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M E S S E N G E R

I

CITIZENS RADIO TRANSCEIVER
MODEL NO. 242-126/129
MODEL NO. 242-138

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

SECTION 1
GENERAL INFORMATION

1.1 GENERAL

The Johnson Messenger I is a radio transceiver designed for two-way radio service in the 27 MHz Citizens band. The transceiver consists of a crystal controlled superheterodyne receiver, a crystal controlled two-stage transmitter, and power supply in a 5 5/8" x 7" x 11 1/2" enclosure. The antenna, power supply, and some audio circuits are common to both receiver and transmitter. A channel selector switch provides operation from any of five sets of crystals which can be installed in the unit. The Messenger I is available in the following models:

MODEL NO.	OPERATING VOLTAGE
242-126	117 VAC, 50-60 Hz
242-127	117 VAC, 6 VDC
242-128	117 VAC, 12 VDC
242-129	117 VAC, 24 VDC
242-138	117 VAC, 230 VAC, 12 VDC

1.2 RECEIVER TUBE AND DIODE LINEUP

TUBE	FUNCTION
V1 (6BJ6)	Tuned RF amplifier
V2 (12BE6)	Mixer-crystal oscillator
V3 (6BJ6)	IF amplifier (455 kHz)
V4 (6AL5)	Dectector, AVC
D2 (1N881)	Automatic noise limiter
V5A (1/2 6AW8A)	Squelch control amplifier
V10A(1/2 12AU7)	First audio amplifier
V5B (1/2 6AW8A)	Second audio amplifier
V6 (12AB5)	Audio power output
V9 (12BW4)	Rectifier, high voltage

1.3 TRANSMITTER TUBE AND DIODE LINEUP

TUBE	FUNCTION
V9 (12BW4)	Rectifier, high voltage
D1 (1N881 or 1138)	DC switch
V10B(1/2 12AU7)	First speech amplifier
V5B (1/2 6AW8A)	Second speech amplifier
V6 (12AB5)	Modulator
V7 (7054)	Crystal oscillator
V8 (7061)	RF power amplifier

SECTION 2
SPECIFICATIONS

2.1 GENERAL

Frequency Range	- 26.965 to 27.255 MHz
Channels	- Five
Dimensions of Enclosure	- 5-5/8" high x 7" wide x 11-3/8" deep
Unit Weight	- 12 lbs.
Microphone	- High impedance ceramic element. Cycolac case. Push-to-talk switch, hang up stud.
Circuitry	- 10 electron tubes, 2 diodes

