MILITARY SPECIFICATION

RECEIVER-TRANSMITTER: RT-1209/URC

This specification is approved for use by the U. S. Marine Corps, 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 establishes the performance, production and test requirements for the Receiver-Transmitter RT-1209/URC.

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-Q-9858	Quality Program Requirements
MIL-E-17555	Electronic and Electrical Equipment, Accessories, and Repair Parts, Packaging and Packaging of
MIL-A-28988	Amplifier, Radio Frequency: AM-6545/GRC-193
MIL-R-29418	Radio Set: AN/PRC-104(V)
MIL-H-49078	Handset H-250 ( )/U
MIL-E-52798	Enamel, Alkyd, Camouflage
MIL-C-55116	Connector, Miniature Audio, Five-pin

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commandant of the Marine Corps, Headquarters Marine Corps, Code LMA-1, Washington, D.C. 20380 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 5820

STANDARDS

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-470	Maintainability Program Requirements (For Systems and Equipments)
MIL-STD-471	Maintainability Demonstration
MIL-STD-781	Reliability Tests Exponential Distribution
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-883	Test Methods and Procedures for Microelectronics

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

HANDBOOKS

Military

MIL-HDBK-472	Maintainability Prediction

DRAWINGS

U.S. Marine Corps

755002A1000	Key, telegraph
755002A1650	Mounting tray, electrical equipment, MT-4874/URC
755002A1800	Amplifier - converter, AM-6879/URC
755002A1810	Cable aseembly, Special purpose, electrical, CX-13104/URC
755002A1811	Cable assembly, Special purpose, electrical, CX-13105/URC

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

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 First article. Prior to submission of any complete production items for acceptance, the contractor shall furnish four first articles for

determination of conformance to this specification. Examination and tests shall be those specified herein. Approval of the first articles by the procuring activity shall not relieve the contractor of his obligation to supply equipments conforming to this specification. Any changes or deviations of the production items from the first articles shall be subject to the approval of the contracting officer.

3.2 Material

3.2.1 Materials, processes and parts. Unless otherwise specified (see 6.2.1), all parts, materials, and processes used in construction of this equipment shall conform to MIL-STD-454. The selection of the class, grade, or type shall be such that when mounted in the equipment, the part or material will perform its intended function.

3.2.2 Integrated electronics. Maximum use shall be made of integrated electronics consistent with the overall equipment requirements specified herein, in order to fully exploit the performance, reliability, cost, size, weight, logistics and maintenance advantages of these techniques. Fullest use shall be made of monolithic integrated circuits. Film integrated circuits, multichip integrated circuits, and hybrid integrated circuits shall also be used where appropriate. Cost-effectiveness considerations shall be utilized to guide the determination of the size and complexity of replaceable equipment modules for the optimum realization of the advantages of integrated electronics.

3.2.3 Integrated electronics, packaging. All solid state devices and all microcircuits employed shall be packaged in hermetically sealed packages. No plastic (for example, epoxy, silicon, organo-metallics, phenolics, and so forth) encapsulated devices shall be accepted without specific written approval of the procuring activity.

3.3 Design and construction.

3.3.1 Major components. The following components and ancillary items are part of, or used with, the receiver-transmitter. Only the receiver-transmitter is to be supplied by the contractor. Compatibility with the ancillary items shall be maintained.

Item	Quantity
Receiver-transmitter RT-1209/URC	1 each
Handset, H-250/U	1 each
Telegraph Key KY-872/PRC-104	1 each
Mounting tray, Electrical equipment, MT-4874/URC	1 each
Amplifier-converter, AM-6879/URC	1 each
Cable assembly, special purpose, electrical, CX-13104/URC	1 each
Cable assembly, special purpose, electrical, CX-13105/URC	1 each

3.3.1.1 Radio set function. The radio set function shall consist of a receiver-transmitter RT-1209/URC fastened to a radio frequency amplifier/automatic antenna coupler AM-6874/PRC-104 by quick disconnect latches; this assembly shall then be latched to an appropriate battery pack to function as a

20 watt (W) man-pack radio set. The radio set control panel shall be a removable, plug in assembly of the receiver-transmitter. Compatibility with the radio set AN/PRC-104 shall be maintained.

3.3.1.1.1 Receiver-transmitter function. The receiver-transmitter shall contain all of the necessary circuitry in 4 plug in modules and control panel assembly to function as a receiver or exciter with the performance required by this specification with the exception that necessary radio frequency interference (RFI) filtering of leads interfacing with Radio Set AN/GRC-193 may be accomplished externally (see 3.3.3). The system interface shall be in accordance with MIL-A-28988 and compatibility with the AM-6879/URC and MT-4874/URC shall be maintained when used in Radio Set AN/GRC-193.

3.3.1.1.2 Control elements. The following controls, receptacles, and indicators shall be provided and located on the control panel.

3.3.1.1.2.1 Mode switch. This switch, with end stops, shall provide the control necessary to enable the radio set to perform the following independent functions:

Receive only (Data)
Receive only (Voice or Continuous Wave (CW))
Transmit/Receive (Voice or CW)
Transmit/Recieve (Data)

3.3.1.1.2.2 Frequency selector. This selector shall consist of six controls. These controls, in a line from left-to-right, shall control the selection of 10 megahertz (MHz), 1 MHz, 100 kilohertz (KHz), 10 KHz, 1 KHz and 100 hertz (Hz) increments. These controls shall be adequately spaced for ease of operation. Detenting at each frequency increment shall be provided. Thumb wheel switches are not acceptable. These controls shall be self-cleaning upon depression with respect to ice. Push type selectors shall be considered acceptable in lieu of rotary devices. End stops shall be provided only on the 10-MHz control.

3.3.1.1.2.3 Frequency indication. A display located directly adjacent to the frequency selection controls shall be employed to indicate the operating suppressed carrier frequency of the equipment. This indication of frequency shall appear as whole numbers. The frequency indicators shall be visible during night operation. A light shall be provided to illuminate the frequency display and shall be controlled by a spring loaded switch. Illumination shall be in red.

3.3.1.1.2.4 Sideband selector. A two position switch with end stops shall be provided for selection of upper sideband (USB) or lower sideband (LSB) transmission and reception.

3.3.1.1.2.5 Audio connectors. Two audio type receptacles shall be provided for connecting the audio and keying accessories. The pin connections shall provide the ground, audio output, push-to-talk command, microphone input, and continuous wave (CW) key circuit interfaces to the audio and keying accessories. The connector type shall be U-183 ( )/U in accordance with MIL-C-55116.

3.3.1.1.2.6 On/off volume control. This control shall be a rotary type. The control shall be labeled to indicate the direction of increased volume.

On/off function shall be provided at the minimum equivalent to a counterclockwise (CCW) position. The step switches shall not be used.

3.3.1.1.3 AM-6874/PRC-104 Power amplifier/automatic antenna coupler interface. Mechanical and electrical interface of the receiver-transmitter with the AM-6874/PRC-104 shall be maintained.

3.3.1.1.4 Reliability. The receiver-transmitter shall possess a specified mean-time-between-failure (MTBF), θ_0, of no less than 3400 hours, and minimum acceptable MTBF of no less than 1700 hours over the specified environmental operating range (exclusive of normal battery life).

Duty cycle: continuous keydown operation

3.3.1.1.5 Transmit-receive transition. The receiver-transmitter shall be capable of switching from transmit to receive in less than 60 milliseconds (ms).

3.3.1.1.6 Transmit power up. Full rated power shall be delivered to a 50 ohm load in no more than 60 ms measured from closure of either the push-to-talk (PTT) or the CW key.

3.3.1.1.7 Resetability. The resetability of the frequency selecting subsystem shall be such that upon rechanneling, the operating frequency shall be within 1 part in 10^6 MHz of the front panel setting. The time required to change from any operating channel to any other channel, exclusive of coupler tuning time, shall not exceed 1.5 seconds.

3.3.1.1.8 Reverse polarity. The receiver-transmitter shall incorporate reverse polarity protection by the use of protective diodes.

3.3.1.1.9 Ground. The chassis shall be negative.

3.3.1.1.10 Circuit alignments. Suitable means for proper alignment and calibration shall be provided to compensate for the effects of normal aging of parts.

3.3.1.1.11 Test points. The receiver-transmitter shall incorporate test points to facilitate fault isolation and repair.

3.3.1.1.12 Compatibility. The receiver-transmitter shall be compatible with Handset H-250/U, and the Remote Control Group AN/GRA-39B.

3.3.1.1.13 Interchangeability. Provisions for interchangeability are required and shall be in accordance with requirement 7 of MIL-STD-454.

3.3.1.2 Handset H-250/U. The receiver-transmitter shall interface with a handset in accordance with MIL-H-49078.

3.3.1.3 Telegraph Key KY-872/PRC-104. The receiver-transmitter shall interface with a telegraph key in accordance with Drawing No. 755002A1000.

3.3.1.4 Mounting tray, electrical equipment, MT-4874/URC. The receiver-transmitter shall mechanically interface with mounting tray MT-4874/URC in accordance with Drawing No. 755002A1650.

3.3.1.5 Amplifier-converter, AM-6879/URC. The receiver-transmitter shall electrically interconnect with the AM-6879/URC, in accordance with Drawing No. 755002A1800. Interconnection shall be through cables CX-13104/URC in accordance with Drawing No. 755002A1810 and CX-13105/URC in accordance with Drawing No. 755002A1811.

3.3.2 Receiver-transmitter configuration. The interface of the receiver-transmitter with the AM-6879/URC shall be via one multi-pin connector available at the rear surface of the enclosure and one 6 pin audio connector available on the front surface. The receiver-transmitter when installed in the mount shall meet the interface requirements as established by MIL-A-28988 and Table I.

