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SPECIFICATION NO. 55-A-1036-A-T

RR-1188 Development Test Specifications

27 January 1955

1. GENERAL

This specification shall be a part of Specification 55-A-1036-A for the development of the RR-11BB Communications Receiver.

1.1. Purpose of this Specification

This specification shall outline the test procedure to be conducted on completed prototypes. Necessary test equipment is itemized (exclusive of transistor test equipment), test methods are described and the test requirements are presented.

1.2. Submittal of Test Data

Test data shall be submitted simultaneously with the delivery of prototype models.

1.3. Test Equipment

The following principal test equipment is necessary to conduct prototype tests:

1.3.1. Frequency Secondary Standard

Military BC 22, or equivalent.
General Radio Frequency Meter Model LR-3 (Model 271).

1.3.2. R. F. Signal Generators

Measurement Corporations Model 65-B, or equivalent.
Measurement Corporation Model 90, or equivalent.

1.3.3. Audio Output Power Meter

General Radio Model 583-A.

1.3.4. A. C. Vacuum Tube Voltmeter

Hewlett Packard Model 400-C.

1.3.5. R. F. Bridge

General Radio Model No. 916-A, or equivalent.

1.3.6. Audio Signal Generator

Hewlett Packard Model 200-B or 200-C, or equivalent.

1.3.7. A. M. Communications Receiver

Any type (s) capable of covering the frequency range of from 15 kilocycles to 220 megacycles.

2. TEST DATA

2.1. Life Tests

The requirements of Section 3 of this Specifications are based upon the use of fresh batteries. Test data required by Section 3 shall also be obtained for battery voltages representative of those obtainable after 100 hours, and after 150 hours of receiver operation.

2.2. Temperature Tests

It shall be contingent upon the contractor to devise test methods and submit test data for equipment operation and storage under the requirements of Section 5.3. of the RR-11BB Development Specifications.

3. TESTS

3.1. Frequency Test Points

RR-11BB Tests, unless otherwise indicated, shall be made at 12, 15, 18, 24, and 30 megacycles except that should band switching be employed in the design of the equipment, such tests shall be made at the high and low ends, and the center of each band.

3.1.1. Center Frequency Test Points

In such cases where but a single frequency test point is indicated this shall be so only if band switching is not employed. Should band switching be employed the frequency test point shall be the center of each band.

3.2. RR-11BB Receiver

3.2.1. Antenna Input Impedance

Method of Test:

- a. Receiver on and tuned to the measuring frequency.
- b. Controls set to maximum.
- c. Measurement made with an R. F. Bridge.

Requirement:

Input impedance shall be 300 ohms \pm 100 ohms.

3.2.2. Calibration Accuracy

Method of Test:

- a. Receiver on and tuned to the measuring frequency.
- b. R.F. signal generator modulated 30% at 1000 c.p.s. tuned to the receiver as determined by maximum audio power output.
- c. Determine the frequency of the signal generator with a secondary frequency standard.
- d. The difference between the receiver dial setting and the secondary frequency standard shall determine the calibration accuracy in c.p.s. for per cent calculation against the tuned frequency.

Requirement:

The dial calibration shall be within 0.1% of the tuned frequency.

3.2.3. Tuning Resetability

- a. Receiver on, BFO at 0 (I.F. center frequency), and the frequency dial graduation is approached in clockwise direction. (Frequencies specified in section 3.1.).
- b. An R. F. signal generator, unmodulated, is tuned to the receiver as determined by zero beat at the output.
- c. Determine the frequency of the signal generator with a secondary frequency standard.
- d. Approach the same frequency dial graduation in a counterclockwise direction and repeat steps "b" and "c". Except at band edges, the dial shall be shifted a minimum of 500 kc before resetting.
- e. The difference in the two secondary standard readings shall determine the resetability error in c.p.s. for per cent calculation against the tuned frequency.

Requirement:

The accuracy of dial resetability shall be within 0.01% throughout the tuning range.

3.2.4. Receiver Sensitivity

3.2.4.1. A. M. (Emission types A2 and A3)

Method of Test:

- a. Receiver on and tuned to the measuring frequency, BFO off, and gain controls at maximum.

