CHAPTER 5

ALINEMENT

95. Test Equipment Required for Alinement

The following test equipment is required for alinement of Radio Sets AN/PRC–9A and –10A:

Item	Technical manual
Signal Generator AN/URM–48	TM 11–1257
Electronic Multimeter TS–505/U	TM 11–5511
Rf Wattmeter ME–11/U	
Frequency Meter TS–174B/U	TM 11–5044

96. Discriminator, If., and Pulse-Sweep Generator Alinement

These plug-in units are all hermetically sealed and properly alined at the factory. Consequently, if any one of these units is found to be out of alinement or defective, substitute a good unit for the defective unit. The test, repair, and alinement of the defective plug-in unit can be performed by a skilled technician by following the procedures outlined in paragraphs 75 through 94.

97. Mixer Alinement

(fig. 51)

To aline the mixer stage, proceed as follows:

a. Connect the vtvm across terminal 4 of test socket J7 to ground.

b. Apply a 4.3-mc signal to test point E19 (fig. 33) through a 1,000-$\mu\mu$f blocking capacitor. Tune the rf signal generator input to exactly 4.3 mc, by holding the POWER switch in CAL & DIAL LITE position while adjusting the input signal for a zero beat in the handset.

c. Set the POWER switch to ON. Use the alinement tool (mounted on the chassis) to adjust the core of T2 (fig. 33) for maximum negative voltage on the vtvm. *Do not apply excessive pressure because transformer T2 is fragile and can be easily broken.*

98. Receiver Oscillator Alinement

(fig. 51)

a. Center the pointer of the receiver-transmitter (fig. 3) to the middle of its extremes of travel. Turn the main TUNING capacitor to its fully meshed position. When this is done, a marker line, located just below the lowest frequency mark on the dial drum, should be within one-half of a small division of the dial from the previously set pointer. If this condition is not possible, readjust the dial drum as instructed in paragraph 74.

b. Set the receiver-transmitter to 38.7 mc (27.95 mc on AN/PRC–9A). Calibrate the rf signal generator to this frequency (use Frequency Meter TS–174B/U), and then connect it into the radio set through AUX ANT connector J3. Connect the vtvm across terminal 4 of test socket J7 and ground. Adjust coil L21 (fig. 33) in the receiver oscillator for maximum negative voltage on the vtvm. Reduce the output voltage of the signal generator to a level just enough to enable a peak reading to be obtained on the vtvm. Check against unwanted signal pickup from other sources by varying the output control of the signal receiver. The vtvm reading should vary correspondingly.

c. Set the receiver-transmitter to 53.75 mc (38.7 mc on AN/PRC–9A). Calibrate the signal generator to this frequency. Adjust capacitor C43 (fig. 33) in the receiver oscillator for maximum voltage on the vtvm.

d. Repeat procedures in *b* and *c* above until no further adjustments of L21 and C43 are necessary for peak output at the low and high frequency ends of the band. Finish the alinement at the high frequency end with adjustment of C43.

99. Rf Alinement

(figs. 51 and 52)

a. Set the receiver-transmitter to 38.7 mc (27.95 mc on AN/PRC–9A). Calibrate the rf signal

generator to this frequency. Connect the vtvm across terminal 4 of test socket J7 and ground.

b. Connect the rf signal generator in series with a 33-ohm resistor to the AUX ANT connector J3. Vary the rf signal generator tuning dial slightly until maximum reading on the vtvm is obtained. Adjust coils L13, L11, and L9 (fig. 33) in that order for maximum reading on the vtvm, while reducing the rf signal generator output voltage to a level just sufficient for peak reading

c. Tune the receiver-transmitter and rf signal generator to 53.75 mc (38.7 mc on AN/PRC–9A). Vary the rf signal generator tuning dial slightly for peak reading on the vtvm. Adjust capacitors C26, C22, and C20 (fig. 33) in that order for maximum reading on the vtvm.

d. Repeat the adjustments of L13, L11, and L9 at 38.7 mc and C26, C22, and C20 at 53.75 mc, until no further adjustments are necessary for peak output.

e. Check the receiver alinement with the crystal-controlled 2.15-mc calibrating oscillator V9 as follows. Connect a handset to AUDIO connector J8. Hold the POWER switch in CAL & DIAL LITE position and slowly rotate the TUNING control from the low end of the dial to the high end. A beat note should be heard at each red-marked calibration point on the dial. If satisfactory results are not obtained, repeat the alinement procedures for the mixer, receiver oscillator, and rf amplifier stages. A summarized chart for the receiver alinement is given below.

Receiver alinement

Step	Tune rf signal generator to (mc)		Apply input to	Adjust TUNING capacitor for	Set POWER switch to	Adjust	Indication (vtvm or handset)
	AN/PRC–9A	AN/PRC–10A					
1a	4. 3	4. 3	Test point E–19 through a 1,000 μf capacitor.	----------	CAL & DIAL LITE.	Rf signal generator.	Zero beat in handset.
1b	4. 3	4. 3	Test point E19 through a capacitor.	----------	ON----------	T2 core--------	Peak negative voltage.
2a	27. 95	38. 7	AUX ANT J3----------	38.7 calibration mark (27.95 mc on AN/PRC–9A).	ON----------	L21----------	Peak negative voltage.
2b	38. 7	53. 75	AUX ANT J3----------	53.75 calibration mark (38.7 mc on AN/PRC–9A).	ON----------	C43----------	Peak negative voltage.
3a	27. 95	38. 7	J3 through a 33-ohm resistor.	38.7 mc (27.95 mc on AN/PRC–9A).	ON----------	L13, L11, L9---	Maximum reading.
3b	38. 7	53. 75	J3 through a 33-ohm resistor.	53.75 mc (38.7 mc on AN/PRC–9A).	ON----------	C26, C22, C20--	Maximum reading.
4	----------	----------	----------	Vary slowly from 38 to 55 mc (27 to 39 mc on AN/PRC–9A).	CAL & DIAL LITE.	----------	Zero beat at each calibration point on dial.

Note. Connect Handset H–33B/PT into AUDIO connector J8, and connect vtvm across to pin 4 of test socket J7 and ground.

