also* automated information systems security, computer, data security.

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**trusted computing base (TCB)** The totality of protection mechanisms within a computer system, including hardware, firmware, and software, the combination of which is responsible for enforcing a security policy.

*Note:* A trusted computing base consists of one or more components that together enforce a unified security policy over a product or system. The ability of a trusted computing base to enforce correctly a unified security policy depends solely on the mechanisms within the trusted computing base and the correct input by system administrative personnel of parameters related to the security policy. *See also* automated information systems security, computer, data security.

**truth table 1.** An operation table for a logic operation. (FP) (ISO) **2.** A table that describes a logic function by listing all possible combinations of input values and indicating, for each combination, the output value. (FP)

**TSK** *Abbreviation for transmission security key.*

**TSP** *Abbreviation for Telecommunication Service Priority.*

**TSPS** *Abbreviation for traffic service position system.*

**TSP system** *See Telecommunications Service Priority system.*

**T3 carrier** *See T-carrier.*

**TTTN** *Abbreviation for tandem tie trunk network.*

**T2 carrier** *See T-carrier.*

**TTY** *Abbreviation for teletypewriter.*

**TTY/TDD** A unique telecommunication device for the deaf, using TTY principles.

**tunneling mode** *Synonym leaky mode.*

**tunneling ray** *Synonym leaky ray.*

**Turing machine** A mathematical model of a device that changes its internal state and reads from, writes on, and moves a potentially infinite tape, all in accordance with its present state, thereby constituting a model for computer-like behavior. (FP)

**turnaround time** In a half-duplex circuit, the actual time required to reverse the direction of transmission from send to receive or vice versa. (188) *See also* half-duplex circuit, response time, round-trip delay time.

**turnkey** Pertaining to a procurement process involving contractual action through, at least, the system, subsystem, or equipment installation phase. Follow-on contractual actions for test, training, logistics support, and operation may be included in any combination. (188) *Note:* For precise definition of the types of allowable contractual features, the Federal Acquisition Regulations apply.

**TV** *Abbreviation for television.*

**twin cable** A cable composed of two insulated conductors laid parallel and either attached to each other by the insulation or bound together with a common covering. (188) *See also* cable, open wire.

**twinplex** A frequency-shift-keyed, carrier telegraphy system in which four unique tones (two pairs of tones) are transmitted over a single transmission channel (such as one twisted pair). *Note:* One tone of each tone pair represents a "mark," and the other, a "space." *See also* frequency-shift keying.

**twin sideband transmission** *See independent-sideband transmission.*

**twist** In telephony, a change, as a function of temperature, in the response characteristic of a transmission line.

**twisted pair cable** *See paired cable.*

**two-out-of-five code** A binary-coded decimal notation in which each decimal digit is represented by a binary numeral consisting of

five binary digits of which two are of one kind, conventionally "ones," and three are of the other kind, conventionally "zeros." The usual weights are 0-1-2-3-6, except for the representation of "zero," which is then 01100. (FP) (ISO)

**balanced line, circuit, four-wire circuit, line adapter circuit, metallic circuit, open wire.**

**TWX®** *Acronym for teletypewriter exchange service.*

**two-pilot regulation** In FDM systems, the use of two pilot frequencies within a band so that the change in attenuation due to twist can be detected and compensated for by a regulator. (188) *See also* frequency, frequency-division multiplexing, pilot.

**two-sample deviation** The square root of the Allan variance (two-sample variance). *See also* Allan variance.

**two-sample variance** *Synonym* Allan variance.

**two-source frequency keying** *Synonym* frequency exchange signaling.

**two-tone keying** In telegraphy systems, a system employing a transmission path composed of two channels in the same direction, one for transmitting the "space" binary modulation, the other for transmitting the "mark" of the same modulation; or that form of keying in which the modulating wave causes the carrier to be modulated with a single tone for the "marking" condition and modulated with a different single tone for the "spacing" condition. (188) *See also* frequency exchange signaling, frequency-shift keying, keying, voice-frequency telegraph.

**two-tone telegraph** *See* two-tone keying.

**two-way alternate operation** *Synonym* half-duplex operation.

**two-way simultaneous operation** *Synonym* duplex operation.

**two-wire circuit** A communication circuit formed by two metallic conductors insulated from each other. (188) *Note:* The term is also used, in contrast to a four-wire circuit, to indicate a circuit using one line or channel for communications in both directions. *See also*

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**UHF** *Abbreviation for ultra high frequency. See spectrum designation of frequency.*



**U interface** For basic-rate access in an ISDN environment, the U interface denotes the use of a two-wire loop transmission system that conveys information between the four-wire user-to-network interface (S/T reference point) and the local exchange. The U interface will be located in the servicing dial central office and is not distance sensitive as a service employing a T-interface specification would be. *See also basic rate access, Integrated Services Digital Network, R interface, S interface, T interface.*

**ULF** *Abbreviation for ultra low frequency. See spectrum designation of frequency.*

**ultra high frequency (UHF)** Frequencies from 300 MHz to 3000 MHz. (188) *See also spectrum designation of frequency.*

**ultra low frequency (ULF)** Frequencies from 300 Hz to 3000 Hz. (188) *See also spectrum designation of frequency.*

**ultraviolet (uv)** That portion of the electromagnetic spectrum in which the wavelength is just below the visible spectrum, extending from approximately 4 nm to approximately 400 nm. *Note:* Some scientists place the lower limit at values between 1 and 40 nanometers, 1 nm being the upper wavelength limit of X-rays. The 400-nm limit is the lowest visible frequency, violet. *See also infrared, light.*

**unavailability** A measure of the degree to which a system, subsystem, or equipment is not operable and not in a committable state at the start of a mission, when the mission is called for at an unknown (random) point in time. Expressed mathematically, 1 minus the availability. (188) *Note:* The conditions determining operability and committability must be specified. *See also availability.*

**unbalanced line** A transmission line in which the magnitudes of the voltages on the two

conductors are not equal with respect to ground, e.g., a coaxial cable. (188) *See also balanced, balanced line, common return offset, ground-return circuit, line (def. #1), singing, unbalanced wire circuit.*

**unbalanced modulator** A modulator in which the modulation factor is different for the alternate half-cycles of the carrier. (188) *Synonym asymmetrical modulator. See also balanced, carrier (cxr), modulation, modulation factor.*

**unbalanced wire circuit** A circuit whose two sides are inherently electrically dissimilar. (188) *See also unbalanced line.*

**unbound mode** *Synonym radiation mode.*

**unbundling** In the context of the FCC's Computer III Inquiry, the process of separating individual tariffed offerings and services that are associated with a specific element in the CEI or ONA tariff from other tariffed basic service offerings. (After para. 158, FCC Report and Order, 6/16/86) *See also basic service element, basic serving arrangement.*

**underflow** In computing, a condition occurring when a machine calculation produces a non-zero result that is smaller than the smallest non-zero quantity that the machine's storage unit is capable of storing or representing. *Synonym underflow. See also overflow (def. #6).*

**underground cable** A communication cable designed to be placed under the surface of the Earth in a duct system that isolates it from direct contact with the soil. (188) *Note:* Not to be confused with "direct-buried cable" which is in direct contact with the soil. *See also cable, direct-buried cable, outside plant.*

**underlap** In facsimile, a defect that occurs when the width of the scanning line is less than the scanning pitch. *See also facsimile, tailing.*

**undesired signal** Any signal that tends to produce degradation in the operation of equipment or systems. (188) *See also*



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- distortion, interference, signal, spurious emission.**
- undetected error rate** *Deprecated synonym for undetected error ratio.*
- undetected error ratio** The ratio of the number of bits, unit elements, characters, or blocks incorrectly received and undetected, to the total number of bits, unit elements, characters, or blocks sent. *Synonyms* residual error rate, undetected error rate. *See also* binary digit, bit error ratio, block, character, error, error control.
- undisturbed day** A day in which the sunspot activity or ionospheric disturbance does not interfere with radio communications.
- unidirectional channel** *Synonym* one-way-only channel.
- unidirectional operation** A method of operation in one direction only, between terminals, one of which is a transmitter and the other a receiver. (188) *See also* half-duplex operation.
- uniform encoding** An analog-to-digital conversion process in which, except for the highest and lowest quantization steps, all of the quantization subrange values are equal. *Synonym* uniform quantizing. *See also* analog encoding, code, quantization, quantization level, signal.
- uniform linear array** An antenna composed of a relatively large number of usually identical elements arranged in a single line or in a plane with uniform spacing and usually with a uniform feed system. (188) *See also* antenna.
- uniform quantizing** *Synonym* uniform encoding.
- uniform-spectrum random noise** *See* white noise.
- uniform time scale** A time scale made up of equal intervals.
- unilateral control system** *Synonym* unilateral synchronization system.
- unilateral synchronization system** A synchronization control system between two locations, e.g., A and B, in which the clock at A controls the clock at B, but the clock at B does not control the clock at A. *Synonym* unilateral control system. *See also* bilateral synchronization, clock, double-ended synchronization, single-ended synchronization, synchronization.
- unintelligible crosstalk** 1. Crosstalk giving rise to unintelligible signals. (188) *See also* crosstalk, intelligible crosstalk, interference. 2. Crosstalk from which information cannot be derived.
- unintentional interference** *See* interference.
- unipolar signal** A two-state signal where one of the states is represented by voltage or current and the other state is represented by no voltage or current. (188) *Note:* The current flow can be in either direction.
- unit element** In the representation of a character, a signal element that has a duration (length) equal to the unit interval. (188) *See also* character, code.
- unit interval** In a system using isochronous transmission, that interval of time such that the theoretical durations of the significant intervals of a signal are all whole multiples of this interval. (188) *Note:* The unit interval is the shortest time interval between two consecutive significant instants. *See also* character interval.
- Universal Time (UT)** 1. The basis for coordinated dissemination of time signals, counted from 0000 at midnight. (JCS1-DoD) 2. In celestial navigation applications, the time which gives the exact rotational orientation of the Earth obtained from UTC by applying increments determined by the U.S. Naval Observatory. (JCS1-DoD) 3. The official civil time of the United Kingdom. *Formerly called*

**Greenwich Mean Time.** (JCSI-DoD) *See also* International Atomic Time, UTC(i).

**UNIX™** A computer operating system. *See also* operating system.

**unnumbered command** In a data transmission, a command that does not contain sequence numbers in the control field. *See also* control character.

