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**Final Development Report
for Antenna Couple
Group AN/SRA-3**



engineering report

15 June 1963

**Final Development Report
for Antenna Coupler
Group AN/SRA-33**

Contract NObsr 85301



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abstract

This final report covers progress made in the development of automatically tuned 4-channel uhf Antenna Coupler Group AN/SRA-33 during the period of development.

The data taken during the bench testing of model 1, and the bench and environmental testing of model 2 is included in this report.

The AN/SRA-33 meets all specification requirements under normal operating conditions. The antenna coupler group meets all specifications in regard to environment, with the exception of shock. Minor modifications to the AN/SRA-33 rack structure will provide compliance with the shock requirement.

The over-all performance of the AN/SRA-33 has been very good. No component failures were encountered during the testing of the two equipments. The ability of the equipment to retain its calibration through shock, vibration, and temperature has been verified.

The AN/SRA-33 is compatible with the AN/SRC-20 and AN/SRC-21 radio systems, both in performance and appearance. The antenna coupler will allow multichannel uhf communication with one antenna, and with a level of interference much below that of a multiantenna installation.

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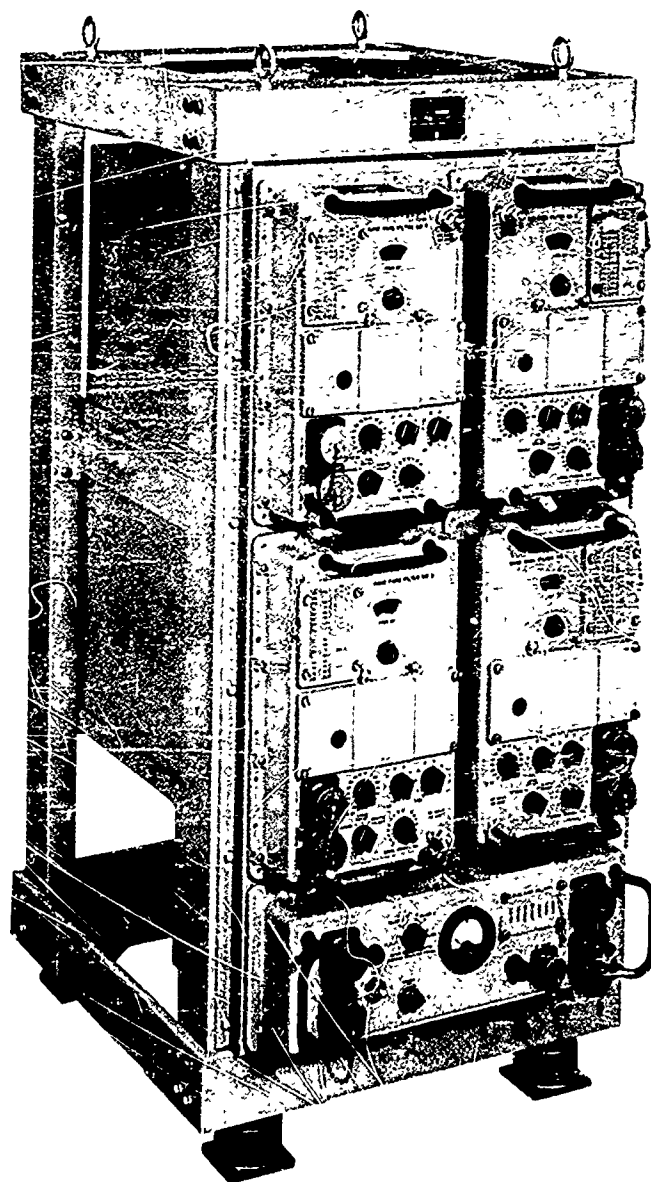


Figure 1-1. Antenna Coupler Group AN/SRA-23,
Front Oblique View

section 1

purpose

1.1 GENERAL

It is the aim and purpose of the work being done under Contract NObsr 85301 to design and develop an automatically tuned 4-channel antenna coupler for coupling a group of transmitters, receivers, receiver-transmitters, or combinations thereof to a common antenna for operation in the frequency range of 225 to 400 megacycles. The equipment shall be a 4-channel, uhf, passive antenna coupler, consisting of four filters packaged in individual removable modules, a power supply module, and an electronic equipment cabinet to contain the modules. A matching section is included as an integral part of the electronic equipment cabinet. This matching section connects the outputs of the four filter modules to a common antenna. Each filter module is capable of being tuned to 1750, 0.1-mc frequency increments from the local operating position. Each filter module also can be tuned from a remote operating position to any one of 19 preset channels. A coaxial connector is provided on the front panel of each filter module for connecting the r-f input. The antenna coaxial connector is located on the rear of the electronic equipment cabinet.

The equipment shall be capable of continuously accepting radio-frequency power from all four input channels modulated 100 percent with a 1-kilocycle tone. Nominal impedance exhibited to the antenna terminal and to each equipment terminal shall be 50 ohms. The electronic equipment cabinet shall be provided with six shockmounts for plane surface mounting with four mounts on the bottom and two on the back. Each module is enclosed in a watertight aluminum case with a cast aluminum front panel. Two AN-type connectors are located on the front panel of each of the four filter modules, one connector attaches to the power supply module, and the other connects to the remote control system. The power supply module has five AN-type connectors, four of which supply power to the four filter modules,

and the remaining which provides a connection to the 115/230-volt, 60-cps power line. Maximum over-all dimensions of the antenna coupler is as follows: 22-1/2 inches wide, 47-3/4 inches high, and 33-1/4 inches deep (including handles, lifting eyes, and all mating connectors).

1.2 DESCRIPTION OF WORK

The contractor, in accordance with any written technical instructions of the Chief, Bureau of Ships, Code 675E, shall accomplish the following:

- (1) Design, develop, construct, test, and furnish two 4-channel, automatically tuned antenna multicouplers.
- (2) Furnish four Technical Manuals, type III, grade B, class 1, in accordance with Military Specification MIL-M-16616 (SHIPS), dated 4 February 1956, and Amendment 1, dated 1 January 1959 (two with each equipment furnished under item (1)).
- (3) The following reports shall be submitted:
 - (a) Letter-type progress report, quarterly, ten copies.
 - (b) Letter-type final report, three months after completion of all work hereunder, fifteen copies.
- (4) Submit Final Management Report (DD Form 1097), items 1 through 5 and 7 through 17 made out accurately and completely in strict accordance with the instructions attached to the DD Form 1097. Contractor submission of DD Form 1097 does not constitute compliance with the requirement for notification to be given by the contractor to the Contracting Officer as specified in the "Limitation of Cost" clause of this contract.

1.3 DETAILED REQUIREMENTS AND PERFORMANCE SPECIFICATION

The applicable specification setting forth the detailed performance of Antenna Coupler Group AN/SRA-33 is SHIPS-C-4282.

section 2

general factual data

2.1 PERSONNEL

Engineering personnel assigned to the project and hours of work performed on the project during the period of this report.

<u>NAME</u>	<u>HOURS</u>
D. Gallagher - Department Head	
R. Kenney - Head Group C, Dept 1	221.4
L. Haerther - Head Group E, Dept 1	43.5
W. Follensbee - Head Group A, Dept 4	41.0
H. Landt - Project Engineer	3178.6
W. Williams - ME	1345.0
W. Fackler - ME	831.2
T. Huls - ME	419.9
M. Cannoy - EE	121.0
D. Fee - ME	82.0
L. Gard - ME	46.8
M. McGrew - ME	6.0
J. Middleton - EE	4.0
K. Jobe - EE	4.0
J. Evert - ME	3.0
Lab Assistants	4356.7
Drafting	4599.9

2.2 PATENTS

- (1) Licenses - Collins Radio Company is licensed under patents of Western Electric and Radio Corporation of America.
- (2) Applicable Patents - 2,476,673 Shaft-Positioning Control Systems.
2,604,965 Automatic Shaft-Positioning Apparatus.
2,572,964 Differential Tuning Mechanism.

NOTE: These patents cover an automatic tuning device generally known as the Collins Autopositioner ®.

2.3 REFERENCES

- (1) Instruction Book for Antenna Coupler CU-355(XN-1) /UR. Collins Radio Company, NAVSHIPS 92041.
- (2) Instruction Book for Antenna Coupler Group AN/SRA-33. Collins Radio Company (manuscript).
- (3) Interim Development Report for Antenna Coupler Group AN/SRA-33, Collins Radio Company IDR-542-1 through IDR-542-7.

2.4 FORMULAS

No new formulas have been derived or used which are not in current usage.

2.5 MEASUREMENT PROCEDURES

2.5.1 SCOPE

The purpose of this procedure is to set forth the individual test requirements and to describe the method of adjusting and testing Antenna Coupler Group AN/SRA-33.

2.5.2 TEST EQUIPMENT

The following equipment or equivalents are required to perform the specified tests.

UHF Transmitter T-217A-GR.

Modulator - Power Supply MD-129A/GR, modified to permit variation of high-voltage power supply input.

Lossy Cable RG-21A/U, approximately 30 feet.

Thru-line Wattmeter, Bird Model 43, (3 required).

Thru-line Element, 5 w, 200 to 500 mc.

Thru-line Element, 25 w, 200 to 500 mc (2 required).

Thru-line Element, 250 w, 200 to 500 mc (2 required).

Termaline R-F Load, Bird Model 82C.
R-F Signal Generator, HP Model 608D.
A-C Ammeter, Weston Model 904.
A-C Wattmeter, Weston Model 432.
A-C Voltmeter, Weston Model 904.
Variable Voltage Transformer, GR Model V10MT.
Radio Set AN/SRC-20.
Receiver, Empire Devices, Model NF-105.
Variable Frequency Power Supply CML Model 1420C.
VTVM, Heath or Eico.
Coaxial Adapter UG-252/U (LC to HN).

2.5.3 TEST CONDITIONS

- (1) Power Handling Capability: 0 to 200 w.
- (2) Impedance: 50 ohms input and output.
- (3) Frequency Range: 225 to 400 mc.
- (4) Ambient Conditions: Normal factory ambient unless otherwise stated.
- (5) During alignment or performance tests, maintain a minimum frequency spacing of 5 mc between the cavity in use and any of the other three cavities.
- (6) When testing the antenna coupler, be sure antenna terminal is terminated in 50 ohms whenever power is applied.

2.5.4 PRELIMINARY TESTS AND SPECIAL INSTRUCTIONS

2.5.4.1 Preliminary Checks

- (1) Check for proper operating of knobs, switches, memory drum, and tuning.
- (2) Check coaxial cables and connectors.
- (3) In case of difficulty, consult AN/SRA-33 Technical Manual.

2.5.4.2 Special Instructions

Antenna Coupler Group AN/SRA-33 is composed of four filter modules and a power supply module mounted in a common cabinet. Each filter module requires a separate set of test data; therefore, it is necessary to identify the various modules for test purposes. The following identification will be used throughout the procedure:

FM1 - Filter Module 1
FM2 - Filter Module 2

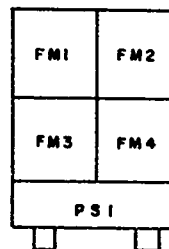
FM3 - Filter Module 3

FM4 - Filter Module 4

PS1 - Power Supply Module

The physical location of each module is identified by the following diagram.

Figure 2-1. Antenna Coupler Group AN/SRA-33, Module Location, Front View



2.6 PERFORMANCE TEST PROCEDURES

The following tests may be performed in any convenient sequence.

2.6.1 TEST NO. 1, SURFACE INSPECTION

Surface inspection as required in Specification MIL-E-16400D, paragraph 4.5.1.

"4.5.1 Surface examination. - Equipment shall be examined for the following:

- (a) Workmanship, assembly and fit, mechanical safety, and marking.
- (b) Materials, parts, and finish.
- (c) Treatment for prevention of corrosion (see 3.5.7.7).
- (d) Treatment for tropicalization, when required (see 3.6.7)."

2.6.2 TEST NO. 2, OPERATING TEST

An operating test as specified in MIL-E-16400D, paragraph 4.5.2.

"4.5.2 Operating Test. - The equipment shall be energized and subject to an operating test to ensure qualitatively the proper functioning of the equipment, including all operating controls and conformance with safety requirements."

