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JOHNSON

MESSENGER 102
HAND-HELD
CITIZENS RADIO TRANSCEIVER
MODEL NO. 242-102

SERVICING INFORMATION

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

SECTION 1
GENERAL

1.1 GENERAL

This servicing information, part no. 001-0006-002, covers the Personal Messenger Citizens Band handheld transceiver, Model 242-102. Previous manuals covering this model are superceded by this edition.

1.2 TRANSCEIVER DESCRIPTION

The Personal Messenger 102, Model No. 242-102, is a single channel 1 1/2 watt DC input to the final RF stage handheld transceiver. It operates in the 26.965 to 27.255 MHz Citizens Band. Supply voltage to operate the transceiver is provided by a rechargeable battery pack included as standard equipment. A battery container, Model No. 250-805, for throw away AA (penlight) cells is offered as an accessory.

SECTION 2
SPECIFICATIONS

2.1 GENERAL

Frequency Range	26.965 - 27.255 MHz
Channels	One
Dimensions of Enclosure	8" high x 3 1/2" wide x 2" deep
Unit Weight	Approximately 1 lb 7 oz
Shipping Weight	Approximately 3 lb
Microphone	Built-in dynamic speaker-microphone
Circuitry	11 transistors and 4 diodes
Compliance	DOT Type Approved RSS 136 FCC Type Accepted Part 95

2.2 RECEIVER

(The microvolt levels listed in the receiver specifications are values measured at the antenna terminal.)

Sensitivity	9 dB minimum at 0.5 microvolts (30% modulated 1000 Hz)
Selectivity	6.5 kHz bandwidth at -6 dB
Frequency Control	±0.005% at 25° C
Spurious Rejection	50 dB except image of 12 dB
Antenna Impedance	Built-in Antenna
Audio Output Power	0.15 watts minimum at 0.5 microvolts
Speaker Impedance	100 ohms
Squelch Range	0.3 to 15 microvolts
Squelch Sensitivity	6 dB or less signal change for 40 dB of quieting at 1 microvolt
Squelch Noise Immunity	Highly immune to impulse-type noise
Intermediate Frequency	455 kHz
AGC Characteristics	Rolloff 30 dB maximum from 5000 to 0.5 microvolts
Noise Limiting	Series-type with automatic threshold adjustment
Circuitry	Single conversion superheterodyne

2.3 TRANSMITTER

Emission	6A3
Frequency Control	±0.005% crystal from -30° C to +60° C
DC Power Input	1 1/2 watts at 13 VDC
RF Power Output	0.8 watts at 13 VDC
RF Spurious and Harmonic Attenuation	Better than FCC and DOT requirements
Modulation	70% minimum upward
Circuitry	All transistor solid state

2.4 POWER SUPPLY REQUIRED

13 volt DC input

Receive:	Standby	-0.009 ampere
	Speech	-0.025 ampere
Transmit:	Carrier	-0.140 ampere
	Speech	-0.180 ampere

2.5 ACCESSORIES

250-804	Rechargeable Battery and Charger
250-803	Earphone with Cord and Plug
251-806	Leather Carrying Case with Strap
250-807	Cigarette Lighter Adapter
250-809-2	External Antenna Adapter
137-829-271	18" Fiberglas Antenna