**unnumbered response** In a data transmission, a response that does not contain sequence numbers in the control field. *See also* response.

**unsuccessful call** A call attempt that does not result in the establishment of a connection. *See also* lost call.

**up-converter** A device for performing frequency translation in such a manner that the output frequencies are higher than the input frequencies. (188) *See also* down-converter, erect position, frequency, frequency translation, inverted position.

**uplink** That portion of a communication link used for transmission of signals from an Earth terminal to a satellite or airborne platform. It is the converse of "downlink." (188) 2. Pertaining to data transmission from a data station to the head-end. (FP) (ISO) (188) *See also* downlink, link, satellite.

**upright position** *Synonym* erect position.

**uptime** The time during which a functional unit is fully operational. (188) *See also* downtime.

**usable line length** *See* available line.

**usage** *Synonym* occupancy.

**useful line** *Synonym* available line.

**user 1.** A person, organization, or other entity (including a computer or computer system), that employs the services provided by a telecommunication system, or by an information processing system, for transfer of

information to others. (188) *Note:* A user functions as a source or final destination of user information, or both. 2. In automated information systems, a person or process accessing an automated information system by direct connections (e.g., via terminals), or indirect connections (i.e., prepare input data or receive output that is not reviewed for content or classification by a responsible individual). 3. In COMSEC, an individual who is required to use COMSEC material in the performance of his/her duties, and who is responsible for safeguarding that COMSEC material. *See also* access originator, automated information system, communications sink, communications source, destination user, originating user, terminal.

**user information** Information transferred across the functional interface between a source user and a telecommunication system for the purpose of ultimate delivery to a destination user. *Note:* In data telecommunication systems, "user information" includes user overhead information. *See also* delivered overhead bit, delivered overhead block, destination user, interface (def. #2), overhead bit, overhead information, source user.

**user information bit** A bit transferred from a source user to a telecommunication system for the purpose of ultimate delivery to a destination user. (188) *Note:* User information bits do not include those overhead bits originated by, or having their primary functional effect within, the telecommunication system. *See also* binary digit, overhead bit.

**user information block** A block that contains at least one user information bit. (188) *See also* block.

**user overhead information** *See* overhead information.

**user service class** *Synonym* class of service.

**user's line** *Synonym* loop (def. #2).

**UT** *Abbreviation for* Universal Time.

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**UTC** *Abbreviation for Coordinated Universal Time. See also International Atomic Time.*

**UTC(i)** Coordinated Universal Time (UTC), as kept by the "i" laboratory, where *i* is any laboratory cooperating in the determination of UTC. *Note:* In the United States, the official UTC is kept by the U.S. Naval Observatory and is referred to as UTC (USNO). *See also Coordinated Universal Time.*

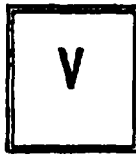
**utility load** *Synonym nonoperational load.*

**utility program** A computer program in general support of the processes of a computer; for example, a diagnostic program, a trace program. *Synonym service program.*

**utility routine** A routine in general support of the processes of a computer; for example, an input routine. (FP) (ISO) *Synonym service routine. See also tool.*

**uv** *Abbreviation for ultraviolet.*

**validation** 1. Tests to determine whether an implemented system fulfills its requirements. (FP) (ISO) (188) 2. The checking of data for correctness or for compliance with applicable standards, rules, and conventions. (188) 3. The portion of the development of specialized security test and evaluation, procedures, tools, and equipment needed to establish acceptance for joint usage of an automated information system by one or more departments or agencies and their contractors. *Note:* This action will include, as necessary, final development, evaluation, and testing, preparatory to acceptance by senior security test and evaluation staff specialists. *See also* automated information system, trusted computer system.



**value-added carrier** A company that sells the services of a value-added network. *See also* enhanced service.

**value-added network (VAN)** A network using the communication services of other commercial carriers, using hardware and software that permit enhanced telecommunication services to be offered. *See also* enhanced service, network.

**VAN** *Acronym for value-added network.*

**variable length buffer** A buffer into which data may be entered at one rate and removed at another, without changing the data sequence. (188) *Note:* Most first-in first-out (FIFO) storage devices serve this purpose in that the input rate may be variable while the output rate is constant or the output rate may be variable while the input rate is fixed. Various clocking and control systems are used to allow control of underflow or overflow conditions. *See also* buffer, data, elastic buffer.

**variant** 1. One of two or more cipher or code symbols which have the same plain text equivalent. (JCS1-DoD) 2. One of several plain text meanings that are represented by a single code group. *Synonym* alternative. (JCS1-DoD) *See also* code, cryptology, encode.

**variation monitor** A device for sensing deviations of any measured variable, such as voltage, current, or frequency, and capable of initiating a programmed action, such as transfer, to other power sources when programmed limits of voltage, current, frequency, or time are exceeded, or providing an alarm, or both. (188) *See also* alarm sensor, reasonableness check, telemetry.

**VC** *Abbreviation for virtual circuit.*

**VDU** *Abbreviation for visual display unit.*

**vector processor** *Synonym* array processor.

**velocity** *See* group velocity, phase velocity.

**verified off-hook** In telephone systems, a service provided by a unit that is inserted on each end of a transmission circuit for the purpose of verifying supervisory signals on the circuit. (188) *Note:* Off-hook service is a priority telephone service for key personnel, affording a connection from caller to receiver by the simple expedient of removing the phone from its cradle or hook. *See also* circuit, dedicated circuit, hot line, point-to-point link, ringdown.

**verifier** A device that checks the correctness of transcribed data, usually by comparing with a second transcription of the same data or by comparing a retranscription with the original data. (FP)

**very high frequency (VHF)** Frequencies from 30 MHz to 300 MHz. (188) *See also* spectrum designation of frequency.

**very low frequency (VLF)** Frequencies from 3 kHz to 30 kHz. (188) *See also* spectrum designation of frequency.

**vestigial sideband (VSB) transmission** A modified double-sideband transmission in which one sideband, the carrier, and only a portion of the other sideband are transmitted. (188) *See also* carrier (cxr), double-sideband transmission, frequency, sideband, sideband transmission.

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**VF** *Abbreviation for voice frequency.*

**VFCT** *Abbreviation for voice frequency carrier telegraph. See voice-frequency telegraph.*

**VF patch bay** *See voice frequency primary patch bay.*

**VFTG** *Abbreviation for voice-frequency telegraph.*

**VHF** *Abbreviation for very high frequency.*

**via net loss (VNL)** *A method of circuit performance prediction and description that allows circuit parameters to be predetermined and the circuit to be designed to meet established criteria. See also circuit, design objective, traffic engineering.*

**video display terminal** *Synonym visual display unit.*

**video display unit** *Synonym visual display unit.*

**video signal** *A signal normally used to transmit changing pictorial information in real time. Note 1: The video signal bandwidth depends upon the mode of transmission, e.g., slow-scan TV, full-scan, or digitized full-scan. Note 2: This definition describes the generic signal between a transmitter and receiver. See also signal, television.*

**videotext** *Pertaining to a type of communication service in which a user can access a remote database and receive the requested data on the user's video display. Note: The database information is transmitted to the user's video display over a separate channel that may be a commercial carrier channel.*

**view** *In satellite communications, the ability of a satellite Earth terminal to "see" a satellite, having it sufficiently above the horizon and clear of other obstructions so that it is within a free line of sight from the satellite Earth terminal. (188) Note: A pair of satellite Earth terminals has a satellite in "mutual" view when both have unobstructed line-of-sight contact with the satellite simultaneously. See also*

*footprint, horizon angle, line-of-sight propagation, satellite.*

**viewdata** *An information retrieval system that uses a remote database accessible through the public telephone network. Video display of the data is on a monitor or television receiver. See also teletext.*

**violation** *See AMI violation.*

**virtual call** *A call, established over a network, that uses the capabilities of either a real or virtual circuit by sharing all or any part of the resources of the circuit for the duration of the call.*

**virtual call capability** *A user service feature in which a call set-up procedure and a call-clearing procedure will determine a period of communication between two DTEs in which user's data will be transferred by the network in the packet mode of operation. Note 1: This service requires end-to-end transfer control of packets within a network. Note 2: Data may be delivered to the network before the call setup has been completed but it will not be delivered to the destination address if the call setup attempt is unsuccessful. Note 3: All the user's data are delivered from the network in the same order in which they are received by the network. Multi-access DTEs may have several virtual calls in operation at the same time. Synonym virtual call facility. See also call, data terminal equipment, network, permanent virtual circuit, virtual circuit.*

**virtual call facility** *Synonym virtual call capability.*

**virtual carrier frequency** *The location in the frequency spectrum that carrier energy would occupy if carrier energy were present. (188) See also carrier (cxr), frequency.*

**virtual circuit (VC)** *A communications arrangement in which data from a source user may be passed to a destination user over various real circuit configurations during a single period of communication. (188) Note: Virtual circuits are generally set up on a per-*



call basis and are disconnected when the call is terminated; however, a permanent virtual circuit can be established as an option to provide a dedicated link between two facilities. *Synonym* logical circuit. *See also* circuit, data, data circuit, network, permanent virtual circuit, virtual call capability.