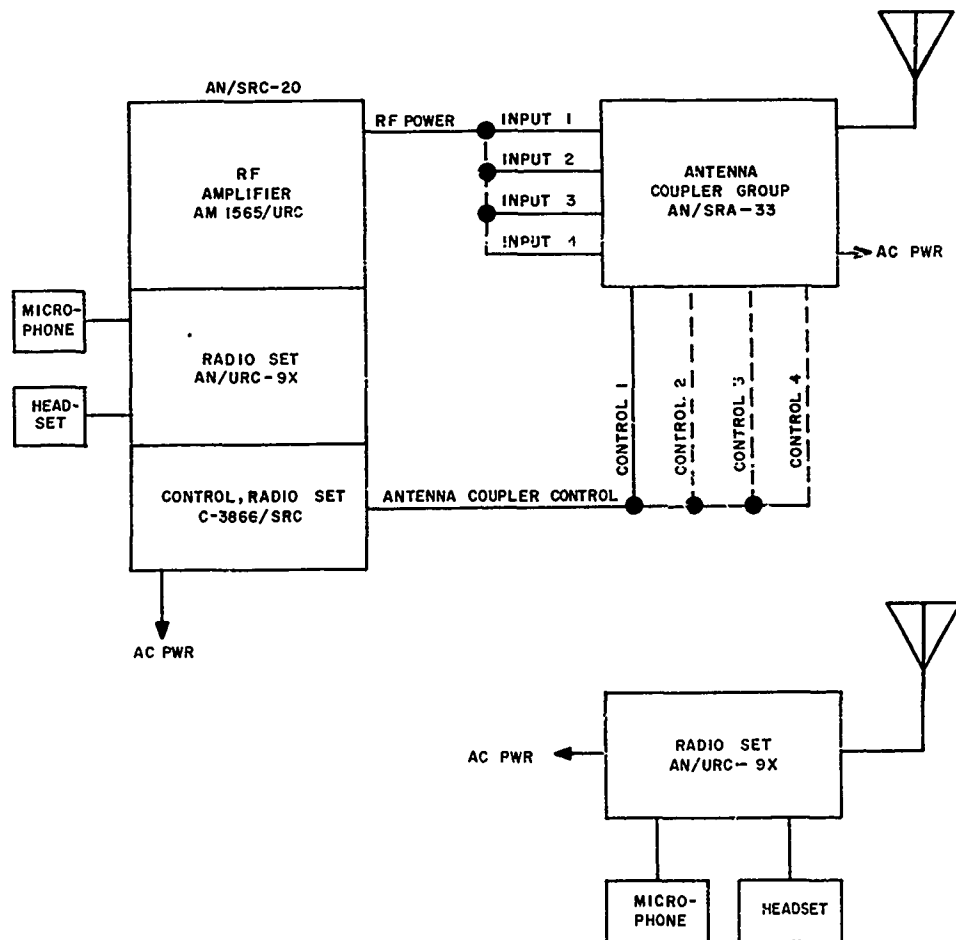


Figure 2-2. Test Circuit for Test No. 2

2.6.2.1 Detailed Test Procedure

- (1) Connect equipment as shown. The test must be performed four times, once for each input to the antenna coupler. Plug in microphones and headsets and energize.
- (2) Preset all channels to the following frequencies:

CHANNEL NO.	FREQUENCY
1	399.9
2	388.8
3	377.7
4	366.6
5	355.5
6	344.4
7	333.3
8	322.2
9	311.1
10	300.0
11	299.9
12	288.8
13	277.7
14	266.6
15	255.5
16	244.4
17	233.3
18	229.1
19	225.0

- (3) Test equipment as required and record results on the following test sheets.
- (4) Inspect equipment for conformance with the safety requirements and enter results in the space provided.

2.6.2.2 Test No. 2A Manual Channel Selection, Detailed Test Procedure

- (1) The AN/SRA-33 contains four filter modules (FM), each must be tested separately. Place LOCAL PRESET-REMOTE PRESET-MANUAL switch of FM1 in the MANUAL position. Channel lockout shall be disabled.
- (2) Select the frequencies given in the preceding table by employing the manual frequency selector knobs of FM1. Record the frequency as read on the frequency dial of FM1. (An error in dial calibration of 0.3 mc is allowed.)
- (3) Repeat test 2A on FM 2, 3, and 4 and record data.

2.6.2.3 Test No. 2B, Local Channel Selection, Detailed Test Procedure

- (1) Place the LOCAL PRESET-REMOTE PRESET-MANUAL switch of FM1 in the LOCAL PRESET position. Channel lockout shall be disabled.
- (2) Select channels 1 through 19 by employing the local channel selector switch of FM1. Record the channel number appearing in the readout window of FM1 and the frequency presented on the frequency dial of FM1.
- (3) Repeat test 2B on FM 2, 3, and 4 and record data.

2.6.2.4 Test No. 2C, Remote Channel Selection, Reception and Transmission Using AN/SRC-20 Radio System, Detailed Test Procedure

- (1) Place AN/SRA-33 LOCAL PRESET-REMOTE PRESET-MANUAL selector for FM1 in the REMOTE PRESET position. Connect the r-f input and control cable from the AN/SRC-20 to FM1. Place the C-3866/SRC LOCAL-REMOTE switch in the LOCAL position. Channel lockout shall be disabled.
- (2) Dial channels 1 through 19 using the telephone dial on the C-3866/SRC. Record frequency readout and channel readout information from FM1 for each channel selected. Also, check to see that transmission and reception is possible on each channel selected.
- (3) Repeat test 2C on FM 2, 3, and 4 and record data.

2.6.2.5 Test No. 2D, Channel Lockout, Detailed Test Procedure

- (1) Enable channel lockout system.
- (2) Connect r-f input and control cable from AN/SRC-20 to FM1.
- (3) Place FM1 LOCAL PRESET-REMOTE PRESET-MANUAL selector switch in the REMOTE PRESET position. Channel FM1 and AN/SRC-20 system to channel 12 by means of the C-3866/SRC telephone dial.
- (4) Place remaining cavity assemblies on channels which do not coincide with FM1 or each other.
- (5) Connect a wattmeter and 50-ohm load to the antenna connector on the AN/SRA-33 in place of the antenna.
- (6) Connect a wattmeter and 50-ohm load to the R-F INPUT connector on FM2.
- (7) Connect an ohmmeter across pins G and H on the control connector for FM2.
- (8) Key the AN/SRC-20.
- (9) Observe wattmeter and ohmmeter readings; if they are normal, indicate on the data sheet.

Normal readings:

Input wattmeter $\approx$ 0 watt

ohmmeter $\approx$ 0 ohm

- (10) Channel FM2 to channel 12.
- (11) Observe wattmeter and ohmmeter readings; if they are normal, indicate on the data sheet.

Normal readings:

Input wattmeter $\approx$ 0 watt

ohmmeter $\approx$ ∞ ohm

- (12) Channel FM2 to its previous position.
- (13) Transfer the wattmeter, load, and ohmmeter to FM3.
- (14) Observe readings when FM3 does not coincide with FM1 in channel number and record data.
- (15) Observe readings when FM3 does coincide with FM1 in channel number and record data.
- (16) Return FM3 to its previous position.
- (17) Transfer the wattmeter, load, and ohmmeter to FM4.
- (18) Observe readings when FM4 does not coincide with FM1 in channel number and record data.
- (19) Observe readings when FM4 does coincide with FM1 in channel number and record data.
- (20) Return FM4 to its previous position.
- (21) Repeat steps (1) through (20) for the conditions where FM2, FM3, and FM4 are connected to the AN/SRC-20. Record data to complete the data sheet provided for test 2D.

2.6.2.6 Test No. 2E, On-Off Power Switch, Dimmer Circuit, and R-F Power Meter, Detailed Test Procedure

Because of the nature of the test, the detailed test procedure and data have been combined. (See data section.)

2.6.2.7 Test No. 2F, Conformance With Safety Requirement, Detailed Test Procedure

Because of the nature of the test, the detailed test procedure and data have been combined. (See data section.)

2.6.2.8 Test No. 2G, Simultaneous, Reception, Transmission, and Channel Changing, Detailed Test Procedure

- (1) Connect an AN/SRC-21 or an AN/SRC-20 to FM1 and FM2.
- (2) Continuously transmit through FM1 and receive through FM2.
- (3) Check lockout system for proper operation when the following conditions prevail.
 - (a) FM1, FM2, FM3, and FM4 coincide in channel number.
 - (b) FM1, FM2 coincide on channel 10 and FM3, FM4 coincide on channel 14.
 - (c) Channel changing all filters at random provides proper reception and transmission.

2.6.3 TEST NO. 3, SUPPLY LINE VOLTAGE AND FREQUENCY

A supply line voltage and frequency test as specified in MIL-E-16400D, paragraph 4.5.4.

"4.5.4 Supply line voltage and frequency. - The equipment shall be operated over the steady state range of voltage and frequency as specified in 3.9.1 or as specified in the individual equipment specification.

3.9.1 Primary power supply line voltage and frequency. - The equipment shall be designed to operate from the primary power supply line voltage and frequency specified in the individual equipment specification. Unless otherwise specified in the individual equipment specification, the equipment shall meet the performance limits of operation over the steady state tolerance of plus or minus 10 percent in voltage and plus or minus 5 percent in frequency from the nominal value specified.

4.5.4.1 Reference measurements shall be made at nominal voltage and frequency. The equipment shall then be operated at the extreme limits of the steady state band in combinations of voltage and frequency shown in Table V. The equipment shall be operated at least 15 minutes in each combination during which time measurements shall be taken to insure performance within limits established in the individual equipment specification.

TABLE V - STEADY-STATE VOLTAGE AND FREQUENCY

Condition	VOLTAGE			FREQUENCY		
	LOWER LIMIT (-10 percent) ¹	Nominal	UPPER LIMIT (+10 percent) ¹	LOWER LIMIT (-5 percent) ¹	Nominal	UPPER LIMIT (+5 percent) ¹
Reference Condition						
A		X			X	
B	X			X		
C			X	X		
D			X			X
E	X					X
¹ Or as specified in individual equipment specification						

4.5.4.2 Transient Voltage. -

4.5.4.2.1 With the equipment operating on the upper limit of steady state voltage, a transient voltage of plus 20 percent voltage recovering to the steady state band in 2 seconds shall be superimposed to determine conformance with 3.9.1.

4.5.4.2.2 With the equipment operating on the lower limit of steady state voltage, a transient voltage of minus 20 percent voltage recovering to the steady state band in 2 seconds shall be superimposed to determine conformance with 3.9.1.

Standard Conditions. - Standard conditions for determination of compliance with performance requirements of this specification shall be as follows:

Supply voltage and frequency - 115/230 v a-c, 60 cps, single phase.

Service Conditions. - Supply voltage and frequency - 115/230 v a-c $\pm$ 10 percent, 60 cps, $\pm$ 5 percent, single phase."

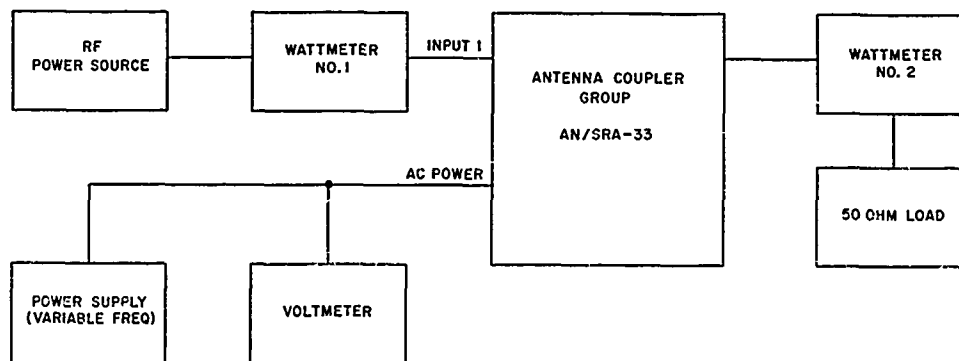


Figure 2-3. Test Circuit for Test No. 3

2.6.3.1 Detailed Test Procedure

- (1) Operate equipment under conditions A, B, C, D, and E as required in MIL-E-16400D, table V, using the preceding test circuit as required by paragraph 4.1.2.2.4.1, and record data.
- (2) Tuning time is the maximum time for the servo system to position the tandem tuning cavities from channel 1 to channel 19.
- (3) Reset accuracy is the change in insertion loss (in db) from the reference insertion loss as measured under condition A. Use channel 10 as the reference channel.
- (4) Apply positive and negative voltage transients as required by MIL-E-16400D, 4.5.4.2, and record test results.
- (5) Note that no parts failed, that normal operation was resumed, and that recycling was not necessary after each transient.

