This Manual is provided by

CBTricks.com

Someone who wanted to help you repair your equipment scanned this manual.

If you would like to help us put more manuals online support us.

Supporters of CBTricks.com paid for the hosting so you would have this file.

CBTricks.com is a non-commercial personal website was created to help promote the exchange of service, modification, technically oriented information, and historical information aimed at the Citizens Band, GMRS (CB "A" Band), MURS, Amateur Radios and RF Amps.

CBTricks.com is not sponsored by or connected to any Retailer, Radio, Antenna Manufacturer or Amp Manufacturer, or affiliated with any site links shown in the links database. The use of product or company names on my web site is not endorsement of that product or company.

If your company would like to provide technical information to be featured on this site I will put up on the site as long as I can do it in a non-commercial way.

The site is supported with donation from users, friends and selling of the Galaxy Service Manual CD to cover some of the costs of having this website on the Internet instead of relying on banner ads, pop-up ads, commercial links, etc. to pay my costs. Thus I do not accept advertising banners or pop-up/pop-under advertising or other marketing/sales links or gimmicks on my website.

ALL the money from donations is used for CBTricks.com I didn’t do all the work to make money (I have a day job).
This work was not done for someone else to make money also, for example the ebay CD sellers.

All Trademarks, Logos, and Brand Names are the property of their respective owners.
This information is not provided by, or affiliated in any way with any radio or antenna Manufacturers.
Thank you for any support you can give.

SECTION 5
THEORY OF OPERATION

5.1 GENERAL

5.1.1 INTRODUCTION

Studying the Messenger 202 schematic and block diagram while following the theory of operation will enable the technician to understand more completely the operation of the unit.

5.1.2 COMMON CIRCUITRY

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

5.1.3 POWER SUPPLY

The common power supply employs a 12BW4 full wave rectifier, V9, followed by a capacitor input filter. The DC load on the power supply is about 65 mA when receiving and 100 mA when transmitting. The vibrator is a shunt coil, full wave, interrupter type.

5.1.4 JUMPER PLUGS

Jumper plug P10 must be in place to make the transceiver operative when the Tone-Alert selective calling unit is not plugged in. It completes audio and squelch circuits. Jumper plug P11 must be in place to make the speaker operative when the accessory socket is not in use. The microphone plug, J9, must be in place to make the speaker operative.

5.1.5 MICROPHONE SWITCHING

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

<u>RECEIVE</u>

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

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

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

<u>TRANSMIT</u>

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

b. Opens speaker lead to prevent the speaker from being driven by the modulator.

c. Grounds cathodes of V7 and V8 through the coil of antenna transfer relay, RY1, to turn on the transmitter and energize RY1 which transfers the antenna from the receiver to the transmitter.

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

5.1.6 INDICATOR LIGHTS

There are two indicator lights 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 keyed. Its intensity increases with modulation.

5.1.7 FACTORY TUNING

The receiver and transmitter are aligned on the assigned channel 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 antennas with a Standing Wave Ratio less than 1.5 : 1.

5.1.8 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.

5.2 RECEIVER CIRCUITS

5.2.1 RF INPUT

With the antenna transfer relay, RY1, in the normal position, signals from the antenna are fed to the receiver tuned input circuit, 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 double-tuned transformer T3.

5.2.2 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.

5.2.3 INTERMEDIATE FREQUENCIES

The 455 kHz output from the mixer passes through IF transformer, T1, to V3, the first IF amplifier; through IF transformers T6 and T7; to V4, the second IF amplifier; then through IF transformer T2 to D3, the 1N294A detector and AVC diode. Gain of the two IF amplifier stages is adjusted by the variable cathode resistor, R83.

5.2.4 NOISE LIMITER

The audio output of the detector, D3, is applied to the anode of a series type noise limiter diode, D2. When audio peaks exceed a certain negative value of the plate, 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 AVC 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 AVC voltage and automatically adjusts the threshold of limiting for variations in carrier level.

5.2.5 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.

5.2.6 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 AVC voltage applied to the V5A control grid, causing V5A to stop conduction; this will allow V5B to conduct and amplify the audio signal.

5.2.7 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.

5.3 TRANSMITTER CIRCUITS

5.3.1 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 stray capacities.

5.3.2 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° 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 6
TROUBLE SHOOTING

6.1 GENERAL

6.1.1 INTRODUCTION

The following procedures serve as a guide for trouble shooting, repair and the necessary alignment required for proper maintenance of the Messenger 202. Consult the schematic diagram and the tables of typical readings (Section 7) for further trouble shooting assistance. To further your familiarity with the transceiver, study the schematic diagram, the theory of operation and the block diagram.

