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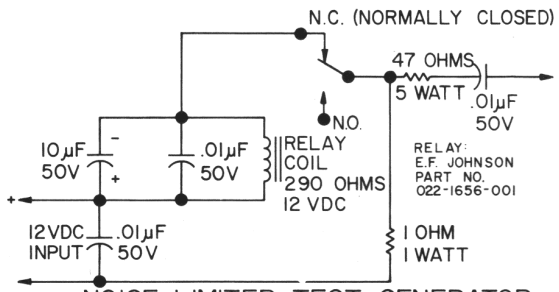
TABLE 5-1

OUT OF CIRCUIT TRANSISTOR MEASUREMENTS

Transistor Type		Ohmmeter Connections + lead	-lead	Resistance in ohms
Germanium PNP	Power	Emitter	Base	30 to 50 ohms
		Emitter	Collector	Several hundred
	Small Signal	Emitter	Base	200 to 250 ohms
		Emitter	Collector	10k to 100k ohms
Silicon PNP	Small Signal	Emitter	Base	10k to 100k ohms
		Emitter	Collector	Very high (Might read open)
Silicon NPN	Power	Base	Emitter	200 to 1000 ohms
	Small Signal	Collector	Emitter	High; often greater than 1 megohm
		Base	Emitter	1k to 3k ohms
		Collector	Emitter	Very high (Might read open)



NOISE LIMITER TEST GENERATOR
FIGURE 5-2

5.3 RECEIVER PERFORMANCE TEST

(With troubleshooting information.)

Receiver RF input values are given into a 6 dB 50 ohm pad.

5.3.1 TEST INSTRUMENT CONNECTIONS

Refer to Table 5-2 for test instruments required.

NOTE

Any 117 VAC operated test instruments with grounded power plugs used for servicing the Messenger 123 must be "floated" (ungrounded).

a. Connect an RF signal generator through a 6 dB pad to the antenna jack.

b. Connect an audio voltmeter across the speaker terminals. Connect the "hot" side of the voltmeter to the top terminal.

c. Use B+ as the test instrument common when injecting signals and making voltage measurements.

d. Connect a VOM in series with the power lead. Set the function switch to DC current and the range selector to the range nearest one ampere full scale.

5.3.2 SENSITIVITY AND RECEIVER CURRENT DRAIN

a. Set the volume control maximum clockwise (maximum volume) and the squelch control to maximum counterclockwise (minimum squelch).

b. Set the channel selector to channel 11.

c. Set the signal generator output for 1µV modulated 30% at 1000Hz on channel 11 (27.085 MHz). Use a crystal controlled generator equivalent to the one listed in Table 5-2.

d. Adjust the volume control for a -10 dB indication on the audio voltmeter.

e. Switch the signal generator audio off. The indication on the audio voltmeter should drop 8dB or more.

f. Reset the volume control to maximum clockwise

TABLE 5-2

TEST INSTRUMENTS REQUIRED FOR SERVICING AND ALIGNMENT

TYPE	REQUIRED CHARACTERISTICS	USE	RECOMMENDED MODEL
VTVM	A low range of 0-1.5 volts on AC and DC	Measure RF, AF and DC voltages	Heath IM-11 with RF probes or equivalent
Oscilloscope with RF Pickup Loop	Direct connection to vertical plates, or vertical amplifier good to 30 MHz. Refer to Figure 5-8 for pickup loop fabrication details.	Check modulated waveforms and audio.	Heath I0-12 or equivalent modified for direct connection to vertical plate. Precision ES-550B
Audio Voltmeter	Measure from -40 dB to +10 dB	Measure audio	Heath IM-21 or equivalent
Audio Generator	With variable attenuator and frequency of 400 to 2500 Hz	Check audio amps. Modulate transmitter.	Heath IG-72 or equivalent
Frequency Meter	Accuracy of ±0.0005% Frequency range of 455 kHz and from 25 to 30 MHz	Measure receiver and transmitter RF frequencies	Viking Instruments Model VFS 700
Thruline Wattmeter	Input and output impedance of 50 ohms. 5 or 10 watts. Accuracy of ±5% of full scale reading.	Measure transmitter power output. Measure antenna VSWR.	Bird Model 43 with 5A or 10A element
DC Current Meter		Measure receiver and transmitter current drain.	Simpson 270 or Triplett 630 or equivalent
Dummy Antenna	Power rating of at least 5 watts 50 ohms resistive	Load for Thruline Wattmeter	Bird Model 80 coaxial resistor or equivalent
Crystal controlled RF Signal Generator with 6 dB 50 ohm pad	23 CB frequencies plus 455 kHz and attenuated output of 1 to 100,000 microvolts capable of 30% modulation at 400 and 1000 Hz	Receiver RF source	Radio Research, Model 71-4 or Model 72 or equivalent. Accuracy ±0.0005% except ±.01% at 455 kHz
RF Voltmeter with	10 mV - 300 volts	Measure RF voltages	Millivac 38B or equivalent

The following is a list of instruments that can be used if the instruments in the above list are not available.

