JOHNSON

MESSENGER

III

300

CITIZENS RADIO TRANSCEIVER
MODEL NO. 242-143
MODEL NO. 242-149
MODEL NO. 242-150

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Covers A-D Models

SERVICE MANUAL

MESSENGER

III

300

CITIZENS RADIO TRANSCEIVER
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MODEL NO. 242-149
MODEL NO. 242-150

7-71FJ

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SECTION 1
GENERAL INFORMATION

1.1 SCOPE OF THIS MANUAL

This service manual includes servicing and alignment instructions for the Messenger III and 300 Transceivers. A special section on installation and mobile noise suppression is included.

1.2 FACTORY CUSTOMER SERVICE

A liaison between the customer and the factory is provided by the E. F. Johnson Company Customer Service Department. This department is available for consultation and assistance on technical problems, parts information, and availability of local and factory repair facilities.

If it is necessary to write to the Customer Service Department, please include a complete system diagram. Especially important are accessories used, attachments and modifications effected during or after installation.

For any of the above requirements contact:

E. F. Johnson Company
Customer Service Department
Waseca, Minnesota 56093

1.3 FACTORY RETURNS

Normally, repair service is available locally through authorized Johnson Business/Industrial Radio Service Centers; a list of these service centers is available upon request from the factory Customer Service Department. Do not return any equipment to the factory without authorization from the Customer Service Department.

1.4 PURCHASE OF PARTS

The authorized Johnson Service Centers stock commonly needed replacement parts. In case a part is not available locally it may be ordered from the Customer Service Department. When ordering, please supply the following information:

Model number of the unit
Serial number of the unit
Description of the part

1.5 DESCRIPTION

The Messenger III, Model 242-150 (eleven channels), Model 242-143 (twelve channels) and Messenger 300, Model 242-149 (twelve channels) are 5 watt DC input to the final RF stage Citizens Radio transceivers. The Messenger III, Model 242-150 has an eight pin power receptacle. The Messenger III, Model 242-143 and Messenger 300, Model 242-149 have single pin power receptacles. The basic transceivers weigh 5 1/2 pounds and are completely solid state. Supply voltages to operate the transceivers are provided by the vehicle's battery in mobile operation or by an AC operated 13.8

Volt DC power supply in base station operation. Specific reference to any Messenger model will be made only where differences exist.

NOTE:

The Messenger 300, Model No. 242-149, is identical to the twelve channel Messenger III, Model No. 242-143, except for a crystal filter in the Messenger 300 which replaces L4, the Messenger III 4.3 MHz IF transformer.

SECTION 2
SPECIFICATIONS

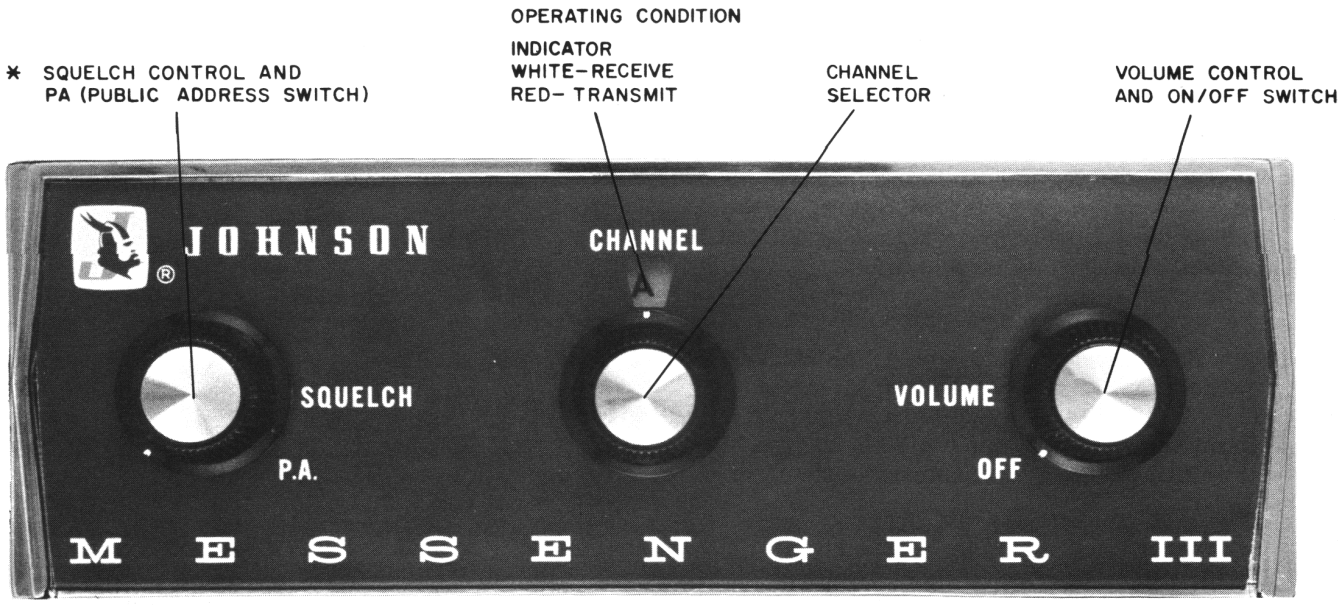
2.1 GENERAL

Frequency Range	26.965 - 27.255 MHz
Channels	12 (11 in Model No. 242-150)
Dimensions of Enclosure	2-3/16" high x 6-3/16" wide x 8-3/4" deep
Unit Weight	Approximately 5 lbs.
Shipping Weight (one unit)	Approximately 7 lbs.
Microphone	High capacity (low impedance) ceramic element. Cycolac case. Push-to-talk switch, hang up stud.
Circuitry	18 transistors, 10 diodes and 2 thermistors
Compliance	FCC Type Accepted Rule Part 95 DOT Type Approved RSS 136

