

MILITARY SPECIFICATION

COUPLER GROUP, ANTENNA, AN/URA-38()

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 This specification covers the requirements for a general purpose Antenna Coupler Group AN/URA-38(). This equipment is an automatic tuning system intended for surface ship and shore use with radio transmitters and 15, 25, and 35 foot whip antennas, operating over a frequency range of 2 to 30 Megahertz (MHz) and with power levels from 0 to 1000 watts average power and 1500 watts peak envelope power (PEP). The equipment design shall include provisions for manual and automatic tuning and shall also be tunable without the use of RF power (silent tuning).

1.1.1 The AN/URA-38() basically consists of Antenna Coupler Unit CU-938()/URA-38() that is installed at the base of an associated antenna, and Antenna Coupler Control Unit C-3698()/URA-38() that is normally installed with, or adjacent to, the associated radio transmitter.

1.1.2 The CU-938()/URA-38() is hereafter referred to as the CU-938(), and the C-3698()/URA-38() is hereafter referred to as the C-3698().

1.2 Operational requirements. Each unit shall give reliable performance within the limits specified herein, under conditions of intermittent or continuous operation during exposure to the adverse conditions normally encountered in Naval ship and shore communications service. Mechanical and electrical ruggedness is of paramount importance for assurance of reliable performance without failure.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

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| MIL-I-10 | - Insulating Materials, Electrical, Ceramic 1c Class L. |
| MIL-C-17 | - Cables, Radio Frequency; Coaxial, Dual, Coaxial Twin Conductor, and Twin Lead |
| MIL-S-901 | - Shock Test, H. I. (High Impact); Shipboard Machinery, Equipment and Systems; Requirements for |
| MIL-A-907 | - Antiseize Compound, High Temperature |

- MIL-C-915 - Cable and Cord, Electrical, for Ship-board Use, General Specification for
- MIL-S-3786 - Switches, Rotary (Circuit Selector, Low Current Capacity), General Specification for
- MIL-C-5015 - Connectors, Electric, "AN" Types
- MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys
- MIL-E-16400 - Electronic Equipment, Naval Ship and Shore; General Specification
- MIL-W-16878 - Wire, Electrical, Insulated, High Temperature
- MIL-E-17555 - Electronic and Electrical Equipment Accessories and Repair Parts, Packaging and Packing of
- MIL-S-19500 - Semiconductor Devices, General Specification for
- MIL-B-23071 - Blower, Miniature, for Cooling Electronic Equipment (10 to 500 Cfm), General Specification for
- MIL-T-28706 - Transmitter, Radio, AN/URT-23(V)
- MIL-C-39019/3 - Circuit Breaker, Magnetic, Low-Power, Sealed, Trip-free, Style BC20 (Double-pole)
- MIL-C-39012 - Connectors, Coaxial, Radio Frequency, General Specification for
- MIL-S-45180 - Sealing Compound, Gasket, Hydrocarbon, Fluid, Water Resistant
- MIL-C-45662 - Calibration System Requirements
- MIL-P-52192 - Primer Coating, Epoxy

FEDERAL

- QQ-N-290 - Nickel Plating (Electrodeposited)
- QQ-A-601 - Aluminum-Alloy Sand Castings

STANDARDS

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-108 - Definitions of Basic Requirements for Enclosures for Electric and Electronic Equipment
- MIL-STD-109 - Quality Assurance Terms and Definitions
- MIL-STD-167 - Mechanical Vibrations of Shipboard Equipment
- MIL-STD-202 - Electronic Equipment Parts, Selected Standards for R.F. and Acoustical Parts
- MIL-STD-454 - Standard General Requirements for Electronic Equipment

- MIL-STD-461 - Electromagnetic Interference Characteristics Requirements for Equipment
- MIL-STD-781 - Reliability Tests: Exponential Distribution
- MIL-STD-1310 - Shipboard Bonding and Grounding and other Techniques for Electromagnetic Compatibility
- MIL-STD-1631 - Procedure for Selection of Electronic and Electrical Parts and Materials During Design of Military Items
- MS-26574 - Circuit Breaker, Trip Free, Push Pull, 1/2 thru 10 Amp, Type I, ASG

PUBLICATIONS

MILITARY

0967-297-6010

- Technical Manual, AN/URA-38A

DRAWINGS

MILITARY

RE-B2697587

- Installation Control Drawings, Data List, for AN/URA-38()

(Copies of specifications, standards, handbooks, publications and drawings required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

CONSOLIDATED CONTROLS CORPORATION - Drawing No. 214C40-2

(Application for copies should be addressed to Consolidated Controls Corporation, Bethel, CT.)

3. REQUIREMENTS

3.1 General. Equipments shall be in accordance with the provisions of MIL-E-16400, to the extent specified herein.

3.1.1 First article sample. Prior to beginning production, a sample shall be tested as specified in 4.3.

3.1.2 Material. Materials shall be in accordance with the requirements of MIL-E-16400, except as otherwise specified herein.

3.1.3 Selection of parts. Selection of all parts shall be in accordance with MIL-E-16400.

3.1.3.1 Nonstandard parts. Requests for approval for the use of nonstandard parts, including preparation and submission of data, shall be submitted in strict accordance with the requirements of MIL-E-16400.

3.1.3.1.1 Prescreening of approval requests. Prescreening of nonstandard parts approval requests shall be accomplished in accordance with MIL-STD-1631.

3.1.3.1.2 All nonstandard parts shall have been documented in accordance with the requirements of MIL-E-16400, and approved, prior to the conduct of first article tests required by 4.3.

3.1.3.1.3 If any Government furnished equipment (GFE) is provided, it may include nonstandard parts. The equipment furnished in accordance with this specification shall employ standard parts or approved nonstandard parts. Nonstandard part approvals previously granted under earlier contracts for equipments represented by the GFE shall not be construed as being extended to equipments furnished in accordance with this specification. Nonstandard parts cited in Government furnished drawings shall not be construed as being approved for use in equipments furnished in accordance with this specification.

3.1.3.2 Individual selection. The performance of the equipment shall not be dependent on the selection of individual parts, unless such selection is specifically approved by the command or agency concerned. If such individual part selection is approved, sufficient information and data shall be included as is necessary in all applicable technical publications and engineering drawings to enable designated repair activities to perform such selection.

3.1.4 Microelectronic devices. Selection and application of microelectronic devices shall be in accordance with MIL-E-16400. Only plug-in types shall be used.

3.1.5 Semiconductor devices. Semiconductor devices made of germanium shall not be used.

3.2 Production equipment. Production equipments shall be identical to the equipment that has been subjected to and passed the first article examinations and tests (see 4.3).

3.3 Interchangeability. Interchangeability shall be in accordance with Requirement 7 of MIL-STD-454, as specified in MIL-E-16400.