3.3.4 Control life. All controls shall be functioned end-to-end without failure for no less than 10,000 cycles.

3.3.5 Control end stops. All controls identified as having end stops shall be capable of withstanding repeat force in each direction of 48 inch-ounces without permanent deformation to the end stops. Push type controls shall withstand no less than 15 pounds with permanent deformation to the end stops. Push type frequency selectors shall not be actuated with less than 2 pounds of force, nor require more than 6 pounds for activation. Push type dial lamp switch shall not be activated with less than 1 pound of force nor require more than 6 pounds for activation.

3.3.6 Covers and seals. Covers for the receiver-transmitter incorporate captivated hardware. Seals or sealing surfaces shall be capable of 25 open and close cycles without loss of leakage resistance.

3.3.7 Soldering. Soldering shall be in accordance with Requirement 5 of MIL-STD-454.

3.4 Maintainability. Design criteria for the maintainability of the equipment components, and ancillary items to be contractor-furnished shall be in accordance with MIL-STD-470, MIL-STD-471, and MIL-HDBK-472. The mean time to repair (MTTR) for the replacement of defective modules shall be no more than 15 minutes. The MTTR for the radio set, modules and subassemblies, other than throwaway items, at the depot levels, shall be no more than 3 hours. Comformance to the specified MTTR shall be certified by a demonstration test using personnel with equivalent depot level training.

3.5 Transportability. The receiver-transmitter shall be capable of being transported either as part of a portable, man-pack radio or by wheeled or tracked vehicles as part of a vehicular radio set.

3.6 Performance.

3.6.1 General characteristics.

3.6.1.1 Frequency range. The receiver-transmitter shall be capable of tuning the frequency range of 2.0000 to 29.9999 MHz in steps of 100 Hz.

Table I. Interface definition

INTERFACE CONNECTOR PIN NO.	LINE FUNCTION	LINE SOURCE	LINE CONDITION V.S. STATUS	OPERATING LIMITS
38, 39	+26.5 VDC (Nom.)	PA	Direct connection to power source	2 pins RX - 200 mA nom. TX - 0.6 A max. 20 - 32 VDC
25, 26	GND (DC Return)	PA	Direct connection to chassis ground	2 pins Chassis is negative
32	Shield Ground (Cable Shield)	NA	Direct connection to chassis ground	
14 20 35 29 12 13	Freq. Code, 10 MHz (2) 10 MHz (1) 1 MHz (8) 1 MHz (4) 1 MHz (2) 1 MHz (1)	RT	0 logic - Ground through diode and switch. 200 ohms maximum 1 logic - Open (true) 50,000 ohms minimum to ground	0 = 5 mA max. Max. pullup voltage = 5.25 VDC
30	PA ON/OFF	RT	0 - Ground through diode and CE junction of NPN transistor OFF - Open when RT is in RX only mode or OFF	100 mA max. 32V max.
45	System ON/OFF	RT	ON - +26.5 VDC when RT is "ON" in any mode OFF - 0 VDC, direct connection to RT power source input circuits	0.3 A max. No voltage from PA allowed

Table I. Interface definition - Continued

INTERFACE CONNECTOR PIN NO.	LINE FUNCTION	LINE SOURCE	LINE CONDITION V.S. STATUS	OPERATING LIMITS
4	PA Keyline	RT	Keyed - Ground through CE junction of NPN transistor Not keyed - Open	50 mA max. 32 V max. 50K ohms min.
10	Tune in Progress	PA	Ground during automatic tune cycle +6V during normal RX/TX	1 mA max. 2.5K ohms max.
33	Tune Start	RT	Ground pulse (30 ms. min.) through CE junction of NPN transistor when: (a) any frequency digit (except 100 Hz) is changed; (b) RT is switched "ON" or (c) RT mode selector is switched from RX only to TR position (but NOT in reverse).	Pullup voltage - 26VDC (nom.) through 12K ohms Note: Each user of this line shall use positive logic and diode isolation to present an open circuit to ground in the absence of tune start
44	Tune Fault	PA	Not Fault - Ground Fault - Open	2.5K ohms max. 6 VDC pullup 2 mA max.

Table I. Interface definition - Continued

INTERFACE CONNECTOR PIN NO.	LINE FUNCTION	LINE SOURCE	LINE CONDITION V.S. STATUS	OPERATING LIMITS
8	ALC (Xmit Gain Control)	PA	Positive going analog of RF output power above adjustable threshold. DC source impedance must be less than 2K ohms	Zero + 0.6VDC offset provides no RF attenuation +6 VDC provides NLT 37 dB attenuation. Attenuation curve is monotonic with linearity of 8 + dB per V
40	Sidetone enable	PA	Sidetone - Ground Not sidetone - Open	2.5K ohms max. 6 VDC pullup 1 mA max. Note: This line must remain open in receive only (PA OFF) modes.
5	V forward	RT	Positive going voltage proportional to forward power at output of harmonic filter.	10K source impedance.
41	V reflected	RT	Negative going voltage proportional to reflected power at output of harmonic filter.	10K source impedance.

Table I. Interface definition - Continued

INTERFACE CONNECTOR PIN NO.	LINE FUNCTION	LINE SOURCE	LINE CONDITION V.S. STATUS	OPERATING LIMITS
19	Keyline	RT	Keyed - Ground through diode and CE junction of NPN transistor Not keyed - Open	50 mA max. 32V max. 50K ohms min.
2	RF IN/OUT	NA	RF signal to and from mod. /demod. module of RT	50 Ohms nominal
1,3,6,7	Signal return (gnd)	NA	Shielding pins for RF IN/ OUT above (pin 2)	
16	RF IN	NA	RF signal into harmonic filter module in Xmit mode	Jumpered to pin 2 in interfacing connector when PA power output is greater than 20W. 50 ohms nominal
9,15,21, 22	Signal return (gnd)	NA	Shielding pins for RF IN above (pin 16)	
47	RF OUT [RF drive to PA (0.25W) or Ant. coupler (20W)]	NA	RF signal out of harmonic filter module in Xmit mode.	50 ohms nominal
42,43,46, 48	Signal return (gnd)	NA	Shielding pins for RF OUT above (pin 47)	

Table I. Interface definition - Continued

INTERFACE CONNECTOR PIN NO.	LINE FUNCTION	LINE SOURCE	LINE CONDITION V.S. STATUS	OPERATING LIMITS
23	EXT. FREQ. STD. (5 MHz RF input)	PA	This input normally shorted to ground. To utilize external frequency standard remove jumpers E1 to E2, E3 to E4, and E5 to E6 in synthesizer module. Install jumper E4 to E5.	0 ± 0.5 dBm 50 ohms nominal.
36	+6.5 VDC	RT	+6.5V when pin 45 is high (+28V ON)	350 mA max. This line may be used only by the AM-6874/ PRC-104
37	+12.5 VDC	RT	+12.5V when pin 45 is high (+28V ON)	50 mA max. This line may be used Only by the AM-6874/ PRC-104.
11	2 - 3 MHz Band	RT	GND through CE junction of NPN transistor when selected frequency is in 2.0000 to 2.9999 MHz range Otherwise: +28V through 2970 ohm relay.	50 mA max. Diode isolation required.
31,34	SPARE	NA		
17,18,24 27,28	Signal return (gnd)	NA	Shielding pins for Pin 23	

3.6.1.2 Frequency stability. In the transmit modes, the frequency of the carrier shall be locked to a single temperature compensated crystal oscillator (TCXO) reference. The frequency stability of the transmit carrier, in parts per million (ppm), shall be the same as that specified for the TCXO. The frequency stability of the receiver local oscillators, in ppm, shall be the same as that of the TCXO.

3.6.1.2.1 Long term. The frequency drift due to aging of the reference TCXO shall not exceeed five parts in 10^7 per day, one part in 10^6 during the first 30 days after calibration. The stability shall not be degraded by more than two parts in 10^7 for each 30-day period thereafter. An adjustment shall be provided which allows the frequency to be brought within one part in 10^7 of a given calibration frequency of the frequency standard. This adjustment shall provide a frequency adjustment range of plus and minus five ppm from the setting which provides the correct TCXO output frequency. Any setting of this frequency adjustment element over its entire adjustment range shall not degrade the frequency stability versus service conditions of the radio set beyond that specified in 3.6.1.2.4.

3.6.1.2.2 Phase jitter. The root mean square (RMS) value of phase jitter, measured in a minimum of 100 samples of adjacent 10.0 ms periods shall not be greater than 2.5 degrees. The probability of experiencing phase changes of greater than 5 degrees between any two successive 10 ms frames shall not exceed 5 percent. Under vibration conditions specified in 3.7.1(e)2, the RMS value of phase jitter shall be less than 4.0 degrees from 2.0 MHz to 10.0 MHz and less than 12.0 degrees from 10.0 MHz to 30 MHz.

3.6.1.2.3 External frequency standard. Provisions shall be included for accepting a single higher-stability externally supplied 5 MHz frequency standard. Removal and relocation of jumper wires to disable the TCXO and reroute the reference input is allowed.

3.6.1.2.4 Stability vs service conditions. The frequency stability of the receiver and transmitter (measured under 1:9 transmit-receive conditions) shall be within one part in 10^6 of the nominal channel frequency under combined effects of temperature, humidity, and voltage variation. This requirement shall apply over the ambient temperature range of -40° C to +71° C, a supply voltage range of 20 to 32 volts (V), and the standard humidity test specified in 4.3.2. The permanent frequency shift shall not exceed an additional ±1 ppm for any other environmental tests. Sensitivity shall not degrade more than 1 decibel (dB) beyond that specified (10 dB SINAD) due to phase and frequency variation produced during vibration (see 3.7.1(e)2). Transmitter phase and frequency variations during vibration (see 3.7.1(e)2) shall not degrade a maximum received SINAD by more than 1 dB.