100. Transmitter Alinement

(figs. 33 and 52)

Aline the transmitter only after the receiver has been alined. Proceed as follows:

a. Turn the stem of coil L3 clockwise to the bottom position.

b. Turn C11 to the position where the top of the stem is flush with the bottom of the mounting plate on which the mounting brackets for the alinement tool are located.

c. Adjust neutralizing capacitor C17 to minimum capacitance; that is, the red dot on the movable portion is farthest from the two mounting holes at the base of the capacitor. Maximum capacitance is indicated when the red dot is on the side of the two mounting holes and between them.

d. Connect the wattmeter between AUX ANT jack J3 and chassis ground.

e. Connect the ground lead of the vtvm to chassis ground; connect the dc probe to pin 3 of test socket J7. Zero the pointer on the vtvm.

f. Set the frequency meter to 39 mc (28 mc for AN/PRC–9A), and let it transmit at this frequency. Hold the POWER switch of the radio set in CAL & DIAL LITE position. Turn the TUNING control to 39 mc (28 mc on AN/PRC–9A), and adjust it for zero beat in the handset. Lock the TUNING control (with the DIAL LOCK lever) at this frequency. Release the POWER switch to ON. The receiver-transmitter is now set at the low-end alinement frequency, and the frequency meter acts as a standard frequency reference.

g. Lock the radio set in transmit operation by taping down the push-to-talk button on the handset, or fabricate a spring clip for use in holding down the button. Disable the afc circuit by removing the second if. plug-in can (U102) and the pulse-sweep generator plug-in can (U301).

h. Adjust the frequency meter for use as a heterodyne detector at 39 mc, and tune L3 until zero beat is obtained in the headset of the frequency meter. The low end of the transmitter is now tuned to exactly the same frequency as the low end of the receiver.

i. Adjust L9 for maximum rf power output (as indicated on the wattmeter or its equivalent). Readjust L3 for zero beat.

j. Set the frequency meter to 54 mc (38 mc for AN/PRC–9A), and let it transmit at this frequency. Replace plug-in cans U102 and U301. Unlock the push-to-talk button on the handset, so that the radio set is in the receive condition. Hold the POWER switch in CAL & DIAL LITE position. Turn the TUNING control to 54 mc (38 mc on AN/PRC–9A), and adjust for zero beat in the headset at this frequency. Release the POWER switch to ON. The receive-transmitter is now set at the high-end alinement frequency, and the frequency meter acts as a standard frequency reference at the high end.

k. Lock the radio set in the transmit operation by taping down the push-to-talk button on the handset, or fabricate a spring clip for use in holding down the button. Again remove plug-in cans U102 and U301 to disable the afc circuit.

l. Adjust the frequency meter for use as a heterodyne detector, and tune C11 until zero beat is obtained in the headset of the frequency meter. Adjust C20 for maximum rf power output (as indicated on the wattmeter), and then readjust C11 for zero beat. The high end of the transmitter is now tuned to exactly the same frequency as the high end of the receiver. Replace plug-in cans U102 and U301.

m. Adjust the neutralizing capacitor C17 so that the transmitter frequency shift is less than 1,000 cycle when the wattmeter is removed and the AUX ANT center conductor is shorted to its outer conductor. Short the AUX ANT conductors in the most direct and shortest way possible. Measure the frequency shift on the frequency meter. This neutralizing adjustment may be made only at the high-end alinement frequency.

n. Remove the AUX ANT short, and reconnect the wattmeter. Readjust C20 for maximum power output and then C11 for zero beat on the frequency meter headset while it is set at the 54-mc (38 mc on AN/PRC–9) high-end alinement frequency.

o. Repeat the low-end, high-end, and neutralizing alinement procedures (*f–n* above) until no further adjustment is necessary.

p. Check the transmitter alinement at 54 mc (38 mc on AN/PRC–9A) as follows: Connect a vtvm to pin 3 of test socket J7. Measure the voltage with the transmitter operating at 54 mc (38 mc on AN/PRC–9A) into the wattmeter connected to J3. Turn off power, remove the wattmeter from AUX ANT J3, and short the center conductor of J3 directly to its outer conductor. Turn on power, and with the transmitter operating into the shorted antenna jack, check for a change in the voltage reading on the vtvm. It should not change more than .2 volt. A summarized chart of the transmitter alinement is given below.

Transmitter alinement

Step	Set frequency meter to	Adjust radio set TUNING control (mc) to		Position of push-to-talk switch	Adjust	Indication
		AN/PRC–9A	AN/PRC–10A			
1*a*	39 mc (transmit) (28 mc for AN/PRC–9A).	28	39	Receive	TUNING control to 39 mc (28 mc on AN/PRC–9A).	Zero beat in radio set handset.
1*b*	39 mc (heterodyne) (28 mc for AN/PRC–9A).	28	39	Transmit	L3	Zero beat in frequency meter headset.
1*c*	----------	28	39	Transmit	L9	Maximum rf output on wattmeter.
1*d*	39 mc (heterodyne). Repeat step 1*b*	28	39	Transmit	L3	Zero beat in frequency meter headset.
2*a*	54 mc (transmit) (38 mc for AN/PRC–9A).	38	54	Receive	TUNING control to 54 mc (38 mc on AN/PRC–9A).	Zero beat in radio set handset.
2*b*	54 mc (heterodyne) (38 mc for AN/PRC–9A).	38	54	Transmit	C11	Zero beat in frequency meter headset.
2*c*	----------	38	54	Transmit	C20	Maximum rf output on wattmeter.
2*d*	54 mc (heterodyne). Repeat step 2*b*	38	54	Transmit	C11	Zero beat in frequency meter headset.
3*a*	54 mc (heterodyne) (38 mc for AN/PRC–9A).	38	54	----------	C17	Less than 1,000-cycle frequency shift when AUX ANT is shorted.
3*b*	54 mc (heterodyne) (38 mc for AN/PRC–9A).	38	54	----------	C11	Zero beat in frequency meter headset.
3*c*	----------	38	54	----------	C20	Maximum rf output on wattmeter.
3*d*	54 mc (heterodyne) (38 mc for AN/PRC–9A).	38	54	Transmit	C11	Zero beat in frequency meter headset.
4	Repeat steps 1*a* through 3*d* until no readjustments are necessary.					
5	Check alinement by observing less than .2 volt change on vtvm when wattmeter is removed and J3 shorted.					