2.2 RECEIVER

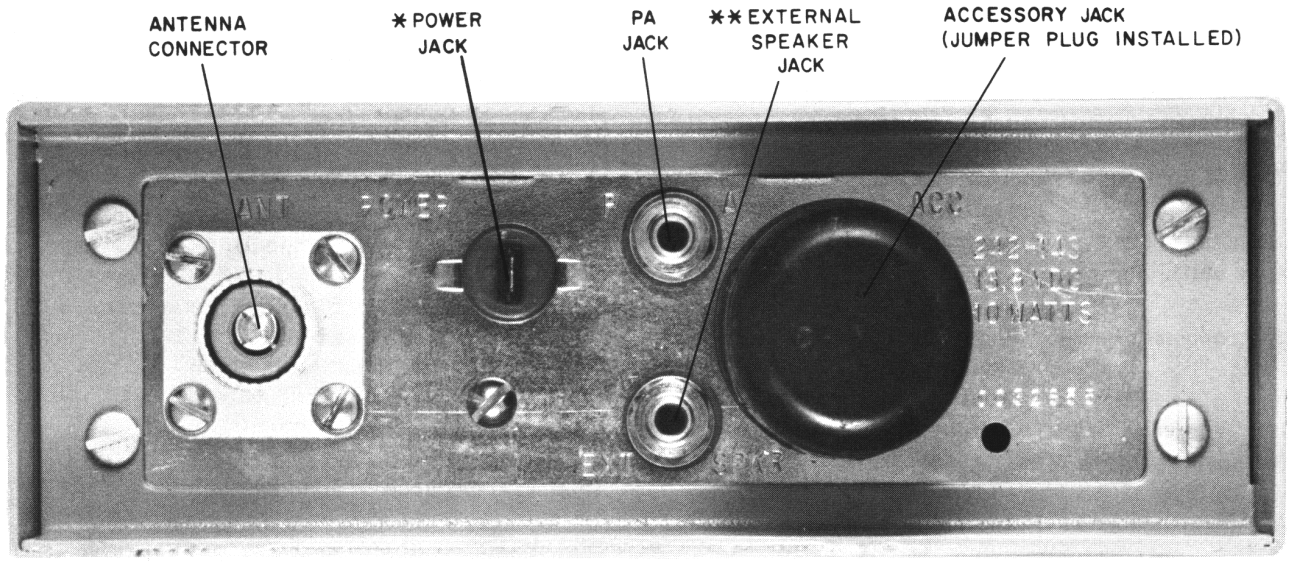
(All microvolts are at antenna terminal; numbers are 1/2 the microvolts into a 50 ohm 6 dB pad)

Sensitivity	8 dB minimum at 0.5 microvolts
Selectivity	
Messenger III:	6 kHz bandwidth at -6 dB (nominal) 30 kHz bandwidth at -60 dB (nominal)
Messenger 300:	7 kHz bandwidth at -6 dB (nominal) 19 kHz bandwidth at -60 dB (nominal)
Frequency Control	±0.005% crystal from -30°C to +60°C
Spurious Rejection	70 dB except image, 50 dB (nominal)
Antenna Impedance	50 ohms (nominal)
Audio Output Power	3 watts minimum at 10% distortion for 1 microvolt input
Speaker Impedance	3.2 ohms (nominal)
Squelch Range	15 microvolts minimum
Squelch Sensitivity	1 dB or less signal change for 40 dB of quieting at 1



* THE TRANSMITTER IS DISABLED WHEN THE SQUELCH CONTROL IS SWITCHED TO PA POSITION

FRONT VIEW
FIGURE 1



* ON THE MESSENGER III, MODEL 242-150 THE POWER RECEPTACLE IS AN EIGHT PIN MALE PLUG.

** THE INTERNAL SPEAKER IS DISCONNECTED WHEN AN EXTERNAL SPEAKER IS CONNECTED.

REAR VIEW
FIGURE 2

	microvolt
Squelch Noise Immunity	Highly immune to impulse-type noise
Intermediate Frequencies	4.3 MHz and 455 kHz
AGC Characteristics (See Figure 12)	12 ±6 dB roll-off from 500 to 0.5 microvolts
Noise Limiting	Series-type, automatic threshold adjustment and IF clipping

2.3 TRANSMITTER

Emission	8A3
Frequency Control	±0.005% crystal from -30°C to +60°C
DC Power Input	5 watts maximum at 13.8 VDC
RF Power Output	3 watts minimum at 13.8 VDC
RF Spurious and Harmonic Attenuation	Better than FCC and DOT requirements (FCC and DOT type accepted)
Output Impedance	50 ohms (nominal)
Audio Input Impedance	1000 ohms (nominal)
Audio Frequency Response	±4 dB 400-3000 Hz
Modulation	High level AM, class B modulator, speech compression, clipping and audio filtering
Circuitry	All transistor solid state

2.4 POWER SOURCE REQUIRED

	13.8 volt DC input
	Receive: Squelched 0.2 amp
	Transmit: 0.7 amp

2.5 ACCESSORIES

12" fiberglas antenna - 27 MHz	137-829-xxx
4' fiberglas antenna - 27 MHz	137-828-xxx
Tone Alert	250-861-xx
External Speaker	250-822-1
Ni-Cad rechargeable battery	250-826-1
Power Pack for Messenger III, Model 242-143 and Messenger 300, Model 242-149	250-856-2
Portable Pack for Messenger III Model 242-143 and Messenger 300, Model 242-149	250-825-3
117 volt power supply and Tone Alert for Messenger III, Model 242-143 and Messenger 300, Model 242-149	239-123-xx
117 volt AC power supply for Messenger 300 and III, Model 242-143	239-125-1
In-Converter	239-120
Car noise suppression kit	250-801-1
100' coaxial cable	142-801-2
50' coaxial cable	142-801-1

SPECIFICATIONS (cont'd)

Power cable for Messenger III, Model 242-143 and Messenger 300, Model 242-149	023-1652-001	12 VDC battery cable (negative ground), for Messenger III, Model 242-150	023-1657-001
12 VDC battery cable (positive ground), for Messenger III, Model 242-150	023-1658-001	Antenna Meter	250-849
		CB Matchbox	250-49

SECTION 3
VEHICLE INSTALLATION

3.1 GENERAL

A good antenna installation is essential for satisfactory transceiver performance. Select a good antenna location carefully. A level unobstructed area will generally provide the best ground plane. When necessary, the trunk lid area will suffice as an antenna location but generally it is not as desirable as the roof area. In most instances, the hood area is less suitable for antenna installation and use of this area for antenna mounting should be discouraged.

When selecting the antenna location consider the easiest and shortest route for the transmission line.

The transceiver should be mounted with the best maintenance accessibility and operating convenience in mind. Avoid mounting the transceiver in the direct hot air stream of the vehicle's heater.

If possible, connect the power lead to the accessory section of the ignition switch. This gives the operator the added feature of being able to turn the transceiver on and off with the ignition switch.

When installing the Messenger it is recommended that the following sequence of installation operations be followed.