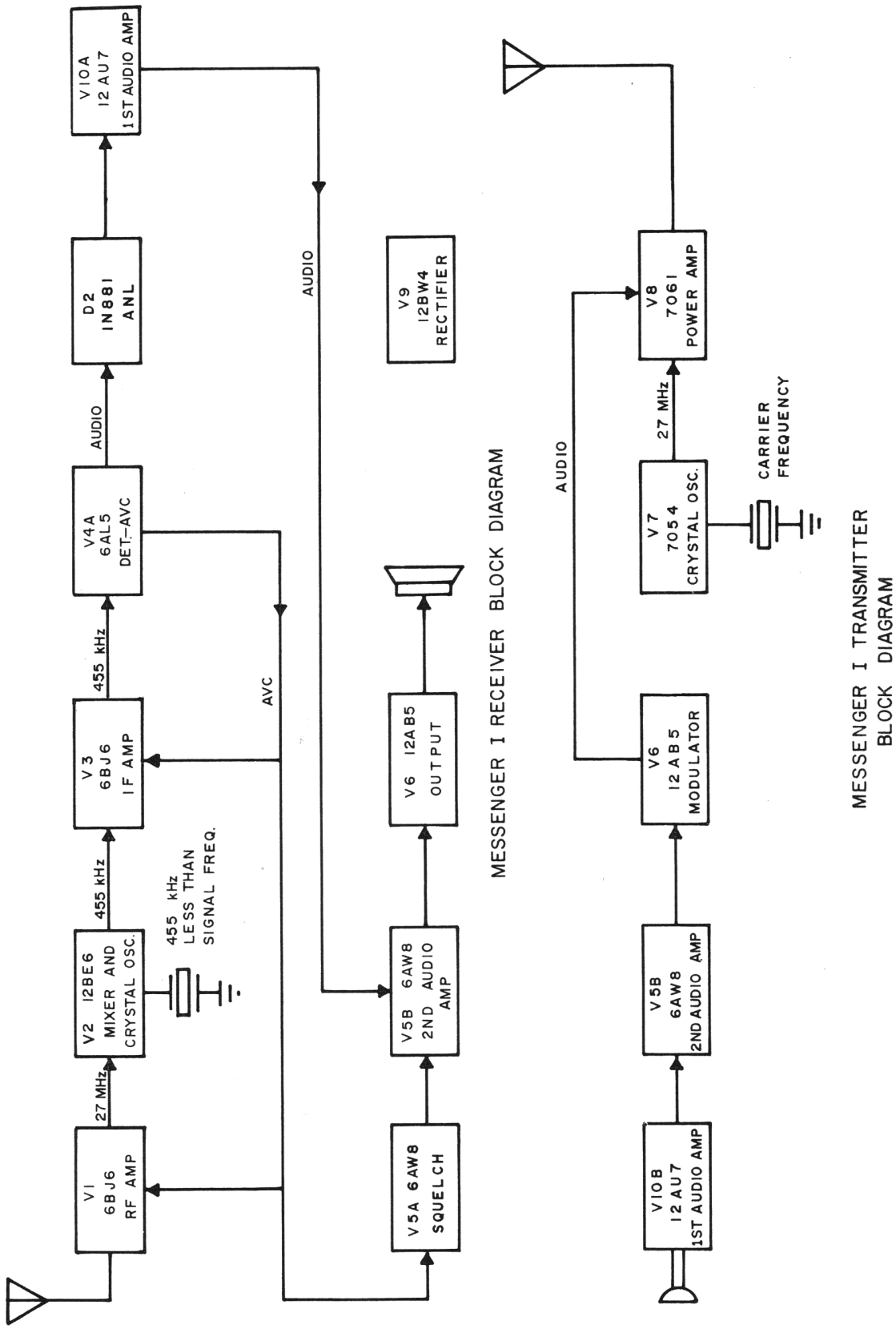

V1 6BJ6 RF AMP
27 MHz
V2 12BE6 MIXER AND CRYSTAL OSC.
455 kHz
455 kHz LESS THAN SIGNAL FREQ.
V3 6BJ6 IF AMP
455 kHz
V4A 6AL5 DET.-AVC
AUDIO
D2 IN881 ANL
V10A 12AU7 1ST AUDIO AMP
AUDIO
AVC
V5A 6AW8 SQUELCH
V5B 6AW8 2ND AUDIO AMP
V6 12AB5 OUTPUT
V9 12BW4 RECTIFIER
MESSENGER I RECEIVER BLOCK DIAGRAM
V10B 12AU7 1ST AUDIO AMP
V5B 6AW8 2ND AUDIO AMP
V6 12AB5 MODULATOR
AUDIO
V7 7054 CRYSTAL OSC.
27 MHz
V8 7061 POWER AMP
CARRIER FREQUENCY
MESSENGER I TRANSMITTER BLOCK DIAGRAM

FIGURE I

SPECIFICATIONS (cont'd)

Compliance	- FCC Type Accepted Rule Part 95 DOT Type Approved RSS 136
Power Source	- 6.5 Volt DC Receive: 9.2 amperes Transmit: 10.2 amperes - 13.6 Volt DC Receive: 4.6 amperes Transmit: 5.1 amperes - 117 Volt AC, 50-60 Hz Receive: 60 watts Transmit: 70 watts
Circuit Protection	- Fuse: 20 amperes for 6.5 volts DC 9 amperes for 13.6 volts DC 2 amperes for 117 VAC

2.2 RECEIVER

RECEIVER	(All microvolt numbers are given at the antenna terminals and the numbers are 1/2 the number of microvolts into a 6dB pad.
Sensitivity	-10 dB S+N/N ratio with 4.0 microvolts. 30% modulated at 1000 Hz
Selectivity	- 6 kHz bandwidth at -6 dB 43 kHz bandwidth at -60 dB
Frequency Control	- ±.005% maximum crystal from 30°C. to +50°C.
Spurious Rejection	- 45 dB except image of 30 dB
Audio Output Power	- 3 watts at 10% distortion
Speaker Impedance	- 3.2 ohms
Squelch Range	- 0.3 to 300 microvolts
Squelch Sensitivity	- 6 dB or less signal change for 40 dB of quieting at 1 microvolt.
Intermediate Frequency	- 455 kHz
AGC Characteristics	- Flat within ±12 dB from 50,000 to 5 microvolts with 15 dB roll-off from 5 to 0.5.
Noise Limiting	- Series type, automatic threshold adjustment.
Circuitry	- Single conversion superheterodyne. Electron tubes.

TRANSMITTER

Emission	- 6A3
Frequency Control	- ±0.005% maximum crystal from -30°C. to +50°C.
DC Power Input	- 5 watts maximum at 13.6 VDC or 117 VAC.
RF Power Output	- 2.8 watts at 13.6 VDC or 117 VAC
RF Spurious and Harmonic Attenuation	- Better than FCC and DOT requirements
Output Impedance	- 50 ohms unbalanced
Audio Input Impedance	- High
Audio Frequency Response	- +1 to -4 dB from 400 to 2500 Hz
Modulation	- High level AM, class AB1 modulator, audio peak clipping and audio filtering.

