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COLLINS

maintenance and checkout manual

Collins Radio Company

HF Communications Central AN/SRC-16

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HF Communications Central AN/SRC-16

Prepared for the U.S. Navy

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1.1 INTRODUCTION

This publication describes operating practices that improve and maintain the quality of AN/SRC-16 communication. Test and adjustment procedures are recommended for initial installation and regular maintenance routines. There is also a section devoted to maintenance aids and troubleshooting hints.

Subsequent sections of this document contain the following information.

a. Section 2 — Operating Practices
b. Section 3 — System Tests and Adjustments
c. Section 4 — Transmitter, Receiver, and 500W Power Amplifier Tests and Adjustments
d. Section 5 — 5-KW Power Amplifier and Adjustments
e. Section 6 — Maintenance Aids and Troubleshooting Hints

2.1 GENERAL

Operating practices involve two major areas:

a. Equipment Status
b. Frequency Utilization

2.2 EQUIPMENT STATUS

The NTDS technician aboard ship should keep a status board on the equipment similar to the one in table 2-1. Radio circuitry is not primarily logic circuitry, and since transmission and tube characteristics do change, the radio system parameters are subject to change. The radio system parameters that should be checked regularly are listed in table 2-2. The equipment racks and units that comprise the system are shown in figures 2-1 through 2-6.

2.3 FREQUENCY UTILIZATION

Good communication results from proper use of rf equipment. Design characteristics of couplers dictate that a 15 percent frequency separation should be maintained if the communication network is to operate efficiently. It is realized that these specifications cannot be adhered to at all times; however, deviation should be kept to a minimum.

Good NTDS communication will rely on many factors; the most important being a clean hf frequency.

Procedure 2-1 gives indications of expected test results for tests performed on SRC-16.

Procedure 2-2 gives a list of visual operating conditions. Also listed in the table is a list of improper visual indications and probable cause of failure.

Table 2-1. Data Chart.

SRC-16	TX TESTS	RX TESTS	PA TESTS	SYSTEM TESTS	REMARKS
	DATE	DATE	DATE	DATE	MISC. INFO.
Chan 1 Chan 2 Chan 1 and 2 (5 kw) Chan 3 Chan 4 Chan 3 and 4 (5 kw)					

Table 2-2. System Parameters Checked.

EQUIPMENT	CHECKS
Transmitters	100-KC, 500-KC, KC Stabilizer Tune Power Operate Power (agc)
Receivers	$\frac{S+N}{N}$ 500-KC, 100-KC, KC Stabilizer AGC-Threshold and Response Output Response Output Levels
Power Amplifiers	Tube Statics ADC ALC Neutralization Distortion
SRC-16 System PA, TX, and RX	Distortion Frequency Lock
Antennas	VSWR

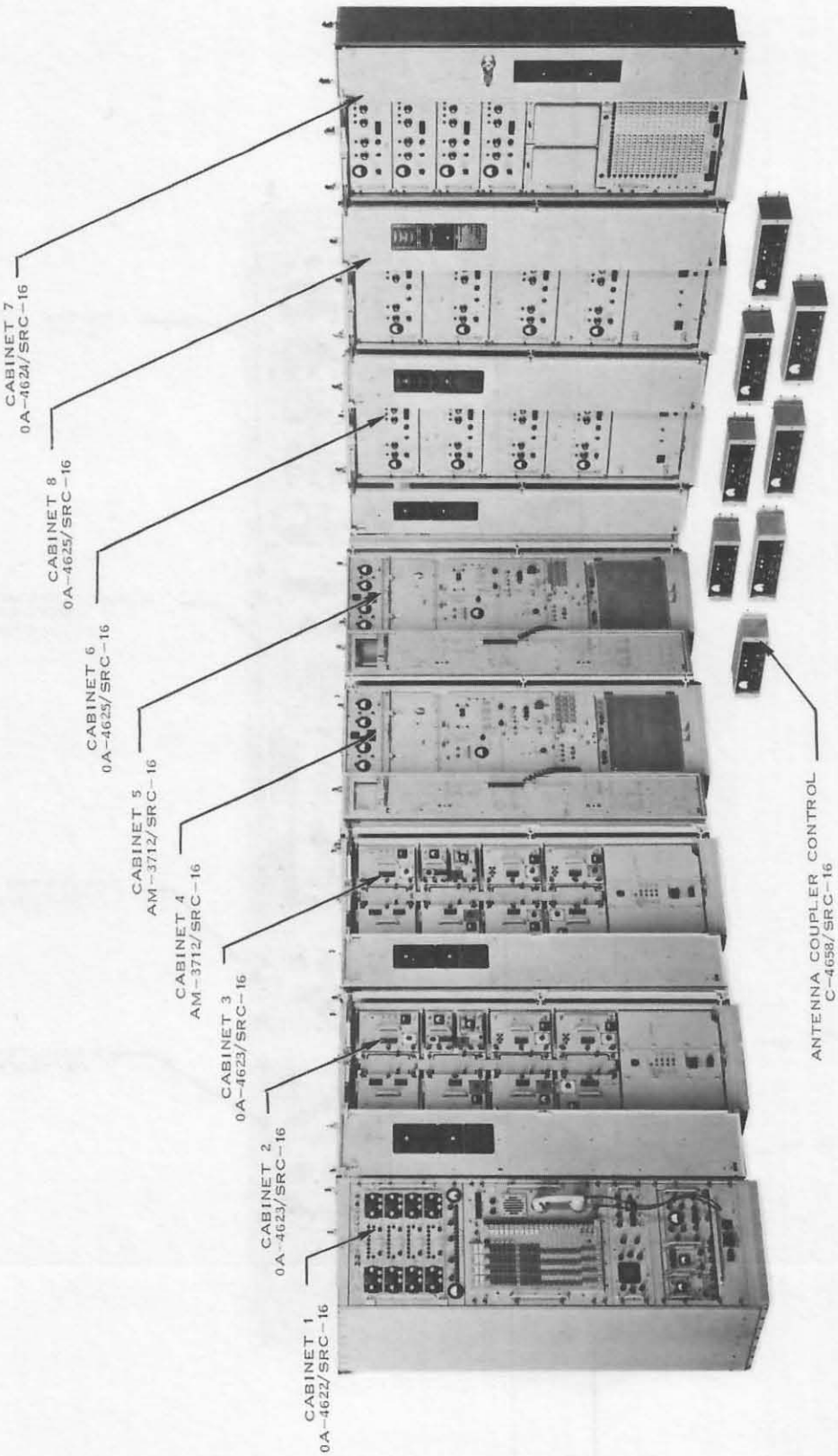


Figure 2-1. Communications Central AN/SRC-16.

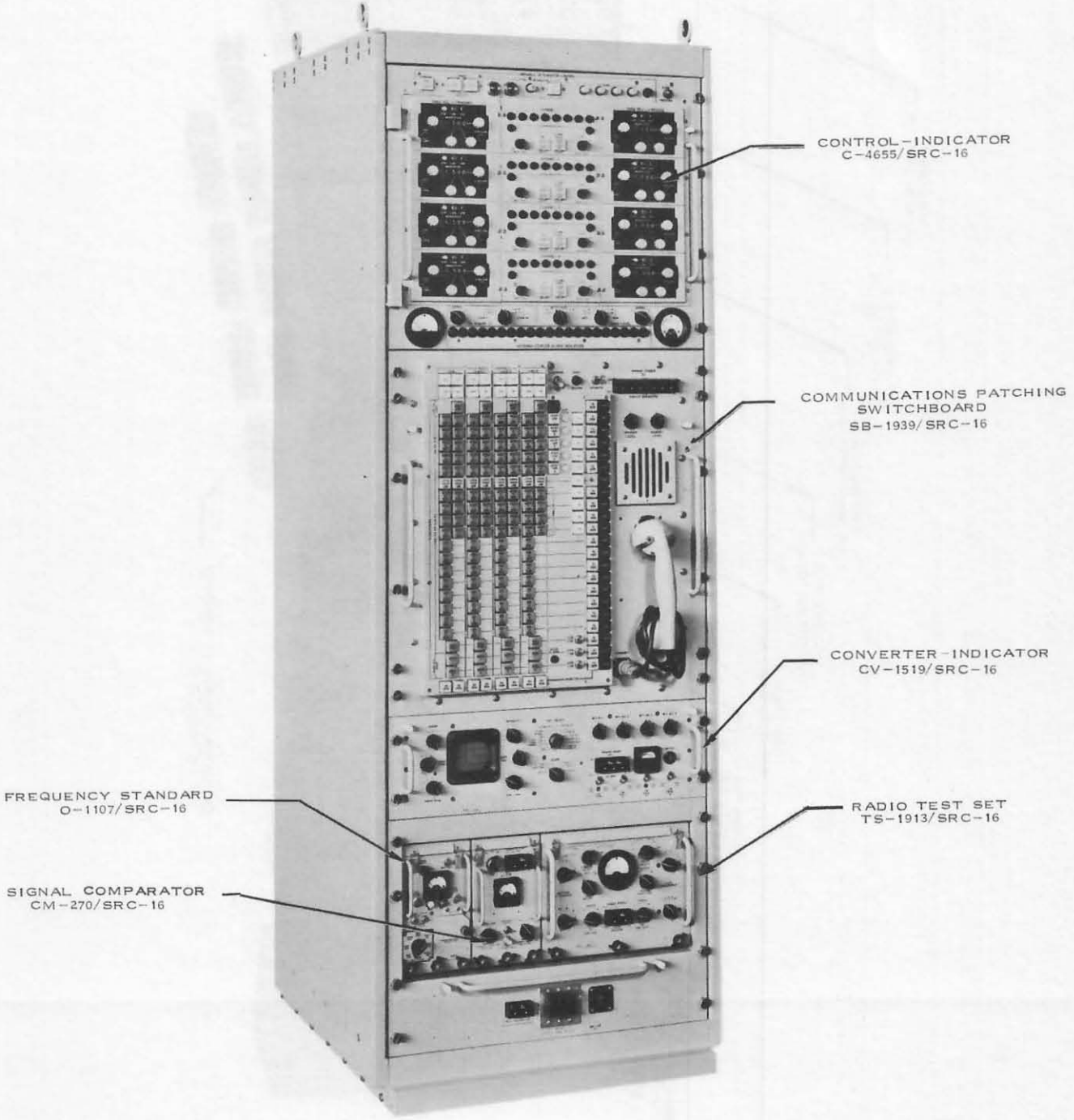


Figure 2-2. Communications Central Control Group OA-4622/SRC-16.

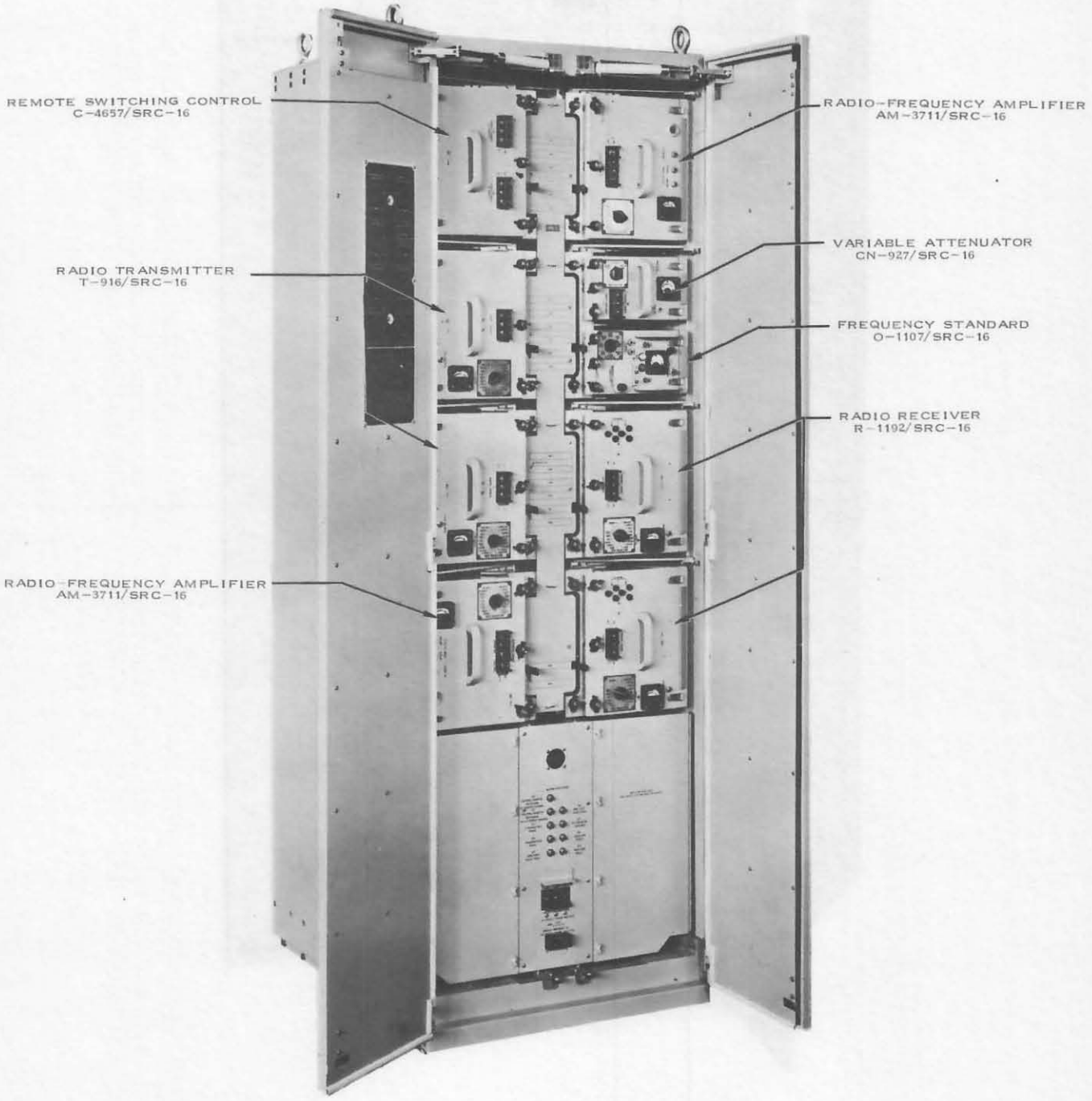


Figure 2-3. Radio Receiver-Transmitter Group OA-4623/SRC-16.