6.1.2 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	Hewlett Packard 606A or equivalent, 24-50 MHz, with attenuated output of 1 microvolt to .1 volt capable of 30% modulation at 1000 Hz
6 dB 50 ohm pad	Connect to RF signal gen-

	erator output for all trouble shooting and alignment procedures
Frequency Meter	Accurate to ±.0002%, frequency range 24 to 50 MHz
Dummy Antenna	51.5 ohms resistive, 8 watts or more
DC Voltmeter	Triplett 630 or equivalent
AC-VTVM	Triplett Model 850 with RF probe, or equivalent
DC-VTVM	Heath IM - 11 or equivalent
Audio Generator	1000 Hz - Heath Model IG72 or equivalent
RF Milliammeter	0-500 mA

6.1.3 GENERAL INFORMATION

The Messenger 202 with four IF transformers in the receiver provides better selectivity than the early version with two IF transformers. Since certain IF transformers are overcoupled to produce a flat "nose" on the selectivity curve (see Figure 6), it is important to follow specified alignment procedures for best results (see alignment charts). Simply tuning each transformer for maximum in the usual manner will give a selectivity curve too narrow at the nose and too wide at the skirts. The alignment procedure gives a short-cut method which saves time.

The Messenger 202 receiver front end is not stagger-tuned but peaked on the assigned channel. Both 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 assigned channel frequency.

The Messenger 202 transmitter is adjusted at the factory to couple to a 51.5 ohm resistive antenna.

6.1.4 TROUBLE SHOOTING

In well-designed equipment, most 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.

Relay contacts may be cleaned 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 to 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.

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.

6.2 RECEIVER TROUBLE SHOOTING

6.2.1 TEST EQUIPMENT CONNECTIONS (FIGURE 4)

a. The test equipment called for in the equipment list is connected as shown in Figure 4.

b. Connect the AC-VTVM from the green speaker lead to chassis.

c. Connect the RF signal generator to the antenna jack through a 6 dB 50 ohm pad, except where otherwise indicated.

6.2.2 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 202 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.

6.2.3 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 6.2.1 and Figure 4

- Connect a DC-VTVM to the diode load, terminal 2 of T2.

- Increase the output of the RF signal generator from 1 microvolt to 100,000 µV.

- The AVC voltage measured on the VTVM should go more negative as the signal is increased (see tables of typical voltage readings, Section 7).

- If the AVC voltage does not change, check the AVC detector, D1, and its associated network.

6.2.4 SQUELCH

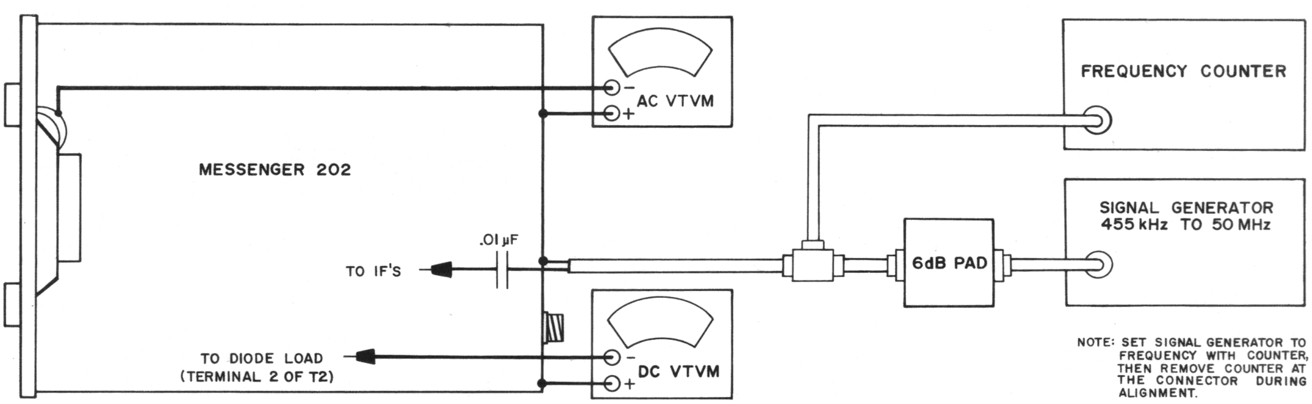
a. To check the squelch section:

- Connect test equipment as indicated in 6.2.1.

- Remove the RF input.

- Turn the VOLUME control full clockwise.

- Turn SQUELCH control clockwise just



RECEIVER ALIGNMENT AND TEST EQUIPMENT CONNECTIONS
FIGURE 4

enough to quiet the audio (usually between 9 and 11 o'clock).

