MILITARY SPECIFICATION

TRANSMITTING SET, RADIO

1. SCOPE

1.1 Scope.- This specification covers radio transmitting sets for general purpose installation to effect communication at the VHF frequencies.

1.2 Classification.- The equipment shall be of the following types, as specified (see 6.1):

Type I - Radio transmitting unit.
Type II - Remote control unit.
Type III - Test harness assembly.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

MILITARY
MIL-C-3098 - Crystal Units, Quartz.
MIL-C-17151 - Control, Radio Set C-1138( )/UR.
MIL-T-17113 - Tests; Shock, Vibration and Inclination (for Electronic Equipment General Specification.
MIL-P-17555 - Preparation for Delivery of Electronic Equipment; Miscellaneous Electrical Equipment (Except Rotating Electrical Equipment) and Associated Repair Parts.

NAVY DEPARTMENT
General Specifications for Inspection of Material.

STANDARDS

MILITARY
MIL-STD-167 - Mechanical Vibrations of Shipboard Equipment.

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

3. REQUIREMENTS

3.1 Material.- The material for the equipments shall be equivalent to the material used in the prototype equipment furnished by the bureau or agency concerned.

3.2 Design.- The electrical design of the equipments shall be the same as the prototype equipment furnished by the bureau or agency concerned, unless otherwise specifically approved and authorized contractually.

3.3 Construction.- The construction of the equipments shall be the same as the prototype equipment furnished by the bureau or agency concerned, except minor manufacturing changes to conform to the contractor's practices will be permitted when mechanical and electrical performance of the equipment are not degraded in any respect as determined by the bureau or agency concerned.

3.4 Parts. - All parts shall be mechanically interchangeable with the prototype equipment furnished by the bureau or agency concerned. When non standard parts are employed in the prototype and suitable interchangeable standard parts are available, the standard part shall be used.

3.5 Performance. - The performance shall be within the limits specified herein. The performance limits specified are representative of the characteristics of the prototype equipment. Equipment manufactured which does not meet the performance limits will not be approved unless it is fully demonstrated to the satisfaction of the bureau or agency concerned that the deficiencies are also characteristic of the prototype equipment.

3.6 Conditions of operation. - The equipment shall be constructed to operate continuously and shall meet the requirements of this specification under the following conditions:

(a) Ambient temperature range -20° Centigrade (C.) (-4° Fahrenheit (F.)) to +50°C. (+122°F.).
(b) Relative humidity range - 30 to 95 percent.
(c) Line voltage variation - ±10 percent.
(d) Line frequency variation - ±5 percent.
(e) Inclination and shock as specified in Specification MIL-T-17113.
(f) Vibrations as specified for type I of Standard MIL-STD-167.

3.7 Type I - radio transmitting unit. - This unit shall include the radio frequency (r.f.) unit, modulator unit, power supply - control circuit section and cabinet.

3.7.1 Frequency range. - The unit shall operate at any frequency within the range of 115 to 156 megacycles (mc.), inclusive.

3.7.2 Emission. - The unit shall provide for the transmission of intelligence by A-2 and A-3 emissions.

3.7.3 Power output. - The transmitter carrier and sideband power output as measured into a 50 ohm resistance load shall be not less than 30 watts and 15 watts, respectively.

3.7.4 Tuning and loading. - Over the range 115 to 156 mc., inclusive, the equipment shall be capable of tuning and loading into any length of coaxial line of 50 ohms characteristic impedance when the line is terminated in loads, real and complex, of such values as to produce standing wave ratios on the lines whose values do not exceed 2.0 to 1.0.

3.7.5 Carrier ripple and noise. - The equipment shall be so designed that the r.f. carrier ripple and noise shall not exceed a level 40 decibel (db) below the 100 percent modulated carrier.

3.7.6 Input power. - The equipment shall be suitable for operation from a rated alternating-current (a.c.) power source of 115 volts, single phase, 60 cycles. The equipment shall also be suitable for operation from a rated a.c. power source of 230 volts, single-phase, 60 cycles. Additionally, the equipment shall be suitable for operation as specified above when the input power frequency is 50 cycles. Total continuous power drain shall not exceed 725 watts. The power factor shall be not less than 85 percent.

