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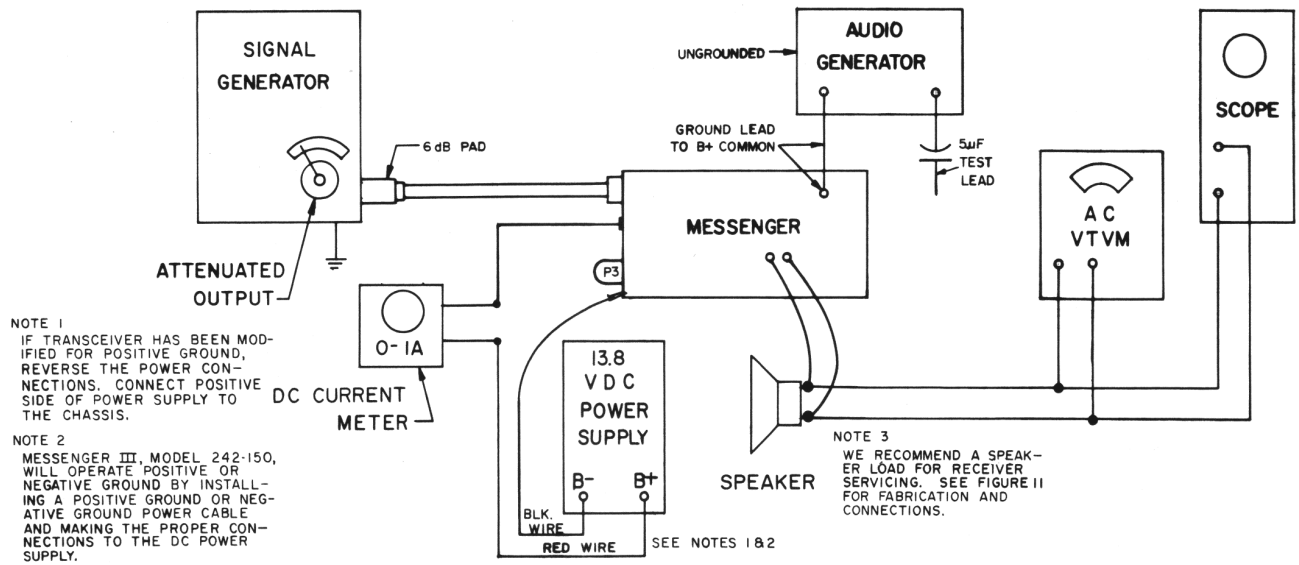
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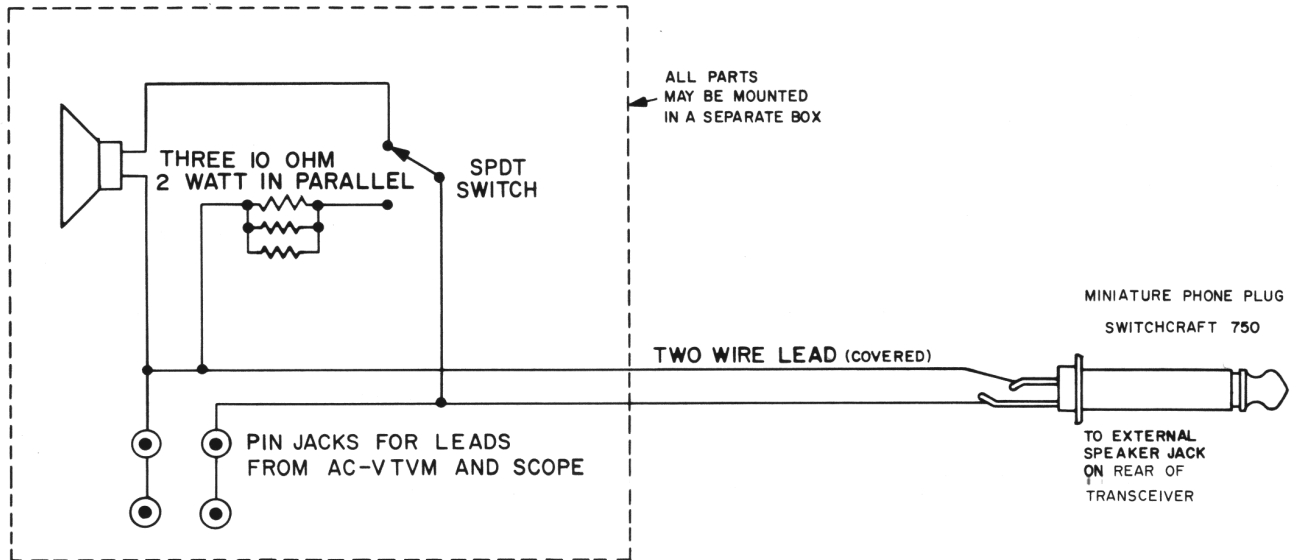
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RECEIVER TEST INSTRUMENT CONNECTIONS
FIGURE 10



TEST ASSEMBLY
CONNECTING AC-VTVM AND SCOPE
FIGURE II

SERVICING (cont'd)

at the corners. After the screws are removed the speaker may be easily lifted from the chassis.