- Reconnect the RF input.
- Feed a 1 μV, 30% modulated at 1000 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.

6.2.5 AUDIO

a. Connect test equipment as indicated in 6.2.1.

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.

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

6.2.6 IF STAGES

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

6.2.7 RF AMPLIFIER - 1st MIXER

a. Connect test equipment as indicated in Section 6.2.1.

b. Set the RF signal generator at the customer's 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 2.5 volts (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.

6.3 TRANSMITTER TROUBLE SHOOTING

6.3.1 TEST EQUIPMENT CONNECTIONS

a. Connect the test equipment as shown in Figure 5. Be sure to connect the 50 ohm antenna.

b. Connect DC-VTVM to junction of L2 and R42 (see Bottom View, Messenger 202).

c. Connect DC voltmeter across R46, the 100 ohm meter shunt, with the positive terminal at the junction of R46 and R72. 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.

6.3.2 PRELIMINARY TRANSMITTER TEST

a. Turn power on and key transmitter.

b. Power output should be approximately 5 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 9.

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.

6.3.3 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.

6.3.4 POWER AMPLIFIER TROUBLE SHOOTING

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

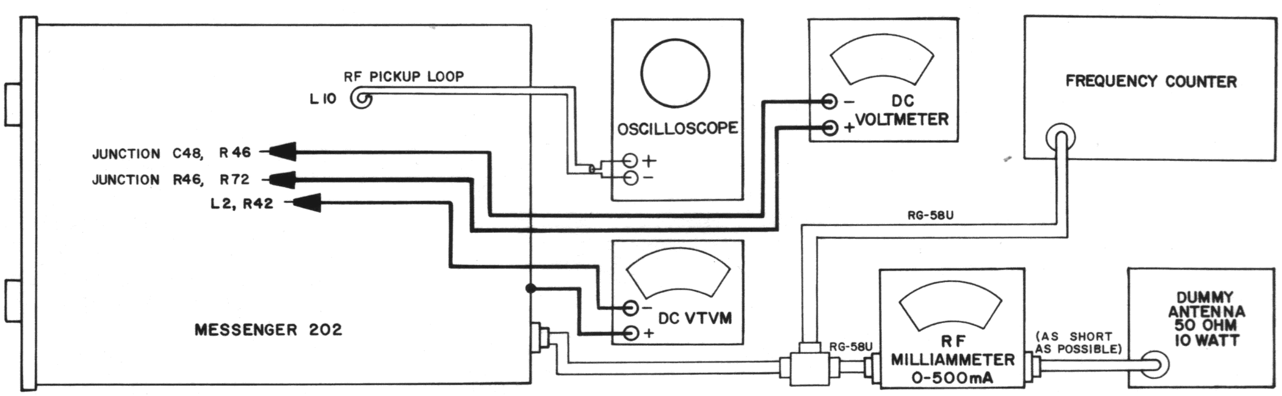
- reduced power output
- excessive current drain with reduced power output
- distorted modulation

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

6.4 MAINTENANCE

6.4.1 CHASSIS REMOVAL

Disconnect the power cord, microphone cable, antenna cable, Tone-Alert cord or jumper plug and the accessory cord or jumper plug. Stand the unit on its front panel on a flat surface. Remove the six #8 sheet metal screws fastening the cabinet to the rear of the chassis. Carefully slide the cabinet up and off the chassis.



TRANSMITTER ALIGNMENT AND TEST EQUIPMENT CONNECTIONS
FIGURE 5

6.4.2 CHANGING CHANNELS

Determine an acceptable operating frequency within the transceiver's present frequency range, as indicated by the last numeral in the model number, stamped near the antenna terminal on the rear of the chassis. (Refer to the frequency chart, under the Equipment Description.) For example, Model Number 242-0328-003 is capable of operation between 35 and 40 MHz and may be converted for operation at any frequency within this range. Order replacement crystals accordingly.

The transmitter crystal socket is located ahead of the power transformer, T5, the receiver crystal socket is located behind V2, a shielded 12BE6. Transmit and receive crystals are marked with a T and an R respectively. Insert the new crystals in their proper sockets after removing those being replaced. Follow alignment procedure for receiver and transmitter as presented in the Alignment Section.