3.4 Composition. The Antenna Coupler Group AN/URA-38() shall consist of one each of the following:

- (a) Antenna Coupler Control Unit C-3698()/URA-38().
- (b) Antenna Coupler Unit CU-938()/URA-38().
- (c) Pair of Mounting Brackets (two sets, see 3.8.1).

- (d) Interconnecting cable(s), for interconnection of AN/URT-23() and C-3698().
- (e) Set of mating connectors for all receptacles for which interconnection cables of (d) are not furnished.

3.4.1 Accessory equipment. In addition to the basic coupler group of 3.4, the following accessory items shall be furnished in the quantities as specified (see 6.1 (c)).

- (a) Test Set, Antenna Alignment, TS-3228()/URA-38().
- (b) The radio transmitter AN/URT-23() referred to herein is an associated radio transmitter that uses the AN/URA-38() for antenna tuning purposes. The AN/URT-23() is not a part of the AN/URA-38(), or vice versa, and is provided separately (see MIL-T-28706).

3.4.2 Compatibility. The AN/URA-38() shall be compatible with the AN/URT-23() Transmitter.

3.5 Frequency range. The frequency range of the equipment shall be from 2.0 MHz to 30.0 MHz.

3.5.1 Method of tuning. The AN/URA-38() shall be tunable either automatically or manually. Automatic tuning occurs each time primary power is applied, by depressing the RETUNE switch on the C-3698() front panel or each time the associated transmitter is retuned. Logic circuits in the equipment then energize servo controls which cycle the tuning elements until the impedance of the associated antenna is matched. This condition shall be achieved manually through the operation of C-3698() pushbutton controls.

3.6 Primary power source. Each equipment shall be capable of operating and providing rated performance from a primary power source as follows:

- (a) 115 volts ac ± 10 percent, 48 Hz to 63 Hz, single phase
- (b) 115 volts ac ± 10 percent, 380 Hz to 420 Hz, single phase

3.6.1 The equipment shall conform to the performance limits of operation under the conditions of transient voltage, transient frequency, and power interruption as specified in MIL-E-16400. The equipment shall provide protection against transients generated when the tuning motors energize or de-energize.

3.6.2 Electrical overload protection. Electrical overload protection shall be in accordance with MIL-E-16400. Circuit breakers conforming to MIL-E-16400 shall be used. The use of fuses for this purpose is prohibited.

3.7 Operational requirements. The equipment shall be capable of accepting emission types that produce the average and peak powers specified in 3.1.6.1.

3.8 Equipment arrangement. The antenna coupler control unit C-3698() is installed with or adjacent to the radio transmitter with which it is to be used. The antenna coupler unit CU-938() is installed at the base of the associated

3.11 Temperature, humidity and heat. The antenna coupler unit shall be designed to perform in accordance with the requirement of this specification under the ambient conditions for temperature Range 2 and humidity conditions specified in MIL-E-16400. The coupler control unit shall be designed to perform in accordance with the requirements of this specification under the ambient conditions for temperature Range 4 and humidity conditions specified in MIL-E-16400. The antenna coupler group shall be capable of performing continuously for 48 hours at full power at the maximum temperature specified for each unit.

3.12 Inclination. The equipment shall be capable of storage in any orientation. The equipment shall conform to the inclination requirements of MIL-E-16400, with an inclination angle of 60°.

3.13 Reliability

3.13.1 Quantitative reliability requirement. The specified mean-time-between failures (MTBF) (as defined by MIL-STD-781) shall be 1,000 hours under any combination of specified environments.

3.14 Basic conditions. For the purpose of this specification the following conditions shall apply to the RF power input signal to the antenna coupler.

3.14.1 Power input. RF power input to the antenna coupler shall be supplied to the RF power input connector, via a 50 ohm coaxial cable. All signals denoted in the following conditions shall be equivalent to those output signals supplied by the AN/URT-23(). For the purpose of comparison, all power levels noted in the following conditions shall be equivalent to those dissipated in a standard 50 ohm dummy load under test conditions.

3.14.2 Standard 50 ohm dummy load. For purpose of tests, the standard 50 ohm dummy load used during that procedure shall consist of a non-reactive 50 ohm resistance element. The dummy load shall have sufficient power handling capability so that it will dissipate 1500 watts average RF power over the frequency range from 2.0 to 30 MHz under any specified operating environmental conditions, without alteration of the electrical characteristics of the resistive element.

3.15 Mechanical design and construction. Mechanical design and construction furnished in accordance with this specification shall conform to all pertinent requirements of MIL-E-16400.

3.15.1 Construction. Construction shall conform to the requirements of MIL-E-16400. The equipment shall consist basically of an antenna coupler unit, the components of which are secured to a chassis mounted in a sealed case, (see 3.15.1.2), and a coupler control unit, the components of which are mounted on a chassis and panel assembly hinged to a case.

3.15.1.1 Cases. The CU-938() shall be a type 356T51 aluminum casting in accordance with QQ-A-601. The case of the CU-938() shall be an airtight, pressurized heat exchange type with fins provided on the case for heat removal. The case of the C-3698() shall be made of aluminum and shall have a hinged front panel. The C-3698() front panel shall be grounded to the case with a polytetrafluoroethylene-covered flexible ground lead.

3.15.1.2 Enclosure. The enclosure for the equipment shall be in accordance with MIL-E-16400. The degree of enclosure for the CU-938() shall be watertight and airtight in accordance with MIL-STD-108. The CU-938() shall conform to the nuclear air blast requirements of MIL-E-16400. Pressurization shall be in accordance with 3.15.1.2.1. The degree of enclosure for the C-3698() shall be drip-proof (45 degrees) as specified in MIL-STD-108.

3.15.1.2.1 Pressurization. The antenna coupler unit shall be capable of withstanding pressurization of 48 pounds per square inch gauge (psig) of dry nitrogen gas. The leak rate of the antenna coupler unit shall be less than

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1 x 10⁻⁶ atm pressurization shall be possible using pressurization kit

AN/URA-
CU-938()
table.

3.15.1. Warning device. The equipment shall be provided with an over pressure device, which shall be an adjustable type, and which shall be of the absolute type set to operate when pressure reaches 10 ± 1 psig. A sign warning of the danger of over-pressurized to the equipment. The equipment, when shipped, shall have a warning tag for the purpose of alerting the installer of the pressure of the unit prior to operational use. All cable connectors shall be pressure-proof, water-proof,

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3.15.1. Warning device. The equipment shall be provided with a pressure switch of the absolute type set to operate when pressure reaches 10 ± 1 psig. The switch shall be Consolidated Controls Corporation or equivalent, approved by the Command or Agency concerned.

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3.15.1. The equipment shall conform to the requirements of MIL

3.15.1. The equipment cases shall be furnished with mounting studs and ground connection. The studs shall not interfere with the operation of the units. Type III bond strap in accordance with MIL-STD-1316.