TYPE	CHARACTERISTICS	USE
International crystal C-12B test set NOTE: This instrument lacks 1000 Hz modulation for signal generator and accuracy is lower than the 0.0005% desired, but offers a desirable combination of features at low cost. It is battery operated and portable.	Frequency Meter - 23 CB frequencies, 26.965 to 27.255 MHz, with an accuracy of ±0.0015%.	Measure receiver and transmitter RF frequencies
	RF Power Meter - 5 watts ±1/4 watt	Measure transmitter power output
	Dummy antenna - 5 watts	Load for transmitter
	RF signal generator - 23 CB frequencies ±0.0015%, output 1 to 100 microvolts, 30% modulation at 400 Hz	Receiver RF source
	AM modulation meter - range 0-100% accuracy 3% at 400 Hz and 80% modulation.	Measure transmitter percent of modulation
E. F. Johnson antenna meter, Model 250-849	50 ohms	Measure antenna VSWR

(maximum volume). Switch the signal generator audio on.

g. Check the receiver current drain. It should be approximately 500 mA with 2.5 VAC across the speaker terminals.

5.3.3 AUDIO

1. Performance Test

a. Set the squelch control fully counterclockwise.

b. Set the audio voltmeter range selector to the 3 volt range.

c. Set the volume control full on.

d. Set the signal generator output for 1μV modulated 30% at 1000 Hz.

e. The audio output on the voltmeter should be 2.5 volts ±3dB on channels 1, 11 and 21.

2. Troubleshooting

The condition of the receiver audio can be checked by signal injections. Refer to the following procedure.

a. 1. Connect the "hot" side of an audio generator to a 5 μF capacitor. Connect the common side of the audio generator to B+.

2. Set the volume control maximum clockwise and the squelch control maximum counterclockwise.

b. 1. The reference level for Table 5-3 is 2.5 volts RMS of audio across the speaker terminals.

2. Use an oscilloscope to check stage to stage distortion.

3. Table 5-3, Typical Audio Levels, lists the audio gain distribution, measured with an audio voltmeter, that should be obtained from a typical audio section.

NOTES

(Class B audio output transistors Q9 and Q10)

1. Check the base and emitter voltages of the class B audio output transistors, Q9 and Q10. The voltages should be approximately equal. If one of the transistors shows no voltage difference between emitter and base, it is probably faulty.

2. Severe audio distortion may be the result of an open Q9 or Q10. A shorted transistor can cause R17 to burn and possibly blow the fuse. The faulty transistor may have an excessively warm case.

TABLE 5-3
TYPICAL AUDIO LEVELS

Test Point	Volts RMS
	Levels required to produce 2.5 RMS
top of volume control	0.0012
collector of Q7	0.015
base of Q8	0.015
collector of Q8	2.35
base of Q9	2.1 drops to 0.75 when 5 μF cap is touched to base of Q9
collector of Q9	---

5.3.4 AGC

1. AGC Performance Test

a. Set the channel selector to channel 11.

b. Set the squelch control to the maximum counterclockwise position.

c. Set the signal generator output to 0.1 volt modulated 30% at 1000 Hz on channel 11 (27.085 MHz).

d. Adjust the volume control for a 0 dB indication on the audio voltmeter.

e. Reduce the signal generator output to 1 μV. The audio voltmeter should drop 12 dB ±6 dB.

2. AGC Troubleshooting

a. Increase RF signal generator output from 1 μV to 0.5 V. The audio voltage at the speaker should increase relatively fast at first, as signal generator output is increased from 1 μV-10 μV, then tend to level off.

b. If the voltage at the speaker increased proportionately as the input voltage increased, check D3 by bridging it with a new diode, and check its associated circuitry.

c. If D3 and its associated circuitry appear to be good, connect a DC voltmeter between the junction of C14, C13, R9 and B+. The AGC voltage measured here should go less negative as the input voltage is increased from 1 μV to 0.1 V.

d. Refer to Table 5-4 for a list of typical AGC voltage readings.

TABLE 5-4
TYPICAL AGC LEVELS

Test Conditions:

Volume control advanced for reference of 2.5 VRMS at the speaker terminals with 1000 μV input to 50 ohm 6 dB pad between generator and antenna terminal. Signal generator set to 27.085 MHz (channel 11) at 30% modulation, 1000 Hz. Audio measured across the speaker.