2.4.1. A. M. - Met. . of Test - Cont'd

- b. The receiver input is connected to the R.F. signal generator modulated 30% at 1000 c.p.s. through a 300 ohm dummy load and the output terminated in an audio output power meter (4000 ohms).
- c. Tune the signal generator to the receiver and adjust the R.F. input to establish a 0.5 milliwatt noise plus signal output.

Requirement:

The R.F. input voltage shall not exceed 15 microvolts for a 0.5 milliwatt output.

2.4.2. C. W. (Emission type A1)

Method of Test:

- a. Receiver on and tuned to the measuring frequency, BFO tuned to 1000 c.p.s., and gain controls at maximum.
- b. The receiver input is connected to the R.F. signal generator through a 300 ohm dummy load and the output terminated in an audio output power meter (4000 ohms)
- c. Tune the signal generator to the receiver and adjust the R.F. input to establish a 0.5 milliwatt noise plus signal output.

Requirement:

The R.F. input voltage shall not exceed 5 microvolts for a 0.5 milliwatt output.

2.5. Signal to Internal Noise Ratio

Method of Test:

- a. Receiver ON and tuned to the measuring frequency, BFO adjusted to 1000 cycles, and gain controls adjusted as further noted.
- b. The receiver input is connected to the R.F. signal generator through a 300 ohm dummy load and the output terminated in an audio output power meter (4000 ohms)
- c. Tune the signal generator to the receiver and adjust the output to 5 microvolts.
- d. Adjust the receiver gain controls to establish a .5 milliwatt noise plus signal output.

2.5. Signal to Internal Noise Ratio - Method of Test - Cont'd

- e. Remove the signal without disturbing the receiver settings.
- f. Note the amount of noise output.

Requirement:

The ratio of signal plus noise to noise shall be not less than 10 decibels.

2.6. Image Rejection

Method of Test:

- a. Measure the receiver A. M. sensitivity at the high end of the band (s).
- b. Re-tune the signal generator to the receiver frequency plus twice the I. F. (2nd I. F. if double conversion used)
- c. Re-measure the receiver sensitivity A. M. at this image frequency.
- d. The image rejection in decibels shall be calculated from the ratio of the two sensitivity measurements obtained in a and c.

Requirement:

The image rejection shall be 30 decibels or greater.

2.7. I. F. Rejection

Method of Test:

- a. Measure the receiver A. M. sensitivity at the low end of the band (S).
- b. Re-tune the signal generator to the intermediate frequency.
- c. Re-measure the receiver A. M. sensitivity at the I. F. frequency.
- d. The I. F. rejection in decibels shall be calculated using the ratio of the two sensitivity measurements obtained in a and c.

Requirement:

The I. F. rejection shall be not less than 60 decibels.

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Method of Test:

- a. Overall selectivity measurements shall be made at the approximate center of the band (s). The BFO off and gain controls at maximum.
- b. The R. F. signal generator modulated 30% at 400 c.p.s. shall be tuned to the center frequency and the microvolt input and milliwatt output recorded as the reference level.
- c. Increase the R. F. input signal 3 decibels.
- d. Detune the R. F. signal generator each side of the center frequency until the audio power output decrease to the reference level.
- e. Measure the frequency of the R. F. signal generator with a secondary frequency standard and record.
- f. Increase the R. F. microvolt input in steps of 6, 10, 20, 40, and 60 decibels above the reference input level and repeat steps d and e for each step.

Requirement:

Overall Selectivity shall approximate the following:

Response (Decibels)	Bandwidth (Kilocycles)
- 3	5.0
- 6	5.4
-10	6.2
-20	7.8
-40	11.2
-60	16.0

3.2.9. Audio ResponseMethod of Test:

- a. The receiver shall be connected to an R. F. signal generator modulated 30% at a variable frequency using a standard dummy antennas. The output shall be terminated in an audio power output meter (4000 ohms).
- b. The R. F. microvolt input shall be adjusted for 0.5 milliwatt output at 1000 c.p.s.
- c. The modulating frequency shall be varied between 150 and 7000 c.p.s. and the power recorded at 100, 150, 200, 400, 700, 1000, 1500, 2000, 2500, 4000, and 7000 c.p.s.

Requirement:

The audio response shall be essentially flat and not fall

below 3 decibels over the range of 150 to 2500 c.p.s.

