

AIR-GROUND RADIO
COLLINS 242F-9C TRANSMITTER
TESTS

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1. GENERAL

1.01 This section contains the procedure to be followed in performance testing the Collins 242F-9C transmitter and the associated SG-34 station guardian. These procedures describe the tests to be performed to determine the operating efficiency of the transmitter and corrective action to be taken should the operating requirements not be met. Portions of this section are also designated to be performed as routine maintenance procedures on a regularly recurring basis. Test routines to be performed and intervals of performance are in Section 406-110-330.

1.02 In order to maintain optimum performance of the transmitter, a program of routine maintenance should be followed. This program should include performance tests; visual inspections for loose, broken, burned, or otherwise damaged components; and inspections of all interconnecting wires and cabling. Relay contacts should be inspected and burnished, if required. The power amplifier blower should receive periodic lubrication and its impeller blades should be cleaned as required.

1.03 A record of meter readings should be logged and maintained at the station location. All adjustments, parts replacements, tube replacements, repair work, and wiring and/or apparatus modification should be recorded. The date and results of each performance test should be entered in the record.

2. APPARATUS

2.01 The following test equipment is required to perform the tests and adjustments in this section.

1—Western Electric 21A Transmission Measuring Set and Audio Signal Generator

1—Hewlett-Packard 410B Vacuum Tube Voltmeter

1—Frequency Meter—Accurate to 0.0005 percent at the transmitter operating frequency.

3. TEST PROCEDURE

3.01 Test conditions and resultant indications are outlined under performance tests (Part 4). If the transmitter fails to provide the required carrier output signal and if the tuning and adjustment procedures in Section 406-110-501 fail to correct the abnormal condition, fault-locating procedures should be followed. Voltage Tables A, B, and C should be consulted if extensive maintenance procedures are required.

3.02 Should meter or lamp indications not meet the performance test requirements, refer to the fault-locating step of the same number for the probable cause before proceeding to the next step.

Warning: *This equipment uses voltages which are dangerous to life. Observe the safety precautions described in Section 010-110-001.*