3.7.7 Overall stability. - The total frequency inaccuracy of the transmitter shall not exceed the inaccuracy of the crystal unit by more than plus or minus 0.002 percent.

3.7.8 Type of crystal. - The equipment shall employ Crystal Unit CR-24/U conforming to Specification MIL-C-3098.

3.7.9 Multiplication. - The output frequency of the crystal oscillator shall be multiplied by 6.

3.7.10 A-2 characteristics. - When operating the transmitter in the A-2 modulated continuous wave (MCW) condition, keying shall effect modulation of the carrier at a frequency of 1000 cycles ±10 percent.

3.7.11 Keying speeds. - Keying speeds from 10 up to 40 words per minute shall be possible when operating in the A-2 condition.

3.7.12 Audio amplifier.- The audio amplifier shall provide the following characteristics:

3.7.12.1 This equipment shall incorporate features necessary to provide for automatic gain control (AGC), volume expander (background noise limiter), and peak limiting clipper.

3.7.12.2 The AGC shall operate to maintain a constant amplifier peak level 20 ± 5 db above the clipping level, as specified in 3.7.12.4 for variation of input levels from minus 25 to plus 5 db (reference 0 db equals 0.006 watt).

3.7.12.3 The volume expander shall operate to reduce the amplifier output to zero when the input levels fall below a normal minimum. This minimum level shall be adjustable between minus 25 and plus 2 db.

3.7.12.4 The peak limiting clipper shall operate to symmetrically remove excessive positive and negative audio amplitude peaks. The level at which clipping occurs shall be sufficient to permit 100 percent modulation of the carrier.

3.7.12.5 Audio signal frequencies above 5000 cycles per second (c.p.s) shall be attenuated at least 50 db.

3.7.12.6 Amplifier circuits following the speech amplifier shall provide sufficient gain to permit 100 percent modulation with the input levels specified in 3.7.12.2, and shall be adjustable down to 10 percent modulation.

3.7.13 Frequency response.- The overall audio frequency response characteristics of the transmitter, from a 1000 c.p.s. reference exclusive of microphone, shall be flat within plus or minus 3 db between 300 and 3500 c.p.s. A high degree of attenuation shall exist below 300 c.p.s.

3.7.14 Modulation characteristics.- The transmitter shall be constructed for 100 percent modulation when operating with inputs as specified in 3.7.12.2., Audio frequency distortion in the transmitter shall not exceed 5 percent at 90 percent modulation at 1000 c.p.s. The distortion requirement is applicable with the peak input level to the clipper circuit adjusted to the clipping level.

3.7.15 Carrier control.- Control of the transmitter carrier shall be in accordance with the following:

3.7.15.1 When operating in the A-2 (MCW) condition the transmitter carrier shall be controlled by the telegraph key. upon closing the key, the transmitter shall change from "standby" to "transmit" condition, within 1/4 second. The carrier shall then remain on continuously, unless the keying is interrupted for more than 1.0 ±0.2 seconds.

3.7.15.2 When operating in the A-3 (voice) condition, the transmitter carrier shall be controlled by the handset "push-to-talk" switch. Upon actuation of the "push-to-talk" switch the transmitter shall change from "standby" to "transmit" within 1/4 second; upon release of the switch the transmitter shall be changed from "transmit" to "standby" within 1/4 second.

3.7.16 Antenna transfer.- The transmitter shall provide for automatic transfer of an antenna to a receiver used in conjunction with the equipment when the transmitter carrier is "off". This transfer shall be effected within 1/4 second.

3.7.17 Standby.- "Standby" condition is defined as that in which the equipment is ready to operate on closing a telegraph key or "push-to-talk" switch.

3.7.18 Local control.- Complete control of the equipment including start-stop, carrier, tuning, emission, and frequency selection shall be possible from the front panel and subpanels.

3.7.19 Control circuits (two wire). - In addition to the control specified in 3.7.18, remote MCW keying or voice modulation, depending upon local selection, carrier control, and receiver monitoring shall be provided.