3.1.1 INSTALLATION SEQUENCE

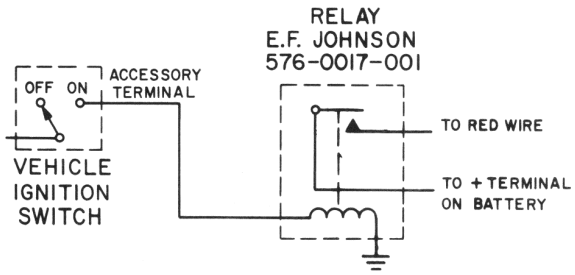
CAUTION:

Avoid installing the Messenger in the direct air stream from the vehicle's heater as temperatures in this area can measure to 150°F which can result in component failure.

1. Install the antenna and transmission line.
2. Install the transceiver's dash mounting bracket with the hardware provided.
3. Install the microphone holder.
4. Install the transceiver in the dash mounting bracket.
5. Connect the power lead to the accessories section of the ignition or to the "hot" side of the battery.

NOTE:

In some cases of severe DC line noise, the accessory terminal is not a desirable place to obtain B+ for the transceiver as the windshield wipers, heater, turn signals, air conditioning, windshield washer and ignition sometimes all draw from the same line. Although the transceiver contains a noise filter it may not remove all noise generated on the accessory line. In this case, a direct line to the battery, or an accessory switch operated relay connected directly to the battery, is a good solution. See Figure 3.



CONNECTIONS FOR ACCESSORY SWITCH OPERATED POWER RELAY
FIGURE 3

6. Trim the antenna for minimum VSWR.

7. Test drive the vehicle.

8. Instruct the operator in the proper operation of the Messenger and correct voice communications procedures.

3.1.2 ANTENNA AND TRANSMISSION LINE INSTALLATION

1. Drill the holes necessary to mount the antenna.

2. Route the transmission line from the antenna location to the transceiver. Keep the transmission line as short as possible. Refer to Figure 4 for the correct method of installing UHF connectors. When the installation of the transmission line is complete, check for continuity between the center conductor and the antenna with the antenna end of the transmission line connected. Also check for a shorted transmission line by disconnecting both ends of the line and measuring the resistance between the inner and outer conductors.

3. Install the antenna, following the manufacturer's instructions.

3.1.3 TRANSCEIVER INSTALLATION

1. Select the transceiver's mounting location. Make sure it is not in the direct air stream of the vehicle's heater. Using the mounting bracket as a guide drill the bracket mounting holes. Secure the mounting bracket.

2. Install the transceiver in the mounting bracket. Tighten the mounting bracket to the transceiver's cabinet.

3. Install the microphone holder.

3.1.4 ANTENNA TRIMMING

1. Insert a Johnson Model 250-849 Antenna Meter into the transmission line.

2. Key the transmitter and trim the antenna for the best VSWR. This should be a ratio of 1.5:1 or better.

3.1.5 OPERATIONAL CHECKOUT

1. While test driving the vehicle give the transceiver a complete operational checkout. Make several contacts with the base station. If vehicle noise degrades the transceiver's performance, read the section on noise suppression and take appropriate action to correct any noise suppression deficiences.

3.2 NOISE SUPPRESSION

3.2.1 NEED FOR NOISE SUPPRESSION

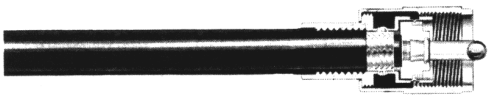
Any radio installed in an automobile or truck has to contend with electrical noise generated by the engine's ignition system and generator system when the engine is running. Of course, when the engine is not running, the noise is not present. However, if the radio is to be really useful and versatile, it must be able to receive weaker radio signals while the vehicle is traveling at reasonably high rates of speed. Unfortunately, the electrical noise from the engine increases as the engine speed increases. This noise takes the form of whining, popping, crackling, etc. and can make it difficult to understand a voice through the interference. It can completely "cover up" weak signals when the vehicle is operating at extended distances from the base station or other mobile stations (in "fringe areas"). Therefore, the electrical noise from the engine will materially determine the amount of "range" that the mobile station has

RG-8/U

Cut end of cable even. Remove vinyl jacket 1-1/8", except 83-1SP plug remove vinyl jacket 1-1/4".

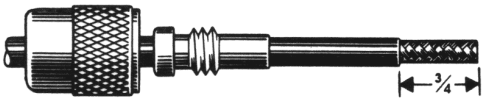
Bare 5/8" of center conductor. Trim braided shield. Slide coupling ring on cable. Tin exposed center conductor and braid.

Screw the plug sub-assembly on cable. Solder assembly to braid through solder holes, making a good bond between braid and shell. Solder conductor to contact. Do not use excessive heat.

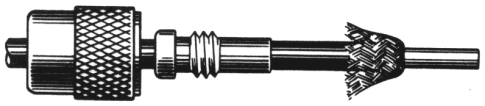


For final assembly, screw coupling ring on plug sub-assembly.

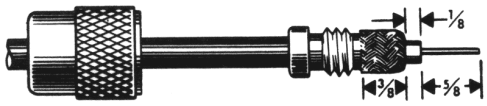
RG-58A/U



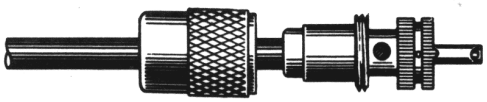
Cut end of cable even. Remove vinyl jacket 3/4". Slide coupling ring and adapter on cable.



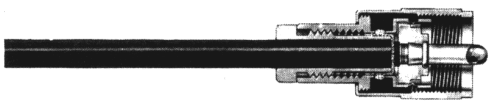
Fan braid slightly and fold back as shown.



Position adapter to dimension shown. Press braid down over body of adapter and trim to 3/8". Bare 5/8" of conductor. Tin exposed center conductor.



Screw plug sub-assembly on adapter. Solder braid to shell through solder holes. Use enough heat to create bond of braid to shell. Solder conductor to contact.



For final assembly, screw coupling ring on plug sub-assembly.

UHF COAXIAL CONNECTORS
ASSEMBLY INSTRUCTIONS
FIGURE 4

while it is in motion and how fast the vehicle can travel at any given range and still satisfactorily receive other stations.

3.2.2 CAUSES OF IGNITION NOISE

The engine of any vehicle contains at least a dozen or more tiny "spark" radio transmitters such as spark plugs, regulator points, distributor points, generator brushes, etc. The ignition wiring of the engine acts as an antenna to radiate the radio noise from these arcs into the radio. Additional noise may be generated by unnecessary arcs which are caused by poor connections. Loose connections between the spark plugs and the connectors on the spark plug wires or between the wires and the distributor cap cause unnecessary arcs. Another noise source is the build-up of static electricity on moving parts of the engine and its accessories, such as the armature of the generator. When these charges of static electricity "discharge", the effect is much the same as a bolt of lightning but on a much smaller scale. Since the car body is usually used as the ground return for lights, accessories and the ignition system, small arcs may occur between various parts of the car body that are not properly bonded together electrically. These small arcs also generate noise.