4. PERFORMANCE TESTS

STEP	PROCEDURE																								
1	<p>Place LOCAL-REMOTE switch to OFF position. Place PLATE switch to OFF position. Place POWER switch to ON position.</p> <p>Requirement: The green POWER lamp shall be illuminated. The red PLATE lamp shall be extinguished. The yellow CRYSTAL HEATER lamp shall flash on and off at a slow rate.</p>																								
2	<p>Place the MULTIMETER SWITCH in the positions shown below. The MULTIMETER should then indicate as shown.</p> <table> <thead> <tr> <th>SWITCH POSITION</th> <th>INDICATION</th> </tr> </thead> <tbody> <tr> <td>BIAS PS X 1</td> <td>66</td> </tr> <tr> <td>28VPS X 1/2</td> <td>56</td> </tr> </tbody> </table>	SWITCH POSITION	INDICATION	BIAS PS X 1	66	28VPS X 1/2	56																		
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3	<p>Place PLATE switch to the ON position.</p> <p>Requirement: The red PLATE lamp shall be illuminated.</p>																								
4	<p>Place the MULTIMETER SWITCH in the following positions. The MULTIMETER should then indicate as shown. The POWER AMPLIFIER METER should indicate zero.</p> <table> <thead> <tr> <th>SWITCH POSITION</th> <th>INDICATION</th> </tr> </thead> <tbody> <tr> <td>DR PLATE MA X 1</td> <td>0</td> </tr> <tr> <td>300VPS X 5</td> <td>60</td> </tr> <tr> <td>850 VPS X 10</td> <td>85</td> </tr> <tr> <td>2000 VPS X 40</td> <td>50</td> </tr> </tbody> </table>	SWITCH POSITION	INDICATION	DR PLATE MA X 1	0	300VPS X 5	60	850 VPS X 10	85	2000 VPS X 40	50														
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5	<p>Place the LOCAL-REMOTE switch in the LOCAL position.</p> <p>Requirement: The transmitter is keyed and the blower B401 is turned on. The POWER AMPLIFIER METER shall indicate between 130 and 150 milliamperes.</p>																								
6	<p>Place the MULTIMETER SWITCH in the positions shown below. The MULTIMETER shall then indicate as shown.</p> <table> <thead> <tr> <th>SWITCH POSITION</th> <th>INDICATION</th> </tr> </thead> <tbody> <tr> <td>DR PLATE MA X 1</td> <td>50 to 60</td> </tr> <tr> <td>OSC</td> <td>See Note</td> </tr> <tr> <td>BUFFER</td> <td>"</td> </tr> <tr> <td>DBLR 1</td> <td>"</td> </tr> <tr> <td>DBLR 2</td> <td>"</td> </tr> <tr> <td>RF AMP 1</td> <td>"</td> </tr> <tr> <td>RF AMP 2</td> <td>"</td> </tr> <tr> <td>RF AMP 3</td> <td>"</td> </tr> <tr> <td>RF AMP 4</td> <td>"</td> </tr> <tr> <td>RF PWR</td> <td>50</td> </tr> <tr> <td>VSWR</td> <td>1 (Approx.)</td> </tr> </tbody> </table>	SWITCH POSITION	INDICATION	DR PLATE MA X 1	50 to 60	OSC	See Note	BUFFER	"	DBLR 1	"	DBLR 2	"	RF AMP 1	"	RF AMP 2	"	RF AMP 3	"	RF AMP 4	"	RF PWR	50	VSWR	1 (Approx.)
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STEP	PROCEDURE
7	<p>Note: The MULTIMETER indications for these switch positions shall be compared with those indications recorded during the initial installation and tune-up. A 10-percent variation between initial and subsequent readings is tolerable. Refer to Table D for typical MULTIMETER indications.</p> <p>Remove the remote audio input line from TB401-1 and TB401-2. Connect the audio signal generator to TB401-1 and TB401-2 and adjust the signal generator for an output of 0 dBm at 1000 Hz. Place the multimeter switch to % MOD position.</p> <p>Requirement: MULTIMETER must not indicate more than 90 ±5 percent.</p> <p>Increase the audio signal generator output by 10 dBm.</p> <p>Requirement: MULTIMETER must not indicate more than 100 percent.</p> <p>Remove audio signal generator from TB401-1 and TB401-2. Replace remote audio input line.</p>
8	<p>Using the frequency meter, determine the operating frequency of the transmitter.</p> <p>Requirement: The measured frequency shall not deviate from the assigned frequency by more than +0.001 percent.</p>
9	<p>Place MULTIMETER switch to the OFF position. Place LOCAL-REMOTE switch to the REMOTE position. Remove all test apparatus. This completes the operations tests for the transmitter.</p>

5. FAULT-LOCATION PROCEDURES

STEP	PROCEDURE
1	<p>Check fuse F402, lamps DS401 and/or DS403, and jack J401.</p>
2	<p>Check the bias supply components. Disconnect the bias lead from C48 and connect the VTVM to the bias lead. The VTVM should indicate between 7 and 24 Vdc. Check capacitors C46, C47, and C48; check driver tube V1 for shorted elements. Disconnect the bias lead from C66; connect the VTVM to the bias lead. The VTVM should indicate between 33 and 66 Vdc. Check capacitors C61, C65, C66, C88, C89, C90, and C91. Check the +28 volt dc power supply components.</p>
3	<p>Check fuse F401; lamp DS402; transformer T401; switches S402, S403, S404, S405, S406, S410; and relays K401 and K402.</p>

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STEP	PROCEDURE
4	Check the +300 Vdc power supply components, fuse F401, and switch S408. Check the +300 volt lead with the VTVM; the indication should be +300 volts. Check capacitors C55, C56, C57, C62, C79, C80, C87 and C60. Check power amplifier tube V1 and driver tube V2. Check +850 Vdc power supply components, fuse F401, and switch S408. Disconnect +850 Vdc lead from capacitor C54 and connect VTVM to +850 Vdc lead; VTVM should indicate +850 volts. Check capacitors C52, C53, and C54. Check driver tube V1. Check +2000 Vdc power supply components, fuse F401, and switch S408. Check for evidence of arcing.
5	Check blower B401, relay K402, and fuse F403. Recheck the power amplifier tuning and adjustment procedures per Section 406-110-501. Check AGC circuit components.
6	Check components in the appropriate circuit. Check driver and power amplifier tubes V1 and V2. Check AGC circuit components and power coupler. Check filter (Z3, Z4, or Z5), power coupler and output loading.
7	Check the audio input level, and modulation circuit components and adjustments. Check the audio limiter components and the audio feedback circuit components and adjustments.
8	Check the oscillator adjustment procedure per Section 406-110-501; check the crystal oven for proper operation; replace the crystal.