3.6.1.2.5 Warm-up time. The frequency stability requirement of 3.6.1.2.4 shall be met within 5 seconds after the receiver-tranmsitter has been turned on at any temperature between -40° C and +71° C and any input voltage between 20 and 32 direct current (DC) volts (VDC).

3.6.1.3 Input power. When operated in accordance with the inspection conditions of 4.3(a) through (d) and (f) at rated power output, and measured at nominal center and band edge frequencies, the maximum currents shall be in accordance with the following:

(a) I_T = Input current Transmit mode (Keydown CW)
I_T MAX = 0.90A

(b) Input current receive mode

I_R MAX = 0.24A

(c) I_{AVG} = Input current when averaged over a 9:1 receiver-transmit duty cycle on 12 test frequencies

I_{AVG} MAX = 0.306A

These measurements shall be made at 24 V $\pm$ 0.50 V.

3.6.1.3.1 Input voltage. The receiver-transmitter shall meet full requirements specified herein with input voltages between 20.0 and 32.0 VDC over the full ambient temperature range of the equipment.

3.6.1.4 Power sources. The receiver-transmitter shall operate from an external power source (such as the amplifier converter AM-6879/URC, Drawing No. 755002A1800) which shall meet the requirements of 3.6.1.3.1.

3.6.1.5 Audible indicators. Five distinctive audio signals as follows shall be available at the handset earphone to alert a trained operator.

3.6.1.5.1 Battery condition indicator. Circuitry shall be provided in the receiver-transmitter to inform the operator of the battery condition. When the battery voltage drops below the alarm set point, a repeating audio click shall be heard in the headset. The alarm set point shall be adjustable by means of an internal control with a minimum range of 17.5 V to 20.5 V. The alarm set point shall be adjusted in production to 19 VDC.

3.6.1.5.2 Power output indicator. When the receiver-transmitter is used in Radio Set AN/PRC-104, presence of sidetone shall guarantee that the radio set is generating a radio frequency (RF) signal with a power output within 3 dB of the power output specified in MIL-R-29418. The absence of sidetone shall indicate a lower or no power output condition.

3.6.1.5.3 Tuning indicator. A continuous 1 KHz $\pm$ 100 Hz tone shall be heard in the headset during the antenna coupler tune cycle. This tone shall cease when the tuning cycle has been completed.

3.6.1.5.4 No-tune indicator. If the antenna coupler fails to satisfactorily complete a tuning cycle, a beeping tone shall follow normal tuning indicator. This shall be an indication that the voltage standing wave ratio (VSWR) exceeds 1.5 to 1.

3.6.1.5.5 VSWR indicator. When the receiver-transmitter is used in the AN/PRC-104, a short 1000 Hz beep at the beginning of a transmission shall indicate a previous momentary high VSWR condition during the last transmission. If a permanent change in VSWR exceeds the 1.5 to 1 threshold, a retune cycle shall be initiated.

3.6.2 Receiver requirements.

3.6.2.1 Modes of reception. A frequency change of 1 KHz or greater shall cause all internal antenna tuning elements to be removed from the receive circuit leaving the antenna connected directly to the receiver.

(a) Voice mode. The receiver shall be capable of USB voice or CW and LSB voice or CW reception over the frequency range of 2.0000 to 29.9999 MHz.

(b) Data mode. The receiver shall be capable of receiving narrow band secure voice signals in either sideband over the frequency range of 2.0000 to 29.9999 MHz. Selection of data mode will be provided by a position of the mode switch.

(c) Receive only mode. The receiver shall be capable of operating in USB, LSB, data and CW modes in a manner that inhibits the keyline function making transmission impossible. A change in frequency greater than 1 KHz shall cause associated couplers to home and the antenna to be connected to the receiver.

3.6.2.2 Sensitivity. The output signal-plus-noise-plus-distortion to noise-plus-distortion ratio shall be at least 10 dB when an RF signal of 1.4 uV open circuit from a 50-ohm source is applied to the receiver input terminals for a 2.0000 MHz to 29.9999 MHz range.

3.6.2.3 Overall selectivity. Overall selectivity of the receiver shall be defined as that from antenna connection to audio output. The pass-band characteristics shall be as follows:

(a) USB: carrier +500 Hz to carrier +3000 Hz: 3 dB from peak maximum; carrier -1000 Hz to carrier -3000 Hz: 55 dB min; at the carrier -4000 Hz and at the carrier +5000 Hz: 60 dB minimum.

(b) LSB: carrier -500 Hz to carrier -3000 Hz: 3 dB from peak maximum; at the carrier +1000 Hz to carrier +3000 Hz: 55 dB minimum; at the carrier +4000 Hz and at the carrier -5000 Hz: 60 dB minimum.

(c) Ripple (peak to valley): 2.0 dB maximum 500 Hz to 3000 Hz. 0.5 dB is allowed as production tolerence.

(d) Attenuation: The low frequency attenuation shall be no greater than 3 dB down from peak response at 500 Hz and shall decrease at a rate no greater than 2 dB per 50 Hz, to 350 Hz. Additionally, 1 dB attenuation per 10°C shall be allowed from -5°C to -46°C for frequencies below 500 Hz.

3.6.2.4 Envelope delay distortion. The envelope delay distortion shall not exceed 500 microseconds from 825 to 2750 Hz.

3.6.2.5 Automatic gain control (AGC) characteristics. The AGC shall maintain the audio output within 0 to -12 dB when the input signal to the receiver is reduced from 100 uV to the reference sensitivity level and within 0 to 6 dB when the input signal to the receiver is increased from 100 uV to 0.3 V. AGC attack time shall be 30 ms maximum in all modes. The release time constant shall be 750 ms minimum to 1.50 seconds maximum in the voice and CW

modes. In the data mode, the release time shall be 60 ms to 130 ms. Attack and release times are defined as the time intervals required for the audio output level to stabilize to within ± 3 dB of its final value, when measured from application and removal, respectively, of a 40 dB input signal level change with a minimum input signal of -100 dB.

3.6.2.6 Audio output power. In the voice mode, the receiver audio amplifier shall be capable of delivering a minimum of 2 milliwatts (mW) of audio power between 500 and 3000 Hz into a 500 ohm ± 20 percent resistive load for a received signal plus-noise to noise ratio of 10 dB or better in all modes of operation. A volume control located on the front panel shall be provided to permit reduction in audio output power of at least 40 dB relative to maximum output. In the data mode, the audio output shall be 0 dBm ± 3 dBm for an input signal level of -87 dBm. At other input signal levels, the data mode output power shall comply with 3.6.2.5.

3.6.2.7 Audio distortion. Receiver total harmonic distortion in single sideband (SSB) operation shall not exceed 5 percent for audio outputs between 5 mW and 0.1 mW. For outputs between 0.1 mW and 0.02 mW, total harmonic distortion (THD) shall not exceed 10 percent. Limits shall apply at any audio frequency between 350 Hz and 3000 Hz, and for RF signal inputs up to 100 millivolts (mV).

3.6.2.8 Spurious responses.

3.6.2.8.1 Internally generated spurious outputs. With the receiver antenna connections terminated in a shielded 50-ohm resistor, spurious responses shall not exceed the requirements below except spurious responses caused by the 5 MHz reference oscillator and its harmonics which shall not be counted. The 5 MHz signal and its harmonics shall not exceed a SINAD of 25 dB.

(a) Generated spurs. No internally generated spurious output shall exceed a SINAD of 20 dB.

(b) Output spurs. No more than 30 internally generated spurious outputs from both sidebands (total) shall be greater than a SINAD of 3 dB and of these no more than 10 shall be greater than 10 dB.

3.6.2.8.2 External single-signal spurious responses. The receiver shall exhibit the following performance with regard to rejection of undesired signals:

(a) Frequency range response. Within the frequency range 0.975 F_O to 1.025 F_O, not more than four responses shall be permitted at each test frequency which require input amplitudes within the range 55-60 dB above that required at the operating frequency to produce a 10 dB output SINAD. All other responses occurring within this test range shall require a minimum of 60 dB above that required at the operating frequency to produce a 10-dB output SINAD.

(b) Suboctave filter. Within the frequency range 0.7 F_L to 1.4 F_L for the suboctave filter containing the operating frequency, but outside of the region defined in (a) above, spurious responses shall require a minimum amplitude 70 dB above that required at the operating frequency to produce a 10 dB output SINAD.

(c) Intermediate frequency (IF) minimum amplitude. Receiver first IF shall require a minimum amplitude 60 dB and first and second image responses shall require a minimum amplitude 70 dB above that required at the operating frequency to produce a 10 dB output SINAD.

(d) Minimum amplitude. Outside the frequency range of (b) above, but below 1 gigahertz (GHz), and excluding the three responses in (c) above, all other responses shall require a minimum amplitude 80 dB above that required at the operating frequency to produce a 10-dB output SINAD.

3.6.2.9 In-band intermodulation distortion. Intermodulation distortion products produced when the receiver processes two unmodulated RF signals producing audio outputs at 1000 and 1110 Hz shall each be a minimum of 30 dB below the reference output tones, except two of eight measurements are allowed to go to 27 dB as a production tolerance. The requirement shall be met for each operating mode over an input signal amplitude range of 100 uV to 100,000 uV open circuit, per tone, and for audio output levels of 0 dBm per tone or less.

3.6.2.10 Front-end intermodulation distortion. The receiver shall exhibit the specified front-end intermodulation performance for any operating mode. Two unmodulated RF signals of equal amplitude shall be applied to the antenna terminals in such a relationship that $mF_1 + nF_2 = F_o \pm 1000$ Hz, and adjusted in amplitude to produce an audio output SINAD of 10 dB in the appropriate sideband. For the case where both signals are within the first IF 3 dB bandwidth, but outside the final IF band, the minimum signal level required to produce a 10-dB output SINAD shall be -57 dBm per tone. For both tones outside the first IF 40 dB bandwidth, but within the range included between 0.7 F_L and 1.4 F_H, the minimum signal level required to produce a 10-dB output SINAD shall be -35 dBm per tone. For either or both tones outside the range included between 0.7 F_L and 1.4 F_H, the minimum signal level required to produce a 10-dB output SINAD shall be -13 dBm.