2. The two speaker leads are long enough to allow placing the speaker aside while making tests or during alignment. If complete removal is desired, disconnect the two leads at the speaker by pulling them from the terminals.

CAUTION:

If the speaker is left attached during servicing, do not place the speaker so that it can short the IF transformer shield cans to the chassis. To do so would short the power supply.

5.2.4 TEST INSTRUMENTS REQUIRED

NOTE:

Equivalent or superior equipment may be substituted.

- a. Power Supply - 13.8 VDC regulated, Hewlett-Packard 6201A
- b. Oscilloscope - Tektronix 561A
- c. AC-VTVM - Heath Model AV-3
- d. RF Signal Generator - 0.455 to 50 MHz with attenuated output of 1 microvolt to 1 volt capable of modulation at 1000 Hz at 30%. Hewlett-Packard 606A.
- e. Audio Signal Generator - 1000 Hz - Heath Model AG-9A or equivalent
- f. VTVM - Tripplett Model 850 with RF Probe
- g. 50 ohm 6 dB pad - Connected to output of signal generator for the troubleshooting and alignment procedures

5.2.5 TEST INSTRUMENT CONNECTIONS

See Figures 10, 11 and 14.

NOTE:

The Messenger is "floated" above ground and care must be exercised in connecting test instruments. We recommend that a standard 2

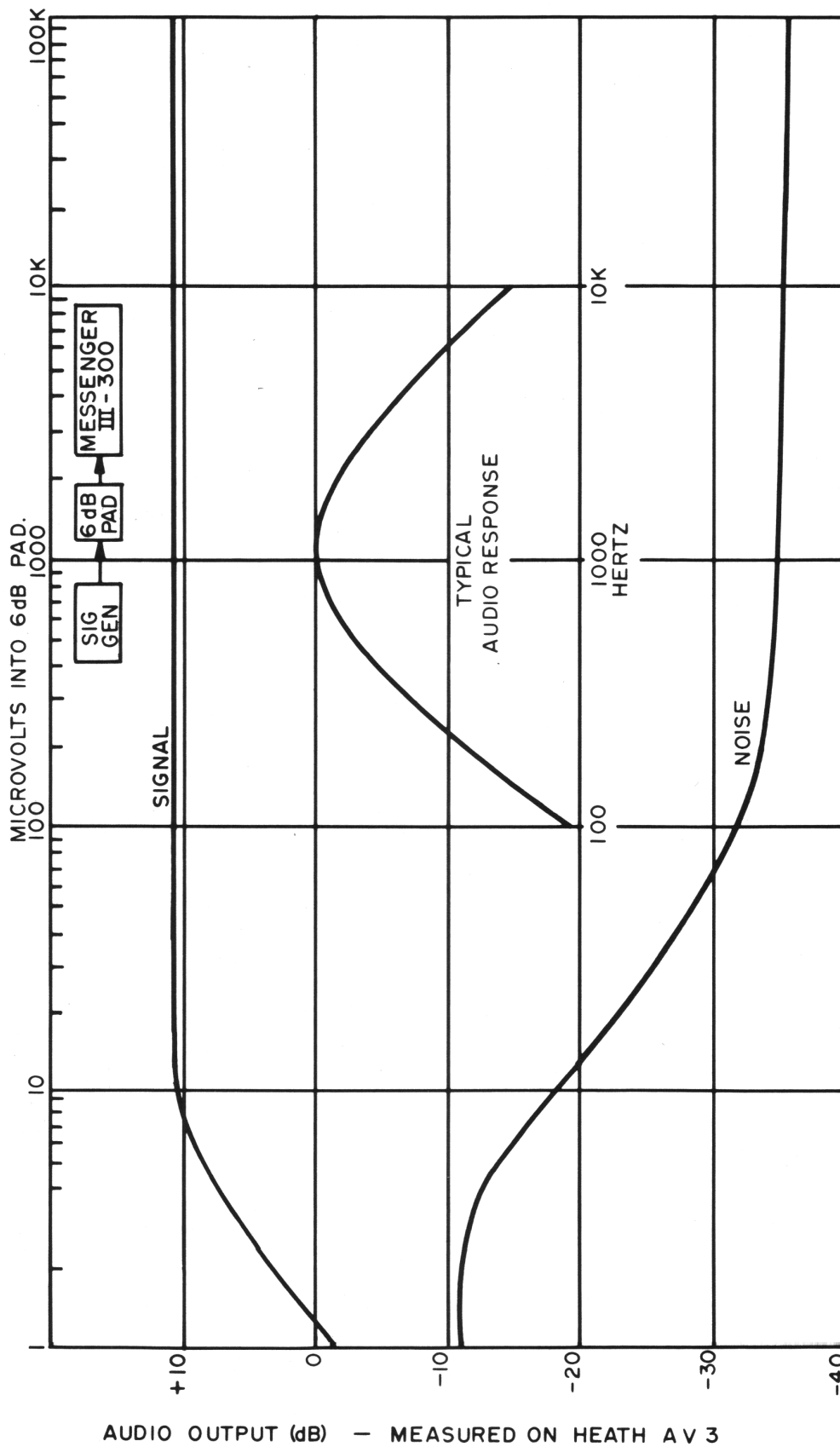
prong plug be used for connecting to 117 VAC rather than a grounding 3 prong plug. The test equipment called for in the equipment list will work satisfactorily if connected as shown in Figures 10, 11 and 14. The AC-VTVM and oscilloscope connections may be made as shown in Figure 10 or a test cable may be used as shown in Figure 11. If an audio generator or VTVM other than the ones described in the equipment list is used, it must be isolated from ground. It may be necessary in the use of the audio generator to place a capacitor in series with the ground lead as well as the hot lead. The RF signal generator used for the receiver tests and alignment is connected to the receiver through a 6 dB pad for all measurements. In some instances the signal generator output may also be in series with a 0.1 μ F capacitor and this will be indicated where appropriate. The test equipment connection to the receiver for troubleshooting and alignment will be as follows, except where noted.