6. ASSOCIATED APPARATUS

A. SG-34 Station Guardian

6.01 This part contains the procedure to be followed in performance testing the SG-34

station guardian. (See Fig. 1.) Prerequisite to the following performance test is the satisfactory completion of the performance test for the transmitter.

STEP	PROCEDURE
<p>Power Level Alarm</p>	
1	At the SG-34 station guardian, place the RF POWER selector switch to FOR (forward) position. Place the POWER ON switch in the up position.
2	At the transmitter, place the LOCAL-REMOTE switch in the LOCAL KEY position. Place the MULTIMETER SWITCH in the RF POWER position. (The MULTIMETER <i>must</i> indicate 50 watts before this test is continued.)
3	At the transmitter, adjust the AGC BIAS control, R358, in a counterclockwise direction until the meter on the station guardian indicates the power level at which operation of the alarm lamp is desired.

STEP	PROCEDURE
4	<p>Requirement: The amber ALARM lamp should be lighted. Readjust the POWER LEVEL ADJUST screw to meet this requirement, if necessary.</p> <p>At the transmitter, adjust the AGC BIAS control, R358, in a clockwise direction until the MULTIMETER again indicates 50 watts. Return transmitter switches to their original configuration (REMOTE or LOCAL).</p>
STEP	PROCEDURE
1	<p>VSWR Alarm Level</p> <p>At the transmitter, place the LOCAL-REMOTE switch to the OFF position. Place the PLATE switch in the OFF position.</p>
2	<p>Reverse the MicroMatch coupler in the transmission line so that the end marked LOAD is connected to the transmitter and the end marked TRANSMITTER is connected to the antenna end of the coaxial cable. Do not reverse the cable connections to the probes. Turn the RF POWER selector switch of the SG-34 to BACK position. Place the POWER ON switch in the up position.</p>
3	<p>At the transmitter, rotate the AGC BIAS control, R358, fully counterclockwise. Place the PLATE switch to the ON position. Place the LOCAL-REMOTE switch to LOCAL KEY position. Slowly rotate the AGC BIAS control, R358, in a clockwise direction until the meter indicates that power, in watts, at which an alarm is desired.</p> <p>Note: If not previously known, the required value of reflected power can be determined by use of Fig. 2 and a simple calculation. Locate the VSWR value on either the top or bottom scale, as applicable. Locate the corresponding point on the appropriate curve. On the left-hand scale, find the percent of incident power required. Convert the percentage to a decimal figure and multiply the normal transmitter operating power by this figure. The answer will be the reflected power in watts for the VSWR.</p>
4	<p>At the SG-34, adjust the VSWR LEVEL ADJUST screw until the red alarm lamp lights.</p>
5	<p>At the transmitter, place the LOCAL-REMOTE switch to the OFF position. Place the PLATE switch to the OFF position. Reconnect the MicroMatch coupler in the normal manner with the end marked TRANSMITTER connected to the transmitter and the end marked LOAD connected to the coaxial cable leading to the antenna.</p>
6	<p>At the transmitter, place the PLATE switch to the ON position. Place the LOCAL-REMOTE switch to LOCAL KEY position. Rotate the AGC BIAS control, R358, in a clockwise direction until the MULTIMETER again indicates an RF power of 50 watts. The AGC BIAS control, R358, should now have been returned to its original position.</p> <p>This completes the performance tests on the SG-34 station guardian.</p>

TABLE A
NOMINAL TRANSISTOR DC VOLTAGES (NOTES 9, 12)