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3.15.1. The stud shall be a thru-bolt inserted through the case and shall be installed in accordance with MIL-STD-1316.

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3.15.1. Non-corrosion-resistant treatment and painting. Corrosion resistant treatments shall be as specified in MIL-E-16400, interior surfaces of all enclosures shall be painted in accordance with MIL-E-16400, unless otherwise specified herein. Cover screw unit shall be painted after assembly to seal out sea

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3.15.1. The unit shall be anodic coated in accordance with the requirements of MIL-A-8625.

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3.15.1. The unit shall be primed with composition G epoxy primer 2192.

3.15.1. The unit shall be used on all antenna coupler unit threads exposed.

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3.15.1. The antenna coupler unit, type II compound shall be used on all outside nuts, bolts, connections, and sealing surfaces.

3.15.1.4.5 After assembly of the antenna coupler unit, all unpainted surfaces outside of the unit shall be primed and painted except mating threads, gasketing material, and insulators.

3.15.1.5 Fastener hardware. Fastener hardware shall conform to the requirements of MIL-E-16400, except as otherwise specified herein. All screws, nuts, bolts, and other threaded and thread-locking devices shall be of austenitic corrosion-resistant steel, except in those applications requiring material capable of withstanding high tensile stresses, or in applications where high intensity RF fields require the use of brass, conforming to the requirements of MIL-E-16400. Corrosion-resistant steel cross-recessed drive screws and bolts shall be employed in all screw and bolt applications throughout the equipment in accordance with MIL-E-16400 (head styles and drive). Cadmium plating is not acceptable on captive-type bolts used on the equipment front panels.

3.15.1.6 Cables. Interconnecting cables between the antenna coupler, coupler control, and the transmitter shall be communications, non-flexing, service standard Navy cables selected from MIL-C-17 and MIL-C-915. The interconnecting cables will be provided by the installing activity. The minimum number of conductors shall be used, and ten percent spare conductors shall be provided.

3.15.1.7 Connectors. External multiconductor cabling connectors shall be in accordance with MIL-E-16400. Mating plugs shall be provided with cable clamps. All external mounted connector receptacles shall be provided with suitable protective plastic caps to prevent damage to the connector when the mating connector is not installed.

3.15.1.7.1 RF output insulator. The antenna coupler RF output insulator shall be beryllium oxide, ceramic grade K150 in accordance with MIL-I-10.

3.15.1.7.1.1 The through-bolt stud used with the output insulator shall be 1/2 inch in diameter, fabricated of brass, hermetically sealed to the insulator, and threaded on each end for connectors. The bolt threads external to the coupler shall be 3/8 x 24 threads, 3/4 inch long. The bolt threads internal to the coupler shall be 1/4 x 20 threads, 5/8 inch long. The external terminal shall be fitted with a corona ring. All metal that may be exposed to the weather shall be nickel-plated, 0.005 inch, in accordance with QQ-N-290

3.15.1.8 Time meter. A time meter is not required.

3.15.1.9 Motors. Motors used in the equipment shall comply with the requirements of MIL-E-16400.

3.15.1.9.1 Blowers. The use of brush type motors for continuous duty applications is not acceptable. Blowers used shall comply with the requirements of MIL-B-23071 and shall have a guaranteed minimum life of 5000 hours. The blowers shall operate with either the keyline or the 120 degree (F) thermal switch in operation.

3.15.1.10 Interlock indicators. Interlock indicators are not required. Interlocks shall be part of the case assembly, rather than the frame.

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3.15.1.11 Accessibility. In addition to the requirements of MIL-E-16400, the circuit mounting boards and components shall be easily accessible for maintenance, repair, or replacement.

3.15.1.12 Test provisions. Test provisions shall be in accordance with Requirement 32 of MIL-STD-454, as specified in MIL-E-16400. MIL type light emitting (LE) diodes in accordance with MIL-S-19500/467 shall be used as current and status indicators in individual current paths to logic or switching devices on printed circuit boards.

3.15.1.13 Indicator lights. Indicator lights shall be in accordance with MIL-E-16400. The equipment shall be protected from malfunction in the event of indicator lights failure. Dimmer controls are not required.

3.15.1.14 Factory adjustment controls. The design of the equipment shall not include "factory" or sealed adjustment controls, unless specifically approved by the Command or Agency concerned. Where these controls are approved, a complete description and instructions for adjustment of such controls shall be included in the technical publications.

3.15.1.15 Shock, vibration and inclination. The equipment shall be capable of conformance to the requirements specified herein without the use of resilient shock and vibration mounts. The antenna coupler unit shall be deck-mounted; the coupler control unit shall be hull-mounted.

3.15.1.15.1 Shock. The equipment shall be capable of withstanding the Grade A, Class I, Type A shock test specified in MIL-S-901.

3.15.1.15.2 Vibration. The equipment shall be capable of withstanding the Type I vibration test of MIL-STD-167.

3.15.1.15.2.1 During vibration testing in accordance with the procedure of 4.3.1.22, no vibration-related component shall be produced which is greater than three percent modulation of the CW output. No break-up of the output signal is permitted.

3.15.1.15.3 Inclination. The equipment shall conform to the inclination requirements of 3.12 and MIL-E-16400.

3.15.1.16 Printed wiring. The fabrication of printed wiring boards and the insertion of parts and assemblies thereon shall conform to the requirements of MIL-E-16400.

3.15.1.17 Soldered connections. Soldered connections shall conform to the requirements of MIL-E-16400.

3.15.1.18 Welding. Welding shall conform to the requirements of MIL-E-16400.

3.15.1.19 Attachment of wires and leads. Attachment of wires and leads shall conform to the requirements of MIL-E-16400.

3.15.1.20 Internal wiring and cabling. Internal wiring and cabling shall conform to the requirements of MIL-E-16400. All wiring shall be TFE insulated. Hookup wire shall conform to the requirements of MIL-W-16878, Type E.

3.15.1.21 Conductor identification. Identification of conductors shall conform to the requirements of MIL-E-16400. The method used for identification shall be consistent throughout the equipment.

3.15.1.22 Marking and identification of parts. Marking and identification of all assemblies, electrical, and moving mechanical parts, and any mechanical parts required to be removed for normal maintenance, shall be in accordance with MIL-E-16400. "Hertz" or "Hz" shall be used for all indications of frequency on hardware and associated software.

3.15.1.23 Gasket. Particular attention shall be made in the selection of a gasket that will ensure compliance with 3.15.1.2. The gasket shall be of a permanent type, re-useable for the life of the coupler, regardless of the number of openings for maintenance actions.

3.15.1.24 Gears. Gears shall conform to the requirements of MIL-E-16400. Only metal gears shall be used.

3.15.1.25 Test set, antenna alignment, TS-3228()/URA-38(). An antenna alignment test set shall be provided for use in maintaining the equipment. The test set shall consist of a set of extender cards, a test harness set, and an instruction sheet. The test set shall be housed in a metal case.