SECTION 3
SERVICING

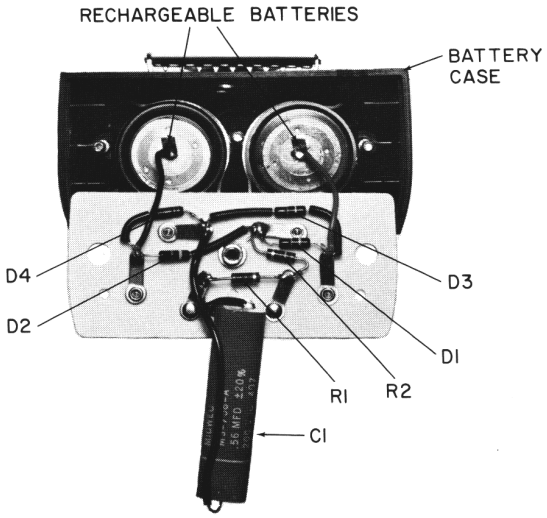
3.1 RECHARGEABLE BATTERY

The rechargeable batteries, part no. 503-0003-001, included with the Personal Messenger 102 are rated at 225 mA hours. But, the duty cycle the unit is operated on determines the hours the battery will supply enough current for normal operation. A fully charged battery pack can be expected to last for approximately 8 hours when the unit is operated at an 80% squelched receive, 10% received signal and 10% transmit duty cycle. If the operator transmits one-half of his operating time, the battery life can be greatly reduced.

A battery pack can be considered discharged when its voltage drops to 11 volts. Perform the following tests on batteries that are suspected of being faulty.

a. Charge the battery pack for 16 hours.

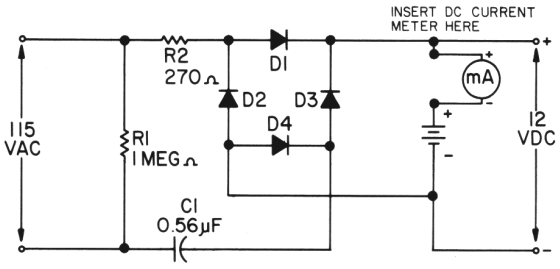
b. Connect a 500 ohm resistor across the + and - terminals of the battery pack. With this load the battery should take approximately 9 hours to discharge to a level of 11 volts. If the batteries fail this test, the recharging circuit should be investigated. If the recharger works normally, the batteries should be replaced.



RECHARGEABLE BATTERY PACK
FIGURE 3-2

3.2 BATTERY RECHARGING CIRCUIT

The typical charging current supplied by the recharger full wave rectifier is 18 mA. This current must be checked to determine the condition of the recharger. Figure 3-1 illustrates the necessary connections for measuring the charging current.



RECHARGING CIRCUIT
SCHEMATIC DIAGRAM
FIGURE 3-1

3.3 GENERAL SERVICING INFORMATION

If it becomes necessary to replace a transistor or diode, use a heat sink on the component leads - a small alligator clip or similar device is helpful. Use a soldering iron of at least 47 watts. Refer to the circuit board views, Figures 3-4 and 3-5 and photographs, Figures 5-1, 5-2 and 5-3 for parts identification. A suggested troubleshooting procedure follows:

a. Check the battery voltage under load; the voltage should be approximately 13 volts. If in doubt as to battery condition, refer to the rechargeable battery information.

b. Be sure crystals are firmly seated and that the receiver and transmitter are on the same channel.

c. Check the QUIET control; it may be too far clockwise, or the VOLUME may be too low.

d. Be sure the push to talk switch button is fully depressed when transmitting.

e. If the previous checks fail to solve the trouble, an inspection of the circuit should be made. Disassemble the unit following the steps in disassembly for servicing.

3.4 DISASSEMBLY FOR SERVICING

a. Carefully remove the battery pack by loosening the two screws. The screws are captive and will not fall out.

b. Remove the back of the case by taking out the three small screws.

c. Remove the VOLUME and QUIET control knobs. They are held in place with a screw in the center.

d. Remove the three standoff studs which hold the printed circuit board in place.

e. Remove the earphone jack nut.

f. Carefully tip the circuit board up on the switch side and remove the two screws holding the switch in place. Pull the earphone jack out of its hole.

g. Lift the printed circuit board slightly and remove the black (B-) and red (B+) quick disconnect leads from the battery terminals.

h. Remove the white lead from the antenna and the two blue leads from the speaker.

i. Make a visual inspection for broken or loose leads and loose, dirty or shorted components. Check antenna.