TRANSISTOR	Q1	Q2	Q3 (Note 1)	Q4 (Note 2)	Q5 (Note 11*)	Q6 (Note 11*)		
EMITTER	10.7	4.5	4.8	4.4	0.54	0.12		
BASE	11.3	5.1	5.4	5.2	0.89	0.54		
COLLECTOR	15.9	16.9	16.9	16.9	16.5	16.5		
TRANSISTOR	Q201 (Notes 3, 4)	Q202 (Note 5)	Q203 (Note 6)	Q204 (Note 7)	Q205	Q206		
EMITTER	0.64	0	0	0	5.1	6.0		
BASE	0.94	0.47	0.48	0.24	5.7	6.6		
COLLECTOR	29.5	6.0	6.0	30.0	14.1	29.9		
TRANSISTOR	Q301	Q302	Q303	Q304	Q305	Q306	Q307	Q308
EMITTER	0.18	0.29	15.4	0.28	4.0	4.0	3.4	0.9
BASE	0.72	0.65	15.9	0.79	4.5	4.5	3.85	1.42
COLLECTOR	4.68	5.4	18.5	13.7	28.6	28.6	28.6	16.4
TRANSISTOR	Q309	Q310	Q311	Q312	Q401	Q402	Q403	
EMITTER	1.14	0.4	15.8	0	40.0	30.0	9.45	
BASE	1.47	1.03	14.5	0.59	40.05	30.05	10.0	
COLLECTOR	8.4	3.2	28.8	16.4	59.0	40.0	34.5	

TABLE B
NOMINAL TRANSISTOR AC VOLTAGES (NOTES 8, 12)

TRANSISTOR	Q2	Q3 (Note 1)	Q4 (Note 2)	Q201 (Notes 3, 4)	Q202 (Note 5)	Q203 (Note 6)	Q204 (Note 7)
EMITTER	2.4	1.6	2.7	1.26	0	0	0
BASE	3.1	3.3	3.1	0.17	0.5	0.52	0.69
COLLECTOR	10.1	10.1	10.1	14.8	6.0	6.0	30.0

TABLE C
NOMINAL TRANSISTOR AUDIO VOLTAGES

TRANSISTOR	Q301 (Notes 10, 12)	Q302 (Notes 10, 12)	Q303 (Notes 10, 12)	Q304 (Notes 10, 12)	Q305 (Notes 10, 12)
EMITTER	2.0	15.2mV	194mV	18.0mV	0.78V
BASE	2.4mV	16.8mV	197.9mV	19.3mV	0.78mV
COLLECTOR	71.0	197.0mV	2.9mV	1.75mV	72.0mV
TRANSISTOR	Q306 (Notes 10, 12)	Q307 (Notes 10, 12)	Q308 (Notes 10, 12)	Q309 (Notes 10, 12)	Q310 (Notes 10, 12)
EMITTER	1.75V	0.57V	52.0mV	0.19V	24.5mV
BASE	1.75V	0.54V	54.0mV	0.197V	26.7mV
COLLECTOR	72.0mV	1.15mV	0.54V	1.95V	180.0mV

TABLE D
TYPICAL MULTIMETER INDICATIONS
FOR 50-WATT OPERATION

METER FUNCTION	MULTIMETER INDICATION		
	225 MHZ	312 MHZ	400 MHZ
BUFFER	26	43	60
DBLR 1	40	48	57
DBLR 2	46	57	68
RF AMP 1	74	52	30
RF AMP 2	28	27	26
RF AMP 3	37	31	28
RF AMP 4	16	34	52

Notes For Tables A, B, and C

1. Measurement taken at junction of L9 and C43.
2. Measurements taken at junction of L13 and C40.
3. Measurement taken at junction of L201 and C203.
4. Measurement taken at external end of C202.
5. Measurement taken at junction of L204 and C212.
6. Measurement taken at junction of L206 and C227.
7. Measurement taken at junction of L208 and C239.
8. The ac voltages for the transistors in the oscillator-doubler and exciter modules are average values for a 242F-9C adjusted to 50-watt output.
9. The dc voltages for the transistors in the oscillator-doubler and exciter modules are average values obtained under the following conditions.
 - (a) The crystal is removed.
 - (b) AGC BIAS control, R415, is in maximum counterclockwise position.
 - (c) RF DRIVE control, R358, is in maximum clockwise position.
 - (d) 242F-9C is turned on.
 - (e) MULTIMETER SWITCH is OFF.
10. The audio rms voltage levels are average values and are shown for a 0-dBm input with modulation set for 90 percent.
11. Dc readings obtained by using Weston Model 911A 20,000 ohm/Voltmeter, except as noted by asterisk (*). These readings are obtained by using Hewlett-Packard Model 410B VTVM.
12. The color coding for the transistors, with the exception of Q401, 402, and 403 are as follows:
 - Yellow — emitter
 - Green — base
 - Blue — collector