6.4.3 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 7
TYPICAL READINGS

7.1 TYPICAL RESISTANCES AT CONNECTORS
Measured to ground

7.1.1 J3, 9 pin power socket, 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

7.1.2 J5, antenna socket, with antenna disconnected

Pin	Resistance-ohms
Center Pin	47,000
Body	0

7.1.3 J9, 4 pin microphone socket - microphone disconnected

Pin	Resistance-ohms
1	Infinite
2	3.0
3	200,000 Capacitor charges
4	0

7.1.4 J10, 12 pin Tone-Alert socket - plug disconnected

Pin	Resistance-ohms
1	Infinite

2	Continuity to pin 8 on J11
3	1 meg
4	1.7 meg
5	Infinite
6	0
7	570,000
8	Infinite
9	200,000
10	Infinite
11	0.2
12	2,800

7.1.5 J11, 8 pin car-tel socket, plug disconnected

Pin	Resistance-ohms
1	Infinite
2	200,000
3	0
4	Infinite
5	4.5 meg
6	Infinite
7	2,800
8	Continuity to pin 2 on J10

7.2 TYPICAL WINDING RESISTANCES

7.2.1 T4, output and modulation transformer

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

7.2.2 T5, 12 VDC and 115 VAC vibrator transformer

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

7.2.3 VIB-1, Vibrator

(6 volt) pin 1 to pin 4	10
(12 volt) pin 1 to pin 4	43

7.2.4 LS1, Speaker

Voice coil	2.7

7.2.5 L12, Audio Inductor

Black to black	185

7.3 TYPICAL AUDIO LEVELS IN RECEIVER

Conditions:
Volume control full clockwise.
Squelch control counterclockwise.
Measured to chassis with AC-VTVM.
0.4 Volts RMS, 455 kHz, 30% modulated at 400 Hz applied to T2, Terminal 5.

	Volts RMS
Diode Load, T2 Terminal 2	0.15
Top of Vol. Control, R21 Terminal 3	0.0135
V10A grid, pin 7	0.012
V10A plate, pin 6	0.12
V10B plate, pin 1	0.12
V5B grid, pin 2	0.11
V5B plate, pin 3	4.7
V6 grid, pin 3	4.2
V6 plate, pin 9	148
T4, modulator secondary, yellow	140
T4, output secondary, green	2.5

7.4 TYPICAL RF AND IF LEVELS IN RECEIVER

Reference: 1 volt DC at diode load (terminal 2 of T2), measured with DC-VTVM. Input levels are given at the input to a 6 dB 51.5 ohm pad.

TUBE	FUNCTION	INPUT FREQUENCY	INPUT LEVEL
T2, pin 5	Det. Diode	455 kHz	0.75 volt

TYPICAL READINGS (cont'd)

V4 plate, pin 5	IF AMP	455 kHz	2.35
V4 grid, pin 1	IF AMP	455 kHz	21,500 microvolts
V3 plate, pin 5	IF AMP	455 kHz	180,000 microvolts
V3 grid, pin 1	IF AMP	455 kHz	2,900 microvolts
V2 plate, pin 5	MIXER	455 kHz	3,100 microvolts
V2 signal grid, pin 7	MIXER	455 kHz	5,000 microvolts
V2 signal grid, pin 7	MIXER	35.7 MHz	230 microvolts
V2 oscillator grid, pin 1	MIXER	455 kHz	*76 microvolts
V1 plate, pin 4	RF AMP	35.7 MHz	140 microvolts
V1 grid, pin 1	RF AMP	35.7 MHz	8.0 microvolts
Antenna socket		35.7 MHz	0.9 microvolts

* Crystal will not oscillate when signal generator is connected to oscillator grid.

NOTE:
TYPICAL VALUES MAY VARY ±20%

7.5 TYPICAL AVC CHARACTERISTICS

Conditions:

Volume control advanced for reference of .0245 VRMS at voice coil.
Signal Generator: Hewlett-Packard 606A with 6 dB 51.5 ohm pad
35.7 MHz, 30% modulated at 400 Hz
Audio measured with AC-VTVM across voice coil

RF INPUT TO PAD MICROVOLTS	AUDIO OUTPUT dB	AVC LINE TERMINAL 2, T2 VOLTS
0.316	-11.5	- 0.32
1	0 *	- 1.15
3.16	+ 8.0	- 2.25
10	+13.0	- 3.4
31.6	+16.75	- 4.7
100	+18.5	- 6.1
316	+21.0	- 7.6
1K	+23.0	- 9.4
3.16K	+25.5	-11.8
10K	+28.5	-14.7
31.6K	+32.5	-19.1
100K	+35.5	-25.0

* Reference .0245V RMS

Input to open tight squelch: Typical 100 to 300 microvolts.