SECTION 3
THEORY OF OPERATION

3.1 GENERAL

3.1.1 INTRODUCTION

Studying the Messenger I schematic and block diagram (Figure 1) while following the theory of operation will enable the technician to understand more completely the operation of the unit.

3.1.2 COMMON CIRCUITRY

The transmitter and receiver utilize common power supply and audio circuits and a common antenna.

3.1.3 POWER SUPPLY

The common power supply employs a 12BW4 full wave rectifier, V9, followed by a capacitor input filter. The vibrator is a shunt coil, full wave, interrupter type.

3.1.4 MICROPHONE SWITCHING

A SPDT switch on the ceramic microphone controls transceiver operation in the following manner:

RECEIVE

a. Opens cathode of first speech amplifier, V10B, so microphone will not feed through the speaker.

b. Grounds one end of speaker voice coil to place it in circuit.

c. Opens cathodes of transmitter oscillator and amplifier (V7 and V8) to turn them off.

TRANSMIT

a. Grounds cathode of first speech amplifier V10B, so microphone will feed through to second speech amplifier.

b. Grounds cathodes of V7 and V8 through the coil of the antenna switching relay, RY1, to turn on transmitter, thus energizing RY1 and transferring the antenna to the output of the transmitter.

c. Rectified PA grid voltage blocks grid of receiver's first audio amplifier V10A, to keep audio from the receiver section out of the transmitter. It also blocks the grid of receiver's crystal oscillator to prevent receiver's crystal from oscillating. This same negative voltage passes through diode switch, D1, and charges AGC line and opens squelch to allow transmitter audio system to operate.

ANTENNA SWITCHING

The relay, RY1, transfers the antenna from the receiver input to the transmitter output when the microphone switch, SW2 is pressed. The relay is actuated by the cathode current of the 7061 power amplifier, V8.

3.1.5 INDICATOR LIGHTS

Two indicator lights are provided on the front panel. The amber colored light is fed from the high voltage AC supply and indicates that the unit is turned on. The red colored light is connected across the transmitter RF amplifier screen resistor, R55, and indicates that the transmitter is turned on. Its intensity increases with modulation.

3.1.6 FACTORY TUNING

The receiver and transmitter are aligned for operation on all 23 CB channels at the factory. The transmitter output circuit is tuned when working into a 51.5 ohm resistive dummy antenna and no further adjustment should be necessary when using with a low standing voltage wave ratio (VSWR).

3.2 RECEIVER CIRCUITS

3.2.1 RF INPUT

With the antenna transfer relay, RY1, in the normal position, signals from the antenna are fed to the receiver tuned input circuit made up of L1 and C2. This circuit provides a voltage gain of approximately 10 from the 50 ohm input to the grid of V1, the 6BJ6 RF amplifier. Signals from V1 are then fed to transformer T3, which is double-tuned.

3.2.2 CRYSTAL OSCILLATOR-MIXER

The output of T3 is fed to the signal grid of V2, the 12BE6, which serves as crystal oscillator and mixer. The crystal, Y1, operates at series resonance, 455 kHz below the signal frequency, in an impedance-inverting, electron coupled oscillator circuit. Inductor L3 serves as the impedance-inverting device and the screen (pin 6) of V2 acts as a grounded plate for the crystal oscillator section. There is no frequency multiplication. Feedback for the crystal oscillator is provided by the cathode choke, L4. When the transmitter is operating, the oscillator grid of mixer V2 is blocked by rectified DC grid voltage from the power amplifier, V8. This prevents the receiver crystal from oscillating.

3.2.3 INTERMEDIATE FREQUENCY

The 455 kHz mixer signal is coupled through the IF transformer, T1, to the IF amplifier V3; then through T2 to the detector-AGC tube, V4A.

3.2.4 NOISE LIMITER

The audio output of the detector, V4A, is applied to the anode of a series type noise limiter diode, D2. When audio peaks exceed a certain negative value at the anode, the diode momentarily stops conducting, thereby gating the audio signal and preventing strong pulses from reaching the speaker. The threshold of limiting is set (by the bias taken from the AGC line) at approximately 30% modulation of the incoming carrier. The junction of R19 and R20 is bypassed for audio by C25 and serves as a reference for bias of the diode. The time constant is small enough, however, that this bias changes with AGC voltage and automatically adjusts the threshold of limiting for variations in carrier level.

3.2.5 RECEIVER AUDIO

Audio output of the limiter passes through the volume control, R21, and to the 12AU7 1st audio amplifier, V10A. The V10A plate load, R4, is common to the plate circuit of the transmitter first audio stage, V10B. When the transmitter is operating, the grid of V10A is blocked by rectified DC grid voltage from pin 3 of the power amplifier, V8. This is done to prevent receiver audio from reaching the common audio system and modulating the transmitter.

