SPECIFICATION

RADIO SET AN/URC-35( )

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SPECIFICATION

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1. SCOPE

1.1 This specification covers the Radio Set AN/URC-35( ). This equipment i Navy, service approved, radio set for general purpose voice and CW communicati and is to be used for limited duty, semi-portable applications such as in amph landing craft, shipborne vehicles, for use by beach landing parties and for em gency shipboard use. The equipment operates in the 2.0 to 30.0 megacycles (mc frequency range and provides transmission and reception of single sideband, CW AM (compatible) signals.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on the date of invitatio bids, form a part of the specification to the extent specified herein:

SPECIFICATIONS

BUREAU OF SHIPS

SHIPS-R-4185 (and Amendments)	Specification, Radio Set AN/WRC-1( )
SHIPS-A-4183 (and Amendments)	Specification, Antenna Coupler CU-937/UR

3. REQUIREMENTS

3.1 Models - Equipments to be supplied shall be preproduction and productic type.

3.1.1 Preproduction models - Preproduction models, in the quantity specified the contract, shall be furnished for the preproduction inspection specified in The model(s) shall be of the production type.

3.2 Components - The Radio Set AN/URC-35( ) shall consist of one each of the following:

(a) Receiver-Transmitter, RT-618/URC
(b) Amplifier, Radio Frequency AM-3007( )/URT with Power Supply-------
(c) Radio Remote control auxiliary unit.
(d) Handset, H-169/U including cord and plug assembly.
(e) Shock and vibration mounting system (packed separately).
(f) Set of cable assemblies for equipment system interconnection.
(g) Set of publication material as specified in the contract.

3.2.1 AMPLIFIER, RADIO FREQUENCY AM-3007 ()/URT- The requirements for Ampli Radio Frequency AM-3007( )/URT are as specified in Bureau of Ships Specificatio SHIPS-R-4185, 13 April 1962, and its amendments.

3.3 Material and Parts - The selection and use of material and parts in e equipment shall be in accordance with MIL-E-16400, except as otherwise specifi herein. Particular attention shall be paid to the unacceptable materials and the nonstandard parts requirements of MIL-E-16400. Requests for waiver of spe fication requirements must be furnished prior to purchase of nonstandard parts the preproduction equipments.

3.4 Design - The general design of the equipments shall be the same as the Government Furnished Equipment (GFE) unless otherwise specifically approved by Bureau of Ships, or as otherwise specified herein. Component material supplied must meet requirements of MIL-E-16400 or be specifically approved by the Bureau Ships.

3.4.1 GFE - The GFE is a developmental, service test type and requires extens modifications to conform to this specification and additionally, requires exten production engineering design.

3.5 Construction - The construction of the equipments shall be the same as t of the GFE unless otherwise specified herein.

3.6 Performance - The performance of the equipments shall be within the limi specified herein. In the event of any conflict or inconsistency between the pe formance or other requirements of this specification and the GFE, this specific shall govern.

3.7 Simplicity - The contractor is encouraged to perform analysis studies in to improve the equipment, reduce complexity and cost, as specified in MIL-E-164

3.8 Reliability - The equipments shall be designed for a minimum of maintenance and to conform to the reliability requirements of MIL-E-16400. Furthermore, the reliability and prediction analysis as specified in MIL-R-22732 is required. The Mean Time Between Failure (MTBF) for the AN/URC-35 system shall be not less than 300 hours.

3.8.1 The requirement for "minimum of maintenance" shall be interpreted as requiring the ready and rapid location and replacement of faulty components, the ready replacement of fuses, tubes and indicator lamps, realignment and calibration operations, and the ability to effect minor maintenance operations with a minimum of time and effort.

3.9 Operational requirements - Each radio set shall give reliable performance, within the limits specified herein, under the conditions of intermittent or continuous operation upon its exposure to the adverse conditions normally encountered in Naval communications service. These conditions shall include at least the following factors, acting either separately or in any combination:

(a) Variation in ambient temperature within the limits specified for class 2 electronic equipment in MIL-E-16400, but modified to +50°C for the maximum operating temperature.

(b) Variation in relative humidity within the limits specified in MIL-E-16400.

(c) Variation in primary power supply voltage and frequency within the limits specified in 3.10.2.

(d) Operation with small physical separation between the receiving antenna and antennas of transmitters of high power (up to 500 watts radiated) without damage to the receiver and with maximum protection against overload, desensitization, cross-modulation and intermodulation.

(e) Operation with minimum susceptibility to intentional and unintentional interferences of all types, including intentional jamming.

(f) Operation in conjunction with external accessories as specified, without adverse reaction on, or compromise of, the nominal performance characteristics of the radio set.

(g) Operation within the radio interference (rfi) and enclosure radiation limits of MIL-I-16910.

3.10 General Characteristics

3.10.1 **Frequency range - The frequency** range of the radio set shall be fro 2.0 to 29.9995 Mc. **Each radio set shall be capable of adjustment** to any frequ within this range in 0.5 **kilocycle (kc) increments. In addition, the receiver** shall include provisions for tuning between the 0.5 Kc increments with a verni frequency control.

3.10.2 Primary power source - **Each radio set shall operate from a primary po** source of 28 volts DC nominal **supplied from an external source. Operation of** radio set from an **internally mounted storage battery** of an approved type shall also be possible. By use of an **auxiliary** power supply subassembly which can b mounted internally in the RF Amplifier in place of the battery, operation from 115 v ± 10%, 48 to 450 cycle, AC power source shall be possible.

3.10.2.1 The self-contained, **rechargeable battery shall have the maximum s** of-the-art **ampere hour capacity toward attaining as closely as possible a desi objective of providing 8 hours of continuous operation with a receive-to-transm ratio of 9 to 1 at 25° ±5°C ambient temperature and transmission in voice singl sideband mode.**

3.10.3 Over-all dimensions and weights

3.10.3.1 The maximum dimensions and weights of the radio set shall not exc the following:

Item	Width Inches	Depth* Inches	Height Inches	Weight Pounds
Receiver-Trans-mitter	**17-3/8**	**18-1/2**	7	60
R.F. Amplifier	**17-3/8**	**18-1/2**	7	50***
Power Supply	4-3/4	11-1/4	5-3/8	25
Remote Control	8-1/2	6	6	6
Shock/vibration mount	19-3/4	16-3/4	3-1/4**	16

*Exclusive of rear connectors
**Maximum unloaded height of bedplate
***Without Power Supply installed.

3.10.4 Each radio set shall be of such design as to provide the following modes of operation:

A1 Continuous wave telegraphy (CW).
A2 Modulated continuous wave telegraphy (in receive mode).
A3 Telephony (AM compatible) with full carrier and upper sideband modulation.
A3a Single sideband, reduced carrier, selectable sideband (in transmit
A3j Single sideband suppressed carrier, selectable sideband.

3.10.5 Method of tuning- Frequency selection of the receiver-transmitter over the complete frequency range of the radio set shall be accomplished in increments of 0.5 Kc., where changing the setting of the digital tuning knobs is all that is required to tune the radio. Tuning between the 0.5 kc., increments in the receive mode shall be possible with a vernier frequency control. Frequency tuning of the RF amplifier shall be accomplished automatically when the digital tuning knobs of the associated receiver-transmitter are switched. Broadband RF input, interstage, and output transformers shall be utilized and there shall be no tuning adjustment required when changing frequency other than switching these transformers.

3.10.6 Average Power control - An average power control circuit (APC) shall be provided in the equipments RF amplifier and shall generate a control voltag to adjust the associated transmitter output, keeping the RF amplifier average power output within safe limits when operated as a system.

3.10.7 Peak power control - A peak power control circuit (PPC) shall be pro vided in the equipments RF amplifier and shall generate a control voltage to a just the associated transmitter output to keep the input to the RF amplifier t the desired level for voice operation.

3.10.8 Hardware and parts

3.10.8.1 All screws and nuts employed in the fabrication of the equipment shall be of corrosion-resisting-steel. Parts or components covered by specifi tions, are exempt from this requirement.

3.10.8.2 Test points - Test points shall be so provided and located as t permit the isolation of malfunction to within any major unit or subassembly an to check electronic assembly gains.

3.10.8.3 Filters - Filters used in the sideband selection process shall b electro-mechanical or crystal filter type.

3.10.8.4 Tropicalization - Tropicalization of the radio set or any compone thereof will not be required.

3.10.8.5 Blown fuse indicators - Blown fuse indicating fuse holders shall employed. A spare fuse holder is not required.

3.10.8.6 Solid state devices - Each radio set shall make use of solid stat devices to the maximum extent possible in order to increase the reliability of equipment. Use of commercial grade solid state devices will be permitted upon approval from Bureau of Ships, provided that the over-all requirements of the ment are not degraded and the devices are used within the ratings specified on corresponding JAN data sheet when a corresponding interchangeable MIL approved version is available. Information shall be provided in the equipments technic manual concerning suitable interchangeable equivalents.

3.10.8.7 Time meter - A time meter will not be required.

3.10.8.8 Fuses - Fuses shall be of the glass tube type and shall be mounted in a fuse holder, as specified in 3.10.8.5.

3.10.8.8.1 Both sides of the AC power line shall be fused.

3.10.8.9 Head telephone and plugs - Head telephones and telephone plugs are not required to be furnished by the contractor.

3.10.8.10 Hand keys and plugs - CW hand keys and plugs are not required to be furnished by the contractor.

3.10.8.11 Securing devices - Corrosion resisting steel, slotted head screws and bolts shall be employed in all screw and bolt applications throughout the radio set. Captive type bolts shall be used on equipment front panels and electronic plug-in assemblies.

3.10.8.12 Circuit alignment - Resonant circuits shall be provided with adjustable trimmers, or equally effective means, to permit accurate alignment.

3.10.8.12.1 The trimmers shall provide sufficient means of adjustment to compensate for the effects of normal aging of electron tubes or other parts.

3.10.8.12.2 Composite bandpass filters may be furnished as sealed units without trimmers, provided the input and output sections which are designed to couple to transistors, do not require adjustment.

