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MILITARY SPECIFICATION

TEST SET, RADAR, AN/UPM-( )

This specification is approved for use by the Space and Naval Warfare Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope This specification covers the Radar (Identification, Friend or Foe (IFF)) Test Set, AN/UPM-( ), hereinafter referred to as the equipment. The equipment is to be designed for both ship and shore installations for calibration and testing of interrogators, transponders (including diversity type transponders), and other components of the Air Traffic Control Radar Beacon System (ATCRBS) IFF MK XII System (AIMS).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbook The following specifications, standards, and handbook form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

MILITARY

MIL-C-17/30	Cable, Radio Frequency, Flexible, Coaxial, 93 Ohms, M17/030-RG062
MIL-C-17/73	Cables, Radio Frequency, Flexible, Coaxial, 50 Ohms, M17/073-RG212
MIL-C-17/84	Cables, Radio Frequency, Flexible, Coaxial, 50 Ohms, M17/084-RG223
MIL-S-901	Shock Tests, H.I. (High-Impact), Shipboard Machinery, Equipment And Systems, Requirements For
MIL-C-5015	Connectors, Electrical, Circular Threaded, AN Type, General Specification For
MIL-P-15024	Plates, Tags And Bands For Identification Of Equipment
MIL-E-16400	Electronic, Interior Communication And Navigation Equipment, Naval Ship And Shore General Specification For
MIL-E-17555	Electronic And Electrical Equipment, Accessories, And Provisioned Items (Repair Parts), Packaging Of
MIL-C-28777	Cable Assembly, Electronic Test Equipment, (3 Wires, 125 and 250 Volts AC and 28 Volts DC) Grounding Plug Connector, General Specification For
MIL-T-28800	Test Equipment For Use With Electrical And Electronic Equipment, General Specification For
MIL-C-39012	Connectors, Coaxial, Radio Frequency, General Specification For
MIL-C-39012/1	Connectors, Plug, Electrical, Coaxial, Radio Frequency, (Series N (Cabled), Pin Contact, Class 2)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Commander, Space and Naval Warfare Systems Command (SPAWAR-003-121), Washington, DC 20363-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A FSC 6625

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MIL-C-39012/4	Connectors, Coaxial, Radio Frequency (Series N (Uncabled)-Receptacles-Jam Nut And Flange Mounted, Socket Contact, Class 2)
MIL-C-39012/16	Connectors, Plug, Electrical, Coaxial, Radio Frequency, (Series BNC, (Cabled), Pin Contact, Class 2)
MIL-C-39012/21	Connectors, Coaxial, Radio Frequency (Series BNC (Uncabled)-Receptacles, Female, Jam Nut Mounted, Class II)
MIL-C-39012/26	Connectors, Plug, Electrical, Coaxial, Radio Frequency, (Series TNC (Cabled), Pin Contact, Class 2)
MIL-H-46855	Human Engineering Requirements For Military Systems, Equipment And Facilities
MIL-A-55339	Adapter, Connector, Coaxial, Radio Frequency, (Series BNC To Series N), Class 2
MIL-A-55339/20	Adapter, Connector, Coaxial, Radio Frequency, (Between Series BNC To Series N), Class 2, Straight Plug
MIL-A-55339/22	Adapter, Connector, Coaxial, Radio Frequency, (Between Series BNC To Series C), Class 2, Straight Plug
MIL-A-55339/38	Adapter, Connector, Coaxial, Radio Frequency (Between Series BNC to Series TNC), Class 2, Straight Plug
MIL-A-55339/46	Adapter, Connector, Coaxial, Radio Frequency, In-Line, (Between Series SMA Jack To Series BNC Jack), Class 2
MIL-A-55339/47	Adapter, Connector, Coaxial, Radio Frequency, In-Line, (Between Series SMA Plug To Series BNC Jack), Class 2

STANDARDS

MILITARY

MIL-STD-12	Abbreviations For Use On Drawings, And In Specifications, Standards And In Technical Documents
MIL-STD-105	Sampling Procedures And Tables For Inspection By Attributes
MIL-STD-109	Quality Assurance Terms And Definitions
MIL-STD-415	Test Provisions For Electronic Systems And Associated Equipment, Design Criteria For
MIL-STD-454	Standard General Requirements For Electronic Equipment
MIL-STD-471	Maintainability Verification/Demonstration/Evaluation
MIL-STD-781	Reliability Design Qualification And Production Acceptance Tests Exponential Distribution
MIL-STD-1364	Standard General Purpose Electronic Test Equipment
MIL-STD-1472	Human Engineering Design Criteria For Military Systems, Equipment And Facilities
MIL-STD-1553	Aircraft Internal Time Division Command/Response Multiplex Data Bus
DoD-STD-1679	Software Development

HANDBOOK

MILITARY

MIL-HDBK-241	Design Guide For Electromagnetic Interference (EMI) Reduction In Power Supplies

2.1 2 Other Government publications The following other Government publications form a part of this specification to the extent specified herein Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

PUBLICATIONS

DEPARTMENT OF DEFENSE (DoD)

DoD AIMS 64-900D	Performance/Design And Qualification Requirements Mode 4 Input/Output KIR/KIT-1A/TSEC
DoD AIMS 65-1000B	Technical Standard For The ATCRBS/IFF/MARK XII Systems (AIMS)

(Application for copies should be addressed to WR-ALC/MMAM-AIMS, Robins Air Force Base, GA 31098-5609 (Attn DoD AIMS Program Office))

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NAVAL AIR SYSTEMS COMMAND (NAVAIR)

MS-6536D	Procedures And Requirements For Preparation And Soldering Of Electrical Connections

SPACE AND NAVAL WARFARE SYSTEMS COMMAND (SPAWAR)

NAVSHIPS 0967-146-0010	Dictionary Of Standard Terminal Designations For Electronic Equipment

(Copies of specifications, standards, handbook, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA RS-232C-69	Interface Between Data Terminal Equipment And Data Communication Equipment Employing Serial Binary Data Interchange

(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, N.W , Washington, DC 20006.)

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE STD-488-1978	Digital Interface For Programmable Instrumentation

(Application for copies should be addressed to the Institute of Electrical and Electronic Engineers, 345 East 47th Street, New York, NY 10017.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70-1978	National Electrical Code

(Application for copies should be addressed to the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets, or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General The equipment shall be portable type equipment in accordance with MIL-T-28800 for Type I equipment, except as hereinafter specified

3.1.1 First article When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.3 and 6.3).

3.2 Equipment description. The equipment shall consist of a test set in a case with an accessory compartment which contains associated cables, adapters, attenuators, and terminations necessary for testing various IFF equipments.

3.2.1 Oscilloscope general requirements. The oscilloscope portion of the equipment shall be in accordance with MIL-T-28800 for Type II equipment, except as hereinafter specified.

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3.3 Environmental conditions. The equipment, including the oscilloscope, shall conform to the environmental requirements of MIL-T-28800 for Class 3. The enclosure shall be Style C as specified in MIL-T-28800, except the transit drop environmental condition and the stacking provisions are not required.

3 3.1 Temperature and humidity Except as otherwise specified herein, the equipment shall conform to the temperature requirements of MIL-T-28800

a. Operating -20° Celsius (C) to 55°C (the accuracies of this specification do not have to be maintained below 0°C)
b. Nonoperating -50°C to 85°C

3.3 2 Altitude. Except as specified in a and b, the equipment shall conform to the altitude requirements of MIL-T-28800

a. Operating 0 to 10,000 feet (ft) above sea level
b. Nonoperating. 40,000 ft above sea level, maximum

3 3.3 Vibration. The equipment shall conform to the vibration requirements of MIL-T-28800 for Class 3 equipment.

3.3 4 Shock. The equipment shall conform to the high impact shock requirement of MIL-S-901, Grade A, principal unit, Type A The mounting may be either Class I or Class II, however, the oscilloscope shall be installed in the equipment for either testing. The Class II mounting, if used, shall be subject to the approval of the procuring activity

3 4 Parts, materials, and processes Parts, materials, and processes shall be in accordance with MIL-T-28800 and as specified in 3.4 1 through 3 4.3

3 4 1 Parts Parts shall be in accordance with 3 4.1.1 through 3 4.1.5 9

3 4.1 1 Input and output (I/O) jacks Type UG-62B/U jacks in accordance with MIL-C-39012/21, or equivalent, shall be used for all I/O unless otherwise specified herein All jacks shall be labled as to IN, OUT, or I/O.

3 4.1.2 Cable, coaxial (radio frequency (RF)). Coaxial cable (RF) shall be in accordance with MIL-T-28800, except that double shielded, flexible, coaxial cable (RF), Malco part number 250-4291-0121, or equivalent, may be used to interconnect subassemblies within the test equipment

3 4.1.3 Readouts Readouts shall be in accordance with MIL-T-2880C, except that liquid crystal diode or light emitting diode or vacuum florescent alphanumeric displays may be used, or a built-in display terminal

3 4 1 4 Wire, hookup Hookup wire shall be in accordance with MIL-T-28800, except color coding of the cabling within the oscilloscope and interconnections between terminals of the sockets for the printed circuit boards (PCBs) will not be required Cable harness wires shall be color coded, or serially numbered by hot stamping.

3 4 1.5 Accessories Accessories and accessory storage shall be provided as specified in 3 4.1 5.1 through 3.4.1.5.9.

3 4.1.5.1 Accessory stowage The portable equipment front panel cover shall be provided with a means for stowage of the items specified in a through f

a. Cables
b. Adapters and probes
c Operator's manuals
d Spare bulbs
e Extender board(s)
f. At least two interface cable assemblies

The method of stowage of the accessories shall be subject to the approval of the procuring activity.

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3.4.1.5.2 Video test probe. Three video test probes shall be supplied. The probes shall be two Tektronix P6131 2-meter probes, and one Tektronix P6101A 2-meter probe, or equivalent. Each probe shall be suitably marked for identification. Equivalent probes shall be subject to the approval of the procuring activity.

3.4.1.5.3 RF cables. RF cables shall be as specified in 3 4.1.5.3.1 through 3 4.1.5.3.3.

3.4.1.5.3.1 General service cables. Two 8-ft lengths of RF cable, Type RG-223/U in accordance with MIL-C-17/84, having a Type TNC male plug in accordance with MIL-C-39012/26, or equivalent, on one end and a Type N male plug in accordance with MIL-C-39012/1, or equivalent, on the other end, shall be provided. Cables shall be marked with their attenuation at 1030 megahertz (MHz).

3.4.1.5.3.2 High power cable. One 10-ft length of RF cable, Type RG-212/U in accordance with MIL-C-17/73, having a Type N male plug in accordance with MIL-C-39012/1, or equivalent, on each end, shall be provided. This cable shall be marked to indicate its attenuation at 1030 MHz.

3.4.1.5.3.3 RF jumper cable. A length of RF cable, Type RG-223/U in accordance with MIL-C-17/84, having sufficient length and connector types to connect the LOW PWR RF IN to the MAIN or AUX RF I/O connectors, shall be provided.

3 4.1.5.4 General service cables. Four 5-ft lengths of RF cable, Type RG-62A/U in accordance with MIL-C-17/30, each having a plug UG-260D/U in accordance with MIL-C-39012/16, or equivalent, on each end, shall be provided.

3.4.1.5.5 Adapters. The following adapters, or their equivalent, shall be supplied

Type	Applicable specification	Quantity
HN(M) to N(F)	MIL-A-55339	1
BNC(F) to SMA(F)	MIL-A-55339/46	1
BNC(F) to SMA(M)	MIL-A-55339/47	1
BNC(F) to N (M)	MIL-A-55339/20	2
BNC(F) to C (M)	MIL-A-55339/22	1
TNC(F) to BNC(M)	MIL-A-55339/38	2

3 4.1.5.6 Terminations A dummy load shall be supplied with an impedance of 50 ohms, and shall be capable of dissipating 2 watts (W) of power and shall have a Type BNC male connector Also, the video feed-through terminations specified in a and b, or their equivalent, shall be supplied. Each termination shall have a Type BNC plug on one end and a Type BNC jack on the other end, and shall be capable of dissipating 2 W.

	Resistance	Quantity
a	75 ohms ±5 percent	2
b.	93 ohms ±5 percent	1

3.4.1.5 7 Service test cable. The service test-cable(s) shall be supplied to enable powering the oscilloscope of the basic equipment when separated from the basic chassis of the equipment for maintenance purposes.

3 4.1.5.8 Extender board(s) For maintenance, one extender board shall be provided for accommodating each style of plug-in PCB used in the system The extender board(s) shall have a sufficient length to extend the accommodated circuit board out of its card file position to a position of complete two-side accessibility. The extender board shall be keyed to prevent accidental reversal of the extended circuit board.

3.4.1.5.9 Primary power cables. A cable conforming to the requirements of MIL-C-28777 shall be provided. The equipment chassis shall be electrically connected to the ground pin on the connector plug.

3.4.2 Materials. Materials shall be as specified in 3.4.2.1 and 3.4.2.2.

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3.4.2.1 Material flammability. Material used as part of the equipment shall conform to the Flammable materials paragraph of MIL-E-16400.

3.4.2.2 Unacceptable materials. Equipment design shall not include polychlorinated biphenyls, asbestos and asbestos compounds, fragile or brittle materials, beryllium and beryllium compounds, unless so identified, and lithium and lithium compounds not specifically approved by the procuring activity. The Restricted materials paragraph of MIL-T-28800 shall apply

3 4.3 Soldering and soldering processes Soldering and soldering procedures and processes shall conform to WS-6536D Subject to procuring activity approval, this may not apply to manufacturer supplied assemblies (see 6 4.7) This requirement does not apply to the oscilloscope section (see 3.6.18)

3.5 Design requirements. Design requirements shall be as specified in 3.5.1 through 3.5.15

3.5.1 Electrical power The equipment shall conform to the requirements of MIL-T-28800 for a nominal 115 volt (V), single-phase, 50 hertz (Hz), 60 Hz, and 400 Hz source The input power, excluding the oscilloscope power, shall not exceed 225 W.

3.5 1 1 Power input A connector shall be provided on the rear of the equipment for accepting the input power The connector shall be a Type MS3102A14S-7P in accordance with MIL-C-5015, or equivalent, to mate with the primary power cable (see 3.4.1.5.9).

3 5 1 2 Elapsed time meter An elapsed time meter is required and shall be mounted on the front panel of the equipment

3.5.2 IFF system compatibility The equipment shall conform to the applicable requirements of DoD AIMS 65-1000B and DoD AIMS 64-900D

3 5 3 Electrical cable protection Equipment design shall preclude damages to electrical cabling during all conditions of assembly, removal, insertion, and tilting of equipment

3 5.4 Controls, indicators, and panel layouts. The design of controls and indicators, and their arrangement on operator and maintenance panels, shall conform to the criteria of MIL-STD-1472 and shall be in accordance with the Controls, indicators, and panel layout paragraph of MIL-E-16400 The color coding and marking of pin jacks and other tests points shall be in accordance with MIL-STD-415 Abbreviations used on panels shall be in accordance with MIL-STD-12 Final front panel layout shall be subject to the approval of the procuring activity

3.5 4 1 Alarm lamps Lamps used on front panels for alarms and other purposes shall conform to the requirements of the Transilluminated displays paragraph of MIL-STD-1472 A capability for remote indication of the status of the alarm lamps shall be provided Legend lights shall be used in preference to simple indicator lights, except where design considerations demand that simple indicators be used Lamps used in legend switches shall conform to the requirements of the Legend switches paragraph of MIL-STD-1472 Legend switches shall be used in preference to toggle switches, except where design considerations demand that toggle switches be used Lamp testing shall be in accordance with the Lamp testing paragraph of MIL-STD-1472

3 5 4.2 Audible alarms The requirements of the Audio displays paragraph of MIL-STD-1472 shall be followed in the design of audible alarms. When a single tone audible alarm is provided, the alarm shall be of the summary alarm type which has a shutoff switch with an automatic reset feature The audible alarm shall have an associated lamp which is not affected by the shutoff switch The audible alarm, shutoff switch, and the lamp shall be enclosed by a line on the front panel and be labeled SUMMARY ALARM and be connected to other alarm lamps in the system A capability for remote indication of the audible alarm and the alarm lamp shall be provided.

3 5 4.3 Control knobs In the interest of conserving panel space, and with approval of the procuring activity, dual concentric control knobs may be employed to control related functions There shall be no more than two control knobs on the front panel This requirement does not apply to the oscilloscope section (see 3.6.18).

3 5.5 Modular construction. The equipment shall employ modular design to provide easily replaceable assemblies and subassemblies. Each replaceable assembly or subassembly, including the power supply, shall provide complete circuit functions and shall be capable of being removed without the need of unsoldering. Modular construction and selection of modules shall be in accordance with MIL-STD-454, Requirement 73.

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3.5.6 Dimensions. The equipment, excluding the accessory stowage (see 3.4.1.5.1) the front panel cover, and front panel protrusions and minor protrusions, such as rivets and inset handles, shall be not greater than 25 inches (in.) wide by 19 in. deep by 16 in. high.

3.5.6.1 Expansion of RF section. The RF section shall have space for expansion of at least 15 percent.

3.5.7 Weight. The weight of the equipment, less accessories and front panel cover, shall not exceed 110 pounds (lbs), and shall not exceed 135 lbs with the front cover and standard accessories (see 3.4.1.5).

3.5.8 Circuit card keying All plug-in circuit cards shall be uniquely keyed to prevent accidental insertion into the wrong circuit card connector The keying also shall prevent inadvertent reversal of circuit card, whether directly plugged into the connector, or extended by the accessory extender board.

3.5.9 Power supply. Alternating current (AC) and direct current (DC) voltages required by the equipment (except the voltages required by the oscilloscope and units under test (UUT)) shall be supplied by a common power supply. The oscilloscope is not required to have a separate ON-OFF switch but shall have an indicator lamp to show that power has been applied.

3 5 9.1 Power supply short circuit protection. The equipment shall have the capability to prevent power supply damage when any of the working DC voltages become shorted.

3.5.9.2 Power supply reserve. The power supply shall have at least a 20 percent reserve power for each supply voltage not unique to the display.