3.5 TROUBLESHOOTING

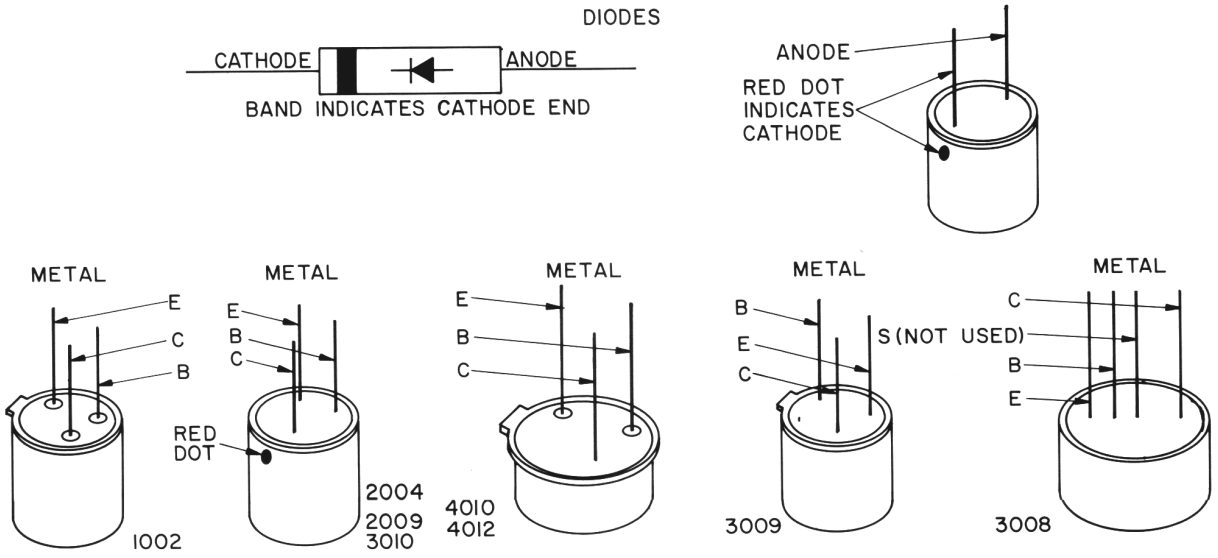
a. Connect the Personal Messenger to a 13 volt DC source. This can be either a fully charged battery pack or a power supply. The red lead is positive (+) and ground. It is the lead connected closest to the antenna.

NOTE

A power supply can be used for initial transmitter checks, but the battery pack must be installed when performing final transmitter tuning.

b. In looking for troubles, the most likely order of expected failure is electrolytics, open speaker, shorted jack, shorted or open disc capacitors and transistors or diodes. Do not replace transistors without careful investigation for other troubles.

c. A check of transistor emitter voltages will generally indicate if the transistors are operating normally, Q1, Q4 and the AGC are interconnected and failure of any of several components can cause Q1 and Q4 to operate abnormally.



SEMICONDUCTOR CASE DIAGRAMS
BOTTOM VIEWS
FIGURE 3-3

TABLE 3-1
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 probe or equivalent.
Oscilloscope with RF Pickup Loop	Direct connection to vertical plates, or vertical amplifier good to 30 MHz. Refer to Figure 4-3 for pickup loop fabrication details.	Check modulated waveforms and audio	Heath I0-12 or equivalent modified for direct connection to vertical plate or 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.
RF Signal Generator	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.
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 ±0.01% at 455 kHz.
RF Voltmeter	10 mV minimum sensitivity.	Measure RF voltages.	Millivac 38B or equivalent.

The following instrument can be used if the instruments in the above list are not available.