3.15.1.25.1 Extenders. An extender for each type of printed circuit board shall be provided. The extenders shall contain dual inline package switches. The switches shall be able to make and break circuits, and inject control and ground signals, without interference from interlock or fault circuits (see 0967-297-6010).

3.15.1.25.2 Test harness set. The test harness set shall consist of a 10 ft. control cable, a 6 ft. primary power cable, a 10 ft. transmission cable, and a 3 ft. discriminator test cable (see 0967-297-6010).

3.15.1.25.3 Instruction sheet. The instruction sheet shall contain instructions on the use of the test set. The instruction sheet shall be captive and laminated.

3.15.1.25.4 Logic probe. A clip-on indicator providing status of digital logic devices is required for each digital device type.

3.15.1.26 Handles. Two handles of 3/8-inch bar stock shall be mounted on each end of the antenna coupler unit to facilitate hand-carrying.

3.15.1.27 Cooling. The antenna coupler unit shall provide specified operation, under continuous locked key duty, without the requirement for special external cooling facilities.

3.15.1.27.1 Fan. The coupler unit shall utilize a fan cycled by a thermostatic switch and the transmitter keyline. The mounting of the thermostat shall be placed away from, as much as possible, hot or cold spots inside the coupler unit. The thermostat shall cycle the fan to an "on" condition whenever the average temperature inside the coupler unit reaches a limit of 120 ± 5 degrees F and the coupler is in a power-on condition. The fan must also be cycled to an "on" condition each time the transmitter is keyed. The fan shall have a separate circuit breaker.

3.15.1.28 Salt fog. Particular attention shall be paid in the design of the coupler unit for salt fog.

3.16 Detailed performance.

3.16.1 RF power capability. The equipment shall be capable of handling LSB, USB, ISB, FSK, CW and compatible AM transmissions, under continuous operating conditions, with a normal power up to levels of 1000 watts average power and 1500 watts PEP over the 2.0 to 30.0 MHz frequency range. The coupler shall provide a minimum bandwidth of 25 kHz. The equipment shall be protected from damage due to a short or open circuit on the RF output connector with full power applied to the coupler.

3.16.1.1 Direct antenna access. Direct antenna access through the antenna coupler unit shall be controlled by the control unit. Vacuum relays shall be used to bypass the antenna coupler unit circuitry. The bypass circuitry shall be capable of operating with a 1000 watt CW input.

3.16.2 Duty cycle. The antenna coupler shall be capable of continuous operation at full rated power from 2.0 to 30 MHz within the environmental extremes specified herein upon completion of tuning.

3.16.3 Methods of tuning.

3.16.3.1 Automatic tuning. In the automatic mode of operation, the AN/URA-38() shall automatically tune within an average time period of approximately 10 seconds and not more than 20 seconds and shall, when tuned, provide an impedance match to the associated transmitter such that the VSWR does not exceed 1.5:1 over the 2 to 30 MHz frequency range. The coupler shall tune in response to a tune initiate signal from the associated transmitter. This shall be a CW signal of 50 to 250 watts in the frequency range from 2 to 30 MHz. Upon receipt of a tune/retune command, the antenna coupler tuning elements shall proceed to the "home" position. During this portion of the cycle, the associated transmitter shall be inhibited from transmitting. Upon reaching the "home" position, the transmit inhibit signal (key interlock) shall be released. When the tune power signal is received, the antenna coupler unit shall automatically tune the antenna, as defined in 3.16.4, to the 50 ohm transmission line within a VSWR of 1.5 to 1. When this is completed, normal transmission of signals from the associated transmitter shall be allowed. The coupler shall have provisions to prevent tuning to RF energy coupled in from any adjacent transmitting antenna which is associated with a transmitter capable of 1000 watts average power output. The antenna coupler unit shall be provided with a pushbutton operated "retune" switch on the

front panel for the purpose of operator control for an automatic retune cycle. This function shall be in addition to the automatic tune function. The design requirement is for a fully automatic-tuned antenna coupler that will permit continued operational use with 1000 watts average power applied. In the event of failure of the antenna coupler or associated transmitter, the equipment shall prevent keying of the associated transmitter and sound a failure alarm.

3.16.3.1.1 Tuning life. The automatic tuning system shall perform a total of 6,000 tune cycles without failure or degradation which will require adjustment or replacement of assemblies or parts.

3.16.3.2 Manual tuning. The equipment shall have provisions for alternate selection of a manual mode of tuning from the C-3698() coupler control unit. Provisions shall permit the manual controlled adjustment of the antenna coupler unit tuning elements, using the front panel meter for indication of RF tune power and VSWR for emergency remote tuning in the event of a failure in the "automatic" mode control logic circuitry. The manual mode shall permit use of the equipment in the event the antenna coupler fails to achieve a "tuned" condition due to faulty automatic tune control circuitry, located in the C-3698(). The manual mode shall permit tuning to a VSWR of 1.5:1. The coupler shall manually tune with 50 to 250 watts of RF power throughout the frequency range of 2.0 to 30.0 MHz.

3.16.3.3 Silent tuning. The equipment shall have provisions for alternate selection of a silent mode of tuning. Provisions shall be included for a manual adjustment of the antenna coupler unit tuning elements, without RF power, to near resonance by means of a meter and using previously calibrated and logged positions of the tuning elements. Final "fine" tuning shall then be accomplished automatically when the associated transmitter is keyed to operate.

3.16.3.4 Control of tuning. Control of antenna coupler variable tuning elements and selection of any required fixed tuning elements in the manual and silent modes of operation shall be by means of controls located on the front panel of the coupler control unit. The manual mode of tuning shall not make use of frequency coding for presetting. "Automatic" tuning control circuitry shall be by-passed and not used in the manual mode of tuning. Push button operated switches shall be provided on the coupler control unit to be used for controlling the tuning elements of the coupler.

3.16.3.5 Automatic tuning. The antenna coupler shall automatically tune to a VSWR not exceeding 1.5:1 when in the presence of an adjacent 35-foot whip antenna under the following conditions:

- (a) The output power from the associated transmitter does not exceed 1000 watts average power.
- (b) Frequency is within the 2 to 30 MHz range.
- (c) Frequencies within five percent of the frequency of the adjacent transmitting antenna are excluded. With a conjugate match, this is equivalent to two to three dB of isolation. (Additional isolation depends on the off frequency impedance characteristics of the coupler's matching elements.) The coupler shall be

designed to tune and operate in this potentially high RF field. The coupler shall not respond to RF energy from any source other than the associated transmitter.

3.16.3.5.1 Given a tuned condition at any frequency from 2 to 30 MHz, upon removal of the associated transmitter's RF signal, it shall be possible to re-apply the same RF signal (at the same frequency) without initiating a new tuning cycle. The transmitter will furnish a CW signal for tuning.