3.5.10 Power source transient-state conditions The equipment shall conform to the requirements of MIL-T-28800 for transient-state conditions of the electrical power source, except that operation may be momentarily impaired and false output signals generated during the transient

3.5.11 Leakage current protection. Protection shall be provided from leakage current in excess of 5 milliamperes (mA) peak AC from any accessible conductive parts of the equipment to either pole of the power source.

3.5.12 Design for accessibility. The design of the equipment shall be in accordance with the requirements of the Accessibility paragraph of MIL-STD-1472, except as otherwise specified herein.

3.5.13 Enclosure. The enclosure shall be as specified in 3.5.13.1 through 3.5.13.5

3.5.13.1 General The case shall be constructed in accordance with MIL-T-28800 for Style C enclosure. Carrying handles shall be employed. Four mounting holes shall be provided on the bottom of the case to facilitate mounting the equipment on a horizontal surface.

3.5.13.2 Main chassis The case shall accept the main chassis and contain slides which shall permit complete withdrawal from the case for convenient maintenance With the chassis fully withdrawn, either a tilting mechanism shall permit the chassis to be tilted 90 degrees upward for access to subassemblies mounted on the bottom of the chassis, or no subassemblies shall be mounted on the bottom or require access from the bottom.

3.5.13.3 Schematic diagram and operating instruction Schematic diagrams and operating instructions shall not be affixed to the case. The required information shall be as specified in the technical manual.

3.5.13.4 Color. The color of the case shall be color Y in accordance with MIL-T-28800. The front panel shall be color T or Y. The color of the front panel of the oscilloscope shall be Y or R in accordance with MIL-T-28800

3.5.13.5 Panel illumination. Illumination of the front panel shall not be required

3.5.14 Thermal design. Thermal design shall be in accordance with MIL-STD-454, Requirement 52.

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3.5.15 Protective cover. A removable cover shall be provided which will fasten to the front of the unit to protect the controls, jacks, and indicators. Cover material shall be similar to the material used for the construction of the equipment case. The intent of the cover is for protection during shipment or storage and stowage of accessories only and it shall be removed during any operation or testing of the equipment. Design of the cover and fastening method shall be subject to approval by the procuring activity.

3.6 Electrical performance requirements. Electrical performance shall be as specified in 3.6.1 through 3.6.19.3.4.

3.6.1 Pulse repetition frequency (PRF). One set of keyboard microcomputer (KM)-controlled switches shall be provided to select internally generated PRFs or pulse repetition intervals (PRIs). A separate KM-controlled switch shall be provided to select either internal or external triggering of the PRF. The equipment shall simultaneously display both PRFs and PRIs. The PRFs shall be displayed to at least the nearest integer value (with an accuracy of ±1 pulse per second (pps)).

3.6.1.1 PRF-transponder testing. When the KM frequency select switch is in the 1030-MHz-XPDR TEST position (see 3.6.17.1.1 and 3.6.17.1.2) the equipment repetition rate shall be variable over a range of less than 5 PRF to greater than 10,000 PRF, by KM controls, in 1-microsecond (µs)-steps. The accuracy and jitter shall be as specified in 3.6.1.2.

3.6.1.2 PRF-interrogator testing. When the KM frequency select switch is in the 1090-MHz-INTR TEST position (see 3.6.17.1.3 and 3.6.17.1.4) the equipment repetition rate shall be selectable in 1-µs steps from 100 µs (10,000 PRF) to 200,000 µs (5 PRF). The accuracy shall be within ±1.0 µs or ±0.01 percent of the indicated setting, whichever tolerance is greater. The period-to-period jitter shall not exceed 0.1 µs.

3.6.1.3 External triggered PRF. The equipment repetition rate shall be capable of being controlled by an external trigger having the characteristics specified in a through e.

a. Positive or negative polarity
b. Any repetition rate between 5 PRF and 10,000 PRF
c. Any pulse duration between 0.3 µs and 25 µs
d. Any peak voltage between 2 V and 30 V across a 75-ohm ±5 percent resistor
e. Rise time less than 0.5 µs per V

3.6.1.3.1 External trigger input characteristics. The external trigger shall be applied through a connector mounted on the front panel. The input impedance shall be not less than 100,000 ohms in parallel with 50 micromicrofarads (µµF). The equipment shall not be damaged by pulses of 200 V peak amplitude, 250 µs duration at a repetition rate of 2000 Hz, or by 500 volts direct current (VDC) applied to the jack.

3.6.1.4 Delays. Each delay (see 6.4.15) referenced herein shall not be retriggerable, unless approved by the procuring activity.

3.6.2 Zero trigger output. The equipment shall generate a Zero trigger for each PRF. When the equipment is externally triggered, the Zero trigger output at a front panel jack shall be delayed by not more than 0.25 µs with respect to the external trigger.

3.6.2.1 Zero trigger characteristics. The Zero trigger shall be 20 ±5 V positive amplitude when working into 75 ohms in parallel with 1100 µµF. The pulse duration (see 6.4.14) shall be 1.5 ±0.5 µs with a rise time not greater than 0.1 µs. The decay time shall not be greater than 0.2 µs.

3.6.2.2 Video outputs. The equipment shall have less than 5 percent overshoots on pulses and the peak combination of noise and DC bias on the video output signal shall be less than 3 percent of the peak pulse amplitude or 50 millivolts, whichever is greater.

3.6.2.3 Video polarity and jitter. All video pulses shall be positive with respect to ground unless otherwise specified herein. All pulses shall have less than 0.1 µs jitter in both pulsewidth and pulse spacing (see 6.4.15) with respect to the Zero trigger, unless otherwise specified herein.

3.6.3 System timing. For each PRF, the equipment shall generate the selected challenges, a suppression gate, a Mode 4 pretrigger, a Mode 4 gain time control (GTC) trigger, first reply, second reply (unless externally triggered), reset signals, and the variable pulses 1 and 2, if selected.

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3.6.3.1 Variable pulses 1 and 2. The equipment shall generate two variable pulses for each PRF. Each pulse shall be capable of being logically ORed with the reply train or the challenge train when selected by the KM controller. Each pulse shall be capable of being timed from less than 3 µs to greater than 500 µs after the Zero trigger. It shall be possible by KM selection to turn either of the variable pulses ON or OFF. Each pulse shall be capable of having pulsewidths from less than 0.275 µs to greater than 10 µs. Variable pulse 1 shall have a separate jack for output, at 5 V ±1.0 V into a 75-ohm load. Rise time and fall time shall be less than 0.1 µs. Jitter between either pulse and the Zero trigger shall be less than 0.05 µs. Variable pulses 1 and 2 position shall be adjustable in 0.1 µs increments (from 3 µs to 500 µs). For variable pulses 1 and 2 the pulsewidth shall be KM controlled in 0.05 µs increments from less than 0.275 µs to greater than 10 µs. It shall be possible to KM select variable pulse 2 to be logically ORed with variable pulse 1. When this is selected, variable pulse 2 delay shall be referenced to variable pulse 1 and the delay shall be from 1 µs to 100 µs in 0.1 µs increments.

3.6.3.2 Signal timing. The timing of these signals shall be as specified in a through j

a. Challenges (selective identification feature (SIF)). For Mode 1, Mode 2, Mode 3/A, and Mode C the P3 pulse shall occur from 25 µs to 430 µs after the Zero trigger as controlled by KM switches in 1 µs steps.

b. Challenges (Mode 4). For Mode 4 synchronization (sync) pulses and Mode 4 Word A, Word B, and Word C the first pulse of each group shall occur 168.0 ±0.5 µs after the Mode 4 pretrigger pulse.

c. Suppression gate. The suppression gate shall start 23 ±1 µs before the P3 pulse in SIF challenges and 20 ±5 µs before the P4 pulse in Mode 4 challenge.

d. Mode 4 pretrigger The Mode 4 pretrigger shall occur from 4 µs to 38 µs after the 0 trigger as controlled by KM switches in 1-µs steps.

e. Mode 4 GTC trigger. The Mode 4 GTC trigger shall occur 372.0 ±0.5 µs after the Mode 4 pretrigger.

f. First SIF reply. The first framing pulse (F1) of the first SIF reply shall occur 3.0 ±0.5 µs after the P3 pulse of each SIF challenge when the KM range delay switches are set for minimum delay. The P3 pulse shall be the internally generated P3 pulse or the demodulated external P3 pulse, whichever is KM selected.

g. Mode 4 reply. The first pulse of a three-pulse Mode 4 reply shall occur 372 ±0.5 µs after the Mode 4 pretrigger when the KM range delay switches are set for minimum delay.

h Second SIF reply. The first framing pulse of the second SIF reply shall be adjustable from 0 µs to greater than 50 µs after the first framing pulse of the first SIF reply as KM-controlled in increments of 0.05 µs.

i. Second Mode 4 reply The third pulse of the second M4 reply shall be adjustable from 0 µs to at least 90 µs after the third pulse of the first M4 reply or from the single pulse of the first Mode 4 reply.

j. Reset signals The first pulse of the reset signal shall occur from less than 30 µs to greater than 3000 µs after the Zero trigger as controlled by the KM control

3.6.4 Challenge and tag generator. The equipment shall generate any one or any combination of five challenge modes. The modes shall be Mode 1, Mode 2, Mode 3/A, Mode C, and Mode 4, in that order. The timing of these signals shall be as specified in 3.6.4.3.1 through 3.6.4.3.5

3.6.4.1 Mode selection By a separate switch for each mode by the KM controller, it shall be possible to select and interlace two or more modes. The selected mode control functions shall interlace in order. Only the selected modes shall be generated without timing gaps. The mode interlace capability shall also permit the capability to generate a single continuous mode control function.

3.6.4.2 Mode repeat. The KM control shall perform the function of mode repeat selection. It shall be possible to repeat all selected mode control functions for a selected number of PRF cycles. Mode repeat multipliers shall be 1, 2, 4, and 8 times. For example, if Mode 1 and Mode 3 are selected and mode repeat multiplier is 4, the mode control functions generated by subsequent PRF cycles will be 1111333311113333, and so forth.

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3.6.4.3 Challenge mode controls. Under control of the mode selection and mode repeat controls, the unit shall generate the signals specified in 3.6.4.3.1 through 3.6.4.3.6.

3.6.4.3.1 Challenge, Mode 1. Two pulses, 0.8 ±0.03 µs wide having a nominal spacing of 3.0 ±0 05 µs between leading edges, shall be generated

3.6.4.3.2 Challenge, Mode 2 Two pulses, 0.8 ±0.03 µs wide having a nominal spacing of 5.0 ±0.05 µs between leading edges, shall be generated.

3.6.4.3.3 Challenge, Mode 3/A Two pulses, 0.8 ±0.03 µs wide having a nominal spacing of 8.0 ±0.05 µs between leading edges, shall be generated

3.6.4.3.4 Challenge, Mode C. Two pulses, 0.8 ±0.03 µs wide having a nominal spacing of 21.0 ±0.05 µs between leading edges, shall be generated.

3.6.4.3.5 Challenge, Mode 4. The Mode 4 challenge shall be selectable as either a Mode 4 sync group, Mode 4 Word A, Mode 4 Word B, or Mode 4 Word C as specified in 3.6.4.3.5.1 through 3.6.4.3.5 4.

3.6.4.3.5.1 Mode 4 sync. Mode 4 sync is four pulses 0.5 ±0.03 µs wide, spaced at 2.0 ±0.05 µs intervals The S1, S2, S3 and S4 pulses may be removed via KM switches from the train

3.6.4.3.5.2 Mode 4 Word A Mode 4 Word A is a pulse train consisting of 28 pulses 0 5 ±0.03 µs wide, spaced 0 µs, 2 µs, 4 µs, 6 µs, 10 µs, 13 µs, 15 µs, 17 µs, 20 µs, 24 µs, 26 µs, 30 µs, 33 µs, 35 µs, 38 µs, 41 µs, 43 µs, 45 µs, 48 µs, 50 µs, 52 µs, 54 µs, 56 µs, 61 µs, 63 µs, 66 µs, 68 µs, and 71 µs with respect to the leading edge of the first pulse No pulse of the pulse train shall vary more than ±0 07 µs from its stated position

3.6.4.3.5.3 Mode 4 Word B Mode 4 Word B is a pulse train consisting of 28 pulses 0.5 ±0 03 µs wide, spaced 0 µs, 2 µs, 4 µs, 6 µs, 10 µs, 12 µs, 15 µs, 17 µs, 19 µs, 22 µs, 25 µs, 28 µs, 30 µs, 32 µs, 35 µs, 37 µs, 40 µs, 44 µs, 46 µs, 51 µs, 53 µs, 55 µs, 57 µs, 60 µs, 62 µs, 64 µs, 66 µs, and 70 µs with respect to the leading edge of the first pulse. No pulse of the pulse train shall vary more than ±0 07 µs from its stated position.

3.6 4 3.5 4 Mode 4 Word C. Mode 4 Word C is a pulse train consisting of 36 pulses 0 5 ±0.03 µs wide, spaced 0 µs, 2 µs, 4 µs, 6 µs, 10 µs, 12 µs, 14 µs, 16 µs, 18 µs, 20 µs, 22 µs, 24 µs, 26 µs, 28 µs, 30 µs, 32 µs, 34 µs, 36 µs, 38 µs, 40 µs, 42 µs, 44 µs, 46 µs, 48 µs, 50 µs, 52 µs, 54 µs, 56 µs, 58 µs, 60 µs, 62 µs, 64 µs, 66 µs, 68 µs, 70 µs, and 72 µs with respect to the first pulse No pulse of the pulse train shall vary more than ±0.07 µs from its stated position.

3.6 4.3.6 Interrogator sidelobe supression (ISLS) pulse Provision shall be made in the KM to select an ISLS pulse and to combine the pulse with the challenge video signals The pulsewidth shall be 0.8 ±0.03 µs and the pulse spacing shall be 2.0 ±0.05 µs following the P1 pulse for Mode 1, Mode 2, Mode 3/A, and Mode C interrogations. For Mode 4, the pulsewidth shall be 0.5 ±0.03 us and the pulse spacing shall be 8.0 ±0.07 µs after the first sync pulse A KM switch shall be provided to remove the ISLS pulse from the challenge train. The ISLS pulse shall also be available at the mixed video output (see 3 6.9).

3.6.4.4 P1 and P3 pulse select. KM switches shall be provided to remove either P1 or P3, or both, from the challenge train

3.6.4.5 Challenge and tag outputs. Challenge and tag outputs shall be as specified in 3.6 4.5.1 and 3.6.4.5.2.

3.6 4.5.1 Video output The selected challenges ORed with variable pulses 1 and 2, if KM-selected, shall be provided to a separate front panel jack. The output level of the video signal shall be variable from less than 0 1 V to 5 V into a load of 75 ohms ±5 percent The rise time of all pulses shall be less than 0.1 µs. The decay time of all pulses shall be less than 0.15 µs. A KM switch position on the video level control shall enable the output from the front panel CHAL out jack to the mixed video outputs (see 3.6.9).

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3.6.4.5.2 RF output. When challenge modulation has been KM-selected (see 3.6.17.4.1.1), the KM-selected challenges ORed with variable pulses 1 and 2, if KM selected, shall modulate the RF outputs.

3.6.4.6 Jitter. The jitter between the first challenge video pulse and the Zero trigger shall be less than ±0.05 µs.

3.6.5 First reply code generator. The equipment shall generate SIF and Mode 4 replies. These replies shall be delayable to simulate targets at different ranges. All reply pulses shall be 0.45 ±0.03 µs wide and the timing of these signals shall be as specified in 3.6.5.1.2 through 3.6.5.1.8.

3.6.5.1 Code selection. A multi-position KM switch shall be provided to select the functions specified in a through i:

a OFF
b. SIF codes
c. SIF + X codes
d. Variable emergency
e Identification of position
f. Mode 4-3 pulse
g Mode 4-1 pulse
h SIF 1 train and SIF 2 train
i. Mode inhibit select

3.6.5.1.1 OFF. With the code select KM switch in the OFF position, no reply codes shall be generated.

3.6.5.1.2 SIF codes. With the code select KM switch in the SIF position, SIF replies shall be generated which consist of a pair of bracket pulses, F1 and F2, plus a maximum of 12 information pulses having the spacings specified in a through n·

a.	F1 (Bracket 1)	0 µs (Reference)
b.	C1	1.45 ±0.02 µs
c.	A1	2.90 ±0.02 µs
d	C2	4.35 ±0.02 µs
e	A2	5.80 ±0.02 µs
f.	C4	7.25 ±0.02 µs
g	A4	8.70 ±0.02 µs
h.	B1	11.60 ±0.02 µs
i.	D1	13.05 ±0.02 µs
j.	B2	14.50 ±0.02 µs
k.	D2	15.95 ±0.02 µs
l.	B4	17.40 ±0.02 µs
m	D4	18.85 ±0.02 µs
n	F2 (Bracket 2)	20.30 ±0.02 µs

3.6.5.1.2.1 Code select. The availability of the information pulses shall be controlled by KM code select switches for SIF code selection of 0000 through 7777, and F2 ON-OFF. The SIF 1 code shall be distinct for each SIF mode, that is, Mode 1 code may be set to 1100, Mode 2 code to 3457, and so forth. KM switches shall allow this code setting.

3.6.5.1.2.2 RF IN-OUT signal The detected RF IN-OUT signal shall pass through a digital delay line or other (nonanalog delay line) suitable device to determine what mode is being challenged. The challenged mode will enable SIF 1 and SIF 2 (if selected) code outputs in that respective mode SIF 1 codes shall have the capability to be different for each mode interrogated or challenged.

3.6.5.1.2.3 Mode inhibit select. It shall be possible by KM control to inhibit all replies to any combination of Mode 1, Mode 2, Mode 3/A, Mode C, and Mode 4. This feature shall work concurrently with 3.6.5.1a through h selected functions.

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3.6.5.1.3 SIF + X codes. With the KM code select switch in the SIF + X position, any of the SIF codes specified in 3.6.5.1.2 shall be generated plus an additional pulse spaced 10.15 ±0.02 µs from the F1 pulse.