- a. Connect the DC power supply.
- b. Connect the AC-VTVM across the speaker terminals as indicated in Figures 10 and 11.
- c. Connect a 6 dB pad to the output to the RF generator.
- d. Set the RF signal generator modulator for 1000 Hz at 30%.

5.2.6 PRELIMINARY RECEIVER TEST

- a. Connect test equipment to the receiver as illustrated in Figure 10.
- b. Set signal generator for 1 microvolt output. Modulate the generator with 1000 Hz at 30%.
- c. Turn volume control to maximum and squelch to minimum (CCW).
- d. The current drain on the power supply for the receiver will be approximately 180 mA with a 13.8 VDC power supply.
- e. There should be at least +5 dB of audio across speaker, and other specifications should be obtained as listed in Section 2.

If these conditions are not met, recommended



AGC AND AUDIO CURVE
FIGURE 12

SERVICING (cont'd)

receiver checks may be made as outlined in the following text.

	150	+2.6
	500	+2.7
5.2.7 AGC	1,500	+2.75
a. The Messenger utilizes a flat, delayed, amplified AGC system. AGC is applied to the base of Q8 in the IF section, and to the bases of the AGC amplifiers, Q5 and Q2. Q5 is in series with the first mixer, Q4, and Q2 is in series with the RF amplifier, Q1. Since the AGC may affect many stages, it is important to make checks on this section first.	5,000	+2.8
	15,000	+2.85

- b. AGC problems will cause:
1. Receiver to be completely inoperative.
 2. Severe overloading at high signal levels.
 3. Erroneous voltage readings at the bases of Q1, Q2, Q4, Q5 and Q8.
 4. If no AGC is developed by D1 (a faulty D1) the squelch will not open with an RF signal but will open manually with the squelch control, R43.
- c. Connect an RF signal generator to the antenna terminals.
- d. Connect a DC voltmeter between the cathode of D1 and B+. Connect the minus side of the meter to B+. See the following chart, Typical AGC Voltages at the Cathode of D1.