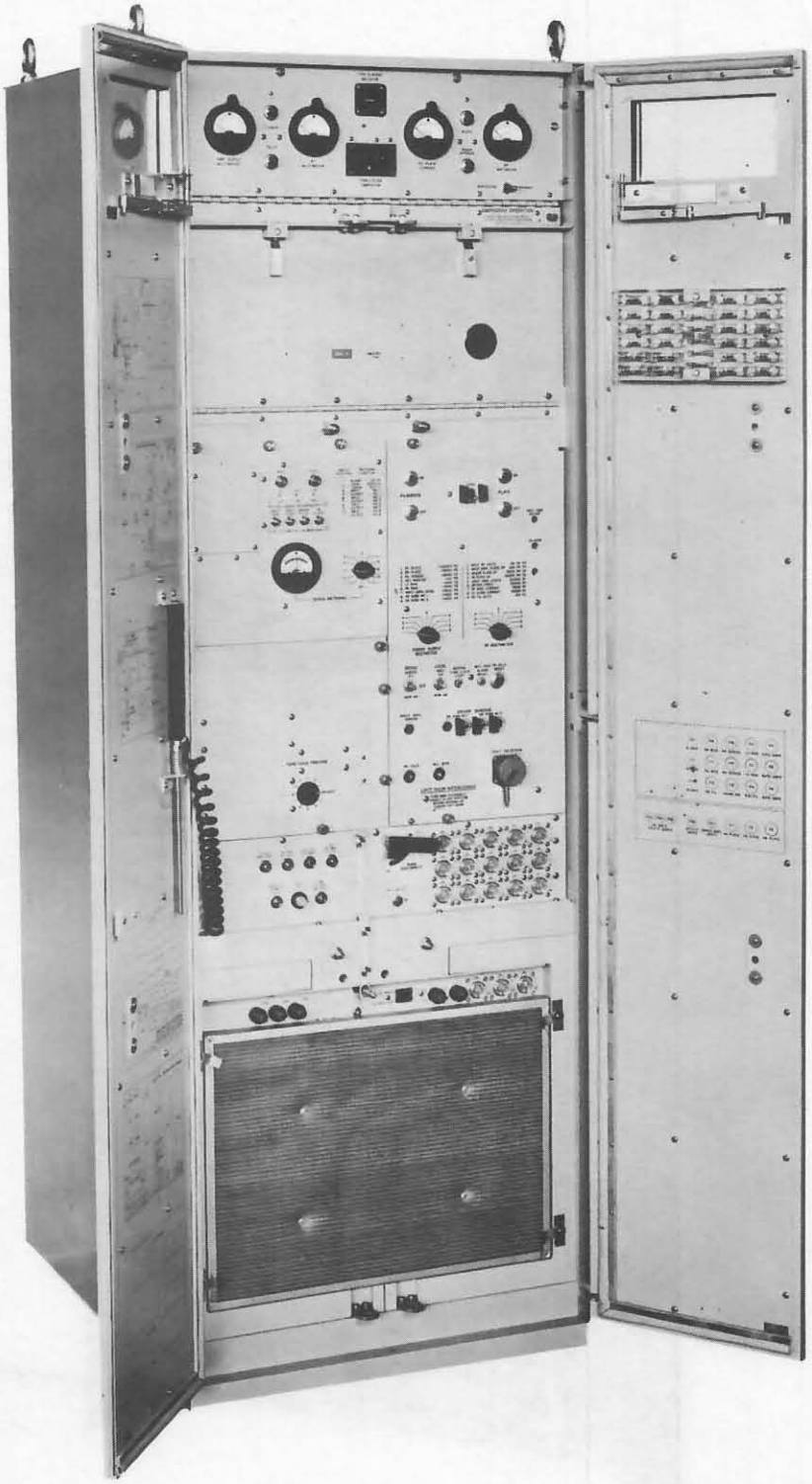


Figure 2-4. Radio-Frequency Amplifier AM-3712/SRC-16.

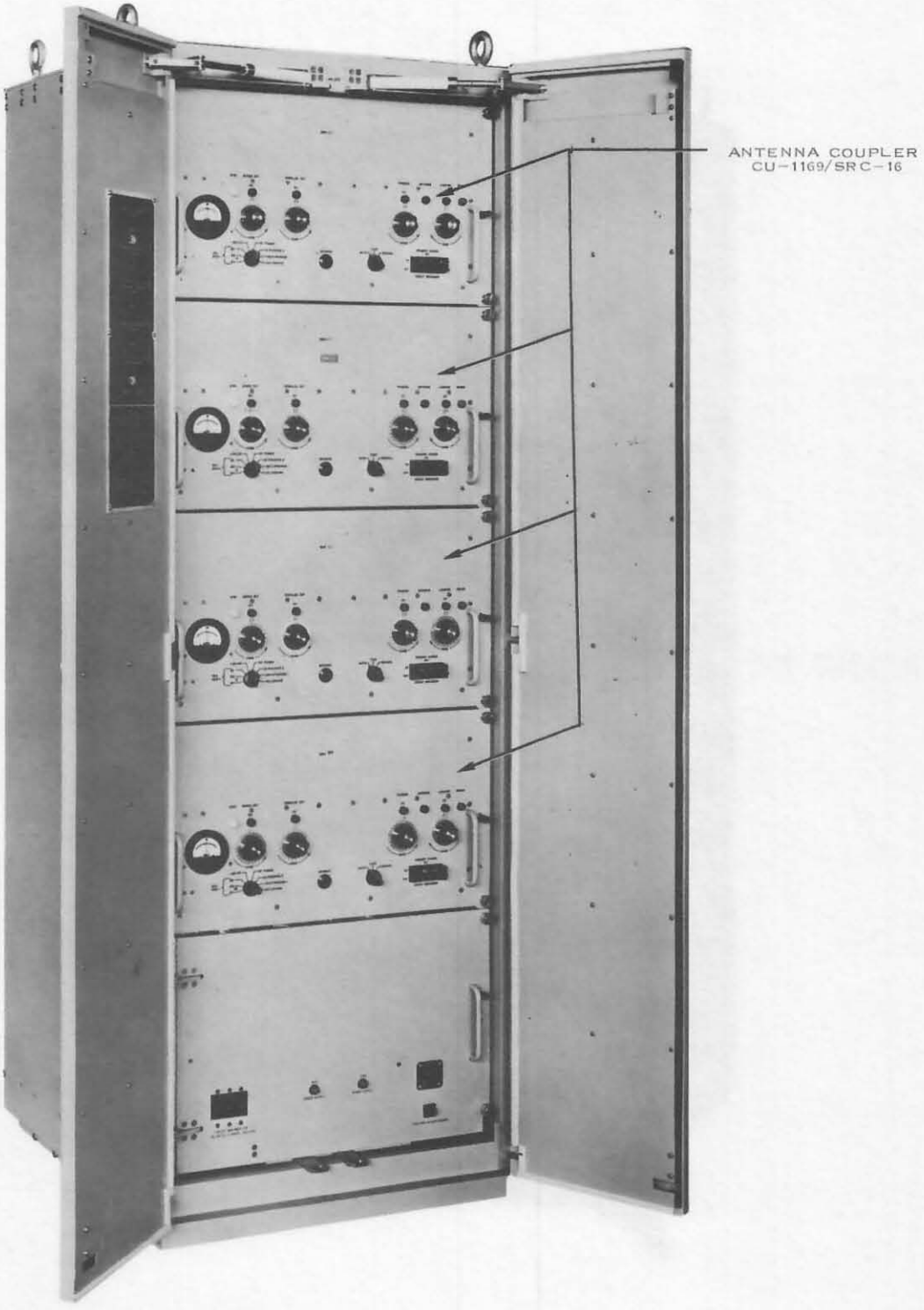


Figure 2-5. Antenna Coupler Group OA-4625/SRC-16.

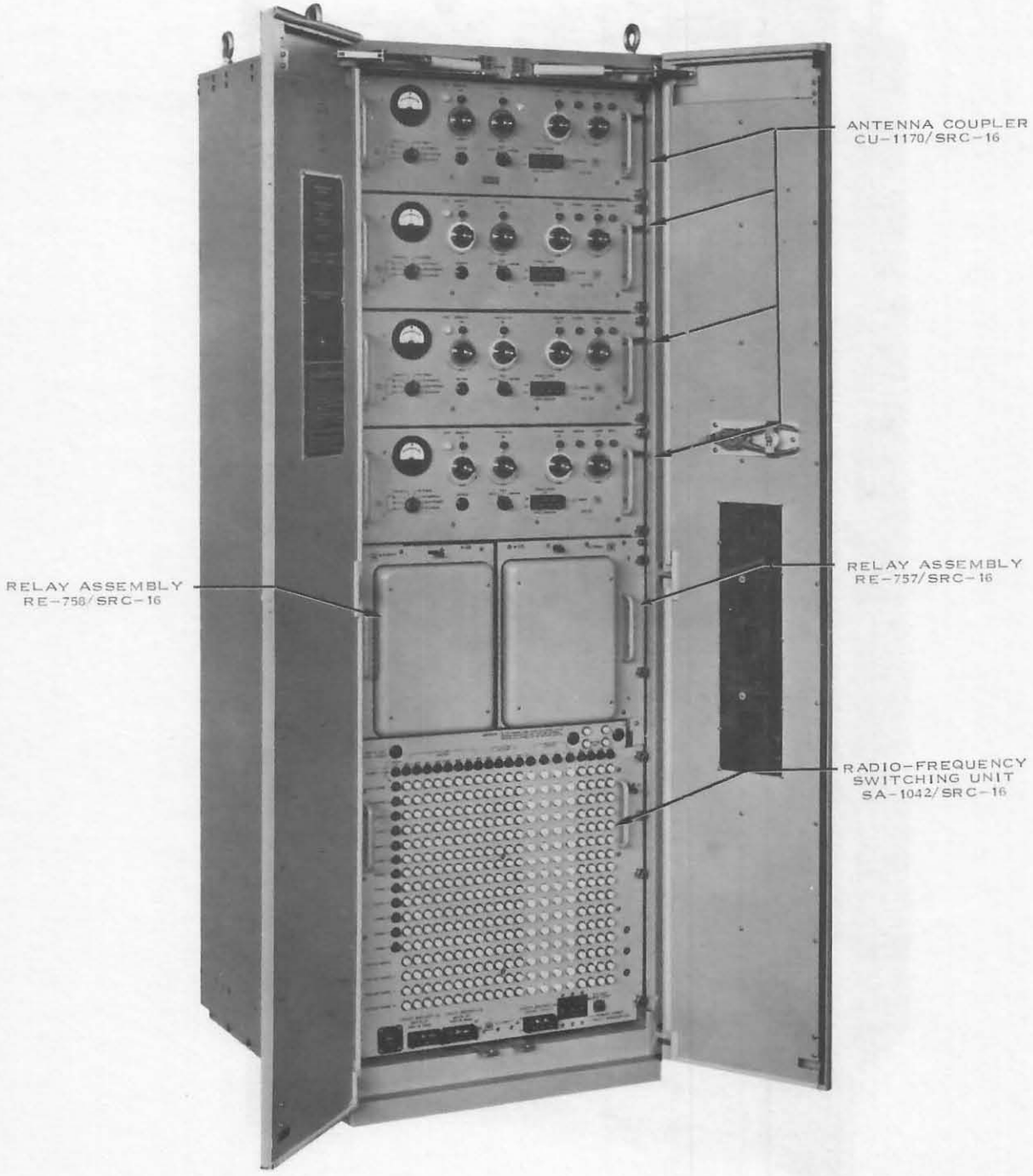


Figure 2-6. Antenna Coupler Group OA-4624/SRC-16.

2.4 PROCEDURE 2-1 EXPECTED RESULTS TEST

2.4.1 500-W TX Gain Check

An audio input of +4 dbm into one sideband should produce 125w of rf at the dummy load. TX gain should be maximum. The rf output should be measured with an ac vtvm across the dummy load. (This measurement should be taken with the antenna coupler out of the circuit.)

2.4.2 5-KW TX Gain Check

An audio input of +4 dbm into one sideband should produce 1250 ±100-w rf out. The rf should be measured with an ac vtvm across the dummy load. (This measurement should be taken with the antenna coupler out of the circuit).

2.4.3 RX Level Check

A single tone audio input into both transmit sidebands should produce a 0 vu ±2 vu indication on the receive audio meter channel indicator.

2.4.4 RX $\frac{S+N}{N}$

The signal plus noise-to-noise ratio should be no worse than 10 db with a 1-uv input. A typical $\frac{S+N}{N}$ reading will be from 15 to 17 db.

2.4.5 TX, RX, and PA Third Order Distortion

The maximum allowable 3rd order distortion product is 30 db below the level of a single tone at rated pep. Normally, a good check will indicate -35 db or better.

2.4.6 Phase Lock Test

An audio input of 0 dbm input into both sidebands will produce a Lissajous pattern on the converter-indicator scope if TX and RX are on frequency. The Lissajous pattern should not revolve more than once in a 60-second period.

2.4.7 CW Check

Hold down the CW key. The TX output should be 250 ±50w with maximum TX gain.