3.6.5 1 4 Emergency codes The emergency codes with the KM code select switch in the EMERGENCY position, any of the SIF codes specified in 3 6 5 1.2 shall be generated, plus three sets of bracket pulses spaced as specified in a through f with respect to the F1 pulse of the initial pulse train.

a	Bracket 1, Set 1	24 65 ±0.1 µs
b.	Bracket 2, Set 1	44.95 ±0 1 µs
c	Bracket 1, Set 2	49.30 ±0 1 µs
d	Bracket 2, Set 2	69 60 ±0.1 µs
e	Bracket 1, Set 3	73.95 ±0.1 µs
f.	Bracket 2, Set 3	94.25 ±0 1 µs

3 6.5 1 5 Variable emergency spacings. When the KM code select switch selects VAR EMERG, it shall be possible by use of the KM to vary the interval between F2 of the preceding bracket pair and F1 of the next bracket pair ±1 ±0.05 or 0 ±0.03 µs about the ideal spacing of 4.35 µs The variable spacing control shall cause all F2-F1 intervals to vary simultaneously The variable emergency function shall not exclude the ability tc vary the position of individual pulses in the initial code train utilizing the variable pulse facility

3.6 5.1 6 Identification of position. When the KM code select switch selects Identification of position, any SIF pulse train code specified in 3 6.5.1.2 shall be generated, followed by a second identical train for Mode 1 The spacing between the first bracket pulse of the first train and the first bracket pulse of the following train shall be 24 65 ±0 1 µs For Mode 2, Mode 3/A, and Mode C only the first bracket pulse of the second train shall be generated

3.6 5.1.7 Mode 4-3 pulse When the KM code select switch selects Mode 4-3 pulse, three pulses shall be generated The nominal spacing between leading edges of adjacent pulses shall be 1 75 ±0.05 µs

3 6 5 1.8 Mode 4-1 pulse When the KM code select switch selects Mode 4-1 pulse, a single pulse shall be generated For single pulse replies, the pulse shall occupy the same timing position, ±0.05 µs, as the third pulse of a three-pulse reply

3 6 5 1 9 SIF 1 train and SIF 2 train. The equipment shall have an alternate train mode selected by KM control The replies to odd interrogations shall be from the SIF 1 train and variable pulse 1, and the even replies to interrogations shall be from the SIF 2 train and variable pulse 2 By setting the range separation between the first and second targets to zero, it shall be possible to generate a single target whose code alternates from interrogation to interrogation

3.6 5 2 Range delay The equipment coded replies shall be capable of being delayed over a range of 0 µs to 4095 µs from the timing specified in 3 6 3.2f and 3 6.3 2g

3 6.5.2.1 Delay selection The amount of delay shall be selectable in 1-µs increments, using KM switches with an accuracy of ±0 5 µs for delays from 0 µs to 1023 µs and ±0.8 µs for delays from 1024 µs to 4095 µs. The clock shall maintain this accuracy without adjustment

3.6.5.3 First reply outputs Seperate or mixed video outputs and RF outputs shall be furnished

3.6 5.3.1 Video output The selected and delayed replies ORed with the variable pulses, if KM-selected, shall be provided to a separate front panel jack. The output level of the video signals shall be KM-adjustable in increments of less than 0 11 V from less than 0.1 V to greater than 5 V into a load of 75 ohms ±5 percent The rise time of all pulses shall be less than 0.1 µs The decay time of all pulses shall be less than 0 15 µs A KM switch on the video level control shall enable the output from the front panel jack to the mixed video outputs (see 3.6.9).

3.6.5.3 2 RF output. When reply modulation has been KM-selected (see 3.6.17.4.1.2), the selected replies shall modulate the RF outputs

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3.6.5.4 Jitter. The jitter between the first video reply pulse and the Zero trigger or the external P3, if selected, shall be less than ±0.05 µs or ±0.01 percent of the delay time, whichever tolerance is greater.

3.6.6 Second reply code generator. The equipment shall have a second code generator which is completely independent of the first reply code generator (see 3.6.5). The reply pulses shall be 0.45 ±0.03 µs wide and the timing of these signals shall be as specified in 3.6.3.2.

3.6.6.1 SIF code selection. SIF replies shall be generated which consists of a pair of bracket pulses, F1 and F2, plus a maximum of 12 information pulses having the spacings specified in a through n

a.	F1 (Bracket 1)	0 µs (Reference)
b.	C1	1.45 ±0.02 µs
c.	A1	2.90 ±0.02 µs
d.	C2	4.35 ±0.02 µs
e.	A2	5.80 ±0.02 µs
f.	C4	7.25 ±0.02 µs
g.	A4	8.70 ±0.02 µs
h.	B1	11.60 ±0.02 µs
i.	D1	13.05 ±0.02 µs
j.	B2	14.50 ±0.02 µs
k.	D2	15.95 ±0.02 µs
l.	B4	17.40 ±0.02 µs
m.	D4	18.85 ±0.02 µs
n.	F2 (Bracket 2)	20 30 ±0.02 µs

3.6.6.1.1 Code select. The availability of the information pulses shall be controlled by KM code select switches for SIF code selection of 0000 through 7777 and F2 ON-OFF.

3.6.6.2 Mode 4 reply. When the second reply generator is KM-selected for Mode 4 replies, a three pulse Mode 4 reply shall be generated (see 3 6.5.1.7).

3.6.6.3 Triggering. The second reply code generator shall be capable of being triggered by either an external trigger, noise, or by the internal range delay trigger which also triggers the first reply code generator. The choice of trigger source shall be made by a KM switch. When the KM switch is set to select external triggers and no triggers are furnished, there shall be no output from the second reply code generator

3.6.6.3.1 External trigger. When external triggering has been KM-selected, the equipment shall generate one reply for each trigger having the characteristics specified in a through e

a. Positive or negative polarity
b Any repetition rate between 5 PRF and 10,000 PRF
c Any pulse duration between 0.3 µs and 25 µs
d A peak voltage of from 2 V to 30 V measured across a 75-ohm ±5 percent terminating resistor
e Rise time less than 0.5 µs per V

3.6.6.3.1.1 External trigger parameters. The external trigger shall be applied through a front panel jack. The equipment shall not be damaged by pulses of the characteristics specified in a and b

a. 200 V peak amplitude, 250 µs duration, and having repetition rates up to 2000 pps
b. 500 VDC applied to the external trigger jack

The input impedance shall be not less than 100,000 ohms in parallel with 50 µµF. Internal circuitry shall not be damaged by pulse repetition rates over 20,000 PRF. Rate limiting circuitry may be employed.

3.6.6.3.1.2 Noise triggering. When noise triggering is KM-selected, the internal noise generator shall trigger the replies. The average reply rate shall be KM-selectable from zero to at least 20,000 replies per second in increments of 10.

3.6.6.4 Delay control. For internal triggering, an independent delay control shall allow delay of the F1 pulse of the second reply code or the third pulse of a Mode 4 reply relative to the F1 pulse of the first SIF reply code or the third pulse of a Mode 4 reply code. The amount of delay shall be from 0 µs to at least 50 µs. For external triggering, this delay shall also function with the timing referenced to the external trigger. This delay shall be KM-controlled in increments of 0.05 µs.

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3.6.6.5 Second reply outputs. Separate or mixed video outputs and RF outputs shall be furnished.

3.6.6.5.1 Video output. The selected and delayed replies shall be provided to a separate front panel jack. Both replies may be logically ORed to 1 jack upon KM switch selection. The output level of the video signals shall be adjustable from less than 0.1 V to 5 V into a load of 75 ohms ±5 percent. The rise time of all pulses shall be less than 0.1 µs. The decay time of all pulses shall be less than 0.15 µs. A KM switch position on the video level control shall enable the output from the panel jack to the mixed video outputs (see 3.6.9).

3.6.6.5.2 RF outputs. When reply modulation has been KM-selected (see 3.6.17 4.1.2), the KM-selected replies shall modulate the RF outputs.

3.6.6.5.3 Round reliability generator. The equipment shall have a KM-controlled round reliability generator. The first reply outputs (see 3.6.6.5.3) and the second reply outputs (see 3.6.6.5) shall be capable of being KM-adjusted from zero to one in increments of 0.1. The value indicated represents the probability that the generated reply will be allowed to reach the RF I/O jack and the reply output jacks. The round reliability generator shall inhibit replies pseudo-randomly.

3.6.7 Video reset signal. The equipment shall generate video reset signals with the timing of these signals specified in 3.6.7.1.

3.6.7.1 Reset signal. The reset signal shall consist of three pulses. The first pulse shall be 8 ±0.2 µs wide. The second pulse, 2.0 ±0.25 µs wide, shall occur 10 ±0.1 µs from the half voltage point of the first pulse. The third pulse shall be 4.0 ±0.25 µs wide and shall occur 15 ±0.1 µs from the half voltage point of the first pulse. Each reset pulse may be inhibited by KM switches.

3.6.7.2 Triggering. One reset signal shall be generated in synchronism with each Zero trigger (see 3.6.2).

3.6.7.3 Delay control. A KM control shall adjust the start of the reset signal from less than 30 µs to greater than 3000 µs from the Zero trigger in 1-µs increments.

3.6.7.4 Reset outputs. The reset signal shall be provided to the reset front panel jack. The output level of the video pulses shall be 4.5 ±1 V. A KM controlled switch shall enable the output from the reset generator to the mixed video outputs (see 3.6.9).

3.6.8 Reply signal gating. The replies from the first and second reply code generators shall be gated by an external signal if KM-selected, the SIF target gate if KM-selected, and selectable internal gating. Gating signals to simulate a radar IFF system shall be generated.

3.6.8.1 External gating. The equipment shall provide for external gating operation. When an external gate with the characteristics specified in a through d is applied to the equipment through a front panel connector, output replies shall occur as KM-selected, either only during the gate period or only when the gate is absent. The external gating shall be enabled and disabled by KM control.

a. Polarity positive
b. Amplitude 5 ±2 V
c. Duration 1 µs to DC
d. Impedance nominal 75 ohms

3.6.8.2 Azimuth gating simulators. The equipment shall generate a series of video signals to simulate the operation of a radar IFF system for the benefit of automatic IFF data systems. Simulated video signals generated shall include an azimuth gate, and active readout gates. An internal connection shall provide the Zero trigger (see 3.6.2) for the active readout gates.

3.6.8.2.1 Azimuth gate. When selected by a KM switch, a gating signal shall be generated simulating a sector of sweep of the simulated antenna rotation. A KM control shall permit adjustment of the sector angle from less than 3 degrees to greater than 10 degrees in width, based on the simulated externally variable antenna rotation rate of from less than 6 revolutions per minute (rpm) to greater than 60 rpm in 10-µs increments. A KM control shall be provided for moving the start of the sector angle from a point less than 45 degrees beyond north to a point greater than 135 degrees beyond north. The azimuth gate shall internally control the active readout signals, the first reply code generator, and the second reply code generator. The synchro signals, either internally simulated or externally provided, will never be used simultaneously with the north reference pulses and azimuth change pulses.

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3.6.8.2.2 Active readout generator. The equipment shall contain circuits for generating active readout gates simulating range limits, which in conjunction with the azimuth gate produce simulated target areas bound by range and azimuth limits. The signals specified in a through c shall be generated:

a. Positive readout gate. The positive readout gate shall be KM-adjustable from less than 150 µs to greater than 1200 µs following the input Zero trigger. and from less than 30 µs to greater than 300 µs in duration, in 10-µs intervals.

b. Negative readout gate. The negative readout gate shall be a negative gate coincident with the entire positive readout gate

c SIF target gate The SIF target gate shall be a positive gate, coincident with the positive readout gate and capable of inhibiting the SIF reply trains at all times except during the gate duration, if selected by KM control.

3.6.8.2.2 1 Pulse characteristics. The readout gate characteristics shall be as specified in a through c when terminated by 75 ohms ±5 percent:

		Positive	Negative
a.	Polarity·	Positive	Negative
b	Amplitude:	20 ±5 V	-4.8 ±0.8 V
c.	Pulsewidth	30 µs to 300 µs	30 µs to 300 µs

3.6.8.2.3 Azimuth signal generator. The equipment shall generate a simulated north pulse and simulated azimuth change pulses having angular relationships to the azimuth gating.

3.6.8.2 4 Azimuth change and north pulses. The equipment shall generate a series of azimuth change pulses representing the simulated output of a 12 bit digital encoder. The pulse rate shall simulate the variable antenna rotation. At each 4096th change pulse, a separate simulated north pulse shall be generated The simulated variable antenna rotation time shall be adjustable from 1 second to 10 seconds for north reference pulses in increments of 0.1 second or less. The rotation rate shall be as specified in 3.6.8.2.1 for synchro based systems.

3.6.8.2.5 Output pulse characteristics. Azimuth change and north pulse output characteristics shall be as specified in a through e when loaded by 75 ohms ±5 percent

a.	Polarity.	Positive
b.	Amplitude	3.5 ±1 V
c	Pulsewidth·	2 ±1 µs
d.	Rise time.	0.1 µs maximum
e.	Fall time	0.2 µs maximum

The north pulse output may be the same jack as the external north pulse input (see 3.6.8.2.6).

3.6.8.2.6 External north. A front panel jack shall be provided to accept an external north pulse with the characteristics specified in a through d

a.	Polarity	Positive
b	Amplitude.	2 V to 30 V
c.	Pulsewidth.	0.25 µs to 20 µs
d.	Rise time	0.02 µs maximum

A KM switch shall be provided, which in the external north position, shall cause the internally generated north pulse to be disabled, and shall cause azimuth change pulse generator to reset to the reference or north condition.

3.6 8.2 7 Front panel connectors. Front panel connectors shall be type M39012/21-0001 in accordance with MIL-C-39012/21 Alternate front panel connector finishes and materials may be used subject to the approval of the procuring activity.

3.6.8.2.8 Synchro capability. The equipment shall be capable of inputting three synchro wires, two reference wires, and feeding signals to the readout and target gates to enable them each time the synchro points north. The input impedance shall be greater than 2 kilohms on each synchro and reference line input. The module shall have extra external pins on the input connector for handling 400-Hz or 60-Hz synchros, 90-V or 11.8-V synchro levels, and 115-V or 26-V reference signals. The synchro jack used shall be subject to the approval of the procuring activity.

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3.6.8.2.9 Selectable internal gating. The equipment shall provide for selecting, by KM control, the number of consecutive interrogations and replies passed to the front panel video output connectors and the RF modulator from 0 to 255. Provisions shall be made for selecting, by a KM control, the number of consecutive interrogations and replies inhibited from passing to the front of panel connectors and the RF modulator from 0 to 255. Replies shall include all signals from the first and second reply code generators, including variable pulses. Interragations shall include all signals sent to the challenge and tag output jack. There shall be a KM switch to allow interrogations to be gated

3 6.9 Mixed video As selected, any or all of the signals specified in a through f shall be combined as mixed video

a Challenge and tag signals (see 3.6.4)
b First reply signals (see 3 6 5) These signals may be gated by any of the gates specified in 3.6.8.
c Second reply signals (see 3.6.6). These signals may be gated by any of the gates specified in 3.6.8.
d. Reset signals (see 3.6.7)
e ISLS pulse (see 3.6.4.3.6)
f. Demodulated RF signals (see 3 6.17.5.1)

3 6.9.1 Mixed video output levels Both high level and variable level outputs shall be provided simultaneously

3.6.9.1.1 High level. For the high level output, all selected signals shall be positive, 20 ±5 V in amplitude with a rise time less than 0.10 µs and a decay time less than 0.15 µs when terminated with 75 ohms ±5 percent.

3.6.9.1 2 Variable level For this output, all selected signals shall be positive, variable from less than 0.1 V to at least 5.0 V by a KM control in less than 0 11 V increments. A KM selection shall be provided to vary the pulsewidth of the signals outputted on this front panel jack from 0.25 µs to 2.0 µs Wher variable width is deselected, all signals should be their normal widths. Rise times shall be less than 0 10 µs and decay times shall be less than 0.15 µs. These signal characteristics shall be provided when the output is terminated with 75 ohms ±5 percent. Alternate implementations of variable pulsewidth may be acceptable if approved by the procuring activity.

3.6 10 Mode 4 KIR simulator KM controls shall allow selection of the Mode 4 pretrigger output or an external Mode 4 pretrigger input to enable the Mode 4 challenge video output, the Mode 4 ISLS trigger output, and the Mode 4 GTC trigger output signals for interrogator testing The timing of these outputs shall retain their reference to the 0 trigger with either Mode 4 pretrigger enable selection The KIR simulator shall be capable of providing the inputs to the interrogator for automatic testing so the test sequences specified in 3.6 19.2.2.1 may be run with or without a KIR If external KIR testing is selected, the sequences will actually operate with the external KIR and not with the simulator The signals referenced in 3.6.10.1 through 3.6.10.4, and 3.6.13 shall be available on the external interface card to the interrogator (and have Type BNC jacks there) or be available from the front panel of the test set.