2.6.4 TEST NO. 4, HEAT TEST

A heat test as specified in MIL-E-16400D, paragraph 4.5.6.

"4.5.6 Heat test. - Equipment shall be operated continuously with full power and with its cooling system in normal operation in an ambient temperature of $+50^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for at least 8 hours without damage to or deterioration of any parts thereof. Leakage of impregnating or potting compounds shall be considered as damage to the unit showing such leakage."

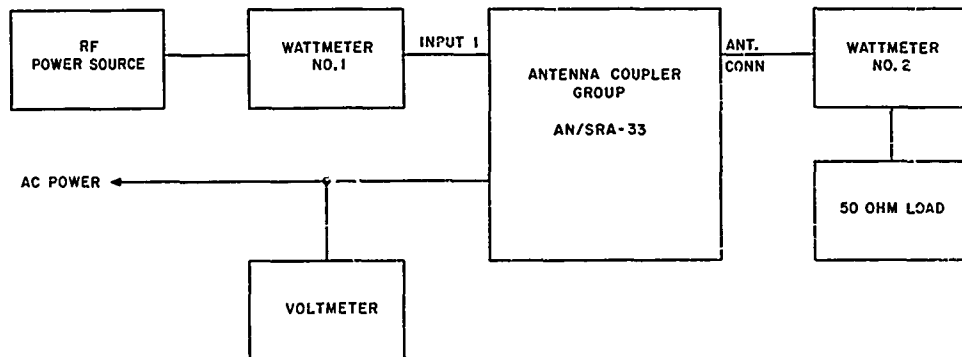


Figure 2-4. Test Circuit for Test No. 4

2.6.4.1 Detailed Test Procedure

- (1) Install equipment in temperature chamber and take reference insertion loss and tuning time at room temperature after allowing equipment to warmup one hour. (Use channel 3 as reference channel.)
- (2) Operate equipment with a continuous r-f input power of 200 watts modulated 100 percent by a 1-kc tone. Take readings hourly for a period of eight hours.
- (3) Reduce ambient temperature to prevailing room temperature and at the end of one hour operating period, measure performance and record data.
- (4) Immediately after the test, inspect the equipment for any leakage of impregnating or potting compounds or any deformation of parts or components.

2.6.5 TEST NO. 5, POWER TEST

A power test as specified in MIL-E-16400D, paragraph 4.5.10.

"4.5.10 Power. - Equipment shall be checked to determine power required from the supply line and equipment power factor."

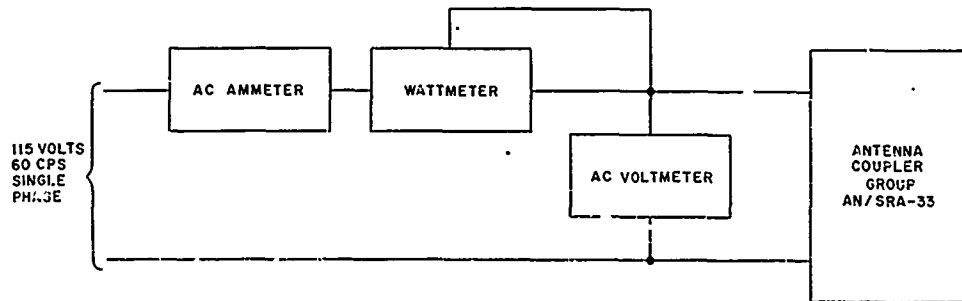


Figure 2-5. Test Circuit for Test No. 5

2.6.5.1 Detailed Test Procedure

- (1) Connect equipment to power source as shown in figure 2-5.
- (2) Energize equipment and allow to warm up.
- (3) Measure and record the input voltage, input current, and input power as necessary to fill in the required test data, and determine the va input and the power factor.

2.6.6 TEST NO. 6, RESET ACCURACY AND TUNING TIME

Test requirement from individual equipment specification SHIP-C-4282, paragraph 3.3.2.3.1.5 and paragraph 3.3.2.3.3.

"3.3.2.3.1.5 Tuning Time. - Maximum tuning time shall not exceed 15 seconds.

3.3.2.3.3 Resettability. - The ability of the tuning mechanism to reset automatically to a preset frequency shall be such that the change in inherent power insertion loss, after recycling, shall not exceed 0.3 decibel (db) in power."

2.6.6.1 Detailed Test Procedure

Use test circuit from Test No. 4, Heat Test.

- (1) Connect equipment as shown and apply power.
- (2) Maintain a constant r-f power input (10 watts).
- (3) Select each channel individually (1 to 19) and record output power for each channel in reference column.
- (4) Reselect the individual channels again (1 to 19) and record the output power for each channel in the reset column.
- (5) Perform the necessary calculations to determine the insertion losses based on 10-watts input and the change in insertion loss.
- (6) Determine the maximum tuning time by channeling FM1 from channel 1 to 19 and repeat by channeling from channel 19 to 1. Measure elapsed time for tuning in each direction with a stop watch and record the data.

2.6.7 TEST NO. 7, OFF-CHANNEL REJECTION

Test requirement from individual equipment specification SHIP-C-4282, paragraph 3.3.6.

"3.3.6 Off-channel rejections. - Minimum attenuation, between the antenna terminal and any equipment terminal, shall be as follows:

- (a) Twenty db at frequencies 1.5 mc from resonance.
- (b) Forty db at frequencies 3 mc from resonance.
- (c) Sixty db at frequencies 10 mc or greater from resonance."

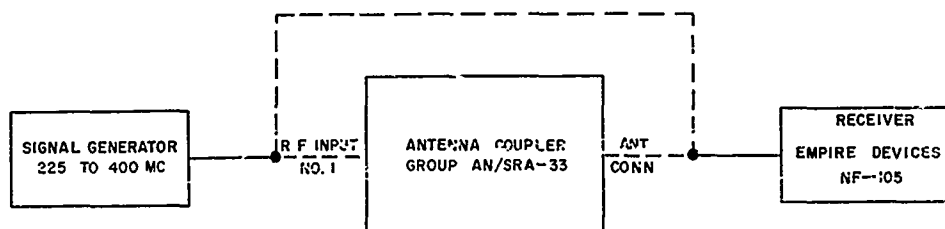


Figure 2-6. Test Circuit for Test No. 7

2.6.7.1 Detailed Test Procedure

- (1) Connect the signal generator directly to the receiver.
- (2) Set signal generator to 385.0 mc.
- (3) Tune receiver to 385.0 mc and adjust signal generator level until a 10-db reading is obtained with 80 db of fixed attenuation in the signal lead.
- (4) Insert the antenna coupler in series with the generator and the receiver.
- (5) Tune the antenna coupler to 395, 388, 386.5, 385, 383.5, 382, and 375 mc, and record the db of attenuation at each frequency. At each frequency maintain the generator output constant.
- (6) Repeat the preceding tests for center frequencies of 342.0 and 235.0 mc.

2.6.8 TEST NO. 8, INSERTION LOSS

Test requirement from individual equipment specification SHIPS-C-4282, paragraph 3.3.5.

"3.3.5 Insertion loss. - Insertion loss between any equipment terminal and the antenna terminal shall be not greater than 2.0 db over the frequency range under normal conditions, and shall not exceed 3 db over the class 1 ambient temperature range."

2.6.8.1 Detailed Test Procedure

Use test circuit from Test No. 4, Heat Test.

- (1) Connect equipment as shown and energize.
- (2) Maintain r-f input constant at 10 watts.
- (3) Channel the equipment through all the channels (1 to 19) and record output power on each channel.
- (4) By transferring the r-f input cable to the remaining filter modules, repeat steps (2) and (3) for FM2, 3, and 4 and record output power.
- (5) Calculate insertion loss for each channel in db to complete data sheet.

2.6.9 TEST NO. 9, VIBRATION TEST

Vibration test as required by MIL-E-16400D which references MIL-STD-167.

MIL-E-16400D

"4.5.15.1 Shock and vibration. - Equipment shall be subjected to the shock tests specified in specification MIL-S-901 and the type I vibration tests specified in standard MIL-STD-167. The equipment shall be energized and in operating condition during these tests."

MIL-STD-167

- "3.1.4.3.1 Exploratory vibration test. - To determine the presence of resonances in the equipment under test, the equipment shall be secured to the vibration table and vibrated at frequencies from 5 cps (or lowest attainable frequency) to 33 cps, at a table vibratory amplitude of 0.010 plus or minus 0.002 inch. The change in frequency shall be made in discrete frequency intervals of 1 cps and maintained at each frequency for about 15 seconds. The frequencies at which resonances occur shall be noted.
- 3.1.4.3.2 Variable frequency test. - The equipment shall be vibrated from 5 cps (or lowest attainable frequency) to 33 cps, in discrete frequency intervals of 1 cps, at the amplitudes shown in Table I. At each integral frequency, the vibration shall be maintained for 5 minutes.
- 3.1.4.3.3 Endurance Test. - The equipment shall be vibrated for a total period of at least 2 hours, at the resonant frequencies chosen by the test engineer. If no resonance was observed, this test shall be performed at 33 cps, unless excepted by 3.1.4.3.4. The amplitudes of vibration shall be in accordance with Table I."

TABLE I - AMPLITUDES OF VIBRATION

FREQUENCY RANGE (cps)	TABLE AMPLITUDE PLUS OR MINUS (inch)
5 to 15	0.030 ± 0.006
16 to 25	0.020 ± 0.004
26 to 33	0.010 ± 0.002

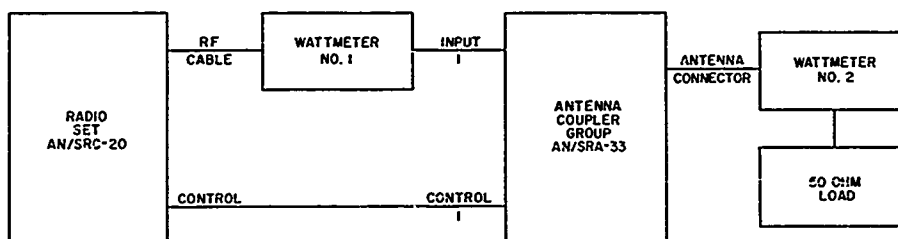


Figure 2-7. Test Circuit for Test No. 9

2.6.9.1 Detailed Test Procedure

- (1) Connect equipment as shown and energize.
- (2) Set equipment so that remote channel selection is obtained by using the telephone dial located on the C-3866/SRC front panel. Turn AM-1565/URC off.
- (3) In plane no. 1, subject the equipment to the exploratory vibration test as specified in MIL-STD-167, paragraph 3.1.4.3.1, and note resonances on data sheet.
- (4) Subject the equipment to the variable frequency test as specified in MIL-STD-167, paragraph 3.1.4.3.2, and record data.
- (5) Perform the endurance test as specified in MIL-STD-167, paragraph 3.1.4.3.3, at the resonant frequencies noted. If no resonances were observed, perform at the test at 33 cps. Record the required data and any necessary remarks.
- (6) Repeat steps (3) through (5) in planes 2 and 3.

Plane 1 - Vibration in a plane perpendicular to the front panel.

Plane 2 - Vibration in a plane perpendicular to the top of the case.

Plane 3 - Vibration in a plane perpendicular to the side of the case.

Place a check in the space provided if the channel dialed is selected properly; that is, the insertion loss is less than 3 db on each channel selected.

2.6.10 TEST NO. 10, TEMPERATURE TEST

Temperature test as required by Military Specification MIL-E-16400D, paragraph 4.5.8.

"4.5.8 Temperature tests. -

4.5.8.1 Nonoperating condition. - Equipment shall be capable of normal operation immediately after passing through the following temperature cycle:

- (a) With equipment set up for test in a temperature controlled room, reduce room temperature to -62°C and hold to within $+0 -5^{\circ}\text{C}$ of that temperature for at least 3 days.
- (b) Increase room temperature to $+75^{\circ}\text{C}$ and maintain that temperature within $\pm 3^{\circ}\text{C}$. for at least 4 hours.
- (c) Reduce room temperature to $25^{\circ} \pm 2^{\circ}\text{C}$ and maintain that temperature for at least 4 hours.

4.5.8.2 Operating condition. - Equipment cooling system shall be in normal operation during the temperature operating tests.