Typical AGC Voltages At The Cathode Of D1

Microvolts at the Antenna Terminals	Squelch Fully Unsquelled
0.5	0
1.5	+0.95
5	+2.0
15	+2.3
50	+2.0

5.2.8 SQUELCH

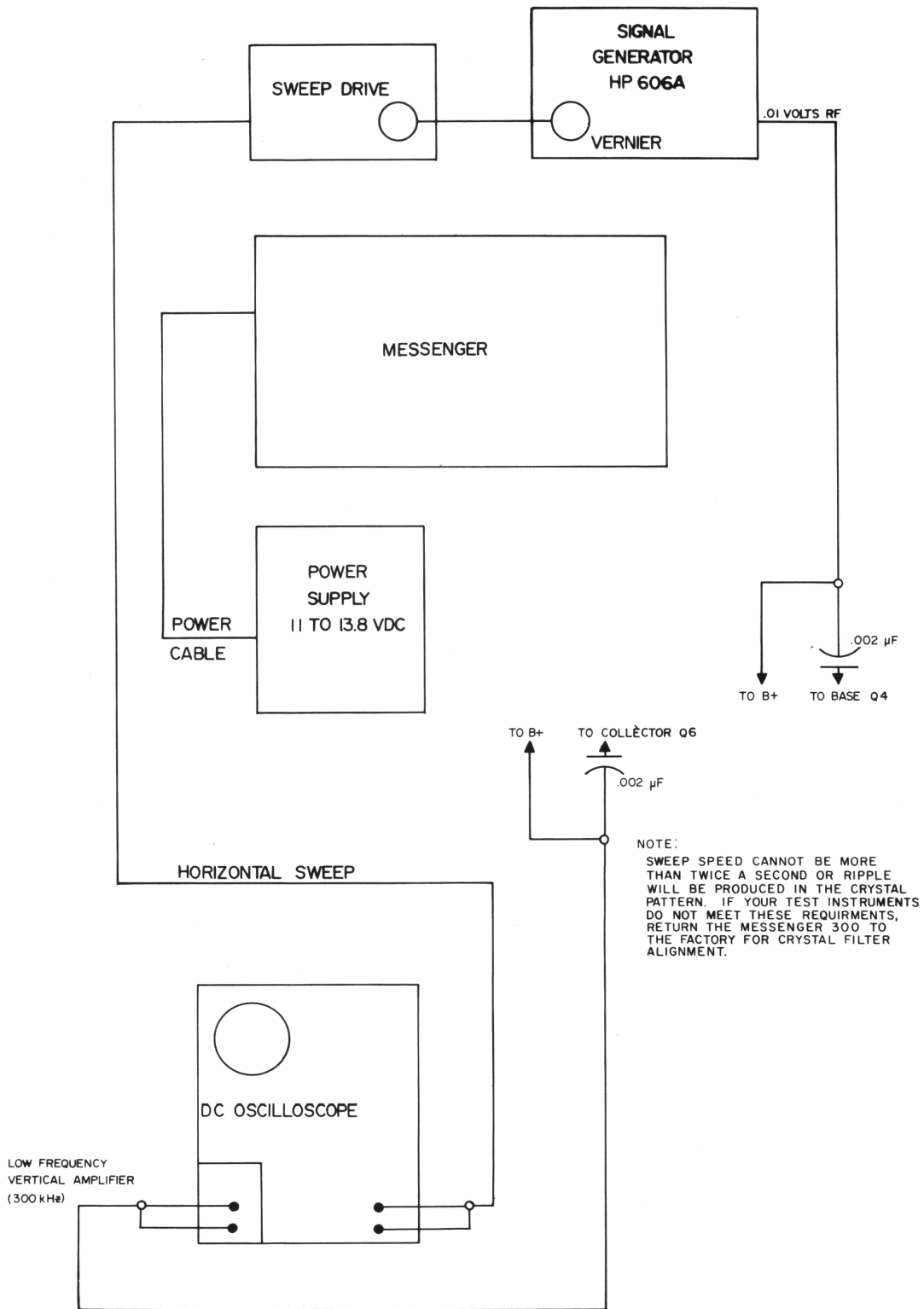
Squelch Section Troubleshooting

- a. Connect a DC voltmeter between the emitter of Q12 and B+. Apply power to the receiver.
- b. While monitoring the DC voltmeter, rotate the squelch control from minimum to maximum.

The voltage should change from approximately -2.6 to -6.5 volts.
- c. If the voltage does not change at Q12, check the diode D6 by bridging it with a new device.
- d. An open D6 will result in no squelch at all, and no change in voltage at the emitter of Q12.
- e. If D6 was not open, check the bias of Q10 and Q11.
- f. If diode D6 is shorted, the voltage at Q11 will be normal and squelch will operate very slowly. The emitter of Q12 in this case will read very low at minimum squelch, and normal at maximum squelch. Check by substituting the diode with a device known to be operational.