RF Input to 6 dB pad (microvolts)	Relative Audio Output (dB)	Voltage at Junction of C14, C13 and R9
1	-4	-0.9
3	+4	-0.65
10	+8.2	-0.21
30	+8.8	+0.21
100	+10.3	+0.52
300	+10.3	+0.74
1,000	+10	+0.88
3,000	+10.6	+0.98
10,000	+11.8	+1.06
30,000	+12.5	+1.14
100,000	+13.2	+1.23
300,000	+13	+1.53
1,000,000	+4.5	+2.63
3,000,000	+12	+3.5

5.3.5 IF and RF Troubleshooting

Check the RF and IF stages by signal injection. Connect an audio voltmeter across the speaker terminals. Set the signal generator to 30% modulation at 1000 Hz. Set the channel selector to channel 11. Table 5-5 lists the injection points and the input levels necessary to obtain 3 VRMS at the speaker terminals with the volume control set to maximum and the squelch control to minimum.

TABLE 5-5
TYPICAL RF AND IF LEVELS IN RECEIVER

Conditions: The input levels listed in this table are the levels required to produce 3 VRMS at the speaker terminals with the volume maximum and the squelch minimum.

Test Point	Input Frequency	Input Level
Antenna terminal	27.085 MHz	1.13 μV
Base of mixer	27.085 MHz	58 μV
Base of first IF amp	455 kHz	290 μV
Base of second IF amp	455 kHz	8.4 mV
Collector of second IF amp	455 kHz	450 mV

5.3.6

1. Squelch Threshold Performance Test

   a. Set the channel selector to channel 11 (27.085 MHz).

   b. Disconnect the signal generator (if connected) from the antenna terminal.

   c. Adjust the squelch control until the background noise disappears.

   d. Set the signal generator to 100 μV 30% modulated at 1000 Hz.

   e. Connect the signal generator to the antenna jack. The squelch should open.

   f. Reduce the signal generator to 1 μV. The squelch should remain open.

2. Squelch Troubleshooting

   a. The squelch amplifiers Q5 and Q6 obtain their information from the AGC line. When squelch action is faulty, check the AGC section first.

   b. If the AGC section appears to be functioning properly, connect a DC voltmeter to the emitter of Q7 (-15 VDC range).

   c. With power applied to the receiver, monitor the DC voltmeter while rotating the squelch control from minimum to maximum. The voltage indicated should go from approximately -2.6 V to 6.5 V.

   d. If the voltage does not change at Q7, substitute D6 with a diode known to be good.

NOTE

If D6 is shorted, the voltage at Q6 will be normal but the squelch will operate very slowly. The emitter of Q7 would read very low at minimum squelch and normal at maximum squelch.

   e. Check the voltages at Q5 and Q6.

5.3.7 Noise Limiter Performance Test

A noise limiter test generator such as illustrated in Figure 5-2 must be available to perform the following test.

   a. Turn the squelch control full counterclockwise.

   b. Connect the noise generator illustrated in Figure 5-2 to the center conductor of the antenna jack inside the chassis. The signal generator is connected to the antenna jack at the outside of the chassis rail.

   c. Set the RF signal generator to 1μV unmodulated.

   d. Connect an audio voltmeter across the speaker terminals and set the volume control for an indication of 0 dB.

e. Turn the noise generator on. The audio voltmeter should indicate an increase of no more than 5 dB.

5.3.8 S-Meter Performance Test

Refer to the Receiver Alignment section for S-meter calibration instructions.

5.4 TRANSMITTER PERFORMANCE TEST
(With troubleshooting information)

5.4.1 Test Instrument Connections

a. Refer to Table 5-2 for test instruments required.

b. Connect a wattmeter and 50 ohm load to the antenna jack.

c. Connect the "hot" side of an audio generator through a 0.05 μF capacitor to the junction of C23 and RY1. Connect the common side to B+.

Connect a jumper wire between the junction of C23 and the microphone white lead to B+.

d. Connect a DC current meter (VOM) to the free (unsoldered at C74 and L6) end of wire W9 (minus lead) and the junction of C74 and L6 (positive lead). Set the function switch to DC current and the range selector to the range nearest 1 ampere full scale. Refer to Figure 6-2.

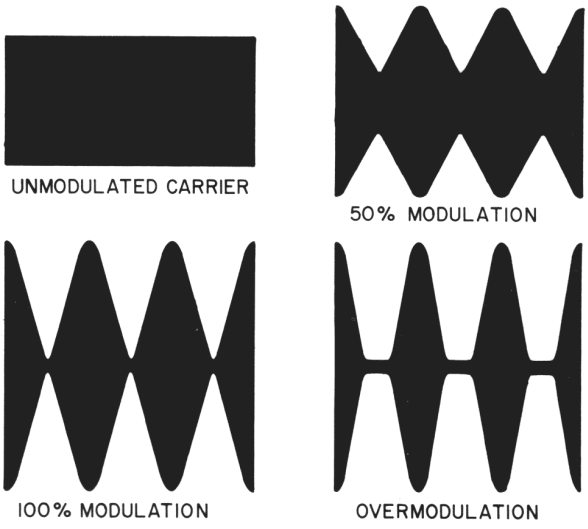
e. Have an RF pick-up loop as illustrated in Figure 5-3 available for checking modulation.