3 6.10 1 External Mode 4 pretrigger input The equipment shall accept, from the interrogator under test, a Mode 4 pretrigger having the characteristics specified in a through e

a.	Amplitude	1.5 V to 5 V positive
b.	Width	0.5 µs to 10.0 µs
c.	Rise time (see 6.4.11)	0.1 µs or less
d	Decay time (see 6.4.12).	0.5 µs or less
e	Impedance (of load)	90 ohms ±10 percent

3.6.10.2 Mode 4 challenge video output The equipment shall output the challenge video during Mode 4 when enabled (see 3.6.10) on this output with the characteristics specified in a through f

a.	Amplitude	4.5 ±₁ V positive
b	Width	0.5 ±0.10 µs
c.	Rise time.	0.1 µs or less
d.	Decay time:	0.15 µs or less
e.	Impedance (of load)	90 ohms ±10 percent
f.	Timing	First sync pulse shall be 168 ±0.5 µs after the Mode 4 pretrigger

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3.6.10.3 Mode 4 ISLS trigger output. The equipment shall output a Mode 4 ISLS trigger during Mode 4 when enabled (see 3.6.10) on this output with the characteristics specified in a through f:

a.	Amplitude	4 ±1 V positive
b.	Width	0.3 µs to 1.5 µs
c	Timing.	5.9 ±0.1 µs after the first sync pulse of the Mode 4 interrogation output
d.	Rise time	0.2 µs or less
e.	Decay time·	0.2 µs or less
f.	Impedance (of load)	90 ohms ±10 percent

3 6.10.4 Mode 4 GTC trigger output. A Mode 4 GTC trigger output shall be provided at the front panel, when enabled during Mode 4, with the characteristics specified in a through g

a.	Amplitude·	4.5 ±1 V positive
b.	Width	0.80 ±0.2 µs
c.	Rise time	0.10 µs or less
d.	Decay time	0.2 µs or less
e.	Jitter	Less than 0.5 µs with respect to the Mode 4 pretrigger or the Zero trigger
f.	Timing	372.0 ±0.5 µs after the Mode 4 pretrigger (see 3.6 13)
g	Impedance (of load)	90 ohms ±5 percent

3 6.11 Mode 4 KIT simulator. The equipment shall accept Mode 4 challenge video signals and Mode 4 enable triggers and output simulated Mode 4 replies and Mode 4 disparity signals for transponder testing. The KIT simulator shall be capable of providing the inputs to the transponder for automatic testing so the test sequences specified in 3.6.19.2.2.1 may be run with or without a KIT However, if external KIT testing is selected, the sequences will actually operate with the external KIT and not with the simulator. The signals referenced in 3.6.11.1 through 3.6.11.4.1 shall be available on the external interface card to the transponder (and have Type BNC jacks there) or be available from the front panel of the test set.

3 6.11.1 Mode 4 challenge video input. The equipment shall accept from the transponder under test, Mode 4 challenge video having the characteristics specified in a through e.

a.	Amplitude	1.5 V to 5 V positive
b.	Width	0.4 µs to 0.6 µs
c	Number of pulses	Up to 37 pulses spaced 3 ±1 µs apart
d.	Impedance (of load)	90-ohm ±10 percent
e.	Pulse train droop	15 percent maximum

3.6.11.2 Mode 4 enable trigger input. The equipment shall accept a transponder Mode 4 enable trigger having the characteristics specified in a through e.

a.	Amplitude	1.5 V to 5 0 V positive AC coupled
b	Width	0.5 µs to 3.0 µs
c.	Rise time	0.1 µs or less
d.	Decay time	1.0 µs or less
e.	Impedance (of load)	90 ohms ±10 percent

3.6.11.3 Mode 4 reply output. For each enable trigger input logically ANDed with a transponder Mode 4 P4 pulse, Mode 4 reply shall be generated (except when inhibited in accordance with 3 6.11.4 or by a KM switch) with the characteristics specified in a through e

a.	Amplitude.	4.5 ±1 V positive
b	Width	0.5 ±0.1 µs
c	Spacing	3 pulses spaced by 1.75 ±0.025 µs
d	Timing	199.5 ±0.75 µs after the P4 pulse ±0 05 µs jitter
e.	Impedance (of load).	90 ohms ±10 percent

3.6.11.4 Mode 4 disparity output. When disparity is selected (see 3.6.11.4.1) or an ISLS pulse is present in the Mode 4 video input (see 3.6.4.3.6), the Mode 4 reply output shall be inhibited and the equipment shall generate a disparity pulse with the characteristics specified in a through d:

a.	Amplitude.	4.5 ±1 V positive
b.	Pulsewidth·	0.3 µs to 1.0 µs

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c.	Timing:	65 ±1.0 µs after the enable trigger (fourth sync pulse of a Mode 4 interrogation) for ISLS disparity or coincident with the pulse at 19.0 µs ±1 0 µs for Mode 4 Word B, or 198 µs ±2.0 µs after the enable trigger for Mode 4 Word A, disparity
d.	Impedance (of load)	90 ohms ±10 percent

ISLS disparity shall take precedence over Word A and Word B disparities

3 6.11 4.1 Disparity switch A KM switch shall be provided to inhibit the pulse at 52 µs when Mode 4 Word A, is selected or the pulse at 19 µs when Mode 4 Word B, is selected (see 3.6 4.3.5)

3 6 12 Mode 4 pretrigger selection KM controls shall allow selection of an external Mode 4 pretrigger which would enable the KIR simulator output signals (see 3 6.10 2 through 3.6.10 4) if KM-selected This selection shall default to external on power-up or reset. The Mode 4 pretrigger output shall be provided during Mode 4, independent of the KIR simulator output enable selection

3 6 13 Mode 4 pretrigger output A Mode 4 pretrigger output shall be provided at the front panel, with the characteristics specified in a through f.

a	Amplitude	4.5 ±1 V positive
b	Width	0.8 ±0.2 µs
c	Rise time	0 1 µs or less
d	Decay time	0 2 µs or less
e	Jitter	Less than 0.5 µs with respect to the Zero trigger
f	Impedance (of load)	90 ohms ±5 percent

3.6 13.1 Adjustment KM controls shall be provided to adjust the Mode 4 pretrigger timing in 1- s steps from 4 µs to 36 µs after the Zero trigger.

3 6 14 Suppression-gate generator unit The suppression-gate generator unit shall be capable of generating the suppression pulse specified in 3 6 14 1 The suppression gate shall be provided to the front panel A KM switch shall be provided to turn the suppression gate generator on and off

3.6 14.1 Suppression-pulse The suppression-pulse output shall be provided in synchronism with the Zero triggers, as specified in a through f

a	Amplitude	The amplitude shall be 20 ±5 V
b	Rise time	The rise time shall be less than 0 4 µs
c	Decay time	The decay time shall be less than 0 4 µs
d	Duration	The pulse duration shall be variable from 2 µs to 220 µs in 1-µs increments by KM control for up to 1000 PRF For PRF above 1000, an error message shall be displayed if suppression pulse is required to be counted down or limited in duration or amplitude or not to be generated
e	Timing	The suppression pulse shall start as specified in 3 6.3.2
f	Impedance (of load)	75 ohms in parallel with 1100 µµf

3 6 15 Jamming replies. The equipment shall have the capability to simulate Mode 4 jamming by adding from 0 to 5-KM selected Mode 4 reply signals to a normal three-pulse Mode 4 reply.

3.6.15 1 Timing. The jamming replies and the Mode 4 reply shall occur within a time period consisting of 16 consecutive time slots spaced in 4.0 µs intervals with Mode 4 reply positioned in the sixteenth time slot regardless of the number of jamming replies selected

3.6.15.2 Jamming cycle The jamming pattern specified in TABLE I shall be repeated every fourth PRF cycle Other suitable patterns and cycles may be used with the permission of the procuring acitivity

3 6.16 Measurement section The measurement section shall permit the measurement of pulsewidth, pulse spacings, PRFs, frequency of continuous wave (CW) clock signals, frequency of ultra high frequency (UHF) pulses and CW signals, bandwidth of UHF receivers and preselectors, bandwidth of 60 MHz intermediate frequency (IF) amplifiers and the peak power of CW signals and UHF pulses. All measurements and outputs from the equipment shall be done in as short a time as practicable.

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TABLE I. Jamming patterns.

Number of selected jamming signals	1			2			3			4			5			
Time slots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PRF 1	X1/			X			X			X			X			02/
PRF 2		X			X			X			X			X		0
PRF 3			X			X			X			X			X	0

1/ Denotes jamming signal

2/ Denotes three-pulse Mode 4 reply

3.6.16.1 Display. The KM display shall be the readout for the measurements specified in 3.6.16. The units shall be automatically generated to indicate the unit of measure (that is, voltage-standing-wave-ratio (VSWR), μs, Hz, MHz, dBm, and so forth). Decimal points shall be automatically selected for correct display of the measurement. The display shall be latched to a completed count condition and updated after each new count is completed

3.6.16.2 Function select switch. A multi-position KM switch shall be provided to select the types of measurements specified in a through e

a. Pulse spacing and pulsewidth
b. High frequency (HF)
c. Bandwidth
d. Power
e. VSWR

3.6.16.3 Spacing. When the KM function selector switch is in the spacing position P1 to Px, the first pulse entering the RF IN-OUT jack after the Zero trigger shall be P1. The time between any of the selected pulses leading edges shall be measured and sent to the display automatically upon selection of that function. The pulsewidth checks shall measure the pulsewidth at the half amplitude points of the selected pulse as measured with a square law detector.

3.6.16.3.1 Pulsewidth and pulse spacing counter. The start pulse shall initiate the counting action and the stop pulse shall end the counting. The display shall indicate the time between the start and stop pulses. Counting shall occur at a clock rate of at least 40 MHz with an accuracy of ±1 count or ±0.025 μs, whichever is greater. The counter frequency shall be crystal-controlled and require no alignment. The display value shall be updated no faster than two times per second

3.6.16.3.2 Display. At least five digits of the numerical display shall be activated with a decimal point illuminated between the proper digits. Only the indicator legend μs shall be displayed

3.6.16.4 PRF-jack. When a signal is present on the front panel PRF-jack, the PRF of the incoming signal shall be measured. The counter range shall be at least 999,999 pps, each pulse having a minimum width of 0.3 μs and a minimum spacing of 1.0 μs. The counter shall not measure PRI. The counter display shall be as specified in 3.7.17.3 and shall be updated every one half second to 5 seconds. The counter accuracy shall be ±1 count or ±0.01 percent, whichever is greater. The range of the signals measured shall be as specified in a through c.

a.	Polarity	Positive
b.	Amplitude.	2 V to 30 V
c.	Rise time and fall time	Less than 0.15 μs

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3.6.16.5 HF. When the KM function selector switch is in the HF position, the frequency of external pulses and CW signals applied to RF I/O jacks shall be measured. The accuracy shall be ±10 kilohertz (kHz) or ±0.02 percent, whichever is greater.

3.6.16.5.1 Counter. The counter shall measure frequencies on the MAIN and AUX RF I/O jacks from 960 MHz to 1200 MHz at power levels from 25 W or less CW or to 75 W CW, and from 25 W or less pulsed to 10 kilowatts (kW) pulsed. The counter shall measure frequencies on the low power input jack from 12 MHz to 1200 MHz at power levels from 10 milliwatts (mW) CW and 10 mW pulsed to the lower limits of the MAIN and AUX jacks. The minimum pulsewidth for pulsed signal measurements shall be 0.35 µs above 55 MHz and 1.0 µs for 55 MHz and below. Signals of up to 15 kW at 0.5 percent duty cycle or 75 W CW shall not damage the equipment if applied to the MAIN or AUX RF I/O jacks. The appropriate range shall be printed by each of the appropriate jacks. The impedance of the MAIN and AUX RF I/O jacks and the low power input jack shall be 50 ohms, and the VSWR shall be less than 1.5:1. The counter shall display an input out of the range signal to the display when required, and at least five digits of the frequency display shall be given.

3.6.16.5.2 Display. The proper digits of the display shall be activated with a decimal point illuminated between the proper digits and only the unit legend MHz shall be displayed. At least two digits shall be displayed to the right of the decimal point.

3.6.16.6 Power (PWR) measurement. Whe the KM function selector switch is in the PWR position, the equipment shall be capable of measuring the peak power of CW or pulsed RF signals applied to the MAIN, AUX, or low power RF IN jack. The signal to be measured shall be selected by the KM demodulator select switch and readout to the display (see 3.6.16.6.1). For pulsed RF signals, any single pulse of a pulse train shall be capable of being selected for the power measurement either by number or delay. Power measurement of CW signals may be selected by using the 0 pulse or by a separate CW selection. During automatic testing, the first pulse shall be used for power measurements. The range of signals measured shall be as specified in 3.6.16.5.1. The accuracy shall be ±0.5 decibel (dB).

3.6.16.6.1 Display. At least three digits of the display shall be activated. A decimal point between the proper digits shall be illuminated and only the indicator legend dBm shall be illuminated.

3.6.16.7 UHF bandwidth measurement. When the KM function selector switch is in the BANDWIDTH position, the selected RF generator (1090 MHz - INTR TEST or 1030 MHz - XPDR TEST) shall be swept from at least -20 MHz to at least +20 MHz about the center frequency with a ±2-MHz tolerance (see 3.6.17.1.2 and 3.6.17.1.4). The swept signal shall be in synchronism with the Zero trigger and timed such that the Zero trigger may be used as a trigger for viewing the swept output. A 4 ±1.5 V strobe shall be generated and supplied to a front panel output jack. The position of the strobe on the trace shall represent the frequency of the sweep at the point for the ranges and accuracies specified in a through f.

	Frequency range	Accuracy
a.	1010.0 MHz to 1024.9 MHz	±0.5 MHz
b	1025.0 MHz to 1035.0 MHz	±0.2 MHz
c	1035.1 MHz to 1050.0 MHz	±0.5 MHz
d.	1070.0 MHz to 1084.9 MHz	±0.5 MHz
e.	1085.0 MHz to 1095.0 MHz	±0.2 MHz
f	1095.1 MHz to 1110.0 MHz	±0.5 MHz

The sweep frequency is not required to be less than 120 Hz or greater than 450 Hz.

3.6.16.7.1 IF bandwidth measurement. The equipment shall have a KM selection for a 60-MHz swept frequency front panel output. The swept frequency shall be from at least 40 MHz to 80 MHz and shall be variable from -30 decibels referred to one milliwatt (dBm) to -90 dBm. This signal may be applied to a separate front panel jack.

3.6.16.7.2 Counter. The counter shall count the frequency of the RF sweep at the point of the strobe.

3.6.16.7.3 Display. At least five digits of the numerical display shall be activated with a decimal point illuminated between the proper digits. Only the indicator legend MHz shall be illuminated.

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3.6.16.7.4 Alternate UHF bandwidth and frequency measurement. Any alternate method of UHF bandwidth measurement and frequency measurement may be selected subject to the approval of the procuring activity.

3.6.16.8 VSWR measurement. When the KM function selector switch is in the VSWR position the RF IN-OUT shall be passed to a VSWR OUT jack. The VSWR OUT will then go to an antenna. The incident and reflected values shall be measured and the VSWR computed. The accuracy shall be as specified in a through e and shall be fed to the readout for frequencies from 1010 MHz to 1110 MHz.

VSWR	Accuracy (percent)
a. From 1.0 to 1.2	±10
b. From 1.2 to 1.8	±5
c. From 1.8 to 2.5	±10
d. From 2.5 to 5.0	±25
e. Greater than 5.0	An indication of at least 5.0

At least three digits of the readout shall be displayed, with the decimal point in the proper position. The VSWR indicator shall also be activated. The VSWR section shall not be damaged by power levels specified in 3.6.16.5.1. The VSWR OUT jack shall be as specified in 3.6.17.2.2. The equipment shall measure the VSWR for pulsed RF signals over the power range of 100 W to 10 kW. Alternate methods of VSWR measurement may be acceptable subject to the approval of the procuring activity. Provisions shall be made to measure the VSWR of the transponder.

3.6.17 RF section. The RF section shall contain two signal generators, a dual modulator, directional couplers, attenuators, detectors, mixers, and coaxial switches to permit the generation and measurement of RF signals. It shall be possible to turn off all internal 1090 MHz and 1030 MHz oscillators by KM control.

3.6.17.1 Signal generators. The equipment shall provide the fixed frequency and swept frequency RF output signals specified in 3.6.17.1.1 through 3.6.17.1.6, each of which is selectable by a KM frequency select switch.

3.6.17.1.1 Fixed 1030-MHz frequency. The equipment shall provide a crystal-controlled (phased locked loop) 1030-MHz output signal with an accuracy of ±0.01 percent. This frequency shall be selected by setting the KM frequency select switch to the 1030 MHz XPDR TEST position.

3.6.17.1.2 Swept 1030-MHz frequency. The equipment shall provide a swept RF output signal over the range of 1010 MHz to 1050 MHz. This mode shall be selected by setting the KM frequency select switch to the 1030-MHz XPDR TEST position and the measurement function switch to the BANDWIDTH position.

3.6.17.1.3 Fixed 1090-MHz frequency. The equipment shall provide a crystal-controlled (phase locked loop) 1090-MHz output signal with an accuracy of ±0.01 percent. This frequency shall be selected by setting the KM frequency select switch to the 1090-MHz INTR TEST position.

3.6.17.1.4 Swept 1090-MHz frequency. The equipment shall provide a swept RF output signal over the range of 1070-MHz to 1110-MHz. This mode shall be selected by setting the KM frequency select switch to the 1090-MHz INTR TEST position and the measurement function switch to the BANDWIDTH position.

3.6.17.1.5 1030-MHz CW frequency. The equipment shall provide a crystal-controlled CW 1030-MHz output signal, with an accuracy of ±0.01 percent, to a separate front panel TNC jack.

3.6.17.1.6 Fixed alternate frequency. The equipment shall provide an alternate KM selectable fixed frequency output from 1010 MHz to 1110 MHz selectable in increments of 1 MHz or less. The accuracy for this mode shall be plus or minus one increment or ±0.5 MHz, whichever is greater.

3.6.17.1.7 Spurious RF outputs. The equipment shall have no spurious RF outputs higher than 70 dB below the primary output frequency or -110 dBm, whichever is greater.

3.6.17.2 RF power outputs. The equipment shall provide power outputs, controllable by digital attenuators or other means, subject to the approval of the procuring activity, as specified in 3.6.17.2.1 through 3.6.17.2.4.

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3.6.17.2.1 MAIN RF power OUT. The RF output level at the MAIN RF I/O jack shall be adjustable over the range of 0 dBm to -95 dBm, by the KM controlled MAIN attenuator in 1-dBm increments, when matched to a load of 50 ohms. The jack shall be as specified in 3.6.17.2.2.

3.6.17.2.1.1 Accuracy. For fixed frequency operation (see 3.6.17.1.1 and 3.6.17.1.3) the output level shall be accurate to within ±1.0 dB of the attenuator setting. For swept frequency operation (see 3.6.17.1.2 and 3.6.17.1.4) the output level at the center of the frequency sweep shall be within ±0.5 dB of the fixed frequency level and the output level over the sweep bandwidth shall be flat within 1.0 dB peak-to-peak. For fixed alternate frequency operation (see 3.6.17.1.6), the output level shall be accurate to within ±1.0 dB of the attenuator setting for frequencies from 1010 MHz to 1050 MHz and from 1070 MHz to 1110 MHz.