2.4.8 FSK Check

Select the SEND position on the C-1004. Insert a test tape in TTY selected. TX gain should be somewhat less than maximum. Note that rf output is present. Adjust the bfo for channel selected for an X pattern on the converter-indicator scope.

2.5 PROCEDURE 2-2 VISUAL OPERATING CHECKS FOR AN/SRC-16

2.5.1 Proper Visual Indications

a. All alarm lights on SRC-16 control panel should be extinguished.
b. The SIMPLEX or DUPLEX switch on the switchboard should be lighted.

c. The AM or SSB switch on the switchboard should be lighted.
d. An audio subscriber chosen on the switchboard should be lighted.
e. The 0.5 or 5 KW button on the control panel should be lighted depending upon choice.
f. The 6-15 MC or 10-30MC button on the control panel should be lighted depending upon antenna selected.
g. The TX and RX gain switches should be set to MAX.
h. The STANDBY, TUNE, or OPERATE light should be lighted on TX and RX indicators.
i. RF power out should be noted when the TX is keyed, and in operate.
j. An audio level should be noted on RX audio meter for channel selected, indicating audio out of RX.

2.5.2 Notes: Improper Visual Indications

a. Coupler alarm light on (individual coupler alarm located on control panel) — indicates an arced over or circuit breaker tripped condition.
b. XMTR Alarm — Caused by a circuit breaker tripping, overheating, or the unit being extended without auxiliary air.
c. PA Alarm — Caused by a circuit breaker tripping, overheating, or the unit being extended without auxiliary air.
d. Remote Alarm Switching — Caused by a circuit breaker tripping or power supply failure. Could also be caused by a malfunction in either the TX, RX, or PA control modules.
e. VAR ATTN ALARM — Caused by a circuit breaker tripping or power supply failure.
f. SWITCHBOARD ALARM — Caused by a tripped circuit breaker on switchboard, by a failure of the switchboard power supply, or a malfunction in audio circuit control functions.
g. FREQ. COMP. ALARM — Frequency comparator circuit breaker has tripped or power supply has failed.
h. RECEIVER ALARM — Receiver circuit breaker has tripped, the power supply failed, or the unit is extended without auxiliary air.
j. RX OVERLOAD ALARM — This alarm occurs every time a 5-volt rf signal is seen at the input to the RX overload module, caused by operating a TX on the same antenna too close to the RX frequency.
k. RX COUPLER or XMTR COUPLER ALARM
   1. If the lights flash, it means that the coupler has returned to STANDBY.
   2. If a channel has just been tuned, and another channel in the same frequency range receives a XMTR COUPLER and RX COUPLER alarm, it indicates that there are no couplers available.
   3. XMIT COUPLER ALARM — Malfunctioning control line information, no coupler available, or coupler circuit breaker has tripped.
   4. RX COUPLER ALARM — Malfunctioning control line information, no coupler available, or coupler circuit breaker has tripped.

3.1 PROCEDURES

The following procedures are used to determine that the system is operating properly.

a. Checks to be made at equipment installation and semiannually:

Procedure 3-1 BFO check
Procedure 3-2 CW check
Procedure 3-3 FSK check
Procedure 3-4 Audio subscriber check
Procedure 3-5 AM check
Procedure 3-6 Duplex check
Procedure 3-7 Coupler check
Procedure 3-7A Arc-over protection check
Procedure 3-8 Antenna check

b. Checks to be made during period as procedure indicates

Procedure 3-9 Frequency lock check
Procedure 3-10 Distortion check
Procedure 3-11A Frequency standard checks — external
Procedure 3-11B Frequency standard checks — internal
Procedure 3-11C Frequency standard checks — other NTDS ships
Procedure 3-12 NTDS system check

Procedures for all checks assume the equipment to be initially in the STANDBY condition and returned to same after completion of checks.

Note: If trouble is encountered with any checks indicated, refer to the Technical Manual. In some cases, information in section 6 of this procedure may be useful.

3.2 PROCEDURE 3-1 BFO CHECK

This check indicates whether or not the BFO knob is centered on its null.

a. Remove BFO oscillators A9, 10, 11, and 12
b. Check resistance with an ohmmeter between pins 1 and 14 of A21J4, 8, 12, and 16.
c. Vary BFO knob for above test points and note that a resistance null is indicated when BFO knob is exactly vertical. Loosen knob and adjust accordingly.

3.3 PROCEDURE 3-2 CW OSCILLATOR CHECK

This procedure checks CW operation and output levels.

3.3.1 Equipment Setup

a. Set TX and RX on the same test frequency.
b. Set TX and RX gain to MAX position.
c. Depress STBY-OPR button for channel selected. TX and RX should go to OPERATE after coupler has tuned.
d. Depress CW subscriber on the switchboard.
e. Select the shipboard CW patch that corresponds to SRC-16 CW patch.
f. Close and lock CW key for the patch made.
g. Depress USB-RX MON button for the channel selected. Adjust speaker level for desired volume.
h. Vary the BFO adjust for the channel selected and note that a change in tone pitch occurs.

3.3.2 Adjustments

a. Place all the CW FREQ SELECT switches on the converter-indicator in the 1500 CPS position. After each of the following adjustments, select the proper patches on ships switchboard and SRC-16.
   1. CW1 — A13 Adjust R4 for 250 w out on SRC-16 power meter
   2. CW2 — A14 Adjust R4 for 250 w out on SRC-16 power meter
   3. CW3 — A15 Adjust R4 for 250 w out on SRC-16 power meter
   4. CW4 — A16 Adjust R4 for 250 w out on SRC-16 power meter
b. Place all of the CW FREQ SELECT switches on the converter-indicator in the 1000 CPS position.
   1. CW1 — A13 Adjust R10 for 250 w out on SRC-16 power meter
   2. CW2 — A14 Adjust R10 for 250 w out on SRC-16 power meter
   3. CW3 — A15 Adjust R10 for 250 w out on SRC-16 power meter
   4. CW4 — A16 Adjust R10 for 250 w out on SRC-16 power meter
c. Make the following transmit/receive relay time adjustments for each patch. (TX CW key-on time)
   1. CW1 — A13 Adjust R9 (Radioman's discretion)
   2. CW2 — A14 Adjust R9 (Radioman's discretion)
   3. CW3 — A15 Adjust R9 (Radioman's discretion)
   4. CW4 — A16 Adjust R9 (Radioman's discretion)

3.4 PROCEDURE 3-3 FSK CHECK

This procedure checks FSK operation of the SRC-16.

3.4.1 Equipment Setup

a. Patch the dc loops from ship's switchboard to the SRC-16. Adjust each SRC-16 subscriber patch for a 60-ma loop.
b. Depress an FSK subscriber on the SRC-16 switchboard. Select corresponding FSK patch on ship's switchboard for TX and RX.
c. Set C-1004, associated with TTY selected, to the SEND position.

3.4.2 Adjustments

a. Place the meter on the converter-indicator to the proper TTY loop current position. After each of the following adjustments, select the proper patches on SRC-16 and ship's switchboard for next adjustment.
   1. FSK 1 — A21 Adjust R5 for approximately 6 on converter-indicator meter for TTY LOOP CURRENT position 1.

2. FSK 2 — A21 Adjust R6 for approximately 6 on converter-indicator meter for TTY LOOP CURRENT position 2.
3. FSK 3 — A21 Adjust R7 for approximately 6 on converter-indicator meter for TTY LOOP CURRENT position 3.
4. FSK 4 — A21 Adjust R8 for approximately 6 on converter-indicator meter for TTY LOOP CURRENT position 4.
5. FSK 1 — A21 Adjust R1 for 2 vdc at J1 of A1 — FSK oscillator 1.
6. FSK 2 — A21 Adjust R2 for 2 vdc at J1 of A2 — FSK oscillator 2.
7. FSK 3 — A21 Adjust R3 for 2 vdc at J1 of A3 — FSK oscillator 3.
8. FSK 4 — A21 Adjust R4 for 2 vdc at J1 of A4 — FSK oscillator 4.

3.4.3 Equipment Setup

The setup is the same as the above plus the following.

a. SRC-16 RX and TX on the same test frequency.
b. RX gain to MAX position.
c. TX gain to MID position.
d. Depress STBY-OPR button for the channel selected. TX and RX should go to OPERATE when coupler is tuned.
e. Insert test tape in TTY and start sending.

3.4.4 Adjustments

a. Place the converter-indicator in the proper scope position.
b. Adjust the bfo, for the SRC-16 RX channel in use, for a normal X pattern on the scope.
c. Repeat steps a and b for all SRC-16 FSK subscribers.

3.5 PROCEDURE 3-4 AUDIO SUBSCRIBER SHIPS CHECK

This procedure checks the operation of the C-1138A/UR radio set controls with the radio set adapter units in the SRC-16.

a. TX and RX in OPERATE at test frequency.
b. Patch the C-1138 to SRC-16 TX and RX at ship's switchboard.
c. Patch the corresponding voice subscriber 6 on SRC-16 switchboard.
d. Turn on 60 Hz for the C-1138.
e. Depress START button on C-1138 selected. POWER ON light should come on.
f. Depress RX MON button for channel and sideband selected on the SRC-16.
g. Adjust speaker level for noise.
h. Key and talk into mike at the C-1138. Power output should be noted for channel selected. The transmission should be heard loud and clear. The CARRIER ON light at the C-1138 should light when the handset switch is depressed.
i. Repeat for SRC-16 voice subscribers 7, 8, and 9.

3.6 PROCEDURE 3-5 AM OPERATION CHECK

This procedure checks the SRC-16 AM operation.

a. RX and TX on same test frequency and in OPERATE condition.
b. Depress the AM button on the SRC-16 switchboard. Depress USB MON button on the channel selected.
c. Patch in a C-1138 at the ship's switchboard. Depress the START button. Depress the corresponding voice subscriber at the SRC-16 switchboard.

d. Turn speaker level knob to desired level.
e. Key and talk into the mike at the C-1138. The transmission should be heard loud and clear at the SRC-16 switchboard. The SRC-16 power meter should indicate 125 ±10 w.
f. Repeat for all channels.

3.7 PROCEDURE 3-6 DUPLEX CHECK

This procedure checks the operation of the DUPLEX mode on the SRC-16.

a. Depress DUPLEX button on channel selected.
b. Select same frequency on TX and RX. Depress STBY-OPR button on the TX and RX. RX should go to OPERATE. TX will return to STANDBY. Change frequency on TX and depress STBY-OPR button. TX will go to OPERATE.

3.8 PROCEDURE 3-7 ANTENNA COUPLER CHECK

This procedure checks antenna coupler operation and alarm circuitry.

Part One

1. Terminate the 2- to 6-MHz antenna coupler output in a 50-ohm load.
2. Select 2 MC on the TX frequency selector. Depress the STBY-OPR button. Coupler selected should go to READY, TX channel indicator light to OPERATE.
3. Select 5.999 MC on frequency selector of another channel. Depress the STBY-OPR button. Coupler should go to READY, TX channel indicator light goes to OPERATE.
4. Turn off coupler that has just been checked. The coupler alarm, for that particular coupler, should light on cabinets 1 and 7.
5. Repeat for the remaining seven 2- to 6-MHz couplers.
6. After all couplers have been checked and all couplers have been turned off, a TX CPLR and RX CPLR alarm should occur on the control panel of the SRC-16 for that channel which was in use, as well as any other TX channels that are in the 2- to 6-MHz frequency range.

Part Two

1. Terminate the 6- to 15-MHz antenna coupler output in a 50-ohm load.
2. Switch coupler select switches on cabinet 7 to 6-15 MC for 7A2-7A5 couplers.
3. Select 6 MC on the TX frequency selector. Depress the STBY-OPR button on the channel selected. Coupler should go to READY, TX channel selector light goes to OPERATE.
4. Turn off coupler that has just been checked. The coupler alarm for that particular position should light on cabinets 1 and 7.
5. Repeat for the remaining 6- to 30-MHz couplers.
6. After all couplers have been checked and all couplers have been turned off, a TX CPLR and RX CPLR alarm should occur on the control panel of the SRC-16 for the channel that was in use, as well as any other TX channels that are in the range of 6 to 15 or 15 to 30 MHz.

Part Three

1. Turn all couplers on. Switch couplers 7A2-7A5 to the 15- to 30-MHz range. Terminate the 15- to 30-MHz antenna coupler output in a 50-ohm load.

2. Depress the 6-15MC buttons on the control indicator for all SRC-16 channels. RX and TX CPLR alarms should occur on all channels that have transmitters in the 6- to 15-MHz frequency range.
3. Depress 10-30MC button on control indicator for all SRC-16 channels. Any TX channels in 6- to 9.999-MHz range will indicate TX and RX CPLR alarms.
4. Select 29.1 MC on the TX frequency selector. Depress the STBY-OPR button. Coupler 7A4 will tune and go to READY and the TX channel indicator will go to OPERATE. Turn off coupler 7A4. The 7A4 coupler alarm light on cabinets 1 and 7 will light. Coupler 7A5 will be selected next.
5. Repeat for all couplers.

3.8.1 Procedure 3-7 ARC-Over Protection Check

This procedure checks the operation of the 2- to 6-MHz antenna coupler ARC-OVER protector circuit.

a. Extend the 2- to 6-MHz coupler to be checked and install jumper cables.
b. Select an SRC-16 channel in the 2- to 6-MHz range. Depress STBY-OPR button.
c. Remove the top cover from the coupler and locate the arc-over balls of the phasing-loading tank circuit. They can be seen through the second hole in cover plate.
d. Short arc-over balls (E2 and E3) together with a long-handled insulated screwdriver. Coupler will return to STBY. The SERIES and STANDBY lights on the coupler will be lighted.
e. Repeat for all 2- to 6-MHz couplers.