3.16.4 Antenna impedance characteristics. The antenna impedance characteristics of Table I shall be used for the design of the antenna coupler tuning elements.

Table I. Nominal antenna characteristic impedance.

Frequency (MHz)	Nominal characteristic impedance (R ±jX)		
	15 ft. whip R ±jX	25 ft. whip R ±jX	35 ft. whip R(±tol) ±jX(±tol)
2.0	6.2 -j1125	3.2 -j600	2 +3 -j465 ±j20
2.5	6.3 -j900	4.2 -j500	2.75 +3 -j372 ±j20
3.0	6.5 -j750	6.0 -j400	3.5 +3 -j280 ±j20
3.5	6.6 -j625	7.0 -j350	5 +3 -j226 ±j20
4.0	6.9 -j545	9.3 -j280	6.5 +3 -j173 ±j20
5.0	7.65 -j415	13 -j190	20 +3 -j98 ±j20
6.0	8.75 -j330	19 -j120	29 ±5 -j24 ±j20
7.0	10.4 -j270	35 -j75	55 ±10 +j55 ±j40
8.0	12.3 -j217	50 -j20	135 ±25 +j173 ±j40
9.0	15.1 -j166	75 +j0	425 ±50 +j231 ±j40
10.0	19.9 -j125	150 +j40	600 ±100 -j57 ±j40
11.0	24.3 -j85	210 +j25	307 ±50 -j308 ±j40
12.0	31.75 -j52	250 -j5	131 ±20 -j280 ±j40
13.0	42 -j15	250 -j110	65 ±20 -j234 ±j40
14.0	56.5 +j37	210 -j130	50 ±20 -j195 ±j40
15.0	71.5 +j75	180 -j160	26 ±5 -j145 ±j40
16.0	97 +j123	160 -j180	23 ±5 -j99 ±j40
17.0	129 +j174	130 -j190	22 ±5 -j72 ±j40
18.0	174 +j213	85 -j190	26 ±5 -j40 ±j40
19.0	250 +j244	55 -j170	50 ±10 -j10 ±j40
20.0	389 +j260	30 -j170	69 ±10 +j32 ±j20
21.0	506 +j80	20 -j210	137 ±20 +j38 ±j20
22.0	467 +j0	19 -j100	178 ±20 -j29 ±j20
23.0	366 -j212	18 -j65	150 ±20 -j97 ±j20
24.0	277 -j205	18 -j50	111 ±20 -j123 ±j20
25.0	232 -j188	20 -j35	90 ±10 -j121 ±j20
26.0	200 -j163	23 -j9	65 ±10 -j94 ±j20
27.0	175 -j142	30 +j0	43 ±10 -j74 ±j20
28.0	46 -j122	35 +j30	31 ±10 -j57 ±j20
29.0	41 -j106	60 +j60	30 ±10 -j40 ±j20
30.0	39 -j85	110 +j95	27 ±10 -j21.5 ±j20

3.16.5 VSWR. The equipment shall automatically match any specified antenna impedance to a 50 ohm transmission line with a VSWR of not greater than 1.5:1 (see 3.16.3).

3.16.6 Efficiency. With the impedances of Table I, the equipment shall automatically tune and provide an antenna coupler unit RF input to output efficiency of not less than 50 percent in the 2.0 to 4.0 MHz range, and not less than 70 percent from 4.0 MHz to 30.0 MHz. This requirement applies only to the 35 foot whip as described in Table I.

3.16.7 Overload protection. The equipment shall not be damaged by a short or open circuit on the RF output connector, with full power input as specified in 3.16.1. Overload protection devices shall be circuit breakers located on the front panel of the C-3698()/URA-38(). The +28V and fan circuits shall use a type MS26574 circuit breaker. The main line (on-off) circuit shall use a type MIL-C-39019/3 circuit breaker capable of operating from 48 to 420 Hz.

3.16.8 Overload alarm. Audible overload alarm shall be provided on the C-3698() front panel. This alarm shall operate automatically in conjunction with the equipment's overload lamp circuit. A front panel switch shall be provided on the coupler control unit to permit disabling of the alarm.

3.16.9 Safety devices. In addition to devices resulting from the safety criteria of MIL-E-16400, safety devices for the following conditions shall be provided:

- (a) Excessive temperature of antenna coupler unit
- (b) Low antenna coupler pressure
- (c) Excessive antenna coupler pressurization
- (d) Rotor end stops

3.16.9.1 Sensors. The pressure and temperature sensors shall activate the alarm light and alarm audio signal without affecting transmitter performance. Tuning of the coupler shall not be possible in the automatic mode while in alarm overload condition.

3.16.9.2 Pressure relief. The antenna coupler unit shall contain a pressure relief device that shall automatically depressurize the unit in the event internal pressure beyond safe values occurs. The pressure relief device shall be set for 10 ± 1 psig.

3.16.9.3 End stops. The design of the variable coil in the antenna coupler shall include positive rotor stops contained within the coil assembly. The mechanical end stops shall be located on the coil assembly and function independently of the electrical limit switches. The design shall be such as to be capable of stopping the rotor motion without damage to any part of the coil when the driver motor brake is held disabled. Both the capacitor and coil shall have electrical limit stops.

3.16.10 High power RF switching. Any switching of high-voltage RF circuits shall be accomplished by means of vacuum switches.

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3.16.11 Arcing. There shall be no arcing or corona in the antenna coupler unit, under any condition of operational use throughout the frequency range of 2.0 to 30.0 MHz.

3.16.11.1 Spark gap. A spark gap shall be provided and designed to protect the tuning elements from arc-over at any frequency from 2.0 to 30.0 MHz during any operational condition specified herein. Protection against lightning discharge shall be inherent in the design.

3.16.12 Controls. The antenna coupler control unit shall have controls mounted on the front panel. This includes the switches and meters necessary to observe and control the status of tuning. Locking devices are not required.

3.16.13 Servo amplifiers. No balancing of servo amplifiers shall be necessary at any time to maintain performance. If more than one servo amplifier is used, they shall be directly interchangeable. The servo amplifiers shall have sufficient interlocking to prevent shorting of the input and damage to the servo amplifier.

3.16.13.1 The AN/URA-38() shall have sufficient servo-amplifier interlocking to prevent short circuiting of the power supply.

3.16.14 Interconnecting cables and connectors. Interconnecting cables, other than RF type, between the control and coupler units, will be non-flexing service standard Navy cables selected in accordance with MIL-C-17. Connectors and receptacles for use with interconnecting cabling between the coupler and control unit shall be provided as part of the AN/URA-38() equipment. The RF and control interconnecting cables will be provided by the installing activity, and delivery of such cables is not required as part of the equipment. The minimum number of conductors shall be used, and 10 percent spare conductors shall be provided in each cable.