5.4.2 RF Power Output and Modulation

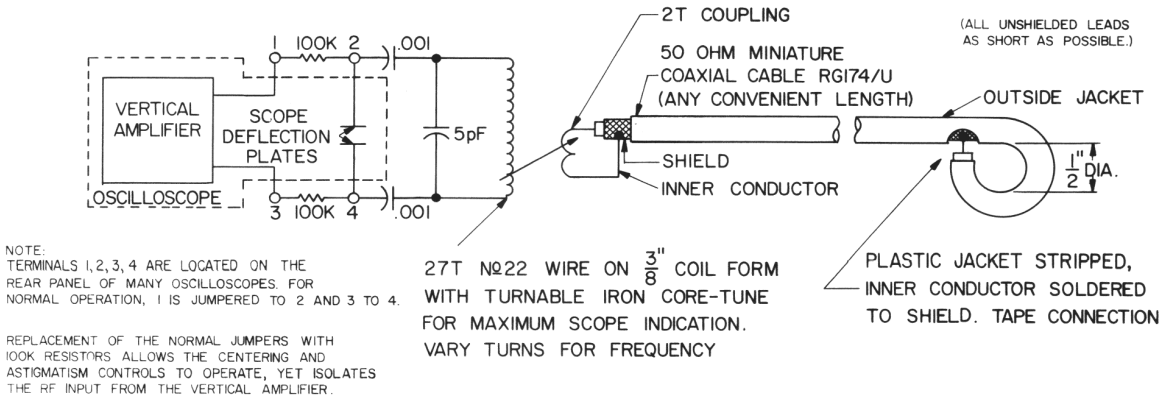
NOTE

All the measurements given in this section are for a normally operating transceiver with 13.8 VDC power supply.

a. Key the transmitter with no modulation applied. Check the power output on channels 1 through 23. The limits are 4.0 watts maximum and 2.8 watts minimum with a Q17 emitter current of 410 mA as measured with the DC current meter. The power output difference between any two channels should not be more than 0.5 watts. Re-



TRANSMITTER WAVEFORMS
FIGURE 5-4



fer to section 6 for the transmitter alignment procedure. Check the relative power output meter with no modulation. It should indicate approximately mid-scale.

b. Connect an RF pick-up loop, constructed as illtrated in Figure 5-3,to L8.

c. Set the audio generator output level to 4 mV. Key the transmitter. Approximately 50% modulation should be indicated on the oscilloscope. Refer to the transmitter waveforms illustrated in Figure 5-4.

d. Increase the audio level to 8 mV. The modulation should increase to at least 70% minimum upward and 80% minimum downward.

e. Increase the audio to 80 mV. The waveform should be clean and free of RF distortion.

TABLE 5-6
FREQUENCY SYNTHESIZER TROUBLESHOOTING

Trouble	Probable Cause
Receiver and transmitter completely inoperative. No apparent synthesizer output.	Q13
Receiver completely inoperative.	D9, D10
Transmitter inoperative.	D8, D11
Transceiver operation intermittent.	Alignment improper. Selector switch dirty.
Transceiver inoperative on some channels, operates normally on others.	Faulty crystal. Refer to Table 5-8 and Figure 5-5.

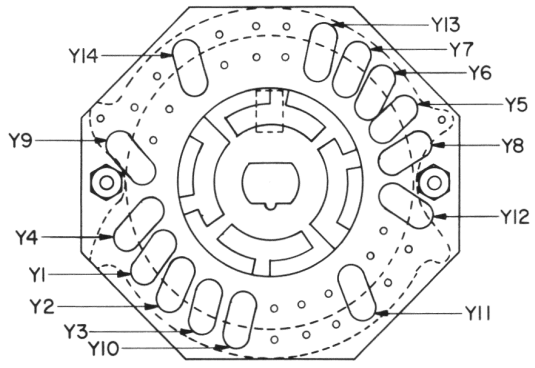
5.5 SYNTHESIZER

The following measurements are necessary only if the synthesizer has been repaired or is suspected of functioning improperly. Refer to Tables 5-6, 5-7 and 5-8 for synthesizer troubleshooting information.