3.9 PROCEDURE 3-8 ANTENNA CHECK

This procedure checks for antenna problems.

a. Visual inspection of the antenna for corroded parts, loose connections, water in junction boxes, etc., should be made monthly. This inspection is important to the operation of the transmitter and receiver. Following is a list of problems that may occur if the antenna is not checked and steps taken to correct the problem areas.
   1. Corroded parts — loose connections. This condition can produce bad effects on both the transmitter and receiver. Unnecessary noise will be generated, which will be sensed by the receiver, causing receiver desensitization i.e. the high antenna noise level will cause receiver agc to be generated which will mask any desired low-level signals. When rf power is being delivered to the antenna with these conditions present, interfering signals will be generated causing blocking and interference to receivers on other frequencies. The higher the power level the greater the interference as far as level and band coverage is concerned.
   2. Water in junction boxes. This condition can cause high reflected power levels and reduce the power delivered to the antenna as well as reducing the receiver input signal.

3.10 PROCEDURE 3-9 FREQUENCY LOCK TEST — WEEKLY CHECK

This check will determine whether or not the TX and RX are on frequency.

a. Conditions:
   1. Select whip coupler dummy load position for channel selected.
   2. TX and RX on same frequency and in OPERATE.
   3. Depress TEST TONE on the SRC-16 switchboard for the channel selected.

4. Select and adjust F1 on the test set for 0 dbm on the TX audio level meter.
5. Select BOTH sideband position with the FUNCTION SELECT switch.
6. Select TEST TONE on the converter-indicator.

b. A Lissajous pattern should occur on the scope when the vertical and horizontal gains are properly adjusted. The Lissajous should not rotate significantly.

c. Return equipment to STBY.

3.11 PROCEDURE 3-10 DISTORTION TEST — MONTHLY CHECK

This check is used to determine the amount of distortion (3rd order, harmonic, etc.) generated by a transmitter, receiver, and power amplifier in a loop configuration. Step a. of this procedure verifies operation of the test set.

a. Test Set Self Check
   1. Set XMIT TONE ATTENUATORS and LEVEL MEASUREMENT ATTENUATOR on the test set to 0.
   2. Set FUNCTION SELECT switch to SELF TEST position.
   3. Set TONE SELECT switch and FILTER SELECT switch to F1. Adjust F1 TONE LEVEL and RECEIVE AUDIO LEVEL switches for 0 VU indication on test set meter.
   4. Set TONE SELECT switch and FILTER SELECT switch to F2 and adjust F2 TONE LEVEL for 0 VU on the test set meter.
   5. Set TONE SELECT switch to the BOTH position and turn LEVEL MEASUREMENT attenuation controls until the test set meter reads 0 VU. Positions (F2 & F1) through 800 on the FILTER SELECT switch should indicate at least -45 db.

b. TX/RX Loop Distortion
   1. Select whip coupler dummy load position for the channel selected.
   2. RX and TX on the same frequency and in OPERATE.
   3. Depress TEST TONE on the SRC-16 for the channel selected.
   4. Set FUNCTION SELECT switch on test set to DISTORTION USB.
   5. Adjust F1 and F2 TONE LEVELS on the test set for 0 dbm (each tone) on audio level meter. Set TONE SELECT switch to BOTH.
   6. Set FILTER SELECT switch to F1. Adjust RECEIVE AUDIO LEVEL for 0 VU on test set meter.
   7. Set FILTER SELECT switch to F2 position. The RX audio level should be 0 VU.
   8. Switch the FILTER SELECT switch to positions (F2 & F1) through 800. Set the LEVEL MEASUREMENT switches on test set for a reading of 0 db on the VU meter. A minimum of -30 db attenuation in positions (F2 & F1) through 800, should be read.
   9. Repeat step 8 for the LSB distortion position on test set.
   10. Return equipment to STBY.

3.12 PROCEDURE 3-11A FREQUENCY CHECK — EXTERNAL — MONTHLY

This procedure provides an indication of the 100-kHz standard stability; however, the standards should be checked at a standards lab every 6 months.

It is not necessary to have all three standards calibrated at the standards lab. If one is calibrated, the other two can be set to the calibrated standard by using the frequency comparator. This procedure is detailed in paragraph 3.13 below.

It is possible to check any frequency standard against WWV using the following procedure; however, do not attempt to adjust any frequency standard to the WWV frequency. If the standard is off-frequency it should be sent to a calibration lab for calibration.

a. Select DUPLEX on SRC-16 channel. Select a WWV frequency on the TX and RX for the channel selected.

b. Depress the STBY-OPR button.
c. Depress TEST TONE of SRC-16 switchboard.
d. Select TEST TONE on the converter-indicator scope switch.
e. Select BOTH on test set FUNCTION SELECT switch.
f. ALissajous pattern will be displayed on the converter-indicator scope if the frequency standard being used is on frequency. If the frequency standard is far off frequency, a square or fast-rotating Lissajous pattern will be displayed. It should be noted again that no frequency adjustments should be attempted by this method.

3.13 PROCEDURE 3-11B FREQUENCY STANDARD CHECK — EXTERNAL — MONTHLY

This check is used to determine the accuracy of the frequency standards when compared against a reference source.

a. Select the most recently calibrated frequency standard as a reference. Check the other standards against this one and note that the needle on comparater meter does not pass through the reference point marker (in one direction) more than once in 10 seconds.
b. Adjust the fine frequency adjustment of the frequency standard being checked as necessary to satisfy the condition as stated in step a. If the fine frequency control is out of range before the standard is brought on frequency, use the coarse frequency adjustment control. Consult the SRC-16 instruction manual chapter F, Section 6-2.d for this procedure.

3.14 PROCEDURE 3-11C FREQUENCY STANDARD CHECK — OTHER NTDS SHIPS

This check should be made whenever a new NTDS ship enters the net and at the start of net operation. The net frequency standards should be adjusted to the most recently lab-calibrated standard.

a. Net Control Ship
   1. The FUNCTION SELECT switch on the test set should be in the BOTH position. The TONE SELECT switch in the F1 or F2 position.
   2. The SRC-16 TX channel selected should be in OPERATE at a test frequency. Depress the TEST TONE button.
b. Picket Ship
   1. The FUNCTION SELECT switch on the test set should be in the BOTH position. The TONE SELECT switch in the F1 or F2 position.
   2. The SRC-16 should be in DUPLEX with the RX in OPERATE at the test frequency. Depress the TEST TONE button.
   3. The picket ships should adjust the 100-kHz standard in use as described in procedure 3-11B.

3.15 PROCEDURE 3-12 NTDS SYSTEM CHECK

This test will check general system parameters for the NTDS system.

a. The TX and RX channel selected should be in OPERATE and in the dummy load position. The dummy antenna box will be in OPERATE Position.
b. RX gain should be at MAX.
c. Depress the NTDS 1 button for the channel selected.
d. With the SSQ-29 in the NET TEST mode, depress TX START button. Tone attenuability for all 15 tones should be at least 13 db.

Even though the radio/data terminal can pass the 13-db tone attenuability test, this is not necessarily an indication of how well the system will operate in the net. Problems such as corroded parts, loose connections on the antenna, noisy receivers, transmitters with high intermodulation products or low carrier suppression, a data terminal with control code, or doppler circuit problems can all affect net operation. Each unit such as transmitter, receiver, and PA should be checked individually for such problems before placing the channel in the net. If each ship checks its equipment carefully by regularily performing preventative maintenance procedures, many net problems can be eliminated which will in turn increase the efficiency of the net.

4.1 INTRODUCTION

This section contains alignment procedures for the receiver, transmitter and 500-w power amplifier. The procedures are comprehensive and normally no further adjustments are required. If troubles with the adjustments are encountered, the technical manuals for AN/SRC-16 should be used.

4.2 PROCEDURE 4-1 CONDENSED RECEIVER ADJUSTMENTS

4.2.1 Equipment Setup

a. Extend the receiver to be adjusted and connect the auxiliary air hose.
b. Set the RX gain control on the control-indicator (for the channel selected) to the MAX position.
c. Set the receiver frequency selector to 5 MC and depress the STBY-OPR button.
d. Depress the NTDS 2 button on the SRC-16 switchboard for the channel selected. (The NTDS-2 receive lines should be terminated in 600 ohms inside the SRC-U1 junction box. If they are not, connect one 600-ohm resistor across terminals 31 and 32 and one across terminals 33 and 34.)

4.2.2 Adjustment Procedures

4.2.2.1 Use a 410B VTVM to adjust the following:

4.2.2.1.1 Frequency Multiplier

a. 500-kHz adjustment: R7 J4 1.9 to 2.0v; control R7; measure at-J4; limits 1.9 to 2.0 v
b. 500-kHz adjustment: R26 J5 0.9 to 1.0 v; control-R7; measure at-J4; limits 1.9 to 2.0 v
c. 100-kHz adjustment:R35 J8 0.5 to 0.6 v; control-R7; measure at-J4; limits 1.9 to 2.0 v

4.2.2.2 Use a Fluke 801 to adjust the following:

4.2.2.2.1 Power Supply

a. Place the positive lead of the meter in J2 of the frequency divider. Place the negative lead on ground.
b. Adjust R18 on the power supply for 18 ±0.005 v

4.2.2.2.2 KC Stabilizer

a. Place the meter between the + and - test points on the KC stabilizer. Short TP 5 to ground (unlocks vfo). Adjust the VFO BIAS pot on the KC stabilizer to obtain 10 +0.05v.

4.2.2.2.3 Receiver

a. Connect an HP-606A signal generator to J2 of the RX overload module associated with the channel to be adjusted (located on the bottom door of cabinets 6 and 8). Adjust the

HP-606A for 5 MHz and approximately 50-uv output. Monitor the USB output jack on the receiver with a headset or scope for approximately a 1000-Hz tone. If a headset or scope is not available, adjust the signal generator for a peak on the 400D (see step e). Tune the signal generator as necessary. Reduce the signal input to 1 uv.

b. Connect the HP-410B (-DC) to J2 on the RX gain control module. Adjust R12 on the USB mixer module for zero voltage.
c. Increase the signal generator output to 1 volt.
d. Connect the HP-410B (AC) to J4 on the USB mixer module. Adjust R4 on the RX gain control module for 1 volt.
e. Connect a HP-400D at the USB audio output jack. Adjust ADJ A on the audio amplifier for 1.1 volts.
f. Reduce signal generator output to 10 uv. Note that the audio output, as indicated on the HP-400D does not drop more than 6 db.
g. Reduce the signal input to 1 uv. Note the output on HP-400D. Remove the input signal. The output on the HP-400D should drop at least 10 db. On a good receiver the output normally drops 15 to 17 db.
h. Reconnect the HP-606A to J2 of the RX overload module. Adjust the output for 50 uv and monitor the LSB audio output jack for 1000 Hz with scope or headset. Tune the signal generator as necessary. Reduce the input to 1 uv. If a headset or scope is not available, adjust the signal generator for a peak on the HP-400D. (See step 1.)
i. Connect a HP-410B (-DC) to J4 on the RX gain control module. Adjust R12 on the LSB mixer module for zero voltage.
j. Increase the signal generator output to 1 volt.
k. Connect the HP-410B (AC) to J4 on the LSB mixer module. Adjust R16 on the RX gain control module for 1 volt.
l. Connect a HP-400D at the LSB audio output jack. Adjust ADJ B on the audio amplifier for 1.1 volts.
m. Reduce the signal generator output to 10 uv. Note that the audio output as indicated on the HP-400D does not drop more than 6 db.
n. Reduce the signal input to 1 uv. Note the output on the HP-400D. Remove the input signal. The output on the HP-400D should drop at least 10 db. On a good receiver the output normally drops 15 to 17 db.
o. Return equipment to its normal configuration.
p. Repeat the above steps for the other receivers.

4.3 PROCEDURE 4-2 CONDENSED TRANSMITTER ADJUSTMENTS

4.3.1 Equipment Set Up

a. Extend the transmitter to be adjusted and connect the auxiliary air hose.
b. Set the TX gain control on the control-indicator (for the channel selected) to the MAX position.
c. On cabinet 7, depress the dummy load whip coupler position associated with the selected channel.
d. Depress the SSB button on the SRC-16 switchboard for the channel selected.
e. Set the transmit frequency selector to 5MC and depress the STBY-OPR button.
f. Depress the TEST TONE button on the SRC-16 switchboard for the channel selected.

4.3.2 Adjustment Procedure

4.3.2.1 Use a HP-410B VTVM to adjust the following:

4.3.2.1.1 Frequency Multipler

a. 500 KHz adjustment; R7 1.9 to 2.0 v; control-R7; measure at-J4; limits-1.9 to 2.0 v
b. 500 KHz adjustment; R26 J5 0.9 to 1.0 v; control-R7; measure at-J4; limits-1.9 to 2.0 v
c. 100 KHz adjustment; R35 J8 0.5 to .6 v; control-R7; measure at-J4; limits-1.9 to 2.0 v

4.3.2.2 Use a Fluke 801 to adjust the following:

4.3.2.2.1 Power Supply

a. Place the positive lead of the meter in J2 of the frequency divider. Place the positive lead on the ground.
b. Adjust R18 on the power supply for 18 ±0.005 v.

4.3.2.2.2 KC Stabilizer

a. Place the meter between the + and - test points on KC stabilizer. Short TP5 to ground (unlocks vfo). Adjust the VFO BIAS pot on the KC stabilizer to obtain 10 ±0.05 v.