3.16.14.1 Connectors must be of easy replacement types for repair purposes. The RF input connector shall be type N. The mating connectors used for interconnection of the transmitters listed in 3.4.2 and the C-3698() shall be MIL-C-5015 types. Connector 2P1 shall be MS-3406-20-21S with MS-3437B-34-C cable clamp. Connector 2J1 shall be MS-3402-20-21P. The mating connectors used for interconnection of the C-3698() and CU-938() shall be MIL-C-5015 types. Connector 1J1 shall be MS-3142H-28-21S and connector 1P1 shall be MS-3406-28-21P with MS-3437B-60-C cable clamp. RF connectors shall be selected from MIL-C-39012. All of these connectors shall be provided with each equipment.

3.16.15 Test set, antenna alignment, TS-3228()/URA-38(). The test set shall provide the capability for performing on site maintenance and alignment procedures. This shall be accomplished through the use of the PC extender cards which shall contain dual in-line package switches. The switches shall be able to make and break circuits, and inject control and ground signals, without interference from interlock or fault circuits (see 0967-297-6010). A meter shall be provided to assist in troubleshooting. The test set shall provide a clip-on logic status indicator, if digital logic circuitry is used in the C-3698().

Additional LED indicators shall be incorporated on the extender boards if complete functional status is not included on the PCBs in the C-3698().

3.16.16 Electromagnetic compatibility (EMC). The equipment shall conform to requirements of MIL-STD-461 for Class IB, C-E equipment.

3.17 Workmanship. Workmanship shall be in accordance with MIL-E-16400.

3.18 Maintenance concept for design. Maintenance of the equipment shall be accomplished at the organizational level. Capabilities and limitations at this maintenance level are as follows: fault isolation, removal and replacement of discrete circuit components such as tubes, transistors, resistors, coils and capacitors; replacement of meters, indicator lamps, fuses, tuning and alignment; fault location and isolation of assemblies and piece parts, removal and replacement with use of required test equipment, and diagnostic and repair procedures.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 ensure supplies and services conform to prescribed requirements.

4.1.1 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; (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.

4.1.2 Quality assurance terms and definitions. Quality assurance terms and definitions used in this specification shall be as specified in MIL-STD-109.

4.1.3 Accuracy of test apparatus. The accuracy of instruments and test equipment used to control the test parameters, whether located at a Government testing laboratory, the contractor's plant or an independent testing facility, shall satisfy the requirements of MIL-C-45662. All instruments and test equipment used in conducting the tests specified herein shall:

- (a) conform to laboratory standards whose calibration is traceable to prime standards at the U.S. Bureau of Standards;
- (b) have an accuracy of at least one-third the tolerance for the variable to be measured. In the event of conflict between this accuracy and a requirement for accuracy in any one of the specified test methods, the specified test method shall govern;
- (c) be appropriate for measuring the test parameters.

4.1.4 All approved nonstandard parts shall be subjected to quality conformance inspection, in accordance with the individual equipment specification, as indicated in MIL-E-16400. Inspection shall be as specified by the procuring activity, otherwise Group A only, in accordance with the individual equipment specification.

4.2 General inspection. Inspection shall be as specified in MIL-E-16400 unless otherwise specified.

4.2.1 Classification of inspections. The methods of examination and testing of electronic equipment fall within the following classifications:

- (a) First article inspection
- (b) Quality conformance inspection
 - (1) Production inspection (Group A)
 - (2) Production control inspection (Group B)
 - (3) Environmental inspection (Group C)
- (c) Reliability testing
- (d) Inspection of preparation for delivery

4.3 First article inspection. Successful first article inspection shall be made on each first article specified in the contract. First article inspection shall consist of all examinations and testing necessary to determine compliance with the requirements of this specification, including the tests specified in 4.3.1 and any additional tests required by the preproduction paragraph of MIL-E-16400, except the following:

- (a) Water Cooling
- (b) Reliability
- (c) Magnetic Test
- (d) Noise (acoustic)
- (e) Structural integrity

4.3.1 In addition to the first article inspection of 4.3, the following tests shall be conducted, as a minimum:

- (a) All tests necessary to confirm complete compliance with all requirements specified in Section 3 of this specification.
- (b) Tests listed in 4.3.1.1 through 4.3.1.24.

4.3.1.1 RF power capability. 1000 watts average RF power (minimum) shall be applied to the antenna coupler for 30 minutes at each specified frequency.^{1/} Load impedances corresponding to the nominal values cited in Table I shall be utilized. During each period of continuous application of RF power, the antenna coupler shall be examined for any temperature rise exceeding 10 Centigrade degrees and temperature measurements noted. The equipment shall operate within the requirements of this specification during each period.

^{1/}Test frequencies (MHz)

2.0	4.0	16.0
2.5	6.0	20.0
3.0	8.0	24.0
3.5	12.0	29.0

4.3.1.1.1 Short and open circuits. Tests shall be conducted at 2.0, 8.0, and 24.0 MHz to demonstrate compliance with 3.16.1 concerning short and open circuits. Performance of the equipment shall not be degraded as a result of this test.

4.3.1.1.2 Direct antenna access. Tests shall be performed to verify compliance with the requirements of 3.16.1.1.

4.3.1.1.3 Operational test. The equipment shall successfully complete a continuous operational test with 1000 watts (minimum) average power input, at 2.0 MHz., at +65°C (50°C for the C-3698()), into a 35 foot (10.698 M.) whip antenna (or simulator) for a continuous period of 48 hours without damage or degradation of the AN/URA-38() equipment.

4.3.1.1.4 Methods of tuning. Tests shall be performed to verify the methods of tuning specified in 3.16.3, using the frequencies specified in 4.3.1.1. Tests should be performed in conjunction with the AN/URT-23() Transmitter, if available. Tests to verify compliance with requirements of 3.16.3.5 shall be performed for each of the test frequencies of 4.3.1.1, with the AN/URA-38() coupled to a 35 foot whip. For each test frequency, a 1000 watt CW signal shall be supplied to a second AN/URA-38() coupled to a second 35 foot whip. The interfering field shall be established at frequencies throughout the 2 to 30 MHz. range but excluding the band within five percent of the test frequency. With the interfering field established, the coupler under test shall be tuned in the automatic mode, then switched to manual to hold matching element positions. The interfering transmitter shall then be unkeyed, and the VSWR measured for the coupler under test. The frequency of the interfering field shall be adjusted in sufficiently small increments to insure detection of any regions in which the test coupler will not complete tuning or will not tune to within the required 1.5:1 VSWR.

4.3.1.1.5 Frequency range. Ten randomly selected frequencies, other than those used for the RF power capability test of 4.3.1.1 shall be selected from Table I with the corresponding load conditions to demonstrate that the equipment will tune to any frequency within the specified range. This test may be performed using a reduced level of power. Successful tuning will be indicated by a VSWR of not more than 1.5 to 1.