**virtual circuit capability** A network service feature providing a user with a virtual circuit. *Note:* This feature is not necessarily limited to packet mode transmission, e.g., an analog signal may be converted at its network node to a digital form, which may then be routed over the network via any available route.

**virtual connection** A logical connection that is made to a virtual circuit.

**virtual height** The apparent height of an ionized layer, as determined from the time interval between the transmitted signal and the ionospheric echo at vertical incidence. (188) *See also* air sounding, ionosphere.

**virtual memory** In computer systems, the memory as it appears to the operating programs running in the CPU; this memory may appear smaller, equal to, or larger than the real memory present in the system. *See also* central processing unit.

**virtual network** A network providing virtual circuits and established from the facilities of a real network. *See also* virtual circuit.

**virtual storage** The storage space that may be regarded as addressable main storage by the user of a computer system in which virtual addresses are mapped into real addresses. *Note:* The size of virtual storage is limited by the addressing scheme of the computer system and by the amount of auxiliary storage available, and not by the actual number of main storage locations. (FP) (ISO)

**visible spectrum** *See* light, optical spectrum.

**visual display unit (VDU)** A device with a display screen, usually equipped with a keyboard, for example, a cathode ray tube

display, light-emitting diode display, liquid crystal display, or plasma panel. (FP) (ISO) *Synonyms* monitor (def. #2), video display terminal, video display unit.

**vitreous silica** Glass consisting of almost pure silicon dioxide (SiO<sub>2</sub>). *Synonym* fused silica. *See also* fused quartz.

**VLF** *Abbreviation for* very low frequency. *See* spectrum designation of frequency.

**VNL** *Abbreviation for* via net loss.

**V number** *Synonym* normalized frequency (def. #1).

**vocoder** *Acronym for* voice-coder. A type of voice coder, usually consisting of a speech analyzer and a speech synthesizer. (188) *Note 1:* The analyzer circuitry converts analog speech waveforms into digital signals. The synthesizer converts the digital signals into artificial speech sounds. *Note 2:* For COMSEC purposes, a vocoder may be used in conjunction with a key generator and a modulator-demodulator device to transmit digitally encrypted speech signals over normal narrowband voice communication channels. These devices are used to reduce the bandwidth requirements for transmitting digitized speech signals. *Note 3:* There are analog vocoders that move incoming signals from one portion of the spectrum to another portion. *See also* code, communications security.

**vodas** *Acronym for* voice-operated device anti-singing. A device used to prevent the overall voice frequency singing of a two-way telephone circuit by ensuring that transmission can occur in only one direction at any given instant. (188) *See also* singing.

**vogad** *Acronym for* voice-operated gain-adjusting device. A device used to give a substantially constant output amplitude for a wide range of input amplitudes. (188) *See also* clipper, compandor, compressor, expander, peak limiting.

**voice-data signal** *See* quasi-analog signal.

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**voice frequency (VF)** Those frequencies lying within that part of the audio range that is employed for the transmission of speech. (188) *Note 1:* In telephony, the usable voice-frequency band ranges from a nominal 300 Hz to 3400 Hz. *Note 2:* In telephony, the bandwidth allocated for a single voice-frequency transmission channel is usually 4 kHz, including guard bands. *See also* audio frequency, frequency, voice frequency channel.

**voice frequency carrier telegraph (VFCT)** *Synonym* voice-frequency telegraph.

**voice-frequency (VF) channel** A transmission path suitable for carrying analog signals and quasi-analog signals. (188) *See also* channel, frequency, voice frequency.

**voice frequency (VF) primary patch bay** A patching facility that provides the first appearance of local-user VF circuits in the technical control facility (TCF). (188) *Note:* The VF primary patch bay provides patching, monitoring, and testing for all VF circuits. Signals will have various levels and signaling schemes depending on the user terminal equipment. *See also* circuit, patch bay.

**voice-frequency telegraph (VFTG)** A method in which one or more dc telegraph channels are multiplexed into a composite nominal 4-kHz voice frequency channel for further processing through a transmission line or radio network. (188) *Synonym* voice frequency carrier telegraph. *See also* channel, frequency, two-tone keying.

**voice grade** In the public regulated services, a service described by the *Code of Federal Regulations*, Title 47, part 68. *Note:* The term does not imply any specific signaling or required supervisory scheme. *See also* subvoice-grade channel.

**voice-operated relay (vox) circuit** A voice-operated relay circuit that permits the equivalent of push-to-talk operation of a transmitter by the operator. (188) *See also* attack time, push-to-talk operation.

**voice-plus circuit** *Synonym* composited circuit.

**volatile storage** A storage device whose contents are lost when power is cut off. (FP) (ISO)

**volatlility** *See* data volatility.

**voltage standing wave ratio (VSWR)** The ratio of maximum to minimum voltage in a standing wave pattern that may appear along a transmission line. *Note:* It is used as a measure of impedance mismatch between the transmission line and its load. (188) *See also* standing wave ratio.

**volume** A portion of data, together with its data carrier, that can be handled conveniently as a unit; for example, a reel of magnetic tape, a disk pack. (FP)

**volume unit (vu)** The unit of measurement of the power of an audio-frequency signal, as measured by a vu meter. (188) *Note:* The vu meter is a volume indicator built and used in accordance with American National Standard C16.5-1942. Zero vu equals zero dBm (1 milliwatt) in measurements of sine wave test tone power. *See also* transmission level point.

**vox** *Acronym for* voice-operated relay [circuit].

**V reference point** The proposed interface point in an ISDN environment between the line termination and the exchange termination.

**VSB** *Abbreviation for* vestigial sideband. *See* vestigial sideband transmission.

**V.-series Recommendations** Sets of telecommunications protocols and interfaces defined by CCITT Recommendations. *Note:* Some of the more common V.-series Recommendations are:

**VSWR** *Abbreviation for* voltage standing wave ratio.

**vu** *Abbreviation for* volume unit.

**waiting signal** See DCE waiting signal, DTE waiting signal.

**WAN** *Abbreviation for wide area network.*



**wander** Long-term random variations of the significant instants of a digital signal from their ideal position in time. *Note:* Wander variations are usually considered to be those that occur over a period greater than 1 second. See also jitter, significant instant, swim.

**WATS** *Acronym for Wide Area Telephone Service. See also local access and transport area.*

**waveform** The representation of a signal as a plot of amplitude vs. time.

**wavefront** The locus of points having the same phase at the same time.

**waveguide** A material medium that confines and guides a propagating electromagnetic wave. (188) *Note 1:* In the microwave regime, a waveguide normally consists of a hollow metallic conductor, generally rectangular, elliptical, or circular in cross-section. This type of waveguide may, under certain conditions, contain a solid or gaseous dielectric material. *Note 2:* In the optical regime, a waveguide used as a long transmission line consists of a solid dielectric filament (optical fiber), usually circular in cross-section. In integrated optical circuits an optical waveguide may consist of a thin dielectric film. *Note 3:* In the rf regime, ionized layers of the stratosphere and refractive surfaces of the troposphere may also serve as a waveguide. See also optical fiber, thin film waveguide.

**waveguide dispersion** See dispersion.

**waveguide scattering** Scattering (other than material scattering) that is attributable to variations of geometry and refractive index profile of an optical fiber. See also material scattering, nonlinear scattering, Rayleigh scattering, scatter.

**wave impedance** In an electromagnetic wave, the ratio of the electric field strength to the magnetic field strength at the point of observation. (188) See also field strength, impedance.

**wavelength** The distance between points of corresponding phase of two consecutive cycles of a wave. (188) *Note:* The wavelength,  $\lambda$ , is related to the propagation velocity,  $v$ , and the frequency,  $f$ , by  $\lambda = v/f$ . See also electrical length, frequency, phase velocity.

**wavelength-division multiplexing (WDM)** In optical fiber communications, any technique by which two or more optical signals having different wavelengths may be simultaneously transmitted in the same direction over one fiber, and then be separated by wavelength at the distant end. (188) See also fiber optics, frequency-division multiplexing, multiplexing, time-division multiplexing.

**wavelength stability [of an optical source]** The maximum deviation, over the period of interest, of the source's peak optical wavelength from its mean operating value.

**WDM** *Abbreviation for wavelength-division multiplexing.*

**weakly guiding fiber** An optical fiber in which the refractive index contrast is small (usually less than 1%). See also refractive index [of a medium].

**weighted standard work second** A measurement of traffic operating work which is used to express the relative time required to handle the various kinds of calls (work functions), and which is weighted to reflect appropriate degrees of waiting-to-serve time.

**weighting** See C-message weighting, flat weighting, F1A-line weighting, HA1-receiver weighting, noise weighting, 144-line weighting, 144-receiver weighting, psophometric weighting.

**weighting network** A network whose loss varies with frequency in a predetermined manner,

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used for improving or correcting transmission characteristics, or for noise measurements. (188) *See also* network, noise weighting.

**white area** The area or population that does not receive interference-free primary service from an authorized AM station or does not receive a signal strength of at least 1 mV/m from an authorized FM station. (After CFR 47) *See also* blanketing.

**white facsimile transmission** 1. In an amplitude-modulated facsimile system, that form of transmission in which the maximum transmitted power corresponds to the minimum density of the subject copy. (188) *See also* black facsimile transmission, facsimile. 2. In a frequency-modulated system, that form of transmission in which the lowest transmitted frequency corresponds to the minimum density of the subject copy. (188)

**white noise** Noise whose frequency spectrum is continuous and uniform over a wide frequency range. (188) *Note:* White noise has equal power per hertz over the frequency band of interest. *See also* frequency, in-band noise power ratio, pink noise, pseudorandom noise.