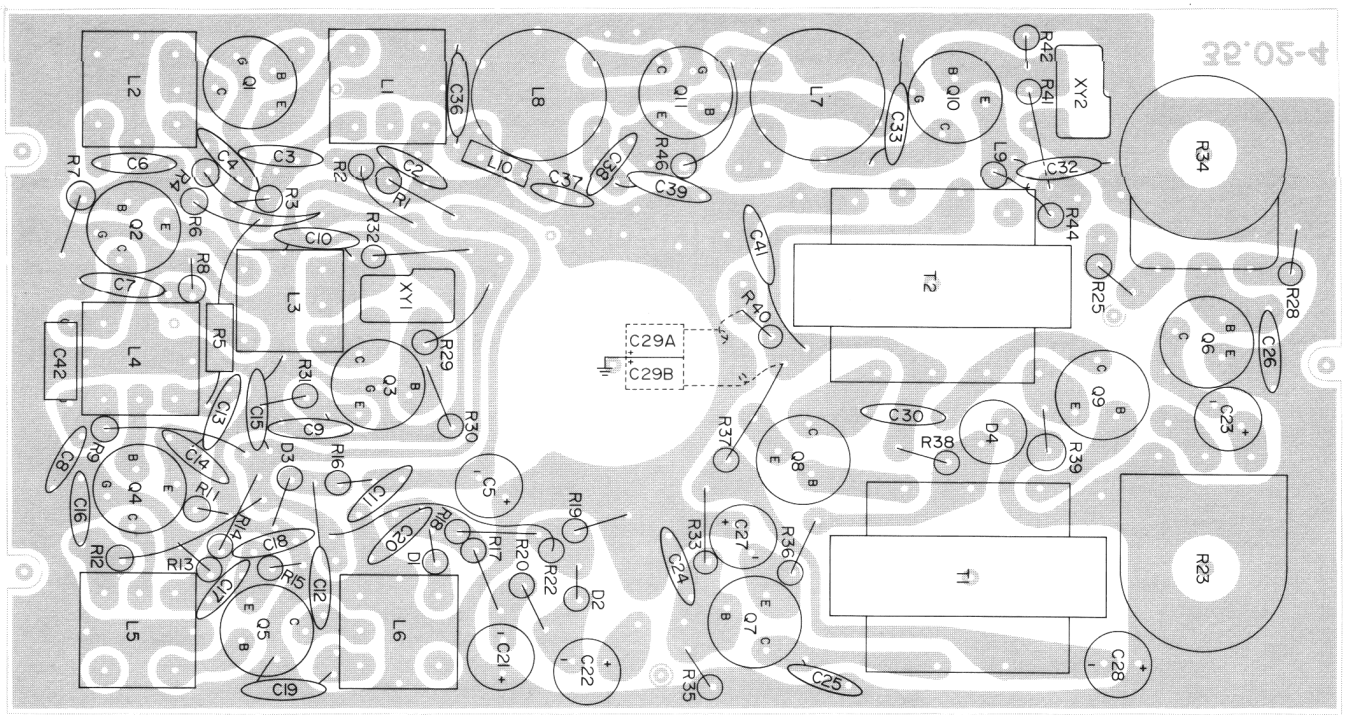
TYPE	CHARACTERISTICS	USE
International crystal C-12B test set NOTE: This instrument lacks 1000 Hz modulation for signal generator and accuracy is lower than the 0.0005% desired, but offers a desirable combination of features at low cost. It is battery operated and portable.	Frequency Meter - 23 CB frequencies, 26.965 to 27.255 MHz, with an accuracy of ±0.0015%.	Measure receiver and transmitter RF frequencies.
	RF signal generator - 23 CB frequencies ±0.0015%, output 1 to 100 microvolts, 30% modulation at 400 Hz.	Receiver RF source.