Note. Connect wattmeter to AUX ANT jack J3; and connect vtvm to pin 3 at test socket J7.

CHAPTER 6

FINAL TESTING

101. Purpose of Final Testing

The tests described in paragraphs 102 through 127 are made to assure that a repaired equipment meets minimum performance standards before being issued for service. If the equipment fails to pass any of these tests, troubleshooting and repair procedures must be performed to correct the trouble.

102. Test Equipment Required for Final Testing

Test equipment required for final testing Radio Set AN/PRC–9A and –10A is as follows:

a. Rf Signal Generator. The rf signal generator (Signal Generator AN/URM–48 or equivalent) must supply up to 1,000 microvolts (uv) at 20 to 100 mc; must have up to 25 kc deviation; must have modulating frequencies of 250, 400, 1,000, 2,500, and 5,000 cps, or provide for external modulation; and must have an output impedance not exceeding 50 ohms.

b. If. Signal Generator. The if. signal generator (Signal Generator I–208 or equivalent) must supply a 4.3-mc signal with an output of at least .2 volt. The signal frequency must be continuously variable between 4.27 and 4.33 mc.

c. Audio Oscillator. The audio oscillator (Audio Oscillator TS–382/U or equivalent) must supply audio signals from 250 to 5,000 cps.

d. Millivoltmeter. The millivoltmeter (Electronic Multimeter ME–6A/U, Voltmeter ME–30A/U (or equivalent) must be able to measure ac voltage in millivolts.

e. Frequency Meter. The frequency meter (Frequency Meter TS–174B/U or equivalent) must be capable of measuring frequencies from 27 to 55 mcs.

f. Electronic Voltohmmeter. The electronic voltohmmeter (Electronic Multimeter TS–505/U or equivalent) must be able to measure dc voltages and must have an input resistance of not less than 10 megohms on all voltage ranges.

g. Output Meters. The output meter (Output Meter TS–585A/U or equivalent) must read directly in mw and must offer an impedance of 600 ohms.

h. Panoramic Indicator. The panoramic indicator (Panoramic Indicator IP–173/U or equivalent) must be capable of indicating deviation frequencies from 5 to 17 kc.

i. Rf Wattmeter. The rf wattmeter (Rf Wattmeter ME–11/U or equivalent) must be capable of accurately reading radio-frequency power outputs from 0 to 2 watts. It must have a termination impedance of 50 ohms (nonreactive).

Note. To aid in servicing, a cable may be made that has a plug for mating with J8 at one end and a terminal board at the other end. Test connections could then be made to this terminal board for independently turning on and off the transmitter, headset connections, and audio oscillator input.

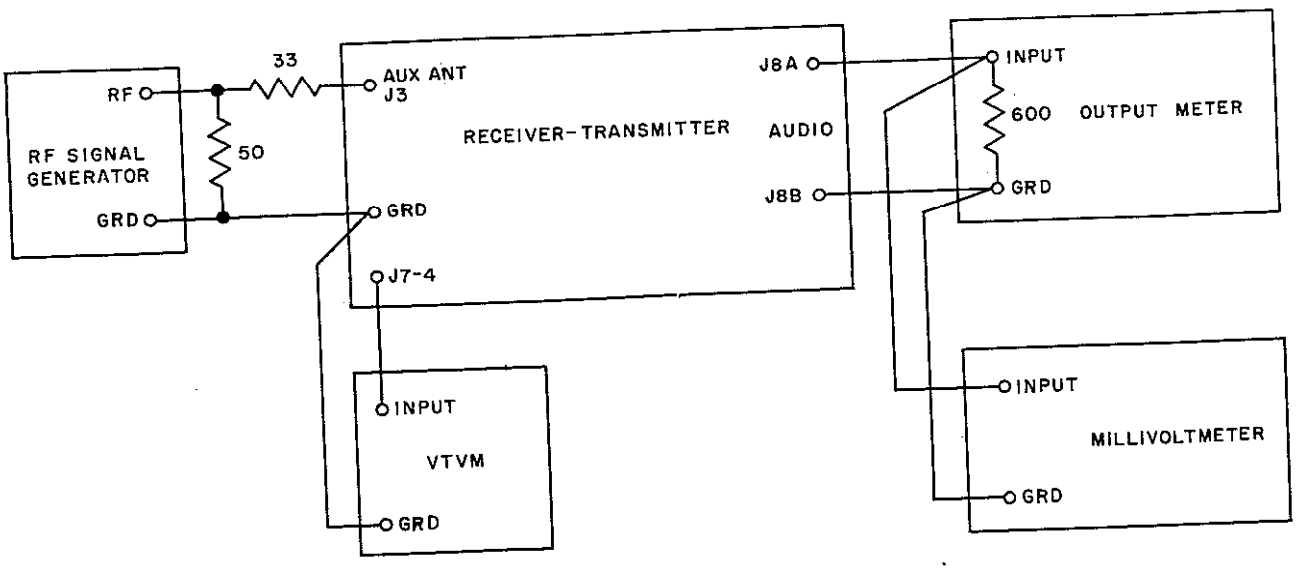
103. Test Setup and Standard Conditions for Receiver Testing

Most of the tests on the receiver section are performed under the standard conditions listed below and illustrated in figure 51. Modifications from this basic setup are covered in the paragraphs for the individual tests.

a. Connect a 33-ohm resistor as dummy antenna in series with the rf signal generator. Connect a 50-ohm terminating resistor across the rf signal generator (fig. 51). Use ½-watt carbon resistors.

b. Connect the output meter across terminals A and B of AUDIO connector J8. Set the impedance control knob of the output meter for 600 ohms. Connect the millivoltmeter in parallel with the output meter; connect the *hot* side of the millivoltmeter to pin A. Pin B connects to chassis ground.

c. Apply an rf input signal of .7 microvolt 15-kc deviation at 1,000 cps to AUX ANT connector J3. This will be referred to as the *standard rf input.*



NOTES
1. ALL RESISTOR VALUES ARE IN OHMS.
2. USE A 1,000 UUF CAPACITOR IN SERIES WITH HOT SIDE OF SIGNAL GENERATOR TO FEEDTEST SIGNALS INTO RECEIVER AT POINTS OTHER THAN J3.