**white signal** In facsimile, the signal resulting from the scanning of a minimum-density area of the subject copy. (188) *See also* facsimile.

**wide area network (WAN)** A physical or logical network that provides capabilities for a number of independent devices to communicate with each other over a common transmission-interconnected topology in geographic areas larger than those served by local area networks. *Note 1:* A user may describe a collection of physical networks, e.g., ISDN, X.25, T1, as the user's logical WAN environment. *Note 2:* A MAN is a special case of a WAN in which the area covered is a metropolitan area. WANs may be country-wide or world-wide. *See also* local access and transport area, local area network, metropolitan area network, network.

**Wide Area Telephone Service (WATS)** A toll service offering for customer dial-type telecommunications between a given customer

[user] station and stations within specified geographic rate areas employing a single access line between the customer [user] location and the serving central office. Each access line may be arranged for either outward (OUT-WATS) or inward (IN-WATS) service, or both. (CFR 47) *Note:* The offering is for fixed-rate inter- and intra-LATA services measured by zones and hours. *See also* local access and transport area.

**wideband** 1. An imprecise designation of a signal that occupies a broad frequency spectrum. *Note:* This term is often used to distinguish it from a narrowband signal, where both terms are subjectively defined relative to the implied context. 2. That property of any circuit having a bandwidth wider than normal for the type of circuit, frequency of operation, and type of modulation carried. *Note:* The term has many meanings depending upon application. At audio/telephone frequencies, a bandwidth exceeding 4 kHz can be considered wideband. At HF radio frequencies (3-30 MHz), a bandwidth larger than 3 kHz would be considered wideband. In communications security systems, any bandwidth exceeding that of a nominal 4-kHz telephone channel is considered wideband. (188) 3. That property of any communication facility, equipment, channel, or system in which the transmitted bandwidth is greater than 0.1 percent of the midband frequency. (188) 4. In commercial telephone usage, that property of a circuit having a bandwidth greater than 4 kHz. (188) *Synonym* broadband. *See also* bandwidth, communications system, frequency, narrowband signal, spectrum designation of frequency.

**wideband channel** A communication channel of a bandwidth equivalent to twelve or more voice-grade channels. (CFR 47)

**wideband modem** 1. A modem whose modulated output signal can have an essential frequency spectrum that is broader than that which can be wholly contained within, and faithfully transmitted through, a voice channel with a nominal 4-kHz bandwidth. (188) 2. A modem whose bandwidth capability is greater

than that of a narrowband modem. *See also* bandwidth, frequency, modem, narrowband modem, narrowband signal, secure voice cord board, wideband.

**wild-point detection** *Synonym* reasonableness check.

**window** 1. A band of wavelengths at which an optical fiber is sufficiently transparent for practical use in communications applications. *See also* spectral window. 2. A portion of a display surface in which display images pertaining to a particular application can be presented. *Note:* Different applications can be displayed simultaneously in different windows. (FP)

**wink** In telephone switching systems, a single supervisory pulse. (188).

**wink pulsing** In telephone switching systems, recurring pulses of a type where the off-pulse is very short with respect to the on-pulse, e.g., on key telephone instruments, the hold position (condition) of a line is often indicated by wink pulsing the associated lamp at 120 impulses per minute, 94 percent make, 6 percent break (470 ms on, 30 ms off). (188) *See also* pulse, pulsing.

**wireline common carrier** Common carriers [that] are in the business of providing landline local exchange telephone service. (CFR 47)

**word** A character string or a bit string considered to be an entity for some purpose. (FP) (ISO) (188) *Note:* In telegraph communications, six character intervals are defined as a word when computing traffic capacity in words per minute, which is computed by multiplying the data signaling rate in baud by 10 and dividing the resulting product by the number of unit intervals per character. *See also* baud, binary digit, bit string, block, byte, character, code word, computer word.

**word length** The number of characters or bits in a word. (FP) *See also* binary digit, character.

**word processing** The use of a system to manipulate text by performing functions such as entering, editing, rearranging, sorting, storing, retrieving, displaying, and printing. *Synonym* text processing.

**work space** That portion of main storage that is used by a computer program for temporary storage of data. (FP) (ISO)

**work station** 1. For automated systems, a configuration of input, output, display and processing equipment that provides an operator interface to a system, such as a central computer, communication, or control system. 2. A configuration of input, output, display, and processing equipment that constitutes a stand-alone system not requiring external access.

**World Time** *Synonym* Coordinated Universal Time.

**worst hour of the year** That hour of the year during which the median noise over any radio path is at a maximum. (188) *Note:* This hour is considered to coincide with the hour during which the greatest transmission loss occurs. *See also* path loss, transmission loss.

**write** To make a permanent or transient recording of data in a storage device or on a data medium. (FP)

**write cycle time** The minimum time interval between the starts of successive write cycles of a storage device that has separate reading and writing cycles. (FP) (ISO)

**write head** A magnetic head capable of writing only. (FP) (ISO)

**write protection label** A removable label, the presence or absence of which on a diskette prevents writing on the diskette. (FP) (ISO) *Synonym* write-protect tab.

**write-protect tab** *Synonym* write protection label.



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**X-dimension of recorded spot** In facsimile, the center-to-center distance between two recorded spots measured in the direction of the recorded line. (188)



*Note:* This term applies to facsimile equipment that responds to a constant density in the subject copy by yielding a succession of discrete recorded spots. *See also* facsimile, maximum keying frequency, recording.

**X-dimension of scanning spot** In facsimile, the center-to-center distance between two scanning spots measured in the direction of the scanning line on the subject copy. (188) *Note:* The numerical value of this term will depend upon the type of system used. *See also* facsimile, scanning.

**xerographic recording** Recording by action of a light spot on an electrically charged photoconductive insulating surface where the latent image is developed with a resinous powder. *See also* recording.

**XO** *Abbreviation for crystal oscillator.*

**X.-series Recommendations** Sets of data telecommunications protocols and interfaces defined by CCITT Recommendations.

**XT** *Abbreviation for crosstalk.*

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**Y-dimension of recorded spot** In facsimile, the center-to-center distance between two recorded spots measured perpendicular to the recorded line. (188) *See also* facsimile, recording, scanning.

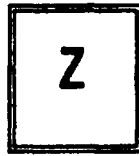


**Y-dimension of scanning spot** In facsimile, the center-to-center distance between two scanning spots measured perpendicular to the scanning line on the subject copy. (188) *Note:* The numerical value of this term will depend upon the type of system used. *See also* facsimile, scanning.

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**Z** *Abbreviation for Zulu time. See Coordinated Universal Time (UTC).*



**zero-bit insertion** A bit-stuffing technique used with bit-oriented protocols to ensure that six consecutive "one" bits never appear between the two flags that define the beginning and the ending of a transmission frame. *Note:* When five consecutive "one" bits occur in any part of the frame other than the beginning and ending flag, the sending station inserts an extra "zero" bit. When the receiving station detects five "one" bits followed by a "zero" bit, it removes the extra "zero" bit, thereby restoring the bit stream to its original value.

**zero dispersion slope ( $S_0$ )** For an optical fiber, the value of the chromatic dispersion slope,  $S(\lambda)$ , ( $\text{ps}/\text{nm}^2\text{-km}$ ), at the fiber's zero-dispersion wavelength,  $\lambda_0$ , that is,  $S_0 = S(\lambda_0)$ .

**zero-dispersion wavelength ( $\lambda_0$ )** In a single-mode optical fiber, the wavelength at which material dispersion and waveguide dispersion cancel one another. *See also* dispersion, material dispersion coefficient.

**zerofill** To fill unused storage locations with the representation of the character denoting "0". (FP) (ISO)

**zero-level decoder** A decoder that yields an analog level of 0 dBm at its output when the input is the digital milliwatt signal. (CFR 47) *Note:* The signal is a 1000 Hz sine wave. *See also* digital milliwatt.

**zero suppression** The elimination of nonsignificant zeros from a numeral. (FP) (ISO)

**OTLP** *Abbreviation for zero transmission level point.*

**zero transmission level point (OTLP)** An arbitrary point in a communication system chosen as the reference for all relative transmission levels. (188) *Note:* The absolute level at this point is not necessarily 0 dBm (1 mW). *See also* dBa0, dBr, dBmC0, level (def

#1), relative transmission level, signal level, transmission level.