TABLE 3-2
RECEIVER TROUBLESHOOTING

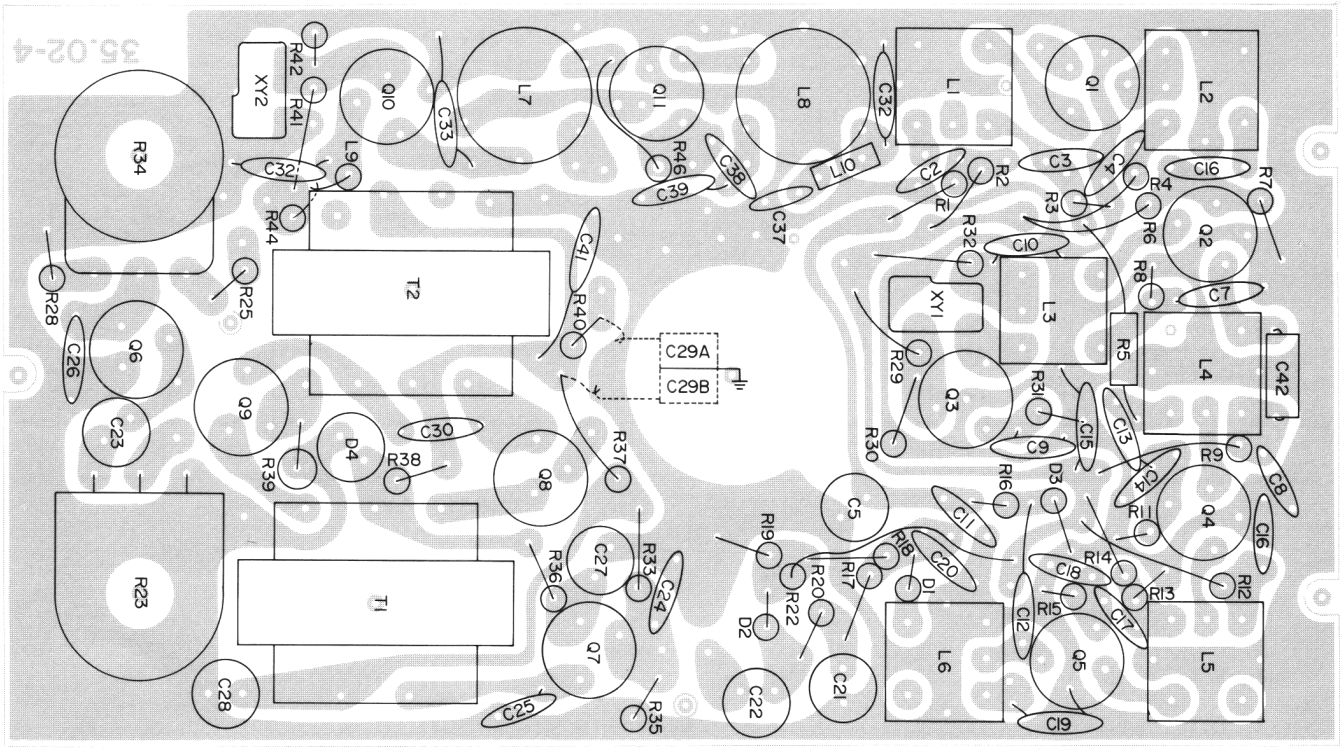
Trouble	Probable Cause	Check
Current drain high (over 100 mA)	Q8 or Q9 shorted	Check the base bias of Q8 and Q9 (It should be about -0.15V). Check the collector voltage.
Current drain high (30-100 mA, no signal)	Short in C4, C10, C18, C29B, L6, etc.	Check voltages in receiver and look for visual shorts.
Receiver dead. Current drain is normal.	Bad receiver transistor or inoperative receiver oscillator	Check for oscillator operation by measuring the oscillator injection voltage at the emitter Q2 with an RF probe. The typical injection level is from 0.05 to 0.2 volts RF.
Q1 and Q4 emitter voltage abnormal		
1. Q1 emitter voltage = 0	Short in L1 or C3	Check collector current of Q1 (voltage drop across R4). If collector current is high, suspect a short in L1 or C3.
2. Q1 emitter voltage is low but not 0. Q4 emitter voltage = 0	Short in L4 or R5 short to the case of L3	Check L4 and R5 for shorts.
3. Q1 and Q4 emitter, base and collector voltages all at about -6 volts.	Open R1, R16 or D3	Check the condition of R1, R16 and D3.
4. Q1 emitter voltage 0 or very low and collector current = 0	Q1	Check Q1 out of circuit with an ohmmeter or replace.
Low receiver gain	Q1, C27, C23 or C22 faulty	Check components with an ohmmeter.
Oscillator does not oscillate.	Faulty L3 or Q3	Check components with an ohmmeter.
Receiver motorboats or oscillates.	C5 (bad or low capacity)	Substitute C5.
Quiet control action abnormal (audio increases just before drop off.)	C5	Substitute C5.

TABLE 3-3
TRANSMITTER TROUBLESHOOTING

Trouble	Probable Cause	Check
Transmitter oscillator inoperative	Oscillator tuning	Check oscillator emitter voltage and tuning of L7.
Oscillator current normal but no or low power output	Q11	Check tuning of L7. Substitute Q11.
Audio oscillation not in the audio circuits	Q11	Substitute Q11.
Audio oscillation in audio circuit	C24	Substitute C24.