4.5.8.2.1 Class 1. - Class 1 equipment shall be capable of normal operation (without alignment or adjustment, other than the accessible controls employed for operation of the equipment) throughout the following temperature cycle; tolerances in operating characteristics shall be as specified in the individual equipment specification:

- (a) Hold room temperature at $-54^{\circ}\text{C} +0 -5^{\circ}\text{C}$ for at least 24 hours.
- (b) Increase room temperature in steps of 10° each at 30 minutes per step, until $+65^{\circ} \pm 2^{\circ}\text{C}$ is reached and hold at that temperature for at least 4 hours.
- (c) Reduce room temperature in steps of 10° each at 30 minutes per step until $+25^{\circ} \pm 2^{\circ}\text{C}$ is reached and hold at that temperature for at least 4 hours."

2.6.10.1 Detailed Test Procedure

Use test circuit from Test No. 9, Vibration Test.

2.6.10.1.1 Nonoperating Condition

- (1) Connect equipment as shown and energize.
- (2) Set equipment so that remote channel selection is obtained by using the telephone dial located on the C-3866/SRC front panel.
- (3) Maintain an r-f power input of 140 watts from Amplifier AM-1565/URC.
- (4) Record reference data under standard test conditions.
- (5) Pass equipment through the temperature cycle specified in MIL-E-16400D, paragraph 4.5.8.1.
- (6) Energize equipment and record data as required on the data sheet.

2.6.10.1.2 Operating Condition

- (1) Record reference data under standard test conditions.
- (2) Turn equipment off and reduce temperature to $-54^{\circ}\text{C} \pm 0 - 5^{\circ}\text{C}$ for at least 24 hours.
- (3) Operate equipment.
- (4) Increase temperature in 10°C steps each, at 30 minutes per step, until $+65^{\circ} \pm 2^{\circ}\text{C}$ is reached and hold for at least four hours. The equipment shall operate continuously during this period. Record data at the end of each 30-minute interval and each hour during the four-hour period.
- (5) Reduce temperature in 10°C steps each at 30 minutes per step until $+25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ is reached; hold for at least four hours. The equipment shall operate continuously during this period. Record data at the end of each 30-minute interval and each hour during the four-hour period.

2.6.11 TEST NO. 11, SHOCK TEST

A shock test as required by Specification MIL-E-16400D, paragraph 4.5.15.1.

MIL-E-16400D

"4.5.15.1 Shock and Vibration - Equipment shall be subjected to the shock tests specified in Specification MIL-S-901 and the type I vibration tests specified in Standard MIL-STD-167. The equipment shall be energized in the operating condition during these tests."

MIL-S-901

"4.4.2 For Medium-Weight Equipment - The tests shall be made on the medium-weight shock machine shown in figure 2, and a total of six blows shall be applied to the equipment. The six blows shall consist of three groups of two blows each. For each group the height of hammer drop and the initial up travel of the anvil table shall be as shown in Table I."

Table I. Height of Hammer Drop, Feet

Group number-----	I	II	III
Number of blows-----	2	2	2
Anvil table travel, inches-----	3	3	1-1/2
Total weight on anvil table, pounds:			
1,000 - 2,000	1.0	2.0	2.0
NOTE: Only applicable portion of table shown.			

2.6.11.1 Test Procedure

Attach the antenna coupler to the mounting fixture using all six shockmounts, four on the bottom and two on the rear of the unit. The fixture must provide rigid support to all six mounts.

2.6.11.1.1 Detailed Test Procedure

Use test circuit from Test No. 4, Heat Test.

- (1) Energize equipment and record the power output for channels 1, 6, 12, and 19. Maintain an r-f input of 10 watts. Also determine the maximum tuning time.
- (2) Shock shall be applied to the antenna coupler in the operating condition.
- (3) Apply first blow, group I, number 1.
- (4) Record readings as in step (2) preceding.
- (5) Apply second blow, group I, number 2.
- (6) Record readings as in step (2) preceding.
- (7) Examine unit for external damage.
- (8) Repeat steps (3) through (7) for group II and group III blows.

section 3

detailed factual data

As specified by the equipment specification SHIP-C-4282, the antenna coupler tests were conducted in accordance with the requirements for MIL-E-16400, class 1 equipments.

A summary of the tests conducted and test results follow.

3.1 SUMMARY OF TEST RESULTS

TEST	SATISFACTORY? SERIAL A1	SATISFACTORY? SERIAL A2	NOTES
Test No. 1 - Surface inspection	yes	yes	See note (1)
Test No. 2 - Operating test	yes	yes	
Test No. 3 - Supply line voltage and frequency	yes	yes	
Test No. 4 - Heat test	yes	yes	
Test No. 5 - Power test	yes	yes	
Test No. 6 - Reset Accuracy and tuning time	yes	yes	
Test No. 7 - Off-channel rejection	yes	yes	
Test No. 8 - Insertion loss	yes	yes	
Test No. 9 - Vibration test	not performed	yes	
Test No. 10 - Temperature test	not performed	yes	See note (2)
Test No. 11 - Shock test	not performed	no	

3.2 NOTES ON SUMMARY OF TEST RESULTS

- (1) The test to determine the accuracy of the frequency readout dial shows several readings where the dial-indicated frequency differs from the actual frequency by more than ± 0.3 mc. This discrepancy is due to an error in the dial silk-screen. Laboratory data taken on several tuning assemblies show very good agreement between shaft rotation and frequency for the sampled units. The dial silk-screen is being corrected.

- (2) The AN/SRA-33 was mounted on the shock machine and reference data taken. All modules were performing normally. No power output could be obtained from filter module no. 4 due to a defective coaxial switch in the machining section.

Blow number 1 of group no. I was applied. No mechanical damage was observed and electrical operation of the unit was the same as the reference data.

Blow number 2 of group no. I was applied. Again no mechanical damage. Electrical operation the same.

Blow number 1 of group no. II was applied. Two screws holding the rear, right center rack support brace were sheared off. No other apparent mechanical damage. Electrical operation was unaffected.

Blow number 2 of group no. II was applied. The six screws holding the module mounting frame to the right side of the rack sheared. The two front shockmounts also received considerable damage. One of the two screws on the rear of the left center rack support also sheared on this blow. Electrical operation was normal after this blow.

The test on the AN/SRA-33 was concluded after the fourth blow. The two remaining blows of group III were not applied due to the condition of the rack and module mounting frame.

It is important to note that the four filter modules and the power supply module were not damaged in any way. The modules received no mechanical damage either externally or internally. Electrical operation was not affected by the application of the four blows. All failures during the shock test were confined to the module mounting frame, rack, and shockmounts.

- (3) Although not required, some testing was done by Collins Radio Company to determine the suitability of the enclosures. These tests were not official tests and were not witnessed by the Naval personnel. The four filter modules and the power supply module of serial A2 were tested per MIL-STD-108D for watertight enclosures.

Three to five pounds of pressure was placed into each module and then the module was submerged under 3 feet of water. The modules then were observed for any sign of bubbling. The modules were found to be watertight.

The complete antenna coupler group then was tested per MIL-STD-108D for splash-proof enclosures. The unit failed to pass this test because of water entering the matching network which is mounted in the equipment cabinet, and hence, external to the modules. Examination of the matching section after test showed the water was entering through the switch solenoid mounting holes.

3.3 TEST DATA

The following pages contain the data obtained while testing Antenna Coupler Group AN/SRA-33. Data are presented for both serial A1 and A2.

3.3.1 TEST NO. 1, SURFACE INSPECTION

EQUIPMENT: AN/SRA-33 SERIAL: A1 PLACE INSPECTED: Collins Radio CompanyDATE INSPECTED: 14 January 1963 INSPECTED BY H. L. Landt

	SATISFACTORY	UNSATISFACTORY
Workmanship:	X	
Assembly and Fit:	X	
Mechanical Safety:	X	
Marking:	X	
Materials:	X	
Parts:	X	
Finish:	X	
Treatment for Prevention of Corrosion	X	
Treatment for Tropicalization:	N/A	
REMARKS: All data within specification limit.		

3.3.2 TEST NO. 2, OPERATING TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A1 PLACE TESTED: Collins Radio CompanyDATE TESTED: 11 January 1963 TESTED BY: L. Johnson, J. Early, H. Landt.TEST CONDITIONS: Standard

TEST DATA A:

FREQUENCY SELECTED (mc)	FREQUENCY OBTAINED (mc)			
	FM1	FM2	FM3	FM4
399.9	400	400	400	399.5
388.8	389	389.5	389	388
377.7	378	378	378	377
366.6	367	367	367	366
355.5	356	356	356	355
344.4	344.5	345	344	344
333.3	334	333.5	333	332
322.2	322	322.5	322	322
311.1	311	311	310.5	310
300.0	299	300	299	299
299.9	299	300	299	299
288.8	287.5	288	288	287.5
277.7	276	277	276.5	276
266.6	265	266	265.5	265
255.5	254	254.5	254	254
244.4	243	243	243	242.5
233.3	232.5	232.5	232.5	232.5
299.1	229	229.5	229.5	229.5
225.0	225.0	225.0	225.0	225.0

TEST DATA B:

CHANNEL SELECTED	CHANNEL OBTAINED				FREQUENCY OBTAINED (mc)			
	FM1	FM2	FM3	FM4	FM1	FM2	FM3	FM4
1	1	1	1	1	400	400	400	400
2	2	2	2	2	389	389	388	388
3	3	3	3	3	378	378	377	377
4	4	4	4	4	367	367	366	365
5	5	5	5	5	356	356	355	354.5
6	6	6	6	6	344	345	345	344
7	7	7	7	7	334	333.5	333	332
8	8	8	8	8	322	322.5	322	322
9	9	9	9	9	311	311	310.5	309.5
10	10	10	10	10	299	300	299	299
11	11	11	11	11	299	300	299	299
12	12	12	12	12	287	288	288	287.5
13	13	13	13	13	276	277	276.5	277
14	14	14	14	14	265	266	265.5	265
15	15	15	15	15	254	254.5	254	254
16	16	16	16	16	243	243	243	242.5
17	17	17	17	17	232.5	233	232.5	232.5
18	18	18	18	18	229	229.5	229.5	229
19	19	19	19	19	225	225.5	225	225

TEST DATA C:

Channel Selected	Channel Obtained				Frequency Obtained (mc)				Trans and Receive Possible			
	FM1	FM2	FM3	FM4	FM1	FM2	FM3	FM4	FM1	FM2	FM3	FM4
1	1	1	1	1	399.9	399.9	399.9	399.9	X	X	X	X
2	2	2	2	2	388.8	388.8	388.8	388.7	X	X	X	X
3	3	3	3	3	377.7	377.7	377.7	377.7	X	X	X	X
4	4	4	4	4	366.6	366.6	366.6	366.6	X	X	X	X
5	5	5	5	5	355.5	355.5	355.5	355.5	X	X	X	X
6	6	6	6	6	344.4	344.4	344.4	344.4	X	X	X	X
7	7	7	7	7	333.3	333.3	333.3	333.3	X	X	X	X
8	8	8	8	8	322.2	322.2	322.2	322.2	X	X	X	X
9	9	9	9	9	311.1	311.1	311.1	311.1	X	X	X	X
10	10	10	10	10	300.0	300.0	300.0	300.0	X	X	X	X
11	11	11	11	11	299.9	299.9	299.9	299.9	X	X	X	X
12	12	12	12	12	288.8	288.8	288.8	288.8	X	X	X	X
13	13	13	13	13	277.7	277.7	277.7	277.7	X	X	X	X
14	14	14	14	14	266.6	266.6	266.6	266.6	X	X	X	X
15	15	15	15	15	255.5	255.5	255.5	255.5	X	X	X	X
16	16	16	16	16	244.4	244.4	244.4	244.4	X	X	X	X
17	17	17	17	17	233.3	233.3	233.3	233.3	X	X	X	X
18	18	18	18	18	229.9	229.9	229.9	229.9	X	X	X	X
19	19	19	19	19	225.0	225.0	225.0	225.0	X	X	X	X

TEST DATA D:

Marked with an (X) if satisfactory

AN/SRC-21 Connected To	Wattmeter And Ohmmeter Connected To	Channels Numbers Do Not Coincide		Channels Numbers Do Coincide	
		Wattmeter Reading Satisfactory	Ohmmeter Reading Satisfactory	Wattmeter Reading Satisfactory	Ohmmeter Reading Satisfactory
FM1	FM2	X	X	X	X
	FM3	X	X	X	X
	FM4	X	X	X	X
FM2	FM1	X	X	X	X
	FM3	X	X	X	X
	FM4	X	X	X	X
FM3	FM1	X	X	X	X
	FM2	X	X	X	X
	FM4	X	X	X	X
FM4	FM1	X	X	X	X
	FM2	X	X	X	X
	FM3	X	X	X	X

TEST PROCEDURE AND DATA E:

Place Yes or No in the blanks provided.