3.10.8.13 Minimum electrical functional parts - The receiver-transmitter shall co subdivisions of electrical circuit functions in the form of replaceable, plug-in electronic assemblies conforming to MIL-E-16400 (see 3.10.8.18.5).

3.10.8.14 Electrical components - In cases where appreciable savings in cost may be incurred, or where physical size precludes the use of MIL-STD-242, approved electrical components, or nonstandard parts, approved by the Bureau of Ships, may be used provided that performance of the radio set is maintained at a level consistent with this specification.

3.10.8.15 Lights - A dimmer control for the equipment panel lights will not be required.

3.10.8.16 RF input and output connectors - The coaxial radio frequency connectors (receiver antenna receptacle, external frequency standard input, RF amplifier output) shall be type N, selected for use with RG-10( )/U type cable. The receptacles shall be mounted at the rear of the equipment cabinets and shall be suitably labeled.

3.10.8.17 RF input circuit - The RF input circuit for the receiver-transmitter shall be designed for a nominal 50 ohm input and shall be protected from damage from high voltage or current surge inputs. It is anticipated that an RF voltage of 100 volts may be encountered at the receiver-transmitter antenna input connection. In order to meet this requirement an RF overload circuit shall be provided between the antenna input connector and the RF preselection circuits of the receiver-transmitter. This overload circuit shall be automatically resetable. The use of fuses in the antenna circuit shall not be permitted.

3.10.8.18 Enclosure - The enclosures of the equipment shall be splash-proof in the operating condition in accordance with MIL-STD-108.

3.10.8.18.1 The receiver-transmitter shall consist basically of a frame, a front panel, cabinet and a group of replaceable plug-in electronic assemblies. Retractable chassis slides shall be provided on the receiver-transmitter and RF Amplifier units that will permit the chassis, when withdrawn from the case, to be oriented 90 degrees from its normal position. Locks shall be provided to maintain the chassis in the desired position. The frame shall consist of the power supply, receptacles for insertion of the plug-in electronic assemblies and required control functions. The front panel shall be securely mounted to the frame, with two handles provided, one mounted on each side of the front panel and each capable of supporting the entire weight of the unit.

3.10.8.18.2 The cabinets shall be of aluminum. Retractable chassis slides shall be provided to enable rapid removal of the chassis from the cabinet. The cabinet, in conjunction with the front panel, shall provide an adequate moisture seal when the unit is closed.

3.10.8.18.3 Cabinet assembly - Cabinet assembly shall be streamlined to the extent that it shall have no sharp corners or edges. The receiver-transmitter and power amplifier units shall be designed to permit standard rack mounting when required. The design and construction of the units shall be such that when the units are mounted in a standard rack, no additional brackets, other than the rack mounting brackets, or reinforcing members shall be required to preclude the deformation or malformation of any cabinet, chassis, assembly, panel or to any part contained therein not subject to shock. The equipments technical manual shall include a simple fabrication drawing for the manufacturer, by an installation activity, of suitable mounting brackets that will permit mounting of the units in a standard mounting rack provided the notching conforms to MIL-STD-189.

3.10.8.18.4 The following controls, meters, lights and receptacles shall be provided on the equipment unit front panels:

(a) RECEIVER-TRANSMITTER	Functional description
FREQUENCY	Knobs to provide tuning to 0.5 Kc. increments.
FREQUENCY VERNIER	To unlock the oscillators and provide for variable tuning in the receive mode only.
UNLOCKED (light)	Miniature yellow light to indicate oscillator unlocked condition when using the frequency vernier control in receive mode.
R.F. GAIN	To control the gain of the R.F. and I.F. amplifiers in the receive mode.
AUDIO GAIN	To control the audio output level in the receive mode.
NOISE BLANKER	To turn noise blanker circuit on or off and to adjust threshold level.
LIGHTS	To switch dial lamps on or off.
BFO	To provide BFO pitch adjustment in the CW receive mode.
LOCAL-REMOTE	To transfer the operating control point between the local handset or CW key and a remote control station.
MODE SELECTOR	To select the desired mode of operation
FUNCTION SELECTOR	To select OFF, STANDBY, TRANSCEIVE.
HANDSET	Handset receptacle for use with Navy handset H-169/U for transmitting and receiving.
HEADSET	Capped headset phone jack receptacle for monitoring in local operation.
CW KEY	Capped jack receptacle for local CW hand key plug.

3.10.8.18.5 Plug-in modular (electronic) assemblies - The "plug-in" modular electronic assemblies shall be as follows:

(a) RECEIVER-TRANSMITTER

(1) R.F. Amplifier
(1) Translator/synthesizer
(1) Mode selector
(1) Receiver I.F./audio
(1) Frequency standard
(1) Noise blanker
(1) Transmitter audio
(1) Transmitter I.F.

3.10.8.18.5.1 The dust covers of all plug-in electronic modular assemblies employing printed circuit boards on which the component designations are not marked shall be provided with stenciled component and parts layout for assista in locating parts during maintenance and repair. All assemblies shall be provided with appropriate Federal stock number, type identification and manufacturing serial number.

3.10.8.19 Finish - The external finish of all units be in accordance with class 2 of MIL-E-15090.

3.10.8.20 Front panel layout design - The contractor shall submit a proposed equipment front panel layout design for the receiver-transmitter and the remote control units for approval prior to the construction of the pre-production equipment.

3.10.8.21.1 GFE design changes - The GFE equipment is a developmental, service test, model shop constructed type of equipment requiring extensive changes to include desired technical, operational and production modifications The following is a list of major changes required under this specification:

3.10.8.21.1 General changes shall be as follows:

(a) Improve chassis guide pin and receptacle design to permit more positive seating for a length equivalent to the pin total length, and to eliminate undesired cantilever loading.
(b) Improve the chassis of all units to strengthen for increased shock conditions.
(c) Provide surge limiting resistors where practicable in power supplies
(d) Modify receiver AGC circuitry for conventional AGC system.
(e) Provide wafer switches of more durable material and design for easy repair replacement.
(f) Design and provide modular assembly plugs and receptacles, for production closed entry type..
(g) Provide improved positive detents for digital controls on front pane on all digital switches.
(h) Improve parts identification including cables and connectors.
(i) Improve design for shaft-to-digital encoder for lower cost; improve reliability and reduce complexity.
(j) Improve design for cable markers so that they will not come off in temperature and humidity tests.
(k) Provide additional test points as required for adequate maintenance checks including translator/synthesizer electronic assembly input.
(l) Provide Plug-in relays, or substitute improved, more reliable relays or substitute diode gates for relays wherever possible.

3.10.8.21.2 The deleted items for the receiver-transmitter shall be as follows:

(a) MOISTURE INDICATOR on the equipment's front panel.
(b) Terminal connections for external audio output transformer center tap leads from the rear mounted multipin connector receptacle of the equipment. (Optional audio transformer center tap grounding connections shall be provided on equipment's chassis.

3.10.8.21.2.1 The items changed for the receiver-transmitter shall be as follows:

(a) Modify the dial light circuitry in the "on" position for an intensity at a level between the present GFE settings of dim and bright. Change switch to toggle type.
(b) Provide different mode and function selector knobs having better mechanical purchase.
(c) Modify circuitry to include 0.5 Kc. incremental tuning in lieu of 1 Kc. tuning.
(d) Change rear connector for antenna to a type N and label "ANTENNA".
(e) Change external frequency standard input connector to a type N and label "EXTERNAL FREQ. STD. INPUT 5 MC".
(f) Label internal frequency standard output connector "INTERNAL FREQ. STD. OUTPUT 5 MC".
(g) Change multipin receptacle mounted on the rear of the equipment's cabinet to a smaller type similar to those specified in MIL-C-26482. Spare terminals shall be provided.
(h) Redesign AGC circuit with a satisfactory time constant for all modes of operation. Design shall be for a conventional system in lieu of the existing step AGC system.
(i) Modify R.F. amplifier electronic plug-in assembly for greater linearity.
(j) Provide improved changes in I.F./audio plug-in assembly to remove regeneration.
(k) Provide adequately overrated components in critical circuits and where such components are not easily available for maintenance replacement.
(l) Provide capability for receiving and transmitting in the CW mode.
(m) Provide internal selection of 0 db, -10 db, -20 db and full carrier suppression level in the transmit mode.

3.10.8.21.2.2 The additions for the receiver-transmitter shall be as follows:

(a) Provide 500-cycle and "VERNIER" tuning controls on the front panel of the equipment.

(b) Provide yellow warning light on front panel to indicate tuning control in vernier or unlocked state.
(c) Provide headphone jack on front panel for monitoring operation.
(d) Provide jack on front panel for local CW hand key plug.
(e) Provide BFO pitch control on the front panel.
(f) Provide an internally connected case-to-chassis interconnecting cable (to permit operation of the receiver-transmitter retracted from its case on its chassis slides) if it can be accomplished without increasing the over-all case dimensions.

3.10.8.21.3 The radio remote control auxiliary unit shall be modified as follows:

(a) Provide separate headset and microphone jack receptacles connected in parallel with the handset connector. The receptacles shall be similar to those used on control units C-1138/UR, but with caps for waterproofing.
(b) Strengthen the unit mounting bracket to withstand shock and vibration.

4. BASIC CONDITIONS AND DEFINITIONS

For purposes of this specification, the following basic conditions and definitions shall apply, as pertinent to the specified performance requirements of this specification. They shall be regarded as being in addition to those specified in MIL-STD-449. These conditions and definitions are specifically applicable to the measurement of sensitivity, spurious response and oscillator radiation characteristics in the receiver section of the receiver-transmitter; measurement of the output power, spurious response, intermodulation distortion, bandwidth and carrier suppression in the transmitter section of the receiver-transmitter; and the measurement of the power output, harmonic output and distortion in the R.F. amplifier unit.

4.1 Receiver-Transmitter; Receiver Section

4.1.1 Standard dummy antenna - A standard dummy antenna shall be a device, the electrical constants of which, together with those of the standard signal generator, are such as to simulate the impedance characteristics of antennas suitable for use with each equipment throughout its frequency range.