PERSONAL MESSENGER 102 (CB)
CIRCUIT BOARD
(VIEWED FROM COMPONENT SIDE)
FIGURE 3-4

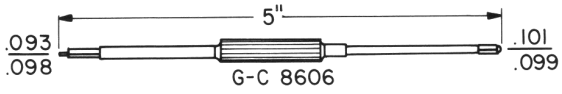


PERSONAL MESSENGER 102 (CB)
CIRCUIT BOARD
(VIEWED FROM COPPER SIDE)
FIGURE 3-5

SECTION 4
ALIGNMENT

4.1 GENERAL

Exercise care in tuning (turning) the iron cores in the RF and IF transformers. These cores are small and easy to break. Use a GC (General Cement) 8606 delrin alignment tool for all tuning (refer to Figure 4-1).



ALIGNMENT TOOL REQUIRED
FIGURE 4-1

The white antenna lead must be disconnected from the whip antenna and connected to the signal generator through a 27 pF capacitor for receiver alignment. Refer to the section on disassembly for servicing for information on how to gain access to the antenna lead.

A mismatch results when a signal generator is connected to the white antenna lead. Because of this, the signal generator output must be set to 1.84 μV into a 6 dB pad to obtain the 0.5 μV level required to meet sensitivity specifications (9 dB signal + noise to noise ratio).

A calibrated test jig must be constructed to accurately measure the transmitter power output. A diagram of this test jig is illustrated in Figure 4-2.

4.2 RECEIVER ALIGNMENT

4.2.1 TEST INSTRUMENT CONNECTIONS

a. Connect an audio voltmeter across the speaker terminals. If desired, the blue speaker leads can be disconnected and loaded with a 100 ohm resistor.

b. Disconnect the white antenna lead from the whip antenna.

c. Connect the signal generator through a 6 dB pad and a 27 pF capacitor to the white antenna lead.

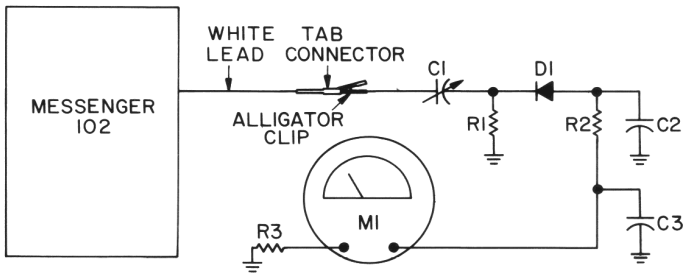
d. Insure that the transceiver is connected to a 13 volt DC power source. This can be a fully charged battery pack or a power supply.

4.2.2 ALIGNMENT

a. Set the signal RF output level to 1.84 μV. This level will produce 0.5 μV at the white antenna lead. Set the modulation for 30% at 1000 Hz.

b. Tune the signal generator for a maximum indication on the audio voltmeter. Make sure the squelch control is set to the fully unsquelched position.

c. With a GC-8606 delrin alignment tool, turn the core of L3 counterclockwise until the oscillator stops. This is observed by a decrease in the audio voltmeter indication. Set the core 1 1/2 turns clockwise from the oscillator starting point. (This is to allow for variations in crystals and supply voltage).



NOTES:
1. THE ⏚ SYMBOL INDICATES THE SAME CIRCUIT POINT AS THE RED BATTERY LEAD.
2. C1 MUST BE TUNED FOR MAXIMUM INDICATION ON M1.
3. TEST JIG MUST BE CALIBRATED AGAINST A TRANSCEIVER WITH 50 OHM OUTPUT IMPEDENCE AND A WATTMETER.