3.7.19.1 A maximum number of two conductors shall be required for remote control. The direct current (d.c.) voltage on the control lines shall not exceed 48 volts.

3.7.19.2 Operation and control, satisfactory to the bureau or agency concerned, shall be provided when type II units are connected to the transmitter through a metallic pair of wires whose loop resistance does not exceed 1000 ohms and whose attenuation at 1000 cycles does not exceed 10 db.

3.7.19.3 The impedance of the audio circuits used between remote control positions and the transmitter unit shall be nominally 600 ohms.

3.7.19.4 Monitoring signals to type II units shall be provided by use of the same pair of wires for carrying transmitted and received voice signals.

3.7.20 Control circuits (standard). - In addition to the requirements of 3.7.19, the transmitting equipment shall include control circuits in accordance with the following:

3.7.20.1 Necessary circuits, parts, and terminal boards, shall be incorporated integral with the transmitter unit to permit control of the equipment satisfactory to the bureau or agency concerned, from standard Navy radiophone control units. (Such units are constructed in accordance with Specification MIL-C-17151.)

3.7.20.2 Transmitting equipments incorporating control circuits as specified in 3.7.19 and 3.7.20 shall provide for operation from one to four remote stations (radiophone units) connected in parallel through the ship or station distribution board to the transmitting equipment. A change in the number of connected remote control stations shall have no appreciable effect on the operation or performance of the transmitting equipment. Operation satisfactory for the bureau or agency concerned shall be obtained when the remote stations are located up to 1000 feet from the transmitter.

3.7.20.3 The potential employed in remote start-stop and power indicator circuits shall be 115 volts a.c.

3.7.20.4 The current values required in the transmitter start-stop remote control circuits shall not exceed 1 ampere steady state current or 2.5 amperes instantaneous peak.

3.7.20.5 Remote control lines employed for telegraph key circuits shall not be required to carry in excess of 140 milliamperes, and the potential appearing across the open contacts of the control key shall not exceed 175 volts.

3.7.20.6 The transmitting equipment shall include a low voltage d.c. supply for microphone and telephone control circuits.

3.7.20.6.1 The low voltage supply shall furnish nominal 12 volts d.c. with not more than 1/2 percent ripple voltage and shall supply, in addition to loads in the transmitting equipment and any other loads required to effect local control, a continuous load of 660 milliamperes without damage or sign of overheating. Temporary overloads for 1 minute at infrequent intervals of 1.2 amperes (external load) shall not cause damage.

3.7.20.6.2 The output voltage shall be within the limits of 9-1/2 to 15 volts from the continuous load condition to minimum load and for specified variation of line supply voltage.

3.8 All remote points for one particular installation shall be provided with identical remote control units (see type II equipment and 3.7.20).

3.9 Type II - remote control unit. - The remote control unit shall effect remote A-2 keying or voice modulations, depending upon local selection, carrier control, and monitoring of type I equipment.

3.9.1 Operation and control.- Operation and control satisfactory to the bureau or agency concerned shall be provided when remote control units are connected to type I equipment through metallic pairs of wires whose loop resistance does not exceed 1000 ohms and whose attenuation does not exceed 10 db.

3.9.2 Impedance.- The impedance of the audio circuits used between remote control positions and the transmitter unit shall be nominally 600 ohms.

3.9.3 Monitoring.- The monitoring signal levels shall be adjustable at each remote control unit in a continuously variable substantially logarithmic fashion.

3.9.4 A switch shall be provided on the front panel to permit connecting or disconnecting the remote control circuit.

3.10 Type III - test harness assembly.- The test harness assembly shall include terminations and interconnecting cables for operating type I equipment when the chassis is removed from the cabinet and when the modulator and r.f. subassemblies are removed from the chassis for maintenance purposes.