3.6.2.11 Desensitization. The receiver shall exhibit the specified performance with regard to desensitization by unmodulated out-of-band signals. The audio output SINAD established by a desired in-band signal of -100 dBm available power shall not be degraded to less than 17 dB by unmodulated out-of-band signals at the frequency spacings and amplitudes indicated in Table II.

Table II. Overload (desensitization) selectivity

Frequency Separation	Minimum Desensitizing Signal Level (dBm)		
	2.0000M Hz	16.0000 MHz	29.0000 MHz
± 2.5%	-31	-14	-9
± 5.0%	-26	-7	-6
± 10.0%	-17	-3	-2
$0.7F_L = F_S = 1.4F_H$ 1/	+15	+17	+17

1/ F_L = Lower limit frequency of suboctave filter containing F_o

F_H = Upper limit frequency of suboctave filter containing F_o

F_S = Out-of-band interfering signal

F_O = Receiver operating frequency

3.6.2.12 Cross modulation. The receiver shall exhibit the specified cross modulation distortion performance for any in-band signal level between 3 uV, open circuit, and 100 mV, open circuit. The in-band signal shall be unmodulated and shall be at the proper frequency to produce an audio output frequency of 1400 Hz. The out-of-band signal shall be 90 percent amplitude modulated at 400 Hz. Performance shall be as follows:

(a) Out-of-Band Tolerance. For an out-of-band carrier frequency in the range 0.7 F_L to 1.4 F_H for the suboctave filter containing F_O with a carrier amplitude equal to or less than -2 dBm, cross modulation components in the audio output at 1000 Hz and 1800 Hz shall each be a minimum of 20 dB below the desired 1400 Hz.

(b) Out-of-Band Frequency. For an out-of-band carrier frequency outside the range of (a) above, with an amplitude equal to or less than +17 dBm, cross modulation components in the audio output at 1000 Hz and 1800 Hz shall each be a minimum of 20 dB below the desired 1400 Hz.

3.6.2.13 Protection. The receiver shall be capable of withstanding up to 20 W continuously from a source having an impedance of 50 ohms without causing damage. This requirement shall be met at resonant, tuned conditions in addition to any other combination of frequency and tune status.

3.6.2.14 Receiver-tranmsitter component impedance. In the receive mode, the RF impedance shall be a nominal 50 ohms. The VSWR shall be less than 3:1.

3.6.3 Transmitter requirements.

3.6.3.1 Modes of transmission. The transmitter shall provide the emission of USB or LSB voice, USB or LSB CW (at speeds up to 300 words per minute), and be compatible with narrow band voice security equipment over the frequency range of 2.0000 MHz to 29.9999 MHz.

3.6.3.2 Power output. RF power into a 50 ohm resistive dummy load shall be 0.250 W CW or peak envelope power (PEP).

3.6.3.2.1 Power output vs operating conditions. The above values for the transmitter power output shall be maintained within $\pm$ 2.0 dB over the complete tuning range of the transmitter, at ambient temperature and over an input voltage range of 20 to 32 VDC. The output power may vary from - 2 dB to +4 dB over the temperature range of -45.6°C (-50°F) to +71°C (+160°F) with automatic level control (ALC) signal held constant.

3.6.3.2.2 Duty cycle. The receiver-transmitter shall be capable of continuous keydown operation.

3.6.3.3 CW keying. The CW signal shall consist of a 1000 $\pm$ 25 Hz tone that is capable of being keyed from 5 to 300 words per minute with a resulting

USB or LSB radiated signal that is free from keying harmonics, key clicks, keying lag, and other spurious or objectionable radiations. CW hang time shall be 1.0 second ± 0.1 second.

3.6.3.4 Spurious outputs. The level of antenna radiated or antenna terminal conducted emissions other than the desired output frequencies shall be in conformance with the following when the receiver-transmitter is loaded into a 50 ohm resistive load:

(a) Suppressed carrier. Suppressed carrier at least 42 dB below the PEP at ambient.

(b) Unwanted sideband. Unwanted sideband at least 45 dB below the PEP (except intermodulation distortion (IMD) products).

(c) Discrete spurious outputs. All discrete spurious outputs generated by the presence of a single tone at rated output shall be down at least 30 dB in the frequency range from carrier to 3 KHz in the desired sideband. Spurious outputs such as harmonics of the modulating frequencies shall be below a straight line drawn from -30 dB at 3 KHz from carrier to -60 dB at 10 KHz from carrier on the desired sideband side of the carrier. Intra and adjacent-channel distortion shall be at least 37 dB down from each reference tone when measured at an output level up to +22 dBm PEP. At one test frequency, a measurement down to 35 dB shall be allowed.

(d) Suboctave filter. Within the suboctave filter band containing the operating frequency, but outside the selected sideband, not more then 3 spurious product pairs shall be permitted within the range from 45 to 60 dB below the CW output. Harmonics of the operating frequency and a maximum of two other spurious products at each test frequency falling between F_H and $2F_L$ or between F_L and $0.5\ F_H$ shall be at least 50 dB below the CW output. Harmonics of the operating frequency and all other spurious products falling above $2F_L$ or below $0.5F_H$ shall be at least 60 dB below the CW output.

3.6.3.4.1 Hum. Hum and ripple shall be at least 40 dB below the output level of a single tone modulating the transmitter to rated PEP output.

3.6.3.4.2 In-band noise level. In-band noise level characteristics shall be as follows:

(a) Broadband noise. Broadband noise measured in a 30 Hz bandwidth shall be at least 50 dB below a single tone at rated output. Spectrum measured shall be between ± 500 Hz from single tone and within ± 3 KHz from carrier.

(b) Unmodulated broadband noise. With no modulation, the inband broadband noise measured in a 30 Hz bandwidth shall be at least 40 dB below rated single tone output.

3.6.3.5 Audio input. The transmitter shall have an audio input impedance of 150 ohms ± 10 percent for voice mode and 600 ohms ± 10 percent for data mode. Standard audio input level shall be -56 dBm into 150 ohms for voice mode and 0 dBm into 600 ohms for data mode.

3.6.3.6 Overall transmitter frequency response. Overall transmitter frequency response shall be defined as that from the audio input to the RF output. The passband characteristics shall be as follows:

(a) USB: From carrier +500 Hz to carrier +3000 Hz: -3 dB maximum from peak.

(b) LSB: From carrier -500 Hz to carrier -3000 Hz: -3 dB maximum from peak.

(c) Ripple (peak to valley): 2.0 dB maximum 500 Hz to 3000 Hz. 0.5 dB is allowed as production tolerance.

(d) Attenuation: The low frequency attentuation shall be no greater than 3 dB down from peak response at 500 Hz and shall decrease at a rate no greater than 2 dB per 50 Hz to 350 Hz. Additionally, 1 dB attentuation per 10°C shall be allowed from -5° to -46°C for frequencies below 500 Hz.

3.6.3.7 Sidetone. The receiver-transmitter shall be equipped to monitor transmissions by sidetone in all transmission modes. The sidetone level, with the transmitter modulated to the full output, shall be adjustable by means of an internal control which is accessible in maintenance over a minimum audio output range of 0.5 mW + 9 dB. Sidetone level shall be adjusted in production to 0.5 mW ± 3 dB and shall remain within this tolerance under all conditions of supply voltage and operating temperature range specified. Sidetone level shall be independent of the audio level control and shall give maximum assurance of proper transmitter operation.

3.6.3.8 Audio compression. An audio compression circuit shall be provided to permit operation using signals of +20 dB above nominal without undue distortion.

3.6.3.9 ALC. The ALC characteristics for the transmitter shall satisfy the following requirements:

Gain:	8 ± 3 dB per volt from 1 V to 6 V.
Time constants:	Attack 15 ms maximum, decay 750 ± 100 ms.
Offset:	0.6 VDC maximum.
Sense:	Positive-going for increasing attentuation.
Range:	37 dB minimum from 0 V to 6 V.

3.6.3.10 Output level adjust. The receiver-transmitter shall include a gain adjustment potentiometer to allow interchange of external PA/couplers without the necessity of resetting ALC threshold.

3.6.4 Transmitter output impedance.

3.6.4.1 Transmitter impedence. In the transmit mode the receiver-transmitter RF impedance shall be a nominal 50 ohms.

3.6.4.2 Tune-fault warning. A low (ground) on Pin 44 of the receiver-transmitter interface connector shall enable a tune-fault aural indication in the audio output. This low shall be supplied by the equipment interfaced with the receiver-transmitter.

3.6.5 Burn-in. The receiver-transmitter shall be able to withstand the burn-in test as specified in 4.8.54 prior to acceptance for delivery.

3.6.6 Vibration test. The receiver-transmitter shall be able to withstand the vibration test as specified in 4.8.55 prior to acceptance for delivery.

3.6.7 Temperature cycling. The receiver-transmitter shall be able to withstand the temperature cycling test as specified in 4.8.56 prior to acceptance for delivery.

3.7 Environmental requirements.

3.7.1 Service conditions. The receiver-transmitter shall be capable of meeting the requirements specified herein under the following service conditions.

(a)	Low temperature (operating)		-45.6°C (-50°F)
(b)	High temperature (operating)		+71°C (+160°F)
(c)	Humidity		up to 98 percent
(d)	Altitude		Sea Level to 4572 meters (15,000 feet)
(e)	Vibration		
	1	Vibration, Secured Cargo	Transported as secured cargo by rail, sea, truck or semitrailer.
	2	Vibration	Installed in ground vehicles, wheeled (utility vehicle M151A2), 6000 miles rated mileage. Frequency range limited to 55 Hz.
(f)	Shock		
	1	Bench handling	The receiver-transmitter shall be capable of meeting performance requirements after the normal handling required for bench testing.
	2	Drop	The receiver-transmitter shall meet the performance requirements with no more than superficial damage after a series of drops from a height of 0.9144 meters (3 ft) to a surface of 5 centimeters (2 in) of plywood backed by concrete.
(g)	Dust		Dry dust (fine sand) laden atmosphere at air velocities up to 609.6 meters (2000 ft) per minute.