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Figure 51. Connections for receiver testing.

d. Maintain the audio output level (at terminal A of AUDIO connector J8 across a 600-ohm load impedance) constant at 1 milliwatt by adjustment of the VOL control. This will be referred to as the *Standard audio output.*

e. Connect an electronic voltohmmeter (vtvm) across pin 4 of test socket J7 to ground.

104. Receiver Quieting Sensitivity

Note. The following tests are made at signal frequencies of 39, 47, and 54 mc with Radio Set AN/PRC-10A, and 28, 33, and 38 mc with Radio Set AN/PRC-9A. All the signal frequencies shown in parentheses are used only with the AN/PRC-9A.

The receiver quieting sensitivity test measures the ratio of the receiver noise output with no signal input to the receiver noise output with an unmodulated signal input. The receiver volume control should be set for *standard audio output* (par. 103*d*) with *standard rf input* (par. 103*c*).

a. Connect the radio receiver-transmitter as shown in figure 51. Set the rf signal generator to supply a 39-mc (28-mc) signal at 1.5 uv of unmodulated output.

b. Adjust the radio set for 39 mc (28 mc). Tune the signal generator for maximum limiter grid voltage on the vtvm, and then adjust the fine tuning of the signal generator for maximum dip on the audio voltmeter. Turn the SQUELCH control to OFF.

c. Reduce the signal generator output to .7 uv, and turn on frequency modulation of 15-kc deviation at 1,000 cps.

d. Adjust the radio set VOL control for 1 milliwatt of audio output power. The set is now adjusted for standard audio output with standard rf input.

e. Reduce the rf signal generator output to zero, and note the db reading on the output meter.

f. Set the rf signal generator for 1.5 uv of unmodulated carrier output. The db drop from that noted in *e* above should be at least 16 db (17 db in AN/PRC-9A).

g. Repeat the test at 47 mc (33 mc) and at 54 mc (38 mc).

105. Receiver Operating Sensitivity and Squelch Sensitivity

The operating sensitivity test measures the ratio of the standard audio output with standard modulated input to the audio output with unmodulated

signal input. It is a signal-plus-noise to noise test in which the receiver volume control is preset for *standard audio output* with *standard rf input*. The squelch sensitivity test measures the ratio of the modulated signal input needed to release K2 when the SQUELCH control is at maximum to the modulated signal input needed to release K2 when the SQUELCH control is set at the minimum level, which energizes K2.

a. Connect the radio receiver-transmitter as shown in figure 51. Set the rf signal generator to supply an unmodulated standard rf input signal at 47 mc (33 mc).

b. Turn the SQUELCH control to OFF. Set the radio set to the rf signal generator frequency, and then tune the input signal for maximum limiter grid voltage on the vtvm. Adjust the rf signal generator fine tuning for maximum dip on the output meter.

c. Adjust the rf signal generator for modulation of 15-kc deviation at 1,000 cps. The indication on the output meter should not be less than 1.2 milliwatts.

d. Adjust the radio set VOL control for 1 milliwatt of output (standard output).

e. Turn off the rf signal generator modulation. There should be a minimum drop of 11 db (12 db in AN/PRC–9A). This is the db measure of receiver operating sensitivity.

f. Turn the modulation on, and decrease the rf signal generator output to zero.

g. Turn the SQUELCH control clockwise until the audio (noise) output cuts off due to relay K2 energizing.

h. Turn the SQUELCH control counterclockwise until audio output returns (relay K2 releases). Audio should reappear within three dots on the SQUELCH control scale. Repeat the procedures given in *g* above.

i. Increase the rf signal generator input until the audio output returns. This should occur before the rf signal generator output reaches 2 microvolts.

j. Turn the SQUELCH control to maximum clockwise position.

k. Increase the rf signal generator input until the audio output returns. At this point, the input should be less than 100 microvolts. The rf signal generator input in this procedure (SQUELCH control at maximum) should be at least four times as great as the input obtained in *i* above. This is a measure of squelch sensitivity.

l. Turn the SQUELCH control to OFF, and repeat the test at 54 mc (38 mc).

106. Receiver Overall Selectivity

This test measures the receiver band width at two points on the voltage response curve: at two times down and at 1,000 times down. The centering of the response curve about the carrier frequency is also checked.

a. Connect the radio receiver-transmitter as shown in figure 51. Turn the SQUELCH control to OFF. Set the rf signal generator to supply an unmodulated signal of 1 microvolt at 47 mc (33 mc).

b. Tune the radio set to 47 mc (33 mc), and then adjust the rf signal generator for maximum limiter grid voltage on the vtvm. Adjust the fine tuning for maximum dip on the output meter.

c. Set the rf signal generator input for −5 volts of limiter grid voltage on the vtvm. Note the input required.

d. Double the rf signal input noted in *c* above. Now vary the frequency of the input signal on both sides of the resonant frequency until the same meter reading (−5 volts) is observed on each side. Note the frequency deviations from the carrier frequency. Their sum should be between 72 and 88 kc (65 and 85 KC with AN/PRC–9A). Their difference divided by 2 should be less than 4 kc (5 kc).

e. Increase the rf signal input to 1,000 times the input noted in *c* above. Again vary the frequency of the input signal until the reference meter reading (−5 volts) is observed on each side of the center frequency. Note the frequency deviations. Their sum should not exceed 280 kc.

Note. In *d* and *e* above, vary the frequency of the rf signal generator in a slow uniform manner so that irregularities in the response characteristic, if they exist, can be observed.

f. The center frequency of the overall selectivity curve is that frequency between the two frequencies at the two times down points (*d* above). The center frequency should be within 4 kc (5 kc) of the carrier frequency.

107. Spurious Responses

Spurious responses are responses to undesired signals. A good radio receiver should have a high rejection ratio for such unwanted signals.

a. Connect the radio receiver-transmitter as shown in figure 51. Apply an unmodulated 1-microvolt input signal at 47 mc (33 mc).

b. Measure the voltage at terminal 4 of J7 (limiter grid voltage) with a vtvm and record these readings.

c. Increase the rf signal generator output voltage 100,000 times (100 db) and tune the rf signal generator from 2 to 100 mc while observing the voltage reading at terminal 4 of J7. At those frequencies that produce a limiter grid voltage greater than the readings recorded in *b* above, decrease the rf signal generator voltage to a value that will produce the same limiter grid voltage reading. The ratio of this signal voltage to 1 uv (2.5 uv on AN/PRC–9A) is the rejection ratio for that frequency.

d. The rejection ratio of spurious responses, including those of the image frequency (dial frequency plus 8.6 mc), should be greater than 60 db (voltage ratio of 1,000). The rejection ratio of the if. should be greater than 100 db (voltage ratio of 100,000).