4.3.1.1.6 VSWR. Tests shall be performed to determine compliance with 3.16.5.

4.3.1.1.7 Efficiency. Antenna coupler efficiency tests, throughout the 2.0 to 30.0 MHz frequency range and using the load impedances specified in Table I, shall be conducted. The test report shall show the coupler efficiency measured at one MHz intervals. The test shall be performed on two equipments, if available. Only testing for the 35 foot whip requirements shall be performed.

4.3.1.1.8 Overload protection and protective circuits. Tests shall be performed to verify satisfactory operation of the overload circuits specified in 3.16.7.

4.3.1.1.9 Overload alarm. Tests shall be made to verify compliance with the requirements of 3.16.8.

4.3.1.10 Safety devices. Tests shall be performed to verify satisfactory operation of the safety devices specified in 3.16.9.

4.3.1.11 Spark gap. Tests shall be performed to verify compliance with the requirements of 3.16.11.1.

4.3.1.12 RF output insulator. Tests of the insulator shall be performed in accordance with MIL-I-10.

4.3.1.13 Servo amplifiers. Tests shall be performed to verify compliance with the requirements of 3.16.13.

4.3.1.14 Compatibility. Tests shall be performed to verify compatibility of the AN/URA-38() with the transmitters listed in 3.4.2 subject to availability of the transmitters.

4.3.1.15 Power interruption. In addition to the tests specified in MIL-E-16400, a test shall be conducted to verify operation with high voltage transients of three and one-half times primary voltage but of short duration (less than one cycle). No permanent changes shall be produced in power output as a result of this test.

4.3.1.16 Pressurization. A test shall be conducted to show that the antenna coupler can withstand a pressure of four times the maximum pressure setting of the pressure relief value without rupturing. The pressure shall be maintained for a period of four hours. The test may be conducted with an empty case.

4.3.1.17 Antenna coupler leak rate test. A pressure leakage test of the antenna coupler shall be performed to determine the leak rate. The technique for determining the leak rate shall be in accordance with Method 112A, test condition C, procedure IV, of MIL-STD-202. The coupler shall be purged immediately after the test.

4.3.1.17.1 Alternate methods of determining the leak rate may be used. The actual technique is subject to approval by the command or agency concerned. The leak rate shall be equal to or less than specified in 3.15.1.2.1. This test shall be the last test performed as part of First Article inspection.

4.3.1.18 Tuning. The equipment shall conform to the requirements of 3.16.3.1 using 500 feet of cable between the transmitter and the antenna coupler unit.

4.3.1.18.1 Tuning life. During the 6,000 tune-ups specified in 3.16.3.1.1, various frequencies and dummy loads simulating different antennas shall be used in conjunction with the AN/URT-23(). No more than 25 retunes requiring a second cycle shall be allowed. No retunes in excess of two attempts shall be permitted, and if such occurs, it will constitute failure to meet this requirement. Full output power (1000 watts) shall be applied and recorded for each tune cycle. For first article inspection, this test is required on only one equipment.

4.3.1.19 Heat test. The antenna coupler group shall be subjected to a continuous operational test with 1500 watts average RF input power at 65 degrees centigrade for 48 hours. The test frequency shall be 2.0 MHz with the corresponding load impedance shown in Table 1. Heat sensing elements shall be appropriately located on the coupler to detect any abnormal temperature rise. VSWR readings shall be made periodically throughout the test to determine that the ratio does not exceed 1.5 to 1. At the end of the 48 hour period, prior to reducing the temperature, the equipment shall be operated for five minute periods at 4.0, 8.0, 12.0, 24.0, and 29.0 MHz., with load impedances corresponding to Table 1. At each frequency the VSWR shall be measured and not exceeded 1.5 to 1. After the equipment has been stabilized at room ambient, the leak rate shall be measured to determine conformance with 3.15.1.3.1. No retightening of C-3698() cover bolts, or any hardware affecting the coupler pressure seal is permitted prior to measurement of the leak rate. There shall be no damage to, or degradation of, any parts as a result of the heat tests.

4.3.1.20 Temperature and humidity. Tests shall be conducted in accordance with MIL-E-16400. Measurement of power output shall be made prior to and after testing. Measurements shall be within the limits established in 3.16.1. During humidity tests, checks shall be made at the end of the second and fifth cycles of the temperature cycling portion, and at the conclusion of the eight hour operating (humidity cycling) test. Proper operation of the coupler into a 35 foot whip or whip simulator shall be demonstrated at test frequencies of 4.3.1.1 prior to, and at the completion of storage and operating temperature tests, and temperature cycling and humidity cycling (eight hour operating) humidity tests. During humidity tests, coupler operation into a 35 foot whip simulator shall be verified at 2,8, and 24 MHz at the end of the second cycle of the temperature cycling portion, and at 30 minute intervals during the eight hour operating (humidity cycling) portion. Performance shall be within the limits established in 3.16.

4.3.1.21 Enclosure. Tests shall be performed in accordance with requirements of MIL-E-16400. Testing of the CU-938() shall be confined to the airtight test with internal pressure 10 psi above external air pressure. Proper operation of the coupler into a 35 whip or whip simulator shall be demonstrated at test frequencies of 4.3.1.1 prior to and after testing. Performance shall be within the limits established in 3.16.

4.3.1.22 Shock, vibration, and inclination. Proper operation of the coupler into a 35 foot whip or whip simulator shall be demonstrated at test frequencies of 4.3.1.1 prior to, and at the completion of shock and vibration tests. During the shock blows, and during vibration, the coupler shall be operating to deliver power from a 1000 W CW transmitter to a 50 rhm power attenuator permitting coupler performance monitoring. Coupler operating frequency shall be changed following each shock blow, and at 15 minute intervals throughout the vibration test period. Performance during vibration tests shall be in accordance with the requirements of 3.15.1.15.2 Inclination tests are not required.

4.3.1.23 Steady state and transient voltage and frequency. Tests shall be conducted in accordance with MIL-E-16400. Operation of the equipment shall not be degraded during or after the tests.

4.3.1.24 Test set TS-3228(). Operation of the test set to perform the functions specified in 3.15.1.25 shall be made.

4.3.1.25 Electromagnetic compatibility test. Compliance with 3.16.16 shall be verified by tests performed in accordance with MIL-STD-462.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the following:

4.4.1 Production inspection. Production inspection shall be made on every equipment offered for delivery. This inspection shall comprise such examination and testing as 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 in the required range, tests which detect deviations from design, tests of adjustments, and tests which detect hidden defects of material. In addition to the production inspection specified in MIL-E-16400, the additional inspections specified herein shall be conducted, as a minimum, on each production equipment. These inspections shall be conducted at nominal line voltage and room ambient temperature and humidity conditions, unless otherwise specified.