5.2.9 AUDIO

- a. Connect the audio generator thru a 5 μ F capacitor to the top of the volume control with an output of 0.0025 volts RMS \pm 10% at 1000 Hz (positive side to the generator). The ground lead is connected to the circuit common, B+.
- b. Set audio control for +10dB on the AC-VTVM and turn squelch to minimum. (CCW)



TEST EQUIPMENT SET-UP FOR
CRYSTAL FILTER TUNING
FIGURE 13

SERVICING (cont'd)

- c. The output as monitored on the AC-VTVM and scope should be approximately +10 dB undistorted. See the Typical Receiver Audio Level Chart following.

- d. Typical Receiver Audio Levels

Test Conditions:

Volume control set for a level of 1 mV at the base of Q12. 1.5 μ V at the antenna terminals modulated at 80%, 1000 Hz.

<u>Point</u>	<u>Volts RMS</u>
Base of Q12	0.001
Collector of Q12	0.0075
Base of Q13	0.0075
Collector of Q13	0.9 volts
Base of Q14 or Q15	0.2 volts
Collector of Q14 or Q15	4 volts

- e. The voltages at the emitters and bases of the Class B amplifiers (Q14 and Q15) should be approximately the same. If one of the transistors shows no voltage difference between the emitter and base, it is probably defective.

- f. Parts replacement in Audio Stage.

Replacement of Q14, Q15, R58, C51, C57 or D5 will require the removal of L8 in order to gain access to these components. L8 is mounted on the side of the chassis and held in place by two screws.

Notes on the Class B Stage.

An open transistor in this stage would be evidenced by severe audio distortion. A shorted transistor will cause R58 to burn and possibly blow a fuse. It is often possible to find the defective transistor by determining which has an excessively hot case. Remove the suspected faulty transistor and

check it using the information available in Section 5.1.

5.2.10 IF

- a. Connect test equipment as shown in Figure 10 and outlined in Section 5.2.5.
- b. Set volume control for +10 dB on AC-VTVM and turn the squelch to minimum.
- c. Set the modulated RF Signal Generator to 455 kHz with an output of 200 microvolts.
- d. Connect a 0.1 μ F capacitor in series with the output of the signal generator.
- e. Connect the output of the signal generator to the base of Q6. There should be approximately +10 dB of undistorted audio across the speaker terminals. If the output is weak or distorted, check the IF stage voltages as well as the detector diode, D2, and the noise limiter D3.

5.2.11 CRYSTAL FILTER (Messenger 300 only)

NOTE:

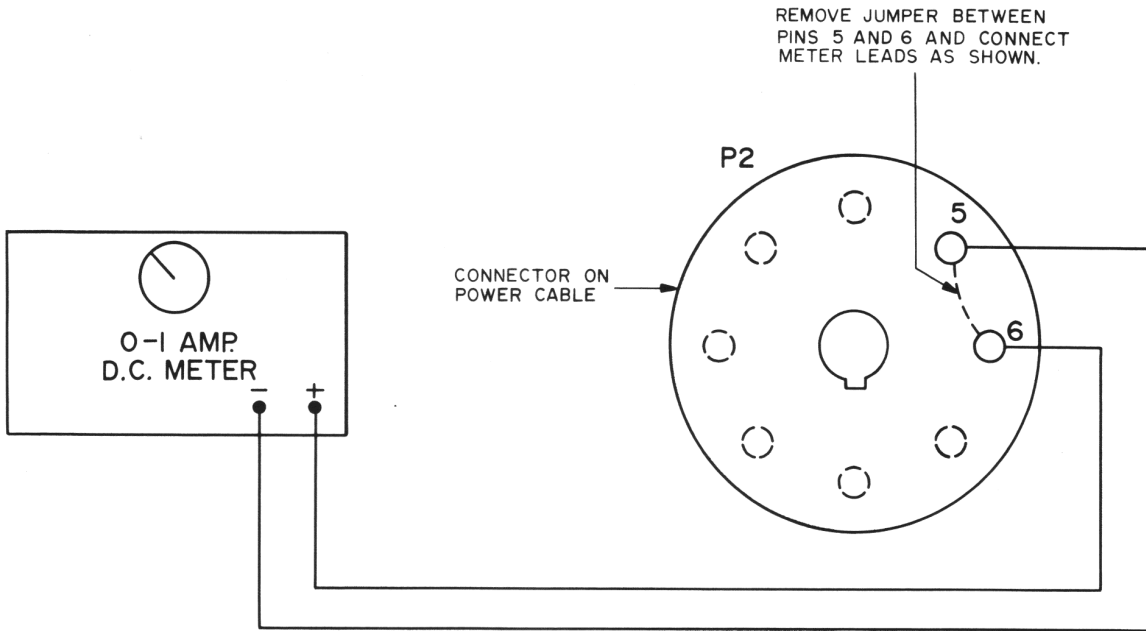
The Messenger 300 should be returned to the factory for required crystal filter alignment if the necessary test equipment shown in Figure 13 is not available.

