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FEDERAL STANDARD

TELECOMMUNICATIONS: CODING AND MODULATION REQUIREMENTS FOR NONDIVERSITY 2400 BIT/SECOND MODEMS

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

1. Scope

1.1 Description. This standard establishes the coding and modulation requirements for 2400 bit/second modems owned or leased by the Federal Government for use over analog transmission channels other than those derived from high-frequency radio facilities.

1.2 Purpose. This standard is to facilitate interoperability between telecommunication facilities and systems of the Federal Government.

1.3 Application. This standard shall be used by all Federal agencies in the design and procurement of nondiversity 2400 bit/second modems for use with nominal 4 KHz channels derived from either switched networks or dedicated lines. Typically, such channels are derived from frequency division multiplex equipment associated with microwave, cable, and satellite transmission systems.

2. Requirements

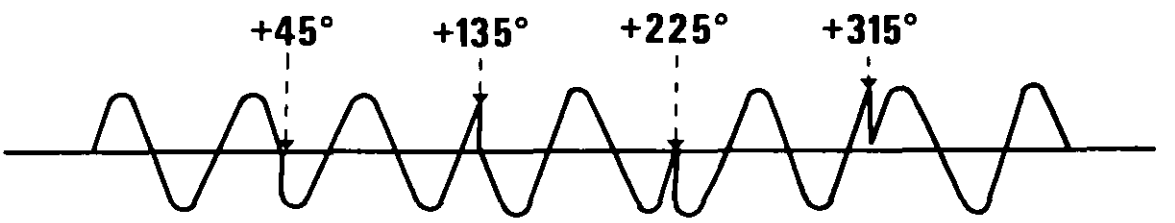
2.1 2400 Bit/second Operation

2.1.1 The transmit carrier frequency shall be 1800 ±1 Hz.

2.1.2 The data stream to be modulated is divided into pairs of consecutive bits (dibits). Each dibit is encoded as a phase change of the 1800 Hz carrier relative to the phase of the carrier during transmission of the immediately preceding dibit as indicated below.

DIBIT	PHASE CHANGE
00	+ 45°
01	+ 135°
11	+225°
10	+ 315°

The phase change is the actual phase shift in the transition region from the end of one signaling element to the beginning of the following signaling element as illustrated below.



At the demodulator, the dibits are decoded and the bits are reassembled in the correct order. The left-hand digit of the dibit is the one occurring first in the data stream as it enters the modulator portion of the modem.

2.1.3 Synchronization

2.1.3.1 During the interval between Request to Send (RS) indication from an associated Data Terminal Equipment (DTE) and the modem responding with a Clear to Send (CS) indication, synchronization signals will be generated by the transmitting modem(s). Unless a scrambler is utilized, continuous 225° phase changes (dibit 11) shall be transmitted for the duration of the synchronization period.

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2.1.3.2 Modems capable of 2-wire, half-duplex operation shall have the ability to delay Clear to Send (CS) indication for a period of at least 185 ms following the receipt of Request to Send (RS) indication. During 2-wire, half-duplex operation using the above delay, modems shall also withhold Receiver Ready (RR) indication after the end of each modem transmission for a period, not to exceed 175 ms, to protect against the effect of line echoes.

2.1.4 The data rate shall be 2400 bit/second ±0.01 percent.

2.2 1200 Bit/Second Operation (Optional)

2.2.1 1200 bit/second data rate operation shall be achieved, when available, by encoding binary 0 and 1 bits as +90° and +270° phase changes, respectively.

2.2.2 The data rate shall be 1200 bit/second ±0.01 percent.

2.2.3 All other characteristics shall be as specified for 2400 bit/second operation.

2.3 Secondary Channel (Optional)

2.3.1 Secondary channel modulation rate shall not exceed 75 baud.

2.3.2 Characteristic frequencies of the binary 1 (mark) and binary 0 (space) shall be 390 ±1 Hz and 450 ±1 Hz, respectively.

2.3.3 When simultaneous transmission of the primary channel and secondary channel occur in the same direction, the secondary channel shall be 6±0.6dB lower in power level than the primary channel.

2.4 Scramber (Optional)

2.4.1 When utilized, digital input signals will be encoded in the modem prior to modulation of the 1800 Hz carrier. Similarly, demodulated signals will be decoded by an inverse process at the distant modem.

2.4.2 The encoder and decoder shall be capable of being bypassed by switch selection.

2.5 General Characteristics

2.5.1 The modem shall be capable of presenting an input and output impedance to the analog line of 600± 60 ohms balanced.

2.5.2 The output level of the modulator shall be adjustable from -12dBm to -3dBm in no greater than 1dB steps. Output level shall not be adjustable by operating personnel.

2.5.3 The demodulator shall have an input sensitivity adjustable to -42±3dBm and -32±3dBm. When the above-stated input sensitivities are used, the input level dynamic range shall be at least 30dB above the input sensitivity.

2.5.4 A fixed compromise equalizer shall either be incorporated into the receiver or be switchable between the receiver and transmitter. The characteristics of this equalizer are dependent upon system application.

3. Changes. When a Federal agency considers that this standard does not provide for its essential needs, a statement citing inadequacies shall be sent in duplicate to the General Services Administration, Federal Supply Service, Washington, D.C. 20406, in accordance with provisions of Federal Property Management Regulations 41 CFR 101-29.3. The General Services Administration will determine the appropriate action to be taken and will notify the agency.

Preparing Activity:

National Communications System
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