(h)	Leakage (Immersion)	Submergence to a depth of 0.9144 meters (3 ft) of water without leakage.
(i)	Rain	Blowing rain at rates up to 0.127 meters (5 in) per hour at wind velocities up to 64.37 meters per hour (40 miles per hour (MPH)).
(j)	Salt Fog	The receiver-transmitter shall resist the effect of a salt laden atmosphere typical of coastal areas.
(k)	Fungus	The receiver-transmitter shall not support the growth of fungi under conditions of high humidity, warm atmosphere and the presence of inorganic salts.

3.7.2 Storage conditions. The receiver-transmitter shall be capable of being stored under the following conditions without degradation.

(a) Ambient temperature range. From -62°C (-80°F) to +71°C (+160°F)

(b) Altitude. From Sea level to 50,000 feet

3.7.3 Orientation. The receiver-transmitter shall be capable of operation at any orientation.

3.8 Electromagnetic compatibility (EMC). The receiver-transmitter shall be self-compatible and shall comply with the applicable portions of MIL-STD-461, Class 1A and 1B. The radiated emission in RE-02 tests shall not exceed that which would result if the spurious output energy allowed by 3.6.3.4(d) were coupled to a test whip antenna 3.048 meters long (10 feet) connected to the RF input at the interface connector. The radiated susceptibility fields applied in RS-03 tests shall not exceed those which would, with the test whip antenna, produce antenna terminal voltages equal to those specified in 3.6.2.8.2. The susceptibility criteria shall be 26 dB SINAD.

3.9 Dimensions. Receiver-transmitter dimensions (maximum) shall be length 18.42 cm (7-1/4 inches), width 6.67 cm (2-5/8 inches) and depth 18.42 cm (7-1/4 inches).

3.10 Weight. The weight of the receiver-transmitter shall not exceed 2.73 kilograms (kg) (6.0 pounds).

3.11 Finish. The receiver-transmitter shall be finished in accordance with the requirements of MIL-E-52798 including required metal preparation and primers. Exterior color shall be forest green.

3.12 Marking. Marking shall conform to Requirement 67 of MIL-STD-454.

3.13 Workmanship. All workmanship shall be in accordance with the requirements established in MIL-STD-454.

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 Quality program requirement. The contractor shall provide and maintain an effective quality program acceptable to the Government for supplies covered herein. The quality program shall be in accordance with MIL-Q-9858.

4.1.2 Government verification. All quality assurance operations performed by the contractor will be subject to Government verification at any time. Verification will include (a) surveillance of the operations to determine that practices, methods, and procedures of the written inspection system are being properly applied, (b) Government product inspection to measure quality of product to be offered for acceptance, and (c) Government product 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 made or until conformance of 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.

4.2 Classification of inspections and tests. The inspection requirements specified herein are classified as follows:

(a) First article inspection (see 4.4)
(b) Production inspection (see 4.5)
(c) Sample inspection (see 4.6)
(d) Environmental inspection (see 4.7)

4.3 Inspection conditions. Unless otherwise specified (see 6.2.1), all examinations and tests shall be performed under the following conditions:

(a)	Temperature	room ambient
(b)	Altitude	normal ground
(c)	Vibration	none
(d)	Humidity	relative humidity up to 90 percent
(e)	Input voltage	batteries as specified in 3.6.1.4 or electronic power supplies with a series resistor added to simulate internal voltage drop
(f)	Transmitter load	50 ± 1 ohm nonreactive
(g)	Receiver load	500 ohm ± 20 percent nonreactive

(h)	Receiver antenna voltage	All voltages specified shall be applied as open circuit voltage from a 50 ohm source.
(i)	Tolerances	Tolerances except for performance limits are ± 10 percent
(j)	Frequency	The RF test frequencies shall be within ± 5 KHz of the nominal frequency specified.

4.4 First article inspection. The Government representative present will select which item is to be subjected to each test. The requirements of 4.5.1 and 4.5.2 apply as a prerequisite to performing first article inspection tests. First article inspection shall consist of tests indicated in Table III.

4.5 Production inspection. Production inspection shall be made on every equipment offered for delivery. The 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, tests which detect deviations from design, tests of adjustment, and tests which detect hidden defects of material. Production inspection shall consist of the tests and examinations indicated in Table III.

4.5.1 Inspection of parts, subassemblies, and items. Inspections shall be performed to determine conformance to the specified requirements prior to inspection of preparation for delivery. All silicon monolithic and hybrid microcircuits including both digital and linear circuit types shall be subjected to and pass as a minimum the quality assurance tests in accordance with MIL-STD-883, Method 5004, Class B.

4.5.2 Mechanical inspection. Each receiver-transmitter shall be given a through mechanical and visual inspection to determine that the quality of all material and workmanship is in compliance with the requirements specified herein. Particular attention shall be given to the following:

(a) Completeness
(b) Nameplates, identification markings and labels
(c) Ease of operation of connector mating, thumb screws, controls and switches and any other part intended for adjustment, movement or operation
(d) Finishes
(e) Welded joints
(f) Check of solder joints
(g) The fit of components in their respective positions
(h) Check of mounting means
(i) Check of safety features
(j) Fastening and securing devices or parts
(k) Accessibility of components and parts for servicing
(l) Cable run between components including plugs and receptacles
(m) Fit of sealing gasket on cover and wear on gasket
(n) Check of all connector fittings
(o) Test points
(p) Overall dimensions
(q) Weight
(r) Other visual defects

TABLE III. Tests

Test	Requirement Paragraph	Test Paragraph	First Article	Production	Sample	Environmental
1. Frequency Range	3.6.1.1	4.8.2	X	X		
2. Frequency Stability	3.6.1.2	4.8.3	X	X		
	3.6.1.2.1	4.8.3.1	X		X	
3. Phase Jitter	3.6.1.2.2	4.8.4	X		X	
4. Stablilty vs. Service Conditions	3.6.1.2.4	4.8.5	X	X		X
5. Warm-up Time	3.6.1.2.5	4.8.6	X	X		X
6. Input Power	3.6.1.3	4.8.7	X	X		
7. Input Voltage	3.6.1.3.1	4.8.8	X			X
8. Power Sources	3.6.1.4	4.8.9	X	X	X	
9. Audible Indicators	3.6.1.5	4.8.10	X	X	X	
10. Modes of Reception	3.6.2.1(a)	4.8.11	X	X		
	3.6.2.1(b)	4.8.11	X	X		
	3.6.2.1(c)	4.8.11	X	X		
11. Sensitivity	3.6.2.2	4.8.12	X	X		
12. Overall Selectivity	3.6.2.3					
	3.6.2.3(a)	4.8.13	X		X	
	3.6.2.3(b)	4.8.13	X		X	
	3.6.2.3(c)	4.8.13	X		X	
	3.6.2.3(d)	4.8.13	X		X	
13. Envelope Delay Distortion	3.6.2.4	4.8.14	X		X	
14. AGC Characterisitcs	3.6.2.5	4.8.15	X		X	
15. Audio Output Power	3.6.2.6	4.8.16	X		X	
16. Audio Distortion	3.6.2.7	4.8.17	X		X	
17. Spurious Responses	3.6.2.8	4.8.18	X		X	
	3.6.2.8.1	4.4.18.1	X		X	
	3.6.2.8.2(a)	4.8.18.2	X		X	
	3.6.2.8.2(b)	4.8.18.2	X		X	
	3.6.2.8.2(c)	4.8.18.2	X		X	
	3.6.2.8.2(d)	4.8.18.2	X		X	
18. In-band Intermod Distortion	3.6.2.9	4.8.19	X		X	
19. Front-end Intermod Distortion	3.6.2.10	4.8.20	X			
20. Desensitization	3.6.2.11	4.8.21	X		X	
21. Cross Modulation	3.6.2.12					
	3.6.2.12(a)	4.8.22	X		X	
	3.6.2.12(b)	4.8.22	X		X	
22. Protection	3.6.2.13	4.8.23	X		X	
23. Modes of Transmission	3.6.3.1	4.8.24	X	X		
24. Power Output	3.6.3.2	4.8.25				
Power Output vs. Operating Conditions	3.6.3.2.1	4.8.25	X	X		X
Duty Cycle	3.6.3.2.2	4.8.25	X	X		X
25. CW Keying	3.6.3.3	4.8.26.1	X	X		
		4.8.26.2	X			
26. Spurious Outputs	3.6.3.4	4.8.27	X	X	X	
	3.6.3.4(a)	4.8.27	X	X	X	
	3.6.3.4(b)	4.8.27	X	X	X	
	3.6.3.4(c)	4.8.27	X	X	X	
	3.6.3.4(d)	4.8.27	X	X	X	
27. Hum	3.6.3.4.1	4.8.28	X		X	
28. In-band Noise Level	3.6.3.4.2	4.8.29	X		X	