3.6.17.2.2 AUX RF power OUT. The RF output level at the AUX RF I/O jack shall be adjustable over the range of 0 dBm to -95 dBm, by the KM controlled AUX attenuator in 1-dBm increments, when matched to a load of 50 ohms. The jack shall be a Type N connector M39012/4-0001 in accordance with MIL-C-39012/4 and shall be mounted on the front panel. Alternate front panel connector finish and materials may be used subject to the approval of the procuring activity.

3.6.17.2.2.1 AUX attenuator. The AUX attenuator shall be independent of the MAIN attenuator selectable via a KM switch.

3.6.17.2.2.2 Accuracy. For fixed frequency operation (see 3.6.17.1.1 and 3.6.17.1.3) the output level shall be accurate to within ±1.0 dB of the attenuator setting. For swept frequency operation (see 3.6.17.1.2 and 3.6.17.1.4) the output level at the center of the frequency sweep shall be within ±0.5 dB of the fixed frequency level and the output level over the sweep bandwidth shall be flat within 1.0 dB peak-to-peak. For fixed alternate frequency operation (see 3.6.17.1.6), the output level shall be accurate to within ±1 dB of the attenuator setting for frequencies from 1010 MHz to 1050 MHz and from 1070 MHz to 1110 MHz.

3.6.17.2.3 CW 1030-MHz power out. The power out level at the 1030-MHz CW jack shall be +15 dBm ±2 dB.

3.6.17.2.4 Combined RF output levels. A KM switch shall be provided to combine internally the MAIN RF output (see 3.6.17.2.1) and the AUX RF output (see 3.6.17.2.2) and provide the combined signals at the MAIN RF I/O connector. The MAIN attenuator shall control the level of the combined RF output signal from 0 dBm to -95 dBm. The AUX attenuator shall control the level at the AUX channel signals from a level equal to the MAIN channel output signals to 70 dB below the MAIN channel output if not KM selected to be independent. The minimum output signal due to any combination of attenuator settings is not required to be below -95 dBm.

3.6.17.3 Display. The bottom row of the display shall always display the attenuator settings for the MAIN and AUX RF I/O. The format shall be as follows: MAIN RF -XX AUX RF -XX I. The I following the AUX RF shall be present if the auxiliary RF output is independent and shall be blank otherwise. If any signal is present on the PRF in jack (see 3.6.16.4), the bottom row of the display shall indicate the following: PRFXXXXXX RF -XX AUX -XXI. The Xs for both formats shall be the preset settings or values for the attenuators and the PRF. The bottom row need not show this information during help menus, or at other times deemed suitable to the procuring activity. Alternate display formats shall be acceptable with the approval of the procuring activity.

3.6.17.4 Modulation. The signal generator outputs shall be capable of providing CW signals or being separately modulated with pulses as specified in 3.6.17.4.1 through 3.6.17.4.1.5.

3.6.17.4.1 Modulation selection. KM switches shall be provided to select individually the internal modulating signals for each of the equipment RF outputs. An OFF position shall be included.

3.6.17.4.1.1 Challenge pulse modulation. When the KM modulation select switch is in the CHAL position, any of the challenge signals selected (see 3.6.4) shall modulate the MAIN and AUX outputs, if KM-selected.

3.6.17.4.1.2 Reply pulse modulation. When the KM modulation select switch is in the REPLY position, any of the reply signals selected (see 3.6.5, 3.6.6, and 3.6.8.1) shall modulate the MAIN and AUX RF outputs, if KM-selected.

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3.6.17.4.1.3 GTC long modulation. When the KM modulation select switch is in the GTC long position, the MAIN and AUX outputs, if KM-selected, shall be modulated with single pulses, 0.5 ±0.1 µs wide, spaced 15 µs, 30 µs, 60 µs, 120 µs, 240 µs, and 480 µs ±5 percent from the Mode 4 GTC trigger (see 3.6.3.2e and 3.6.14) or from the P3 pulse of an SIF challenge (see 3.6.3.2a). The equipment shall automatically switch to the appropriate trigger for the mode being generated.

3.6.17.4.1.4 GTC short modulation. When the KM modulation select switch is in the GTC SHORT position, the MAIN and AUX outputs, if KM-selected, shall be modulated with single pulses, 0.5 ±0.1 µs wide, spaced 15 µs, 65 µs, 115 µs, and 165 µs ±5 percent from the Mode 4 GTC trigger (see 3.6.3.2e and 3.6.14) or from the P3 pulse of an SIF challenge (see 3.6.3.2a). The equipment shall automatically switch to the appropriate trigger for the mode being generated.

3.6.17.4.1.5 CW modulation. For all positions of the KM RF output frequency select switch (see 3.6.17.1), when the KM modulation select switch is in the CW position, the MAIN and AUX RF outputs, if KM-selected, shall be CW signals.

3.6.17.4.2 External modulation. For all positions of the KM RF output frequency select switch (see 3.6.17.1) and all positions of the KM modulation select switch (see 3.6.17.4.1), the equipment shall be capable of being modulated by external signals. Separate front panel jacks shall be provided to accept modulation signals for the MAIN and AUX modulators. The modulation input signal shall be less than 0.5 V for the fully OFF condition and 1.0 V to 30 V for the fully ON condition. The input impedance shall be 1000 ohms ±10 percent. The equipment shall not be damaged by modulation signals up to 30 VDC. The minimum pulsewidth for external modulation shall be greater than 0.275 µs.

3.6.17.4.3 Delay. The delay between the modulator pulse applied to the signal generator and the signal generator output pulse shall not exceed 0.3 µs.

3.6.17.4.4 Modulation fidelity. When modulated by pulses in 3.6.4.5.2, 3.6.5.3.2, 3.6.6.5.2, and 3.6.17.4.2, the RF signal shall have the characteristics specified in a through e:

a. Rise time 0.05 µs to 0.1 µs
b. Decay time 0.05 µs to 0.15 µs
c. Pulse train amplitude variations shall be less than 2 percent of the average maximum amplitude
d. The change in pulsewidth (modulator input versus RF output) shall be less than ±0.025 µs as measured at the 0.8 ±0.2 V level of the external modulation.
e. The change in pulse spacing (due to changes of pulsewidth) shall be less than 0.01 µs with two 0.5 µs pulses, spaced 1.45 µs apart, as reference.

3.6.17.4.5 Modulation ON-OFF ratio. When pulse modulation is selected, the equipment modulators shall have an ON-to-OFF ratio, as measured at either RF I/O jack, of 80 dB or greater with an attenuator setting of any value between 0 dBm and -35 dBm. Between attenuator settings of -35 dBm and -95 dBm, the ON-to-OFF ratio shall be allowed to degrade linearly to no less than 20 dB as the attenuator setting approaches and reaches -95 dBm.

3.6.17.5 Demodulation. The demodulation section shall contain attenuators, couplers, detectors, amplifiers, and a frequency probe circuit to permit measurement of pulse fidelity, RF power, RF frequency, and PRF characteristics of UHF signals. Either demodulated internal signals or video signals used to modulate the test set shall be furnished to the pulsewidth and pulse spacing measurement section along with demodulated external signals.

3.6.17.5.1 Demodulation selection. A KM switch shall be provided to select one of the equipment RF inputs for demodulation over the range of 960 MHz to 1200 MHz. An OFF position shall be included. The demodulated output shall also be available at the mixed video output (see 3.6.9).

3.6.17.5.1.1 Main RF input. When the KM DEMOD SEL switch is in the MAIN position, the equipment shall demodulate RF inputs of +40 dBm to +70 dBm applied to the front panel MAIN RF IN-OUT connector and produce a video signal of at least 1.0-V amplitude to be supplied to a front panel jack.

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3 6.17.5.1.2 AUX RF input. When the KM DEMOD SEL switch is in the AUX position, the equipment shall demodulate RF inputs of +40 dBm to +70 dBm applied to the front panel AUX RF I/O connector and produce a video signal of at least 1.0-V amplitude to be supplied to a front panel jack.

3.6.17.5.1.3 Low power RF input. When the KM DEMOD SEL switch is in the LOW PWR position, the equipment shall demodulate RF inputs of -10 dBm to +20 dBm applied to the front panel LOW PWR RF INPUT connector (Type TNC) and produce a video signal of at least 1.0-V amplitude that shall be supplied to a front panel jack

3.6 17.5.1 4 Input VSWR. The VSWR presented to any UUT connected to any of the RF I/O connectors shall be no greater than 1.2 1

3.6.17.5.2 Pulse fidelity. The distortion in the demodulated video output pulse rise time, fall time, and width, compared to the output of a properly terminated square law detector shall not deviate by more than ±0 02 µs or ±2 5 percent, whichever tolerance is greater, over the frequency ranges of 1000 MHz to 1100 MHz.

3 6.17.6 Back-to-back measurement capability. The equipment shall be provided with a separate RF signal path with an attenuator of 92 ±4 dB between the MAIN RF I/O connector and another connector at the frequencies of 1030 MHz and 1090 MHz.

3.6.18 Oscilloscope section. The oscilloscope shall be a Tektronix 2445, or equivalent, mounted in the equipment The oscilloscope shall use the original manufacturer's case in the mounting, or shall be provided with a suitable transportation case as part of the mounting.

3.6.19 Microprocessor or microcontroller control The equipment shall have a microprocessor or microcontroller under firmware control, controlling the major areas specified in a through c

a Operator interface and front panel control (see 3.6 19 1)
b Automatic test and evaluation for the IFF equipments specified in 1 and 2 (see 3 6 19 2)
1 Interrogators
2 Transponders
c. EIA RS-232C interface and IEEE STD-488 interface testing, both of the test set and with the test set (see 3.6.19.3).

The microprocessor or microcontroller selected shall be subject to the approval of the procuring activity. The microprocessor or microcontroller shall have an external reset on the front panel. The electronic ICs used in the equipment shall be second-sourced The firmware shall provide extensive operator prompting via menu-type displays, flexible syntax entries, and so forth. The firmware shall control the keys for entry of switch and variable setting data The operator shall not require any programming knowledge to use the equipment, and entries shall be made with as few keystrokes as possible It shall be acceptable for the firmware to print questions and ask the operator to enter YES/NO (Y/N) or a number (1/2) as a response It shall require less than 1 hour of training to understand how to select any and all switches and variable settings All menu type displays and operator prompts shall be subject to the approval of the procuring activity.

3.6.19.1 Access to variable settings and switches. Certain variable settings and switches shall be accessible only via the computer by utilizing an alphanumeric or other display and keypad. The display entry mode and the switches and potentiometers that may not be thus controlled are subject to the approval of the procuring activity.

3 6 19.1.1 Test selection Upon initial equipment turn on, the display shall offer a selection between interrogator, transponder and manual entry of switch positions and variables The equipment shall prompt the operator by instructing him to select the test he desires by entering the appropriate number The test set shall offer a selection between interrogator manual, transponder manual, and automatic testing. In the automatic mode, the unit shall do the automatic test as specified in 3.6 19.2. The test set shall offer four save files which can save the entire status of the test set and restore the selected status at a later time

3.6.19.1.2 Cable hookup prompting. The interrogator and transponder manual modes shall be optimized so that few operational parameters shall need changing during the respective tests for the equipment. The test set shall provide prompting for cable hookup, when required, for the tests specified in a through h.

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a. RF power
b. VSWR
c. RF frequency
d. Pulsewidths
e. Pulse spacing
f. RF bandwidths
g. Generating interrogations
h. Generating replies

3.6 19 1.2.1 Data entry. During the manual portions, it shall be possible to return to the last frame displayed to change any parameter or advance to the next frame to change a parameter. No operating parameters shall change with the advancing or returning frames. The equipment shall provide blinking characters or underlined characters for all data entries, thus clearly specifying what is being entered. The equipment shall display and allow one to vary and set the value of each variable parameter and switch under KM control during the manual portions of data entry. These KM entries and display values shall have an accuracy of *1 incremental change compared to the actual output.

3.6.19.1.2.2 Help menus. The equipment shall contain helpful messages or menus. The help menus shall be subject to the approval of the procuring activity.

3.6.19.1.3 Display. The display unit shall consist of at least 190 alphanumeric characters (ANC) Each shall be capable of displaying the entire alphabet as well as the numbers 0 to 9 Each ANC shall be at least 0 15 in high. The intensity of the display shall be adjustable by the operator or by automatic means. The intensity control shall be subject to the approval of the procuring activity. If the display utilizes random access memory (RAM), no limitation shall be caused by the RAM for remote using of the display (see also 3.6.19.3).

3.6.19 1 4 Keypad The keypad shall consist of the numbers 0 to 9, a decimal point, if required, a clear entry, a reset, and an entry as a minimum. The entries shall be in logical units, that is, dBm, µs, millisecond (ms), V, and so forth. No lookup tables shall be required for data entry The keypad shall have a two-key lockout feature The equipment shall inhibit any entry which shall cause damage to its circuitry, that is, PRF too high and so forth. Erroneous entries shall not destroy any other entry. The format of the data displayed shall be clear. Common AIMS MK XII abbreviations shall be allowed. During BITE and automatic equipment testing a NEXT ERROR field shall be displayed with a number beside it, which, if an error shows up, shall allow the operator to record it and resume testing from that point. This number shall be displayed for approximately 5 seconds. The test equipment shall continue the test sequence starting with the next test to be performed. The keypad shall allow for continuous incrementing and decrementing of any entry from its present value by depressing and holding certain keys down The rate of incrementing and decrementing shall be nonlinear with approximately five counts for the first second, 20 counts for the second second, and 50 counts for all additional seconds The RF attenuators shall be exempt from the nonlinear rate and shall operate with one increment each time the switch is depressed.

3 6 19 2 Automatic testing The equipment shall contain all circuitry required to test the IFF equipment specified in a through m

Interrogators	Transponders
a AN/APX-76 System	h. AN/APX-64
b. AN/APX-103	i. AN/APX-100
c. AN/TPX-54	j. AN/APX-101
d. AN/UPX-23	k. KY-532/ASQ
e. AN/UPX-27	l. KY-533/ASQ
f RT-868( )/APX-76	m. RT-859( )/APX-72
g. RT-988( )/APX-76	

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The equipment shall have a KM switch to select the AUTO TEST function. When AUTO TEST is selected, the equipment shall load the AUTO TEST software from programmable read only memories (PROMs) in the interface cable assembly (see 3.6.19.2.2), and begin execution of the software immediately. The AUTO TEST shall allow selection of any of the modes specified in n through s:

n. Loop on test
o Loop on error
p. Continue on error
q Pause on error
r. Stop on error
s. Single step test

Alternate modes of AUTO testing may be allowed subject to the approval of the procuring activity.

3.6.19.2.1 Interface signals. All signals required to perform the AUTO TEST functions shall be available through the auto test connector on the front panel or from the MAIN and AUX RF ports.

3.6.19.2.1.1 Interface signals for the interrogator systems. The equipment I/O signals specified in a through h shall be supplied for interface to the interrogator systems by the equipments AUTO TEST front panel jack

a. System triggers
b. Mode enable line inputs
c. Suppression signals
d. Video I/O signals
e MODE TAG signals
f. KIR interface signals
g. Ground
h Seven spare lines for interrogator system

Ribbon, woven, or other suitble cables may be used to connect the interface boards to the test set.

3.6.19.2 1 1.1 Input impedance and AC coupling (interrogators) No line except the RF I/O, the SIF pretrigger line, and any enabled mode line shall see an input impedance of less than 10 kilohms looking into the test set. Items a and c through f of 3.6.19.2.1 1 shall be AC-coupled inputs All interfaces shall be capable of up to ±30 VDC levels No interface circuitry shall be subject to damage due to normal operation of either interrogator set

3.6.19.2 1.2 Interface signals for the transponder systems The equipment I/O signals specified in a through f shall be required for interface to the transponder systems by the equipment jacks·

a Suppression signals
b. KIT interface signals
c. Control signals
d Mode codes
e Ground
f. At least seven spare lines for transponder systems

A ribbon, woven, or other suitable cable may be used to connect the interface board to the test set The equipment RF I/O jack shall be connected to the transponder antenna jack for transponder tests

3.6.19 2.1.2.1 Input impedance (transponder). No signal line, except the RF I/O line and the control lines, shall see an input impedance of less than 10 kilohms or more than 1100 picofarads looking into the test set All interfaces shall be capable of up to ±30 VDC levels. No interface circuitry shall be subject to damage due to normal operation of the transponder system

3.6 19.2.2 Interface cable assembly Each UUT shall have a unique interface cable assembly for automatic testing The assembly shall consist of a small interface board with a cable and connector to mate with the AUTO TEST connector on the front panel of the equipment, and the cables and connectors required to connect with the UUT to be tested A switched power input jack shall be located on the interface devices to provide primary power to the UUT The interface board shall have the PROM containing the AUTO TEST software for the associated UUT. Active circuitry shall be allowed in the interface devices if the first auto test sequence performs a test of the interface circuitry. Each cable assembly shall require the approval of the procuring activity.