4.1.1.1 A device, meeting the requirement of 4.1.1 shall be a 50 ohm, non-inductive resistance. This resistance, intended to simulate the nominal average impedance of the concentric transmission line specified herein, shall include the resistance arm of the output attenuator in shunt with the output terminals of the standard signal generator. The resistance added externally to the standard signal generator, to simulate the 50 ohm resistance, shall produce a total of 50 ohms when added to the effective output resistance of the standard signal generator.

4.1.1.2 The intent of 4.1.1.1 is that the standard signal generator produce the equivalent of the signal voltage induced by a radio field in an antenna which has the constants that are simulated by the dummy antenna plus standard signal generator impedance. Hence, the microvolt reading obtained from the standard signal generator shall be the actual equivalent antenna voltage.

4.1.2 Standard output signal plus noise-to-noise ratio - Standard output signal plus noise-to-noise ratio shall be 10 decibels (db). This ratio shall be determined in terms of root mean square (r.m.s.) values.

4.1.2.1 For A2 reception, the output signal plus noise-to noise ratio shall be the ratio between a standard audio output signal, obtained under conditions of measurement for modulated continuous wave sensitivity and the output due to noise when the modulation is removed from the R.F. carrier.

4.1.2.2 For A1 reception, the output signal plus noise-to-noise ratio shall be the ratio between a standard audio output, obtained under conditions of measurement for CW sensitivity, and the output due to noise with the carrier removed.

4.1.3 Standard audio output - Standard audio output shall be nominally 6 milliwatts of power which is dissipated into a 600 ohm, noninductive resistance across the audio frequency (a.f.) line output terminals.

4.1.4 Standard gain - Standard gain shall be that gain which produces standard output signal plus noise-to-noise ratio (see 4.1.2) with standard audio output.

4.1.5 Standard modulation frequency - Standard modulation frequency shall be 1000 c.p.s.

4.1.6 Standard beat note frequency - Standard beat note frequency for CW and single sideband reception shall be 1000 c.p.s.

4.1.7 Sensitivity - Sensitivity of a radio receiver is that characteristic which determines the minimum strength of a signal input capable of producing a desired ratio of output signal plus noise-to-noise.

4.1.7.1 Standard CW sensitivity - Standard CW sensitivity shall be the number of microvolts of pure CW radio frequency energy, (applied to the antenna input through a standard dummy antenna) required to produce not less than standard audio output (see 4.1.3) under conditions of standard output signal plus noise-to-noise ratio, as defined in 4.1.2.

4.1.7.2 Standard MCW sensitivity - A standard MCW sensitivity shall be the number of microvolts of pure CW radio frequency energy, modulated 30 per cent at standard modulation frequency (applied to the antenna input through a standard dummy antenna) required to produce not less than standard audio output (see 4.1.3) under conditions of standard output signal plus noise-to-noise ratio, as defined in 4.1.2.

4.1.7.3 Standard single sideband sensitivity - Standard single sideband sensitivity shall be the number of microvolts of pure CW sideband energy, (applied to the antenna input through a standard dummy antenna) required to produce not less than standard audio output (see 4.1.3) under conditions of standard output signal plus noise-to-noise ratio, as defined in 4.1.2,

4.1.8 Selectivity - Selectivity of a radio receiver is that characteristic which determines the extent to which it is capable of differentiating between the desired resonant signal and RF signals of other frequencies.

4.1.8.1 Weak signal selectivity - Weak signal selectivity shall be the degree to which the radio receiving set is capable of differentiating between the desired signal and relatively weak interfering signals of frequencies relatively close to the desired signal frequency. It shall be expressed in terms of the attenuation, in db, which the radio receiving set introduces to frequencies removed from resonance, with respect to the resonant sensitivity, using standard audio output as a common reference level.

4.1.9 Spurious responses

4.1.9.1 Image Rejection - Image rejection shall be the degree to which the radio receiving set is capable of rejecting signals off resonance which, in combination with the fundamental or any harmonic of the conversion oscillator(s), produce frequencies which are amplified by the I.F. amplifier(s), and result in spurious responses. It shall be expressed in terms of the attenuation, in db which the radio receiving set introduces to the image frequencies, with respect to the resonant sensitivity, using standard audio output as a common reference level.

4.1.9.1.1 Image rejection shall be relative to the resonant frequency rather than the image frequency.

4.1.9.1.2 I.F. rejection - I.F. rejection shall be the degree to which the radio receiving set is capable of rejecting signals having the frequency(s) of the I.F. amplifier(s). I.F. rejection shall be expressed in terms of the attenuation, in db, the radio receiving set shall introduce to I.F. frequencies, with respect to the resonant sensitivity, using standard output as the reference level.

4.1.10 Resonant overload - Resonant overload shall be the condition wherein the audio output of the radio receiving set, as adjusted for measurement of standard sensitivity, falls 3 db with increase of input carrier level.

4.1.11 Maximum undistorted output - Maximum undistorted output shall be the output power level with an input carrier, such as to produce the standard sideband measurement frequency (see 4.1.12.2), at which the total output harmonic content is 2 per cent, in voltage, with r.f. input into the radio receiving set adjusted for 1000 microvolts.

4.1.11.1 The total harmonic content shall be that measured by the elimination of the voltage of the fundamental modulation frequency, the resultant harmonic voltage components being measured by means of a distortion analyzer.

4.1.12 Standard sideband measurement frequency - Standard sideband measurement frequency shall be 1000 cycles; that is, 1000 cycles higher than the carrier for the upper sideband and 1000 cycles lower than the carrier for the lower sideband.

4.2 Receiver-Transmitter; transmitter section

4.2.1 Local input - The term local input in this specification indicates that control and modulating functions for the receiver-transmitter are being provided by the handset (or other appropriate device connected to the handset receptacle on the front panel) or the local CW hand key. The audio input impedance in the "local" mode of operation shall be nominally 30 ohms. Two tones between the frequency ranges of 300 to 3500 cps and at a nominal level of 44 millivolts per tone shall be sufficient to drive the receiver-transmitter to its standard two tone output defined herein.

4.2.2 Remote inputs - The term remote inputs in this specification indica that control and modulating functions will be provided at the rear of the receiver-transmitter case. The nominal input impedance for the remote audio input shall be 600 ohms. Remote input functions shall be operable upon closur of a keyline. Nominal two tone input to produce a standard transmitter two tone R.F. output in the single sideband mode shall be 150 millivolts per tone when the frequencies of the tones lie between 300 and 3500 cps and separated not less than 90 cps nor more than 1000 cps.

4.2.2.1 Standard single sideband R.F. output - A standard single sideband R.F. output shall be produced when a nominal two tone input is applied to eith the local or remote input connections. A two tone R.F. output having a peak e velope power of 100 milliwatts developed across 50 ohms at the receiver-trans- mitter output terminals shall be considered standard single sideband R.F. outp

4.2.2.2 Maximum R.F. output - An output of 250 milliwatts PEP must be produ before limiting occurs.

5. ELECTRICAL PERFORMANCE

Each radio set shall comply with the following requirements for electrical performance, as applicable, when operating under the following standard test conditions, unless otherwise specified herein.

5.1 Standard test conditions

5.1.1 Primary power - The primary power test condition shall be 115 volts, 60 cps, single phase on AC and 28 volts on DC.

5.1.2 Audio frequency (a.f.) outputs - All a.f. outputs shall be measured with respect to a 600 ohm noninductive resistive load connected across the output terminals, unless otherwise specified herein.

5.1.3 Master oscillator - The "INT. STD." internal frequency standard adjustment control shall be adjusted as required to assure correct setting of the output frequency from the self-contained master oscillator frequency standard.

5.1.4 External/Internal frequency standard switch - The "FREQ. STAND." switch shall be adjusted to its "INT. STD." position.

5.1.5 Ambient temperature - The ambient temperature shall be between 20° and 30°C.

5.1.6 Relative humidity - The relative humidity shall be below 95 per cent.

5.1.7 Antenna impedance - The antenna impedance on transmit or receive shall be 50 ohms nonreactive.

5.1.8 R.F. input to receiver - All r.f. inputs to the receiver shall be applied to the antenna input terminals through a standard dummy antenna.

5.1.9 Receiver phone level controls - The receiver phone level controls shall be adjusted as specified herein for the determination of performance of the radio receiver.

5.1.10 Receiver beat frequency oscillator (BFO) control - The BFO control shall be normally adjusted at its zero or midscale position, but may otherwise be adjusted, as required herein, to determine the performance of the radio receiver.

5.1.11 Transmitter R.F. outputs - Transmitter R.F. outputs shall be measured with respect to a 50 ohm noninductive load connected to the output terminals through a suitable transmission line.

5.1.12 R.F. amplifier R.F. input - All R.F. amplifier R.F. inputs shall be applied to the unit from a standard source impedance.

5.1.13 R.F. amplifier bias - The R.F. amplifier bias shall be adjusted as required to insure that the correct operating point has been set for the tubes.

5.1.14 Primary power line input adjustment - The equipment's line voltage adjustment shall be adjusted as required to insure that proper input voltage is applied to the equipment.

5.2 Detailed Performance

5.2.1 General requirements

5.2.1.1 Shock and vibration - The radio set shall be capable of meeting the grade II requirements of MIL-S-901, and MIL-STD-167 when attached to shock and vibration mount assembly of the equipment.

5.2.1.2 Power output - The radio set shall be capable of transmitting 100 watts PEP in SSB mode, USB or LSB, 50 watts in CW mode, and 25 watts carrier in AM. mode into a 50 ohm load. The above power output ratings in the sideband mode shall be based on measurements made with two equal amplitude tone inputs.

5.2.1.3 Peak power control (PPC) - A PPC circuit shall be provided to limit power output peaks to a level sufficient to safeguard the R.F. amplifier and the associated antenna coupler from damage.

5.2.1.4 Average power control (APC) - An APC circuit shall be provided to limit the average power output to a level sufficient to protect the R.F. amplifier tubes from damage due to excessive plate dissipation.

5.2.1.5 Intermodulation distortion - Third order intermodulation products shall be at least 30 db below either tone of a two tone envelope at 100 watts PEP.

5.2.1.6 Carrier suppression - The carrier level shall be adjustable to at least 50 db below a 1000 cps modulated single sideband output signal when operating at 100 watts PEP output into a 50 ohm load.