TABLE III. Tests, cont'd

	Test	Requirement Paragraph	Test Paragraph	First Article	Production	Sample	Environmental
29.	Audio Input	3.6.3.5	4.8.30	X			
30.	Overall Transmitter Frequency Response	3.6.3.6	4.8.31	X		X	
31.	Sidetone	3.6.3.7	4.8.32	X	X	X	
32.	Audio Compression	3.6.3.8	4.8.33	X		X	
33.	Automatic Level Control	3.6.3.9	4.8.34	X	X	X	
34.	Tune-Fault Warning	3.6.4.2	4.8.35	X	X		
35.	Transmitter Impedance	3.6.4.1	4.8.36	X		X	
36.	Receiver-transmitter Component Impedance	3.6.2.14	4.8.37	X		X	
37.	Receiver-transmitter Function	3.3.1.1.1	4.8.38	X		X	
38.	ON/OFF and Volume Control	3.3.1.1.2.6	4.8.39	X	X		
39.	Reliability	3.3.1.1.4	4.8.40	X			
40.	Maintainability	3.4	4.8.41	X			
41.	Orientation	3.7.3	4.8.42	X			
42.	Control Life	3.3.4	4.8.43	X			
43.	Control End Stops	3.3.5	4.8.44	X			
44.	Transmit-Receive Transition	3.3.1.1.5	4.8.45	X	X		
45.	Transmit Power Up	3.3.1.1.6	4.8.46	X	X		
46.	Resetability	3.3.1.1.7	4.8.47	X		X	
47.	Reverse Polarity	3.3.1.1.8	4.8.48	X		X	
48.	Ground	3.3.1.1.9	4.8.49	X			
49.	Compatibility	3.3.1.1.12	4.8.50	X			
50.	Electromagnetic Compatibility	3.8	4.8.51	X		X	
51.	Interchangeability	3.3.1.1.13	4.8.52	X		X	
52.	Covers and Seals	3.3.6	4.8.53	X			
53.	Burn-in	3.6.5	4.8.54	X	X		
54.	Low Temperature	3.7.1(a)	4.8.1.1	X			X
55.	High Temperture	3.7.1(b)	4.8.1.1	X			X
56.	Humidity	3.7.1(c)	4.8.1.2	X			X
57.	Altitude	3.7.1(d)	4.8.1.3	X			X
58.	Vibration	3.7.1(e)	4.8.1.4.1	X			X
			4.8.1.4.2	X			X
59.	Shock	3.7.1(f)	4.8.1.5.1	X			X
			4.8.1.5.2	X			X
60.	Dust	3.7.1(g)	4.8.1.6	X			X
61.	Leakage (Immersion)	3.7.1(h)	4.8.1.7	X			X
62.	Rain	3.7.1(i)	4.8.1.8	X			X
63.	Salt Fog	3.7.1(j)	4.8.1.9	X			X
64.	Fungus	3.7.1(k)	4.8.1.10	X			X
65.	Workmanship Screen-Random Vibration	3.6.6	4.8.55		X		
66.	Temperature Cycling	3.6.7	4.8.56		X		

NOTE: Sequence of service condition tests shall be in accordance with Table I of MIL-STD-810 for Group E, Type j.

4.6 Sample inspection. The tests in Table III indicated as sample tests shall be performed on samples from production in accordance with the following:

Type A Sample Electrical - All sample tests indicated in Table III, except test 2 (Frequency Stability (long term)) and test 50 (Electromagnetic Compatibility) shall be performed in accordance with the procedures for special inspection levels per MIL-STD-105. AQL for each sample test shall shall be 6.5. The inspection level shall be S-3 for normal, tightened and reduced inspection.

Type B Sample Electrical - Test 2 (Frequency Stability (long term)), and test 50 (Electromagnetic Compatibility) shall be performed as follows: Test 2 shall be performed at the submodule level on sample TCXO's drawn from losts intended for use during production. The sampling plan shall be the same as for the Type A test. Test 50 shall be run on one sample drawn from the first 100 production equipments.

4.6.1 Noncompliance. If a sample unit fails a test indicated in Table III, the contractor shall immediately investigate the cause of failure and shall report to the Government inspector the results thereof and the details of the corrective action taken to correct units of the same conditions. If the Government inspector does not consider that the corrective action will enable the product to meet specified requirements, or if the contractor cannot determine the cause of failure, the matter shall be referred to the contracting officer. Approval to ship the lot may be withheld at the discretion of the Government, pending the decision from the contracting officer on the adequacy of corrective action. The Government reserves the right to require selection of new samples and a new sample test to be performed after completion of any reworking of the lot.

4.6.2 Corrective action. Corrective action found necessary by the contractor or procuring agency concerned as a result of test failure shall be at the contractor's expense. Further, the contractor shall retrofit the corrective action into the production from which the failed item was originally selected. Applicability of the corrective action and retrofit to previous production shall be determined by the procuring agency. Cost of all retrofits and subsequent reinspection shall be borne by the contractor.

4.7 Environmental inspection. Testing indicated for environmental inspection in Table III shall be performed upon samples drawn from production as follows:

Type I - The following tests shall be performed one time upon samples drawn from the first 100 equipments produced: rain, salt fog, dust and fungus. One sample shall be drawn for each test.

Type II- The following tests shall be performed quarterly upon samples drawn from production as follows:
Sample 1 - Temperature (high and low), humidity and leakage (immersion), and altitude.
Sample 2 - Vibration and shock.

4.7.1 Approval for shipment. Delivery of first production equipments shall be withheld until successful completion of the first type I and type II tests. Upon successful completion, authorization to ship will be granted for a period of 120 days or successful completion of the next quarterly test, whichever occurs first. Continued authorization to ship shall be granted if the quarterly tests are successfully completed. In the event a sample fails, the provisions of 4.6.1 and 4.6.2 shall apply.

4.7.2 Reinspection of conforming environmental sample units. Unless otherwise specified in the contract (see 6.2.1), sample units which have been subjected to, and passed, environmental tests may be accepted on the contract provided they are resubjected to, and pass, production inspection after repair of all damage.

4.8 Tests.

4.8.1 Environmental.

4.8.1.1 Temperature. Temperature tests shall be in accordance with Procedure I, Method 502.1, and Procedure II, Method 501.1, of MIL-STD-810 and the following:

(a) The low nonoperating (storage) temperature shall be -62°C (-80°F) for 48 hours.
(b) The low-operating temperature shall be -45.6°C (-50°F).
(c) Where performance measurements are specified, the tests in 4.9 shall be performed.
(d) The high nonoperating and operating temperature shall be 71°C (+160°F).
(e) The duty cycle for the equipment during operating periods shall be 1 minute transmit to 9 minutes receive. All measurements shall be made under these conditions except where a test may be required to start from a power off condition.
(f) The receiver-transmitter may be powered by an external power supply.
(g) Unless otherwise specified, the mode of operation shall be V-TR.

Temperature test procedures shall be as follows:

(a) Make performance measurements at Step 1 of Procedure I, Method 502.1.
(b) At Step 5 of Procedure I, Method 502.1, perform the warmup test specified in 4.8.6 at the initial application of input power at 20 VDC input. Make performance measurements.
(c) Testing shall be continuous during transition from low temperature, operating, to high temperature, operating. Starting at a temperature of -45.6°C (-50°F) the temperature shall be first increased to -40°C (-40°F) and then by 20°F degree steps up to the upper limit of 71°C (160°F). The equipment shall be held at each step long enough for temperature stabilization to occur. Performance measurements are made at each temperature step with alternate 20 and 32 VDC input voltages except the measurements at -45.6°C (-50°F) are made with a 24 VDC input voltage.
(d) At Step 8, Procedure II, Method 501.1, continue operating the equipment for 4 hours. Make performance measurements with 20 and 32 VDC input voltage.
(e) Make measurements at Step 10, Procedure II, Method 501.1.

4.8.1.2 Humidity. The receiver-transmitter shall be subjected to the humidity test in accordance with Method 507.1, Procedure III of MIL-STD-810. The equipment shall be operated in all modes where measurements are required.

(a) Make performance measurements at Step 4, Step 6, Step 8 (every 24 hours), and Step II.
(b) Step 6 performance measurements shall be made during the last 5 hours of the fifth cycle.
(c) For environmental inspection in 4.3, humidity test shall be conducted in accordance with MIL-STD-810, Method 507, Procedure III except that steps 7 and 8 shall be omitted. Performance measurements shall be made during the last 5 hours of the fifth cycle.

4.8.1.3 Altitude. The altitude test shall be performed with the equipment powered by a simulated battery in accordance with procedure I, Method 500.1 of MIL-STD-810.

4.8.1.4 Vibration. The vibration requirements of the receiver-transmitter shall be verified by the following tests.

4.8.1.4.1 Vibration, manpack configuration. The receiver-transmitter shall be rigidly clamped to a fixture and vibration tested in accordance with MIL-STD-810, Method 514.2, Procedure X as applicable to:

Category g - Equipment transported as cargo
Transport Mode - Rail, Air, Sea, Truck or Semi-trailer
Curve Selection - Curve AW , Figure 514.2-7 and resonance below 5 is not expected.
Cycling Time - 84 minutes axis.
Sweep time - 12 minutes sweep from 5 to 200 to 5 Hz.
Resonance Dwell - None required.

The receiver-transmitter shall be nonoperating during the vibration exposure and after the vibration shall be tested to demonstrate compliance with 4.2. The receiver-transmitter shall operate within the specified tolerance limits and shall not exhibit damage after the vibration test.

4.8.1.4.2 Vibration, vehicular configuration. The receiver-transmitter shall be hard mounted by normal means to a vibration exciter and tested, in accordance with MIL-STD-810, Method 514.2, Procedure VIII as applicable to:

Category f - equipment installed in ground vehicles (Table 514.2-VI).
Equipment Conditions - Wheeled Vehicles.

Curve Selection	Curve Y
Cycling Time/Axis	3 hours
Frequency Range	5 to 55 Hz
Sweep Rate	1 octave/minute nominal

During the vibration test, the following parameters shall be within the specified limits:

Receiver Sensitivity
Receiver Overall Selectivity

Transmitter Power Output
Frequency Accuracy
Phase Jitter

Parameters such as phase jitter which require appreciable time for the measurement shall be made with the sweep stopped at each of the 1/3 octave vibration frequency points.