- a. Connect the test equipment as shown in Figure 13.
- b. Solder 100 ohm swamping resistors from pin 1 to pin 4 of L2, and from pin 3 to pin 4 of L5. Remove the 4.755 MHz crystal.
- c. Connect the output of the RF Signal Generator to the base of Q4 through a 0.002 μ F capacitor.
- d. Connect the DC oscilloscope to the collector of Q6 as shown in Figure 13.
- e. Apply 13.8 Volts DC power to the Messenger 300.
- f. Check for 1 dB ripple or less. Capacitors C85, C86 and C88 affect the degree of ripple.

SERVICING (cont'd)

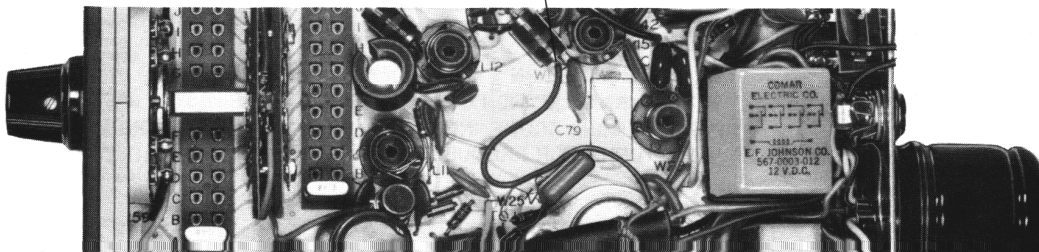
5.2.12 RF AMPLIFIER AND FIRST MIXER

- a. Connect test equipment as shown in Figure 10 and outlined in Section 5.2.5.
- b. Set signal generator to the operating frequency and connect it to the antenna terminals.
- c. Set the modulated RF signal generator for 1 microvolt output.
- d. With maximum volume, the output measured across the speaker terminals on the oscillo-



**D.C. AMMETER CONNECTION TO POWER CABLE
(FOR MESSENGER III, MODEL 242-150)
FIGURE 14**

UNSOLDER BLUE WIRE AT L14 PAD. CONNECT DC AMMETER WITH ALLIGATOR CLIPS BETWEEN THE UNSOLDERED END OF THE BLUE WIRE AND L14. AFTER YOUR MEASUREMENTS ARE COMPLETED, BE SURE TO RESOLDER BLUE WIRE TO L14.



**DC AMMETER CONNECTION TO
MESSENGER III, MODEL 242-143 AND
MESSENGER 300, MODEL 242-149
(PART OF FIGURE 14)**

SERVICING (cont'd)

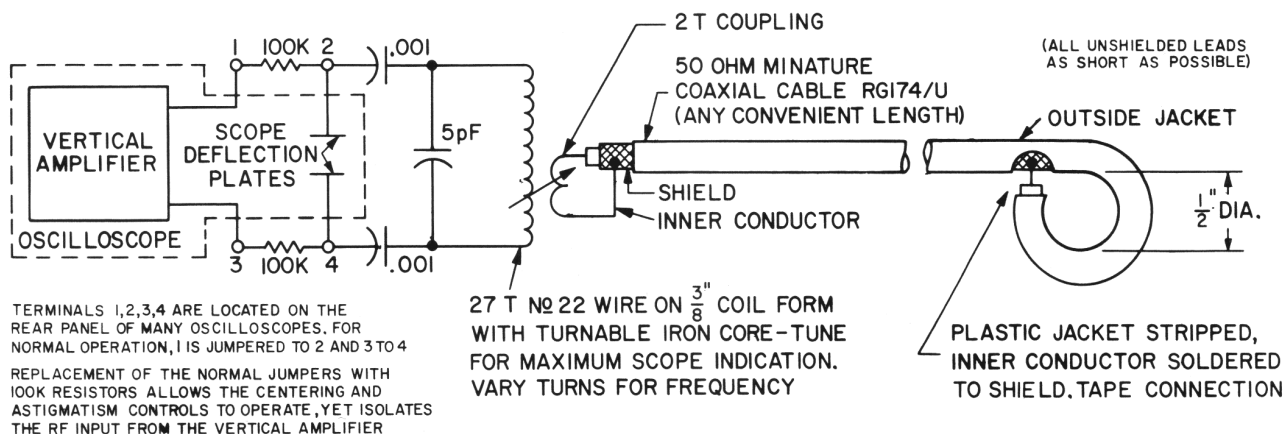
- scope and VTVM should be at least +5 dB undistorted audio.
- If the receiver output is not normal, check the emitter of the oscillator, Q4, with an RF probe. There should be approximately 0.2 volts RF at this point.
 - If the oscillator operation appears normal, check the voltages at Q1 and Q4, and replace if necessary.
 - 50 ohm transmitter load with a power rating of at least 5 watts.
 - Audio generator - Heath IG-72 or equivalent