108. Receiver Limiting

a. Connect the radio set as shown in figure 51. Set the rf signal generator to supply a 3-uv signal with 15 kc deviation at 1,000 cps on a carrier frequency of 47 mc (33 mc).

b. Adjust the receiver volume control for standard audio output, and note the db reading.

c. Increase the rf input signal to 1,000 uv. The audio output should not vary more than 1 db for any input variation between 3 and 1,000 uv.

109. Receiver Audio Fidelity

a. Connect the radio set as shown in figure 51. Set the rf signal generator to supply a 10-uv signal with 15 kc deviation at 1,000 cps on a carrier frequency of 47 mc (33 mc).

b. Adjust the receiver volume control for 2.5 mw audio power output. Note the db reading on the output meter, and use it as a zero reference in determining the db gain or loss at the test audio frequencies shown below. The audio response of the receiver should be within the limits given below.

Audio frequency (cps)	Response
1,000	0 db (2.5 mw level).
250	+4 to −2 db.
400	+5 to 0 db.
2,500	−10 to 0 db.
5,000	−50 to −12 db.

110. Af Power Output

a. Connect the radio set as shown in figure 51. Set the rf signal generator to supply a 10-uv signal with 15 kc deviation at 1,000 cps on a 47-mc (33-mc) carrier frequency.

b. Turn the VOL control to its maximum clockwise position. The output meter should be at least 6 mw.

111. Microphonics

a. Connect the rf signal generator to the radio set as shown in figure 51. Connect either a handset or a headset to AUDIO connector J8, so that the audio output may be heard.

b. Set the rf signal generator to supply a 10-uv unmodulated input signal at 47 mc (33 mc). Tune the radio set to this frequency, and turn the VOL control to its maximum clockwise position.

c. Tap on the case with a rubber mallet, while listening for microphonics in the receiver output. No objectionable noises should be heard.

112. Discriminator Tests

a. Discriminator Center Frequency.

(1) Connect the vtvm to pin 3 of test socket J7. Connect the handset to AUDIO connector J8.

(2) Apply an unmodulated 140-uv 4.3-mc signal to test point E19 (mixer grid) through a .006-μf capacitor.

(3) Hold the POWER switch in CAL & DIAL LITE position, and tune the rf signal generator for zero beat.

(4) Increase the rf signal generator output to 5000 uv.

(5) If the discriminator is exactly on center frequency, the vtvm should read zero. If not, adjust the fine tuning of the rf signal generator until the vtvm reads zero. The amount of deviation from the 4.3-mc frequency setting should not exceed ±4 kc (±5 kc).

b. Discriminator Linearity and Band Width

(1) Connect the radio set and apply an unmodulated 4.3-mc signal to E19 as described in *a* above.

(2) Hold the POWER switch in CAL & DIAL LITE position, and tune the rf signal generator for zero beat. Note the setting of the rf signal generator.

(3) Increase the rf signal generator frequency 30 kc, and note the discriminator voltage.
(4) Continue increasing the input signal frequency until a peak voltage is reached. Note the frequency deviation from the 4.3-mc setting.
(5) Decrease the rf signal generator 30 kc below the 4.3-mc setting, and note the discriminator voltage.
(6) Continue decreasing the input signal frequency until a peak voltage is reached. Note the frequency deviation from 4.3 mc.
(7) The voltages observed in (3) and (5) above should be at least 4.5 volts; the smaller reading should be at least 75 percent of the larger reading.
(8) The sum of the frequency deviations observed in (4) and (6) above should be at least 100 kc.

113. Frequency Stability

a. Couple a frequency meter to receiver oscillator V8, and set the TUNING dial to 55 mc (39 mc).

b. Turn on the radio set, and after no more than 30 seconds, measure the receiver oscillator frequency.

c. Check to see that the battery supply voltages are as follows:

A	1.4 v dc
B_1	65 v dc
B_2	130 v dc
C	−5.6 v dc

d. Measure the receiver oscillator frequency at 5-minute intervals for 30 minutes. The frequency drift of the receiver oscillator should not exceed 9 kc in the first 30 minutes of operation.

114. Reception Test

Screw the short antenna to the SHORT ANT jack. With a similar radio set located at least 50 feet away and tuned to the same frequency, voice signals transmitted from that radio set should be clear and of good quality in the radio set being tested.

115. Test Setup and Standard Conditions for Transmitter Testing

Most of the tests on the transmitter section are performed under the standard conditions listed below and shown on figure 52. Modifications from this basic setup are explained in the paragraphs for the individual tests.

a. Connect the rf wattmeter between AUX ANT connector J3 and ground. A resistor of 50 ohms (nonreactive between 28 and 55 mc) can be used instead to terminate the transmitter output if a wattmeter is not available.

b. Apply an audio input signal of 85 millivolts (330 millivolts for AN/PRC–9A) at 1,000 cps to pin C (mike input) of AUDIO connector J8, through the impedance network shown in figure 52.

c. Connect a millivoltmeter across the audio input to the transmitter.

d. Couple the frequency meter antenna around the rf wattmeter cable or AUX ANT connector J3.

116. Transmitter Frequency

Check the transmitter tuning alinement at 39 mc (28 mc), 47 mc (33 mc), and 54 mc (38 mc), as follows:

a. Connect the radio set as shown in figure 52, except that the handset should be plugged into AUDIO connector J8.