The other half of the 12AU7, V10B, functions as the 1st audio amplifier for the transmitter microphone input. When the receiver is operating, the microphone switch SW2 opens the cathode of V10B, disabling the microphone input.

3.2.6 SQUELCH

The Squelch control increases the screen voltage on the tetrode section of the 6AW8A tube, V5A, causing V5A to conduct. The resulting voltage drop across R29 blocks the grid of triode V5B, the second audio amplifier, which then stops conducting, hence no audio reaches the speaker. The squelch can be opened by an incoming signal which increases the AGC voltage applied to the V5A control grid, causing V5A to stop conduction; this will allow V5B to conduct and amplify the audio signal.

3.2.7 AUDIO AMPLIFIER

The type 12AB5 tube, V6, functions as a class AB1 audio amplifier for the receiver output or as modulator for the transmitter. The speaker is a PM type.

3.3 TRANSMITTER CIRCUITS

3.3.1 CRYSTAL OSCILLATOR

The transmitter employs an impedance-inverting, electron coupled oscillator with a series resonant crystal operating at the carrier frequency. There is no frequency multiplication. Inductor L5 is the impedance-inverting element. The type 7054 tube, V7, acts as the crystal oscillator, with its screen acting as a grounded plate. The plate tank circuit of V7 consists of L7 resonated with the output capacity of V7 and the input capacity of V8, plus C70.

3.3.2 POWER AMPLIFIER

The type 7061 power amplifier, V8, operates class C. Its plate circuit is an unbalanced Pi followed by an L section for additional harmonic reduction. It is neutralized by the capacity bridge method to prevent instability. The neutralizing adjustment is made by C44, a tubular ceramic capacitor. This capacitor is adjusted to introduce into the grid circuit an amount of RF voltage equal to that coupled directly from plate to grid, but 180^{o} out of phase with it. The phase reversal takes place when the neutralizing voltage passes from the bottom end of the resonant grid circuit to the grid end.

SECTION 4
TROUBLE SHOOTING

4.1 GENERAL

Most equipment malfunctions will be the result of tube failures. A quick visual check may spot an open filament. Use a known good tube for replacement of suspected tube rather than rely on the tube tester.

If high voltage failure occurs on DC operation, check vibrator. Always check buffer capacitor, C57, before plugging in a new vibrator.*

Whenever the cabinet is removed for service, clean relay contacts by rubbing a clean strip of paper between both sets of contacts to burnish them. A relay contact burnishing tool may be used but do not use sandpaper or other abrasive materials.

Check cathode voltages first when checking operating potentials in trouble shooting as this will give the first clue of possible trouble and may speed isolation of the circuit area at fault.

If it is necessary to unsolder and resolder components at ground points where coaxial cable shields are grounded, grasp the tail of the coax shield with long nose pliers when heat is applied so that the plier heat sink will prevent melting of the coax center conductor insulation.

* The DC load on the power supply is about 65 mA on receive and 95 mA on transmit.

When the transmitter is turned on, sufficient voltage is developed on the AVC line to cut off the squelch control tube, V5A, thus permitting the second speech amplifier, V5B, to conduct and pass the audio signal through to the modulator. If audio fails to get through, check both V5 and V1, the receiver RF amplifier, as malfunction of either tube or circuit can result in failure of V5A to be cut off.

The Messenger I receiver front end is stagger-tuned for uniform gain over the 27 MHz band. The IF transformers are peaked at 455 kHz; they are not stagger-tuned. The transmit and receive crystals are marked with the assigned channel frequency. The transmit crystal is marked "T" and operates at the channel frequency. The receive crystal is marked "R" and operates at 0.455 MHz less than the channel frequency.

The Messenger I transmitter is adjusted at the factory to couple to a 51.5 ohm resistive unbalanced antenna.

4.1.1 INTRODUCTION

The following procedures serve as a guide for trouble shooting, repair and the necessary alignment required for proper maintenance of the Messenger I. Consult the schematic diagram and the tables of typical readings (Section V) for further trouble shooting assistance. To further your familiarity with the transceiver, study the schematic diagram, the theory of operation and the block diagram.

4.1.2 EQUIPMENT REQUIRED

DC Power Supply 6.5 volts, 11 amp
or 13.6 volts, 6 amp
or 26.4 volts, 3 amp

NOTE: DC power supply should be capable of reducing output voltage 15%.

AC Source, 117 VAC, 60 Hz.

Oscilloscope - Tektronix Model 561A or equivalent.

RF Signal Generator, 24-50 MHz, with attenuated output of 1 microvolt to .1 volt capable of 30% modulation at 400 and 1000 Hz - Hewlett Packard 606 A or equivalent.