Spark plug noise is identified by a regular popping noise which increases with engine speed. Generator noise is characterized by a whirring sound which also increases with engine speed. Regulator noise creates an uneven, rasping sound only when the generator is charging.

3.2.3 METHODS OF SUPPRESSING IGNITION NOISE

One of the first methods of reducing ignition noise is to insure that the ignition system of the engine is in good condition and working properly. This means that the distributor points and condenser should be in good condition and the points properly adjusted. The regulator points should be free from pitting and should be properly adjusted. The spark plugs should be clean and properly adjusted. The generator brushes and commutator should be in good condition and the brushes properly seated.

The generator cover should be free of paint and grease that might prevent good electrical connection to the generator frame. All connections in the high voltage wires between the spark plugs and the distributor should be making good contact. Soldering the wires to the connectors on the ends of the wires will insure this. All other connections in the ignition system should be free of corrosion and thoroughly tightened. All the wires in the distributor cap should be pushed as far into the cap as they will go. The high voltage wire to the coil should also be pushed into its socket as far as it will go. The inside of the distributor cap should be free of any dirt or carbon deposits since these can cause arcing between the distributor terminals.

When the entire ignition system is in good condition, the next step toward suppressing ignition noise is to install noise suppressing devices in the ignition wiring of the engine. The noise suppressing devices to be installed consist mainly of distributor and spark plug suppressors, coaxial capacitors and shielded wires. The distributor and spark plug suppressors are small devices similar to radio resistors, which are inserted in the distributor and spark plug wires. They suppress the electrical noise caused by the spark plugs and distributor. The coaxial capacitors are highly efficient electrical devices which "filter out" or "bypass" directly to ground (ground is the car frame, body or engine) the electrical noise caused by the generator and regulator. The shielded wires prevent the escape of any remaining noise from the generator and regulator wires.

3.2.4 RESISTOR-TYPE SPARK PLUGS

Resistor-type spark plugs may be installed in place of the regular spark plugs. Resistor-type spark plugs are normally "quieter" than standard plugs with suppressors. Since resistor-type spark plugs are standard equipment on some later model cars, they should be checked before resistor-type plugs are purchased. Spark plug suppressors should not be used with resistor spark plugs.

Radio resistor ignition wire is standard equipment on most late model vehicles. If the vehicle does not have radio resistor ignition wire it should be installed.

3.2.5 ADDITIONAL NOISE SUPPRESSION MEASURES

1. Installing short lengths of heavy shield braid or metal straps between various parts of the automobile and engine to improve the electrical bonding will usually reduce interference in the more stubborn cases. These straps should be installed between the firewall and the engine, the engine and the frame, the generator and the frame (or the engine or both), the exhaust pipe and the frame (in one or more places) and in some cases the hood to the frame or firewall. Be sure the cases of the coil and the regulator are well grounded.

2. In stubborn cases of generator whine, a carbon brush (mounted on a short spring-loaded bracket) which rides on the end of the generator shaft will usually reduce this interference. Be sure the brush and bracket are well grounded to the generator or car frame with a short connection.

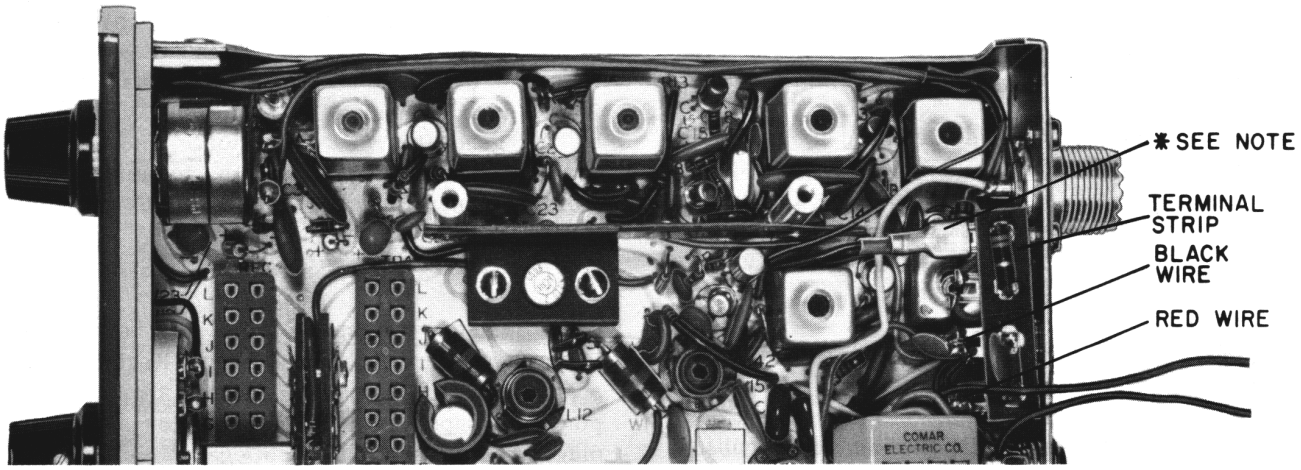
3. Some interference may be caused by the dash instruments, accessories (such as electric windshield wipers, heater blowers and fans, etc.) and the lighting system. In cases where this interference is objectionable, it may be reduced by installing bypass capacitors from the terminals of the troublesome instruments or accessories directly to ground (car frame or dash, etc.) The wire leads of the capacitors should be kept as short as possible. These capacitors should be of the mica or ceramic disc variety and should be from 0.001 μF to 0.01 μF.

3.3 POSITIVE GROUND CONVERSION

(Models 242-143 and 242-149 only)

The Messenger may be used in positive ground systems by modifying the unit in accordance with the following outline:

a. Remove the Messenger from its cabinet by removing the four screws at the rear of the



* QUICK-DISCONNECT MAY BE DISCONNECTED FROM THE TERMINAL STRIP WHEN USING THE BATTERY OPERATED POWER PACK, MODEL 250-856-2. THIS WILL DISCONNECT THE RECEIVE/TRANSMIT INDICATOR LIGHT AND REDUCE CURRENT DRAIN APPROXIMATELY 100mA.