PARTS REQUIRED

C1	8-60pF COMPRESSION MICA TRIMMER
C2	0.005µF CERAMIC DISC CAPACITOR
C3	0.005µF CERAMIC DISC CAPACITOR
D1	IN295 DIODE
M1	60 MICROAMPERE DC CURRENT METER
R1	27 OHM RESISTOR
R2	10k OHM RESISTOR
R3	3.3 OHM RESISTOR

TEST JIG FOR MEASURING
TRANSMITTER POWER OUTPUT
FIGURE 4-2

d. Tune L6, L5, L4, L2, L1, L2, L4, L5 and L6 (in that order) for a maximum indication on the audio voltmeter.

NOTES

1. L1 has two peaks. The correct peak is the one with the core nearest the bottom of its travel.
2. The volume should be reduced slightly if the gain is over +17 dB during the adjustments.
3. The minimum acceptable gain is +14 dB minimum (3.9 volts RMS on the audio voltmeter) with 1.84 μV output from the signal generator.
4. The signal + noise to noise ratio should be 9 dB minimum (signal generator audio modulation on versus audio off).

e. Check quiet (squelch) action. Set the signal generator to minimum output with modulation off. Set the quiet control for a -30 dB indication on the audio voltmeter. Increase the generator output to 1.84 μV. The quiet (squelch) should open.

4.3 TRANSMITTER ALIGNMENT

4.3.1 TEST INSTRUMENT CONNECTIONS

a. Disconnect the white whip antenna lead and connect it to the power meter test jig. A field strength meter can be used if the test jig is not available. A field strength meter should be available for final adjustment.

b. Insert a DC current meter, at least 200 mA, in series with the black battery lead and the power source.

c. Connect an audio generator across the speaker terminals. Set the output to zero.

d. Refer to Figure 4-3. Have an RF pick-up loop and oscilloscope available for checking modulation.

4.3.2 ALIGNMENT

a. Depress the push-to-talk switch.

b. Tune the core of L7 for maximum output with minimum current drain. (Total transmitter current drain is approximately 160 mA).

c. Tune the core of L8 for maximum output.

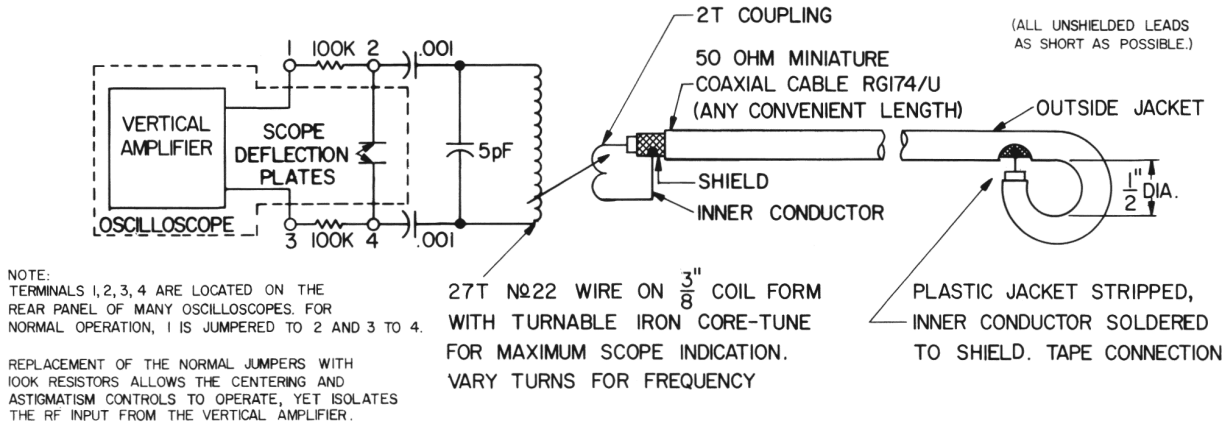
d. Check the modulation with the oscilloscope and RF pick-up loop. Place the loop over L8.

e. Set the audio generator output to 0.1 volts at 1000 Hz.

f. Depress the push-to-talk switch. Minimum acceptable upward modulation is 70%.

NOTE

Alignment of the final transmitter stage should be accomplished with the battery pack installed rather than the power supply. External power supply leads can produce undesirable affects on antenna performance.



OSCILLOSCOPE RF PICK-UP LOOP
AND METHOD OF CONNECTION
FIGURE 4-3