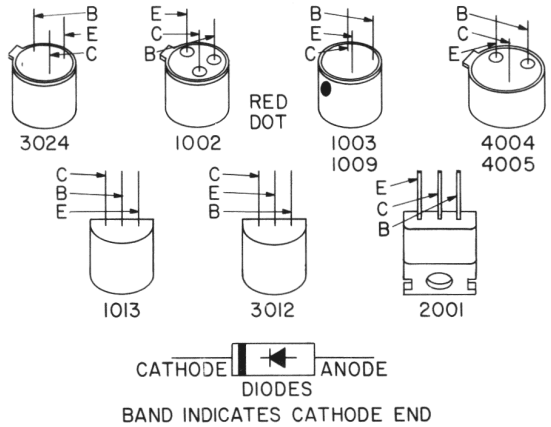
a. Couple a small sample of the transmitter power output, unmodulated, to a frequency meter or electronic counter.

b. Measure the frequency on channels 1, 6, 11, 16, 20 and 23. Table 5-7 lists the maximum frequency variations at a standard temperature of +25° centigrade (72° fahrenheit).

c. If the synthesizer fails to meet the limits listed in Table 5-7, refer to Table 5-6 and 5-8 and the synthesizer alignment instructions in section 6. Refer to section 5-2 and Figure 5-6, semiconductor case diagrams, if a semiconductor is suspected of being faulty. Refer to the transparency for component identification.



CRYSTAL MOUNTING DETAILS
(REAR VIEW)
FIGURE 5-5



SEMICONDUCTOR CASE DIAGRAMS
BOTTOM VIEWS
FIGURE 5-6

TABLE 5-7
LIMITS FOR TRANSMITTER FREQUENCY VARIATION

CHANNEL NO.	FREQUENCY, kHz	0.004% HIGH LIMIT, kHz	0.004% LOW LIMIT, kHz
1	26,965.000	26,966.079	26,963.921
6	27,025.000	27,026.081	27,023.919
11	27,085.000	27,096.083	27,033.917
16	27,155.000	27,156.086	27,153.914
20	27,205.000	27,206.088	27,203.912
23	27,255,000	27,056.090	27,253.910

TABLE 5-8
SYNTHESIZER CRYSTAL TROUBLESHOOTING

Channels Inoperative	Receive Inoperative	Transmit Inoperative	Faulty Crystal
1, 2, 3 and 4	X	X	Y9
5, 6, 7 and 8	X	X	Y10
9, 10, 11 and 12	X	X	Y11
13, 14, 15 and 16	X	X	Y12
17, 18, 19 and 20	X	X	Y13
21, 22 and 23	X	X	Y14
1, 5, 9, 13, 17 and 21	X		Y5
2, 6, 10, 14, 18 and 22	X		Y6
3, 7, 11, 15 and 19	X		Y7
4, 8, 12, 16, 20, 23	X		Y8
1, 5, 9, 13, 17 and 21		X	Y1
2, 6, 10, 14, 18 and 22		X	Y2
3, 7, 11, 15, 19		X	Y3
4, 8, 12, 16, 19 and 23		X	Y4

TABLE 5-9
TYPICAL COMPONENT RESISTANCE READINGS

Component	Winding	Lead	Value
RY1	Coil	Pin 13 to Pin 14	195 $^{+0}_{-20}$% ohms
T6	Primary	Across side with two leads	200 ohms (maximum)
	Secondary	Across outside leads on side with three leads	25 ohms (maximum)
T7	Primary	Brown to Blue	3.4 ohms (maximum)
	Secondary No. 1	Yellow to Orange	1.4 ohms (maximum)
	Secondary No. 2	Green to Black	0.22 ohms (maximum)

SECTION 6
ALIGNMENT

6.1 GENERAL

All test instruments used for alignment must be "floating" (ungrounded). The common (ground) point for the test instruments is B+ on the circuit board.

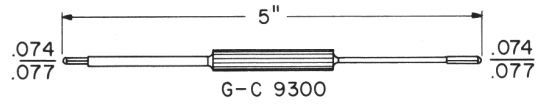
6.2 RECEIVER

Test Instrument Connections
(Refer to Table 5-1 for test instruments required and Figure 6-1 for alignment tools.)

a. Connect a signal generator through a 6 dB 50 ohm pad to the antenna terminal.

b. Connect an RF millivoltmeter to the junction of T9 and C55.

c. Connect an audio voltmeter and oscilloscope across the speaker. Connect the "hot" instrument lead to the bottom of the speaker terminal strip. Connect the common lead at the top (B+).



ALIGNMENT TOOL REQUIRED
FIGURE 6-1

Preliminary

a. Connect a 13.8 VDC source to the transceiver.

b. Check that the lights and on/off switch operate normally.

Synthesizer Adjustment

a. Connect an RF voltmeter to the junction of D10 and D11.

b. Set the channel selector to channel 23.

c. Adjust T8 until the RF voltmeter abruptly begins to indicate the presence of RF. Advance the core until a peak in output is observed.

d. Set the channel selector to channel 12.

e. Adjust T9 for a maximum reading on the RF voltmeter. Tune on the outside peaks. Your indication should be 200 mV minimum.

f. The synthesizer receive crystal starting can be checked by setting the channel selector switch to channels 1, 6, 11, 16, 20 and 23. The meter should read approximately the same for all channels.