**zone** *See* communications zone, Fresnel zone, skip zone.

**zone of silence** *Synonym* skip zone.

**Z Time** *Synonym* Coordinated Universal Time.

**Zulu Time (Z)** *Synonym* Coordinated Universal Time. *Formerly a synonym for Greenwich Mean Time.*

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## APPENDIX: ABBREVIATIONS and ACRONYMS

*[Items shown in bold represent term names or abbreviations that are defined in the glossary.]*

<b>a</b>	<b>atto</b> ( $10^{-18}$ )
<b>Å</b>	<b>angstrom</b>
<b>A</b>	<b>ampere</b>
<b>AAR</b>	<b>automatic alternate routing</b>
<b>AARTS</b>	<b>automatic audio remote test set</b>
<b>ABCA</b>	<b>American, British, Canadian, Australian [armies]</b>
<b>ac</b>	<b>alternating current</b>
<b>ACA</b>	<b>automatic circuit assurance</b>
<b>ACC</b>	<b>automatic callback calling</b>
<b>ACD</b>	<b>automatic call distributor</b>
<b>ACK</b>	<b>acknowledge character</b>
<b>ACU</b>	<b>automatic calling unit</b>
<b>A-D</b>	<b>analog-to-digital</b>
<b>ADC</b>	<b>analog-to-digital converter</b>
<b>ADCCP</b>	<b>Advanced Data Communications Control Procedure</b>
<b>ADH</b>	<b>automatic data handling</b>
<b>ADP</b>	<b>automatic data processing</b>
<b>ADPCM</b>	<b>adaptive differential pulse-code modulation</b>
<b>ADPE</b>	<b>automatic data processing equipment</b>
<b>ADPSSO</b>	<b>automatic data processing system security officer</b>
<b>ADU</b>	<b>automatic dialing unit</b>
<b>ADX</b>	<b>automatic data exchange</b>
<b>AECS</b>	<b>Aeronautical Emergency Communications System [plan]</b>
<b>AF</b>	<b>audio frequency</b>
<b>AFC</b>	<b>area frequency coordinator</b>
	<b>automatic frequency control</b>
<b>AFNOR</b>	<b>Association Française Normal</b>
<b>AGC</b>	<b>automatic gain control</b>
<b>AGE</b>	<b>aerospace ground equipment</b>
<b>AI</b>	<b>artificial intelligence</b>
<b>AIG</b>	<b>address indicator group</b>
<b>AIM</b>	<b>amplitude intensity modulation</b>
<b>AIN</b>	<b>advanced intelligent network</b>
<b>AIOD</b>	<b>automatic identified outward dialing</b>
<b>AIS</b>	<b>automated information system</b>
<b>AISC</b>	<b>application-specific integrated circuits</b>
<b>AJ</b>	<b>anti-jamming</b>
<b>ALC</b>	<b>automatic level control</b>
	<b>automatic load control</b>
<b>ALE</b>	<b>automatic link establishment</b>
<b>ALU</b>	<b>arithmetic and logic unit</b>
<b>A/m</b>	<b>ampere per meter</b>
<b>AM</b>	<b>amplitude modulation</b>
<b>AMA</b>	<b>automatic message accounting</b>

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AME	amplitude modulation equivalent
AMI	alternate mark inversion [signal]
AM/PM/VSB	amplitude modulation/phase modulation/vestigial sideband
AMPS	automatic message processing system
AMPSSO	automated message processing system security officer
AMTS	automated maritime telecommunications system
ANI	automatic number identification
ANL	automatic noise limiter
ANMCC	Alternate National Military Command Center
ANSI	American National Standards Institute
AP	anomalous propagation
APC	adaptive predictive coding
APD, apd, a.p.d.	avalanche photodiode
APK	automatic phase control
ARPA	amplitude phase-shift keying
ARPANET	Advanced Research Projects Agency [now DARPA]
ARQ	Advanced Research Projects Agency Network
ARS	automatic repeat-request
ARU	automatic route selection
ASC	audio response unit
ASCII	AUTODIN Switching Center
ASP	American Standard Code for Information Interchange
ASR	Aggregated Switch Procurement
ATACS	adjunct service point
ATB	automatic send and receive
ATDM	Army Tactical Communications System
ATE	all trunks busy
ATM	asynchronous time-division multiplexing
ATV	automatic test equipment
au	asynchronous transfer mode
AUTODIN	advanced television
AUTOSEVOCOM	astronomical unit
AUTOVON	Automatic Digital Network
AVD	Automatic Secure Voice Communications Network
AWG	Automatic Voice Network
AWGN	alternate voice/data
AZ	American wire gauge
b	additive white Gaussian noise
B	azimuth
balun	bit
BASIC	bel
BCC	balanced to unbalanced
BCD	beginners' all-purpose symbolic instruction code
BCI	block check character
Bd	binary coded decimal
BER	bit-count integrity
	bit
	baud
	bit error ratio

<b>BERT</b>	<b>bit error ratio tester</b>
<b>BETRS</b>	<b>Basic Exchange Telecommunications Radio Service</b>
<b>BEX</b>	<b>broadband exchange</b>
<b>BIH</b>	<b>International Time Bureau</b>
<b>B-ISDN</b>	<b>broadband ISDN</b>
<b>bi-sync</b>	<b>binary synchronous communication</b>
<b>bit</b>	<b>binary digit</b>
<b>BIT</b>	<b>built-in test</b>
<b>BITE</b>	<b>built-in test equipment</b>
<b>BIU</b>	<b>bus interface unit</b>
<b>BNF</b>	<b>Backus Naur form</b>
<b>BOC</b>	<b>Bell Operating Company</b>
<b>BPI</b>	<b>bits per inch</b>
	<b>bytes per inch</b>
<b>bps</b>	<b>bits per second</b>
<b>BPSK</b>	<b>binary phase-shift keying</b>
<b>BR</b>	<b>bit rate</b>
<b>BRI</b>	<b>basic rate interface</b>
<b>BSA</b>	<b>basic serving arrangement</b>
<b>BSE</b>	<b>basic service element</b>
<b>BTN</b>	<b>billing telephone number</b>
<b>BW</b>	<b>bandwidth</b>
<b>c</b>	<b>centi (<math>10^{-2}</math>)</b>
<b>CACS</b>	<b>centralized alarm control system</b>
<b>CAM</b>	<b>computer-aided manufacturing</b>
<b>CAMA</b>	<b>centralized automatic message accounting</b>
<b>CAN</b>	<b>cancel character</b>
<b>CAP</b>	<b>customer administration panel</b>
<b>CARS</b>	<b>cable television relay service [station]</b>
<b>CAS</b>	<b>centralized attendant services</b>
<b>CASE</b>	<b>computer assisted software engineering</b>
<b>CATV</b>	<b>cable television</b>
	<b>community antenna television</b>
<b>CBX</b>	<b>computer branch exchange</b>
<b>C<sup>2</sup></b>	<b>command and control</b>
<b>C<sup>3</sup></b>	<b>command, control, and communications</b>
<b>C<sup>3</sup>CM</b>	<b>C<sup>3</sup> Countermeasures</b>
<b>C<sup>3</sup>I</b>	<b>command, control, communications and intelligence</b>
<b>CCD</b>	<b>charge-coupled device</b>
<b>CCH</b>	<b>connections per circuit hour</b>
<b>CCIF</b>	<b>International Telephone Consultative Committee [<i>a predecessor to the CCITT</i>]</b>
<b>CCIR</b>	<b>International Radio Consultative Committee</b>
<b>CCIS</b>	<b>common-channel interoffice signaling</b>
<b>CCIT</b>	<b>International Telegraph Consultative Committee [<i>a predecessor to the CCITT</i>]</b>
<b>CCITT</b>	<b>International Telegraph and Telephone Consultative Committee</b>



## FED-STD-1037B

CCS	<b>hundred-call-seconds</b>
CCSA	<b>common control switching arrangement</b>
CCTV	<b>closed-circuit television</b>
cd	<b>candela</b>
CDF	<b>combined distribution frame</b>
	<b>cumulative distribution function</b>
CDMA	<b>code-division multiple access</b>
CDR	<b>call detail recording</b>
CDT	<b>control data terminal</b>
CDU	<b>central display unit</b>
C-E	<b>communications-electronics</b>
CEI	<b>comparably efficient interconnection</b>
CELP	<b>code-excited linear prediction</b>
CEP	<b>circular error probable</b>
CFE	<b>contractor-furnished equipment</b>
cgs	<b>centimeter-gram-second</b>
CIAS	<b>circuit inventory and analysis system</b>
CIC	<b>content indicator code</b>
CIFAX	<b>ciphred facsimile</b>
CINC	<b>commander-in-chief</b>
C/KT	<b>carrier-to-receiver noise density</b>
CLASS	<b>custom local area signaling services</b>
cm	<b>centimeter</b>
CMI	<b>coded mark inversion</b>
CMOS	<b>Complementary Metal Oxide Substrate</b>
CMRR	<b>common-mode rejection ratio</b>
CNR	<b>carrier-to-noise ratio</b>
	<b>combat-net radio</b>
CNS	<b>complementary network services</b>
C.O.	<b>central office</b>
COAM	<b>customer owned and maintained equipment</b>
coax	<b>coaxial cable</b>
COBOL	<b>common business oriented language</b>
codec	<b>coder-decoder</b>
COG	<b>centralized ordering group</b>
COMINT	<b>communications intelligence</b>
compandor	<b>compressor-expander</b>
COMSAT	<b>Communications Satellite Corporation</b>
COMSEC	<b>communications security</b>
CONUS	<b>Continental United States</b>
CPE	<b>customer premises equipment</b>
cpi	<b>characters per inch</b>
cpm	<b>counts per minute</b>
cps	<b>characters per second</b>
	<b>cycles per second [deprecated]</b>
CPU	<b>central processing unit</b>
	<b>communications processor unit</b>