6 dB 50 ohm pad - connect to RF signal generator output for all trouble shooting and alignment procedures.

Frequency Meter - accurate to ±.0005% frequency range 24 to 50 MHz, or a calibrated crystal oscillator.

AC-VTVM

DC-VTVM

Crystals for Channel 1, 12 and 22.

Dummy Antenna - 51.5 ohms resistive, 8 watts or more.

VTVM - Triplett Model 850 with RF probe, or equivalent.

Audio Generator - 1000 Hz - Heath Model IG72 or equivalent.

DC Milliammeter 0 - 100 mA

4.2 RECEIVER TROUBLE SHOOTING

4.2.1 TEST EQUIPMENT CONNECTIONS (FIGURE 2)

a. The test equipment called for in the equipment list is connected as shown in Figure 2

b. Connect the AC-VTVM across the speaker leads.

c. Connect a DC-VTVM to the AVC line, terminal 2 of T2.

d. Connect the RF signal generator to the Messenger I antenna jack through a 6 dB pad. Set the signal generator to the desired operating frequency.

4.2.2 PRELIMINARY RECEIVER TEST

a. Connect the AC-VTVM from the green wire on the speaker voice coil to the chassis.

b. Set AC-VTVM switch to 3 volt scale.

c. Set the signal generator to the Messenger I operating frequency. Feed a 1.0 microvolt signal modulated 30% at 1000 Hz into a 6 dB 50 ohm pad connected to the antenna terminal.

d. Audio output should be 2.5 volts (2 watts) or more. Other specifications should be obtained as listed in the Specifications Section. If measurements indicate trouble, proceed with trouble shooting.

4.2.3 AVC

a. Since the AVC affects many stages, it is important to make checks on this system first.

b. Absence of AVC will cause:

- severe overloading on strong signals.
- erroneous voltage readings at V1, V2, and V3.

c. To check the AVC action:

- Connect test equipment as indicated in Section 4.2.1 and Figure 2.
- Connect a DC-VTVM to the diode load, Terminal 2 of T2.
- Increase the output of the RF signal generator from 1 microvolt to .1 volt.
- The AVC voltage measured on the VTVM should go more negative as the signal is increased (see tables of typical voltage readings, Section V).
- If the AVC voltage does not change, check the AVC detector, D1, and its associated network.

4.2.4 SQUELCH

a. To check the squelch section:

- Connect test equipment as indicated in 4.2.1.
- Remove the RF input.
- Turn the VOLUME control full clockwise.
- Turn SQUELCH control clockwise just enough to quiet the audio (usually between 9 and 11 o'clock).
- Reconnect the RF input.
- Feed a 1 μV, 30% modulated at 400 Hz signal into the 6 dB pad connected to the receiver input. Squelch should open and allow audio output.
- Turn the SQUELCH control full clockwise.
- Increase signal input to 2000 μV. Squelch should open.

b. If the voltage at R31 does not vary, check for an open D1 by bridging it with a new diode.

c. If the diode is not open, disconnect one end and check for a short with an ohmmeter. A normal diode will have a front-to-back ratio of approximately 10:1.

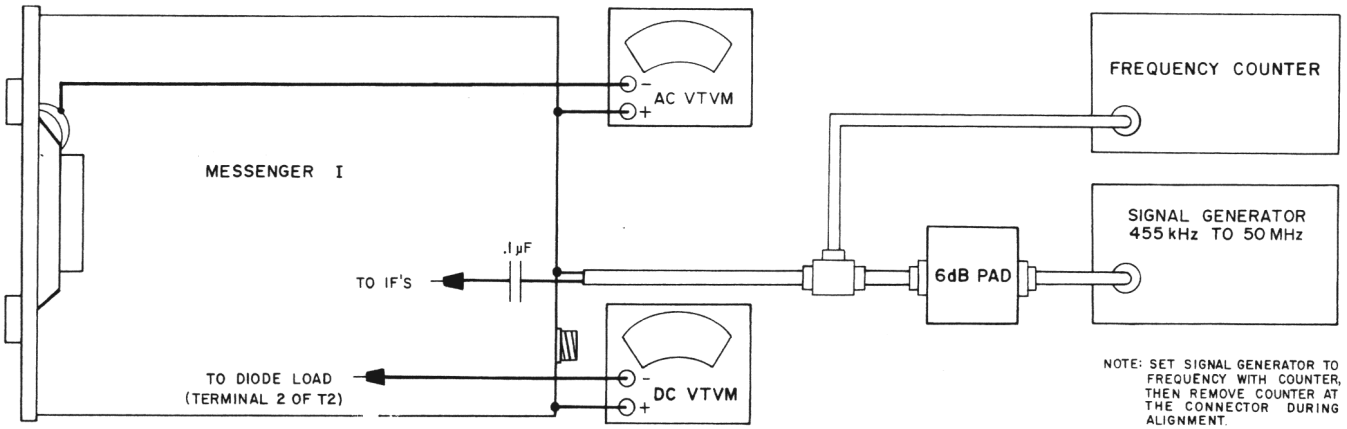
4.2.5 AUDIO

a. Connect test equipment as indicated in 4.2.1.