5.2.1.7 Harmonic radiation - With a two tone single sideband input, the second harmonic output of the radio set shall be at least 40 db below the PEP when measured into a 50 ohm noninductive load connected to the output of the R.F. amplifier.

5.2.1.8 Spurious radiation - The spurious output of the radio set shall be at least 50 db below PEP output.

5.2.1.9 Frequency stability - The frequency stability shall be at least 1 part in 10^8 per day. The equipment shall include provisions for operation of both transmitter and receiver sections controlled by an internal or external frequency standard of 5 Mc.

5.2.1.10 Simplex operation - Action of the disabling system of the equipmen shall be fast enough to permit break-in operation.

5.2.1.11 Radio remote control system - The equipment shall contain compatible provisions for remote control of the equipment in the standard Navy radi remote control system (not frequency control) using a maximum of 3 control units C-1138/UR or equivalent. Continuous, simultaneous key down operation at all three remote positions will not be required, but no permanent damage to the equipment shall result from momentary, inadvertent operation in such manne Simultaneous connection and use of the URC-35 remote control box and the standard Navy C-1138/UR control units will not be required. The "power on" light of the C-1138/UR units need not be operable when used with the AN/URC-35 Radio Set.

5.2.1.12 CW keying - Keying speeds up to 25 dot cycles per second (approximately 40 words per minute) shall be possible. The keyed wave shall be free from transients and splatter.

5.2.2 Detail requirements for receiver-transmitter

5.2.2.1 Accuracy of main tuning indicator calibration - The accuracy of frequency indication shall fall within the limits specified herein. The specified accuracies shall apply to all tuning indicators acting, in combination, to the indicate the tuning of the set.

5.2.2.1.1 Incremental tuning - Incremental tuning of 0.5 Kc shall be provided with accuracy equivalent to that of the master oscillator. It shall be possible to tune the receiver-transmitter to any frequency within the tuning range in less than 20 seconds.

5.2.2.1.2 Frequency selector knobs - A five knob digital type of frequency selection system shall be provided on the front panel. The knob, shall control the selection of MC, 100 Kc, 10 Kc, and 1 Kc. The five knobs shall be equally spaced on a horizontal line across the front panel. Individual windows for display of each digit shall be located directly above each knob. The five knobs shall effectively control the frequency and display of frequency to which the receiver-transmitter is tuned, down to the last kilocycle anywhere within the required range of coverage. Each knob shall cover its range of digits in less than one rotation of the knob and end stops shall be provided Each digit selected shall include mechanical detent provisions.

5.2.2.1.3 Frequency vernier and 0.5 Kc selector - A 0.5 Kc selector control marked 000 and 500 shall be positioned above the 1 Kc dial. This control shall provide tuning to 0.5 Kc with an accuracy equivalent to that of the master oscillator. A frequency vernier control shall permit switching into vernier tuning mode and to provide continuous vernier tuning between 1 Kc increments in the receive mode with a stability of at least ±150 cycles. A yellow warning light shall indicate that the vernier control is in an "on" position. An override circuit shall be provided to automatically return the transmit mode frequency to either the 000 or 500 cycle locked position previously preset by the 0.5 Kc selector control when going from receive to transmit mode even though the tuning in the receive mode is in the vernier condition.

5.2.2.1.4 The backlash in the mechanical tuning arrangement shall not abrogate the requirements of 5.2.2.1.

5.2.2.2 Frequency and gain stability - Frequency stability shall be determined by measuring the variation in carrier frequency when the receiver-transmitter is operated in the transmit mode in CW or AM without modulation. The frequency changes shall be with respect to the effects or results of the frequency variation of all oscillators on the carrier frequency. All figures shall refer to total variations, either instantaneous or gradual. The gain variation figures shall refer to over-all receiver-transmitter gain, but excluding changes due to the fidelity characteristics. The gain variation figures shall apply to either instantaneous, transient, or gradual changes. The requirements specified herein shall apply, as pertinent, at any frequency within the frequency range of the radio receiver-transmitter.

5.2.2.2.1 Sixty minute warm-up period - Measurements shall be made at constant ambient temperature, constant relative humidity and constant frequency of R.F. input signal. Two minutes after turn-on time, the receiver-transmitter shall be within one-tenth of 1 per cent of the frequency it will have reached at the end of 60 minutes. Ten minutes after turn-on time, the receiver-transmitter shall be within 0.001 per cent of the frequency reached 60 minutes after turn-on. Sixty minutes after turn-on, the receiver-transmitter shall be within 1 part in 10^7 of the desired frequency.

5.2.2.2.2 Variation in primary power supply voltage and frequency - A variation of primary power supply line voltage of plus or minus 10 per cent, with respect to a steady state condition of 115 volts AC or 28 volts DC, shall not cause a change in the output carrier frequency of the receiver-transmitter by more than one part in 10^8 or a change in gain of the set in excess of 6 db. A variation of the primary power supply line frequency of plus or minus 5 per cent, with respect to a steady state condition of 60 cycles, shall not cause a change in the output carrier frequency of the set by more than one part in 10^8, or a change in the over-all gain of the set in excess of 2 db. The specified limits for frequency and gain variations for either primary power supply line voltage or frequency changes shall be with reference to the resonant frequency and gain of the set after its stabilization on a primary power source of 115 volts, 60 cycles, AC or 28 volts DC.

5.2.2.2.2.1 The determination of variation of frequency and over-all gain, relative to the foregoing changes in primary power supply line voltage and frequency, and the effects of primary supply line voltage transients upon the performance of the receiver-transmitter, shall be in accordance with the applicable procedures specified in MIL-E-16400. The specified limits for variation of frequency or gain shall be the absolute maximum deviations of either of these parameters, from their respective steady state values, which occur during the time period required by the measurement procedure specified in MIL-E-16400.

5.2.2.2.3 Variation in relative humidity - Exposure of the receiver-transmitter to the conditions cited in MIL-E-16400 for the humidity test, shall not cause a change in the output carrier frequency of the receiver-transmitter more than one part in 10^8. The maximum permissible change in gain for any mode of operation shall be 6 db. The specified limits for variation of frequency and gain shall be the absolute maximum deviations of these parameters, for their steady state values, which occur during the time period required by the humidity tests procedure specified in MIL-E-16400.

5.2.2.2.4 Variation in ambient temperature

5.2.2.2.4.1 Nonoperating condition - The receiver-transmitter shall be capable of normal operation after exposure to the temperature cycle specified in MIL-E-16400 for temperature tests to be applied to equipment when in a nonoperating condition.

5.2.2.2.4.2 Operating Condition - The receiver-transmitter when subjected to the temperature tests, for Class 2 equipment specified in MIL-E-16400 (when in the operating condition), but modified per 3.9(a) shall not exhibit frequency variations in excess of 1 part in 10^7. The specified limits for variation of frequency shall be the absolute maximum deviations of these parameters from their steady state values, which occur during the time period required by the temperature cycling test procedure specified.

5.2.2.2.5 Control Variations - Frequency variations resulting from a variation of any control throughout the full range of operation for any mode of operation shall not exceed one part in 10^7. This requirement shall apply to those controls which operate in non-frequency determining circuits, for controls which affect the R.F. or A.F. gain or level, such as the "R.F. gain" control and the A.F. output level controls. The specified limit for frequency variation shall be absolute maximum deviation of this parameter which occurs during the manipulation of any control throughout its full range of operation.

5.2.2.2.6 Short and long term stability - The receiver-transmitter shall be capable of operation for a period of 24 hours without operator attention. "Without operator attention" shall be interpreted as meaning that reliable reception or transmission of a desired signal shall be assured throughout a 24-hour period without the necessity for readjustment of any tuning control. This requirement shall be applicable throughout the complete nominal frequency range of the receiver-transmitter.

5.2.2.2.6.1 During the 24-hour period of operation specified in 5.2.2.2.6, the radio receiver-transmitter shall not exhibit sudden, sporadic shifts in the frequency generated by any of its oscillators, or sudden changes in gain that may be the result of easing of tensions in tuning drive mechanisms or from siliar effects.

5.2.2.2.6.2 The receiver-transmitter shall exhbibit an over-all frequency stability of not less than one part in 10^8 per day when adjusted for transmission in any mode at any frequency throughout the nominal frequency range of the set. These limits are predicated upon an initial stabilization of the set after turn-on, for a period of not more than 4 hours; and the subsequent operation of the set in an ambient temperature that is constant within 10°C (total) where the relative humidity is substantially constant and where changes in the line voltage and frequency will not exceed plus or minus 10 per cent and plus or minus 5 per cent, respectively.

5.2.2.3 Regeneration - The interstage gain (R.F., I.F. and A.F.) shall be proportioned so that there will be no evidence of unintended oscillations or instability under any condition of operation of the receiver-transmitter when employing electron tubes having maximum transconductance values as specified herein and a supply voltage 10 per cent higher than the nominal primary line voltage. There shall be no abrogation of the requirements for R.F. and I.F. selectivity due to changes in control settings, relative humidity, ambient temperature, and line voltage which may cause selectivity variations attributable to regeneration.

5.2.2.4 Oscillator activity - In the design and adjustment of oscillators to provide suitable values of excitation for detectors, the oscillators shall be operated as actively as is consistent with the requirements of this specification. Limiting of excitation shall be accomplished by diode clamping. This is for the purpose of precluding special selection of oscillator transistors.

5.2.2.4.1 All oscillators shall be designed to oscillate at any frequency within their operating ranges with any transistors of the types selected for use with transconductance values specified therein as "end of useful life". Oscillators shall operate without "squeals" or spurious oscillations with transistors having the specified maximum transconductance values.

5.2.2.5 Frequency standard input - The equipment shall contain provisions that permit the visual or metered comparison of an external higher stability frequency standard input of 5 Mc with the internal frequency standard of the equipment.

5.2.2.5.1 Master oscillator (internal frequency standard adjustment control) - The "INT STD." control shall be adjusted as required, to assure correct accuracy of the output frequency from the self-contained master oscillator frequency standard.

5.2.2.5.2 Frequency standard calibration - The internal frequency standard shall contain a means of indicating calibration accuracy within 1 part in 10^8 when compared to an external frequency standard. A dial shall be provided to indicate amount of correction and a logging chart shall be affixed to the frequency standard to accumulate a record of calibration.