POSITIVE GROUND CONVERSION
MODELS 242-143 AND 242-149
FIGURE 5

cabinet.

b. Locate the terminal strip at the bottom of the rear chassis rail between the antenna jack and the Tone-Alert receptacle. (See Figure 5).

c. Unsolder the red and black wires located on the two terminals nearest the relay and Tone Alert receptacle. Interchange the positions of these wires as shown.

d. Install the transceiver in its cabinet and secure it with the screws at the rear of the unit.

e. Make a label warning that the unit has been converted for positive ground operation.

NOTE:
Units converted for positive ground operation cannot be operated with the Messenger AC operated power supplies or other negative ground sources.

3.4 CHANNEL NUMBER INSTALLATION

The following procedure is for changing Messenger channel indicator dials to read in numbers rather than letters. Refer to Figure 6.

To prevent errors, it is suggested that you first make a list relating the channel letters to channel numbers. For example:

A=Channel 1
B=Channel 7
C=Channel 9
D=Channel 11

Use this list to set up the channel numbers on the dial. The channel numbers, supplied with the Messenger, are die cut to fit the channel selector dial, and are adhesive backed for easy mounting. A pair of tweezers will be found useful for removing the numbers from the card and attaching them to the dial. Fold the card on the perforated line--tear the card on this line to expose one edge of that row of numbers. Replace this portion of the card to protect the adhesive backing on the remaining numbers in that row. Use the following illustration as a guide for the following channel selector dial conversion.

a. Loosen the set screws and remove the three front panel knobs.

b. Remove the two nuts and washers on the two outside controls.

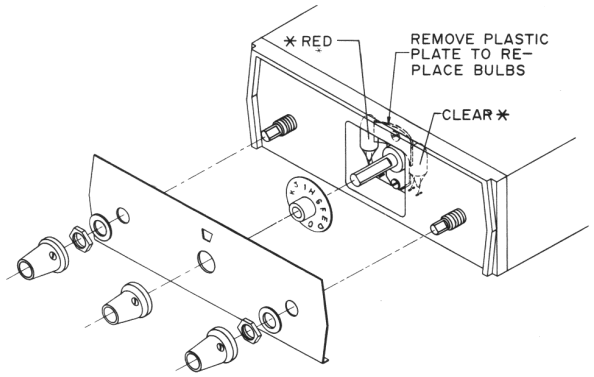
c. The front panel overlay can now be removed.

d. Remove the old letters.

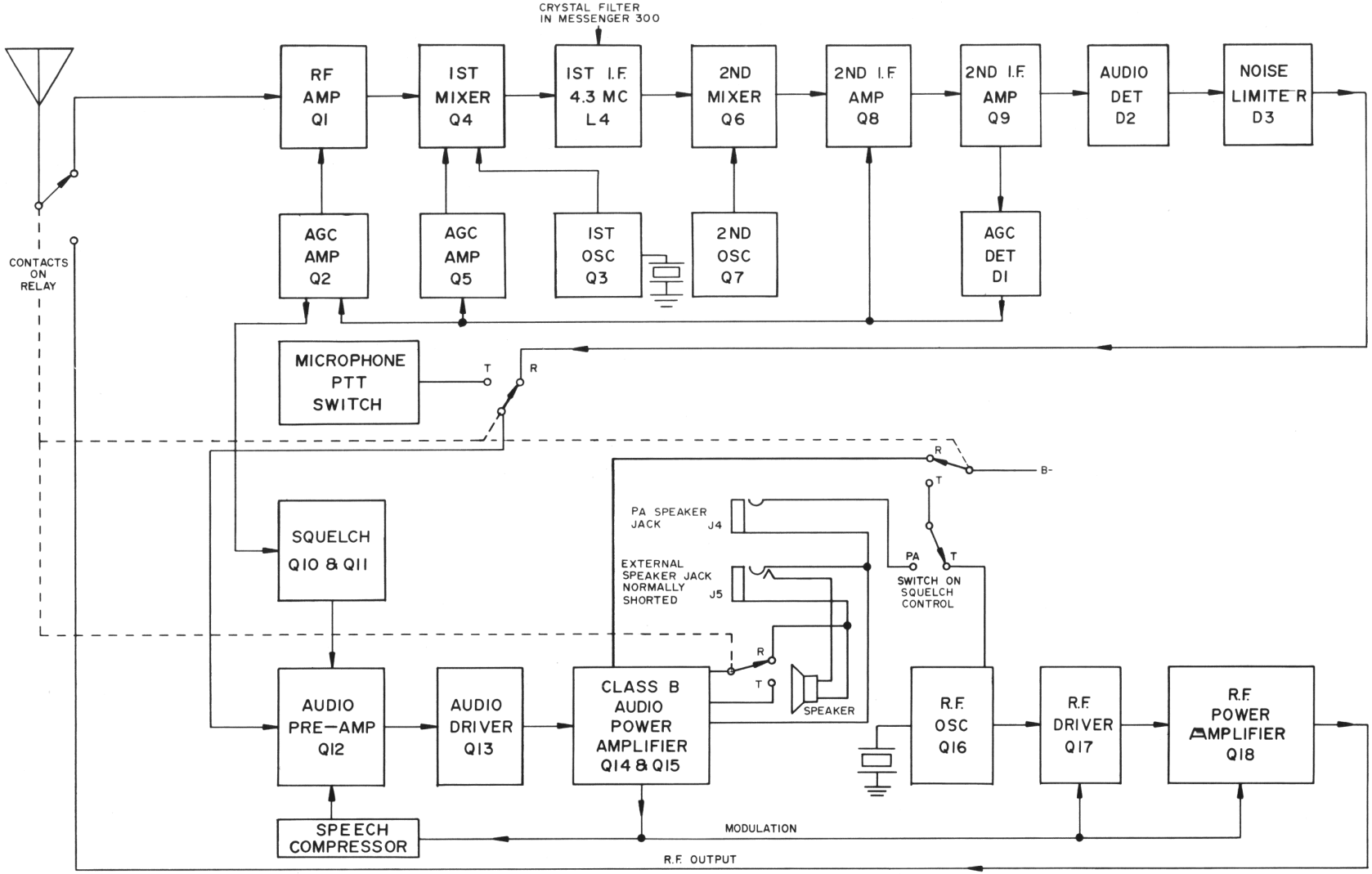
e. Remove the desired numbers from the die cut card and place in position on the dial.

f. Replace the front panel overlay and the washers and nuts on the two outside controls.

g. Replace the three knobs and tighten the set screws.



FRONT PANEL EXPLODED VIEW
FIGURE 6



BLOCK DIAGRAM
FIGURE 7

SECTION 4
CIRCUIT DESCRIPTION

4.1 GENERAL

While studying the circuit description it may be desirable to refer to the block diagram, Figure 7, the simplified schematic diagram, and the schematic diagram found in the back of the manual for a better understanding of the circuitry involved.