CR	circuit reliability channel reliability
CRC	cyclic redundancy check
CRITCOM	Critical Intelligence Communications
CRITICOM	Critical Intelligence Communications Network
CROM	control read-only memory
CRT	cathode ray tube
c/s	cycles per second [ <i>deprecated</i> ]
CSC	circuit-switching center common signaling channel
CSMA	carrier sense multiple access
CSMA/CA	CSMA with collision avoidance
CSMA/CD	CSMA with collision detection
CSU	circuit switching unit customer service unit channel service unit
CTS	clear to send
CTX	Centrex® clear to transmit
CVD	chemical vapor deposition [technique]
CVSD	continuously variable slope delta [modulation]
cw	continuous wave carrier wave composite wave
CX	composite signaling
cxr	carrier
d	<i>deci</i> ( $10^{-1}$ )
da	<i>deka</i> (10)
D-A	digital-to-analog
DACS	digital access and cross-connect systems
DAMA	demand assignment multiple access
DARPA	Defense Advanced Research Projects Agency [ <i>formerly ARPA</i> ]
dB	decibel
dBa	weighted noise power in dB referred to -85 dBm
dBa(F1A)	noise power measured by a set with F1A-line weighting
dBa(HA1)	noise power measured by a set with HA1-receiver weighting
dBa0	noise power measured at zero transmission level point
dBm	dB referred to 1 milliwatt
dBm(psoph)	noise power in dBm measured by a set with psophometric weighting
DBMS	database management system
dBmV	dB referred to 1 millivolt across 75 ohms
dBm0	noise power in dBm referred to or measured at 0TLP
dBm0p	noise power in dBm0 measured by a set with psophometric weighting
dBr	power difference in dB between any point and a reference point
dBrn	decibels above reference noise
dBrnC	noise power in dBrn measured by a set with C-message weighting
dBrnC0	noise power in dBrnC referred to or measured at 0TLP

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<b>dBrn(<math>f_1</math>-<math>f_2</math>)</b>	flat noise power in dBrn
<b>dBrn(144-line)</b>	noise power in dBrn measured by a set with 144-line weighting
<b>dBW</b>	decibels referred to 1 watt
<b>dc</b>	direct current
<b>DCA</b>	Defense Communications Agency
<b>DCE</b>	data circuit-terminating equipment
<b>DCPSK</b>	differentially coherent phase-shift keying
<b>DCS</b>	Defense Communications System
<b>DCTN</b>	Defense Commercial Telecommunications Network
<b>DCWV</b>	direct-current working volts
<b>DDD</b>	direct distance dialing
<b>DDN</b>	Defense Data Network
<b>DDS</b>	digital data service
<b>DEL</b>	delete character
<b>demarc</b>	demarcation point
<b>demux</b>	demultiplex
	demultiplexer
	demultiplexing
<b>DES</b>	Data Encryption Standard
<b>detem</b>	detector/emitter
<b>DFSK</b>	double frequency-shift keying
<b>DIA</b>	Defense Intelligence Agency
<b>DID</b>	direct inward dialing
<b>DIN</b>	Deutsches Institut für Normung
<b>DIP</b>	dual in-line package [switch]
<b>DISC</b>	disconnect command
<b>DLA</b>	Defense Logistic Agency
<b>DLE</b>	data link escape character
<b>DM</b>	delta modulation
<b>DMA</b>	direct memory access
	Defense Mapping Agency
<b>DMS</b>	Defense Message System
<b>DNA</b>	Defense Nuclear Agency
<b>DNIC</b>	data network identification code
<b>DNPA</b>	data numbering plan area
<b>DO</b>	design objective
<b>DoC</b>	Department of Commerce
<b>DoD</b>	Department of Defense
<b>DOD</b>	direct outward dialing
<b>DoDD</b>	Department of Defense Directive
<b>DoDISS</b>	Department of Defense Index of Specifications and Standards
<b>DoD-STD</b>	Department of Defense Standard
<b>DPCM</b>	differential pulse-code modulation
<b>DPSK</b>	differential phase-shift keying
<b>DRAM</b>	dynamic random access memory
<b>DRSI</b>	destination station routing indicator
<b>DS</b>	direct support
	digital signal
<b>DS0</b>	digital signal 0

DS1	digital signal 1
DS1C	digital signal 1C
DS2	digital signal 2
DS3	digital signal 3
DS4	digital signal 4
DSA	dial service assistance
DSB	double-sideband [transmission]
	Defense Science Board
DSB-SC	double sideband suppressed carrier [transmission]
DSC	digital selective calling
DSCS	Defense Satellite Communications System
DSE	data switching exchange
DSI	digital speech interpolation
DSN	Defense Switched Network
DSR	data signaling rate
DSS	direct station selection
DSSCS	Defense Special Service Communications System
DSTE	data subscriber terminal equipment
DSU	data service unit
DTE	data terminal equipment
DTMF	dual-tone multifrequency [signaling]
DTN	data transmission network
DTU	data transfer unit
	data tape unit
	digital transmission unit
	direct to user
DX	direct current [signaling]
	duplex signaling
E	<i>exa</i> ( $10^{18}$ )
E & M	<i>E &amp; M signaling ["ear and mouth" receive and transmit signaling leads]</i>
EAS	extended area service
EBCDIC	extended binary coded decimal interchange code
$E_b/N_0$	signal energy per bit per hertz of thermal noise
EBO	embedded base organization
EBS	Emergency Broadcast System
EBX	electronic branch exchange
EC	Earth coverage
	Earth curvature
ECCM	electronic counter-countermeasures
ECM	electronic countermeasures
EDC	error detection and correction
EDI	electronic data interchange
EDTV	extended-definition television
EHF	extremely high frequency
EIA	Electronic Industries Association
eirp	equivalent isotopically radiated power
	effective isotropically radiated power

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el	elevation
ELECTRO-OPTINT	electro-optical intelligence
ELF	extremely low frequency
ELINT	electronics intelligence
	electromagnetics intelligence
ELSEC	electronics security
EMC	electromagnetic compatibility
EMCON	emission control
EME	electromagnetic environment
emf	electromotive force
EMI	electromagnetic interference
EMP	electromagnetic pulse
EMR	electromagnetic radiation
e.m.r.p.	equivalent monopole radiated power
EMS	electronic message system
EMSEC	emanations security
emu	electromagnetic unit
EMV	electromagnetic vulnerability
EMW	electromagnetic warfare
ENQ	enquiry character
EO	end office
EOD	end of data
EOF	end of file
EOL	end of line
EOM	end of message
EOP	end of program
	end output
EOS	end of selection character
EOT	end of transmission character
	end of tape
EOW	engineering orderwire
EPROM	erasable programmable read-only memory
EPSCS	enhanced private switched communications system
ERL	echo return loss
ERP, e.r.p.	effective radiated power
ES	end system
ESC	escape character
ESM	electronic warfare support measures
ESP	enhanced service provider
ESS	electronic switching system
ETB	end of transmission-block character
ETX	end of text character
EW	electronic warfare
EXCSA	Exchange Carriers Standards Association
f	<i>femto</i> ( $10^{-15}$ )
FAX	facsimile
FC	functional component

FCC	Federal Communications Commission
FCS	frame check sequence
FDDI, FDDI-2	fiber distributed data interface
FDM	frequency-division multiplexing
FDMA	frequency-division multiple access
FEC	forward error correction
FECC	Federal Emergency Communications Coordinators
FED-STD	Federal Standard
FEMA	Federal Emergency Management Agency
FET	field effect transistor
FIFO	first-in first-out
FIPS	Federal Information Processing Standards
FIR	finite impulse response
FIRM	Federal Information Resources Management Regulations
FISINT	foreign instrumentation signal intelligence
FLTSATCOM	Fleet Satellite Communications
FM	frequency modulation
FO	fiber optics
FOC	Final Operational Capability
	Full Operational Capability
FOT	optimum traffic frequency
FPIS	forward propagation ionospheric scatter
fpm	feet per minute
FPS	focus projection and scanning
	feet per second
	foot-pound-second
	frames per second
FSK	frequency-shift keying
FSS	fully separate subsidiary
FSTS	Federal Secure Telephone Service
FT	fiber optic T-carrier
FTAM	file transfer, access, and management
FTF	Federal Telecommunications Fund
FTS	Federal Telecommunications System
FTSC	Federal Telecommunication Standards Committee
FWHM	full width half maximum
FX	fixed service
	foreign exchange service
FYDP	Five Year Defense Plan
G	<i>giga</i> ( $10^9$ )
GBH	group busy hour
GCT	Greenwich Civil Time
GDF	group distribution frame
GFE	Government-furnished equipment
GHz	gigahertz
GMT	Greenwich Mean Time
GOS	grade of service



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GOSIP	Government Open Systems Interconnection Profile
GSA	General Services Administration
GSTN	general switched telephone network
G/T	antenna gain-to-noise temperature
GTP	Government Telecommunications Program
GTS	Government Telecommunications System
h	hecto ( $10^2$ )
	hour
HCS	hard clad silica [fiber]
HD	half-duplex [operation]
HDL	high-level data link control
HDTV	high-definition television
HEMP	high-altitude electromagnetic pulse
HERF	hazards of electromagnetic radiation to fuel
HERO	hazards of electromagnetic radiation to ordnance
HERP	hazards of electromagnetic radiation to personnel
HF	high frequency
HFDF	high frequency distribution frame
HLL	high-level language
HV	high voltage
Hz	hertz
IA	International Alphabet [CCITT]
I&C	installation and checkout
IASA	integrated AUTODIN system architecture
IC	integrated circuit
ICI	incoming call identification
ICNI	Integrated Communications, Navigation, and Identification
ICW	interrupted continuous wave
IDDD	International Direct Distance Dialing
IDF	intermediate distribution frame
IDN	integrated digital network
IDTV	improved-definition television
IEEE	Institute of Electrical and Electronics Engineers
IF	intermediate frequency
I/F	interface
IFF	identification, friend or foe
IFRB	International Frequency Registration Board
IFS	ionospheric forward scatter
IILC	information industry liaison committee
IIR	infinite impulse response
ILD	injection laser diode
ILS	instrument landing system
IM	intensity modulation
	intermodulation
I&M	installation and maintenance
IMD	intermodulation distortion