5.2.2.5.3 The receiver-transmitter shall be capable of operation from an external frequency standard of 5 Mc with any input between the levels of 0.1 and 3 volts.

5.2.2.5.4 The receiver-transmitter shall have provision for frequency standard output capable of providing sufficient voltage for comparison or control of one additional receiver or associated transmitter, such as the Receiver R-1051 Transmitter T-827, or Receiver-Transmitter RT-618.

5.2.2.6 Sideband filter characteristics - The upper and lower bandpass filters employed in the upper and lower sideband amplifiers, respectively, shall each comply with the following requirements:

(a) Bandpass (carrier plus 300 to 3500 cycles or carrier minus 300 to 3500 cycles).
(b) Undulations over bandpass — 3 db peak-to-valley (maximum)
(c) Attenuation at carrier frequency — 10 db minimum
(d) Attenuation frequency of the opposite sideband frequencies (measured at 1 Kc.) — 60 db minimum

5.2.2.6.1 Variations in insertion loss from one sideband filter to another shall be compensated to the extent that, when switching from one sideband filter to the other sideband filter, the total final I.F. noise output in the receive mode and the power output in the transmit mode shall not differ by more than 6 db.

5.2.2.7 Sensitivity and gain - The following sensitivity and gain requirements shall apply to the receiver-transmitter in the receive mode.

5.2.2.7.1 Sensitivity - The sensitivity of the receiver-transmitter, as defined under 4.1.7 shall not be poorer than the values shown in table I for any frequency within the complete frequency range of the receiver-transmitter.

Table I - Sensitivity - Receive Mode

	A1	A2	A3	A3J
IF BANDWIDTH	6.00 Kc	6.00 Kc	6.00 Kc	3.0 Kc
SENSITIVITY	2.0 Micro-volt	4.0 Micro-volt	4.0 Micro-volt	1.0 Micro-volt

5.2.2.7.2 Gain variation - The variation in over-all gain for any mode reception shall not exceed 10 db for the complete working frequency range of a primary frequency band.

5.2.2.8 Selectivity, receive mode

5.2.2.8.1 Over-all selectivity - The selectivity of the receiver-transmitter, in general, shall depend upon the characteristics of the filter used for the mode of reception under consideration and shall conform to the limits established in Table II.

Table II - Over-all Selectivity

Attenuation db	Total bandwidth Kc			
	USB	LSB	AM	CW
3	3.00 min.	3.00 min.	6.00 min	6.00 min
60	6.10 max.	6.10 max.	19.00 max.	19.00 max.

5.2.2.8.2 Cross modulation selectivity - Cross modulation selectivity s be such that an undesired signal, 15 per cent removed in frequency, at an ampl tude of 5 volts, shall not produce an output any greater than 10 db below the standard signal output.

5.2.2.9 Spurious responses in receive mode - Spurious responses of the receiver-transmitter shall be measured and their data shall be recorded. Addi tionally, the set shall comply with the following as defined under 3.10.9.

5.2.2.9.1 I.F. rejection - The I. F. rejection shall be at least 60 db.

5.2.2.9.2 Image rejection - The image rejection shall be greater than 80 d

5.2.2.9.3 Other spurious responses - With no R.F. input and with the receiver-transmitter adjusted as for the reception of single sideband signals, there shall be no more than three spurious signals in excess of that equivalent to an R.F. input of 1 microvolt resulting from either fundamental or spurious frequencies generated within the receiver-transmitter, or from interactions among such frequencies.

5.2.2.9.3.1 Spurious responses, other than those already considered which are generated as the result of off-resonant signals combined with fundamental and harmonic frequencies of oscillators and I.F. amplifiers shall be attenuated to the same degree as specified herein for image rejection (see 5.2.2.9.2). This requirement shall be applicable when the receiver-transmitter is conditioned for the reception of either double or single sideband transmission.

5.2.2.10 Audio output - The audio output from the AF amplifier shall be available at the headset connector and phone jack on the front panel for local operation and at the rear multipin connector for remote operation.

5.2.2.10.1 Audio output voltage regulation - The audio amplifier shall be so designed that the output voltage shall remain constant within ±30 per cent (in volts) of the value obtained with a 600 ohm noninductive resistive load, for a change in the resistive value of this load from 100 to 3000 ohms.

5.2.2.10.2 Maximum undistorted output - With an R.F. input of not less than 1000 microvolts, the maximum undistorted output (see 4.1.11 shall be not less than 60 milliwatts, dissipated into a 600 ohm noninductive resistance load at the remote output terminal of the audio amplifier; or with the audio level control set at the maximum output setting, the undistorted output appearing across a 600 ohm noninductive resistive load connected to the phone jack shall be not less than 15 milliwatts.

5.2.2.10.3 Audio level control - An audio level control shall be provided on the front panel.

5.2.2.10.3.1 Each receiver-transmitter shall operate in such a manner that when adjusted for the reception of A3j signals, increasing values of R.F. input shall not cause a decrease in output below 60 milliwatts of power (dissipated into a 600-ohm, noninductive, resistive load) at any R.F. input level less than at least 100 times greater than that value initially required to obtain 60 milliwatts of power output.

5.2.2.10.3.2 Sidetone - Facilities shall be provided to monitor sidetone at the appropriate receiver audio outputs when the unit is employed in a radio set system.

5.2.2.10.4 Audio amplifier frequency (a.f.) response - The over-all audio amplifier frequency response shall conform with the following:

5.2.2.10.4.1 The zero db reference level for determination of a.f. response shall be 6 milliwatts of a.f. power dissipated into a 600 ohm non-inductive, resistive load.

5.2.2..10.4.2 The a.f. response shall fall within ±2 db from 300 to 3500 cps, with a roll-off with no rise in voltage above 4000 cps.

5.2.2.10.4.3 The requirements of 5.2.2.10.4.1 and 5.2.2.10.4.2 shall apply for any audio power level from 1 milliwatt up to maximum rated undistorted power output and for any noninductive, resistive load from 100 to 600 ohms.

5.2.2.10.4.3.1 The foregoing requirements for a.f. response are predicated on the measurement of this performance characteristic with the use of an a.f. generator which simulates the final detector impedance as "seen" by the detector load. The a.f. generator, in series with whatever impedance is necessary to complete the simulation of the detector audio driving impedance, shall be connected across the detector output load.

5.2.2.10.5 Output signal-to-hum ratio in the receive mode - The output signal-to-hum ratio for AM, upper sideband or lower sideband shall be not less than 40 db for an adjustment of the a.f. level control for maximum output, 35 db for an adjustment of the level control for 6 milliwatt output. These limits shall be applicable under conditions of adjustment of the receiver-transmitter, with a constant signal of 1000 microvolts applied to the antenna input through a standard dummy antenna.

5.2.2.10.5.1 The requirements of 5.2.2.10.5 shall apply to all hum and noise arising in the final detector and the audio amplifier circuits of the receiver-transmitter, as well as the hum arising in other circuits that produce hum modulation or similar effects on the R.F. input signal.

5.2.2.11 Manual "R.F. gain" - The manual "R.F. gain" shall have such range as to permit a variation in the over-all gain of the R.F. and I.F. amplifiers of the receiver-transmitter of not less than 125 db in the receive mode.

5.2.2.12 AGC characteristics - The AGC shall operate in such a manner as to hold the audio output level constant within a total tolerance of 3 db for any variation of input signal between the limits of 5 microvolts and 100,000 microvolts. The increase in audio level from 1 microvolt to 5 microvolts shall not exceed 6 db. The total harmonic distortion shall not increase above that listed in 4.1.11 at input levels up to 100,000 microvolts.

5.2.2.12.1 The requirements of 5.2.2.12 shall apply for the following conditions, single or in any combination:

(a) Any adjustment of R.F. tuning within the nominal frequency range of the receiver-transmitter.
(b) Any adjustment of the "A.F. OUTPUT LEVEL" control from such settings as to obtain maximum undistorted output down to minimum output or up to the point of overload of the audio amplifier.

(c) Any constant level of carrier modulation between 10 and 90 per cent.

(d) Any modulation frequency between the limits of 300 and 3500 cps.

5.2.2.12.2 Resonant overload - Resonant overload (see 4.1.11) shall not occur at any R.F. input level below 1 volt.

5.2.2.12.3 AGC constants - The AGC time constant shall be so arranged that the rise time shall be less than 30 milliseconds.

5.2.2.12.4 Time constant of recovery from surge inputs - The design shall be such that with the receiving channel operating under standard conditions as for the reception of A1 signals, a sharp pulse of CW input signal, at resonance, with a maximum amplitude in excess of 5 volts (to simulate "static" surge) shall not cause a reduction in sensitivity that will persist in excess of 1 second after cessation of the input surge.

5.2.2.12.4.1 The time constant shall be based on the build-up time for 63 per cent of nominal sensitivity. Start of time shall begin at the moment of application or removal of the input signal pulse.

5.2.2.12.5 AGC linearity - There shall be no evidence of blocking, or amplifier saturation at any input level up to 1 volt.

5.2.2.12.5.1 When a composite test signal consisting of two equal sideband voltages which are not harmonically related and are displaced from the carrier by between 300-3500 cycles-per-second, but from each other by not more than 1000 cycles-per-second, is applied to the R.F. input, any intermodulation product present at the audio output shall be not less than 34 db below the audio output level of each sideband tone up to a maximum R.F. input of 0.1 volts rms. The audio output shall be taken across the remote output into a 600 ohm non-inductive resistor, with an output level of not greater than 3 volts per tone.

5.2.2.13 Operation in the receive mode in presence of strong R.F. inputs - The design of the equipment shall be such as to offer the maximum possible protection against the effects of very strong R.F. input signals, particularly with respect to cross modulation, blocking, key thumps, and spurious responses. "Very strong signals" predicates R.F. inputs of the order of 10 volts.

5.2.2.14 Shielding integrity - The radio receiver-transmitter shall be effectively shielded so that when the antenna input circuits are isolated through a well-shielded dummy antenna (see 4.1.1), it shall be capable of operation, in an interfering R.F. field of 10 volts per meter, at any frequency within the specified nominal frequency range of the receiver-transmitter when adjusted for standard conditions as for the reception of A3j signals.