4.8.1.5 Shock.

4.8.1.5.1 Shock (bench handling). The test for bench handling shall be in accordance with Method 516.2, Procedure V, of MIL-STD-810.

4.8.1.5.2 Shock (drop). The receiver-transmitter shall be subjected to test in accordance with Method 516.2, Procedure II, of MIL-STD-810. The receiver-transmitter shall be inspected for damage after each drop. The height shall be limited to 3 feet. Two test items may be used for shock (drop) with one for faces and corners and one for edges.

4.8.1.6 Dust test. The receiver-transmitter shall be subjected to test in accordance with Method 510.1, Procedure I, of MIL-STD-810. Equipment shall be operated during this test.

4.8.1.7 Leakage (immersion). The receiver-transmitter shall be tested individually and assembled in accordance with test Method 512.1, Procedure I of MIL-STD-810.

4.8.1.8 Rain. The receiver-transmitter shall be tested in accordance with Method 506.1, Procedure I, MIL-STD-810, and shall be operating during last 10 minutes.

4.8.1.9 Salt fog. The receiver-transmitter and all other contractor furnished items shall be subjected to Method 509.1, Procedure I, of MIL-STD-810. Operation of the equipment shall not be required. Failure criteria shall include corrosion of finishes and metals. Such corrosion shall be defined as any visible degradation of the equipment surfaces that can be attributed to flakey, pitted, blistered or otherwise loosened finish or metal surfaces.

4.8.1.10 Fungus. The receiver-transmitter and all other contractor furnished items shall be subjected to Method 508.1, Procedure I of MIL-STD-810. All gasket sealed or other nonhermetically sealed equipments shall be sprayed with spore suspension and exposed with the chassis removed and open from the case. Operation of the equipment shall not be required. At the conclusion of the exposure period, examination shall reveal no evidence of viable fungus or corrosion on any surfaces.

4.8.2 Frequency range. The requirements of 3.6.1.1 shall be demonstrated by the selection and operation of the equipment on ten frequencies which exercise every position of each selector control. The frequencies shall include 2.0000 MHz and 29.9999 MHz.

4.8.3 Frequency stability. Frequency measurement of the transmitter carrier shall be made on ten frequencies to demonstrate compliance with 3.6.1.2.

4.8.3.1 Long term frequency stability. Frequency measurement of the transmitter carrier shall be made on ten frequencies to demonstrate compliance with 3.6.1.2.1. The frequency adjustment range requirement shall be verified on one frequency.

4.8.4 Phase jitter. A test shall be performed in the CW transmit mode to demonstrate compliance with the phase jitter requirements of 3.6.1.2.2.

4.8.5 Stability vs service conditions. This test shall demonstrate compliance with 3.6.1.2.4.

4.8.6 Warmup time. The measurement technique for warmup time to demonstrate compliance with 3.6.1.2.5 shall be to measure the transmitter RF output frequency. The CW test frequency shall be 4.9990 MHz USB.

4.8.7 Input power. The receiver-transmitter shall be tested to verify conformance with the transmit and receive current limits specified in 3.6.1.3. These measurements shall be made at the center and band edge frequencies of the suboctave filter bands.

4.8.8 Input voltage. The receiver-transmitter shall be operated and tested with input voltages of between 20.0 and 32.0 VDC to demonstrate compliance with the requirements of 3.6.1.3.1.

4.8.9 Power sources. The receiver-transmitter shall be tested to verify proper operation with an external power source, AM-6879/URC or equal, over the voltage range specified in 3.6.1.3.1.

4.8.10 Audible indicators. The receiver-transmitter shall be tested to demonstrate conformance to 3.6.1.5. Range of adjustment specified for the battery condition indicator may be included as part of the adjustment procedure.

4.8.11 Modes of reception. The modes of reception required by 3.6.2.1(a), (b), and (c) shall be demonstrated using four frequencies.

4.8.12 Sensitivity. The sensitivity requirement of 3.6.2.2 shall be tested using the modes set forth in 3.6.2.1(a), (b), and (c). Tests shall be conducted at the nominal end frequencies for each suboctave filter of the equipment.

4.8.13 Overall selectivity. The overall selectivity of the receiver as required by 3.6.2.3(a), (b), (c), and (d) shall be tested for compliance at 16 MHz from antenna connection to audio output.

4.8.14 Envelope delay distortion. This test shall verify that the receiver envelope delay distortion from the RF input connector to the audio frequency output connector complies with the requirements of 3.6.2.4.

4.8.15 AGC characteristics. A test shall be performed to demonstrate that the AGC attack and release time characteristics are within the times specified in 3.6.2.5.

4.8.16 Audio output power. A test shall be performed to demonstrate that the audio output power and volume control range meet the requirements of 3.6.2.6 in the receive mode at a frequency of 16 MHz.

4.8.17 Audio distortion. The total harmonic distortion of the receiver audio output shall be measured to determine compliance with 3.6.2.7.

4.8.18 Spurious responses.

4.8.18.1 Internally generated spurious responses. The receiver shall be tuned throughout the complete operating frequency range, and measurements of the output SINAD obtained with the 50-ohm antenna connector terminated in a shielded 50-ohm resistor.

Tests for requirements of 3.6.8.1(a) and (b):
Measurements shall be performed in both USB and LSB modes, with test frequencies: XX.X990 MHz (USB), XX.X010 Mhz (LSB), and $\pm$ m (1st LO) $\pm$ n (2nd LO) = 2nd i-f to m=n - 20 where m and n are integral LO harmonic orders.

4.8.18.2 External single-signal spurious responses. The requirements of 3.6.2.8.2(a), (b), (c), and (d) shall be tested over the range of 0.5 MHz to 1 GHz. The test frequencies for (c) and (d) shall be determined from the following formulas:

$$\pm F_S \pm mF_1 = 1F_1$$

$$\pm F_S \pm nF_2 = 1F_2$$

where: F_S = Input signal

F_1 = First Oscillator (LO)

$1F_1$ = First 1F

$1F_2$ = Second 1F

m=n - 1 through 14

4.8.19 In-band intermodulation distortion. The test for in-band intermodulation distortion in accordance with the requirements of 3.6.2.9 shall be conducted at 16 MHz.

4.8.20 Front end intermodulation distortion. The tests for front end intermodulation distortion shall be performed at frequencies which demonstrate requisite operation of all suboctave filters.

4.8.21 Desensitization. The desensitization tests shall be performed at the frequencies indicated in Table II.

4.8.22 Cross modulation. The tests for cross modulation shall be performed at frequencies which demonstrate requisite operation of all suboctave filters.

4.8.23 Protection. The tests for receiver front end protection shall be performed at the center frequencies of suboctave filters. Twenty watts of RF power shall be applied for 1 minute at each frequency.

4.8.24 Modes of transmission. The modes of transmission required by 3.6.3.1 shall be demonstrated at a frequency of 16 MHz.

4.8.25 Power output. RF power output shall be measured and recorded at the nominal end frequencies for each suboctave filter during tests to determine compliance with the requirements of 3.6.3.2

4.8.26 CW keying.

4.8.26.1 CW keying. The 1000 ± 25 Hz tone, 5 to 300 words per minute key rate and hang time requirements shall be tested at 16 MHz to demonstrate compliance to 3.6.3.3.

4.8.26.2 CW keying. The keying harmonics, key clicks, keying lag and other spurious or objectionable radiations shall be tested to demonstrate conformance to the requirements of 3.6.3.3.

4.8.27 Spurious outputs. The test for spurious outputs per 3.6.3.4 shall be performed at the center and band edge frequencies of the suboctave filters incorporated in the receiver-transmitter.

4.8.28 Hum. The hum test shall be performed at the frequencies required for spurious outputs. CW tone keying shall be applied for the purpose of this test at the frequencies indicated by Table I.

4.8.29 In-band noise level. The in-band noise level shall be tested at the frequencies indicated by Table I.

4.8.30 Audio input. The transmitter audio input impedance and input levels shall be measured at 12.1939 MHz to determine compliance with 3.6.3.5.

4.8.31 Overall transmitter frequency response. The audio frequency response test shall be performed at 12.1939 MHz. The measurement shall be made just below the ALC threshold level.

4.8.32 Sidetone. The transmitter shall be operated in all modes and the sidetone measured for conformance with 3.6.3.7. Range of adjustment may be confirmed during the adjustment procedure.

4.8.33 Audio compression. The transmitter shall be operated in the voice mode to determine conformance to 3.6.3.8. The IMD performance shall not be degraded by more than 3 dB when the input signal is increased 20 dB.

4.8.34 ALC. The ALC characteristics required by 3.6.3.9(a), (b), (c), (d) and (e) shall be tested to determine performance at 2.000 MHz.

4.8.35 Tune-fault warning. Each receiver-transmitter shall be tested to insure that a ground applied to pin 44 of the interface connector causes a beeping sound to indicate a no-tune condition.

4.8.36 Transmitter impedance. A test shall be performed to demonstrate compliance with the nominal 50 ohms requirement of 3.6.4.1.

4.8.37 Receiver-transmitter component impedance. The receiver-transmitter input impedance shall be measured every 2 MHz to determine compliance with 3.6.2.14.

4.8.38 Receiver-transmitter function. The requirements of the receiver-transmitter function as it relates to 3.3.1.1.1 shall be accepted upon successful demonstration of the integration of Radio Set, AN/GRC-193, in addition to validation of the interface parameters required by MIL-A-28988.

4.8.39 ON/OFF and volume control. Conformance to 3.3.1.1.2.6 shall be verified at any operating frequency.

4.8.40 Reliability testing.

4.8.40.1 Reliability qualification test. The contractor shall conduct a reliability qualification test on four first articles as selected by the Government. The test shall be conducted in accordance with Test Plan IV, Test Level E of MIL-STD-781. The test parameters shall be in accordance with those in 4.8.40.2.