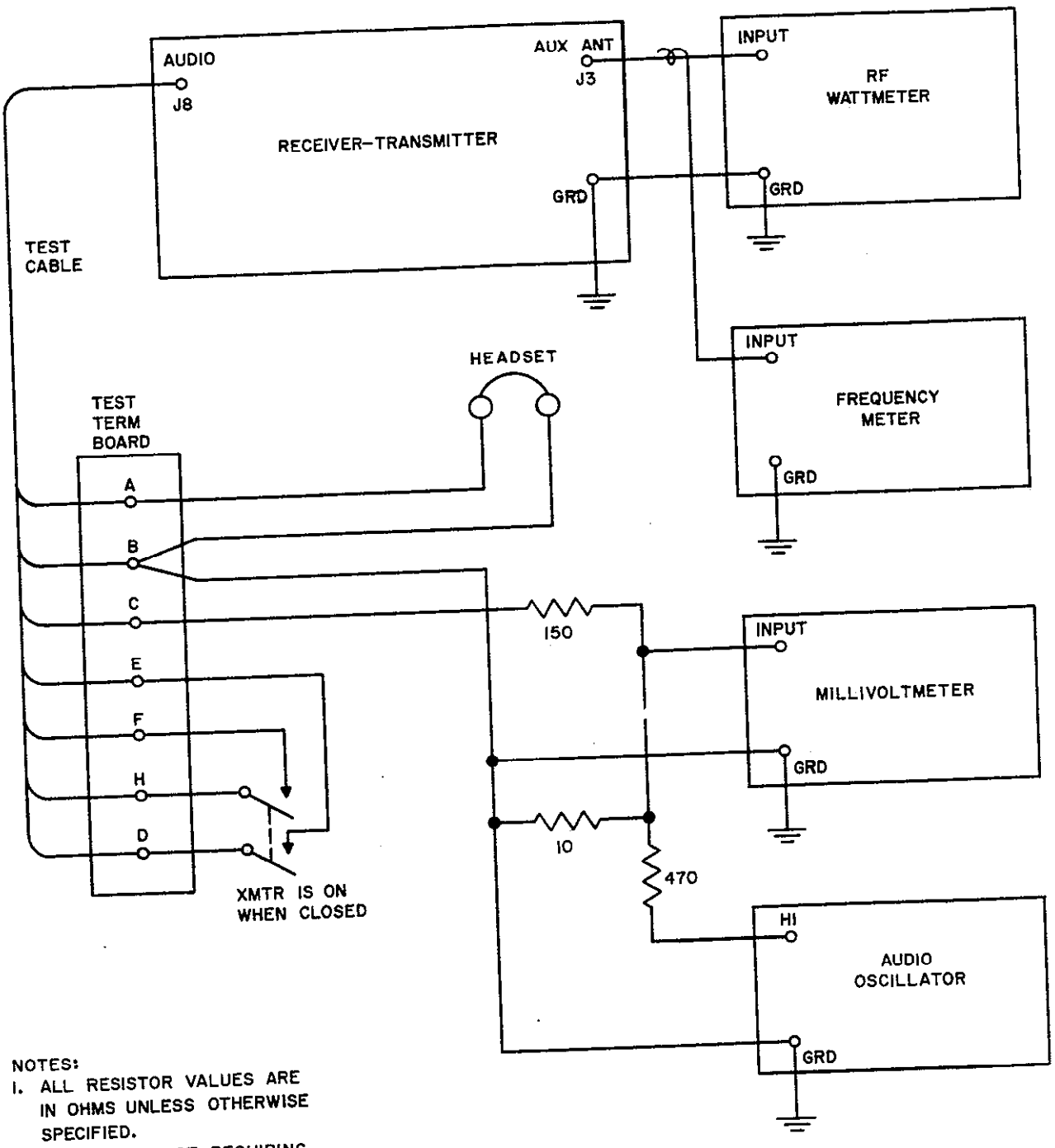
b. Tune the radio set and the frequency meter to 39 mc (28 mc). Let the frequency meter transmit at this frequency, while holding the radio set POWER switch in CAL & DIAL LITE position. Adjust the TUNING control for zero beat in the handset. Lock the TUNING control at this frequency. Release the POWER switch to ON.

c. Press in the handset push-to-talk button. Check the transmitter frequency by heterodyning it with the frequency meter, and measuring the frequency deviation. It should not exceed ±5 kc.

Note. With the reception of a strong signal, the transmitter may not lock in. By slowly turning the heterodyne detector standby switch to **OFF**, then to ON again, the transmitter will lock in at the proper frequency.

d. Note the transmitter output power on the rf wattmeter. The rated maximum power output is .8 watt (1 watt in AN/PRC–9A).

e. Turn off power and disable the afc circuit by temporarily removing second if. plug-in can U102 and pulse-sweep generator plug-in can U301. Turn the radio set on again in transmit operation. Measure the frequency deviation between the transmitter signal and the 39-mc (28-mc) heterodyning signal of the frequency meter. It should not exceed ±50 kc (±75 kc for AN/PRC–9A). Replace U102 and U301.



NOTES:
1. ALL RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
2. FOR TESTS NOT REQUIRING AUDIO INPUT, HANDSET H-33B/PT MAY BE PLUGGED INTO J8 INSTEAD OF TEST CABLE SETUP.

TM 4065A-30

Figure 52. Connections for transmitter testing.

f. Repeat the above tests at 47 mc (33 mc) and at 54 mc (38 mc). The deviation at 47 mc (33 mc) without afc may go up to ±100 kc (±150 kc in AN/PRC–9).

117. Automatic Frequency Control

a. Connect the radio set as shown in figure 52, except that the handset should be plugged into AUDIO connector J8.

b. Set the frequency meter to 54 mc (38 mc), and let it transmit at this frequency. Hold the POWER switch of the radio set in CAL & DIAL LITE position. Turn the TUNING control to 54 mc (38 mc), and adjust it for zero beat in the handset. Lock the TUNING control (with the DIAL LOCK lever) at this frequency, and let it remain there for the rest of this test. Release the POWER switch to ON.

c. Adjust the frequency meter for use as a heterodyne detector, and record the 54-mc (38-mc) frequency setting.

d. Tune the transmitter by adjusting capacitor C11 (fig. 33), so that zero beat is heard in the headset of the frequency meter.

e. Turn off power and disable the afc circuit by temporarily removing second if. plug-in can U102 and pulse-sweep generator plug-in can U301. Turn the radio set on again in transmit operation. Again tune the transmitter by adjusting C11, so that zero beat is heard in the headset.

f. Temporarily increase the frequency setting of the frequency meter to 500 kc above 54 mc (38 mc.). Press in the handset push-to-talk button, and once again aline C11 for zero beat in the headset.

g. Replace U102 and U301. Return the frequency setting to 54 mc (38 mc). Press in the handset push-to-talk button. The transmitter carrier frequency should be within ±10 kc of the heterodyne detector frequency.

h. Again remove U102 and U301. Temporarily decrease the frequency setting of the frequency meter to 500 kc below 54 mc (38 mc). Turn on the transmitter and adjust C11 for zero beat in the headset.

i. Return the frequency meter setting to 54 mc (38 mc.) Replace U102 and U301. Press in the handset push-to-talk button; the transmitter frequency should be within ±10 kc of the heterodyne detector frequency.

j. After completing this test, if within limits, realine the transmitter oscillator to 54 mc (38 mc) (par. 100).