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IMP	interface message processor
IN	intelligent network
IN/1, IN/1+, IN/2	intelligent network concepts
INFOSEC	information systems security
INS	Inertial Navigation System
INTELSAT	International Telecommunications Satellite Consortium
INWATS	inward wide-area telephone service
I/O	input/output [device]
IOC	integrated optical circuit
	initial operational capability
	input-output controller
IP	internet protocol
	intelligent peripheral
IPA	intermediate power amplifier
IPC	information processing center
IPM	impulses per minute
	Institute for Practical Mathematics [FRG]
	interference prediction model
	internal polarization modulation
	interruptions per minute
ips	inches per second
	interruptions per second
IQF	intrinsic quality factor
IR	infrared
IRAC	Interdepartment Radio Advisory Committee
IRC	international record carrier
	Interagency Radio Committee
ISB	independent-sideband [transmission]
ISDN	Integrated Services Digital Network
ISM	industrial, scientific, and medical [applications]
ISO	International Organization for Standardization
ITA	International Telegraph Alphabet
ITC	International Teletraffic Congress
ITS	Institute for Telecommunication Sciences
ITSO	International Telecommunications Satellite Organization
ITU	International Telecommunication Union
IVDT	integrated voice data terminal
IXC	interexchange character
JANAP	Joint Army-Navy-Air Force Publication(s)
JCS	Joint Chiefs of Staff
JCSI	Joint Chiefs of Staff Publication No. 1
JSC	Joint Steering Committee [now JTSSG]
JPL	Jet Propulsion Laboratory
JTC <sup>3</sup> A	Joint Tactical Command, Control and Communications Agency
JTIDS	Joint Tactical Information Distribution System
JTRB	Joint Telecommunications Resources Board
JTSSG	Joint Telecommunications Standards Steering Group [formerly JSC]

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k	kilo ( $10^3$ )
K	Boltzmann's constant
	kelvin
KDC	coefficient of absorption
KDR	key distribution center
KDT	keyboard data recorder
kg	keyboard display terminal
kgms	kilogram
kHz	kilogram-meter-second
km	kilohertz
k ohm, k	kilometer
KSR	kilohm
KTS	keyboard send/receive device
	key telephone system
LAN	local area network
LANTFLT	Atlantic Fleet
laser	light amplification by stimulated emission of radiation
LASINT	laser intelligence
LATA	local access and transport area
LBO	line buildout
LCD	liquid crystal display
LD	long distance
LDM	limited distance modem
LED	light-emitting diode
LF	low frequency
LIFO	last-in, first-out
LLC	logical link control [sublayer]
l/m	lines per minute
LMF	language media format
LNA	launch numerical aperture
LOF	lowest operating frequency
loran	long range electronic navigation
	long range aid to navigation
LOS	line of sight
LP	log periodic
	linearly polarized [mode]
	linear programming
LPA	linear power amplifier
LPC	linear predictive coding
LPD	low probability of detection
LPI	low probability of interception
	lines per inch
lpm	lines per minute
LQA	link quality analysis
LRC	longitudinal redundancy check
LSB	lower sideband

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LSI	large scale integrated [circuit]
	line status indication
LTC	line traffic coordinator
LUF	lowest usable high frequency
LV	low voltage
m	meter
	<i>milli</i> ( $10^{-3}$ )
	minute
M	<i>mega</i> ( $10^6$ )
MAC	medium access control [sublayer]
MACOM	major command
MAN	metropolitan area network
maser	microwave amplification by the stimulated emission of radiation
MCC	maintenance control circuit
MCEB	Military Communications-Electronics Board
MCM	multicarrier modulation
MCS	Master Control System
MCW	modulated continuous wave
MCXO	microcomputer compensated crystal oscillator
MDF	main distribution frame
MDT	mean down time
MEECN	Minimum Essential Emergency Communications Network
MFD	mode field diameter
MF	medium frequency
MFJ	Modification of Final Judgment
MFSK	multiple frequency-shift keying
MHF	medium high frequency
MHS	message handling service
	message handling system
MHz	megahertz
mi	mile
MIC	medium interface connector
	microphone
	microwave integrated current
	minimum ignition current
	monolithic integrated circuit
	mutual interface chart
MIL-STD	Military Standard
MIP	medium interface point
MIPS, mips	million instructions per second
MIS	management information system
MKS	meter-kilogram-second
MLPP	multilevel precedence and preemption
MMW	millimeter wave
modem	modulator-demodulator
mol	mole
ms	millisecond ( $10^{-3}$ second)

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MSK	minimum-shift keying
MTBF	mean time between failures
MTBM	mean time between maintenance
MTBO	mean time between outages
MTBPM	mean time between preventive maintenance
MTF	modulation transfer function [of an optical fiber]
MTSR	mean time to service restoral
MTTR	mean time to repair
$\mu$	<i>micro</i> ( $10^{-6}$ )
$\mu$ s	microsecond
MUF	maximum usable frequency
muldem	multiplexer/demultiplexer
MUX	multiplex
	multiplexer
MUXing	multiplexing
mw	microwave
MWI	message waiting indicator
MWV	maximum working voltage
n	<i>nano</i> ( $10^{-9}$ )
NA	numerical aperture
NACK	negative acknowledge
NACSEM	National Communications Security Emanation Memorandum
NACSIM	National Communications Security Information Memorandum
NAK	negative acknowledge character
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NAVSTAR-GPS	Navigational Satellite Timing and Ranging--Global Positioning System
NBFM	narrowband frequency modulation
NBH	network busy hour
NBRVF	narrowband radio voice frequency
NBS	National Bureau of Standards [ <i>now National Institute of Standards and Technology, NIST</i> ]
NBSV	narrowband secure voice
NCA	National Command Authority
NCC	National Coordinating Center
NCS	National Communications System
	net control stations
NCSC	National Communications Security Committee
NDCS	network data control system
NEACP	National Emergency Airborne Command Post
NEC	National Electric Code®
NEP	noise equivalent power
NES	noise equivalent signal
NF	noise figure
NICS	NATO Integrated Communications System

NID	network interface device network inward-dialing network information database
NIOD	network inward/outward dialing
NIST	National Institute of Standards and Technology [ <i>formerly NBS</i> ]
NIU	network interface unit
nm	nanometer
NMCS	National Military Command System
nmi	nautical mlie
NOD	network outward-dialing
Np	neper
NPA	numbering plan area
NPR	noise power ratio
NRI	net radio interface
NRM	network resource manager
NRZ	non-return-to-zero
NRZI	non-return-to-zero inverted
NRZM	non-return-to-zero mark
NRZI	non-return-to-zero, change on 1's
ns	nanosecond
NSA	National Security Agency
NSC	National Security Council
NS/EP	National Security Emergency Preparedness
NSTAC	National Security Telecommunications Advisory Committee
NTDS	Naval Tactical Data System
NTI	network terminating interface
NTIA	National Telecommunications & Information Administration
NTN	network terminal number
NTSC	National Television Standards Committee
NVIS	near vertical incident skywave
$N_0$	sea level refractivity spectral noise density
O&M	operations and maintenance
OCC	other common carrier
OCR	optical character reader optical character recognition
OCU	orderwire control unit
OCVCXO	oven controlled-voltage controlled crystal oscillator
OCXO	oven controlled crystal oscillator
OD	optical density outside diameter
OMB	Office of Management and Budget
ONA	open network architecture
OPM	operations per minute
OPMODEL	operations model
OPSEC	operations security
OPX	off-premises extension



## FED-STD-1037B

OSHA	Occupational Safety and Health Administration
OSI	Open Systems Interconnection open switching interval
OSI-RM	Open Systems Interconnection--Reference Model
OSRI	originating stations routing indicator
OSSN	originating stations serial number
OTAR	over-the-air rekeying
OTDR	optical time domain reflectometer optical time domain reflectometry
OW	orderwire [circuit]
p	<i>pico</i> ( $10^{-12}$ )
P	<i>peta</i> ( $10^{15}$ )
PABX	private automatic branch exchange
PAD	packet assembler-disassembler
PAL	phase alternation by line
PAM	pulse-amplitude modulation
PAMA	pulse-address multiple access
p/a r	peak-to-average ratio
PAR	performance analysis and review
PARAMP	parametric amplifier
PAX	private automatic exchange
PBX	private branch exchange
PC	carrier power [of a radio transmitter] personal computer
PCB	power circuit breaker printed circuit board
PCM	pulse-code modulation plug compatible module process control module
PCS	plastic clad silica
PCSR	parallel channels signaling rate
PDM	pulse-duration modulation pulse delta modulation
PDN	public data network
PDS	protected distribution system power distribution system program data source
PDT	programmable data terminal
PDU	protocol data unit
PE	phase-encoded [recording]
PEP	peak envelope power
pF	picofarad
PF	power factor
PFM	pulse-frequency modulation
PIC	plastic insulated cable
PIV	peak inverse voltage
PLA	programmable logic array

PLL	phase-locked loop
PLN	private line network
PL/1	programming language 1
PLS	physical signaling sublayer
pm	phase modulation
PM	mean power
	preventive maintenance
	pulse modulation
PMB	pilot-make-busy [circuit]
POI	point of interface
POP	point of presence
POSIX	portable operating system interface for computer environments
POTS	plain old telephone service
P-P	peak-to-peak
P/P	point-to-point
PPM	pulse-position modulation
PPS	pulses per second
PR	pulse rate
PRF	pulse repetition frequency
PRI	primary rate interface
PRM	pulse-rate modulation
PROM	programmable read-only memory
PRR	pulse repetition rate
PRSL	primary area switch locator
PS	permanent signal
psi	pounds [force] per square inch
PSK	phase-shift keying
PSN	public switched network
PSTN	public switched telephone network
PTF	patch and test facility
PTM	pulse-time modulation
PTT	post, telephone, and telegraph
	push to talk
PTTC	paper tape transmission code
PU	power unit
PUC	public utility commission
PVC	permanent virtual circuit
	polyvinyl chloride [insulation]
pW	picowatt
PWM	pulse-width modulation <i>[deprecated]</i>
pWp	pW, psophometrically weighted
pWp0	pWp relative to a 0TLP
pX	peak envelope power <i>[in decibels]</i>
PX	private exchange
	peak envelope power <i>[in watts]</i>
pY	mean power <i>[in decibels]</i>
PY	mean power <i>[in watts]</i>
pZ	carrier power <i>[in decibels]</i>