7.6 TYPICAL AUDIO LEVELS IN TRANSMITTER

Audio measured with AC-VTVM.
Modulation measured with oscilloscope at RF output.
PA plate current 32 mA.
Modulating frequency 1,000 Hz.

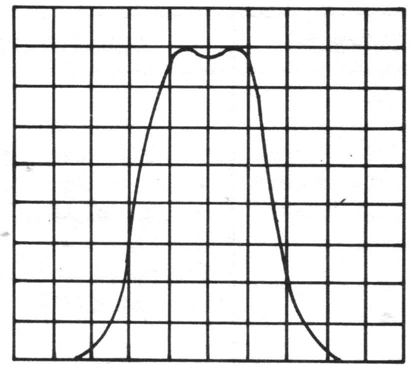
	Reference 50% Modulation	Reference 80% Modulation *
Microphone input	0.013 Volt	0.040 Volt
V10B pin 2 Grid	0.013	0.040
V10B pin 1 Plate	0.10	0.28
V10A pin 6 Plate	0.05	0.14

* Threshold of limiting.

SECTION 8
ALIGNMENT

8.1 RECEIVER ALIGNMENT CHART

ALIGNMENT	CONNECTIONS AND SETTINGS	ADJUSTMENTS
455 kHz IF (with IF transformers completely out of alignment).	Connect test equipment as in Section 4.2.1, except connect signal generator through .01 µF capacitor to pin 1, XV3. See Figure 4. Set signal generator at 455 kHz ±.01% modulated 30% at 400 Hz.	Adjust R83 for maximum IF gain (full clockwise as viewed from top of chassis). Preset top cores of T2, T7, T6, T1 flush with top of can. Adjust bottom core of T2 for maximum audio output. Adjust top core of T2 for maximum audio output. DO NOT re-adjust the bottom or top core. NOTE: Reduce input and volume as necessary on this adjustment. Make final adjustment at each core with input reduced to give approximately 1.5 volts at diode load.
	Transfer RF signal generator to pin 1, XV3.	Adjust top, then bottom core of T7 as above. Adjust top, then bottom core of T6 as above.
	Transfer RF signal generator to pin 1, XV2.	Adjust top, then bottom core of T1 as above.
455 kHz IF (with IF transformers approximately in alignment).	Connect test equipment as in Section 4.2.1, except connect signal generator through .01 µF capacitor to pin 1, XV2. See Figure 4. Set signal generator at 455 kHz ±.01% modulated 30% at 400 Hz.	Adjust each IF transformer, one at a time, top core first, then bottom core of each. DO NOT re-adjust the top or bottom core. Adjust transformers in order as above.

ALIGNMENT	CONNECTIONS AND SETTINGS	ADJUSTMENTS
IF Selectivity Curve, Visual Presentation (Optional)	Use narrow sweep (about 25 kHz) very stable 455 kHz sweep generator and an oscilloscope having a linear sweep and good stability. Replace signal generator with sweep generator at pin 1 of XV2. Connect vertical input of oscilloscope to junction of R17 and D2. Connect sweep generator sawtooth sweep output to sweep input of oscilloscope. Connect a 1 μF or larger paper capacitor across the AVC line to chassis (from the end of R2 on TS6 to chassis is convenient).	Adjust bottom core of T1 to shape the low frequency side of the trace. Adjust the top core of T2 to shape the high frequency side of the trace. See Figure 6 for a typical IF selectivity curve.  TYPICAL IF TRACE FIGURE 6
Crystal Oscillator	Couple the receiver oscillator output to the frequency meter. Turn receiver and test equipment on and allow sufficient warm up.	Zero beat (±100 Hz) the receiver crystal oscillator against the frequency meter at 0.455 MHz less than the assigned channel frequency by adjusting the core in L3.
RF	Connect signal generator through 6 dB pad to antenna jack. Calibrate with frequency counter. Remove counter before alignment. DC-VTVM to diode load (terminal 2 of T2). AC-VTVM across speaker voice coil (green lead to chassis). Set signal generator on assigned channel frequency, modulated 30% at 400 Hz.	Tune top core of T3 from the core out position inward to the first peak, tuning for maximum audio output. Avoid the second peak. Keep signal generator output low, to keep AVC voltage at approximately 1.5 volts at the diode load. Tune bottom core of T3 from the core out position inward to the first peak, tuning for maximum audio output.
Antenna	Connect DC-VTVM at diode load (terminal 2 of T2).	Adjust antenna input to 1 microvolt at the input to the 6 dB 50 ohm pad and measure AVC voltage at the diode load. (Typical 1.0 - 1.7 volts). If it exceeds 1.5 volts, adjust R83 to give 1.5 volts.