4.3.2.2.3 Transmitter

a. Connect the HP-410B VTVM at the dummy load
b. Switch FUNCTION SELECT switch on the test set to LEVEL CHECK USB
c. Switch TONE SELECT switch to F1 and adjust the output for +4 dbm on audio meter.
d. Set the CARRIER ON-OPERATE switch on the dummy antenna control box to OPERATE.
e. Adjust R16 on the transmitter gain module for 80 volts at the dummy load.
f. Set the CARRIER ON-OPERATE switch on the dummy antenna control box to the CARRIER ON position.
g. Adjust R8 on balanced modulator module for 80 volts at the dummy load.
h. Short J4 on the TGC module to ground for approximately 2 seconds and note that the output voltage is reduced and that the voltage returns to 80 v ±5 v when the ground is removed. Short J5 on the TGC module to ground, wait until the output voltage rises to approximately 130 v, and note that the output voltage increases and that the voltage returns to 80 v ±5 v when the ground is removed. Do not allow J5 to be grounded for a long period of time since the circuit breaker on the 1-kw PA may trip off due to a high average power output.
i. Return the equipment to the STBY condition.

4.3.2.2.4 Carrier Suppression

This adjustment should be checked when a balanced modulator module is replaced or repaired. Perform steps a and d below to check carrier suppression. If the reading on the Boonton 91C is 0.8 v or less, no adjustment is required. If the voltage is greater than 0.8 v perform the following steps.

Note

Do not apply any audio to the transmitter input during this test as the resulting rf output may damage the Boonton 91C.

a. Equipment setup will be the same as in step 4.3.1 except depress the TEST TONE button and place the FUNCTION SELECT switch on the test set to the SELF CHECK position.

b. Remove the cover from the balanced modulator module.
c. Short the input terminals of FL2 together.
d. Attach a Boonton 91C at the dummy load.
e. Adjust R24 and C17 for minimum indication on the Boonton 91C.
f. Remove the short from FL2 and short the input terminals of FL1 together.
g. Adjust R44 and C30 for minimum indication on the Boonton 91C.
h. Repeat steps d through g for the lowest reading on the Boonton 91C which should be less than 0.8 v. (Do not short the input terminals of FL1 and FL2).
i. Return equipment to STBY condition.

4.4 PROCEDURE 4-3 RF PA MODULE ADJUSTMENTS

4.4.1 Equipment Setup

a. Extend the pa to be adjusted and attach the auxiliary air hose.
b. On cabinet 7, depress the dummy load whip coupler position associated with the selected channel.
c. Connect a HP-410B at the dummy load and set to the 300 v (AC) scale.
d. Set the dummy antenna control box to the OPERATE position.
e. Select the 0.5 KW pa.
f. Set the frequency selector to 5MC.
g. Set the TX gain to the MAX position
h. Depress the TEST TONE button. Place the FUNCTION SELECT switch on the test set to the SELF TEST position.
i. Depress the SSB button on the SRC-16 switchboard for channel selected. Depress the STBY-OPR button for the channel selected.

4.4.2 Adjustment Procedure

4.4.2.1 Tube Statics

a. Turn the pa screen switches S5 through S8 to the maximum clockwise position. Adjust bias pot R44 for approximately 5.5 as indicated by the meter in the TOTAL PL MA position.
b. Rotate the meter switch through the V4 through V7 position. Observe meter reading. Note the lowest reading and set other three individual tube statics to this reading, using the screen switches S5 through S8. Readjust R44 for 5.5 in the TOTAL PL MA position.

4.4.2.2 ADC-ALC Adjustments

a. Set the F1-BOTH-F2 switch on the test set to the F1 position and adjust the F1 tone for minimum output.
b. Set the FUNCTION SELECT switch on the test set to the USB position.
c. Adjust R30 on the PA fully counterclockwise and R73 fully clockwise.
d. Short test points J3 and J4 (on the pa) to ground.
e. Adjust F1 TONE LEVEL for 171 volts on the HP-410B.
f. Adjust R30 so the voltage at the dummy load is limited to 171 volts.
g. Remove the ground jumpers from J3 and J4.
h. Set the FUNCTION SELECT switch on the test set to the BOTH position and adjust F1 TONE LEVEL for 161 volts on the HP-410B.
i. Adjust R73 so that the voltage at the dummy load is limited to 161 volts.
j. Return channel to STBY.

5.1 GENERAL

The 5-kw test procedure listed in tables 5-1 and 5-2 cover almost every possible adjustment. If any adjustment cannot be made successfully, refer to the AN/SRC-16 Technical Manual, Chapter 0. Section 6 contains information regarding 5-kw repair.

Table 5-1. 5-KW PA Meter Readings.

METER AND POSITION	PLATE OFF	PLATE ON KEY OFF	PLATE ON - KEY ON (NO RF) READING AND ADJUSTMENT
Power Supply Multimeter			
PA PLATE	0	7000 v ±10%	6400 v ±10%
DR PLATE	0	800 v ±10%	780 v ±10%
PA SCREEN	0	900 v ±10%	880 v ±10%
KEY MONITOR	0	0	6 v ±10%
LV BIAS	80	80 v ±10%	26 v ±2% LV bias adj
PA BIAS	0	360 v ±10%	200 v ±10%
INPUT AMPL SCRN	0	250 v ±20%	250 v ±10%
DR SCRN NO. 1	0	250 v ±20%	250 v ±10%
DR SCRN NO. 2	0	250 v ±20%	250 v ±10%
RF Multimeter			
INPUT RF VOLTS	0	0	0
INPUT AMPL PLATE RF	0	0	0
DRIVER PLATE RF	0	0	0
PA PLATE RF	0	0	0
INPUT AMPL STATIC	0	0	200 Ma Input ampl scrn
DRIVER STATIC	0	0	400 Ma DR scrn no. 1 DR scrn no. 2
PA GRID CURRENT	0	0	0
PA SCRN CURRENT	0	0	0
PA FIL VOLTS	7.5 v	7.5 v	7.5 PA fil adj
PA Plate Current	0	0	0.5 A PA bias

Table 5-2. Condensed PA Adjustments.

ADJUSTMENT	INDICATOR	INDICATION	REMARKS
PA FILAMENTS (NORMAL ADJUSTMENT)			
PA FIL ADJUST	PA FIL VOLTS	7.5 v	
PA FILAMENTS (INSTALLATION ADJUSTMENT)			
PA FIL ADJUST	Multimeter	7.5 vac	Measured across T5-3 and T5-5. WARNING The PA PLATE voltage must be off.
R48	PA FIL VOLTS	7.5 v	
BIAS AND STATICS			
PA BIAS A10R6 INPUT AMPL SCREEN DR SCRN NO. 1 DR SCRN NO. 2	PA PLATE CURRENT LV BIAS INPUT AMPL STATIC DRIVER STATIC DRIVER STATIC	0.5 Amps -26 v 200 ma 220 ma 220 ma	Tune-cycle at OPERATE; PA keyed; No rf in. Perform the adjustments in the order given. For DRIVER STATIC, depress toggle 1 and adjust the adjacent pot. Repeat with toggle 2. With both toggles released, the total should be 400 ma.
INTERNAL GAIN			
PA GRID DET BIAS PA PLATE DET BIAS 2ND LEVEL	HP-410B across the dummy load	316 v 300 v 283 v	Manual Tune-cycle at 10; local control. Initially, the adjustments are maximum clockwise and then adjusted in the order given.
1A SERVO AMPL BIAS (Reference)	LV BIAS SERVO METER OUTPUT NO. 1	Bias increase threshold 25 v	Manual tune-cycle at 10; local control. The 25-volt error is obtained by manually turning the Input Amplifier Tank off resonance.

Table 5-2. Condensed PA Adjustments (Cont).

ADJUSTMENT	INDICATOR	INDICATION	REMARKS
1ST LEVEL	HP-410B across the dummy load	80 v	Manual tune-cycle at 5; local control.
COARSE POS DISABLE		70 v threshold	Manual tune-cycle at 4; local control. Tune-cycle steps to 5 at threshold.
PA LOADING ADJUSTMENTS			
C27 WARNING	Multimeter at J13	Equal and Opposite that of A5C73 with PLATE max CW	Tune-cycle at OPERATE; local control; rf drive to obtain 1.65 A of PA PLATE current; Frequency, 6 MHz; SERVO CHECK to OFF; LOAD COIL manually adjusted to 6 MHz. WARNING C27 is at a high potential and must be adjusted with the PA PLATE voltage off.
(Reference)	Multimeter at A5C73	NLT -3.5 v	
GRID	Multimeter at J11	0.5 v less than J12	
(Reference)	Multimeter at J12		
PLATE (Coarse Adjust)	Multimeter at J13	Equal and opposite that of J11	
(Reference)	Multimeter at J11		
PLATE (Fine Adjust)	LOAD COIL Frequency Indicator	6 mc	Tune-cycle at OPERATE; local control; rf drive to obtain 250 v of rf output; frequency, 6 MHz; SERVO CHECK to ON.
(Reference)	HP-4108 across the dummy load	250 v	
COARSE POSITIONING			
A5C30	HP-4103 at junction of A5C31-A5C32	Maximum	Manual tune-cycle at 4; local control; frequency -30 MHz.
A5C32	PA TANK Tuning Indicator	Mechanical coincidence of coarse and fine positioning	Manual tune-cycle at 4; local control; frequency, 2 MHz.

Table 5-2. Condensed PA Adjustments (Cont).

ADJUSTMENT	INDICATOR	INDICATION	REMARKS
NEUTRALIZATION			
Driver Neutral A5C39	DRIVER STATIC FORWARD POWER	Dip Peak	Tune-cycle at OPERATE; local control; frequency, 24 MHz; feedback disconnected at E24 and grounded. WARNING The feedback reconnection must be done with the MAIN DISCONNECT turned OFF.
PA Neutral C23 WARNING	PA PLATE CURRENT FORWARD POWER	Dip Peak	Manually detune the DRIVE TANK to check for coincident DRIVER STATIC dip and FORWARD POWER peak. Manually detune the PA TANK to check for coincident PA PLATE CURRENT dip and FORWARD POWER peak. WARNING C23 at a high potential and must be adjusted with the PA PLATE voltage off.
PA PLATE - DRIVER GRID FEEDBACK			
(Reference)	HP-606A rf out	Reference Out	Tune-cycle at OPERATE; local control; frequency, 6 MHz; feedback disconnected at E2+ and grounded. WARNING The feedback reconnection must be done with the MAIN DISCONNECT turned off.
	HP-4108 across the dummy load	250 v	
(Reference)	HP-606A rf out	10 db greater than Reference Out	Reconnect the feedback to E24 WARNING The feedback connection

Table 5-2. Condensed PA Adjustments (Cont).

ADJUSTMENT	INDICATOR	INDICATION	REMARKS
C24 WARNING	HP-4103 across the dummy load	250 v	must be done with the MAIN DISCONNECT turned OFF. WARNING C24 is at high potential and must be adjusted with the PA PLATE voltage off.
AUTOMATIC GAIN CONTROL			
C29 WARNING	HP-410B across the dummy load	250 v	Tune-cycle at OPERATE; remote control; frequency, 5.999 MHz; single tone into one wideband at +4 dbm. WARNING C29 is at a high potential and must be adjusted with the PA PLATE voltage off.
AUTOMATIC LEVEL CONTROL			
ALC BIAS	HP-710B across the dummy load	500 v	Tune-cycle at OPERATE; remote control; frequency, 5.999 MHz; single tone into both sidebands at +4.5 dbm.
VSWR PROTECT			
REEL PWR ADJ	REFLECTED POWER	500 w Threshold	Tune-cycle at OPERATE; local control; frequency 6 MHz; 500 pf capacitor connection across the dummy load.
PA OVERLOAD			
PA OVLD	PA PLATE CURRENT	1.7 A to 1.72 A Threshold	Tune-cycle at OPERATE; local control.

5.2 5-KW POWER AMPLIFIER CHECKOUT AND ADJUSTMENTS PROCEDURE

5.2.1 Preliminary Settings and Test Connections

a. Select the following:

	CONTROL	POSITION
1.	Main Disconnect	OFF
2.	Local-Remote	Local
3.	Local Key	Off (middle position)
4.	Servo Test	Off
5.	Tune-Cycle S2	Man (Behind tune-cycle doors)
6.	Manual Tune-Cycle Positioner S3	4 (Behind tune-cycle door)

WARNING

FL1, FL2, and FL3 400-Hz line input filters are located toward the rear of the top compartment. The exposed filter terminals are hot unless the power is turned off at the ship's power distribution panel.

b. Connect an HP-606A rf signal generator to rf input J1. J1 is located toward the middle-rear of the top compartment. Adjust the generator for minimum output.

c. Connect rf output J4 to a 5-kw dummy load. The dummy load connection may be made at J4, which is located toward the left front of the top compartment.

d. Attach a 100:1 capacity divider HP-453A or equivalent to the probe of an HP-410B AC VTVM. With suitable adapters connect the probe and divider to the output of the pa. This may be done at J4 or at the dummy load, whichever is more convenient.

e. Tie the meter panel to a partly closed position so the meters can be viewed more conveniently.

WARNING

The pa plate potential, when energized, is approximately 5500 volts. From this point on, do not reach into or allow anyone else to reach into the pa compartment without first taking the following mandatory precautions.

1. Press the PA PLATE OFF switch.
2. Use the safety grounding rod and momentarily ground the pa plate circuit.
3. Remove the cheater from the pa plate shorting interlock. At this time make a close inspection of the two safety grounding rods. Make sure that the ground rod cables and lugs are in good condition and are properly secured. Using an ohmmeter, check the continuity between the ground rod and the cabinet chassis.

f. Open the pa compartment door. Disable the microswitch interlock S8A by pulling the plunger out to the engaged position. Disable the pa plate shorting interlock S8B by wedging a short bolt, or other suitable device, between the interlock plunger and the interlock bracket assembly at the point where the plunger bends downward such that the plunger is held in the door-closed position. Make sure that the device used is firmly seated. Make sure that the interlock shorting contact is well away from the pa plate assembly.

g. Open the tune-cycle door and the right front panel door. Disable the tune-cycle door interlock by pushing the plunger in and raising the interlock bracket to engage the plunger.