118. Transmitter Modulation Capability

This test measures the frequency deviation with audio inputs at several frequencies, and should be made with the transmitter operating at 39 mc (28 mc), 47 mc (33 mc), and 54 mc (38 mc), as follows:

a. Connect the radio set as shown in figure 52, except couple the panoramic indicator instead of the frequency meter around AUX ANT connector J3. Connect the if. signal generator so that the frequency deviation may be measured.

b. Adjust the audio oscillator output so that 85 millivolts (330 millivolts for AN/PRC–9A) of audio signal is indicated on the vtvm. Measure the frequency deviation with the transmitter operating at 39 mc (28 mc), 47 mc (33 mc), and 54 mc (38 mc). The deviation should be within the limits listed below, for the following three audio input signals.

Audio input frequency (cps)	Transmitter frequency deviation (kc)	
	AN/PRC–9A	AN/PRC–10A
400	4 to 10	4 to 10
1,000	5 to 13	5 to 17
2,500	5 to 13	5 to 17

119. Transmitter Rf Power Output

a. Connect the rf wattmeter between AUX ANT connector J3 and chassis ground, as shown in figure 52.

b. Operate the transmitter at frequencies of 39 mc (28 mc), 47 mc (33 mc), and 54 mc (38 mc). The power output should not be less than 6.8 watt (1 watt for AN/PRC–9A) at each of the three frequencies.

120. Neutralization

a. Connect the rf wattmeter between AUX ANT connector J3 and chassis ground. Connect the vtvm to pin 3 of test socket J7 and chassis ground. Plug the handset into AUDIO connector J8, and place the radio set in transmit operation. Tune the radio set to 54 mc (38 mc) at the high end of the frequency range.

b. Note the discriminator voltage observed on the vtvm.

c. Remove the rf wattmeter, and note the change in discriminator voltage under no-load condition.

d. Short circuit the inner conductor of J3 to the outer conductor, and note the change in discriminator voltage under short circuit condition.

e. The changes in discriminator voltage, in both *c* and *d* above, should not exceed .2 volt.

121. Transmission Test

a. Receive voice transmissions from a transmitter in a similar radio set at least 50 feet away. Signals should be heard clearly and distinctly.

b. Tap the radio set under test with a rubber mallet. Extraneous noises or microphonics should not be present.

122. Receiver-Transmitter Testing

Tests relating to both receiver and transmitter sections, as well as to system operation, are given in paragraphs 123 through 127.

123. Dial and TUNING Control Operation

These tests check the TUNING knob movements, ability to reset to the same frequency, and dial lock operation.

a. Adjust the frequency meter for operation as a heterodyne detector at 54 mc (38 mc). Plug the handset into AUDIO connector J8. Connect the rf wattmeter to AUX ANT connector J3. Set the TUNING control to 54 mc (38 mc), and place the radio set in transmit operation. Tune the radio set for zero beat in the headset of frequency meter.

b. Place a piece of masking tape on the TUNING knob, and a second piece of masking tape on the panel that faces the first piece. Draw a straight line through each, so that the TUNING knob may be moved and then brought back to precisely the same position by lining up the two marks on the pieces of masking tape. Do this while the control is set at zero beat.

c. Release the handset push-to-talk button so that the radio set is in receive condition. Rotate the TUNING control one full turn clockwise, and then counterclockwise back to the original setting so that the two lines on the masking tape line up with each other.

d. Operate the push-to-talk button. The beat note heard in the heterodyne detector output should not be more than ±10 kc. Repeat the test several times to be sure that this limit is met. This test checks the backlash in tuning drive assembly O 22.

e. Release the push-to-talk button so that the radio set is in receive condition. Set the TUNING control to the 53.75-mc (38.7-mc) calibrate check point. Hold the POWER switch in CAL & DIAL LITE position while adjusting the TUNING control for zero beat in the handset. Now move the POINTER ADJUST control so that the pointer is exactly on the dial 53.75-mc (38.7-mc) calibrate mark.

f. Release the POWER switch to ON. Turn the TUNING control clockwise approximately one megacycle on the dial, and then return it to the 53.75-mc (38.7-mc) calibrate marker. Hold the POWER switch in CAL & DIAL LITE position. The frequency of the signal in the audio output should not be greater than 50 kc. Repeat this test at least five times, first turning the control clockwise and then counterclockwise. This test checks the backlash between the tuning gang and the dial drum. It should be repeated at the 47.3-mc (34.4-mc) calibrate check point.

g. Check the tuning DIAL LOCK operation as follows: With the POWER switch in CAL & DIAL LITE position, adjust the TUNING control for zero beat in the handset at the 53.75-mc (38.7-mc) calibrate point. Release the POWER switch, and then operate the DIAL LOCK lever to lock the tuning dial. Place the POWER switch back in the CAL & DIAL LITE position. The audio beat note in the receiver output should not exceed 250 cps (70 cps for AN/PRC–9A). Repeat the test at least five times. This shows approximately how far off center frequency the radio set is detuned, when the tuning shaft is locked. An excessive degree can be caused by misalinement or looseness of the tuning drive assembly to the control panel. This may be accompanied by binding or uneven action in the TUNING control operation.

124. System Fidelity

a. Operate the transmitter of one radio set at 47 mc (33 mc), with audio modulation of .1 volt (.3 volt for AN/PRC–9A) at 1,000 cps. Receive its transmitted signal in a similar type receiver at least 50 feet away. Adjust the VOL control of this receiver for 1 mw of audio output, as observed on the output meter. This output is used as a reference level.

b. Check the audio output level when the modulating frequency is changed to the frequencies given below. Do not readjust the VOL control

after it is set for 1 mw output at 1,000 cps. The audio response for the system should be within the limits as shown in the following tables:

(1) Audio response for Radio Set AN/PRC–9A is as follows:

Audio frequency (cps)	Response (db)
1,000	0 (1 mv reference).
150	−13.5 to −5.5.
400	−3 to +3.
2,500	−13 to −5.
5,000	−50 to −12.