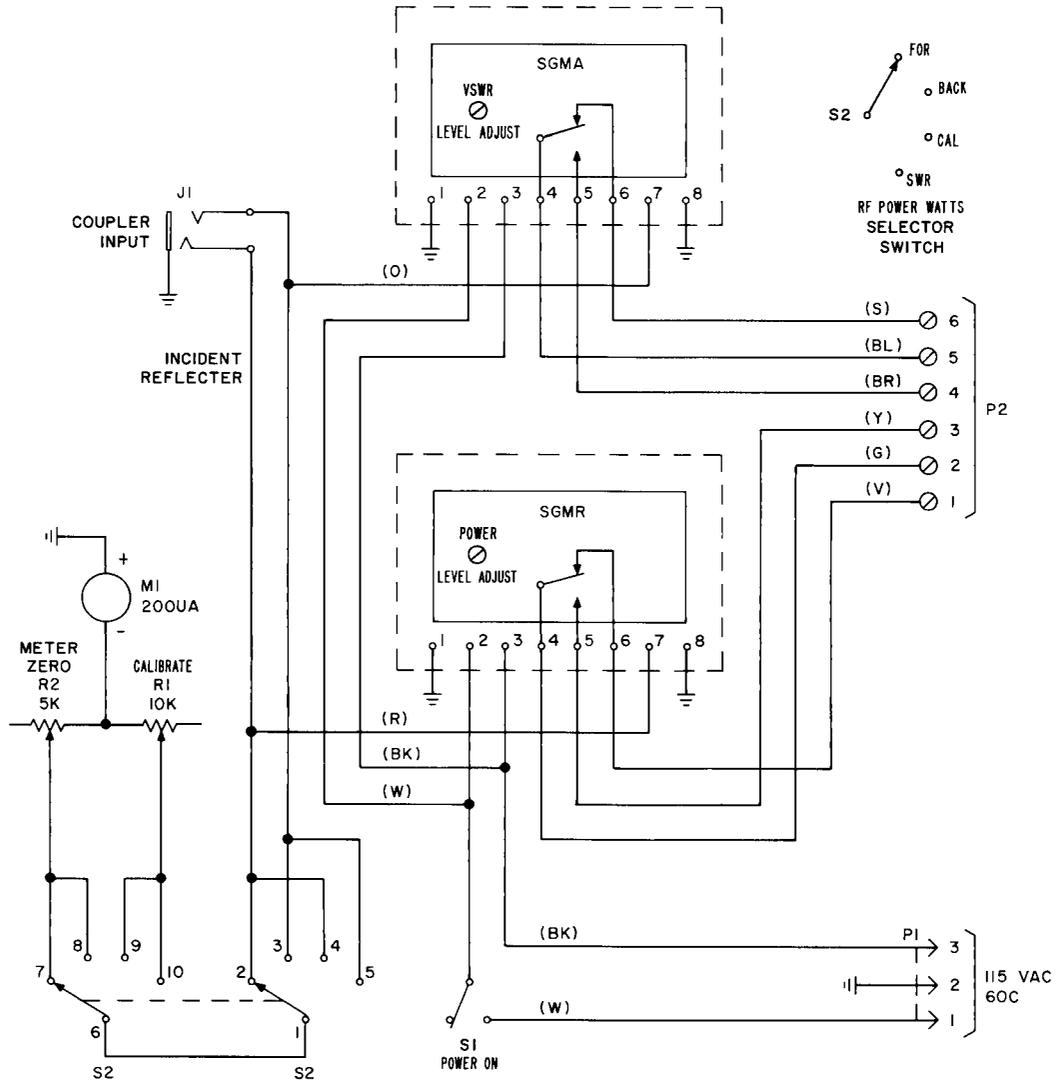
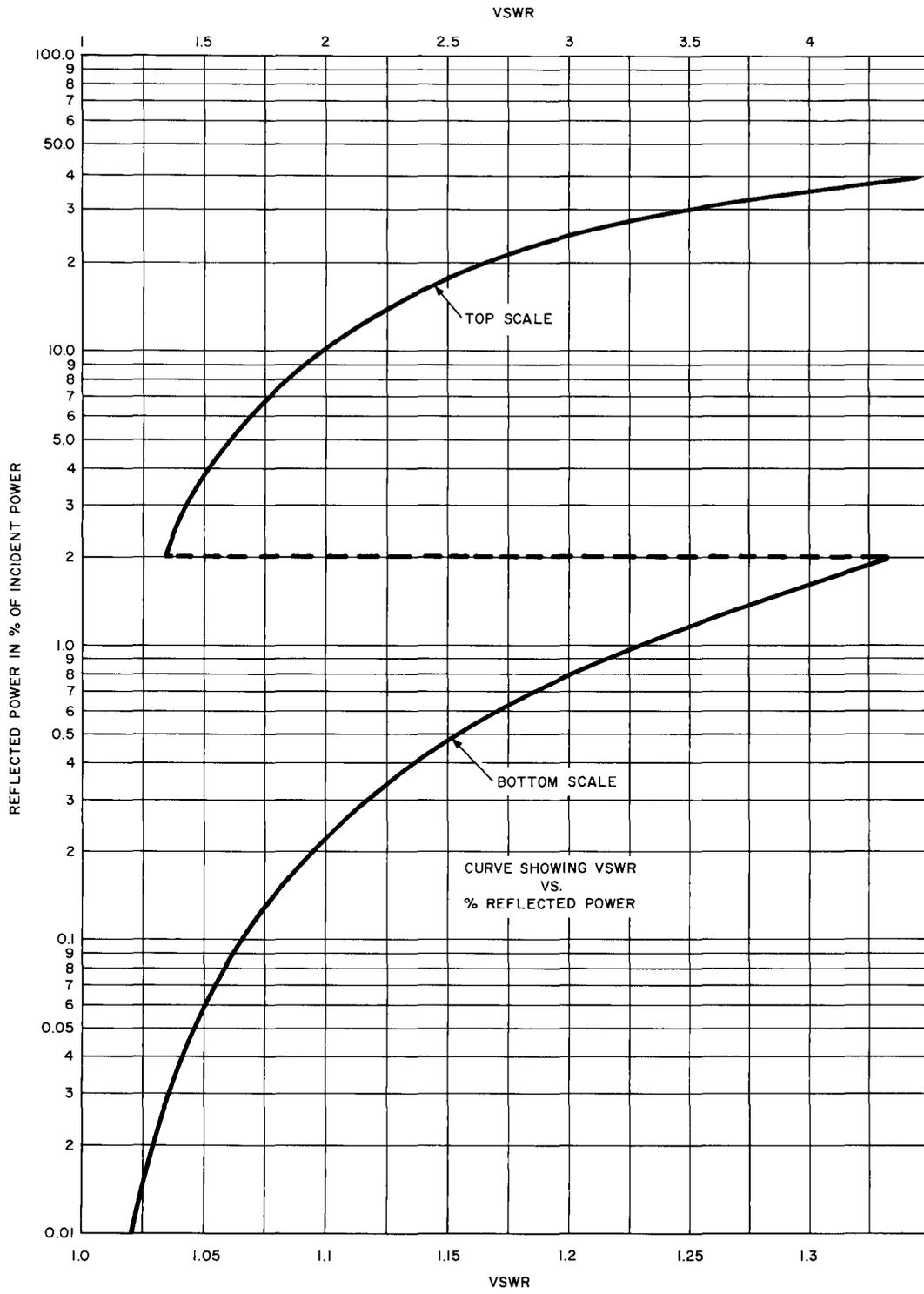


Fig. 1—SG-34 Station Guardian, Schematic Diagram



$$\% \text{ REFLECTED POWER} = \frac{\text{REFLECTED POWER}}{\text{INCIDENT POWER}} \times 100$$

Fig. 2—Reflected Power Curve