IF and RF

a. Set the channel selector switch to the blank channel (between 22 and 23). Adjust the squelch control full counterclockwise.

b. Connect an RF signal generator to the antenna jack at 30% modulation. Set the generator modulation to 1000 Hz at 30%. Connect an audio voltmeter and oscilloscope across the speaker.

c. Set the signal generator to 455 kHz and peak T3, T4, and T5 for maximum audio output. Use as little signal input as convenient. (One that produces a S+N/N of 10 dB, or one that produces about 1 volt RMS of audio is desirable).

d. Set the channel selector to channel 11.

e. Tune the RF signal generator to channel 11 with modulation the same as step b and set the RF level to 1000 μV (1 mV), and increase the volume control until an indication of 0 dB is obtained on the audio voltmeter.

f. Peak T1 and T2, bottom core, for a maximum indication on the audio voltmeter. Reduce the generator output to maintain an audio output between 0 dB and +6 dB.

g. Set generator RF output level to 1 μV, and finish peaking T1 and T2.

h. Peak T1 for cleanest audio output, as seen on an oscilloscope.

Image Trap Adjustment

a. Set the channel selector to channel 1.

b. Set the signal generator to channel 1. Set the RF output level to obtain approximately 10 dB S+N/N, with modulation set at 1000 Hz at 30%.

c. Tune the top slug of T2 to a dip as observed on the audio voltmeter. Turn through dip until audio reaches a peak. Back off until audio starts to drop.

d. Return the signal generator and channel selector to channel 11. Set signal generator RF output level to 1 μV. Set volume control to give 0 dB on the audio voltmeter.

e. T2, bottom slug, can be retuned slightly for maximum audio output.

f. Check receiver gain on channels 1, 11, and 21. Adjust T1 and T2, bottom slug, for uniform gain and signal to noise (gain as observed on the audio voltmeter). The gain should be ±3 dB.

g. Set channel selector to channel 11.

h. Set signal generator to channel 11, 1000 μV, modulated at 1000 Hz 30%. Adjust the volume control to obtain +10 dB on the audio voltmeter.

i. Reduce signal generator output to 1 μV. The audio should drop 20 ±10 dB.

j. Increase Volume Control to maximum. The audio voltmeter should read -3 dB minimum. If possible set the Volume Control to obtain 0 dB audio output. (on low gain units a 100 K 1/2 W. resistor may be added between leads 2 and 3 of 1, or a 1 K resistor may be added between leads 5 and 6 of Z3.)

k. Reduce the modulation to zero. The audio voltmeter should drop 7 dB minimum.

Squelch Test

a. Set the signal generator to 30 μV modulated at 1000 Hz 30%. Advance the squelch control clockwise; the signal should disappear at some point, (for tight squelch problems a 39 K, 1/2 watt resistor may be placed between pins 1 and 2 of Z6).

b. Set the signal generator to 1000 μV; the signal should appear.

6.3 TRANSMITTER ALIGNMENT

Test Instrument Connections
(Refer to Table 5-1 for test instruments required and Figure 6-1 for alignment tools.)

a. Connect the "hot" side of an audio generator through a 0.05 μF capacitor to the junction of C23 and RY1. Connect the common side of the generator to B+ on the circuit board.

b. Connect a jumper wire between the junction of C23 and microphone white lead to B+.

c. Connect an RF millivoltmeter to the base of Q16. Connect the common side of the meter to B+.

d. Connect a 0 to 500 mA DC current meter (this can be a VOM) between the junction of a C74 and L6 (positive) and the free end of W9 (negative). Refer to Figure 6-2 for details.

e. Connect a 50 ohm wattmeter to the antenna terminal.

Alignment Procedure

a. Set channel selector to channel 11.

b. Key the transmitter and adjust T10 for maximum on the RF millivoltmeter. Tune to the outside peaks. Disconnect the meter.

c. Key the transmitter. Adjust L8 for peak current and power output. Adjust L7 to keep final current below 450 mA. Use a 0.001 μF RF bypass capacitor across the current meter terminals.

d. Adjust T12 for maximum current and power output.

e. Adjust T11 for maximum current and power putput.

f. Adjust L7 and L8 for maximum current and power output. The final current must not exceed 410 mA. (Load for maximum power out with minimum current.)

g. Power output should be between 2.8 watts and 4.0 watts. If output exceeds 4.0 watts, repeat step f adjusting for 4.0 watts maximum.

h. Check power output on all 23 channel selector positions. The power output on the 23 CB channels should not vary more than 0.5 watts.

i. Connect an RF pick-up loop (details are illustrated in Figure 5-3) to L8.

j. Turn up the audio level and note the modulation envelope, as viewed on the oscilloscope, for distortion. Readjust T11 and T12 as necessary to eliminate any visible distortion.

k. Set the audio input to obtain 50% modulation. The input required should be less than 4 mV RMS. Increase the input 20 dB above 50% modulation. Check for normal waveform and modulation percentage. This should be 70% minimum upward and 90% minimum downward, 100% maximum.

l. Check all CB channels for clean modulation and absence of spurious oscillations.

m. Disconnect the audio generator and microphone jumper.