3.2.10. Overall Stability

3.2.10.1 Thermal

Method of Test:

- a. The receiver on and tuned to the middle of the band (3), BFO on, and gain controls at maximum.
- b. A secondary frequency standard shall be loosely coupled and tuned for zero beat with the receiver. The frequency is recorded.
- c. Repeat step b at two minute intervals to obtain 12 consecutive readings.
- d. Plot a curve of per cent frequency change versus time.
- e. Local oscillator drift shall not be compensated for by introducing drift into the BFO.

Requirement:

After a two minute warmup, the rate of change of frequency shall not exceed .0004% per minute.

3.10.2. Mechanical Shock (Jarring)

Method of Test:

- a. The receiver shall be on and tuned to the measuring frequency, BFO on and gain controls at maximum.
- b. A secondary frequency standard shall be loosely coupled and tuned to zero beat with the receiver.
- c. The receiver shall then be tilted to a 45 degree angle from the surface of the bench, the rear lower edge of the receiver case serving as the fulcrum. A free fall drop shall be executed from this position, and the secondary frequency standard brought to zero beat with the receiver.

Requirement:

Frequency shift shall not exceed .0004% due to mechanical shock.

3.10.3. Hand Capacity

Method of Test:

- a. The receiver on and tuned to the measuring frequency, BFO on and gain controls at maximum.

2.10.3. Hand Capacity - Method of Test: - Cont'd

- b. A secondary frequency standard shall be loosely coupled and tuned for zero beat with the receiver.
- c. The receiver shall be picked up and handled.

Requirement:

There shall be no evidence of frequency drift due to hand capacity.

2.11. Receiver Radiated Interference

Method of Test:

- a. Receiver radiated interference tests shall be made in accordance with MIL-I-16910(SMIPS) as amended. Figure 39 outlines the test procedure in the 15 kilocycle to 30 megacycle range and Figure 40 prescribes the measurement setup in the 30 to 200 megacycle range. For the RS-11BB tests, the upper range of Figure No. 40 shall be extended to 220 megacycles.
- b. Paragraph 4.5.1.4.10.2. of the above specification is herewith amended to read "Load. - The receiver input shall be terminated into 300 ohms."

Requirement:

- a. Paragraph 3.6.1.2.1. of MIL-I-16910(SMIPS) is herewith amended to read "Receiver Oscillator Radiation. - The RR-11BB receiver shall not exhibit any oscillator radiation in excess of 400 micromicrowatts when subjected to the receiver oscillator radiation test specified in paragraph 4.5.1.4. over the frequency range of 15 kilocycles to 220 megacycles."

2.12. Spurious Response

2.12.1. Internal

Method of Test:

- a. Receiver on, BFO on, and gain controls at maximum. The antenna terminated with a 300 ohm dummy load.
- b. The receiver shall be tuned over its frequency range.

Requirement:

There shall be no evidence of internal spurious responses.

2.12.2. External

Method of Test:

- a. Receiver on BFO on, and gain controls at maximum.

3.2.12.2. External Method of Test: - Cont'd

Method of Test:

- b. A C.W. sensitivity measurement is made at the center of the band (s) and the microvolt input and power output recorded.
- c. Increase the RF signal generator output to 200,000 microvolts and tune the generator over its entire frequency range noting each spurious response other than at the image and intermediate frequencies.
- d. At each noted spurious response the signal generator microvolt output shall be adjusted to obtain the reference output. Record signal input.
- e. Spurious responses shall be calculated from steps b and d above.

Requirement:

Spurious response (external) shall be down 70 decibels.

3.2.13. Vibration

Method of Test:

- a. Vibration tests shall be conducted in accordance with Bureau of Ships Specification 40T9 (SHIPS) paragraphs F-5b(2)a and F-5b(2)e.

Requirement:

- a. After exposure to the above tests, the RR-11RB receive shall exhibit no evidence of mechanical breakdown or impairment affecting the operational characteristics of the equipment.

3.2.14. Drop Test

Method of Test:

- a. The equipment shall be dropped from a height of 36 inches to a solid oak surface. Six successive free fall drops shall be accomplished with the point of impact being four corners and two surfaces of the equipment case.

Requirement:

- a. Upon completion of the drop tests, the equipment shall exhibit no evidence of damage or impairment affecting the operational characteristics of the equipment.