5.2.2 Load-Coil Mechanical Alignment Check

a. Turn load coil L1 maximum clockwise with the shaft knob. The frequency indicator should point directly to HIGH END STOP.
b. Turn load coil L1 maximum counterclockwise. The insulator roller should be approximately 1 inch from the end of the coil. The contact roller at the opposite end should be on the outermost loop of the coil. The frequency indicator should be pointing between 2 and HIGH END STOP but closer to HIGH END STOP.

5.2.3 PA Filament Volt Meter Calibration

These tests are to be performed during the initial installation checkout or anytime after replacement of components related to this circuit.

a. Remove the grid chassis. Remove the T5 filament transformer cover (previously hidden by the grid chassis).
b. Connect a jumper lead between the grid chassis connectors J5-30 and J6-30. This completes the interlock path.
c. Set the MAIN DISCONNECT switch to ON. Press the FILAMENTS ON switch.

WARNING

Do not press the PLATE ON switch.

d. Ascertain that the blower draws air at the bottom and blows the air up to the PA compartment.
e. Momentarily ground center-tap T5-4 with the ground rod. This is the -850 volt line. The -850 volts should not be present (PA PLATE OFF) at this time.
f. With a multimeter, measure the filament voltage across T5-3 and T5-5. Adjust PA FIL ADJUST for 7.5 volts ac.
g. Set the RF MULTIMETER switch to position 9 PA FIL VOLTS. Adjust the calibration resistor, R48, located at the lower end behind the right front panel door, for 7.5 volts as indicated by the RF MULTIMETER.
h. Press the FILAMENTS OFF switch. Set the MAIN DISCONNECT switch to OFF. Remove the jumper between J5-30 and J6-30. Replace the T5 cover. Replace the grid chassis.

5.2.4 PA Filament Voltage Adjustment

a. Set the MAIN DISCONNECT switch to ON. Press the FILAMENTS ON switch.
b. Ascertain that the blower draws air in at the bottom and blows air up to the PA compartment.
c. Set the RF MULTIMETER switch to position 9 PA FIL VOLTS. Adjust PA FIL ADJUST for 7.5 volts as indicated by the RF MULTIMETER

5.2.5 Bias and Statics Adjustments

a. If the TUNE-CYCLE POSITION indicator is not on position 4, press the MANUAL TUNE-CYCLE START switch.

b. Set MANUAL TUNE-CYCLE POSITIONER S3 to OPERATE. Set TUNE-CYCLE S2 to AUTO. Momentarily ground S1A L4 and observe that the TUNE-CYCLE POSITION indicator moves to position 5. S1A is the first wafer on the left facing the back of the tune-cycle door. Terminal L4 is located on the bottom towards the door. It has a TV905 (white-black-green) wire on it.
c. Set TUNE-CYCLE S2 to MAN. Press the MANUAL TUNE-CYCLE START switch. Observe that the TUNE-CYCLE POSITION indicator moves to OPERATE.
d. Check the PLATE OFF meter readings as indicated in table 1.
e. Press the PLATE ON switch. Observe that the PLATE light and the READY OPERATE light are lighted. Check the PLATE ON - KEY OFF meter readings as indicated in table 1.
f. Set LOCAL KEY to ON. Adjust PA BIAS for 0.5 A as indicated by the PA PLATE CURRENT meter.
g. Set the POWER SUPPLY MULTIMETER to position 5 LV BIAS. Adjust the LV BIAS control R6 (unlabeled - located directly below the PA BIAS adjust) for -26 volts as indicated by the PWR SUPPLY MULTIMETER.
h. Set the RF MULTIMETER switch to position 5 INPUT AMPL STATIC. Adjust INPUT AMPL SCRN for 200 ma as indicated by the RF MULTIMETER.
i. Set the RF MULTIMETER switch to position 6 DRIVER STATIC. Depress DR SCRN NO. 1 toggle switch and adjust the adjacent pot for 220 ma as indicated by the RF MULTIMETER. Depress DR SCRN NO. 2 toggle switch and adjust the adjacent pot for 220 ma, as indicated by the RF MULTIMETER. With both toggles released, the total current should be 400 ma. Readjust the two pots slightly, if necessary, so that with equal current from each tube, the total is 400 ma. With only one tube on, the current is greater than 200 ma, because the power supply voltage increases as the other tube is cut off.
j. Check the PLATE ON-KEY ON meter readings as indicated in table 1.
k. Set LOCAL KEY to OFF. Press the PLATE OFF switch.

5.2.6 PA Plate Current Overload Adjustment

a. Manually tune the INPUT AMPL TANK, DRIVER TANK, PA TANK, and LOAD COIL to 6 MHz as indicated by the corresponding frequency indicators.

WARNING

Extreme care must be exercised when performing this step to prevent contacting high-voltage circuits within the cabinet.

b. Adjust GRID and PLATE PA LOADING ADJUSTMENTS R54 and R59 maximum counter-clockwise.
c. Set the signal generator to 6 MHz - CW at minimum output.
d. Press the PLATE ON switch. Set the LOCAL KEY and SERVO CHECK switches to ON.
e. Increase the signal generator output slowly to the point where the INPUT AMPL, DRIVER, and PA TANK automatically tune to the incoming frequency. This normally occurs with not more than 0.5 volts rf input. The LOAD COIL should not move. An rf indication should be observed on the RF WATTMETER and on the HP-410B AC VTVM.
f. Increase the rf drive until the ac vtvm indicates 250 volts. Set SERVO CHECK to OFF.
g. Increase the rf drive to obtain 1.7 A of PA PLATE CURRENT. The PA plate overload should operate at not less than 1.7 A and not more than 1.72 A. Adjust PA OVLD for this requirement. When the PA plate overload actuates reduce the rf drive, reset the PA plate, and then increase the rf drive to recheck the overload current threshold.

h. Reduce the rf drive to minimum. Set LOCAL KEY to OFF. Press the PLATE OFF switch.

5.2.7 Load Coil Adjustments

a. Adjust PLATE PA LOADING ADJUSTMENT R59 maximum clockwise.
b. Press the PLATE ON switch. Set LOCAL KEY to ON.
c. Increase the rf drive to obtain 1.65 A of PA PLATE CURRENT.

Caution

Do not leave the PA PLATE CURRENT at 1.65 A for more than 10 seconds at a time. Overheating may result since all of the doors are open. When not actually making a measurement or making an adjustment, set the LOCAL KEY to OFF.

d. With a multimeter, monitor the following voltages on the grid chassis:

J12	Typically between -3 and -3.3 volts
A5 C73	Not less than -3.5 volts
J13	Not less than +3.5 volts but within ±0.5 volts of the voltage at C73.

e. If the voltage at J-3 was less than +3.5 volts or not within ±0.5 volts of the absolute voltage at C73, adjust C27 in the rf probe assembly A9 to meet this requirement using the procedure given below.

WARNING

C27 is at the same potential as the PA PLATE. The following steps must be strictly adhered to in making this adjustment.

1. Press the PLATE OFF switch
2. Use the safety grounding rod and momentarily ground the pa circuit.
3. Remove the disable from the PA plate-shorting interlock
4. Adjust C27 (clockwise to increase the voltage at J13 - counterclockwise to decrease the voltage)
5. Replace the PA plate-shorting interlock disable.
6. Press the PLATE ON switch.
7. Recheck the voltage at J13
8. Repeat this procedure if necessary to meet the requirement of step 5.1.7.f.

f. Adjust the GRID PA LOADING ADJUSTMENT R54 for 0.5 volts less at J11 than the voltage at J12.
g. Adjust the PLATE PA LOADING ADJUSTMENT R59 for a positive voltage at J13 equal to the absolute voltage at J11. Since some interaction may exist between R54 and R59 repeat steps f and g until the proper voltages are obtained.
h. Reduce the rf drive to obtain 250 volts of rf output as indicated by the HP-410B AC VTVM.
i. Set SERVO CHECK switch to ON. Fine adjust the PLATE PA LOADING ADJUSTMENT to cause the LOAD COIL indicator to indicate 6 MHz. Readjust the rf drive to obtain 250 volts of rf output and the PLATE PA LOADING ADJUSTMENT to cause the LOAD COIL to indicate 6 MHz.
j. Set SERVO CHECK switch to OFF.

5.2.8 PA Output Check

a. Increase the rf drive to obtain 500 volts of rf output as indicated by the HP-410B AC VTVM.

Caution

Do not leave the PA rf output at this level for more than ten seconds at a time. Overheating may result since all of the doors are open. When not actually making a measurement or making an adjustment, set the LOCAL KEY to OFF.

b. Check for the following meter readings:

Meter	Switch Position	Reading
PA Plate Current		Not more than 1.65 a
RF WATTMETER	FORWARD	5000 w
RF WATTMETER	REFLECTED	0 w
RF MULTIMETER	INPUT RF VOLTS	Not more than 2.5v
RF MULTIMETER	PA GRID CURRENT	0 ma
RF MULTIMETER	PA SCRN CURRENT	10 to 100 ma

c. Decrease the rf drive to obtain 250 volts of rf output.

5.2.9 Frequency Tracking Check

a. Set the SERVO CHECK switch to ON. Set the SERVO METERING switch to position 5, OUTPUT NO. 1.
b. With the fine frequency control on the signal generator, slowly decrease the frequency from 6.0 to 2.0 MHz. Observe that the automatic tuning circuits, including the LOAD COIL, track the changing frequency. Observe that after each small change in frequency, the servo meter returns to zero. Observe that the PA PLATE CURRENT and rf output do not become erratic at any point during the tracking check. If erratic meter readings are observed at any point, set the SERVO CHECK switch to OFF and manually tune each of the tuning circuits a small amount to determine which one is causing the erratic readings.
c. If the SERVO METER does not return to zero, it could be due to an erratic output from the INPUT AMPL Tank Circuit. In a normal tune-up sequence, the constant servo error would cause the internal gain to be reduced to a point where the tune-up sequence cannot be completed.
d. Track the tuning circuits to 2.0 MHz and leave the signal generator set to that frequency. Set SERVO CHECK to OFF. Set LOCAL KEY to OFF. Reduce the signal generator output to minimum.

5.2.10 Internal Gain Adjustments

a. Set MANUAL TUNE-CYCLE POSITIONER S3 to position 10. Set TUNE-CYCLE S2 to AUTO. Press the MANUAL TUNE-CYCLE START switch. Observe that the TUNE-CYCLE POSITION indicator moves to position 4.
b. Momentarily ground S1A L4 and observe that the TUNE-CYCLE POSITION indicator moves to position 5. S1A is the first wafer on the left facing the back of the tune-cycle

door. Terminal L4 is located on the bottom towards the door. It has a TV905 (white-black-green) wire on it.

c. Set TUNE-CYCLE S2 to MAN. Press the MANUAL TUNE-CYCLE START switch. Observe that the TUNE-CYCLE POSITION indicator moves to position 10.
d. Adjust 2ND LEVEL, PA PLATE DET BIAS, and PA GRID DET BIAS maximum clockwise.
e. Increase the rf drive to obtain 325 to 350 volts of rf output as indicated by the HP-410B AC VTVM.

NOTE

The 2 MIN DELAY TUNE-CYCLE FAILURE TIMER is activated any time that the PA PLATE is on and the tune-cycle is not in OPERATE. When the 2 minutes runs out, the high voltage will turn off and the FAULT light will turn on. To reset, press the PLATE OFF then the PLATE ON buttons and continue with the test.

f. Adjust PA GRID DET BIAS to obtain 316 volts (2000 watts) of rf output.
g. Adjust PA PLATE DET BIAS to obtain 300 volts (1800 watts) of rf output.
h. Adjust 2nd LEVEL to obtain 283 volts (1600 watts) of rf output.
i. Reduce the rf drive to obtain approximately 150 volts of rf output.
j. Set the POWER SUPPLY MULTIMETER to position 5 LV BIAS. The LV BIAS should indicate -26 volts.
k. Set the SERVO METERING SWITCH to position 5, OUTPUT NO. 1. The SERVO METER should indicate zero.
l. Manually turn the INPUT AMPL tank circuit tuning knob clockwise and then counterclockwise off resonance approximately 1/2 to 1 full turn. A certain amount of force has to be exerted because the servo loop will oppose any movement.

Observe that the servo error increases from zero as the tank circuit is turned off resonance. Observe also that as the servo error increases, a point is reached where the LV BIAS becomes more negative than -26 volts. Adjust 1A SERVO AMPL BIAS so that the LV BIAS just does reach the -26 volt level as the servo error is decreased to 25 volts as read on the top scale (50 volts full scale) of the servo meter. Recheck this requirement on both sides of resonance. If the effect is not symetrical, make sure that the LV BIAS does reach the -26 volt level by the time that the servo error has decreased to 25 volts, from either side of resonance.

m. Reduce the rf drive to minimum.
n. Adjust COARSE POS DISABLE maximum counterclockwise. Adjust 1st LEVEL maximum clockwise.
o. Set MANUAL TUNE-CYCLE POSITIONER S3 to position 5. Press the MANUAL TUNE-CYCLE START switch. Observe that the TUNE-CYCLE POSITION indicator moves to position 4.
p. Adjust the rf drive to obtain 70 volts (100 watts) of rf output. Very slowly adjust COARSE POS DISABLE clockwise until the TUNE-CYCLE just steps to position 5.
q. Reduce the rf drive to minimum. Set TUNE-CYCLE S2 to AUTO. Press the MANUAL TUNE-CYCLE START switch. Increase the rf drive slowly until the TUNE-CYCLE just steps to position 5. The rf output should be 70 volts. Repeat steps P and Q, if necessary to obtain this requirement.
r. With the TUNE-CYCLE on position 5 increase the rf drive to 2.5 volts. Adjust 1st LEVEL to obtain 80 volts (125 watts) of rf output.