3.11 Workmanship.- The equipment including all parts and accessories shall be manufactured and finished in a thoroughly workmanlike manner. Particular attention shall be paid to neatness and thoroughness of soldering, wiring, impregnation of coils, marking of parts, plating, painting, machine-screw assemblage, and brazing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Acceptability tests.- Acceptability tests shall be conducted by the contractor on at least one model of each type of equipment. If considered necessary by the bureau or agency concerned, one model shall be shipped to an agency designated by the bureau or agency concerned for tests to further determine conformance with this specification. Tests conducted by the Government shall be with Government furnished test equipment, facilities and personnel. Copies of the results of tests shall be furnished to the bureau or agency concerned. The number of copies shall be as specified (see 6.1).

4.1.1 Acceptability tests shall include the following:

(a) Surface examination.
(b) RF power output.
(c) Tuning and loading.
(d) Power input and power factor.
(e) Carrier ripple and noise.
(f) MCW oscillator characteristics.
(g) Standby to transmit time.
(h) Transmit to standby time.
(i) MCW hold time.
(j) Keying speeds.
(k) AGC characteristics.
(l) Volume expander characteristics.
(m) Filter characteristics.
(n) Frequency response.
(o) Distortion.
(p) Modulation characteristics.
(q) Clipper characteristics.
(r) Backlash.
(s) Remote operation.
(t) Line voltage and frequency.
(u) Temperature.
(v) Humidity.
(w) Accelerated life.

4.2 Contractor's examination and tests.- Contractor's examination and tests shall include such visual, electrical, and mechanical examination and testing of materials, subassemblies, parts and accessories (including source items) during the process of manufacture, as may be required to reasonably assure that the complete equipment will meet all the requirements of this specification.

4.3 Government examination and tests.-

4.3.1 Production equipment and accessories shall be tested at the contractor's plant by the Government inspector to determine conformance with the requirements of this specification. Inspection tests shall be classified as follows:

(a) Production tests.
(b) Production control tests.

4.3.2 Production tests.- Production tests shall be made on each equipment offered for delivery. These tests shall comprise those which prove the workmanship and reveal the omissions and errors of production process; such as, functional and performance tests at a limited number of points in the required range, tests which detect deviations from design, tests of adjustments, and tests which detect hidden defects of materials.

4.3.3 Production control tests.-

4.3.3.1 Selection of samples.- Samples for production control tests specified in 4.3.3.2 shall be selected at random by the Government inspector from those equipments which have passed the production tests (see 4.3.2). The number of samples to be selected shall be as follows:

(a) Four out of the first 10 equipments.
(b) Two out of the second 10 equipments.
(c) Two out of the next 20 equipments.
(d) One out of each of the following 20 equipments.

4.3.3.2 Production control tests.- The production control tests shall encompass functional and performance tests throughout the required range; tests which will detect any deterioration of the design by wear of such items as dies, molds, and jigs and by substitution of different parts; tests which detect deviations in the processing of materials; tests to determine temperature rise produced in operation and ability of equipment to withstand this heat; tests of efficiency; and tests of the performance with other equipment in a system. The tests shall be performed on the complete equipment as offered for delivery.

4.3.3.3 Procedure in case of failure.- If any of the units fail to meet the requirements, the cause of failure shall be ascertained and corrective means determined. These corrective measures shall be introduced immediately in production and shall also be applied to completed but undelivered equipments. Tightened inspection in the defective areas shall be executed on successive equipments submitted for Government acceptance until the defect has been cleared.

4.4 Inspection procedures.- For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing and marking.- The equipment, accessories, technical publications, equipment and stock repair (maintenance) parts shall be preserved and packaged by level A or C; packed by level A, B, or C and marked by level A and B or C as specified in the contract or order in accordance with Specification MIL-P-17555.

6. NOTES

6.1 Ordering data.- Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Type required (see 1.2).
(c) Number of copies of acceptability test results required (see 4.1).
(d) Government furnished equipment.
(e) Selection of applicable level of preservation, packaging, packing and marking (see 5.1).

Notice.- When 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.

Preparing activity:
Navy - Bureau of Ships

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity *(as indicated on reverse hereof)*.

SPECIFICATION

ORGANIZATION *(Of submitter)*	CITY AND STATE

CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
		$

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

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

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO IF "YES", IN WHAT WAY?

4. REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity)*	DATE

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