- (1) Place switch on PS1 in the OFF position.
Equipment is not energized Yes.
- (2) Rotate the DIMMER control on PS1 to its maximum clockwise position. Place POWER switch in the ON position.
Equipment is energized Yes.
On-off indicator lamp is lighted Yes.
All readout dials are illuminated Yes.
- (3) Slowly rotate the DIMMER control to its maximum counterclockwise position.
All lamps dim properly Yes.
All lamps extinguish in the maximum counterclockwise position Yes.
- (4) Disconnect AN/SRA-33 from the 115-volt power line. Operate 115/230-volt change-over switch to the 230-volt position. (Changeover switch is located inside PS1.)
Connect AN/SRA-33 to the 230-volt power line.
Energize equipment.
Operation on 230 volts is normal Yes.
Restore equipment to 115-volt operation.
- (5) Place a 50-ohm load on the AN/SRA-33 antenna connector.
Connect the AN/SRC-20 control cable to FM1.
Connect the AN/SRC-20 r-f output cable to FM1 R-F INPUT connector, place a wattmeter in this line which is capable of reading forward and reflected power.
Channel AN/SRC-20 and AN/SRA-33 to channel 10.
Key the AN/SRC-20 and note forward power on the r-f line meter.
Rotate METER FUNCTION SWITCH on PS1 to FORWARD (F).
Power 1 position.
R-F line wattmeter and AN/SRA-33 wattmeter agree in reading Yes.
NOTE: ± 15 percent error in AN/SRA-33 wattmeter reading is allowed.
Rotate METER FUNCTION SWITCH to reflected (R) power 1 position.
Reflected power as measured by AN/SRA-33 and r-f line wattmeter agree in reading Yes.
- (6) Repeat outline of step (5) for FM2.
Forward power readings agree Yes.
Reflected power readings agree Yes.

- (7) Repeat outline of step (5) for FM3.
Forward power readings agree Yes .
Reflected power readings agree Yes .
- (8) Repeat outline of step (5) for FM4.
Forward power readings agree Yes .
Reflected power readings agree Yes .

TEST PROCEDURE AND DATA F:

- (1) Personnel protected against potential in excess of 70-volts rms Yes .
- (2) Mechanical safety features. Inspector's comments No exposed moving parts.
Lifting eyes provided.
- (3) Interlocks. Inspector's comments N/A
- (4) External metal parts at ground potential Yes .
- (5) Safety covers provided N/A .
- (6) Warning plates provided N/A .
- (7) Meter circuit safety provisions Yes .
- (8) Control shafts grounded Yes .
- (9) Temperature of exposed parts and enclosure does not exceed a temperature of 60°C at an ambient temperature of 25°C Yes .
- (10) The temperature of front panel and operating controls shall not exceed 43°C.
Front panel temperature 25 °C.
Control temperature 25 °C.
- (11) Personnel protected from glass, moving parts, and couplings Yes .
- (12) Edges and corners of enclosures rounded Yes .

TEST DATA G:

- (1) FM1, FM2, FM3, FM4 coincide; reception and transmission possible? Yes
- (2) FM1, FM2 coincide on channel 10; FM3, FM4 coincide on channel 14; reception and transmission possible? Yes
- (3) Reception and transmission possible during random channel changing on all filter modules? Yes

REMARKS: All data within specification limit, except frequency readout dial accuracy.

3.3.3 TEST NO. 3, SUPPLY LINE VOLTAGE AND FREQUENCY DATA

EQUIPMENT: AN/SRA-33 SERIAL: A1 PLACE TESTED: Collins Radio Company.DATE TESTED: 7 January 1963 TESTED BY: L. Johnson, H. LandtTEST CONDITIONS: Standard

TEST DATA (SUPPLY LINE VOLTAGE AND FREQUENCY)

TEST CONDITION	SUPPLY VOLTS	SUPPLY FREQUENCY	RESET ACCURACY (db)	TUNING TIME (seconds)
REF				
A	115.0	60	0.000	8.5
B	103.5	57	+0.219	11.0
C	126.5	57	+0.086	8.0
D	126.5	63	+0.219	8.5
E	103.5	63	+0.149	9.0
		Limit	0.3	15

TEST DATA (TRANSIENT LINE VOLTAGE)

TEST CONDITIONS	SUPPLY VOLTS	SUPPLY FREQUENCY	RESET ACCURACY (db)	TUNING TIME (seconds)
+20% Transient	82	60	+0.219	8.7
-20% Transient	138	60	+0.219	8.7
		Limit	0.3	15

REMARKS: All data within specification limit.

3.3.4 TEST NO. 4, HEAT TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A1 PLACE TESTED Collins Radio CompanyDATE TESTED: 25 January 1963 TESTED BY: L. Johnson, H. Landt

TEST DATA:

ELAPSED TIME (hours)	AMBIENT TEMPERATURE (degrees C)	CHANNEL 3 INSERTION LOSS (db)	TUNING TIME (seconds)
1	(room ambient)	1.52	9.0
2	50°C	1.64	8.0
3	50°C	1.64	8.0
4	50°C	1.76	8.0
5	50°C	1.85	8.0
6	50°C	1.76	8.0
7	50°C	1.76	8.0
8	50°C	1.85	8.0
9	50°C	1.70	8.0
10	(room ambient)	1.64	8.0
	Limit	3	15

REMARKS: Test was run with 10 watts r-f power input because of the lack of a high power transmitter. All data within specification limit.

3.3.5 TEST NO. 5, POWER TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A1 PLACE TESTED: Collins Radio Co.DATE TESTED: 7 January 1963 TESTED BY: L. Johnson, H. Landt

TEST DATA:

CONDITION	INPUT VOLTAGE (volts)	INPUT CURRENT (amperes)	INPUT POWER (watts)	VOLT- AMPERES	POWER FACTOR (percent)
Standby	115.0	1.80	202.0	207.0	97.5
FM1 Channeling	115.0	2.25	255.0	258.8	98.1
FM 1,2,3,4 Channeling Simultaneously	115.0	3.95	430.0	443.0	97.0

REMARKS: All data within specification limit.

3.3.6 TEST NO. 6, RESET ACCURACY AND TUNING TIME DATA

EQUIPMENT: AN/SRA-33 SERIAL: A1 PLACE TESTED: Collins Radio CompanyDATE TESTED: 7 January 1963 TESTED BY: L. Johnson, H. LandtTEST CONDITIONS: Standard

TEST DATA (RESET ACCURACY)

Channel Selected	Reference Data		Reset Data		Change In Insertion Loss (db)
	Output Power (watts)	Insertion Loss (db)	Output Power (watts)	Insertion Loss (db)	
1	6.70	1.73	6.60	1.82	-0.09
2	7.10	1.49	7.00	1.55	-0.06
3	7.10	1.49	7.20	1.43	+0.06
4	6.95	1.58	6.75	1.70	-0.12
5	7.25	1.40	7.25	1.40	0.00
6	7.40	1.30	7.30	1.37	-0.07
7	7.30	1.37	7.30	1.37	0.00
8	7.05	1.52	6.95	1.58	-0.06
9	6.80	1.67	7.20	1.43	+0.24
10	7.10	1.49	7.00	1.55	-0.06
11	7.30	1.37	7.30	1.37	-0.00
12	7.15	1.46	7.15	1.46	0.00
13	7.05	1.52	7.15	1.43	+0.06
14	7.10	1.49	7.20	1.43	+0.06
15	7.00	1.55	7.00	1.55	0.00
16	7.30	1.37	7.20	1.43	-0.06
17	7.30	1.37	7.30	1.37	0.00
18	7.00	1.55	6.90	1.61	-0.06
19	7.00	1.55	7.10	1.49	+0.06
				Limit	0.3

TEST DATA (TUNING TIME)

DIRECTION OF TUNING	ELAPSED TIME (seconds)
1 to 19	8.0
19 to 1	8.0
Limit	15

REMARKS: All data within specification limit.

3.3.7 TEST NO. 7, OFF-CHANNEL REJECTION DATA

EQUIPMENT: AN/SRA-33 SERIAL: A1 PLACE TESTED: Collins Radio CompanyDATE TESTED: 7 January 1963 TESTED BY: L. Johnson, H. Landt

TEST DATA:

CENTER FREQUENCY (mc)	TEST FREQUENCY (mc)	ATTENUATION (db)
385.0	395.0	64.0
	388.0	52.0
	386.5	36.0
	365.0	1.6
	383.5	36.0
	382.0	43.0
	375.0	65.0
342.0	352.0	62.5
	345.0	43.0
	343.5	36.0
	342.0	1.7
	340.5	36.0
	339.0	42.5
	332.0	62.5
235.0	245.0	64.0
	238.0	53.0
	236.5	43.0
	235.0	1.8
	233.5	40.5
	232.0	55.0
	225.0	65.0

3.3.7 TEST NO. 7, OFF-CHANNEL REJECTION DATA (Cont)

SPECIFICATION LIMITS

20 db = 1.5 mc from resonance

40 db = 3 mc from resonance

60 db = 10 mc or greater from resonance.

REMARKS: All data within specification limit.

3.3.8 TEST NO. 8, INSERTION LOSS DATA

EQUIPMENT: AN/SRA-33 SERIAL: A1 PLACE TESTED: Collins Radio CompanyDATE TESTED: 4 January 1963 TESTED BY: L. JohnsonTEST CONDITIONS: Standard

TEST DATA:

Channel	FM 1		FM 2		FM 3		FM 4	
	Output Power (watts)	Insertion Loss (db)	Output Power (watts)	Insertion Loss (db)	Output Power (watts)	Insertion Loss (db)	Output Power (watts)	Insertion Loss (db)
1	6.3	2.00	6.6	1.82	6.8	1.67	6.8	1.67
2	6.8	1.67	6.7	1.73	6.7	1.73	6.9	1.61
3	6.9	1.61	6.8	1.67	7.3	1.37	6.8	1.67
4	6.75	1.70	7.05	1.52	7.25	1.40	7.25	1.40
5	7.15	1.46	6.75	1.70	7.25	1.40	7.05	1.52
6	7.2	1.43	7.5	1.24	7.2	1.43	7.2	1.43
7	7.2	1.43	7.3	1.37	7.2	1.43	7.3	1.37
8	6.95	1.58	6.75	1.70	7.25	1.40	6.95	1.58
9	6.8	1.67	7.1	1.49	7.2	1.43	7.1	1.49
10	6.9	1.61	7.4	1.30	7.0	1.55	7.4	1.30
11	6.7	1.73	7.1	1.49	6.9	1.61	6.9	1.61
12	7.05	1.52	6.75	1.70	7.35	1.33	7.15	1.46
13	7.15	1.46	7.25	1.40	7.25	1.40	6.85	1.64
14	6.9	1.61	6.9	1.61	6.8	1.67	6.9	1.61
15	6.8	1.67	7.2	1.43	6.8	1.67	6.8	1.67
16	6.9	1.61	7.0	1.55	6.5	1.88	6.8	1.67
17	6.6	1.82	6.8	1.67	6.6	1.82	7.0	1.55
18	6.55	1.83	6.9	1.61	6.8	1.67	7.1	1.49
19	6.8	1.67	6.3	2.00	6.8	1.67	6.9	1.61
	Limit	2.0	Limit	2.0	Limit	2.0	Limit	2.0

REMARKS: All data within specification limit.

3.3.9 TEST NO. 1, SURFACE INSPECTION

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE INSPECTED: Collins Radio CompanyDATE INSPECTED: 4 February 1963 INSPECTED BY H. Landt

WORKMANSHIP	SATISFACTORY	UNSATISFACTORY
Assembly and Fit	<u>X</u>	<u> </u>
Mechanical Safety	<u>X</u>	<u> </u>
Marking	<u>X</u>	<u> </u>
Materials	<u>X</u>	<u> </u>
Parts	<u>X</u>	<u> </u>
Finish	<u>X</u>	<u> </u>
Treatment for Pre- vention of Corrosion	<u>X</u>	<u> </u>
Treatment for Tropicalization	<u>N/A</u>	<u> </u>

REMARKS: All data within specification limit.