- (a) Power. RF power tests shall be performed to verify the antenna coupler matching capability using dummy antennas having nominal characteristics as specified in Table 1. A full power test shall be made at the frequencies specified in Table 1.
- (b) VSWR. VSWR tests shall be conducted simultaneously with the power tests specified in 4.4.1(a) to verify the requirements of 3.16.5.
- (c) Control functions. Tests to verify the tuning capability, and antenna coupler bypass functions shall be performed simultaneously with RF power tests specified in 4.4.1(a).
- (d) Overload circuits and safety devices. Tests shall be conducted to verify satisfactory operation of all overload circuits and safety devices.
- (e) Pressurization. The positive pressure airtight enclosure test of MIL-STD-108 shall be performed.

4.4.2 Production control inspection. Production control inspection shall consist of the tests specified in 4.3.1 through 4.3.1.24 and the following tests of MIL-E-16400:

- (a) Supply line voltage
- (b) Heat test
- (c) Power
- (d) Controls and control circuits

Production control inspection shall be conducted on inspection lots that have passed the production inspection of 4.4.1. Sampling shall be in accordance with MIL-STD-105, using inspection level S-3 with an AQL of 6.5 percent.

4.4.3 Environmental inspection. Environmental inspection shall consist of the following tests of MIL-E-16400:

- (a) Temperature
- (b) Humidity
- (c) Electromagnetic interference emission, susceptibility and equipment and systems self-compatibility
- (d) Shock, vibration and inclination (first envir. inspection only)
- (e) Salt fog

These tests, except for salt fog, shall be performed on sample units of all items that have passed production inspection and production control inspection. Salt fog tests shall be performed in accordance with MIL-E-16400.

4.4.3.1 Sampling for inspection of equipment. For the first environmental inspection, one equipment from the first month's production, or from the first 50, whichever is less, shall be selected. For subsequent environmental inspections one equipment from each successive 100 shall be selected. EMI testing shall be conducted only on one of each successive 200 equipments.

4.5 Reliability testing. Reliability testing shall be performed in accordance with MIL-STD-781. The reliability demonstration shall be performed after completion of the first article testing.

4.5.1 Reliability demonstration tests. Reliability demonstration testing shall be performed on at least four production units. Testing shall be performed at test level D with test plan IV of MIL-STD-781. Testing shall proceed to a decision in accordance with the criteria specified in MIL-STD-781 for test plan IV. The demonstration shall be successfully completed prior to the acceptance of production units.

4.5.2 Reliability sampling tests. Reliability sampling tests shall be conducted throughout production to ensure continued production of acceptable equipment. Sampling testing shall be at test level D, with test plan IVA of MIL-STD-781. At least three units shall be randomly selected from each month's production for reliability sampling tests. Testing shall proceed to a decision in accordance with the criteria specified in MIL-STD-781 for test plan IVA.

4.5.3 Failure. Failure is any malfunction or parameter deviation that prevents the equipment from performing within the operational requirements set forth in this specification.

4.5.4 Reliability tests. Reliability tests shall be conducted at full rated RF input power, using the procedures, schedules and performance limits specified herein, as a minimum. The coupler and the coupler control units may be installed in separate chambers due to the differing temperature requirements.

4.5.4.1 Category of tests.

- (a) Power output
- (b) VSWR
- (c) Leak rate

4.5.4.2 Test frequencies. Test frequencies shall be selected from those listed in Table II. One group shall be checked during each measurement period for the tests cited in 4.5.4.1.

Table II. Frequencies (MHz).

	G-1	G-2	G-3	G-4
(a)	2.050	3.1000	4.150	5.300
(b)	6.900	7.650	8.700	10.850
(c)	12.450	14.900	16.350	18.500
(d)	20.600	24.350	27.800	29.950

4.5.4.3 Test schedule. The test shall consist of three 8-hour schedules per day, the first being "manned", where performance measurements shall be made. The other two schedules may be unmanned and data may be recorded automatically. Schedules include the equipment in operation into a load simulating the antenna characteristics shown in Table I. The schedules are as shown in Table III. The schedules shall be repeated for the first four days, using each group of frequencies from Table III, successively.

Table III. Test schedule.

Manned		Unmanned	
0-2 hours	Equipment "On"	0-3 hours	Equipment "On"
2-3 hours	Performance Measurements (see 4.5.4.4)	3-4 hours	Equipment "Off"
3-4 hours	Equipment "Off"	4-7 hours	Equipment "On"
4-6 hours	Equipment "On"	7-8 hours	Equipment "Off"
6-7 hours	Performance Measurements (see 4.5.4.4)		
7-8 hours	Equipment "Off"		

The same sequence shall be used on the next four days, except that the sequence of frequencies shall be reversed. The schedule shown in Table III shall be repeated as necessary.

4.5.4.4 Performance measurements. Measurements shall be made at the group of frequencies cited in Table II. With an average power input of 1000 watts, the equipment shall meet the requirements of 3.16.5 and 3.16.6. The CU-938() shall be opened and closed once during each set of measurements and repressurized

as necessary. Leak rate shall be measured once during the test and at the conclusion of the test.

4.5.5 Burn-in. The contractor may elect to operate the reliability test samples for a certain time prior to the initiation of reliability demonstration of equipment submitted for acceptance. Failures occurring during this period may be considered nonrelevant but shall be recorded and reported. Burn-in time for all items of equipment submitted for acceptance shall be at the same levels of environment and for the same integral number of cycles as the burn-in conducted on the reliability demonstration test samples.

4.5.6 Failure analysis. All failures shall be analyzed and the results of analysis shall be retained by the contractor and be available for Government review as required.

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

5. PREPARATION FOR DELIVERY

(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 or order. Preparation for delivery requirements for products procured by contractors shall be specified in the individual order).

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

6. NOTES

6.1 Intended use. The equipment described in this specification is intended for use ashore and on shipboard.

6.2 Ordering data. Procurement documents should specify the following.

- (a) Title, number and date of this specification
- (b) Number of first article samples required if other than specified (see 4.3)
- (c) Quantity of accessory items required (see 3.4.1)
- (d) Levels of preservation, packaging, packing, and marking required (see 5.1)

6.3 First article. Invitations for bids should provide that the Government reserves the right to waive the requirement for first article samples as to those bidders offering a product which has been previously procured 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 procurement.

6.4 Nomenclature. Nomenclature referred to herein may be subject to change on any contract resulting in equipment produced in accordance with this specification.

6.5 Environmental inspection. Approval to ship may be withheld at the discretion of the government pending the decision from the contracting officer on the adequacy of corrective action.

6.5.1 Initial shipments. Initial shipment of end items will be contingent upon successful completion of the environmental inspection.

Preparing activity:
Navy - EC

(Project 5985-N432)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No 22-R255

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NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

DIRECT GOVERNMENT CONTRACT SUBCONTRACT

1 HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A GIVE PARAGRAPH NUMBER AND WORDING

B RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2 COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3 IS THE DOCUMENT RESTRICTIVE?

YES NO (If "Yes", in what way?)

4 REMARKS

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DATE

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