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3.6.19.2.2.1 Performance of AN/UPX-27 or AN/UPX-23 tests. A single interface cable assembly shall adapt to and test both of these UUTs, the AN/UPX-27 or AN/UPX-23 interrogator. When KM selected, the AN/UPX-27 or AN/UPX-23 tests shall be performed in the manner specified in a through bb. Any deviation from these tests shall be subject to the approval of the procuring activity.

a The internal 0 trigger shall be applied to SIF in pretrigger line The equipment shall detect any measurable RF power from the interrogator as an error condition.

b. Mode 1, Mode 2, Mode 3/A, Mode C, and Mode 4 shall be enabled.

c The equipment shall measure the center frequency of the RF transmission which will be 1030 ±1 MHz

d The equipment shall display the level of RF power for each mode enabled in b. The equipment shall declare any power level below 400 W an error and shall then disable all modes, except Mode C.

e. The equipment shall verify a suppression gate output of at least 5 V.

f. The equipment shall verify pulse spacing of 21 ±0.15 µs on the RF transmission from P1 to P3.

g The equipment shall verify the P1 to P3 spacing on the MODE TAG A line to be 21 ±0.15 µs.

h The equipment shall verify the MODE TAG A and B amplitudes to be 2 V ±0.5 V.

i. The equipment shall disable Mode C and enable Mode 1.

j. The equipment shall verify RF transmission P1 to P2 spacing of 2 ±0.1 µs.

k The equipment shall verify RF transmission P1 pulsewidth of 0.8 ±0.1 µs.

l The equipment shall verify RF transmission P2 pulsewidth of 0.8 ±0.1 µs.

m The equipment shall verify RF transmission P3 pulsewidth of 0.8 ±0.1 µs.

n The equipment shall measure the time between the leading edge of RF transmission P1 and the ISLS trigger This value will be 1.6 ±0.2 µs.

o The equipment shall allow SIF coder to answer the interrogations now. The digital attenuators shall be set such that the SIF reply signal strength is -75 dBm. The equipment shall detect the SIF 1 reply on the receiver video output.

p. The equipment shall detect the SIF 1 code reply on the defruiter output to the interrogator.

q The equipment shall detect 2 ±0.5-V output on the composite video A and B lines.

r The equipment shall enable Mode 4 override and disable the SIF 1 code and enable the three-pulse M4 code output. The equipment shall detect the Mode 4 enable to KIR after a suitable (1 ms) delay.

s. The equipment shall verify that at least a 2-V Mode 4 trigger is sent from the interrogator.

t. The equipment shall verify that at least a 2-V Mode 4 modulation is sent from the KIR to the interrogator.

u. The equipment shall verify Mode 4 RF transmission P1 to P4 pulse spacing of 6 ±0.1 µs and P1 pulsewidth of 0.5 ±0.1 µs.

v The equipment shall verify Mode 4 video to the KIR of at least 2 V.

w The equipment shall verify Mode 4 video to the interrogator of at least 2 V.

x The equipment shall verify proper GTC operation.

y The equipment shall verify composite video 2 ±0.5 V.

z. The equipment shall decrease the Mode 4 reply signal strength in 1-dB increments until the composite video output occurs only 90 percent of the time. The value of the Mode 4 signal in dBm shall be displayed along with the legend RECVR SENS.

aa. The equipment shall disable all modes and RF output.

bb Should all these tests pass, the equipment shall halt and display a unique code for all tests passed.

3.6.19.2.2.2 Performance of RT-868( )/APX-76 tests. Automatic tests on the RT-868( )/APX-76 shall be performed as specified in a through t. Any deviation from the procedure specified in a through t shall be subject to the approval of the procuring activity.

a. The AN/APX-76 SUM Antenna shall be connected to the MAIN RF I/O jack, and the AN/APX-76 DIFF Antenna shall be connected to the AUX RF I/O jack.

b. With no signals applied, the equipment shall detect any RF power level above 50 W from the interrogator as an error condition.

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c. Mode 1, Mode 2, Mode 3A, and Mode 4 shall be enabled by applying the appropriate mode trigger, and the associated GTC trigger to the UUT Mode 4 shall be enabled with Mode 4, Word C.

d. The equipment shall display the level of RF power for each mode enabled in c. The equipment shall declare any power level below 800 W an error and shall then disable all modes except Mode 3A.

e. The equipment shall measure the center frequency of the RF transmission which shall be 1030 ±0.5 MHz.

f The equipment shall verify pulse spacing of 8 ±0.15 µs from P1 to P3 of the RF transmission.

g The equipment shall disable Mode 3/A and enable Mode 1

h The equipment shall verify RF transmission P1 to P2 spacing of 2 ±0.1 µs and P1 to P3 spacing of 3 ±0.1 µs.

i The equipment shall verify RF transmission P1, P2, and P3 pulsewidth of 0.8 ±0.1 µs.

j The equipment shall verify a transponder blanking output gate of 20 ±5 V amplitude and duration of 100 ±10 µs.

k. The equipment shall enable the SIF coder to answer the interrogations on the SUM Antenna now The digital attenuators shall be set such that the SIF reply signal strength is -67 dBm. The equipment shall verify the SIF 1 reply on the receiver video output This output shall have an amplitude of 5 ±1 V and a duration of 0.45 ±0.1 µs.

l The equipment shall disable all interrogation triggers and apply a three-pulse Mode 4 reply RF signal to SUM Antenna of UUT at a -67-dBm level.

m. The equipment shall verify a Mode 4 video output pulse with amplitude of 3 25 ±1.75 V and a duration of 0.5 ±0.1 µs.

n The equipment shall decrease the Mode 4 reply signal strength in 1-dBm increments until the Mode 4 video output pulse occurs only 90 percent of the time The value of the Mode 4 reply signal in dBm shall be displayed along with the legend minimum trigger level (MTL).

o The equipment shall apply the Mode 4 RF reply to the SUM Antenna at a level of -67 dBm and to the DIFF Antenna at a level of -72 dBm and verify that the Mode 4 video output pulse occurs no more than 10 percent of the time.

p The equipment shall change the level of RF signal to DIFF Antenna to -80 dBm and verify that the Mode 4 video output pulse occurs at least 90 percent of the time

q The equipment shall apply the Mode 4 RF reply to the SUM Antenna at a level of -47 dBm and to the DIFF Antenna at a level of -52 dBm and verify that the Mode 4 video output pulse occurs no more than 10 percent of the time.

r The equipment shall change the level of RF signal to the DIFF Antenna to -60 dBm and verify that the Mode 4 video output pulse occurs at least 90 percent of the time

s A GTC check to verify proper GTC operation should be included.

t Should all these tests pass, the equipment shall halt and display a unique code for all tests passed

3.6.19.2.2.3 Performance of RT-859( )/APX-72 transponder tests The transponder tests shall be performed as specified in a through t. Any deviation from the procedure specified in a through t shall be subject to the approval of the procuring activity

a The equipment shall test the 28-VDC power line which will be 28 ±3 VDC

b The equipment shall detect any measurable RF power level from the transponder as an error condition

c The equipment shall generate -74 dBm Mode 1, Mode 2, Mode 3/A, Mode 4 Word A, and Mode C interrogations and apply them to the MAIN RF I/O jack.

d The equipment shall measure the RF reply frequency which will be 1090 ±2 MHz

e The equipment shall verify reply codes of all 0s and 7s for Mode 1, Mode 3/A, and Mode C, then decode and display the Mode 2 reply code The equipment shall then verify proper emergency and IP operation.

f The equipment shall measure the power of the RF reply and display its values for each mode selected in c. Any measured power below 54 dBm shall be considered an error. The equipment shall then disable all interrogations except Mode C interrogations, and enable a -84 dBm ISLS pulse and apply this pulse to the MAIN RF I/O jack

g The equipment shall verify at least a 5-V suppression gate output

h. The equipment shall measure the F1 to F2 spacing which will be 20.3 ±0.1 µs.

i. The equipment shall measure the F1 pulsewidth which will be 0.45 ±0.10 µs

j The equipment shall measure the MTL (90 percent replies) of the transponder and display this value.

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k. The equipment shall disable the Mode C challenge and enable the -71 dBm Mode 4 Word A challenge and the -71 dBm ISLS P5 to the MAIN RF I/O jack.
l. The equipment shall verify at least a 2-V Mode 4 enable trigger out to the KIT.
m. The equipment shall verify at least 2-V Mode 4 challenge video out.
n. The equipment shall verify at least a 2-V Mode 4 disparity bit in.
o The equipment shall change the level of the ISLS pulse to -81 dBm.
p. The equipment shall verify at least a 2-V Mode 4 reply in.
q The equipment shall disable the ISLS pulse and enable the A/B disparity
r. The equipment shall verify at least a 2-V Mode 4 disparity bit in.
s. The equipment shall enable Mode 4 Word B and disparity and verify at least a 2-V Mode 4 disparity bit in
t. The equipment shall display a unique code for all tests passed.

3.6.19.2.2.4 Performance of the AX/APX-100 transponder tests. A single interface cable shall adapt to and test both the RT-1156/APX-100 and the RT-1157/APX-100 transponders The transponder tests shall be performed as specified herein. The equipment shall prompt the user to hook the MAIN RF I/O jack to the BOTTOM antenna port and the AUX RF I/O jack to the TOP antenna port. The equipment shall run tests 3.6.19.2.2.3a through 3.6.19.2.2.3s followed by the tests specified in a, b, and c herein. Any deviation from this procedure shall be subject to the approval of the procuring activity.

a The equipment shall generate a -29 dBm Mode 4 Word A interrogation on the MAIN RF I/O jack. The equipment shall generate a -34 dBm Mode 4 Word A interrogation on the AUX RF I/O jack simultaneously. The equipment shall detect a Mode 4 reply of at least 200 W on the MAIN RF I/O jack. The equipment shall display the legend

Interrogation	Reply
MAIN RF -29 AUX RF -34 (or an equivalent legend)	(value detected) dBm

for 5 seconds if this test passes The equipment shall then generate a -49 dBm Mode 4, Word A challenge on the AUX RF I/O and a -54 dBm Mode 4 Word A interrogation on the MAIN RF I/O jack simultaneously. The equipment shall detect replies of at least 200 W on the AUX RF I/O jack. The equipment shall display the legend:

Interrogation	Reply
MAIN RF -54 AUX RF -49 (or an equivalent legend)	(value detected) dBm

for 5 seconds if these tests pass.

b. The equipment shall generate a -74 dBm Mode 4 Word A interrogation on the AUX RF I/O and a -79 dBm Mode 4 Word A interrogation on the MAIN RF I/O simultaneously. The equipment shall detect replies of at least 200 I/O on the AUX RF I/O jack. The equipment shall display the legend

Interrogation	Reply
MAIN RF -79 AUX RF -74 (or an equivalent legend)	(value detected) dBm

for 5 seconds if these tests pass.

c The equipment shall display a unique code for all tests passed. For all transponder tests, except b, any detected RF transmission from the transponder below 200 W shall display the level of the RF power along with an error indication.

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3.6.19.2.2.5 Performance of the AN/APX-101 transponder tests. The equipment shall perform the tests specified in 3.6.19.2.2.4, including the prompts and display summaries. Any deviation from the tests specified in 3.6.19.2.2.4 shall be subject to the approval of the procuring activity.

3.6.19.2 2.6 Performance of the KY-532/ASQ transponder tests. The transponder tests shall be performed as specified in 3.6.19.2.2.3a through t. Any deviation from this procedure shall be subject to the approval of the procuring activity.

3 6.19.3 Remote interface. The equipment shall have an EIA RS-232C and IEEE STD-488 interface, both of which are capable of having the microprocessor select an address to a multiplexer or microcontroller which has as its inputs

a. Outputs from all circuits containing internal adjustment voltages
b Power supply voltages
c. Outputs to the external jacks (or at the option of the procuring activity, the unbuffered outputs to the jacks). All front panel variable settings and switches shall be under the control of the interface. These requirements do not apply to the oscilloscope portion. The microprocessor shall specify the multiplex address analog, buffered analog, and buffer value, or digital type of outputs, and the addresses, and selection scheme of each switch and variable setting. The procuring activity shall be informed of this information. The equipment shall have two front panel outputs from its internal multiplexer, a digital output, and an analog output. Both jacks shall be Type BNC in accordance with MIL-C-39012.

3 6.19 3 1 IEEE STD-488 interface The IEEE STD-488 bus shall conform to the requirements of IEEE STD-488 The subset required shall be SH1, AH1, TE5, LE3, SR1, RL1, PP0, DC1, DT1, and C0 Internal link settings shall be provided to select any one of a through d as terminations

a End or identify (EOI)
b Carriage return (CR)
c Carriage return line feed (CRLF)
d. Line-feed Carriage return (LFCR)

The equipment shall be capable of sending to the IEEE STD-488 bus all data displayed including RF power, VSWR, frequency, pulse spacing, and pulsewidths. The IEEE STD-488 controller or the EIA RS-232C controller shall have the capability to select all the switch and variable settings that the microprocessor selects The IEEE STD-488 bus address of the equipment shall be link-selectable internally for any address from 0 to 31.

3 6 19.3.2 EIA RS-232C interface. The EIA RS-232C BAUD rates shall be KM selectable to be 110 Baud, 300 Baud, 600 Baud, 1200 Baud, 2400 Baud, 4800 Baud or 9600 Baud. The EIA RS-232C bus shall allow selection of start, stop, and parity bits, and whether the word length is 7 bits or 6 bits long The EIA RS-232C bus shall offer ANC echoing (selectable) The remote interfaces shall have the capability to send ANC, data, and control words to the test set for direct display of the ANC, data, and so forth.

3 6 19.3.3 Data outputs The equipment shall be capable of outputting all measurements and internal settings over the EIA RS-232C or IEEE STD-488 bus while in the local mode. The outputs shall be approved by the procuring activity.

3 7 Electromagnetic compatibility The equipment shall operate within the limits specified in MIL-T-28800. MIL-HDBK-241 may be used for power supply electromagnetic interference (EMI) design guidance.

3.7.1 Measurement of receiver sensitivity. The equipment shall be designed to be capable of accurately measuring the receiver sensitivity of IFF equipments to a level of -90 dBm minimum.

3.8 Human engineering The contractor shall comply with the human engineering operational and maintenance design criteria of MIL-STD-1472 and the requirements specified herein, except that equipment shall be designed for use by the 5th percentile female to the 95th percentile male Modification of MIL-STD-1472 data for the 5th percentile female includes size, reach, vision, and strength profiles.

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3.9 Equipment safety requirements. The equipment shall be designed in accordance with the Safety criteria paragraph of MIL-E-16400 and the Safety paragraph of MIL-T-28800, except as specified in 3.9.1 through 3.9.11.

3.9.1 Leakage current. The leakage current of the equipment shall not exceed 5 mA.

3.9.2 Overcurrent device location. An overcurrent trip unit of the circuit breaker type shall be connected in series with each ungrounded power conductor as determined by NFPA 70-1978 for grounded source power The overcurrent device shall be connected to the load side of the power switch. Circuit breakers shall also serve as the main power switch when space is available. Circuit breakers shall provide a visible indication of status when tripped.

3.9.3 Overcurrent device selection The Circuit breakers paragraph of MIL-E-16400 shall apply. Design shall also be in accordance with MIL-STD-454, Requirement 8.

3.9.4 Power supply protection. Fault conditions ranging from open circuits to short circuits shall not cause damage to the equipment.

3.9.5 Human error design protection. Front panel control functions shall be designed so that neither incorrect adjustment nor random sequencing of functions will cause damage to the equipment.

3.9.6 Critical controls. Critical controls, the accidental activation of which may cause damage to equipment, injury to personnel, or degradation of system function, shall be designed and located so that these controls are not susceptible to being accidentally moved.

3.9.7 Printed circuit (PC) assembly protection. With power applied to the equipment, removal or insertion of PC assemblies shall not degrade the performance of the assembly or any other part of the equipment Each assembly shall be keyed to prevent incorrect insertion.

3.9.8 Support strength. Drawer slides, detents, mounting surfaces, and other attachment mechanisms which support equipment shall have a safety factor equal to twice the maximum anticipated load

3.9.9 Drawer slide security Equipment design shall include provisions to prevent accidental derailing of equipment mounted on drawer slides and accidental detachment of the equipment from the slides.

3.9.10 115 volts alternating current (VAC) equipment power connections 115 VAC power cable connections within the equipment shall have the conductor and color code assignments specified in TABLE II. Connector pin designation shall be as specified in TABLE II. Black, paired with white or brown insulation color code, shall be maintained from the equipment input connections to all components having the same voltage and frequency as the input power.

TABLE II. 115 VAC equipment power connections.

Pin designation	Conductor assignment	Insulation color code
A	115 VAC return	White or light blue
B	Safety ground	Green or green with yellow stripes
C	115 VAC high (hot)	Black or brown

3.9.11 Equipment electrical power ON-OFF switch and power indicator lamp. A switch or circuit breaker for disconnecting equipment from all electrical power systems shall be mounted on the equipment front panel and its function clearly labeled The switch or circuit breaker shall break all power conductors of the power circuit. A green or amber power indicator lamp shall be mounted near the switch to indicate when the equipment is energized. The lamp shall be connected to the load side of the switch and across the input power conductors.

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3.10 Identification plates. The equipment shall have an identification plate in accordance with MIL-P-15024 for Type A with marking in accordance with MIL-T-28800.

3.11 Software program. The software program shall reside in firmware. Read only memory (ROM) shall not be used Ultraviolet eraseable PROM and electrically alterable PROM shall be the only acceptable firmware.

3 11.1 Computer resources. Navy standard computer resources shall be used to implement system requirements. If not feasible, justification including technical analysis, life-cycle cost comparison, and potential schedule impact shall be provided to the procuring activity prior to the use of any other computer resources This includes computers, microcomputers, microprocessors, displays, peripherals, interfaces, and software

3.11 2 Resource allocation and reserves Resource allocation and reserve requirements specified in the Resource allocation and reserves paragraph of DoD-STD-1679 shall be applied to computer software and firmware development for the equipment The 20 percent reserves as specified in the Resource allocation and reserves paragraph of DoD-STD-1679 are exclusive of growth requirements.

3.11 3 Computer program generation The equipment software and firmware shall conform to the Program generation paragraph of DoD-STD-1679.

3 11 4 Computer programming standards and conventions The equipment software and firmware shall conform to the Programming standards and Programming conventions paragraphs of DoD-STD-1679 A program design language (PDL), which is subject to the approval of the Government, shall be used to specify the detailed design of the software The contractor shall use the PDL representation of the software as a design tool to permit verification of the software performance requirements The PDL is not required to be executable or compilable The use of the precompiler PDL is permitted after conformance to the requirements of a through c

a The precompiler produces compiler statements conforming to the structured programming concept

b The precompiler produces compiler statements that need no further modifications before being compiled by the target compiler.

c The precompiler is available to the Government as a deliverable item to be delivered as part of the program package.

Exceptions to a through c shall be requested in writing and approved by the procuring activity.