5.2.11 Coarse Position Adjustment

a. Set the COARSE POS DISABLE maximum counterclockwise.
b. Set TUNE-CYCLE S2 to MANUAL. Set MANUAL TUNE-CYCLE POSITIONER S3 to position 4. Press the MANUAL TUNE-CYCLE START switch. Observe that the TUNE-CYCLE POSITION indicator moves to position 4.
c. Set the signal generator to 2.0 MHz at 2.5 volts output. Note that after coarse positioning, the PA TANK frequency indicator reads 2 MHz.
d. Increase the frequency of the signal generator, stopping to observe the PA TANK frequency indicator at 4, 6, 12, 18, 24, and 30 MHz.
e. If the PA does not track across the band, remove the cover of the front panel of the grid chassis. Set the signal generator to 8 MHz and adjust C32 until the PA TANK frequency indicator reads 8 MHz.
f. Repeat step p of 5.1.10.
g. Reduce the rf drive to minimum.

5.2.12 Coarse and Fine Positioning Check

a. Set TUNE-CYCLE switch S2 to AUTO. Set MANUAL TUNE-CYCLE POSITIONER S3 to position 4. Adjust the signal generator to 6.0 MHz. Press the MANUAL TUNE-CYCLE START switch. Observe that the tune-cycle goes to position 4.
b. Increase the rf drive to 2.5 volts. Observe coarse and fine tuning action after which the tune-cycle steps to position 5. Repeat this procedure for several frequencies up and down the 2.0- to 3.0 MHz band, especially in the 2.0- to 6.0-MHz range. Note the following indications.
   1. The tuning time from one extreme to the other is approximately 1 minute maximum.
   2. The LV BIAS increases to as much as -80 volts during coarse tuning.
   3. The PA PLATE CURRENT surge just prior to the PA TANK reaching resonance is not more than 1.2 a. The plate current surge is a function of the amount of grid drive (GRID DET BIAS) and the extent to which the PA TANK is initially detuned (coarse position versus resonant point). A seven plate current surge would activate the overload circuits.
c. Reduce the rf drive to minimum.

5.2.13 Driver and PA Neutralization and Feedback Adjustment

a. Press the PA PLATE OFF switch. Press the FILAMENTS OFF switch. Set the MAIN DISCONNECT switch to OFF.
b. Use the shorting rod to discharge all capacitors within the PA compartment. Remove the rf feedback strap between C24 and E24, at the E24 terminal, and reconnect to the ground post adjacent to E24. E24 and the adjacent ground post are located in the PA compartment beside the right-rear corner of filament transformer T5.
c. Set the signal generator to 24 MHz at 2.5 volts.
d. Set the MAIN DISCONNECT switch to ON. Press the PA PLATE ON switch. The filaments should come on immediately. After a 30-second delay the PA PLATE should turn on.
e. Observe that the tune-cycle started on position 4. As fine tuning is completed, the tune-cycle should step to position 5.
f. Reduce the rf drive to minimum. Set TUNE-CYCLE S2 to MAN. Set MANUAL TUNE-CYCLE POSITIONER S3 to OPERATE. Press the MANUAL TUNE-CYCLE START switch. Observe that the TUNE-CYCLE POSITION indicator moves to OPERATE.
g. Set LOCAL KEY to ON. Set SERVO CHECK to ON. Increase the rf drive slowly and observe that fine tuning takes place.
h. Increase the rf drive to obtain 250 volts of rf output. Set SERVO CHECK to OFF.

i. Set the RF MULTIMETER switch to position 6, DRIVER STATIC. Manually detune the DRIVER TANK above and below resonance. The rf output should peak coincident with the small dip in DRIVER STATIC current. Adjust C39, if necessary, so that the rf output peak is coincident with the DRIVER STATIC current dip. The C39 insulator fiber shaft is accessible through the grid chassis front panel access port.

j. Set SERVO CHECK to ON to allow the DRIVER TANK to fine tune, then set SERVO CHECK to OFF again.

k. Reduce the rf drive to obtain approximately 0.7 A of PA PLATE CURRENT. Manually detune the PA TANK above and below resonance. The rf output should peak coincident with the dip in PA PLATE CURRENT. If necessary, adjust C23, using the procedure given below, to meet this requirement.

WARNING

C23 is at the same potential as the PA Plate. The following steps must be strictly adhered to in making this adjustment.

1. Press the PLATE OFF switch.
2. Use the safety grounding rod and momentarily ground the PA plate circuit.
3. Remove the cheater from the PA plate-shorting interlock.
4. Initially adjust C23 one tune in either direction.
5. Replace the PA plate-shorting interlock cheater.
6. Press the PLATE ON switch.
7. Recheck for coincident PA PLATE CURRENT dip and rf output peak by manually detuning the PA TANK above and below resonance. Repeat this procedure, as necessary, until this requirement is met.

NOTE

If any difficulty in stabilizing is expected with the above neutralizing procedure, refer to AN/SRC-16 Technical Manual, Chapter 0, page 06-7, steps 14 through 23. The capacitor value should be 1000 uufd instead of 1000 ufd in figure 6-1.

l. Set LOCAL KEY to OFF. Adjust the signal generator to 6.0 MHz at 2.5 volts.

m. Set MANUAL TUNE-CYCLE POSITIONER S3 to position 5. Press the MANUAL TUNE-CYCLE START switch. Observe that the TUNE-CYCLE POSITION indicator moves to position 4. Observe the automatic coarse and fine tuning. As fine tuning is completed, the tune-cycle should step to position 5.

n. Reduce the rf drive to minimum. Set the MANUAL TUNE-CYCLE POSITIONER S3 to OPERATE. Press the MANUAL TUNE-CYCLE START switch. Observe that the TUNE-CYCLE POSITION indicator moves to OPERATE.

o. Set LOCAL KEY to ON. Set SERVO CHECK to ON. Increase the rf drive to obtain 250 volts of rf output. Note the signal generator output and keep it in mind for a later step.

p. Set SERVO CHECK to OFF. Set LOCAL KEY to OFF. Press the FILAMENTS OFF switch. Set the MAIN DISCONNECT switch to OFF.

q. Use the shorting rod to discharge all capacitors within the PA compartment. Reconnect the rf feedback strap between C24 and E24 (reverse step b).

r. Set the MAIN DISCONNECT switch to ON. Press the PA PLATE ON switch. The filaments should come on immediately. After a 30-second delay, the PA PLATE should turn on.

s. Set LOCAL KEY to ON. Set SERVO CHECK to ON. Increase the signal generator output to a level 10 db greater than the level noted in step o. The rf output should be 250 ±10 volts. If necessary, adjust C24, using the procedure given below, to meet this requirement.

WARNING

C24 is at the same potential as the PA PLATE: The following steps must be strictly adhered to in making this adjustment.

1. Set SERVO CHECK to OFF.
2. Press the PLATE OFF switch.
3. Use the safety grounding rod and momentarily ground the PA plate circuit.
4. Adjust C24 clockwise to increase the rf output or counterclockwise to decrease the rf output. C24 is the left rear vacuum capacitor of the three in front of the PA tube.
5. Press the PLATE ON switch.
6. Set SERVO CHECK to ON.
7. Recheck for 250 ±10 volts of rf output. Repeat this procedure, if necessary, to meet this requirement.

t. Set SERVO CHECK to OFF. Set LOCAL KEY to OFF.

5.2.14 RF Voltmeter Calibrations

a. Adjust the signal generator for 1.0 volts output.
b. Set the RF MULTIMETER switch to position 1, RF INPUT VOLTS. The RF MULTIMETER should read 1.4 volts. Adjust INPUT GRID on the grid chassis to obtain this reading.
c. Reduce the rf drive to minimum. Set LOCAL KEY to ON.
d. Connect the ac vtvm, without the 100:1 divider, to J5 on the grid chassis. J5 is accessible through the front panel access port.
e. Increase the rf drive to obtain 10 volts at J5.
f. Set the RF MULTIMETER switch to position 2, INPUT AMPL PLATE RF. The RF MULTIMETER should indicate 14 volts. Adjust INPUT PLATE on the grid chassis to obtain this reading.
g. Reduce the rf drive to minimum. Replace the grid chassis access port cover. Reconnect the ac vtvm probe and 100:1 probe divider to the PA output.
h. Adjust PA BIAS to obtain 0.1 a of PA PLATE CURRENT. Set the POWER SUPPLY MULTIMETER switch to position 6, PA BIAS. Set the RF MULTIMETER switch to position 7, PA GRID CURRENT.
i. Increase the rf drive to obtain a threshold indication of PA GRID CURRENT.
j. Set the RF MULTIMETER switch to position 3, DRIVER PLATE RF. The rf and PWR SUPPLY MULTIMETERS should have the same indication. Adjust the DRIVER PLATE RF reading with DRIVER PLATE on the grid chassis for this requirement.
k. Reduce the rf drive to minimum. Adjust PA BIAS for 0.5 a of PA PLATE CURRENT.
l. Set the RF MULTIMETER switch to position 8, PA SCRN CURRENT. Increase the rf drive to obtain a threshold indication of PA SCRN CURRENT.
m. Set the RF MULTIMETER switch to position 4, PA PLATE RF. Set the POWER SUPPLY MULTIMETER switch to position 1, PA PLATE. Note the PA PLATE voltage indication on the PWR SUPPLY MULTIMETER.
n. Set the POWER SUPPLY MULTIMETER switch to position 3, PA SCREEN. Subtract the absolute value of the PA SCREEN voltage noted in this step from the absolute value

of the PA PLATE voltage noted in step m. The RF MULTIMETER should indicate this difference as peak PA PLATE RF. For example, if the pa plate voltage is +6200 volts and the PA SCREEN voltage is -850 volts, the PA PLATE RF indication should be 5350 volts peak.

Since the PA PLATE RF meter position is labeled "5000V PK FS", a value greater than 5000 volts cannot be indicated. In order to make this a practical and useable indication, it is recommended that the full-scale deflection calibration be increased to 10,000 volts full scale. Using a fine-point, felt-tip, black marking pencil or a fine-point brush and black paint, as carefully and as neatly as possible, add"2X" in front of the "5000V" silk screen label. The entire label for position 4 will then read "4. PA PLATE RF 2X5000V FS P".

Adjust PA PLATE on the grid chassis for the required difference voltage as indicated by the lower scale (0-10) of the RF MULTIMETER.

o. Set SERVO CHECK to ON. Adjust the rf drive to obtain 250 volts of rf output.

p. Set servo check to OFF. Record the following RF MULTIMETER and POWER OUT indications.

(1) INPUT RF VOLTS _____ Volts
(2) INPUT AMPL PLATE _____ Volts
(3) DRIVER PLATE RF _____ Volts
(4) POWER OUT _____ Watts

These meter readings, taken at 6.0 MHz with 250 volts of rf output, may be used as a reference to keep abreast of any deterioration in gain through the various stages of the grid chassis and PA.

q. Set LOCAL KEY to OFF. Press the FILAMENTS OFF switch.

5.2.15 System AGC and ALC Adjustment

a. Before performing this procedure, make sure that the transmitter to be used has recently been adjusted for proper agc and carrier insert in conjunction with its 500 w PA.

b. Disconnect the signal generator from J1. Reconnect the system rf input to J1.

c. Set LOCAL-REMOTE to REMOTE. Set TUNE-CYCLE S2 to AUTO. Set MANUAL TUNE-CYCLE POSITIONER to OPR. Press the FILAMENTS ON switch. The tune-cycle indicator should now be on position 4.

d. Select 5.999MC and 5KW for the transmitter that is to be used. Do not select TEST TONE at this time.

e. Press the corresponding STBY-OPR switch in the appropriate REMOTE SWITCHING CONTROL chassis. Observe on the rf matrix that a 2- to 6-MHz coupler is selected. In this procedure the coupler is used for control purposes only.

f. Set the AUTO-TEST-MANUAL switch on the selected coupler to TEST.

g. Observe that the PA coarse and fine tunes and steps to position 5 of the tune-cycle.

h. After the tune-cycle steps to position 5, advance the coupler to OPERATE by pressing the ADVANCE button. Observe that as soon as the coupler advances to OPERATE, the PA tune-cycle advances to position 10. The tune-cycle stays at position 10 for 6 seconds and then advances to OPERATE.

i. Select TEST TONE on cabinet 1. Adjust the output of the test set for a single tone into one sideband at a +4 dbm level.

j. The PA rf output should be 250±5 volts (1250 watts). Use the following procedure to adjust C29 for the correct output:

WARNING

C29 is at the same potential as the PA PLATE. The following steps must be strictly adhered to in making this adjustment.

1. Press the FILAMENTS OFF switch.
2. Use the safety grounding rod and momentarily ground the PA plate circuit.
3. Remove the cheater from the PA plate-shorting interlock.
4. Adjust C29 clockwise to increase the rf output or counterclockwise to decrease the the rf output. C29 is the only adjustable vacuum capacitor on the RF PROBE ASSEMBLY A9. It is located to the right of the right-rear corner of filament transformer T5.
5. Replace the PA plate-shorting interlock cheater.
6. Press the FILAMENTS ON switch.
7. Allow a 30-second warm-up period. Recheck the rf output by repeating steps e, f, g, h, and j.
8. Repeat the entire procedure, if necessary, to obtain 250+5 volts of rf output.

k. After the agc has been adjusted and with the PA tune-cycle still in OPERATE, insert a single tone, at a +4.5 dbm level, into each sideband.
l. Adjust ALC BIAS maximum counterclockwise. The rf output should be greater than 500 volts, approximately 530 volts.
m. Adjust ALC BIAS clockwise until the rf output is reduced to 500 volts.
n. Reduce the audio tones to minimum. Press the TEST TONE OFF on the switchboard. Press the STBY-OPR switch to return the channel and PA to standby.
o. Press the FILAMENTS OFF switch. Use the safety grounding rod and momentarily ground the PA plate circuit. Remove the PA plate-shorting interlock cheater.
p. Close the PA compartment door and secure.