5.3.2 TEST INSTRUMENT CONNECTIONS

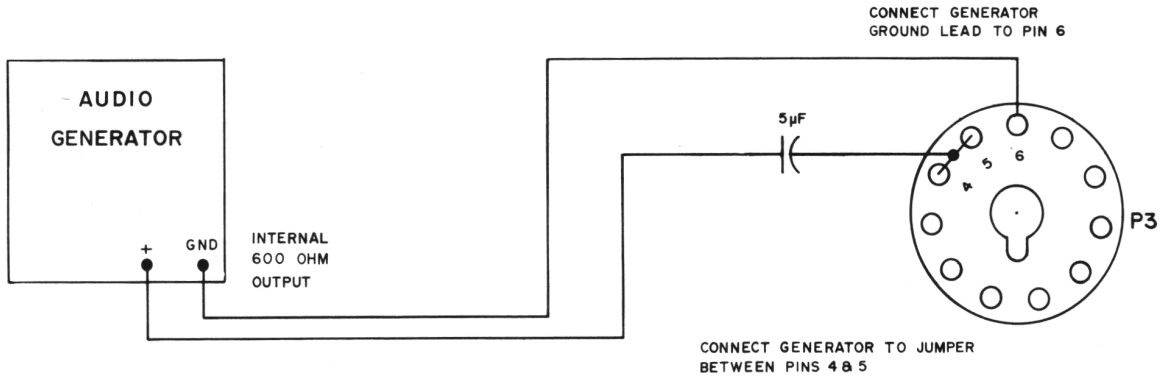
5.3 TRANSMITTER

5.3.1 TEST INSTRUMENTS REQUIRED

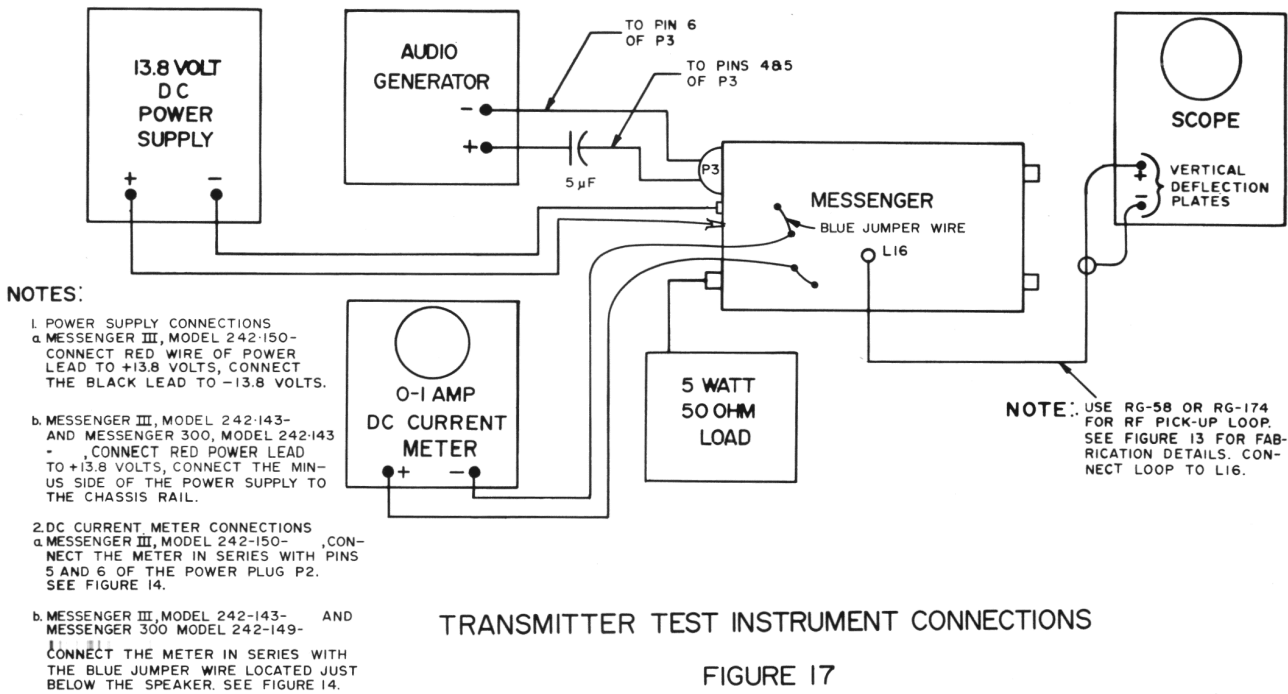
- Regulated DC Power Supply, 13.8 volts at 1.5 amperes. Hewlett-Packard 6201A.
- Oscilloscope - with RF pickup loop capable of direct connection to the vertical plates, see Figure 15.
- 0-1 ampere DC ammeter
- For the Messenger III, Model 242-150, connect the 0-1 amp meter in series with pins 5 and 6 of the power plug P2. These pins are jumpered in the plug as shown on the schematic. Be sure to replace this jumper when the meter is removed. See Figure 14.
- For the Messenger III, Model 242-143 and Messenger 300, Model 242-149, the DC ammeter is connected in series with the blue jumper wire located just below the speaker