3.3.10 TEST NO. 2, OPERATING TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Collins Radio CompanyDATE TESTED: 31 January 1963 TESTED BY: H. Landt and L. JohnsonTEST CONDITIONS: Standard

TEST DATA A:

FREQUENCY SELECTED (mc)	FREQUENCY OBTAINED (mc)			
	FM1	FM2	FM3	FM4
399.9	399	400	400	400
388.8	388	390	390	390
377.7	377	380	378	379
366.6	366	369	367	368
355.5	355	357	356	356
344.4	345	346	345	344
333.3	334	336	334	334
322.2	322	323	322	322
311.1	311	312	311	312
300.0	299.5	300	300	299.5
299.9	299	299	299.5	299.5
288.8	288	289	288	288
277.7	277	277	277	277
266.6	265.5	266	266	265.5
255.5	254	255	254.5	254.5
244.4	243.5	244	243.5	244
233.3	233	233	233	233
229.1	229.5	229.8	229.8	229.5
225.0	225.0	225.5	225.5	225.5

TEST DATA B:

SELECTED CHANNEL	CHANNEL OBTAINED				FREQUENCY OBTAINED (mc)			
	FM1	FM2	FM3	FM4	FM1	FM2	FM3	FM4
1	1	1	1	1	399.9	399.9	399.9	399.9
2	2	2	2	2	388.8	388.8	388.8	388.8
3	3	3	3	3	377.7	377.7	377.7	377.7
4	4	4	4	4	366.6	366.6	366.6	366.6
5	5	5	5	5	355.5	355.5	355.5	355.5
6	6	6	6	6	344.4	344.4	344.4	344.4
7	7	7	7	7	333.3	333.3	333.3	333.3
8	8	8	8	8	322.2	322.2	322.2	322.2
9	9	9	9	9	311.1	311.1	311.1	311.1
10	10	10	10	10	300.0	300.0	300.0	300.0
11	11	11	11	11	299.9	299.9	299.9	299.9
12	12	12	12	12	288.8	288.8	288.8	288.8
13	13	13	13	13	277.7	277.7	277.7	277.7
14	14	14	14	14	266.6	266.6	266.6	266.6
15	15	15	15	15	255.5	255.5	255.5	255.5
16	16	16	16	16	244.4	244.4	244.4	244.4
17	17	17	17	17	233.3	233.3	233.3	233.3
18	18	18	18	18	229.9	229.9	229.9	229.9
19	19	19	19	19	225.0	225.0	225.0	225.0

TEST DATA C:

CHANNEL SELECTED	CHANNEL OBTAINED				FREQUENCY OBTAINED (mc)				TRANS AND RECEIVE POSSIBLE			
	FM1	FM2	FM3	FM4	FM1	FM2	FM3	FM4	FM1	FM2	FM3	FM4
1	1	1	1	1	399.9	399.9	399.9	399.9	X	X	X	X
2	2	2	2	2	388.8	388.8	388.8	388.8	X	X	X	X
3	3	3	3	3	377.7	377.7	377.7	377.7	X	X	X	X
4	4	4	4	4	366.6	366.6	366.6	366.6	X	X	X	X
5	5	5	5	5	355.5	355.5	355.5	355.5	X	X	X	X
6	6	6	6	6	344.4	344.4	344.4	344.4	X	X	X	X
7	7	7	7	7	333.3	333.3	333.3	333.3	X	X	X	X
8	8	8	8	8	322.2	322.2	322.2	322.2	X	X	X	X
9	9	9	9	9	311.1	311.1	311.1	311.1	X	X	X	X
10	10	10	10	10	300.0	300.0	300.0	300.0	X	X	X	X
11	11	11	11	11	299.9	299.9	299.9	299.9	X	X	X	X
12	12	12	12	12	288.8	288.8	288.8	288.8	X	X	X	X
13	13	13	13	13	277.7	277.7	277.7	277.7	X	X	X	X
14	14	14	14	14	266.6	266.6	266.6	266.6	X	X	X	X
15	15	15	15	15	255.5	255.5	255.5	255.5	X	X	X	X
16	16	16	16	16	244.4	244.4	244.4	244.4	X	X	X	X
17	17	17	17	17	233.3	233.3	233.3	233.3	X	X	X	X
18	18	18	18	18	229.9	229.9	229.9	229.9	X	X	X	X
19	19	19	19	19	225.0	225.0	225.0	225.0	X	X	X	X

TEST DATA D:

Marked with an (X) if satisfactory.

AN/SRC-21 Connected To	Wattmeter And Ohmmeter Connected To	Channels Numbers Do Not Coincide		Channels Numbers Do Coincide	
		Wattmeter Reading Satisfactory	Ohmmeter Reading Satisfactory	Wattmeter Reading Satisfactory	Ohmmeter Reading Satisfactory
FM1	FM2	X	X	X	X
	FM3	X	X	X	X
	FM4	X	X	X	X
FM2	FM1	X	X	X	X
	FM3	X	X	X	X
	FM4	X	X	X	X
FM3	FM1	X	X	X	X
	FM2	X	X	X	X
	FM4	X	X	X	X
FM4	FM1	X	X	X	X
	FM2	X	X	X	X
	FM3	X	X	X	X

TEST PROCEDURE AND DATA E:

Place Yes or No in the blanks provided.

- (1) Place power switch on PS1 in the OFF position.
Equipment is not energized yes .
- (2) Rotate the DIMMER control on PS1 to its maximum clockwise position.
Place POWER switch in the ON position.
Equipment is energized yes .
On-off indicator lamp is lighted yes .
All readout dials are illuminated yes .
- (3) Slowly rotate the DIMMER control to its maximum counterclockwise position.
All lamps dim properly yes .
All lamps extinguish in the maximum counterclockwise position yes .
- (4) Disconnect AN/SRA-33 from the 115-volt power line. Operate 115/230-volt changeover switch to the 230-volt position. (Changeover switch is located inside PS1.)
Connect AN/SRA-33 to the 230-volt power line.
Energize equipment.
Operation on 230 volts is normal yes .
Restore equipment to 115-volt operation.
- (5) Place a 50-ohm load on the AN/SRA-33 antenna connector.
Connect the AN/SRC-20 control cable to FM1 R-F INPUT connector, place a wattmeter in this line which is capable of reading forward and reflected power.
Channel AN/SRC-20 and AN/SRA-33 to channel 10.
Key the AN/SRC-20 and note forward power on the r-f line meter.
Rotate METER FUNCTION SWITCH on PS1 to forward (F) power 1 position.
R-f line wattmeter and AN/SRA-33 wattmeter agree in reading yes .
NOTE: ± 15 percent error in AN/SRA-33 wattmeter reading is allowed.
Rotate METER FUNCTION switch to reflected (R) power 1 position.
Reflected power as measured by AN/SRA-33 and r-f line wattmeter agree in reading yes .
- (6) Repeat outline of step (5) for FM2.
Forward power readings agree yes .
Reflected power readings agree yes .

- (7) Repeat outline of step (5) for FM3.
Forward power readings agree yes .
Reflected power readings agree yes .
- (8) Repeat outline of step (5) for FM4.
Forward power readings agree yes .
Reflected power readings agree yes .

TEST PROCEDURE AND DATA F:

- (1) Personnel protected against potential in excess of 70 volts rms yes .
- (2) Mechanical safety features. Inspectors Comments No exposed moving parts.
Lifting eyes provided.
- (3) Interlocks. Inspectors Comments N/A
- (4) External metal parts at ground potential yes .
- (5) Safety covers provided N/A .
- (6) Warning plates provided N/A .
- (7) Meter circuit safety provisions yes .
- (8) Control shafts grounded yes .
- (9) Temperature of exposed parts and enclosure does not exceed a temperature of 60°C at an ambient temperature of 25°C yes .
- (10) The temperature of front panel and operating controls shall not exceed 43°C.
Front panel temperature 25°C.
Control temperature 25°C.
- (11) Personnel protected from glass, moving parts, and couplings yes .
- (12) Edges and corners of enclosures rounded yes .

TEST DATA G:

- (1) FM1, FM2, FM3, FM4 coincide; reception and transmission possible? yes .
- (2) FM1, FM2 coincide on channel 10; FM3, FM4 coincide on channel 14; reception and transmission possible? yes .

(3) Reception and transmission possible during random channel changing on all filter modules? yes .

REMARKS: All data within specification limit, except frequency readout dial accuracy.

3.3.11 TEST NO. 3, SUPPLY LINE VOLTAGE AND FREQUENCY DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Collins Radio CompanyDATE TESTED: 1 February 1963 TESTED BY: L. JohnsonTEST CONDITIONS: Standard

TEST DATA (SUPPLY LINE VOLTAGE AND FREQUENCY)

TEST CONDITION	SUPPLY VOLTS	SUPPLY FREQUENCY	RESET ACCURACY (db)	TUNING TIME (seconds)
REF				
A	115.0	60	0.086	9.0
B	103.5	57	0.128	11.0
C	126.5	57	0.128	10.0
D	126.5	63	0.086	8.0
E	103.5	63	0.000	8.0
		Limit	0.3	15

TEST DATA (TRANSIENT LINE VOLTAGE)

TEST CONDITION	SUPPLY VOLTS	SUPPLY FREQUENCY	RESET ACCURACY (db)	TUNING TIME (seconds)
+20% Transient	82	60	0.000	9.0
-20% Transient	138	60	0.086	8.0
		Limit	0.3	15

REMARKS: All data within specification limit.

3.3.12 TEST NO. 4, HEAT TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED Collins Radio CompanyDATE TESTED: 21 February 1963 TESTED BY: L.V. Johnson

TEST DATA:

ELAPSED TIME (hours)	AMBIENT TEMPERATURE (degrees C)	CHANNEL 3 INSERTION Loss (db)	TUNING TIME (seconds)
1	(room ambient)	1.37	8.0
2	50°C	1.37	8.0
3	50°C	1.52	8.0
4	50°C	1.55	8.0
5	50°C	1.52	9.0
6	50°C	1.52	8.0
7	50°C	1.55	8.0
8	50°C	1.61	8.0
9	50°C	1.52	8.0
10	(room ambient)	1.50	8.0
	Limit	3	15

REMARKS: Test run with 10 watts CW r-f input because of unavailability of high power driver. All data within specification limit.

3.3.13 TEST NO. 5, POWER TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Collins Radio CompanyDATE TESTED: 31 January 1963 TESTED BY: L. Johnson

TEST DATA:

CONDITION	INPUT VOLTAGE (volts)	INPUT CURRENT (amperes)	INPUT POWER (watts)	VOLT- AMPERES	POWER FACTOR (percent)
Standby	115	1.86	210	213.9	98.1
FM1 Channeling	115	2.55	275	293.3	93.8
FM 1,2,3,4 Channeling Simultaneously	115	4.05	445	465.8	95.5

REMARKS: All data within specification limit.

3.3.14 TEST NO. 6, RESET ACCURACY AND TUNING TIME DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Collins Radio CompanyDATE TESTED: 30 January 1963 TESTED BY: L. JohnsonTEST CONDITIONS: Standard

TEST DATA (RESET ACCURACY)

Channel Selected	Reference Data		Reset Data		Change In Insertion Loss (db)
	Output Power (watts)	Insertion Loss (db)	Output Power (watts)	Insertion Loss (db)	
1	7.0	1.55	7.05	1.52	-0.03
2	7.1	1.50	7.1	1.50	0.000
3	7.0	1.55	6.9	1.61	+0.06
4	6.85	1.64	6.95	1.59	-0.05
5	7.25	1.40	7.25	1.40	0.00
6	7.4	1.30	7.4	1.30	0.00
7	7.3	1.37	7.3	1.37	0.00
8	6.95	1.59	6.90	1.61	+0.02
9	7.0	1.55	7.1	1.50	-0.05
10	7.4	1.30	7.3	1.37	+0.07
11	7.3	1.37	7.3	1.37	0.00
12	7.15	1.46	7.15	1.46	0.00
13	6.75	1.70	6.5	1.88	+0.18
14	6.4	1.93	6.3	1.99	+0.06
15	6.6	1.80	6.7	1.73	-0.13
16	6.7	1.73	6.8	1.67	-0.06
17	7.3	1.37	7.3	1.37	0.00
18	7.2	1.43	7.2	1.43	0.00
19	7.0	1.55	7.2	1.43	-0.12
				Limit	0.3

TEST DATA (TUNING TIME)

DIRECTION OF TUNING	ELAPSED TIME (seconds)
1 to 19	8.0
19 to 1	8.0
Limit	15

REMARKS: Output power corrected for 20 feet of RG-213/U coax cable. All data within specification limit.