b. Connect an audio generator through a .1 μF capacitor to the top of the VOLUME control.

c. Set the audio generator for an output of .0025 volts RMS ±10% at 1000 Hz.

d. Adjust the VOLUME control for 2.5 VAC (+10 dB) indicated on the AC-VTVM and turn the SQUELCH to minimum (ccw). Monitor the oscilloscope for undistorted output.



RECEIVER ALIGNMENT AND
TEST EQUIPMENT CONNECTIONS
FIGURE 2

e. If output is distorted or weak, check V10 and V5 voltages. Replace with known good tubes if suspect.

4.2.6 IF STAGES

To check the IF stages, connect the DC-VTVM to the diode load (terminal 2 of T2). Inject RF signals with the signal generator at the points listed in the typical RF and IF level chart; the approximate input levels necessary to obtain 1 VDC output at given test points are listed. When replacing defective components, refer to the receiver alignment chart for their proper adjustment.

4.2.7 RF AMPLIFIER - 1st MIXER

a. Connect test equipment as indicated in Section 4.2.1.

b. Set the RF signal generator at the operating frequency, 1 microvolt 30% modulated with 1000 Hz.

c. With the VOLUME control at maximum, the output across the speaker terminals measured on the AC-VTVM should be at least 2.0 volts (1.2 watts).

d. If the receiver output is not normal, check the oscillator and mixer, V2, and its associated circuitry.

e. If it is necessary to replace components in this stage, re-align the stage as outlined in the Receiver Alignment Chart.

4.3 TRANSMITTER TROUBLE SHOOTING

4.3.1 TEST EQUIPMENT CONNECTIONS

a. Connect the test equipment as shown in Figure 3. Be sure to connect the 50 ohm antenna.

b. Connect DC-VTVM to junction of R6 and C46 (see Bottom View, Figure 7) to give relative indication of rectified PA grid voltage (reduced by drop across R42 due to loading by VTVM).

c. Connect DC voltmeter across R46, the 100 ohm meter shunt, with the positive terminal at the junction of R46 and R48. Each volt read will represent 10 mA PA plate current. CAUTION: Meter is floating at supply voltage above ground. Metal cases of some VTVM's may be "hot" with DC.

4.3.2 PRELIMINARY TRANSMITTER TEST

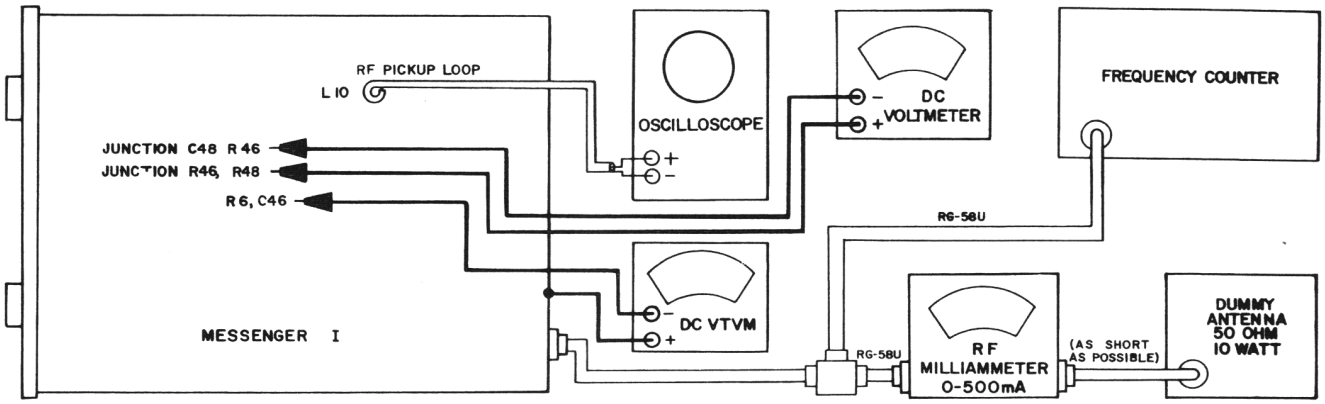
a. Turn power on and key transmitter.

b. Power output should be approximately 2.8 watts.

c. Set the audio generator for 1000 Hz. While monitoring the oscilloscope, increase the audio generator output level to obtain 50% modulation.

d. The modulated waveform should be symmetrical and relatively undistorted. See waveform illustrations, Figure 4.

e. The threshold of clipping should occur at approximately 75% modulation. If the above conditions are not met, proceed with the transmitter trouble shooting procedure.