5.2.2.14.1 The dummy antenna and the antenna input connector shall be shielded so that they will not contribute to signal pick-up.

5.2.2.14.2 The interfering signal entering the receiver-transmitter shall be not more than 100 microvolts referred to the antenna input terminals.

5.2.2.15 (BFO) control - The BFO control shall operated (when the mode switch is set at CW) so as to permit a variation of the frequency of the beat frequency oscillator by not less than ±3000 cps.

5.2.2.15.1 The variation of frequency versus angular rotation of the BFO shall be substantially linear. The frequency of the BFO shall increase in the clockwise direction and decrease in the counterclockwise direction of the control.

5.2.2.16 Modes of transmit operation - The following transmit modes of operation shall be provided in the receiver-transmitter:

5.2.2.16.1 CW(A1) -

5.2.2.16.1.1 CW operation shall be provided on the carrier frequency. A CW hold circuit shall be provided having a hang time of approximately one second so that no relay in the receiver-transmitter will be slaved to the CW key. The keyed CW wave shall be free of transients and splatter to the degree specified under spurious responses. A sidetone output shall be available for monitoring.

5.2.2.16.2 AM(A3) -

5.2.2.16.2.1 Emission in the AM mode of operation shall be comprised of the carrier frequency and the upper sideband portion of the modulator output. AN internal control shall be provided to permit adjustment for full carrier level in the AM mode (100% modulation). The phone input shall be available on the sidetone line for external monitoring.

5.2.2.16.3 Single Sideband (A3a and A3j) -

5.2.2.16.3.1 An internal control shall be provided to permit selection of the single sideband mode for the following nominal levels of carrier insertion:

1) full carrier insertion (0db)
2) -10 db of carrier suppression
3) -20 db of carrier suppression
4) full carrier suppression

5.2.2.17 Spurious responses, transmit mode - Spurious responses of the receiver-transmitter shall be measured and their data shall be recorded. All spurious emissions shall be measured with respect to a single tone 0.25 watt PEP output when the receiver-transmitter is terminated in a standard 50 ohm dummy load.

5.2.2.17.1 Second harmonic radiation - All spurious emissions occurring at frequencies corresponding to the second harmonic of the desired frequency of the receiver-transmitter shall be measured and recorded, as prescribed in MIL-STD-449, or an equivalent technique, on each of the primary frequency channels. Second harmonic radiation shall be suppressed not less than 35 db.

5.2.2.17.2 Carrier suppression - In the A3a and A3j modes of operation the carrier shall be adjustable to at least -50 db with respect to a single tone 0.25 watt PEP output when the receiver-transmitter is terminated in a standard 50 ohm dummy load.

5.2.2.17.3 Intermodulation distortion - Intermodulation distortion shall be measured and recorded on each primary frequency band of the receiver-transmitter. Suitable audio modulating voltages shall be applied to the input terminals in such a manner as to comprise a standard two-tone audio input (44 mv/tone) and the output shall be adjusted so as to supply 0.1 watt PEP to the standard dummy load. All intermodulation products will be at a level at least 35 db below the standard output.

5.2.2.17.4 Output signal-to-hum ratio in transmit mode - Output signal-to-hum ratio shall be measured using a single tone input of 1000 cps adjusted to produce an output of 250 mw. PEP. All primary supply frequencies and multiples of primary supply frequencies shall be suppressed a minimum of 40 db at the R.F. output.

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

6. DRAWINGS AND TECHNICAL PUBLICATIONS

6.1 Technical publications.- Technical publications of the type and quantity required shall be as specified in the contract. The radio set AN/URC-35 technical manual shall additionally include complete data on the accessory unit CU-937/UR antenna coupler.

6.2 Manufacturing drawings shall be supplied in accordance with class 1, type B of MIL-D-17419, unless otherwise specified in the contractor order. Manufacturing drawings supplied shall be complete, clear and reproducible and shall contain complete manufacturing data including material lists, material specifications and source of supply, fabrication and assembly data, test limit data, module (electronic assembly) test specifications, and final test procedures and limits.

7. QUALITY ASSURANCE PROVISIONS

7.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. 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.

7.2 General inspection - Sampling, examination, and tests shall be as specified in MIL-E-16400, except as otherwise specified herein.

7.3 Preproduction inspection - Preproduction inspection shall be made on at least one preproduction unit at the place of manufacture under the supervision of a designated Bureau of Ships representative, unless notified otherwise, in accordance with the requirements of MIL-E-16400. The preproduction inspection may be divided between two units to conserve test time. For example, screened-room bench tests may be conducted on one unit while environmental tests are conducted on the other unit. The division of the tests between the two units shall be determined by the contractor so long as he first determines from tests performed on both units that the two units are reasonably identical, and that other tests performed on one unit and not on the second unit are equally applicable to both units. The reliability tests specified in 7.4.3 will be accepted in lieu of the accelerated life test of MIL-E-16400. It shall be the responsibility of the contractor to prepare a test schedule, including details concerning the manner in which tests are to be conducted and tolerance limits recommended. Three copies of this test schedule and associated data shall be submitted to the Bureau of Ships for approval not less than 30 days prior to the start of the preproduction tests.

7.3.1 In addition to the preproduction inspection specified in MIL-E-16400, the inspections specified in 7.3.1.1, 7.3.1.2, and 7.3.2 shall be conducted, at the test points and under the conditions specified herein, with the radio set, under test and operating under standard conditions of test except as may otherwise be specified in a specific test requirement. The Equipment Frequency Spectrum Signature (4.5.12 of MIL-E-16400) need not be performed.

7.3.1.1 Receiver-Transmitter RT-618/URC -

7.3.1.1.1 Accuracy of main tuning indicator calibration - Measurement shall be made at five points in geometric progression, (starting and ending with the nominal end frequencies).

7.3.1.1.2 Linearity of main tuning indicator calibration - Measurement shall be made at every 100 Kc increment of the highest frequency primary frequency band, at every 10 Kc increment of the last 100 Kc increment, and at every 0.5 Kc increment over the last 10 Kc tuning increment.

7.3.1.1.3 Frequency and gain stability - Frequency and gain stability sha be measured as follows for an R.F. frequency of 7.5 Mc:

(a) Sixty-minute warm-up period (see 5.2.2.2.1).
(b) Line voltage variation, as specified in 5.2.2.2.2.
(c) Variation in relative humidity as specified in 5.2.2.2.3.
(d) Variation in ambient temperature as specified in 5.2.2.2.4.
(e) Control variation as specified in 5.2.2.2.5.

7.3.1.1.4 Regeneration- Each primary frequency band shall be carefully explored for evidence of regeneration.

7.3.1.1.5 Standard sensitivity - Measurements shall be made at the nominal end frequencies and at the geometric mean of these frequencies for the USB mode of reception. In addition, sensitivity measurements shall be made in the LSB, AM and CW mode at the frequency with the lowest USB mode sensitivity.

7.3.1.1.6 Gain variation - Measurements shall be made at the same frequencies as for 7.3.1.1.5 with the radio receiver set conditioned for the USB mode of reception. In addition, gain variation measuremnts shall be made in the LS AM and CW modes at the primary frequency band with the worst USB mode gain variation.

7.3.1.1.7 Over-all selectivity - Measurements shall be made in each mode operation with the receiver-transmitter tuned to 7.5 Mc and 20.1 Mc.

7.3.1.1.8 Cross-modulation selectivity - Measurement shall be made for an R.F. input frequency of 7.5 Mc and 20.1 Mc nominal.

7.3.1.1.9 I. F. rejection - Measurements shall be made at the nominal end frequencies of each primary frequency band.

7.3.1.1.10 Image rejection - Measurements shall be made at the nominal end frequencies of each primary frequency band.

7.3.1.1.11 Other spurious responses - Each primary frequency band shall be completely explored for evidence of spurious responses which fall outside of t allowable limits.

7.3.1.1.12 Audio output voltage regulation - Audio output variation with change of load impedance and with variations of input signal level shall be ma at the line output of the amplifier, as specified. A measurement shall also b made at the audio output delivered from the amplifier to the head telephone ja

7.3.1.1.13 Maximum undistored output - Measurement shall be made for a nom R.F. input frequency of 7.5 Mc.

7.3.1.1.14 Resonant overload - Measurement shall be made for a nominal R.F. imput frequency at 7.5 Mc.

7.3.1.1.15 Audio amplifier frequency response - The audio amplifier shall be measured from the final detector to the audio line output terminals (600 ohm load) over the range of audio frequencies from 30 to 30,000 cps.

7.3.1.1.16 Output signal-to-hum ratio - Measurement shall be made, under the specified adjustment of the radio receiver, for an R.F. input frequency of 7.5 Mc.

7.3.1.1.17 Manual "R.F. gain" - Range, and degree of variation in output with change of control setting shall be measured at 7.5 Mc.

7.3.1.1.18 AGC characteristics - AGC characteristics for the radio receiver when conditioned for the reception of double sideband A3 signals, shall be measured for R.F. input signal levels at 7.5 Mc.

7.3.1.1.19 Time constants (see 5.2.2.12.3) - The SSB-AGC time constant shall be measured for a nominal R.F. input frequency of 7.5 Mc.

7.3.1.1.20 Time of recovery from surge inputs - Measurement shall be made for an R.F. signal of 7.5 Mc.

7.3.1.1.21 "BFO" control - The output frequency range of the "BFO" vernier control shall be measured for an R.F. input frequency of 7.5 Mc. The shielding integrity of the beat frequency oscillator shall be measured over the full range of the "BFO" control.

7.3.1.1.22 Standard power output - Measurements shall be made at the nominal end frequencies and at the geometric mean of these frequencies for each primary frequency band. Power output measurement shall be taken for each mode of transmitter operation on the 2 Mc., 16 Mc. and 29 Mc bands.

7.3.1.1.23 CW output and hold characteristics - The radio transmitter shall be checked for spurious outputs and splatter as specified herein in the CW mode of operation. In addition, power output shall be measured at the nominal end points of each megacycle band. The average power output shall be no less than 62.5 mw. when the transmitter set is terminated in 50 ohms. The CW hold circuit shall be checked to insure that no relay in the set is activated providing a hand key is operated at a rate no slower than one dot cycle per second.