3.3.15 TEST NO. 7, OFF-CHANNEL REJECTION DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Collins Radio CompanyDATE TESTED: 4 February 1963 TESTED BY: L. Johnson

TEST DATA:

CENTER FREQUENCY (mc)	TEST FREQUENCY (mc)	ATTENUATION (db)
385.0	395.0	63
	388.0	50
	386.5	32
	385.0	1.85
	383.5	38
	382.0	50
	375.0	54
342.0	352.0	64
	345.0	51
	343.5	36
	342.0	1.7
	340.5	36
	339.0	45
	332.0	65
235.0	245.0	67
	238.0	52
	236.5	40
	235.0	1.7
	233.5	41
	232.0	53
	225.0	66

3.3.15 TEST NO. 7, OFF-CHANNEL REJECTION DATA (Cont)

SPECIFICATION LIMITS

20 db = 1.5 mc from resonance

40 db = 3 mc from resonance

60 db = 10 mc or greater from resonance.

REMARKS: All data within specification limit.

3.3.16 TEST NO. 2, INSERTION LOSS DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Collins Radio CompanyDATE TESTED: 31 January 1963 TESTED BY: L. JohnsonTEST CONDITIONS: Standard

TEST DATA

Channel	FM 1		FM 2		FM 3		FM 4	
	Output Power (watts)	Insertion Loss (db)	Output Power (watts)	Insertion Loss (db)	Output Power (watts)	Insertion Loss (db)	Output Power (watts)	Insertion Loss (db)
1	7.00	1.55	7.05	1.52	7.05	1.52	7.05	1.52
2	7.10	1.50	7.05	1.52	6.90	1.61	6.60	1.80
3	7.20	1.43	7.20	1.43	7.05	1.52	7.05	1.52
4	6.85	1.64	7.25	1.40	7.25	1.40	6.65	1.76
5	7.25	1.40	7.45	1.27	7.15	1.46	7.25	1.40
6	7.40	1.30	7.30	1.37	7.10	1.50	7.40	1.30
7	7.30	1.37	7.40	1.30	7.40	1.30	7.40	1.30
8	6.95	1.59	7.35	1.34	7.15	1.46	7.45	1.27
9	7.00	1.55	7.40	1.30	7.20	1.43	7.30	1.37
10	7.40	1.30	7.35	1.24	7.40	1.30	7.30	1.37
11	7.30	1.37	7.30	1.37	7.10	1.50	7.40	1.30
12	7.15	1.46	7.35	1.34	7.35	1.34	7.35	1.35
13	6.75	1.70	7.50	1.24	7.35	1.34	7.45	1.27
14	6.40	1.30	7.50	1.24	7.00	1.55	7.30	1.37
15	6.60	1.80	7.40	1.30	7.40	1.30	7.40	1.30
16	6.70	1.73	7.40	1.30	7.30	1.37	7.00	1.55
17	7.30	1.37	7.20	1.43	7.40	1.30	7.40	1.30
18	7.20	1.43	7.10	1.50	7.30	1.37	7.40	1.30
19	7.00	1.55	7.00	1.55	6.90	1.61	7.30	1.37
	Limit	2.0	Limit	2.0	Limit	2.0	Limit	2.0

REMARKS: All data within specification limit.

3.3.17 TEST NO. 9, VIBRATION TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Collins Radio CompanyDATE TESTED: 4 to 6, March 1963 TESTED BY: L. Johnson, H. Landt

TEST DATA

PLANE NO. 1

TEST	OBSERVED RESONANT POINTS				REMARKS
Exploratory	28.4 CPS				
Variable Frequency	FREQUENCY (cps)	CHANNEL 1	SELECTION 10	TEST 19	All data within speci- fication limit.
	5	X	X	X	
	6	X	X	X	
	7	X	X	X	
	8	X	X	X	
	9	X	X	X	
	10	X	X	X	
	11	X	X	X	
	12	X	X	X	
	13	X	X	X	
	14	X	X	X	
	15	X	X	X	
	16	X	X	X	
	17	X	X	X	
	18	X	X	X	
	19	X	X	X	
	20	X	X	X	
	21	X	X	X	
	22	X	X	X	
	23	X	X	X	
	24	X	X	X	
	25	X	X	X	
	26	X	X	X	
	27	X	X	X	
	28	X	X	X	

3.3.17 TEST NO. 9, VIBRATION TEST DATA (Cont)

TEST	FREQUENCY (cps)	CHANNEL 1	SELECTION 10	TEST 19	REMARKS
	29	X	X	X	
	30	X	X	X	
	31	X	X	X	
	32	X	X	X	
	33	X	X	X	

ENDURANCE	ELAPSED TIME (hours)	CHANNEL	SELECTION	TEST	REMARKS
		1	10	19	
	1	X	X	X	Test conducted at 28.4 cps.
	2	X	X	X	

TEST DATA

PLANE NO. 2

TEST	OBSERVED RESONANT POINTS				REMARKS
Exploratory	None Observed				
	FREQUENCY (cps)	CHANNEL 1	SELECTION 10	TEST 19	All data within specification limit.
	5	X	X	X	
	6	X	X	X	
	7	X	X	X	
	8	X	X	X	
	9	X	X	X	

3.3.17 TEST NO. 9, VIBRATION TEST DATA (Cont)

TEST	FREQUENCY (cps)	CHANNEL 1	SELECTION 10	TEST 19	REMARKS
Variable Frequency	10	X	X	X	
	11	X	X	X	
	12	X	X	X	
	13	X	X	X	
	14	X	X	X	
	15	X	X	X	
	16	X	X	X	
	17	X	X	X	
	18	X	X	X	
	19	X	X	X	
	20	X	X	X	
	21	X	X	X	
	22	X	X	X	
	23	X	X	X	
	24	X	X	X	
	25	X	X	X	
	26	X	X	X	
	27	X	X	X	
	28	X	X	X	
	29	X	X	X	
	30	X	X	X	
	31	X	X	X	
	32	X	X	X	
	33	X	X	X	

3.3.17 TEST NO. 9, VIBRATION TEST DATA (Cont)

ENDURANCE	ELAPSED TIME (hours)	CHANNEL	SELECTION	TEST	REMARKS
		1	10	19	
	1	X	X	X	Test was conducted at 33 cps
	2	X	X	X	

TEST DATA

PLANE NO. 3

TEST	OBSERVED RESONANT POINTS				REMARKS
Exploratory	18.2 CPS				
Variable Frequency	FREQUENCY (cps)	CHANNEL 1	SELECTION 10	TEST 19	All data within specifi- cation limit.
	5	X	X	X	
	6	X	X	X	
	7	X	X	X	
	8	X	X	X	
	9	X	X	X	
	10	X	X	X	
	11	X	X	X	
	12	X	X	X	
	13	X	X	X	
	14	X	X	X	
	15	X	X	X	
	16	X	X	X	
	17	X	X	X	
	18	X	X	X	
	19	X	X	X	
	20	X	X	X	
	21	X	X	X	
	22	X	X	X	

3.3.17 TEST NO. 9, VIBRATION TEST DATA (Cont)

TEST	FREQUENCY (cps)	CHANNEL 1	SELECTION 10	TEST 19	REMARKS
	23	X	X	X	
	24	X	X	X	
	25	X	X	X	
	26	X	X	X	
	27	X	X	X	
	28	X	X	X	
	29	X	X	X	
	30	X	X	X	
	31	X	X	X	
	32	X	X	X	
	33	X	X	X	

ENDURANCE	ELAPSED TIME (hours)	CHANNEL	SELECTION	TEST	REMARKS
		1	10	19	
	1	X	X	X	Test was conducted at 18.2 cps
	2	X	X	X	

3.3.18 TEST NO. 10, TEMPERATURE TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Collins Radio CompanyDATE TESTED: 28 February 1963 TESTED BY: L. Johnson, H. Landt

TEST DATA:

NONOPERATING CONDITION						
TEST	CHANNEL SELECTION - INSERTION LOSS (db)					TUNING TIME (seconds)
	CHANNEL 1	CHANNEL 5	CHANNEL 10	CHANNEL 15	CHANNEL 19	
Reference Data	1.61	1.59	1.43	1.37	1.61	8.0
After Temp Cycle	1.50	1.59	1.30	1.37	1.73	8.0
Limit	2.0	2.0	2.0	2.0	2.0	15

OPERATING CONDITION						
TEST	CHANNEL SELECTION - INSERTION LOSS (db)					TUNING TIME (seconds)
	CHANNEL 1	CHANNEL 5	CHANNEL 10	CHANNEL 15	CHANNEL 19	
Reference Data	1.50	1.59	1.30	1.37	1.73	8.0
-54°C 5 Min Warmup	1.59	1.42	1.46	1.54	1.73	10.0
-54°C 30 Min Warmup	1.59	1.42	1.46	1.63	1.82	9.0
-44°C	2.36	2.12	1.25	1.29	2.02	10.0
-34°C	1.64	1.42	1.16	1.59	1.73	9.0
-24°C	1.42	1.42	1.20	1.54	1.73	9.0
-14°C	1.42	1.46	1.25	1.50	1.73	9.0
-4°C	1.37	1.50	1.25	1.54	1.82	8.0
+6°C	1.37	1.59	1.20	1.59	1.87	9.0
+16°C	1.42	1.73	1.25	1.54	2.07	8.0
+26°C	1.42	1.64	1.25	1.59	2.12	8.0
+36°C	1.46	1.92	1.25	1.96	2.22	8.0
+46°C	1.42	1.55	1.25	1.87	2.07	8.0
+56°C	1.64	1.55	1.33	1.63	2.27	8.0

3.3.18 TEST NO. 10, TEMPERATURE TEST DATA (Cont)

OPERATING CONDITION						
TEST	CHANNEL SELECTION - INSERTION LOSS (db)					TUNING TIME (seconds)
	CHANNEL 1	CHANNEL 5	CHANNEL 10	CHANNEL 15	CHANNEL 19	
+65°C	1.46	1.78	1.29	1.59	1.87	8.0
1 Hour +65°C	1.82	2.21	1.64	1.87	1.69	8.0
2 Hours +65°C	2.02	2.12	1.59	1.73	1.92	8.0
3 Hours +65°C	2.02	1.73	1.73	1.73	1.92	8.0
4 Hours +65°C	1.92	2.17	1.92	1.73	2.32	8.0
+55°C	1.97	1.96	1.46	1.59	2.49	8.0
+45°C	1.50	1.69	1.37	1.63	1.87	8.0
+35°C	1.50	1.59	1.33	1.68	1.73	8.0
+25°C	1.50	1.73	1.29	1.54	1.64	8.0
1 Hour +25°C	1.59	1.96	1.25	1.68	1.82	8.0
2 Hours +25°C	1.59	1.87	1.37	1.63	1.78	8.0
3 Hours +25°C	1.59	1.92	1.37	1.73	1.87	8.0
4 Hours +25°C	1.64	1.92	1.46	1.92	1.87	8.0
Limit	3.0	3.0	3.0	3.0	3.0	15

REMARKS: Test was conducted with 140 watts of CW r-f input. Insertion loss corrected for 20 feet of RG-213/U coaxial cable. All data within specification limit.