3.12 Reliability The equipment shall have a lower test mean-time-between-failures (MTBF) (O_1 as defined by MIL-STD-781) of 2000 hours The oscilloscope shall be exempt from this requirement Software shall be included in the R_0 and R_1 values

3.13 Maintainability Maintainability shall be as specified in 3.13.1 through 3.13.3

3.13 1 Quantitative corrective maintenance The equipment, including built-in test (BIT) (see 6 4 4) and the oscilloscope (see 3 t 18) shall have a mean-time-to-repair (MTTR) not exceeding 0.75 hour and a maximum-corrective-maintenance-time (M_{maxct}) (95th percentile) not exceeding 2 0 hours, when corrective maintenance is accomplished at the organizational level of maintenance by the replacement of lowest subassemblies (see 6 4 6) (modules, PCBs, oscilloscope) and chassis-mounted parts (electronic, electrical, electromechanical, and mechanical parts). The corrective maintenance time includes localization, isolation, disassembly, interchange, reassembly, alignment, calibration, and checkout for all corrective maintenance actions. BIT circuits are included in the corrective maintenance time requirement The equipment is considered to be in a corrective maintenance mode whenever a failure or malfunction occurs, including a malfunction that allows degraded operation The oscilloscope is exempt from the requirements of 3 13.1.1 and 3.13.2 through 3.13.2.3.

3.13.1.1 Subassembly (module) maintainability Repairable modules shall have a MTTR of 2.0 hours and a M_{maxct} (95th percentile) of 4.0 hours at the organizational, intermediate, or depot-level maintenance as appropriate Mean-corrective-maintenance-time (M_{ct}) for module repair includes localization, isolation, disassembly, interchange, reassembly, alignment, and checkout for all maintenance tasks. For purposes of maintainability, a module is considered the lowest replaceable subassembly (PC card) for which repair is accomplished by the replacement of piece parts.

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3.13.2 Test measurement and diagnostic equipment (TMDE). TMDE shall be as specified in 3.13.2.1 through 3.13.2.4.

3.13.2.1 Test provisions. The equipment shall contain the test provisions specified in a through d:

a Class A test provisions. Class A test provisions shall provide a means to verify that the on-line (see 6.4.2) equipment is operating properly. Class A provisions shall be accomplished by the use of BIT, built-in test equipment (BITE) (see 6 4.3), or both, and shall have the capability to detect at least 96 percent of the equipment failures (see 6.4.5).

b Class B test provisions. Class B test provisions shall provide a means to fault isolate 94 percent of the equipment failures to the lowest field replaceable subassembly as specified in 1 and 2.

1 84.6 percent of the equipment failures shall be isolated to a single subassembly

2 94.0 percent of the equipment failures may be isolated to three or less subassemblies.

(Identification of field replaceable subassemblies shall be approved by the procuring activity)

Class B test provisions shall be accomplished when the equipment is off-line (see 6 4.1), on-line, or both, through the use of BIT, BITE, or both. A short circuit on any front panel video output shall be detected.

c Class C test provisions. Class C test provisions shall provide a means to fault locate to an electrical function (that is, integrated circuit (IC), filter, mixer, voltage controlled oscillator (VCO), and so forth), and to align the system (see 6.4.9), unit (see 6.4.8), assembly (see 6.4.7), or subassembly (see 6 4.6) Class C provisions may be accomplished by the use of test points in conjunction with automatic test equipment, general purpose electronic test equipment (GPETE)(see 3.13 2 4), or special purpose electronic test equipment

d BIT or BITE restrictions. Class A and B test provisions shall be acomplished utilizing BIT capabilities Class A and B test provisions shall not be accomplished by utilizing external equipment or by substitution of subassemblies and assemblies

3.13.2.2 BIT or BITE criteria. BIT or BITE criteria shall be as specified in a through c

a Protection from BIT or BITE failures. The ability of the prime equipment to perform its intended function shall not be impaired by the malfunction of BIT or BITE.

b BIT or BITE indicators. BIT or BITE indicators shall be lights, meters, or other indicating devices installed in the equipment. The indicators shall provide a GO or NO-GO indication at the level (subassembly, system) for which the indicator is intended and shall be made visible by removal of no more than one cover plate if the indicator is covered. BIT or BITE indicators shall be located as specified in 1 and 2

1. Class A test indicators shall be located on the front panel of the system

2 Class B test indicators may be located on the subassembly or system front panel

c. BIT or BITE activation. BIT or BITE activation shall be as specified in 1 and 2

1. BIT or BITE used in Class A test provisions shall be energized automatically without operator initiation

2 BIT or BITE used in Class B test provisions may be energized automatically or manually When a manually energized test mode is to be employed, a pushbutton switch shall be incorporated.

3.13.2.2.1 BIT capability The equipment shall contain a BIT facility. Upon initial turn-on and every time the reset key is depressed, the equipment shall run through a test which, as a minimum, shall test for an output from each output jack The BIT sampling point may be any point so long as there are only passive devices between that point and the final output jack Upon any failure, a unique code with the legend SELF TEST FAILED shall be displayed, which shall be crossreferenced to a table of errors If no errors occur, the unit shall flash SELF TEST OK before proceeding to the first frame. BIT shall not require any operator intervention or cable hookup. BIT shall not require more than 5 seconds to be performed.

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3.13.2.3 Test point criteria. Test points shall be as specified in a through c.

a. Signal quality and circuit performance. Test points, test jacks, or both, shall be provided to permit the injection of signals and the monitoring of signals at the I/O terminals of the subassembly.

b. Fault isolation Test points, test jacks, or both, shall be provided to permit the injection and measurement of signals at I/O terminals of the subassembly to isolate all faults to the electrical functions (that is, IC, filter, mixer, VCO, and so forth) Test points and test jacks shall provide means for performing fault isolation on the subassembly with the subassembly removed from the prime equipment

c Alignment Test points, test jacks, or both, shall be provided to permit alignment of the equipment, and equipment assemblies and subassemblies.

3.13.2.4 GPETE GPETE, to be used at all levels of maintenance, shall be selected from the standard and substitute standard equipment specified in MIL-STD-1364

3.13.3 Calibration. The equipment calibration interval shall be 1 year or longer The equipment shall be capable of being calibrated in 1 hour or less.

3.14 Workmanship. Workmanship shall be as specified in 3.14.1 and 3.14.2.

3.14.1 General workmanship Workmanship shall conform to the Workmanship paragraph of MIL-E-16400

3 14 2 Workmanship screen. All equipment shall withstand a defect detection vibration screen of random type vibration at $0.04g^2$/Hz ±3dB from 80 Hz to 350 Hz and temperature cycling with operation at the maximum and minimum operating temperatures and dwell time at the nonoperating temperature extremes

4 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements

4.1.1 Responsibility for compliance. All items shall conform to all requirements of Section 3 and Section 5 The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material

4.1.2 Government verification All quality assurance operations performed by the contractor will be subject to Government verification at any time Verification will consist of, but is not limited to, a) surveillance of the operations to determine that practices, methods, and procedures of the written quality program are being properly applied, b) Government product inspection to measure quality of the product to be offered for acceptance, and c) Government inspection of delivered products to assure compliance with all inspection requirements of this specification. Failure of the contractor to promptly correct deficiencies discovered by him or of which he is notified shall be cause for suspension of acceptance until corrective action has been taken or until conformance of the product to prescribed criteria has been demonstrated

4 1 3 Quality assurance terms and definitions Quality assurance terms used in this specification shall be as defined in MIL-STD-109

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4.2 Classification of inspections. The inspection requirements specified herein are classified as specified in a through d.

a. First article inspection (see 4.3)
b. Quality conformance inspection (see 4.4)
   1. Production inspection (Group A) (see 4.4.1)
   2. Production control inspection (Group B) (see 4.4.2)
   3. Environmental inspection (Group C) (see 4.4.3)
c. Safety verification (see 4.5.10)
d Inspection of preparation for delivery (see 4.9).

4.3 First article inspection. Unless otherwise specified (see 6.2), two equipments shall be required for first article inspection. First article inspection shall consist of all examinations and testing necessary to determine compliance with the requirements of this specification. First article inspection shall include the tests specified in TABLE III.

TABLE III Examinations and tests.

Examination or test	Requirement paragraph	Test paragraph	First article inspection	Quality conformance inspection		
				Group A	Group B	Group C
Preoperational inspection	3.4, 3.5.1.1, 3 5.6 1, 3.5.8, 3.5.9, 3.5.9.1, 3.5.13.1, 3.5.13.2, 3.5.13.4, 3.5.15, 3.9, 3.10	4.5.2	X	X		
Performance	3.6, 3.11	4.5.7	X	X		
General workmanship	3.4.3, 3.14.1	4.8.1		X		
Workmanship screen	3.14.2	4.8.2		X		
Accessories	3.4.1.5	4.5.2	X	X		
Environmental						
Temperature and humidity	3.3.1	4.5.5	X			X
Salt atmosphere	3.1	4.5.1	X			
Altitude	3.3.2	4.5.5	X			X
High impact shock	3.3.4	4.5.5	X			X
Vibration	3.3.3	4.5.5	X			X
Environmental tests verification		4.5.6	X			X
EMI	3.7	4.5.8	X			X
Dripproof	3.1	4.5.1	X			X
Input power	3.5 1	4 5.1	X		X	
Leakage current	3.9.1	4.5.10.1	X		X	
Voltage and frequency variation	3.5.1	4.5.1	X		X	
Voltage transient	3.5.10	4.5.1	X		X	
Frequency transient	3.5.10	4.5.1	X		X	
Mechanical stability	3 1	4.5.1	X			
Bench handling	3.1	4.5.1	X			
Reliability	3.12	4.6	X			
Maintainability	3 13	4.7	X			
Human engineering	3.8	4.5.9	X			

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4.4 Quality conformance inspection. Quality conformance inspection shall be as specified in 4.4.1 through 4.4.5.

4.4.1 Production inspection (Group A). Production inspection shall be performed on each equipment offered for delivery. Production inspection shall be comprised of such examinations and testing which will prove the workmanship and reveal the omissions and errors of the production process such as functional and performance tests at a limited number of points, tests which detect deviations from design, tests of adjustment, and tests which detect hidden defects of material. Production inspection shall include the examinations and tests specified in TABLE III, Group A

4.4.2 Production control inspection (Group B) Production control inspection, including sampling, shall conform, as a minimum, to the examinations and tests specified in TABLE III, Group B and to the sampling procedures of MIL-STD-105, using the special inspection level S-3 for normal, tightened, and reduced inspection. Samples shall be chosen from equipments which have passed production inspection The equipment shall satisfactorily conform to the requirements of production control inspection prior to release for shipment The equipment shall conform to an acceptable quality level of at least 6.5 percent

4.4.2.1 Rejected lots. If an inspection lot is rejected, the contractor may withdraw the lot from further inspection. The contractor may also rework a rejected lot to correct the defective units and reinspect the lot, using tightened inspection. Rejected lots shall be kept separate from new lots and shall not lose their identity.

4 4.3 Environmental inspection (Group C). Environmental inspection shall be performed on units which have been subjected to, and have passed, production inspection Environmental inspection shall consist, as a minimum, of the examinations and tests specified in TABLE III, Group C

4 4.3.1 Environmental inspection samples Samples for environmental inspection shall be selected without regard to their quality in accordance with a and b

a One sample from the first 50 units fabricated
b One sample from each successive 100 units, or fraction thereof, produced

4 4 4 Nonconformance corrective action and retest If a sample unit fails the inspection specified in 4.4.2 or 4 4.3, the contractor shall immediately investigate the cause of failure and shall implement the corrective action necessary to correct units of product which were manufactured with the same conditions, materials, processes, and so forth The equipment shall then be retested.

4 4 5 Reinspection of conforming production control and environmental sample units Unless otherwise specified (see 6 2), sample units which have been subjected to, and have passed, production control and environmental inspections may be accepted on the contract provided they are resubjected to, and pass, production inspection specified in 4 4.1 after repair of all damage.

4.5 Test methods. Test methods shall be as specified in 4.5.1 through 4.5.11.

4 5.1 Examinations and tests Examinations and tests shall be in accordance with MIL-T-28800 for Class 3 equipment, except as specified in 4.5.2 through 4.5.11.

4.5.2 Preoperational inspection Each equipment shall be examined for workmanship, assembly and fit, mechanical mounting, electrical connections, materials, parts, finish, treatment for prevention of corrosion to determine conformance to the workmanship requirements, and the parts, materials, and processes requirements specified in 3.4 and 3 14.1. Particular attention shall be given to the inspections specified in a through l.

a Completeness and cleanliness
b Cable runs including RF, video and power connectors, couplers, and heat-shrinkable boots
c Painting and finish
d Weight and dimensions
e Identification plates, identification marking, and labels
f Ease of operation of jacks, switches, sliding parts, and controls
g Fastening and securing of devices, parts, and modules
h. Grounding connections
i. Safety examinations including circuit card keying
j. Chassis slides (ease of withdrawal and tilting, if applicable)
k. Stowage provisions
l. Parts, materials, and processes

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4.5.3 Satisfactory operating check. Parameters to be verified and limits of acceptability for the satisfactory operating check, as required by MIL-T-28800, shall be selected by the equipment contractor and be approved by the procuring activity.

4.5.4 Satisfactory operating test Parameters to be verified and limits of acceptability for the satisfactory operating test, as required by MIL-T-28800, shall be selected by the equipment contractor and be approved by the procuring activity.

4.5.5 Environmental tests. The equipment shall be subjected to the tests specified in a through d for Class 3 equipment in accordance with the examination and test methods specified in MIL-T-28800

a. Temperature and humidity test
b. Altitude test
c. High impact shock test
d. Vibration test

4.5.6 Environmental test verification. The environmental tests verification shall be performed after the required environmental tests (see 4.5.5) have been completed. The environmental test verification shall consist of the performance test (see 4.5.7).

4 5.7 Performance test The equipment shall be subjected to performance tests to ensure that all functions and modes of operation of the equipment are evaluated and are in compliance with the electrical, mechanical, and software requirements specified in 3.6 and 3.11.

4.5.8 EMI test. The equipment shall be subjected to an EMI compatibility test in accordance with the EMI test paragraph of MIL-T-28800. EMI test need not be duplicated If there is a conflict in the test limits, the most stringent test limits apply.

4.5.9 Human engineering testing. The contractor shall test the equipment for human engineering characteristics in accordance with the Human engineering in test and evaluation paragraph of MIL-H-46855.

4.5.10 Safety verification. Examinations, analyses, and tests shall be performed to verify conformance to 3.9.

4.5.10 1 Leakage current test. The leakage current test shall be conducted as specified in 4 5.10 1.1 and 4.5.10 1.2

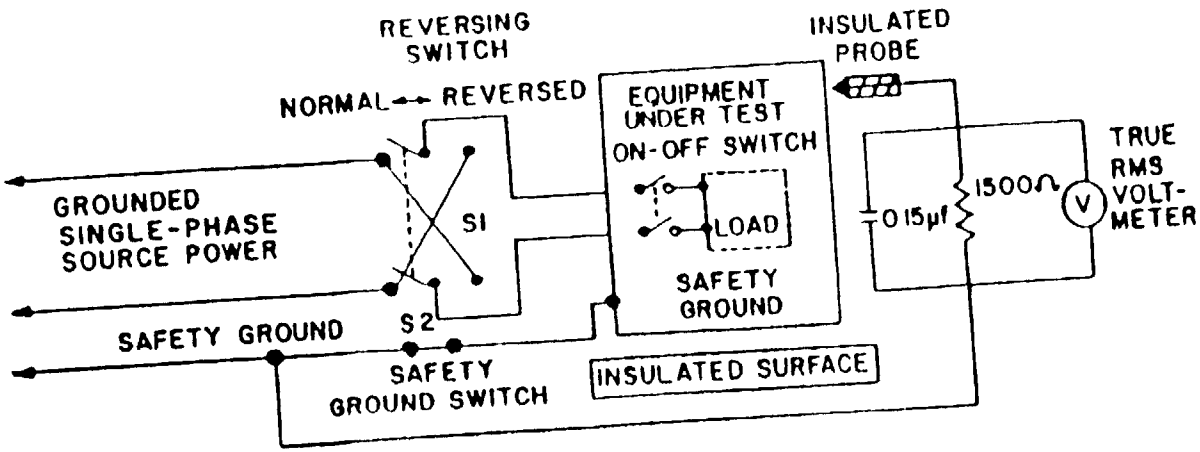
WARNING

THIS TEST MAY BE HAZARDOUS DUE TO THE UNGROUNDED CONDITION OF THE EQUIPMENT DURING THE TEST. DO NOT TOUCH EXPOSED METAL SURFACES.

THE UNITED STATES GOVERNMENT NEITHER ASSUMES NOR ACCEPTS RESPONSIBILITY FOR ANY INJURY OR DAMAGE THAT MAY OCCUR DURING OR AS A RESULT OF THIS TEST.

4 5 10.1.1 Equipment connections One unit of the equipment shall be placed on an insulated surface The safety ground conductor between the equipment and the source power shall be opened during the test. The equipment shall be connected as shown in FIGURE 1 if it is connected to single-phase source power

4.5.10.1.2 Measurement. Leakage current shall be measured on equipment in its normal operating configuration Equipment controls in each operating mode shall be such that maximum power will be utilized during leakage current measurements. The leakage current shall be determined by the voltage-drop method. A true root-mean-square (rms) voltmeter shall be used. The voltage measured across the 1500-ohm resistor shall not exceed 7.5 V at the highest nominal power line voltage and the highest and lowest nominal power line frequencies for which the equipment is designed The overall measurement error shall not exceed 5 percent. The probe shall be used on all external conducting parts such as case, connector housings, recessed calibration or adjustment controls, and control shafts with knobs removed, and the voltage measured for every combination of switch positions available in FIGURE 1. The open safety ground conductor shall be reconnected immediately after the test is completed.



GENERAL ORDER OF TEST:

1 Source power OFF. Connect equipment per diagram.
2. ON-OFF SW OFF. S1 SW normal. S2 SW closed Connect source power.
3 OBSERVE WARNING S2 SW OPEN. ON-OFF SW ON.
4 For each probe point, record voltmeter reading (CASE, CONNECTORS, CONTROLS, SHAFTS).
5 ON-OFF SW OFF. Repeat Step 4.
6 S1 SW REVERSED ON-OFF SW ON Repeat Step 4.
7. ON-OFF SW OFF Repeat Step 4.
8 S2 SW CLOSED S1 SW normal.
9 Repeat Step 3 THRU 8 for each mode of operation
10 Remove source power Disconnect equipment Sign record sheet.