TRANSMITTER ALIGNMENT AND TEST EQUIPMENT CONNECTIONS
FIGURE 3

4.3.3 OSCILLATOR TROUBLE SHOOTING

a. A defective or mis-aligned oscillator stage can result in:

- loss of transmitter output
- intermittent operation
- off-frequency operation

b. To check the oscillator stage:

- key the transmitter and check for oscillator starting. If the oscillator does not start, check the voltage on V7 and replace defective components as necessary.

4.3.4 POWER AMPLIFIER TROUBLE SHOOTING

a. A defective or mis-aligned power amplifier can result in:

- reduced power output
- excessive current drain with reduced power
- distorted modulation

b. Check V8. Replace defective components as necessary and refer to the transmitter alignment chart for adjustments.

4.4 MAINTENANCE

4.4.1 CHASSIS REMOVAL

Disconnect the power cord and antenna cable. Stand the unit on its front panel on a flat surface. Remove the four #8 sheet metal screws fastening the cabinet to the rear of the chassis. Carefully slide the cabinet up and off the chassis.

4.4.2 CHANGING CRYSTALS

To add or change operating channels, remove the chassis from the cabinet. Locate the transmit crystal sockets and receive crystal sockets. A clear plastic plate located above the crystal sockets indicates function and channel switch position of each socket. After determining the proper socket for the crystals you are installing, remove the clear plastic plate and insert the crystals. Transmit crystals are indicated by a T followed by the channel number; receive crystals by an R followed by the channel number. Replace the clear plastic plate and install the chassis in the cabinet.

4.4.3 REPLACING INDICATOR LIGHTS

The "transmit" and "on" indicator lights are long life neon types, soldered by their leads to terminal strips located on top of the chassis. To replace these lights, remove the Messenger chassis from its cabinet and unsolder the light leads from the terminal strip. The lights will slide out of their sockets easily. Insert the new lights carefully to prevent their "snapping in" to the sockets and breaking.

SECTION 5
TYPICAL READINGS

5.1 TYPICAL RESISTANCES AT CONNECTORS (MEASURED TO CHASSIS)

5.1.1 9 PIN POWER SOCKET, J3, WITH PLUG DISCONNECTED.

Pin	Resistance-ohms
1	103
2	0
3	Infinite
4	Infinite
5	Infinite
6	Infinite
7	0.9
8	1.1
9	0
Between pins 3 and 4	4.3
Between pins 1 and 7	103

5.1.2 ANTENNA SOCKET, J5, WITH ANTENNA DISCONNECTED.

Center pin	47,000
Body	0

5.2 TYPICAL WINDING RESISTANCES

5.2.1 OUTPUT AND MODULATION TRANSFORMER, T4.

Blue to red	206
Brown to yellow	164
Green to black	0.36

5.2.2 VIBRATOR TRANSFORMER, T5, 12 VDC AND 117 VAC.

Black to black	4.3
Gray to brown (entire primary)	0.45
Brown to brown	0.31
Brown to yellow	0.15
Red to red	295
Red-yellow to red	151 & 144

5.2.3 VIBRATOR, VIB-1

(6 volt) pin 1 to pin 2	50
(12 volt) pin 1 to pin 2	106

5.2.4 SPEAKER, LS1

Voice coil	2.7

5.3 TYPICAL AUDIO LEVELS IN RECEIVER

Volume control full clockwise.

Squelch control counterclockwise.

Measured to chassis with AC-VTVM.

0.6 volts RMS, 455 KC, 30% modulated at 400 Hz applied to V4 plate, pin 2.

	Volts RMS
Diode Load, T2 Term 2	0.11
Top of Volume control, R21 Term 3	0.018
V10A grid, pin 7	0.014
V10A plate, pin 6	0.20
V10B plate, pin 1	0.097
V5B grid, pin 2	0.083
V5B plate, pin 3	3.5
V6 grid, pin 3	3.0
V6 plate, pin 9	115.0
T4, modulator secondary, yellow	110.0
T4, output secondary, green	2.0