4.2 RECEIVER

4.2.1 GENERAL

The receiver is a crystal controlled, dual conversion superheterodyne with intermediate frequencies of 4.3 MHz and 455 kHz. All of the interstage transformers are double-tuned. A 4.3 MHz crystal filter is used between the first and second mixer in the Messenger 300. A delayed and amplified AGC and series diode noise limiter are included in the receiver.

4.2.2 RF AMPLIFIER

During receive condition the incoming RF signal from the antenna passes through a set of contacts on the switching relay to pin 6 of L1. Transformer L1 furnishes impedance matching and RF tuning. The RF amplifier, Q1, amplifies the incoming signal. The signal at the collector of Q1 is transformed by L2 and coupled to the base of Q4, the first mixer. Transistor Q2 is connected in common emitter configuration between the emitter of Q1 and B+. Q2 acts as a variable emitter resistor and its conduction is controlled by the AGC voltage.

4.2.3 OSCILLATORS

The two crystal oscillators, Q3 and Q7, are in grounded base configuration and use a third overtone crystal. The first oscillator Q3, operates 4.3 MHz above the incoming signal. The second oscillator, Q7, operates at 455 kHz above the first IF frequency or 4.755 MHz.

4.2.4 FIRST MIXER

The first mixer, Q4, has two inputs. One input is supplied by the first oscillator, Q3, and is injected at the emitter of Q4. The second input is the channel frequency RF signal from the RF amplifier. These two inputs are mixed by Q4. A crystal filter connected between the collector of Q4 and the base of Q6 provides the difference frequency tuning of 4.3 MHz in the Messenger 300. Transformer L4 provides difference frequency tuning in the Messenger III.

The gain of the first mixer is controlled in the same manner as the gain of the RF amplifier. A common emitter stage, Q5, is connected between the emitter of Q4 and B+. The conduction of Q5, which determines the emitter voltage of Q4, is controlled by the AGC voltage.

4.2.5 SECOND MIXER

The outputs of the 4.3 MHz crystal filter and second oscillator, operating at 4.755 MHz, are applied to the base of the second mixer, Q6. These two signals are mixed to produce the second IF frequency. Transformer L5 provides 455 kHz difference frequency tuning at the collector of Q6 and couples the 455 kHz signal to the base of the first IF amplifier, Q8.

4.2.6 IF AMPLIFIERS

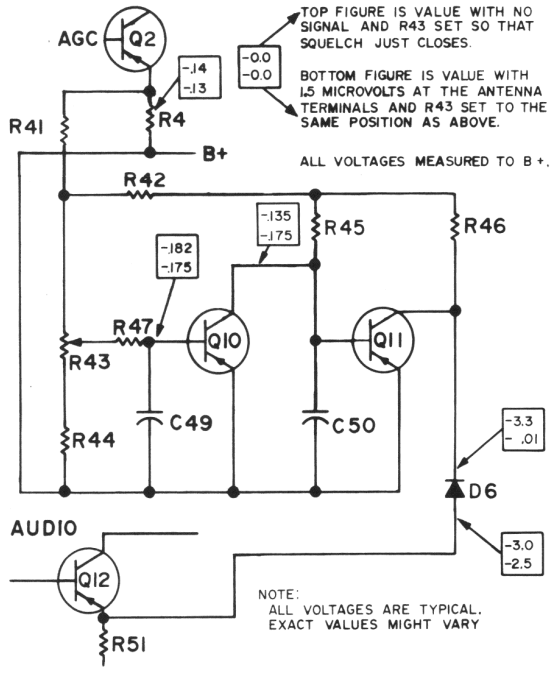
The IF amplifiers, Q8 and Q9, raise the output of the second mixer to a level suitable for de-

tection by detector diode D2. The second IF amplifier also provides the necessary RF voltage for rectification by the AGC detector, D1. AGC is applied to the first IF amplifier through R14 and the secondary of L5.

4.2.7 SQUELCH

The squelch circuit consists of a direct coupled pair of common-emitter DC amplifiers and a diode switch. The control voltage for the squelch circuit is furnished by the action of AGC amplifier Q2. Refer to Figure 8 for the squelch circuit levels in the squelched and unsquelched condition.

Under no signal conditions the DC level at the base of Q10 determines the squelch threshold level. This is set by potentiometer R43. In the squelched condition the base voltage of Q10 is set for a level that will keep Q10 conducting. Q11 is turned off because its base bias is dropped across Q10. When Q11 is turned off approximately -3.5 volts is present at the cathode of D6. D6 is then in the forward biased condition and the emitter voltage of the audio amplifier Q12 is raised to a level sufficient to turn that stage off.



SQUELCH CIRCUIT VOLTAGES
FIGURE 8

When an on frequency RF signal is present at the antenna, the emitter of Q2, due to AGC action, goes in a positive direction or becomes less negative. The base voltage of Q10 follows the emitter of Q2 and tends to turn Q10 off. The collector voltage of Q10 rises sharply and switches Q11 into a heavily conducting state. The anode voltage of D6 is dropped across the heavily conducting Q11 and D6 becomes reverse biased, restoring Q12 to the forward biased condition and enabling the audio. Squelch temperature compensation is provided by thermistor assembly R45.

4.2.8 AGC

AGC is applied directly to the first IF amplifier and indirectly to the RF amplifier and first mixer. A portion of the second IF amplifier output is coupled by C29 to a rectifier filter network consisting of D1, R23, C27 and C28. Because of the diode configuration, an increase in the output of the second IF amplifier causes a positive going DC voltage at the junction of R23 and C28. This positive going DC voltage is applied to the bases of Q2, Q5 and Q8 and causes a decrease in the conduction of the three stages. Q2 and Q5 are connected between the emitters of Q1 and Q4, and through resistors R4 and R35, respectively, to B+. The collectors of Q2 and Q5 are direct coupled to the emitters of Q1 and Q4. Any change in the conduction of Q2 and Q5 results in a change in the gain of Q1 and Q4. An increase in the AGC voltage, the ultimate result of a stronger received signal at the antenna, applied to the bases of Q2 and Q5 causes these stages to conduct less, which increases their collector voltage. This results in an increase in the emitter voltages of Q1 and Q4 and reduces their gain. AGC temperature compensation is provided by thermistor assembly R21.