(2) Audio response for Radio Set AN/PRC–10A is as follows:

Audio frequency (cps)	Response (db)
1,000	0 (1 mw reference).
250	−3 to +2.
400	−2 to +4.
2,500	−13 to −5.
5,000	−50 to −12.

125. Parasitic Oscillations

With the radio set operated alternately as a receiver and a transmitter at 47 mc (33 mc), note the reception in an adjacent radio receiver as the latter is slowly tuned from 20 to 100 mc. Listen for disturbing effects. No parasitic oscillations should be received at all settings of the radio set controls.

126. Relay Operation

Set up four radio sets as shown in figure 25. Theory and detailed connections for this operation are in paragraph 27. Radio sets No. 1 and No. 2 are tuned to the same frequency. Radio sets No. 3 and No. 4 are tuned to a second frequency, which differs from the first frequency by a few megacycles. Radio sets No. 2 and No. 3 make up the relay station. Radio sets No. 1 and No. 4 each should be about 1 mile from the relay station and in opposite directions. With operators at radio sets No. 1 and No. 4, signals should be received clearly and distinctly from both directions without any noise.

127. Remote Operation

Set up the radio set and Control Group AN/GRA–6 as shown in figure 22. Set up Remote Control C–433/GRC about 1 mile from the radio set. Set up another radio set next to the remote control, but not connected to it. In Local Control C–434/GRC, set the LOCAL switch at TEL, the REMOTE switch at SET 1, and the switch inside the case on the chassis at BELL. On the remote control, set the SELECTOR switch at the left write-in position, and the switch inside the case on the chassis, at BELL. On the radio set that is to be operated remotely, set the POWER switch at REMOTE. Tune this set and the one next to the remote control unit to the same frequency. When an operator presses the push-to-talk button on the handset that is plugged into the remote control, he transmits over the set located 1 mile away, while another operator receives on the set next to the remote control. When the operator presses the push-to-talk button of the handset plugged into the receiver next to the remote control, he transmits over that set and the other operator receives on the handset that is plugged into the remote control. Communication in both directions should be clear and distinct.

Section - Demolition - not copied

(Figure 55—See foldin in back of Manual)

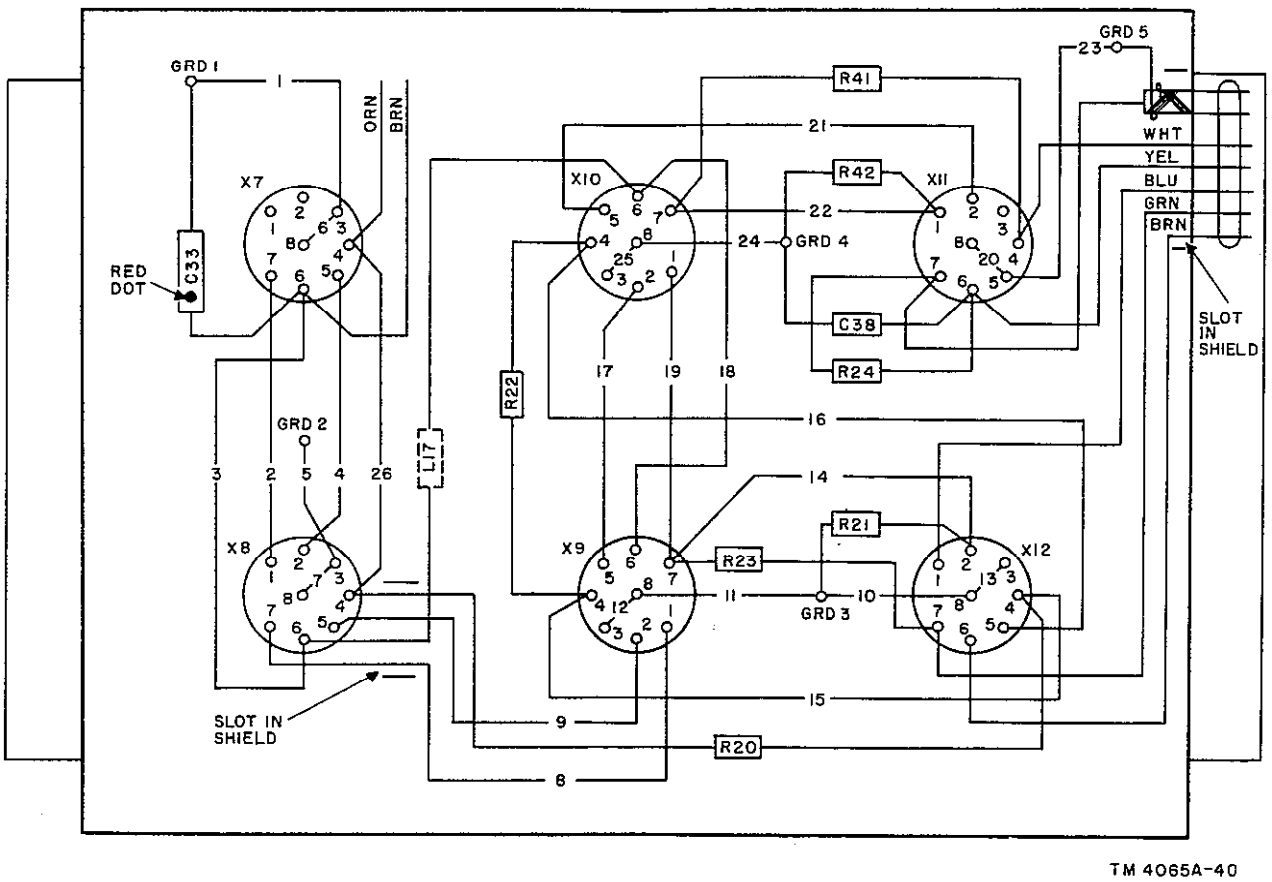


Figure 56. If. chassis, wiring diagram.

(Figure 57—See foldin in back of Manual)

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[AG 413.44 (8 May 56)]