3.3.19 TEST NO. 11, SHOCK TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Allis Chalmers
Milwaukee, Wisconsin

DATE TESTED: 9 April 1963 TESTED BY: H. Landt

ANTENNA COUPLER MODULE NUMBER: CU-1121/SRA-33

TEST DATA

TEST	CHANNEL SELECTION TEST			
	CHANNEL 1		CHANNEL 6	
	POWER OUT (watts)	INSERTION Loss (db)	POWER OUT (watts)	INSERTION Loss (db)
Reference	7.3	1.37	7.3	1.37
*GP 1, HH 1.00', TT 3"	7.3	1.37	7.3	1.37
GP 1, HH 1.00', TT 3"	7.3	1.37	7.6	1.20
GP 2, HH 2.00', TT 3"	7.3	1.37	7.7	1.14
GP 2, HH 2.00', TT 3"	6.8	1.68	7.7	1.14
GP 3, HH 2.00', TT 1.5"				
GP 3, HH 2.00', TT 1.5"				
Spec Limit	---	3.0	---	3.0

*GP = Group, HH = Hammer Height, TT = Table Travel

TEST	CHANNEL SELECTION TEST				TUNING TIME (sec)
	CHANNEL 12		CHANNEL 19		
	POWER OUT (watts)	INSERTION Loss (db)	POWER OUT (watts)	INSERTION Loss (db)	
Reference	7.0	1.55	7.0	1.55	8.0
*GP 1, HH 1.00', TT 3"	7.3	1.37	7.3	1.37	8.0
GP 1, HH 1.00', TT 3"	7.3	1.37	7.3	1.37	8.0
GP 2, HH 2.00', TT 3"	7.3	1.37	6.7	1.73	8.0
GP 2, HH 2.00', TT 3"	7.3	1.37	7.2	1.43	8.0
GP 3, HH 2.00', TT 1.5 "					
GP 3, HH 2.00', TT 1.5"					
Spec Limit	---	3.0	---	3.0	15.0

REMARKS: Test was concluded at the end of the fourth blow due to damage to the module mounting frame and rack. All modules performed satisfactorily during the test except filter module number 4 which was defective before the test began. An examination of the modules after the fourth blow revealed no internal or external mechanical damage.

TEST NO. 11, SHOCK TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Allis Chalmers
Milwaukee, Wisconsin

DATE TESTED: 9 April 1963 TESTED BY: H. Landt

ANTENNA COUPLER MODULE NUMBER: CU-1132/SRA-33

TEST DATA

TEST	CHANNEL SELECTION TEST			
	CHANNEL 1		CHANNEL 6	
	POWER OUT (watts)	INSERTION Loss (db)	POWER OUT (watts)	INSERTION Loss (db)
Reference	7.2	1.43	7.2	1.43
*GP 1, HH 1.00', TT 3"	7.1	1.50	7.2	1.43
GP 1, HH 1.00', TT 3"	7.0	1.55	7.2	1.43
GP 2, HH 2.00', TT 3"	7.0	1.55	7.6	1.20
GP 2, HH 2.00', TT 3"	7.0	1.55	7.5	1.24
GP 3, HH 2.00', TT 1.5"				
GP 3, HH 2.00', TT 1.5"				
Spec Limit	---	3.0	---	3.0

*GP = Group, HH = Hammer Height, TT = Table Travel

TEST	CHANNEL SELECTION TEST				TUNING TIME (sec)
	CHANNEL 12		CHANNEL 19		
	POWER OUT (watts)	INSERTION Loss (db)	POWER OUT (watts)	INSERTION Loss (db)	
Reference	6.8	1.68	6.7	1.73	8.0
*GP 1, HH 1.00', TT 3"	6.8	1.68	6.6	1.80	8.0
GP 1, HH 1.00', TT 3"	6.8	1.68	6.6	1.80	8.0
GP 2, HH 2.00', TT 3"	6.8	1.68	6.5	1.87	8.0
GP 2, HH 2.00', TT 3"	6.5	1.87	6.5	1.87	8.0
GP 3, HH 2.00', TT 1.5"					
GP 3, HH 2.00', TT 1.5"					
Spec Limit	---	3.0	---	3.0	15.0

REMARKS: The total weight on the shock test machine anvil was:

AN/SRA-33-----350 lb

AN/SRA-33 Mounting Fixture-----300 lb

Table Channel Irons, etc.-----460 lb

Total-----1110 lb

TEST NO. 11, SHOCK TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Allis Chalmers
Milwaukee, WisconsinDATE TESTED: 9 April 1963 TESTED BY: H. LandtANTENNA COUPLER MODULE NUMBER: CU-1133/SRA-33

TEST DATA

TEST	CHANNEL SELECTION TEST			
	CHANNEL 1		CHANNEL 6	
	POWER OUT (watts)	INSERTION Loss (db)	POWER OUT (watts)	INSERTION Loss (db)
Reference	6.4	1.94	7.0	1.55
*GP 1, HH 1.00', TT 3"	7.0	1.55	7.0	1.55
GP 1, HH 1.00', TT 3"	7.0	1.55	7.0	1.55
GP 2, HH 2.00', TT 3"	7.0	1.55	7.3	1.37
GP 2, HH 2.00', TT 3"	7.1	1.50	7.5	1.24
GP 3, HH 2.00', TT 1.5"				
GP 3, HH 2.00', TT 1.5"				
Spec Limit	---	3.0	---	3.0

*GP = Group, HH = Hammer Height, TT = Table Travel

TEST	CHANNEL SELECTION TEST				TUNING TIME (sec)
	CHANNEL 12		CHANNEL 19		
	POWER OUT (watts)	INSERTION Loss (db)	POWER OUT (watts)	INSERTION Loss (db)	
Reference	7.3	1.37	7.5	1.24	9.0
*GP 1, HH 1.00', TT 3"	7.4	1.30	7.5	1.24	9.0
GP 1, HH 1.00', TT 3"	7.3	1.37	7.5	1.24	8.0
GP 2, HH 2.00', TT 3"	7.3	1.37	7.6	1.20	9.0
GP 3, HH 2.00', TT 3"	7.4	1.30	7.5	1.20	9.0
GP 3, HH 2.00', TT 1.5"					
GP 3, HH 2.00', TT 1.5"					
Spec Limit	---	3.0	---	3.0	15.0

TEST NO. 11, SHOCK TEST DATA

EQUIPMENT: AN/SRA-33 SERIAL: A2 PLACE TESTED: Allis Chalmers
Milwaukee, Wisconsin

DATE TESTED: 9 April 1963 TESTED BY: H. Landt

ANTENNA COUPLER MODULE NUMBER: CU-113 ±/SRA-33

TEST DATA

TEST	CHANNEL SELECTION TEST			
	CHANNEL 1		CHANNEL 6	
	POWER OUT (watts)	INSERTION Loss (db)	POWER OUT (watts)	INSERTION Loss (db)
Reference	6.9	1.61	0.0	∞
*GP 1, HH 1.00', TT 3"	0.0	∞	0.0	∞
GP 1, HH 1.00', TT 3"	0.0	∞	0.0	∞
GP 2, HH 2.00', TT 3"	4.8	3.18	0.0	∞
GP 2, HH 2.00', TT 3"	3.8	4.20	0.0	∞
GP 3, HH 2.00', TT 1.5"				
GP 3, HH 2.00', TT 1.5"				
Spec Limit	---	3.0	---	3.0

*GP = Group, HH = Hammer Height, TT = Table Travel

TEST	CHANNEL SELECTION TEST				TUNING TIME (sec)
	CHANNEL 12		CHANNEL 19		
	POWER OUT (watts)	INSERTION Loss (db)	POWER OUT (watts)	INSERTION Loss (db)	
Reference	0.0	∞	0.0	∞	8.0
*GP 1, HH 1.00', TT 3"	0.0	∞	6.0	2.22	9.0
GP 1, HH 1.00', TT 3"	0.0	∞	0.0	∞	8.0
GP 2, HH 2.00', TT 3"	0.0	∞	0.0	∞	9.0
GP 2, HH 2.00', TT 3"	0.0	∞	5.6	2.52	9.0
GP 3, HH 2.00', TT 1.5"					
GP 3, HH 2.00', TT 1.5"					
Spec Limit	---	3.0			15.0

REMARKS: CU-1134/SRA-33 did not perform properly upon arrival at Allis Chalmers Corporation. A defective coaxial switch in the matching section was to blame. The unit tuned properly during the test.

section 4

recommendations

Test No. 11 - Shock Test

Results obtained from the shock test indicate that the four filter modules and the power supply module are satisfactory. The electronic equipment cabinet, however, is not satisfactory in its present configuration. The main areas of trouble are the front shockmounts, mounting hardware, and flexing of the main rack structure.

Recommendation

The front shockmounts should be increased in number, thereby reducing the individual loading and resultant deformation in shock.

The number of screws used to attach the module mounting frame to the rack should be increased. The material for these screws also should be changed. Mounting brackets should be added to the rear of this frame in order to attach it to the rack structure.

Steel reinforcing straps should be added to each side of the relay rack. These would be in the form of X bracing to eliminate rack distortion during shock.

Special Test - Splashproof Enclosure

Results obtained from the splashproof test performed on Antenna Coupler Group AN/SRA-33 show that the four filter modules and the power supply module are satisfactory. The unit failed this test due to water entering the matching network, which is a part of the electronic equipment cabinet.

There are three areas where water might enter the network; namely, the antenna connector, and four jacks which connect to the filter module output connector, and the tapped

openings for mounting the switch solenoids. The test showed that the connector areas were satisfactory and that water was entering the network through the solenoid mounting holes.

Recommendation

Prior to the construction of production quantities, a sealed solenoid with an O-ring bushing seal should be incorporated into the design.

4.1 RECOMMENDED DESIGN CHANGES

The following investigations and changes should be made prior to the construction of production quantities of Antenna Coupler Group AN/SRA-33.

- (1) Frequency readout dials should be redesigned to improve calibration accuracy and increase illumination level.
- (2) A loaded gear mesh should be provided between the motor pinion and the servo gear train.
- (3) A connector should be provided between the front panel on the filter modules and the cavity assemblies so that they may be separated easily for maintenance.
- (4) BuShips has requested that the memory drum assemblies should be revised to include a seeking switch for operation of the antenna coupler with the AN/GRC-27.
- (5) The front panels should be revised to allow the switches to be sealed per MIL-B-5423.
- (6) Interference filters should be added to the AN/SRA-33 60-cps line. A dual filter as employed on the AN/URC-9 would be satisfactory.
- (7) Solenoids on matching network should be of watertight construction with an O-ring bushing seal.
- (8) An investigation of the resolution of the 10-mc bridge adjustment potentiometers should be made. An improved resolution will allow the antenna coupler to be aligned more quickly and more accurately.
- (9) Changes to rack, shockmounts, and mounting hardware should be made to allow the unit to meet the shock test as specified in MIL-S-901.
- (10) Buships and NRL personnel suggested that an equipment design change should be made to eliminate the forward-reflected power meter and selector switch from the power supply front panel. Four forward-reflected power meters should be added to an enclosure at the top of the equipment rack, to provide independent monitoring for each filter module.

4.2 RECOMMENDED SPECIFICATION CHANGES

It is recommended that paragraph 3.3.2 of Specification SHIPS-C-4282, dated 20 August 1962, be changed to read as follows:

"3.3.2 Radio Frequency Power

The equipment shall be capable of accepting radio frequency power from all four input channels simultaneously, each channel having a carrier power level not to exceed 140 watts, modulated 80 percent with a 1-kilocycle tone."

This is a more realistic power and modulation level, which would not be exceeded by the AN/SRC-20, AN/SRC-21, or the AN/GRC-27. Also, this power and modulation level is readily obtainable from existing Radio Set AN/SRC-20 for the purpose of testing the AN/SRA-33.

section 5

conclusion

The AN/SRA-33 offers five advantages over previous antenna couplers developed for naval use.

- (1) The antenna coupler has 19 preset channel capability. Twice the assigned channels may be used as compared to previous equipment, thus doubling the usefulness of the system, with no increase in size or weight.
- (2) The antenna coupler can be set to any frequency (0.1 megacycle increments) without the need of a uhf transmitter. This allows for rapid frequency changing, and also permits the antenna coupler to be used with receivers only.
- (3) The antenna coupler offers complete protection for the receivers when transmitters are used with the system. A lockout system prevents a transmitter from damaging a receiver front-end in the event they are operating on the same channel.
- (4) It is possible to remove a filter assembly from the antenna coupler for maintenance without disrupting the other three channels of communication. Without this feature, complete uhf communication capability could be lost in case of an antenna coupler failure.
- (5) Each individual filter assembly is contained in a sealed enclosure. This allows the antenna coupler to operate in high ambient humidity without a sacrifice in performance. This was not possible with previous antenna couplers, unless they were retuned at frequent intervals during changes in humidity level.

The AN/SRA-33 is compatible with the AN/SRC-20 and AN/SRC-21 radio systems. It has been designed expressly for the environments encountered in shipboard applications. It is a reliable and ruggedly constructed piece of equipment which will provide many years of service. With its unique type of construction it is maintained easily. Ease in operation and frequency changing are much improved over previous antenna coupler designs.

Thus it is concluded that Antenna Coupler Group AN/SRA-33 will meet all requirements for shipboard use, and now may be considered for quantity production for application throughout the fleet.