WARNING

DO NOT TOUCH EXPOSED METAL SURFACES

THIS TEST MAY BE HAZARDOUS DUE TO THE UNGROUNDED CONDITION OF THE EQUIPMENT DURING THE TEST. THE UNITED STATES GOVERNMENT NEITHER ASSUMES NOR ACCEPTS RESPONSIBILITY FOR ANY INJURY OR DAMAGE THAT MAY OCCUR FROM THE USE OF THIS DIAGRAM FOR LEAKAGE CURRENT MEASUREMENT.

FIGURE 1 Single-phase test diagram for leakage current measurement

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4.5.11 Software acceptance testing. Software acceptance testing shall be conducted in accordance with the Software acceptance paragraph of DoD-STD-1679 and Government-approved test plan, test specifications, and test procedures to ensure conformance to the formal testing requirements.

4.6 Reliability qualification test. A reliability qualification test shall be conducted in accordance with MIL-STD-781 to demonstrate the equipment's compliance with the quantitative requirements of 3.12. The reliability qualification test shall be conducted on at least five deliverable units, two of which shall be first article units. Environmental conditions shall be for shipboard-sheltered equipments and shall be in accordance with MIL-STD-781 Category 3A equipment as modified by the environmental requirements of 3.3 through 3.3.4 Testing shall proceed in accordance with Test Plan IVC of MIL-STD-781 until a test decision is reached. In case of a reject decision, the procuring activity reserves the right to require a corrective action plan in accordance with MIL-STD-781.

4.7 Maintainability demonstration. A maintainability demonstration shall be performed as specified in 4.7.1 through 4.7.8.

4.7.1 Maintainability equipment demonstration. The contractor shall perform a maintainability and BIT or diagnostics demonstration at the organizational level. The demonstration shall be performed by a Navy civilian or military technician and shall be used to verify conformance to the equipment corrective maintenance (M_{ct} and BIT or diagnostics) requirements. This demonstration may be at the contractor's facilities or at a Government site.

4.7 1.1 Demonstration conditions. The equipment maintainability and calibration requirements shall be demonstrated in accordance with MIL-STD-471 by replacement of subassemblies (modules, individual PCBs) and chassis-mounted electronic, electrical, electromechanical and mechanical components, or parts at the organizational and intermediate level. One hundred candidate corrective maintenance tasks shall be determined in accordance with APPENDIX A of MIL-STD-471. The information specified in a through d shall be made available for each candidate task

a. Designation of specific faulty part
b. Failure mode
c. Means of introducing fault (substitution of faulty part or simulation thereof)
d. For each corrective action, the equipment shall be self-tested to verify that the corrective action brings the equipment back to the required operating capability.

Faults of BIT functions shall be included as corrective maintenance tasks for the maintainability demonstration. The procuring activity or its authorized representative shall use the candidate tasks as a guide to determine a sample of 50 tasks for the demonstration.

4.7.1.2 Subassembly (module) maintainability. The module maintainability requirements shall be demonstrated by replacement of piece parts at the organizational, intermediate, or depot-level, as appropriate. A minimum of five faults shall be determined for each repairable module Fault selection and simulation for each repairable module shall be in accordance with the procedure for the equipment maintainability demonstration. A total of 50 faults shall be determined by the procuring activity for the module maintainability demonstration. These faults do not have to be chosen from the contractor's list of candidates.

4.7.2 Accept or reject criteria Accept or reject criteria shall be as specified in 4.7.2.1 and 4.7.2.2

4.7.2.1 Corrective maintenance. The accept or reject criteria for the demonstration of the corrective maintenance times for the module and equipment demonstration shall be as specified in TABLE IV

TABLE IV. Acceptance criteria.

	M_{ct}	M_{maxct}
Acceptance level	20	0
Sample size	50	50

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Acceptance shall occur when the number of observed corrective maintenance task times which exceed the required value of each specified index (M_{ct}, M_{maxct}) is less than or equal to that shown in TABLE IV corresponding to each index for the specified confidence level. The duration of each task shall be compared to the required value(s) and determined as greater than or lesser than each index. The actual value shall also be determined. An accept decision can only be made when an accept decision is made for both M_{ct} and M_{maxct}. Accept or reject criteria for preventive maintenance shall be the capability to perform each preventive maintenance task with no degradation of system performance. If degradation of system operations exists, the preventive maintenance test will have resulted in a reject decision.

4 7.2 2 BIT or diagnostics. At the insertion of each simulated fault or malfunction, the BIT or diagnostics shall be exercised and compliance or noncompliance with the requirements for fault detection and isolation shall be determined The accept criteria for fault detection and isolation shall be not less than

a 48 out of 50 of the failures are detected
b 46 out of 50 of the detected failures are isolated to three or less subassemblies
c 44 out of 50 of the detected failures are isolated to one subassembly.

More than one erroneous failure indication shall constitute failure of the demonstration.

4 7 3 Preventive maintenance The demonstration shall qualitatively demonstrate that on-line preventive maintenance for the equipment shall not interfere with on-line operation.

4.7 4 Demonstration environment The demonstration at the organizational level shall be performed in an environment similar to that in which the equipment will be installed.

4 7.5 Technicians The Government reserves the right to select and provide the technicians to perform the maintainability demonstration

4 7 6 Technical documentation. Technical documentation shall be limited to the technical manual and related maintenance documentation delivered with the equipment

4 7.7 Rejection Failure to conform to any of the maintainability requirements shall be cause for rejection of the demonstration. If a reject decision is reached, the procuring activity shall be immediately notified The contractor shall, at no additional cost to the Government

a Develop an approach for redesign or correction of all deficiencies, and
b Upon approval of an approach to the redesign or corrections, the contractor shall implement the approach and repeat the demonstration until an accept decision is reached.

4.7 8 Acceptance The maintainability demonstration shall exhibit that the equipment conforms to the accept criteria prior to delivery.

4.8 Workmanship. Workmanship shall be as specified in 4.8.1 through 4 8 2.2.

4 8 1 General workmanship The equipment, including subassemblies and assemblies, shall be examined for workmanship and soldering during the fabrication and assembly process for conformance to the requirements of 3 4.3 and 3.14 1

4 8.2 Workmanship screen Vibration (see 4 8.2.1) and temperature cycling (see 4.8 2 2) shall be performed on each equipment Vibration shall be performed prior to temperature cycling The vibration may be performed at the module, drawer, or end item level. All the hardware, including cables and connectors, shall be exposed to vibration.

4 8.2 1 Vibration The vibration shall be random, or subject to procuring activity approval, pseudo-random or complex waveform vibration, for an accumulated time of 10 minutes in the axis deemed most susceptible to vibration excitation All items shall be hard-mounted (without shock isolators) and subjected to the vibration conditions of FIGURE 2 Input vibration levels shall be measured at the mounting points of the item under vibration If variations are found at these points, the level used for control purposes shall be the average of the levels at the mounting points Control equipment having a bandwidth no greater than 10 Hz for vibration frequencies up to 500 Hz, and 100 Hz, for vibration frequencies above 500 Hz, shall be used for the control and analysis of the acceleration spectral density (ASD). The instantaneous acceleration peaks may be limited to three times the rms acceleration level. The item shall be energized during vibration and appropriate input signals applied to observe any abnormal conditions of the output functional characteristics. All failures occurring during screening shall be corrected and the vibration resumed.

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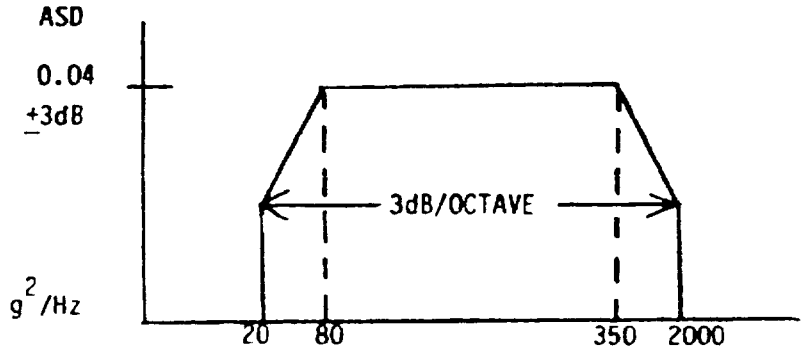

FIGURE 2. Random vibration curve.

4.8.2.2 Temperature cycling. Each equipment shall be subjected to 10 cycles of the temperature curve shown in FIGURE 3. The temperature rate of change shall be not less than 5°C per minute Equipment power shall be turned on and off at the indicated times. The equipment shall be positioned for maximum exposure to the changing temperature. Where the functional test is called for, a minimal functional operating test shall be performed. The dwell time shall be maintained until the largest electrical or electronic part in the equipment reaches 80 percent of the chamber temperature. When failures occur, the equipment shall be reworked and the cycling continued for a cumulative total of 10 cycles.

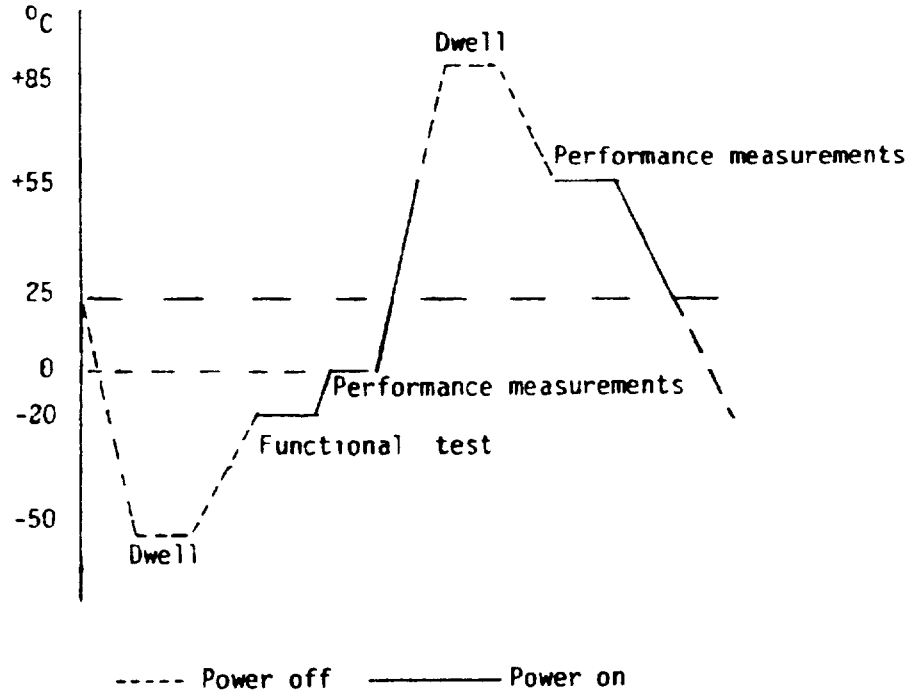

FIGURE 3. One cycle of temperature curve (not to scale).

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4.9 Inspection of preparation for delivery. Inspection shall be conducted to ensure conformance with the requirements of Section 5.

5. PACKAGING

(The preparation for delivery requirements specified herein apply only for direct Government procurements. Preparation for delivery requirements of referenced documents listed in Section 2 do not apply unless specifically stated in the contract. Preparation for delivery requirements for products procured by contractors shall be specified in the individual order.)

5.1 Preservation, packaging, packing, and marking. Unless otherwise specified herein, preparation for delivery shall be in accordance with applicable levels of preservation, packaging, packing, and marking specified in MIL-E-17555 (see 6.2).

6 NOTES

6.1 Intended use. The equipment, covered by this specification, is intended for use as a bench-top instrument on board Naval ships, at shore installations, or in environmentally controlled service areas.

6.2 Ordering data. Procurement documents should specify

a. Title, number, and date of this specification
b. Which of the UUT interfaces are required as specified in 3.6.19.2
c. Number of first article samples to be submitted, if other than specified in 4.3
d. When reinspected production control and environmental sample units may not be accepted (see 4.4.5)
e. Levels of preservation, packaging, packing, and marking (see 5.1).

6.3 First article. When a first article inspection is required, the items should be first article samples. The first article should consist of two units. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Definitions. The definitions and descriptions of NAVSHIPS 0967-146-0010 apply unless otherwise specified herein. The definitions specified in 6.4.1 through 6.4.16 also apply to this specification.

6.4.1 Off-line. Off-line testing consists of tests performed while the tested equipment is not performing its normal operational function.

6.4.2 On-line. On-line test is one which is performed while the equipment is in normal operational use of the supported equipment.

6.4.3 BITE. Any device which is functionally separate from, but permanently connected to, the prime equipment and used for the express purpose of testing the prime equipment.

6.4.4 BIT. Test devices which are an integral part of the equipment being tested. BIT may be automatic, manual, on-line, off-line, or a combination thereof.

6.4.5 Failure. The term failure refers to malfunction or parameter deviation that prevents the equipment from performing full capability in all modes, in the specified operational environment, to specified operating parameter levels.

6.4.6 Subassembly. Two or more parts which form a portion of an assembly, but having parts which are individually replaceable (such as, modules and PCBs with components).

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6.4.7 Assembly. A number of parts or subassemblies or any combination thereof, joined together to perform a specific function and capable of disassembly (such as, audio oscillator, amplifier, synthesizer, crystal oscillator).

6.4.8 Unit. An assembly or any combination of parts, subassemblies, and assemblies mounted together, normally capable of independent operation in a variety of situations.

6.4.9 System. All possible combinations of units required to perform a function.

6.4.10 Pulse shape Pulse shape parameters should conform to FIGURE 4 to aid in clarifying the definitions. E_{max} is the maximum voltage amplitude of the pulse as measured from the zero axis.

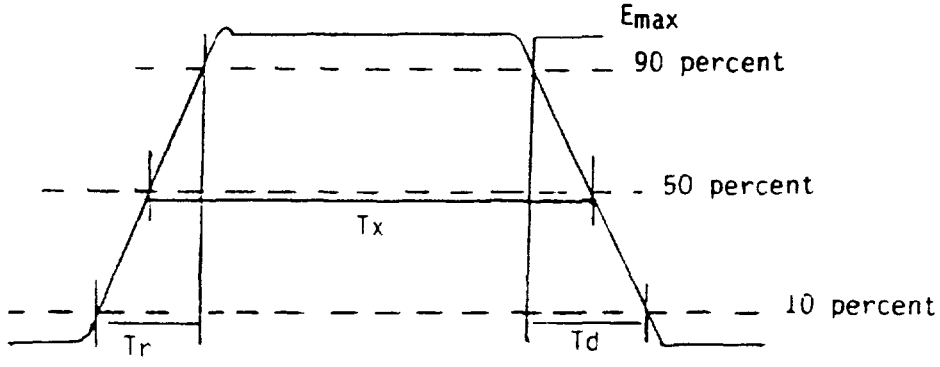

FIGURE 4 Pulse waveform

6.4 11 Pulse rise time. The rise time of a pulse is the time required for the leading edge of the pulse to rise from 10 percent to 90 percent of the maximum pulse amplitude. T_r, as shown in FIGURE 4, is the rise time Unless otherwise specified herein, pulse rise time should be less than 0.1 µs.

6 4.12 Pulse decay time The decay time of a pulse is the time required for the trailing edge of the pulse to decay from 90 percent to 10 percent of the maximum pulse amplitude. T_d, as shown in FIGURE 4, is the decay time Unless otherwise specified herein, pulse decay time should be less than 0.20 µs.

6 4 13 Pulse top The pulse top should be essentially flat (see FIGURE 4). The instantaneous amplitude of the pulse between the 90 percent E_{max} points on the leading and trailing edges should not fall below the 90 percent E_{max} level.

6.4.14 Pulse duration The pulse duration is the time between the 50 percent maximum voltage amplitude points on the leading and trailing edges. T_x, as shown in FIGURE 4, is the duration time.

6.4 15 Delay or spacing. Delay or spacing is the time between 50 percent maximum voltage amplitude points on the leading edges of the pulses concerned, except where otherwise specified herein.

6.4.16 Negative overshoot. The negative overshoot of a pulse during decay should be less than 5 percent of E_{max}, the maximum pulse amplitude (see FIGURE 4).

6.5 All shipments. All shipments of end items will be contingent upon successful completion of the quality conformance inspection

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6.6 Subject term (key word) listing.

AN/APX-64 transponder
AN/APX-76 interrogator
AN/APX-100 transponder
AN/APX-101 transponder
AN/APX-103 interrogator
AN/TPX-54 interrogator
AN/UPM-( ) radar test set
AN/UPX-23 interrogator
AN/UPX-27 interrogator
Built-in-test (BIT)
Built-in-test equipment (BITE)
Electromagnetic compatibility (EMC)
Electronic Industries Association (EIA) RS-232C interface
Flammability
General purpose electronic test equipment (GPETE)
Human engineering
Institute of Electrical and Electronic Engineers (IEEE) STD-488 interface
IFF MK XII
Interface, IEEE STD-488
Interface, EIA RS-232C
Interrogator, AN/APX-76
Interrogator, AN/APX-103
Interrogator, AN/TPX-54
Interrogator, AN/UPX-23
Interrogator, AN/UPX-27
Interrogator, RT-868( )/APX-76
Interrogator, RT-988( )/APX-76
KIR simulator
KIT simulator
KY-532/ASQ transponder
KY-533/ASQ transponder
Maintainability
Modular construction
Reliability
RT-859( )/APX-72 interrogator
RT-868( )/APX-76 interrogator
RT-988( )/APX-76 interrogator
Software
Soldering
Test measurement and diagnostic equipment (TMDE)
Test set, radar, AN/UPM-( )
Transponder, AN/APX-64
Transponder, AN/APX-100
Transponder, AN/APX-101
Transponder, KY-532/ASQ
Transponder, KY-533/ASQ
Transponder, RT-859( )/APX-72
Unacceptable materials
Workmanship screen

6.7 Supersession data. This specification includes the requirements of ELEX-T-457A, dated 19 March 1982

Preparing activity
NAVY - EC

(Project No 6625-N847(EC))

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