4.2.9 AUDIO

Audio detected by D2 is applied through R27 to the cathode of the series noise limiting diode, D3. The noise limiter clips off the positive peaks of impulse noise on the detected audio. Negative impulse noise spikes are clipped by a combination of IF limiting and the detector action of diode D2. The voltage dividing network of R27 and R28 determines the bias of the series noise limiter. RF filtering is performed by capacitor C24. Diodes D7 and D8 provide temperature compensation of

the detector and noise limiter.

The detected and filtered audio is coupled by C37 to the volume control, R40. The audio at the movable contact of the volume control is coupled by C52 to a set of contacts on the transmit-receive relay, through pins 4 and 5 of P3 and to the base of the audio preamplifier, Q12. The amplified audio from the collector of Q12 is coupled to the base of the audio driver, Q13, by C62. Q13 raises the audio from the preamplifier to a level suitable to drive the class B output stage. The output stage furnishes up to three watts of audio to the speaker in receive condition and to the transmitter driver and power output stage during transmit condition.

4.3 TRANSMITTER

4.3.1 GENERAL

The transmitter consists of oscillator, driver, and power output stages. Modulation is furnished by the class B audio stage.

4.3.2 MODULATOR

Audio from the microphone during transmit condition is coupled through the push-to-talk contacts on the microphone to the base of the audio preamplifier, Q12. Operation of the audio stages in transmit is the same as during receive except that secondary terminals 3 and 4 of T2 provide the modulating audio. The audio section contains a speech compressor that provides a gain stabilizing AGC to the emitter of Q12. The AGC feedback loop begins at pin 3 of T2. Audio is coupled from pin 3 by C10 to a rectifier filter and time constant network consisting of D9, R24, C20 and R20. This network converts the audio coupled by C10 from pin 3 of T2 to DC and regulates the attack and decay time of the AGC voltage applied to the emitter of Q12. The larger the audio voltage across the secondary, the greater the AGC that is applied to Q12. This raises the emitter voltage of Q12 and reduces its gain.

4.3.3 OSCILLATOR

The transmitter oscillator, Q16, is a temperature compensated, modified colpitts type. A third overtone crystal operating at the carrier frequency is utilized. Capacitors C67 and C68 are the temperature compensating elements. Transformer L11 provides coupling and oscillator tuning.

4.3.4 DRIVER

The driver stage, Q17, increases the power of the carrier to a level suitable for driving the power output stage Q18.

4.3.5 POWER AMPLIFIER

The grounded collector power amplifier, Q18, is designed to operate at 5 watts DC power input, The power amplifier drives a 50 ohm antenna through a pi network and a set of contacts on the relay.

SECTION 5
SERVICING

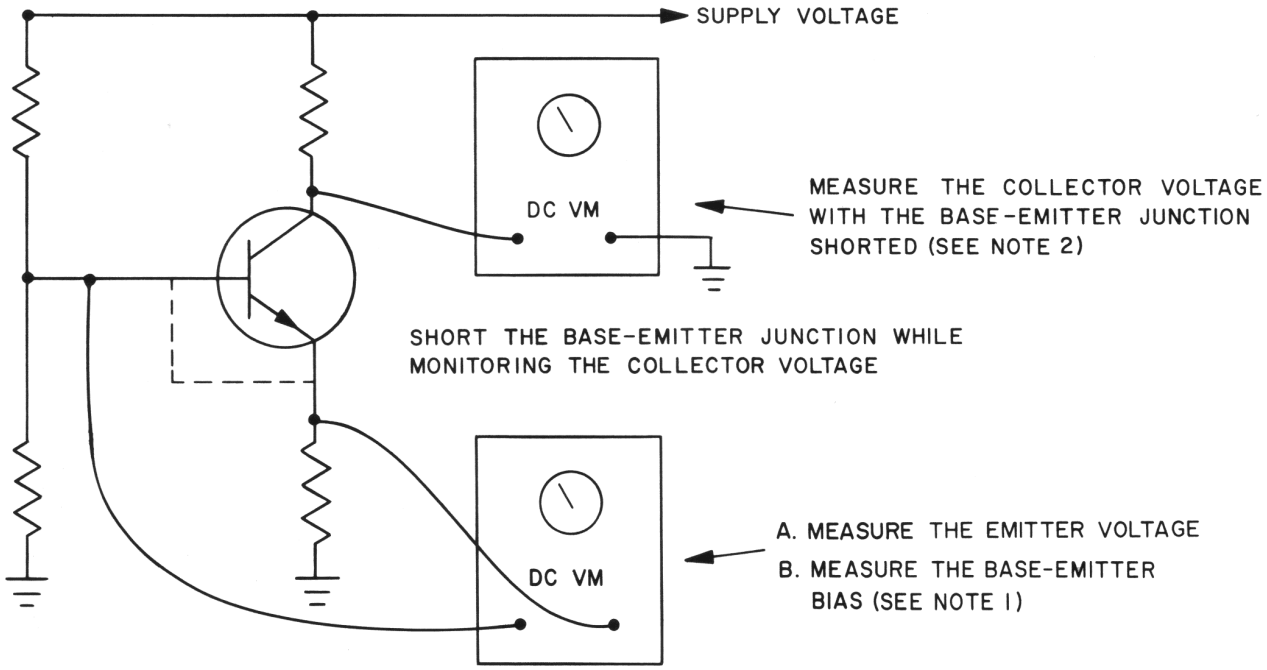
5.1 TRANSISTOR TROUBLE SHOOTING

5.1.1 GENERAL

The following information is intended to aid troubleshooting and isolation of transistor circuit malfunctions.

5.1.2 TRANSISTOR OPERATING CHARACTERISTICS

For all practical purposes the transistor base-emitter junction and the transistor base-collector junction can be considered to be diodes. For the transistor to conduct collector to emitter its base-emitter junction must be forward biased in the same manner as a conventional diode. In a germanium transistor the typical forward biased junction voltage is 0.2 to 0.4 volts. A typical silicon transistor will have forward biased junction



TEST CONNECTIONS FOR
IN-CIRCUIT TRANSISTOR TESTING
FIGURE 9

NOTE 1:

Enough loop current is present in the leads of some electronic voltmeters to destroy transistors if measurements are made directly across transistor junctions. If an electronic voltmeter is used, perform the above measurements with respect to the circuit voltage common.

NOTE 2:

If the collector voltage is measured with a VOM the meter leads may be connected directly across the collector resistor. The difference between the supply voltage and the collector voltage will then be indicated directly on the VOM.

voltage of 0.5 to 0.7 volts. When collector current is high the base-emitter voltage of both germanium and silicon transistors increases from 0.1 to 0.2 volts. The base-emitter bias voltage in the forward biased condition is then 0.4 to 0.5 volts for a germanium transistor and 0.7 to 0.9 volts for a silicon transistor. High current silicon transistors may go up to 2 volts under load.