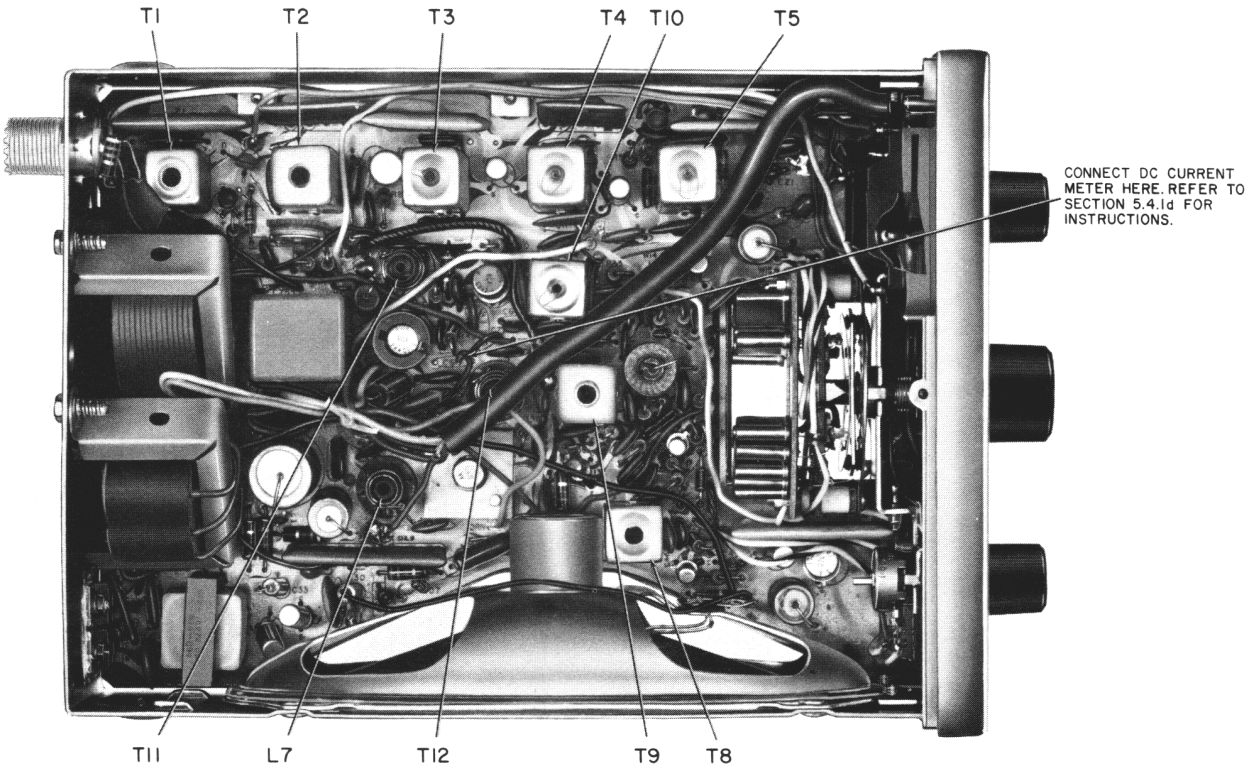
n. Key the transceiver and speak into the microphone. Check for proper modulation.

6.4 METER ADJUSTMENT

a. Set the channel selector to the blank channel between 22 and 23. With 13.8 VDC applied to the transceiver adjust R4 for a zero reading (pointer at left end of scale).

b. Key the transceiver and adjust R5 for a zero reading (pointer at left end of scale).

c. Set the channel selector to channel 23 and key the transceiver. The meter should read up scale (toward right).