7.3.1.1.24 Sidetone output - Audio sidetone outputs shall be checked in each mode of operation to insure operation.

7.3.1.1.25 Spurious responses - Each primary frequency band shall be completely explored for evidence of spurious responses which fall outside of the allowable limits.

7.3.1.1.26 Intermodulation distortion - Measurements shall be made at the nominal mid-frequencies for each primary frequency band.

7.3.1.1.27 Output signal-to-hum ratio - Output signal-to-hum ratio on shall be checked on the 2 Mc, 16 Mc, and 29 Mc bands, on both USB and LSB. Frequency components in the output corresponding to the primary supply frequ and harmonics of the primary supply frequency shall be noted.

7.3.1.1.28 Audio characteristics - The audio circuits shall be checked frequency and gain characteristics. Speech processing shall be checked to in that an essentially constant amplitude of modulation is maintained for variat (within the limits of microphone input voltages) in speech intensity and shal not cause variations in power output.

7.3.1.1.29 APC - With a two tone audio input of 44 millivolts (mv) per tone, the application of a simulated APC voltage shall be capable of reducing the output power to at least 50 mw.

7.3.2 Test Procedures - The procedures to be pursued in the conduct of th test specified in 7.3.1, shall be as specified herein. It shall be assumed t when a specific test procedure is not specified herein for any given test re- quirement, that test shall be performed in accordance with accepted conventio practices.

7.3.2.1 Receiver-Transmitter, RT-618/UR -

7.3.2.1.1 Frequency and gain stability -

7.3.2.1.1.1 Sixty minute warm-up period - The warm-up period shall begin after exposure of the equipment for the ambient temperature for a period of n less than 1 hour with no power applied, to establish the temperature at the s value as the ambient. Frequency measurements shall be made at intervals of n more than 2 minutes for the first 10 minutes, with the first measurements mad 2 minutes after power is applied. Measurements shall be made at intervals of more than 5 minutes for the next 20 minutes, and at intervals of not more tha 10 minutes for the last 30 minutes.

7.3.2.1.1.2 Line voltage variation - The equipment shall be operated 1 hour from a constant supply of 103.5 volts (or 25 volts on DC) in any const ambient temperature. The shift from 103.5 to 126.5 volts (or 31 volts on DC) shall be completed in a time interval not to exceed 5 seconds. The frequency gain variations shall be determined from measurements made at the end of 1 hou stabilization period and at the end of 1 minute period following the shift in voltage.

7.3.2.1.1.3 Humidity - Frequency and gain variation shall be measured with the radio receiver tested in accordance with the requirements of MIL-E-16400 for humidity tests, but modified per 3.9.(a) as to the highest operating test temperature.

7.3.2.1.1.4 Temperature - Frequency and gain stability with temperature variation shall be determined for A1 signals, using the procedure specified for the temperature tests for class 2 equipments (under operating conditions) in MIL-E-16400, but modified per 3.9.(a).

7.3.2.1.2 Over-all selectivity - Over-all selectivity shall be measured by applying an unmodulated R.F. input, at various frequencies off resonance, to the radio receiver through a standard dummy antenna to maintain a constant output from the final detector(s), as indicated by measurement of final detector(s) AC or DC current or voltage output.

7.3.2.1.3 Cross-modulation selectivity - Cross-modulation selectivity shall be measured by applying a signal of 100 microvolt that is modulated 90 per cent at 1000 cps at the resonant frequency to which the radio receiver is tuned, and adjust the gain of the set to produce 60 milliwatts of a.f. output (across the line output connector). The modulation of desired signal shall then be removed, and an interfering off-resonant signal, modulated 90 per cent at 1000 cps shall be applied and adjusted in frequency and amplitude to produce a cross-modulation a.f. output level of -10 db without any change in the control settings of the radio receiver. This interfering signal shall then be readjusted, in both frequency and amplitude on both sides of the resonant frequency to which the radio receiver is tuned, so as to produce -10 db of interfering output as the result of cross-modulation at the various frequencies off resonance. It shall be determined that the interfering output is true cross-modulation by shutting off the desired signal carrier for each measurement. The interfering signal input level shall range from a value which begins to produce the cross-modulation phenomenon at the closest possible spacing to the desired signal frequency, up to interfering signal levels of at least 5 volts. The cross-modulation selectivity shall not be abrogated for desired signal inputs up to at least 60 db above standard sensitivity input. The cross-modulation performance shall be measured in the A3 condition of reception.

7.3.2.1.4 Audio amplifier frequency response- Audio amplifier frequency measurements shall include the audio circuits of the detector. The input level shall be maintained constant and the output measured across a 600-ohm load at the line output receptacle, over a frequency range from 30 to 30,000 cps. The audio input voltage shall be applied to the detector output load through a resistive impedance representing the equivalent resistance of the detector, as an audio generator (for example, one-half the diode load resistance in a series diode detector). The output level at 1000 cps shall be set to 60 milliwatts. Overload shall not occur at any measurement frequency during this test and proper account shall be taken of audio hum and noise on the output readings.

7.3.2.1.5 AGC characteristics - Measurements shall be made of maximum change in audio output for RF inputs between the limits of the threshold of operation and 1 volt.

7.3.2.1.6 Power outputs - All power output measurements shall be made by applying a suitable DC bias to the average power control line in the radio transmitter and adjusting this DC bias so that the average of PEP is equal to that specified in the particular test requirements contained herein.

7.4 ACCEPTANCE INSPECTION

7.4.1 Production inspection - In addition to the production inspection specified in MIL-E-16400 the manufacturer shall conduct the following additional inspections as a minimum, on each production unit at nominal line voltage and room ambient temperature and humidity conditions.

7.4.1.1 Receiver-Transmitter RT-618/URC-

(a) Accuracy of main tuning indicator calibration

(b) Linearity of main tuning indicator calibration.

(c) Frequency stability, except that tests shall be conducted on the frequency standard electronic subassembly only.

(d) Vibration - Each equipment shall be subjected to a 5 minute vibration test at 20 cps, 0.020 inch double amplitude, without a shock vibration mount and with the equipment in the horizontal plane.

(e) Receive mode tests as follows:

1. Sensitivity
2. Gain variation
3. Over-all selectivity except that measurement shall be made for USB, LSB and AM modes only.
4. IF rejection except measure images due to first IF only.
5. Image rejection
6. Audio output voltage regulation
7. Maximum undistorted output.
8. Resonant overload.
9. Manual "RF gain" control except that measurements shall be made only for an RF input frequency of 7.5 Mc.
10. Output signal-to-hum ratio except that measurement shall be made only for an RF input frequency of 7.5 Mc.
11. AGC characteristics.
12. "BFO" control. Record frequencies for both ends and center of "VAR. BFO" control.

(f) Transmit mode tests as follows:

1. Power outputs for each mode of operation.
2. Intermodulation distortion.
3. Opposite sideband suppression.
4. Carrier suppression.
5. Spurious outputs.
6. Output signal-to-hum ratio.
7. Speech compression.

7.4.2 PRODUCTION CONTROL INSPECTION

Production control inspection shall be conducted on two units of the first twenty-five production units and thereafter on one unit out of each twenty-five production units for the remainder of the production run. Inspec shall include that specified in MIL-E-16400 and in 7.3.1 except that the follo ing will not be required.

7.4.2.1 Receiver-transmitter RT-[illegible]/URC -

(a) Weights and dimensions.
(b) Water cooling.
(c) Enclosure.
(d) Radio interference and undesired radiation.
(e) Equipment frequency spectrum signature.
(f) Weld test.
(g) Cross-modulation selectivity.
(h) Operation in presence of strong RF fields.
(i) Radio frequency interference.
(j) Environmental tests.
(k) Reliability tests as specified in MIL-E-16400.

7.4.2.2 Operational - The over-all equipment shall be subjected to a 16-h power-on condition, with a continuous receive-transmit keying duty cycle of a 30 minute receive condition and a 5 minute transmit condition at 100 watt(PEP) output with a standard two-tone input and into a satisfactory dummy load. The contractor shall retain copies of each equipment final test report for a perio of 3 years after delivery of the final equipment and shall make such reports available to an authorized Government representative upon request.

7.4.3 RELIABILITY TEST

Each of the production type equipments subjected to the tests specified in 7.4 shall meet or exceed the MTBF as specified in 3.8.

7.4.3.1 Terms - The following terms are applicable for the reliability tests:

(a) Failures - Equipment failures are defined as any departure from the performance required by the detailed equipment specifications or operations outside the assigned tolerances and not correctable by adjustment of controls.

(b) Primary failure - A primary failure is a failure which has no significant relationship to prior failure of other parts in the equipment.

(c) Mean-time-between-failures - The MTBF for a particular equipment in a given time interval is the mean value of the operating periods between primary failures occurring in that equipment during that interval. It is assumed for the purposes of this specification that the density function of times-to-failure is exponential and that the MTBF will remain constant throughout the useful life of the equipment. The mean operating time between primary failures will be used in this specification as the index of reliability.

7.4.3.2 Maintenance - Corrective maintenance shall be interpreted as allowing for the replacement of faulty semiconductors, crystal diodes, fuses or tubes, relaignment and calibration operations, and other minor maintenance items which can be effected with a minimum of effort.

7.4.3.3 Accept-reject criteria - The equipment reliability accept-reject criteria shall be as in table V.

Table V - Accept-reject criteria.

Time	Failures		
Normalized test*	Reject decision	Accept Decision	Continue test
	If below-noted failure occurs on or before corresponding time, equipment fails.**	If no failures are charged against the equipment, equipment passes.**	If number of failures fall in range below at time shown, continue test.***
0.5	6	0	0 to 5
1.3	7	0	0 to 6
2.1	8	0	0 to 7
2.33	9	0	***

* Normalized test time is accumulated test time divided by the contract specified MTBF.

** Under no conditions is the test to be discontinued because of a decision to pass or fail the test per columns 1 and 3 until the equipment has accumulated an operation time of at least 450 hours. The accept-reject decision relates to the lot the sample represents.