5.2.16 Reflected Power Adjust

a. Set the LOCAL-REMOTE switch to LOCAL. Connect the signal generator to PA rf input J1. Set the signal generator to minimum output at 6.0 MHz.
b. Disconnect the ac vtvm from the PA output. Connect a 500 pf 1000 volt rating capacitor between the rf output T-connect and ground.
c. Set TUNE-CYCLE S2 to MAN. Set MANUAL TUNE-CYCLE POSITIONER S3 to position 5.
d. Press the PA PLATE ON switch. The filaments should come on immediately. After 30 seconds, the PA plate voltage should come on.
e. Press the MANUAL TUNE-CYCLE START switch. The tune-cycle should move to position 4.
f. Increase the rf drive to 2.5 volts. Observe the automatic tuning. The tune-cycle steps to position 5 when fine tuning is completed.
g. Decrease the rf drive to minimum. Set MANUAL TUNE-CYCLE POSITIONER S3 to the OPERATE position. Press the MANUAL TUNE-CYCLE START switch. The tune-cycle should move to OPERATE.
h. Set the REFLECTED-FORWARD switch to REFLECTED. Adjust REFL PWR ADJ maximum counterclockwise.
i. Set LOCAL KEY to ON. Increase the rf drive to obtain 500 watts of reflected power. Slowly adjust REFL PWR ADJ clockwise to the point where the PA plate voltage knocks down and the fault light comes on.

j. Reduce the rf drive to minimum. Press the REFL PWR ALARM RESET switch to reset the PA plate voltage. Slowly increase the rf drive and recheck the reflected power alarm for a 500-w threshold.

k. Reduce the rf drive to minimum. Set LOCAL KEY to OFF. Press the FILAMENTS OFF switch. Disconnect the signal generator from J1. Reconnect the system rf input to J1. Disconnect all adapters and T-connectors from PA output J4. Reconnect the system output cable to J4. Set the LOCAL-REMOTE switch to REMOTE. Close all the access panels. Set the MAIN DISCONNECT to OFF. Close the left cabinet door. Set the MAIN DISCONNECT to ON. Press the FILAMENTS ON switch.

6.1 GENERAL

This section gives useful information regarding system trouble-shooting. It gives trouble symptoms and possible corrective action on a categorized basis. This section will also give advice, which properly applied, will help prevent system failures. Tables 6-1 through 6-3 give correct meter readings for STANDBY and OPERATE positions for transmitter, receiver, and PA. For common module test point voltages and waveforms refer to the AN/SRC-16 Technical Manuals.

6.2 LOSS OF FREQUENCY LOCK

The most frequent trouble encountered in transmitters and receivers is loss of frequency lock. To determine the cause of the trouble the following steps should be taken:

a. Note by the Lissajous pattern whether the frequency lock is fuzzy (unclear) or non-existent. Change the RX frequency in 1-kHz, 10-kHz, 100-kHz, and 1-MHz steps and note whether or not a frequency lock occurs.
b. Refer to tables 6-1 and 6-2 and check meter reading.
c. If the meter readings do not isolate the trouble to the receiver or transmitter, the following method may be used. Return the receiver in question to STBY. Depress the STBY-OPR button on another RX on same frequency. Depress TEST-TONE for the 2 channels in use and manually hold. If frequency lock occurs, the trouble has been isolated to the receiver.
d. If the frequency lock was fuzzy or 1 to 10 kHz off, the problem is generally in the KC Stabilizer.
   1. A5J4 - CONT BIAS 20 volts dc, frequency 000, adjust if necessary
   2. A5J5 - DIG OSC 296 to 305 kHz ±20 Hz, adjust if necessary

   The module should be checked out on the SRM-13 if the adjustment cannot be made.
e. If the trouble is not in the KC stabilizer, the following modules should be checked. Refer to table 6-4 and 6-5 and check the frequency divider, MC stabilizer, frequency multiplier, and rf tuner, for proper indications.

6.3 RECEIVER TROUBLES

Trouble indications sometimes turn out to be poorly seated modules. Before any module swapping takes place, always make sure that good pin contact is being made, by checking each module and unit to be sure that it is properly seated.

Check meter readings in table 6-1. Many times the problem area can be determined from these readings.

6.3.1 Receiver Indication

a. Noisy - Cannot make $\frac{S+N}{N}$ This is generally caused by defective 5899 tubes in the mixer module. The tubes sometimes become gassy, causing noise output to go up. Weak amplifier tubes in the rf tuner can also cause this problem.

Table 6-1. SRC-16 Radio RX Normal Meter Readings.

TEST SELECTOR SWITCH POSITION	STANDBY	OPERATE*
CAL (18)	Green (7)	Green (7)
USB A. F.	0	Depends on signal level (2 to 5)
LSB A. F.	0	Depends on signal level (2 to 5)
250 V	0	Green
130 V	0	Green
27.5 V	Green	Green
6.3 V(A)	Green	Green
6.3 V(B)	Green	Green
26 V (AC)	Green	Green
AGC	0	Depends on frequency (4 to 8)
TUNE	Green	Green
100 KC	Green	Green
500 KC	Green	Green
DET	Green	Green
10 KC	Green	Green
100 KC	N/A	N/A
NORM	0	0

*Operate readings assume 0-dbm input to both transmit sidebands from the test set.

Table 6-2. Radio TX Normal Meter Readings.

TEST SELECTOR SWITCH POSITION	STANDBY	OPERATE
AMP CAL	7	7
USB	2 to 8, depends on audio input	2 to 8, depends on audio input
LSB	2 to 8, depends on audio input	2 to 8, depends on audio input
RF OUT	0	2 to 8, depends on audio input
250 V (DC)	0	Green
130 V	Green	Green
28 V (UF)	Green	Green
26 V (F)	Green	Green
AUX PWR	Green	Green
6.3V (A)	Green	Green
6.3V (B)	Green	Green
6.3V (O)	Green	Green
500 KC B/M	7 to full scale	7 to full scale
500 KC M. S.	Green	Green
100 KC FD.	Green	Green
10 KC	Green	Green
NORM	0	0
18 V	Green (7)	Green (7)

Table 6-3. SRC-16 RF AMP Normal Meter Readings.

TEST SELECTOR SWITCH POSITION	STANDBY	OPERATE
RELAY V (30-second delay after circuit breakers are turned on)	Green	Green
FIL V	Green	Green
KEY UP BIAS (Unkeyed)	Green	Green
KEY UP BIAS (Keyed)	Green	1 to 3
PL CONT	Green	0 to 1
SERVO AMP (Depress servo push-to-test switch)	0	Green
KEY (Must be keyed)	0	Green
T/R RELAY	full scale	full scale
KEY DOWN BIAS (Unkeyed)	full scale	full scale
KEY DOWN BIAS (Keyed)	full scale	Green
TOTAL PK MA (Keyed with no audio into transmitter)	0	5.5
2000 V	0	Green
400 V	0	Green
PL MA V4, V5, V6 and V7 (Keyed with no audio into transmitter)	3 to 5	Green all within 10% of one another)
EXCITER PLATE	0	Green to full scale
RF INPUT	0	Depends on signal level
RF OUT	0	Depends on signal level

b. Poor sensitivity - Probable defective modules are the rf tuner, audio amplifier, RX gain control, or mixer modules.
c. No output at all - check common test points listed in table 6-4, beginning with the rf tuner.
d. RX sensitivity inconsistent across the band. Generally caused by rf tuner module. It can generally be corrected by cleaning tuner contacts or peaking tuner coils. If the above procedures do not solve the problem, check common test points listed in table 6-4 for the rf tuner.

6.4 TRANSMITTER TROUBLES

Because all the frequency generating modules are identical to those used in the receiver, many transmitter problems can be isolated in the same way. Some troubles that cannot be isolated with the above procedures are listed below.

a. Low rf output - Problems of this nature must be first isolated to the transmitter or pa. Generally, this can be done with meter readings. If balanced modulator and tgc adjustments in the transmitter fail to change the rf output, the trouble usually is in the rf pa unit.
b. Low rf output at some frequency. Could be caused by dirty rf tuner contacts or peaking coils out of adjustment.
c. Low rf output - TUNE position or OPERATE position. If R16 in the transmitter gain control (tgc) and R8 in balanced modulator fails to change output, the trouble is probably in electronic control amplifier (eca), balanced modulator or tgc. Always make sure that the TX gain is in the MAX position.

d. Sluggish tgc's - a good check of tgc operation is indicated in the adjustment procedure. Sometimes a tgc may become sluggish, that is, the servo loop does not return the rf output voltage to normal value every time. This may be caused by dirty or sticking gears or noisy 3899 amplifier tubes in tgc.

6.5 500W PA TROUBLE - SHOOTING

Table 6-3 is a list of the pa format panel meter readings taken in the STANDBY and OPERATE conditions. These readings will aid in determining the trouble area. If the trouble is isolated to the pa module, electronic control amplifier or the rf metering module, it is a simple matter of replacing the bad module. If the trouble is in the chassis, the pa should be removed and an ohmmeter used to isolate the faulty circuit or component.

6.5.1 Common PA Troubles

a. Among the most troublesome items in the 500-w pa are the 4CX250F tubes. After being used a short period of time, these tubes develop a low resistance between the screen and plate connections. When this happens, the primary circuit breaker will usually trip when high voltage is applied; i. e., going from STBY to TUNE. If the operator insists on resetting the circuit breaker and attempting to tune the pa, one of the screen resistors R52, R55, R61, and R67 will probably open. If this should happen, the tube with the bad screen resistor will not indicate any static plate current.

   The vendor for this tube has made a modification to eliminate this problem. Because of this modification, the tube is now a 4CX250FG. Using the modified version of this tube should greatly increase tube life.

b. Two other items that have a tendency to fail are relays K1 and K2. Generally these relays fail because of sticking contacts or contacts not closing. If K1 contacts stick open, the indication will be low high-voltage. This relay shorts out the three surge resistors in the 400-Hz input. There would be no high voltage if relay K2 contacts stuck open. If the contacts on K2 stuck closed, high-voltage would be applied to the first tube at all times. It should be noted that the possibility of all contacts sticking open or closed at the same time is rather remote; therefore there will be variations of the above symptoms depending on the number of contacts sticking at any one time.

6.6 5-KW PA MAINTENANCE AIDS

a. Many of the troubles encountered in the 5-KW pa are caused by faulty mating of spring clips between the grid chassis and pa compartment. This should be checked before inserting the grid chassis. Check with an ohmmeter at feedthrough capacitor C33 to make certain the +750-volt dc supply is not shorted to chassis ground.

b. When a trouble exists in the pa compartment, it is generally accompanied by arcing between components or the faulty component itself. This can best be observed by opening the pa compartment door and looking for arcs with the compartment lights out. With filaments on the tune-cycle in position 12, depress PLATE ON button. Usually, faulty components can readily be pinpointed by noting where the arc occurs.

c. Another common trouble that occurs in the 5-KW pa is the improper seating of the 4CX5000 tube when it is replaced. This can be avoided by taking care when replacing the tube to be sure that it seats properly. Look into the tube socket with a mirror before replacing the tube to be sure there are no broken fingers lying in the bottom of the tube socket. It may be necessary to remove the tube socket to repair it if pins are bent, etc.

6.7 COMMON EQUIPMENT TROUBLES IN 5 KW PA.

6.7.1 Common PA Problems (Final)

a. L8, L9 open - No high voltage to plate.
b. C14 or C15 arcing - F7, F8, or F9 blown.
c. L14 and R64 open - Usually caused by spring clip mating problems (E26).
d. L13 shorted - PA does not tune below 3.2 MHz. Remove. The absence of this component does not degrade the pa performance.
e. L11 arcing between coil and roller arm - Cause erratic tuning. Use book procedure for removal and replacement.
f. K13 - Contacts sticking - Low rf output to antenna.
g. C13 - Teflon shield breaks down - Shorts high voltage to ground.

6.7.2 Common Key Chassis Problems

a. Q3 shorting - No pa bias.
b. Q7 shorting - Bias relay stays energized.

6.7.3 Common Relay Problems

a. K11 high power tune-time relay (6 sec) fails to operate - PA tune-cycle will not leave position 10.
b. K5 - filament heating time delay fails to operate - PA plate does not come on after 30 sec.

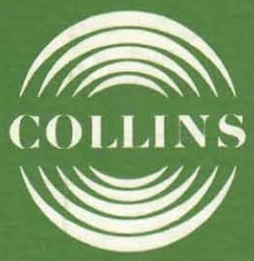
6.7.4 Common Power Supply Problems

a. R9 in 5500V PA PLATE SUPPLY opens - No high voltage.
b. CR28 through CR32 absorbers short-screenfuses blow. If part is not available, bypass them in the circuit. They are used as overload protectors in the circuit.
c. R19 open - erratic final plate readings.

6.7.5 Common PA Loading Problems

a. Positions 5 and 10 loading adjustments cannot be made - CR1 in DC1 of load coil open. CR8 or CR15 in grid chassis shorting - most common problems.
b. Weak tubes - erratic tuning.
c. L1 and L2 corroded, arcing or binding, erratic tuning in grid chassis - Clean with contact cleaner.

Table 5-1 gives a good check of all meter reading. If problems exist in pa check in the meter readings first.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