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PZ	carrier power <i>[in watts]</i>
QA	quality assurance
QAM	quadrature amplitude modulation
QC	quality control
QMR	qualitative material requirement
QOS	quality of service
QPSK	quadrature phase-shift keying
QRC	quick reaction capability
QSTAG	Quadripartite Standardization Agreement
racon	radar beacon
rad	radian
radar	radio detection and ranging
RADC	Rome Air Development Center
RADHAZ	electromagnetic radiation hazards
RADINT	radar intelligence
RAM	random access memory
R&D	reliability, availability, and maintainability
RATT	research and development
RBOC	radio teletypewriter system
RbXO	Regional Bell Operating Company
RC	Rubidium-crystal oscillator
RCC	reflection coefficient
RCVR	radio common carrier
RDF	receiver
REA	radio direction finding
REN	Rural Electrification Administration
rf	ringer equivalency number
RFI	radio frequency
RFP	range finder
RFQ	radio frequency interference
RH	request for proposal
RI	request for quotation
RISC	relative humidity
RJ	routing indicator
RJE	reduced instruction set chip
rms	registered jack
RO	remote job entry
ROC	root-mean-square
ROM	receive only
rpm	read only
RPM	required operational capability
RPOA	read-only memory
rps	revolutions per minute
	rate per minute
	recognized private operating agency
	revolutions per second

<b>RQ</b>	<b>repeat-request</b>
<b>RR</b>	<b>repetition rate</b>
<b>RSL</b>	<b>received signal level</b>
<b>rss</b>	<b>root-sum-square</b>
<b>R/T</b>	<b>real time</b>
<b>RTA</b>	<b>remote trunk arrangement</b>
<b>RTS</b>	<b>request to send</b>
<b>RTTY</b>	<b>radio teletypewriter</b>
<b>RTU</b>	<b>remote terminal unit</b>
<b>RTX</b>	<b>request to transmit</b>
<b>RVA</b>	<b>reactive volt-ampere</b>
<b>RWI</b>	<b>radio and wire integration</b>
<b>RZ</b>	<b>return-to-zero code</b>
<b>s</b>	<b>second</b>
<b>SCC</b>	<b>specialized commercial carrier</b>
<b>SCE</b>	<b>service creation environment</b>
<b>SCF</b>	<b>service control facility</b>
<b>SCP</b>	<b>service control point</b>
<b>SCPC</b>	<b>single channel per carrier</b>
<b>SCR</b>	<b>semiconductor-controlled rectifier</b>
	<b>silicon-controlled rectifier</b>
<b>SCSR</b>	<b>single channel signaling rate</b>
<b>SDLC</b>	<b>synchronous data link control</b>
<b>SDM</b>	<b>space-division multiplexing</b>
<b>SDN</b>	<b>software-defined network</b>
<b>SECAM</b>	<b>système électronique couleur avec memoire</b>
<b>SECORD</b>	<b>secure voice cord board</b>
<b>SECTEL</b>	<b>secure telephone</b>
<b>SETAMS</b>	<b>systems engineering, technical assistance, and management services</b>
<b>SEVAS</b>	<b>Secure Voice Access System</b>
<b>S-F</b>	<b>store-and-forward</b>
<b>SF</b>	<b>single-frequency [signaling]</b>
<b>SGDF</b>	<b>supergroup distribution frame</b>
<b>S/H</b>	<b>sample and hold</b>
<b>SHA</b>	<b>sidereal hour angle</b>
<b>SHF</b>	<b>super high frequency</b>
<b>SI</b>	<b>International System of Units</b>
<b>SID</b>	<b>sudden ionospheric disturbance</b>
<b>SIGINT</b>	<b>signals intelligence</b>
<b>SINAD</b>	<b>signal-plus-noise-plus-distortion to noise-plus-distortion ratio</b>
<b>SLD</b>	<b>superluminescent diode [see superluminescent LED]</b>
<b>SLI</b>	<b>service logic interpreter</b>
<b>SLP</b>	<b>service logic program</b>
<b>SMDR</b>	<b>station message-detail recording</b>
<b>SMSA</b>	<b>standard metropolitan statistical area</b>
<b>SNR</b>	<b>signal-to-noise ratio</b>
<b>SOH</b>	<b>start-of-heading character</b>

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SOM	start of message
sonar	sound navigation and ranging
SONET	synchronous optical network
SOP	standard operating procedure
SOR	start of record
SOW	statement of work
(S+N)/N	signal-plus-noise-to-noise ratio
sr	steradian
S/R	send and receive
SSB	single sideband [emission]
SSB-SC	SSB-suppressed carrier [transmission]
SSN	station serial number
SSP	service switching point
SSUPS	solid-state uninterruptible power system
STALO	stabilized local oscillator
STANAG	Standardization Agreement [NATO]
STD	subscriber trunk dialing
STFS	standard time and frequency signal [service]
STL	standard telegraph level
	studio-to-transmitter link
STP	standard temperature and pressure
	signal transfer point
STU	secure telephone unit
STX	start of text character
SUB	substitute character
SWR	standing wave ratio
SX	simplex signaling
SXS	step-by-step switching system
SYN	synchronous idle character
SYSGEN	system generation
T	tera ( $10^{12}$ )
TADIL	tactical digital information link
TADS	teletypewriter automatic dispatch system
TADSS	tactical automatic digital switching system
TAI	International Atomic Time
TASI	time-assignment speech interpolation
TC	toll center
TCB	trusted computing base
TCC	telecommunications center
TCCF	Tactical Communications Control Facility
TCF	technical control facility
TCP	transmission control protocol
TCS	trusted computer system
TCU	teletypewriter control unit
TCVXO	temperature compensated-voltage controlled crystal oscillator
TCXO	temperature controlled crystal oscillator

TD	time delay
TDD	transmitter distributor
TDM	telecommunications devices for the deaf
TDMA	time-division multiplexing
TE	time-division multiple access
TED	transverse electric [mode]
TEK	trunk encryption device
TEM	traffic encryption key
TEMPEST	transverse electromagnetic [mode]
TGM	compromising emanations
THD	trunk group multiplexer
THF	total harmonic distortion
THz	tremendously high frequency
TIA	terahertz
TIE	Telecommunication Industries Association
TIP	time interval error
TLP	terminal interface processor
TM	transmission level point
TRANSEC	transverse magnetic [mode]
TP	transmission security
TRF	toll point
TRI-TAC	tuned radio frequency
TROPO	tri-services tactical [equipment]
TSK	tropospheric scatter
TSP	transmission security key
TSPS	telecommunications service priority
TSR	traffic service position system
TTL	telecommunications service request
TTIN	transistor-transistor logic
TTY	tandem tie trunk network
TTY/TDD	teletypewriter
TV	telecommunication device for the deaf
TW	television
TWT	traveling wave
TWTA	traveling wave tube
TWX*	traveling wave tube amplifier
TX	teletypewriter exchange service
	transmit
UHF	ultra high frequency
ULF	ultra low frequency
UPS	uninterruptible power supply
USB	upper sideband
USDA	U.S. Department of Agriculture
USFJ	U.S. Forces, Japan
USFK	U.S. Forces, Korea
USNO	U.S. Naval observatory
USTA	U.S. Telephone Association
UT	Universal Time



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UTC	Coordinated Universal Time
uv	ultraviolet
V	volt
VA	value-added [ <i>network service</i> ]
	volt-ampere
VAN	value-added network
VAR	volt-ampere reactive
VARISTAR	variable resistor
VC	virtual circuit
VCO	voltage-controlled oscillator
VCXO	voltage-controlled crystal oscillator
V/D	voice/data
Vdc	volts direct current
VDU	video display unit
	visual display unit
VF	voice frequency
VFCT	voice frequency carrier telegraph
VFDF	voice frequency distribution frame
VFO	variable-frequency oscillator
VFTG	voice frequency telegraph
VHF	very high frequency
VLf	very low frequency
V/m	volts per meter
VNL	via net loss
VNLF	via net loss factor
vocoder	voice-coder
vodas	voice-operated device anti-sing
vogad	voice-operated gain-adjusting device
volcas	voice-operated loss control and echo/signaling suppression
vox	voice-operated relay circuit
VRC	vertical redundancy check
VSAT	very small aperture terminal
VSb	vestigial sideband [transmission]
VSM	vestigial sideband modulation
VSWR	voltage standing wave ratio
vu	volume unit
WADS	wide area data service
WAN	wide area network
WARC	World Administrative Radio Conference
WATS	Wide Area Telecommunications Service
	Wide Area Telephone Service
WAWS	Washington Area Wideband System
WDM	wavelength-division multiplexing
WITS	Washington Integrated Telecommunications System
WORM	write once, read many times
wpm	words per minute

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wps	words per second
WU	Western Union
wv	working voltage
WVDC	working voltage direct current
WWDSA	worldwide digital system architecture
WWMCCS	Worldwide Military Command and Control System
XMIT	transmit
XMSN	transmission
XMTD	transmitted
XMTR	transmitter
XO	crystal oscillator
XT	crosstalk
XTAL	crystal
Z	Zulu time
ZD	zero defects
OTLP	zero transmission level point