*** The maximum test time shall not exceed 700 hours except when proof of correction of specific failures is involved (see 7.4.3.3.1). If an accept or reject decision has not been reached at the end of 700 hours, the contractor shall analyze the test data as to cause of failure. If failure is established to be a result of design deficiencies, the contractor shall modify the equipments as specified in 7.4.3.5. Otherwise the equipment shall be accepted.

7.4.3.3.1 Failures - Corrective maintenance can be applied in event of failure. A failure will be deemed of a random nature if after returning the equipment to test, the equipment accumulates 100 operating hours without recurrent failure due to the same cause.

7.4.3.3.2 Satisfactory performance - Satisfactory performance shall be judged on each equipment tested and shall be indicative of all units of the production following the last acceptable sample.

7.4.3.3.3 Unsatisfactory performance - The failure of the sample shall indicate failure of all units manufactured after the last acceptable sample.

7.4.3.4 Reliability test setup - The contractor shall provide all facilities and test instruments for performing the reliability tests under the environments specified. The test setup shall be suitable for performing the reliability tests for extended periods of time as required. Each test setup of equipment for which a reliability MTBF determination is to be made shall be provided for an elapsed operating time meter to determine the total hours of operating test time accumulated on each unit. The test equipment of each test setup and test facility shall be in proper operation and calibration prior to start of the reliability tests and shall be checked each 24 hour period thereafter. Malfunction, failures of test equipment or facility, or conditions occurring in the test setup beyond limits specified and which cause failures in the equipment will not be counted as relevant equipment failures. These failures shall be recorded and explained and corrective action taken to eliminate recurrences. Rules and procedures for needed repair, replacement or calibration of the test facility, allowable breaks in testing including decisions as to shift testing and shutdowns over weekends and holidays to be made during the test must be anticipated and established subject to the approval of the Bureau of Ships, prior to initiation of the test. Additional rules needed during the test shall be developed entirely at the discretion of the Bureau of Ships. The equipment shall be installed in the test setup and operated for a sufficient length of time to insure that the equipment is properly adjusted and the test

7.4.3.4 Reliability test setup (Cont.)
facility and test equipment are operating satisfactorily. After this check, the reliability tests shall start and all deviations from specified minimum performance limits shall be recorded.

7.4.3.5 Production reliability test - The production reliability test shall be performed on the samples of production equipment selected in 7.4.3.5.1 from those equipments which have passed the contractor's final production line test (see 7.4). Any modifications introduced into the equipment as a result of the deficiencies discovered from the reliability tests will be included in all following equipments at no additional cost to the Government. These modifications shall be included immediately in equipments yet to be fabricated or delivered, and retroactively to those equipments already delivered since the last acceptable sample.

7.4.3.5.1 Selection of samples of equipment for reliability tests - The sample equipment for reliability testing shall be selected as follows:

(a) Two production equipments from the first ten production equipments.
(b) One production equipment from each production group of 30 production equipments to the end of the production run.
(c) If the last production line group is less than 25, no additional production equipments need be selected for testing.

7.4.3.5.2 Reliability test procedures - The reliability tests shall be conducted using the test procedures specified herein.

7.4.3.5.2.1 Environmental conditions shall be as follows:

Temperature	40°C ±5°C (95°F to 113°F)
Input voltage	115 volts AC (+0 -2 per cent), 60 cps, single phase

7.4.3.5.2.2 Test failures - In addition to equipment performance below the specified minimum performance limits, any reduction in complete radio set performance which prevents the equipment from performing its assigned task shall constitute a failure. The operator is permitted, during the test, to restore performance (where possible) by the use of corrective maintenance. (See 7.4.3.2)

7.4.3.5.2.3 Test frequencies - During the reliability tests at least one frequency shall be tested in each band as follows:

Frequency	Megacycle
F1	2.00
F2	5.1
F3	11.7
F4	29.9

7.4.3.5.2.4 Test schedule - The test shall consist of three 8 hour schedules per day, the first being manned where performance measurements shall be made. The second two may be unmanned and pertinent data will automatically be recorded only to the extent that instrumentation permits. Schedules shall be as follows:

Manned Schedule	Two unmanned schedules
0 to 1 hour - Make performance measurements on f1.	2 hours - Equipment off.
1 hour to 2 hours - Equipment in "receive" condition.	2 hours - Equipment in "receive" condition.
2 hours to 2 hours, 30 minutes - Equipment in "transmit" condition.	15 minutes - Equipment in "transmit" condition.
2 hours, 30 minutes to 3 hours - Equipment in "receive" condition.	1 hour - Equipment in "receive" condition.
3 hours to 4 hours - Make performance measurements on f2.	15 minutes - Equipment in "transmit" condition.
4 hours to 5 hours - Equipment in "receive" condition.	1 hour - Equipment in "receive" condition.
5 hours to 5 hours, 30 minutes - Equipment in "transmit" condition.	15 minutes - Equipment in "transmit" condition.
5 hours, 30 minutes to 6 hours, 30 minutes - Equipment in "receive" condition.	1 hour - Equipment in "receive" condition.
6 hours, 30 minutes to 7 hours - Equipment in "transmit" condition.	15 minutes - Equipment in "transmit" condition.
7 hours to 8 hours - Make performance measurements on f3.	

On each successive manned schedule, the starting frequency shall be the frequency from the frequency table not used in the preceding manned schedule. The two unmanned schedules shall be made on the last frequency used in the manned schedule.

7.4.3.5.2.5 Minimum performance limits - During each of the specified performance measurements, the contractor shall provide necessary tests to assure equipment performance is not less than the following minimum performance limits:

(a) CW mode -
  (1) Keying speed shall be at least 25 dot cycles per second.
  (2) Output shall be 50 ±5 watts average into a 50 ohm load in key down condition.

(b) Single sideband mode -

(1) With a two-tone audio signal at level of 50 mv per tone applied to the upper sideband local input, the output of the transmitter shall be 100 watts PEP into a 50 ohm load.

(2) Repeat (1) with an input applied to the lower sideband local input.

(3) With modulation frequencies of 1300 and 1900 cps, all distortion products shall be not less than 30 db below the peak envelope output.

(4) Opposite sideband suppression shall be at least 50 db below the desired sideband having a 1000 cps tone input.

(5) Carrier suppression shall be adjustable to at least 50 db below a sideband tone of 1000 cps.

(c) AM mode -

(1) Carrier reinsert shall be adjustable to 25 watts on AM mode.

(2) With an audio tone of 1000 cps at a maximum level of 50 mv applied to the upper sideband local input, it will be possible to adjust the sideband to equal the carrier (with the carrier adjusted for 25 watts). Without changing any controls on the receiver-transmitter, the sideband power shall not vary more than 3 db when the sideband frequency is changed to 400 to 2500 cps and the input level maintained at 50 mv.

(3) Under the test conditions of (2), the distortion products shall be at least 30 db below the carrier.

(d) Receive mode characteristics -

(1) Sensitivity - The gain of the receiver-transmitter on upper sideband, lower sideband, or AM mode reception shall not be reduced by more than 10 db from standard gain. The minimum output level shall be at least 6 milliwatts on the line output.

NOTE: Standard gain is the gain required to obtain standard output with a 10 db signal plus noise-to-noise ratio and standard sensitivity (1 microvolt input for single sideband and 4 microvolts modulated 30 per cent on AM). Standard output on the line output shall be 6 mv.

(2) AGC operation - With constant input of 100 microvolts, audio output must stay within 3 db.

(3) Spurious response - With receive antenna input shorted, no spurious response greater than an equivalent of 1 microvolt at the front end shall appear in the output.

(e) Frequency generator -

(1) Reference oscillator drift shall not exceed 1 part in 10^8 per day nor 1 part in 10^6 per month. If at the end of each one month period it is impossible to readjust the oscillator frequency to within 1 part in 10^8 of the starting frequency, a failure of the reference oscillator shall be considered to exist.

7.4.3.6 Test log - A log shall be set up for use during the test. The layout and use of the log shall be in general conformance with the requirements of MIL-R-22732 and this specification and receive prior approval of the cognizant inspection agency.

7.4.3.6.1 The test shall begin only after both the equipments to be tested and the test instrumentation facilities have had suitable operational checkout.

7.4.3.6.2 Under no condition is the test to be terminated because of decision to accept or reject the equipment in accordance with subsequent criteria until each equipment under test has accumulated an operating time equal to or greater than 450 hours.

7.4.3.6.3 At the instance of each failure, a log entry shall be made on a single line with observed data for each of the columns required.

7.4.3.6.4 Upon completion of 100 hours of test following a failure, without reoccurrence of the same failure, notation shall be made that the failure is considered random and shall not be counted in making the accept-reject decision.

7.4.3.6.5 On the occasion of a failure, the failed equipment shall be removed and repaired without interruption of the test of equipments continuing to meet test performance requirements. Upon decision that a failed and repaired equipment has been returned to representative operative condition, it shall be returned to test without interruption to the tests of the equipments continuing to meet performance requirements.

7.4.3.6.6 The absence of one or more equipments for the purpose of failure repair shall not affect the accumulation of operating time by the schedule unit until the scheduled test time of that unit has been completed.

7.4.3.6.7 When an accept decision is made because of accumulated operating time, an entry shall be made on a separate line in the log of failures, with notation in column indicating that an accept decision rather than a failure occurrence has occasioned the log entry.

7.4.3.7 Disposition of reliability test equipment - Upon completion of the equipment reliability tests, the units used shall be returned to the production line for any necessary refurbishing and production line final test and examination as specified in 7.4.1. The units selected for a reliability test shall not be used again under the selection of equipments as specified in 7.4.3.5.1.

7.4.3.8 Samples tested - The contractor shall provide a list of serial numbers of equipment tested. This list shall be submitted in increments of each 6 month test period, and applicable to the samples tested during that period.

8. PREPARATION FOR DELIVERY

8.1 Preparation for delivery shall be as specified in the contract or order.

9. NOTES

9.1 Nomenclature referred to herein and those assigned to the GFE units may be subject to change on any contract resulting in equipment produced in accordance with this specification.

Notice - When the Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.