OSCILLOSCOPE RF PICK-UP LOOP
AND METHOD OF CONNECTION
FIGURE 15



AUDIO GENERATOR CONNECTOR TO P3
FIGURE 16



TRANSMITTER TEST INSTRUMENT CONNECTIONS

FIGURE 17

SERVICING (cont'd)

looking down upon the components and L14. See Figure 14. Unsolder the blue wire at L14 pad. Connect DC ammeter with alligator clips between the unsoldered end of the blue wire and L14. After your measurements are complete, be sure to resolder blue wire to L14.

- e. Connect audio generator with .007 volts output through 5 μ F blocking capacitor to pins 4 and 5 of plug P3. Pins 4 and 5 are jumpered so connect to the jumper. Connect the ground side of the generator to pin 6 of P3. See Figure 16.
- f. Connect the DC power supply. Turn transmitter on.

5.3.3 PRELIMINARY TRANSMITTER CHECK

- a. Key the transmitter and check for an RF power output of 3 watts minimum.
- b. Apply a 1000 Hz audio tone and monitor the output waveform on the oscilloscope using the RF pickup loop shown in Figure 15. The output should be a clean modulated RF waveform. If the results of the measurements indicate a defective transmitter continue with the following troubleshooting procedures.

5.3.4 INITIAL TRANSMITTER ADJUSTMENTS

- a. If the transmitter output is low, change the transmitter current with L16, and peak the power output with C79 to obtain desired power point as shown in Figure 20.

NOTE:

C79 has been deleted on late models of Messenger III and 300 to improve tuning. A 390 pF fixed mica capacitor replaces C79. (See parts list). We recommend that a de-

fective C79 be replaced with the 390 pF capacitor.

- b. When the transmitter output is peaked to normal, modulate carrier with 0.007 volts, 1000 Hz sine wave and check for distortion. (See Figure 18.) If distortion is present, or normal transmitter output cannot be obtained, proceed with the troubleshooting and alignment instructions.

5.3.5 OSCILLATOR STAGE

- a. Key the transmitter and check for normal power output.
- b. If the transmitter is inoperative, check the oscillator stage using the scope and RF pickup loop. A tunable receiver may also be used to make a quick check of the oscillator. If no RF is present, check the bias of Q16 and replace components as necessary.

5.3.6 DRIVER STAGE

- a. Key the transmitter; if power output is low, adjust C79 and check the driver stage with an RF pickup loop and oscilloscope. (Figure 15.)
- b. If the RF is low at this point, check the bias of this stage and replace defective components as necessary.

5.3.7 POWER AMPLIFIER STAGE

- a. Key transmitter - normal power output is approximately 3 watts minimum.
- b. If tuning C79 does not affect output power, and the driver stage is normal, check the bias of Q18.