4.8.40.2 Modes of operation and test parameters. The equipment shall operate continuously in the V-TR mode with a 90-percent receive, 10-percent transmit duty cycle. During the test, the following parameters as a minimum shall be measured:

(a) Receiver
    1 Frequency stability (see 3.6.1.2)
    2 Sensitivity at one octave intervals (see 3.6.2.2)
    3 Audio distortion (see 3.6.2.7)

(b) Transmitter
    1 RF power output at the octave intervals (see 3.6.3.2.1).
    2 CW Keying (see 3.6.3.3)
    3 Spurious outputs (see 3.6.3.4)

4.8.40.3 Failure. Failure is defined to occur any time the equipment fails to meet any of the parameters required by this specification.

4.8.41 Maintainability. The maintainability demonstration requirements of 3.4 shall use contractor-furnished personnel.

4.8.42 Orientation. Conformance with the requirements of 3.7.3 shall be demonstrated by operating the receiver-transmitter during inclinations forward, backward, left and right, through angles of 90 to 180 degrees, in all modes.

4.8.43 Control life. The control life requirements of 3.3.4 shall be tested on an assembled receiver-transmitter.

4.8.44 Control end stops. The control end stops requirements of 3.3.5 shall be tested on an assembled receiver-transmitter front panel.

4.8.45 Transmitter-receive transition. The receiver-transmitter shall be tested for compliance with the requirements of 3.3.1.1.5 in the D-TR mode of operation.

4.8.46 Transmit power up. The receiver-transmitter shall be tested for compliance with the requirements of 3.3.1.1.6 in the D-TR mode of operation.

4.8.47 Resetability. The requirements of 3.3.1.1.7 shall be tested at frequencies which demonstrate the worst case situations of the equipment design.

4.8.48 Reverse polarity. The requirements of 3.3.1.1.8 shall be tested to demonstrate no damage other than a blown fuse for reverse polarity. Production sample testing shall be implemented so as to eliminate the destruction of the fuses.

4.8.49 Ground. The requirement of 3.3.1.1.9 shall be tested to demonstrate conformance. The negative connection to the power source for proper operation shall not be required through the case assembly.

4.8.50 Compatibility. Requisite demonstrations shall be included in tests to assure compliance with the requirements of 3.3.1.1.12

4.8.51 EMC. The requirements of 3.8 shall be verified by test in accordance with MIL-STD-462 as follows:

(a) First Article:

(1) CE06
(2) CE03
(3) CE04
(4) CE05
(5) RE02
(6) RS03

(b) Production:

(1) RE02 (transmit only)
(2) RS03 (receive only)

4.8.52 Interchangeability. Electrical and mechanical interchangeability tests shall be performed at the module and accessory level to establish conformance with the requirements of 3.3.1.1.13.

4.8.53 Covers and seals. All covers and seals, handset, telegraph key and interface cable shall be fully attached and removed 25 times followed by a leakage test of method 512, Procedure I, of MIL-STD-810.

4.8.54 Burn-in. The burn-in test shall consist of 48 hours, with the last 24 hours of failure-free operation during which the equipment shall be subjected to 200 tuneup simulations, 9:1 duty cycle, 100 frequency changes, and a complete functioning of all controls and switches. The equipment shall not be accepted if any failure occurs as defined by this specification in the area in which the fault has been recorded (see 3.6.4). The receiver-transmitter and front panel may be burned-in separately. The front panel may be exercised in the following manner: Twenty-four hour burn-in is not required for the front panel; however, all front panel controls and switches shall be operated a minimum of 100 times. Proper operation shall be monitored for each switch transition. Power shall be applied to verify correct decoding of switch outputs during this test. The equipment shall not be accepted if any failure occurs.

4.8.55 Workmanship screen. Prior to conducting temperature cycling test, vibration shall be performed on each equipment. 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.

4.8.55.1 Vibration testing. The vibration shall be random, or subject to procuring activity approval, pseudorandum or complex wave-form vibration, for an accumulated time of 10 minutes in the axis deemed most susceptible to vibration excitation. All test items shall be hard mounted (without shock isolators) and subjected to the vibration conditions of Figure 1. The control accelerometer shall be located next to one of the mounting points of the item under test. 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.

4.8.55.2 Test item. The test 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 test shall be corrected and test resumed.

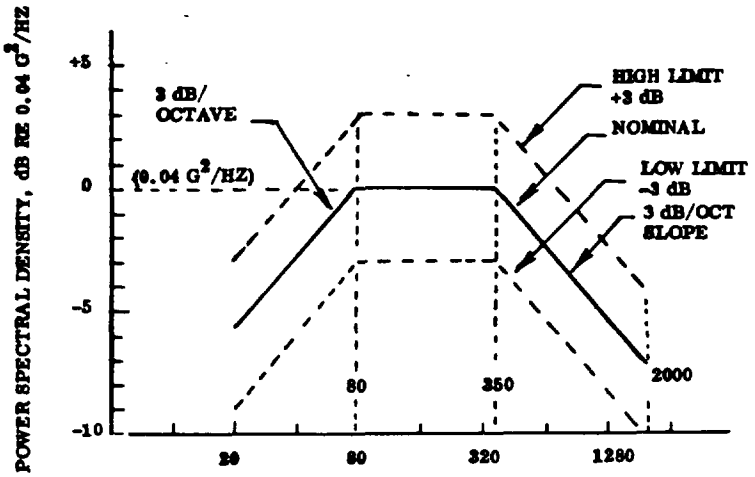

Figure 1. Random Vibration Curve

4.8.56 Temperature cycling. Each equipment shall be subjected to the temperature curve in Figure 2. The number of cycles required shall be determined by the electric/electronic parts count and the parts count chart below. Equipment power shall be turned on and off at the indicated times. When practical, the equipment drawers, panels and enclosures shall be opened or removed for maximum exposure to the changing temperature. The last temperature cycle shall be failure free. When performance measurements are called for, a functional operating test shall be performed. The dwell time shall be 80 percent of the time required for the largest electrical/electronic part to become temperature stabilized. Temperature stabilization shall be as defined in MIL-STD-810 for the nonoperating condition.

Electric/Electronic Parts Count	No. of Temperature Cycles
500 or less	3
501 to 1000	4
1001 to 2000	6
2001 to 3000	8
3001 and up	10

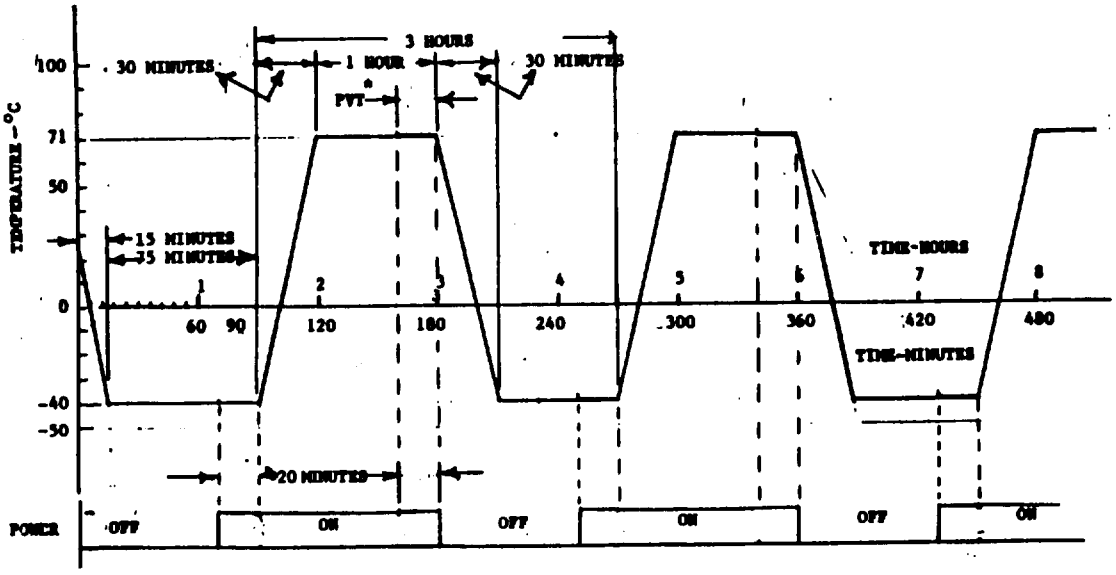

Figure 2. Temperature Cycling Curve

4.9 Performance measurements. Before, during and after the environmental tests, the following measurements shall be performed as a minimum and at a minimum of five frequencies. Performance results and recorded data specifically required under the individual tests shall be provided.

Measurement	
Receiver sensitivity	4.8.12
Receiver overall selectivity	4.8.13
Transmitter power output	4.8.25
Frequency accuracy	4.8.3

The Government reserves the right to perform any test listed at any point in the sequence of the environmental inspections. Failure to satisfy any requirement shall be a basis for rejection. A failure shall be defined as any departure from the performance required by this specification.

5. PACKAGING

5.1 Preservation, packaging, and packing. Preservation, packaging and packing shall be the level of shipment specified in the contract or order in accordance with MIL-E-17555 (see 6.2).

5.2 Marking. In addition to any special marking required by the contract or order, unit packages, intermediate packages, and shipping containers shall be marked in accordance with the requirements of MIL-STD-129.

6. NOTES

6.1 Intended use. The receiver-transmitter is intended for use as a high frequency receiver exciter in such tactical radio sets as the AN/PRC-104 and AN/GRC-193.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

(a) Title, number, and date of this specification.
(b) When materials, processes, and parts are other than as specified (see 3.2.1).
(c) When inspection conditions are other than as specified (see 4.3).
(d) When reinspection of conforming environmental sample units is required (see 4.7.2).
(e) Levels of preservation, packaging, and packing 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 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 procurement.

Preparing activity:
Navy - MC
Project No. 5820-N812

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(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-R-29421(MC)	RECEIVER-TRANSMITTER: RT-1209/URC

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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