ALIGNMENT POINTS
FIGURE 6-2

SECTION 7
PARTS LIST

SYMBOL NO.	DESCRIPTION	PART NO.
	ASSEMBLIES	
ASY1	Low pass filter	023-2763-001
ASY2	Cabinet assembly	023-2201-002
ASY3	Front panel assembly	023-2618-001
	Includes:	
	Front panel	015-0799-002
	Overlay, upper	559-2032-001
	Overlay, lower	559-2033-001
	Knob, channel indicator	547-0008-004
	Knob, volume & squelch	547-0008-001
	Dial, channel indicator	032-0154-101
	Chassis rail	017-1430-007
M1	Meter	554-0015-002
	Crystal switch assembly (See list of crystals for parts included)	583-2029-101
	Bracket, switch support	017-0679-001
R12	Potentiometer, squelch	562-0002-011
R11	Potentiometer, volume	562-0016-004
	Clip	016-1749-001
I1, I2	Incandescent lamp, unbased	549-3001-007
	Spring pin	537-9011-001
	"Rib-Loc" standoff	260-0102-001
L12	Inductor, 20μH	543-3002-002
	Tubing, 0.053ID	042-0240-500
	CAPACITORS	
C1	100pF ±5%, N150	510-3016-101
C2	6.8μF, 35V	510-2045-689
C3	0.01μF +80-20%, 50V	510-3003-103
C4	100pF ±5%, N150	510-3016-101
C5	22pF ±5%, N750, 200V	510-3020-220
C6	15pF, ±5%, mica	510-0004-150
C7	0.01μF +80-20%, 50V	510-3003-103
C8	270pF, ±5%	510-0001-271
C9	Same as C8	
C11	210pF, ±5%, N080	510-3015-211
C12	Same as C11	
C13	0.01μF, +80-20%, 50V	510-3003-103
C14	6.8μF, 35V	510-2045-689
C15	150pF, ±5%	510-0001-151
C16	190pF, ±5%, N150	510-1103-191
C17	0.1μF, +80-20%, 16V	510-3007-104
C18	190pF, ±5%, N150	510-1103-191
C19	0.033μF, ±20%, 16V	510-3010-333
C20	1.0μF, 35V	510-2045-109
C21	Same as C20	
C22	6.8μF, 35V	510-2045-689
C23	0.047μF, +80-20%, Y5U, 50V	510-3003-473
C24	0.01μF, +80-20%, 50V	510-3003-103
C25	Same as C24	
C26	1000μF, +100-10%, 16V	510-4006-005
C27	470μF, 2.5V	510-4001-006
C28	150μF, 25V	510-4006-006
C29	0.022μF, ±20%, Y5U, 50V	510-3002-223
C30	22μF, 15V	510-2003-220
C31	6.8μF, 35V	510-2045-689
C32	2.2μF, 35V	510-2045-229
C33	56μF, ±20%, 6V	510-2001-560
C34	150μF, 25V	510-4006-006
C35	0.22μF, ±20%	510-1004-224
C36	0.022μF, ±20%, Y5U, 50V	510-3002-223
C37	Same as C36	
C38	0.047μF, +80-20%, Y5S, 16V	510-3007-473
C39	Same as C38	
C40	33pF, ±5%, NPO, 200V	510-3013-330
C41	150pF, ±5%	510-0001-151
C42	47pF, ±5%	510-0001-470
C43	0.01μF, +80-20%, 50V	510-3003-103
C44	6.8pF, N750	510-3020-689
C45	18pF, N150	510-3016-101
C46	22pF, ±5%, N150, 200V	510-3016-220
C47	0.01μF, +80-20%, 50V	510-3003-103
C48	Same as C47	
C49	39pF, ±5%, NPO, 200V	510-3013-390
C50	82pF, N750	510-3020-820
C51	56pF, N150, 200V	510-3016-560
C52	0.01μF, +80-20%, 50V	510-3003-103
C53	68pF, ±5%, N150, 200V	510-3016-680
C54	0.01μF, +80-20%, 50V	510-3003-103
C55	Same as C54	
C56	Same as C54	
C57	Same as C54	
C58	56pF, N150, 200V	510-3016-560
C59	Same as C58	
C60	0.001μF, ±20%, 50V	510-3002-102
C61	22pF, ±5%, NPO, 200V	510-3013-220
C62	12pF, ±5%, N750, 200V	510-3020-120
C63	0.01μF, +80-20%, 50V	510-3003-103
C64	0.0047μF, ±20%, 50 VDC	510-3003-470
C65	0.001μF, ±20%, 50V	510-3002-102
C66	47pF, ±5%, NPO	510-3013-470
C67	47pF, ±5%, N150	510-3016-470
C68	0.001μF, ±20%, 50V	510-3002-102
C69	27pF, ±5%, NPO	510-3013-270
C70	100pF, ±5%, N150	510-3016-101
C71	330pF, ±5%	510-0001-331
C72	330pF, ±5%,	510-0004-331
C73	0.047μF, +80-20%, Y5U, 50V	510-3003-473
C74	Same as C73	
C75	.0047μF, ±20%, 125VAC	510-3001-472
C76	0.047μF, +80-20%, Y5U, 50V	510-3003-473
C77	0.01μF, +80-20%, 50V	510-3003-103
C78	0.0047μF, ±20%, 50 VDC	510-3003-472
	DIODES	
D1	1N67A	523-1000-067
D2	Same as D1	
D3	Same as D1	523-1000-295
D4	Same as D1	
D5	silicon, 50V	523-1000-001
D6	1N67A	532-1000-067
D7	silicon, 50V	523-1000-001
D8	1N881	523-1000-881
D9	Same as D8	
D10	Same as D8	
D11	Same as D8	
DZ1	zener, 10V	523-2003-100
DZ2	Same as DZ1	
E1	Insulator for T8 and L5	018-0817-004
	GROMMET	
G1	Grommet, rubber	574-0002-007