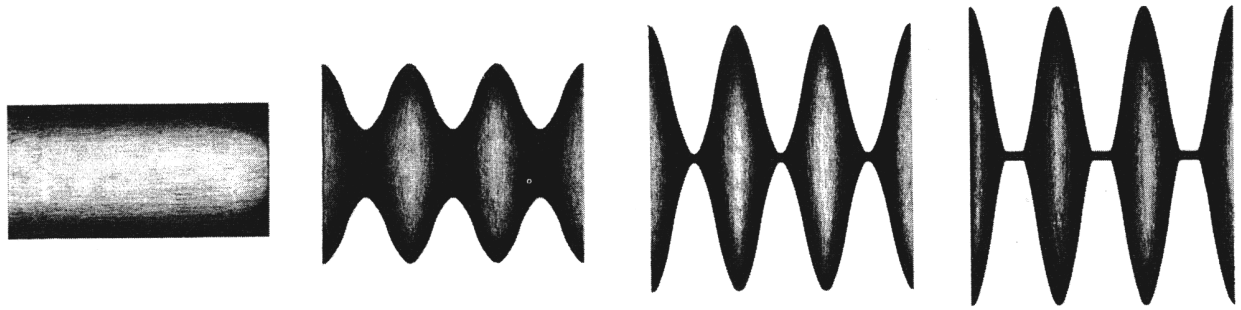
5.4 TYPICAL RF AND IF LEVELS IN RECEIVER

Reference: 1 volt DC on AVC line at terminal 2 of T2, measured with DC-VTVM.

TUBE	FUNCTION	INPUT FREQUENCY	INPUT LEVEL
V4 plate, pin 2	Det. Diode	455 kHz	0.45 volt
V3 plate, pin 5	IF AMP	455 kHz	1.2 volt
V3 grid, pin 1	IF AMP	455 kHz	4000 microvolts
V2 plate, pin 5	MIXER	455 kHz	3000 microvolts
V2 signal grid, pin 7	MIXER	455 kHz	5200 microvolts
V2 signal grid, pin 7	MIXER	27.105 MHz	275 microvolts
V2 osc. grid, pin 1	MIXER	455 kHz	*55 microvolts
V1 plate, pin 5	RF AMP	27.105 MHz	300 microvolts
V1 grid, pin 1	RF AMP	27.105 MHz	8 microvolts
Antenna socket		27.105 MHz	0.9 microvolts

* Crystal will stop oscillating when signal generator is connected to oscillator grid.

NOTE: TYPICAL VALUES MAY VARY ±20%



UNMODULATED CARRIER | 50% MODULATION | 100% MODULATION | OVER 100% MODULATION

TRANSMITTER WAVEFORMS
FIGURE 4

NOTE: Figure 4 shows output waveforms without modulation, at 50%, 100% and over 100% modulation. In this equipment, intentional audio peak clipping (see Figure 6) will limit the crests and valleys to about 90% modulation with sine wave input. With voice modulation, the valleys will be modulated to approximately 100%.

5.5 TYPICAL AVC CHARACTERISTICS

Channel 12

Volume control 1/4 advanced

Signal Generator: Hewlett-Packard 606A with 6 dB pad

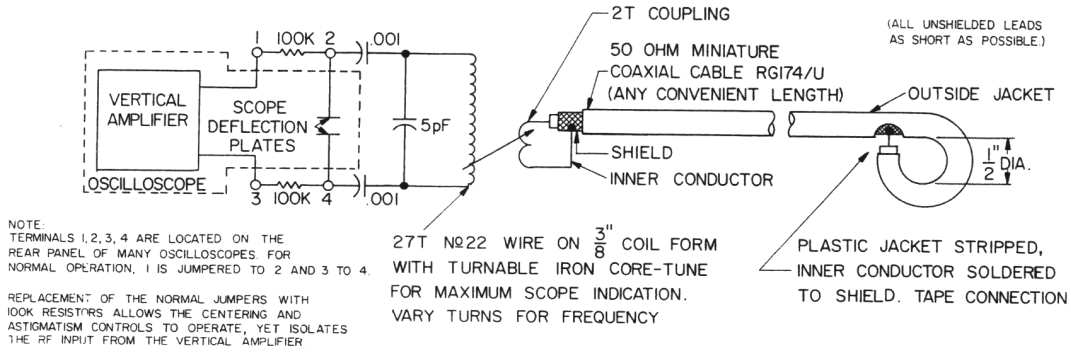
27.105 MHz, 30% modulation at 400 Hz.

Audio measured with AC-VTVM across voice coil.

RF INPUT TO PAD MICROVOLTS	AUDIO OUTPUT dB	AVC LINE TERM. 2 of T2 VOLTS
0.316	-12	-0.64
1.	0*	-1.12
3.16	+10.5	-2.2
10	+16	-3.9
31.6	+20	-5.7
100	+22	-7.6
316	+25	-9.8
1 K	+27.5	-12.6
3.16 K	+30	-17.0
10 K	+32	-21.5
31.6 K	+34	-26.5
100 K	+37	-33.5

* Reference .0245 V RMS

Input to open tight squelch: Approximately 50 to 500 microvolts.



OSCILLOSCOPE RF PICK-UP LOOP
AND METHOD OF CONNECTION
FIGURE 5