A high impedance DC voltmeter is usually the only measuring instrument required for determining the operating status of an in-circuit transistor. The meter is used to measure the transistor bias voltages. See Figure 9 for the correct voltmeter connections for measuring in-circuit transistor bias.

5.1.3 IN-CIRCUIT TRANSISTOR TESTING

a. Refer to Figure 9 for test connections.

b. Measure the emitter voltage. Compare your measurement to the voltage listed on the schematic diagram. A correct emitter voltage reading generally indicates that the transistor is working properly. If you are in doubt as to the condition of the transistor after measuring the emitter voltage, proceed to the following tests.

c. Measure the base-emitter junction bias. The voltage measured across a forward biased junction should be approximately 0.3 volts for a germanium transistor and 0.6 volts for a small signal silicon transistor.

d. Check for amplifier action by shorting the base to the emitter while monitoring the collector voltage.* The transistor should cut off (not conduct emitter to collector) because the base emitter bias is removed. The collector voltage should rise to near the supply level. Any difference is the result of leakage current through the transistor. Generally, the smaller the leakage current the better the transistor. If no change occurs in the collector voltage when the base-emitter junction is shorted the transistor should be removed from the circuit and checked with an ohmmeter or a transistor tester. The following section describes the technique for testing transistors out of the circuit with an ohmmeter.

* Not recommended for high level stages under driving conditions.

5.1.4 OUT OF CIRCUIT TRANSISTOR TESTING

Only high quality ohmmeters should be used to measure the resistance of transistors. Many ohmmeters of both VOM and electronic types have short circuit current capabilities in their lower ranges that can be damaging to semiconductor devices. A good rule of thumb is to never measure the resistance of a semiconductor on any ohmmeter range that produces more than 3 milliamperes of short circuit current. Also, it is not advisable to use an ohmmeter that has an open circuit voltage of more than 1.5 volts. A current limiting resistor may be used in series with ohmmeter probes to make the lower ranges safe for measuring semiconductor resistances. If a current limiting resistor is used its value must be subtracted from the ohmmeter reading. The following section describes a method for determining the short circuit current capabilities of ohmmeters.

5.1.5 HOW TO DETERMINE OHMMETER CURRENT

When the ohmmeter test probes are shorted together (measuring the forward resistance of a diode or the base-emitter junction of a transistor amounts to the same thing) the meter deflects full scale and the entire battery voltage appears across a resistance that we will designate as R1. The current through the probes is the battery voltage divided by the resistance of R1. A very easy method is available for determining the value of R1. Look at the exact center of the ohmmeter scale. Your reading is the value of R1 on the Rx1 range.

The only other unknown required to calculate the short circuit current of an ohmmeter is the internal battery voltage. Let's take a well known meter that has a center scale reading on the ohms scale of 4.62 and a battery voltage of 1.5 volts. Its short circuit current can be calculated by using Ohm's Law. Dividing 1.5 volts by 4.62 ohms equals a short circuit current of 324 mA on the Rx1 range. Obviously, the Rx1 range of this meter cannot be used to measure the resistance of semiconductors. When the value of R1 is known for the

Rx1 range it can then be determined for any range by multiplying R1 by the multiplier value of the range. The value of R1 for the Rx10 range of a meter with an R1 value on the Rx1 range of 4.62 ohms is 4.62 x 10 or 46.2 ohms. The short circuit current on the Rx10 range can then be calculated: 1.5 volts divided by 46.2 ohms equals 32.5 mA. By using this method, the lowest safe range for measuring semiconductor resistance may be determined for any ohmmeter.

Remember that you should not measure any semiconductor resistance on any ohmmeter range which produces more than three milliamperes of short circuit current.

The following chart indicates the results that should be obtained from operational transistors measured out of the circuit.

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

5.2 RECEIVER SERVICING

5.2.1 GENERAL

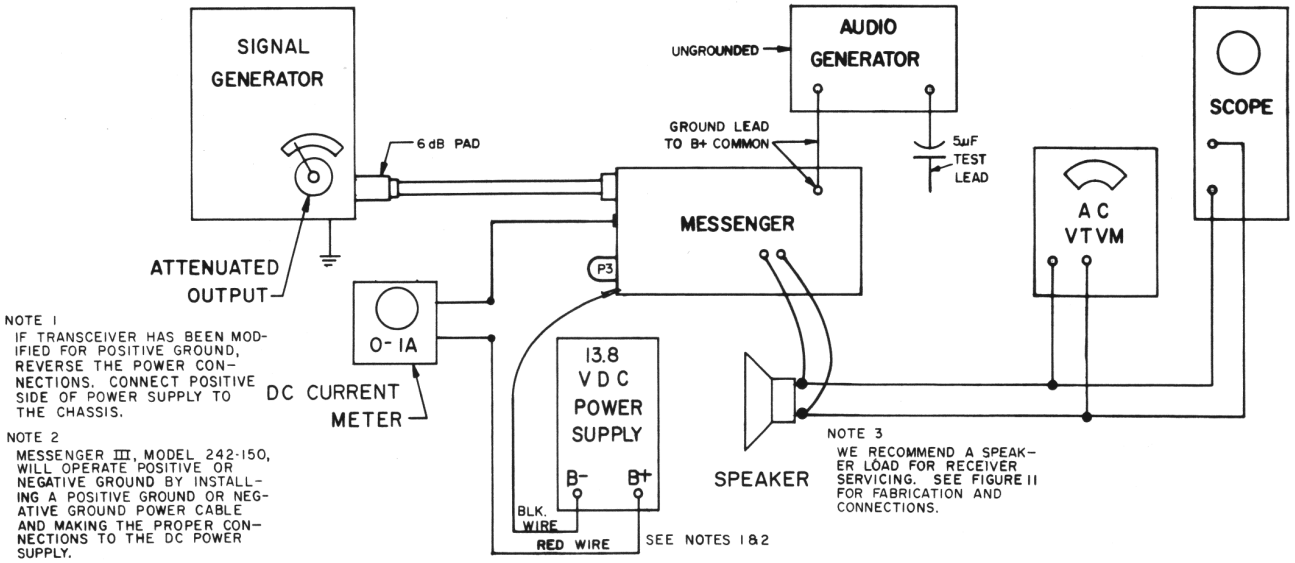
This section covers receiver trouble isolation procedures. When a transistor is suspected of being faulty the servicing technician should refer to Section 5.1, Transistor Troubleshooting.

5.2.2 CHASSIS REMOVAL

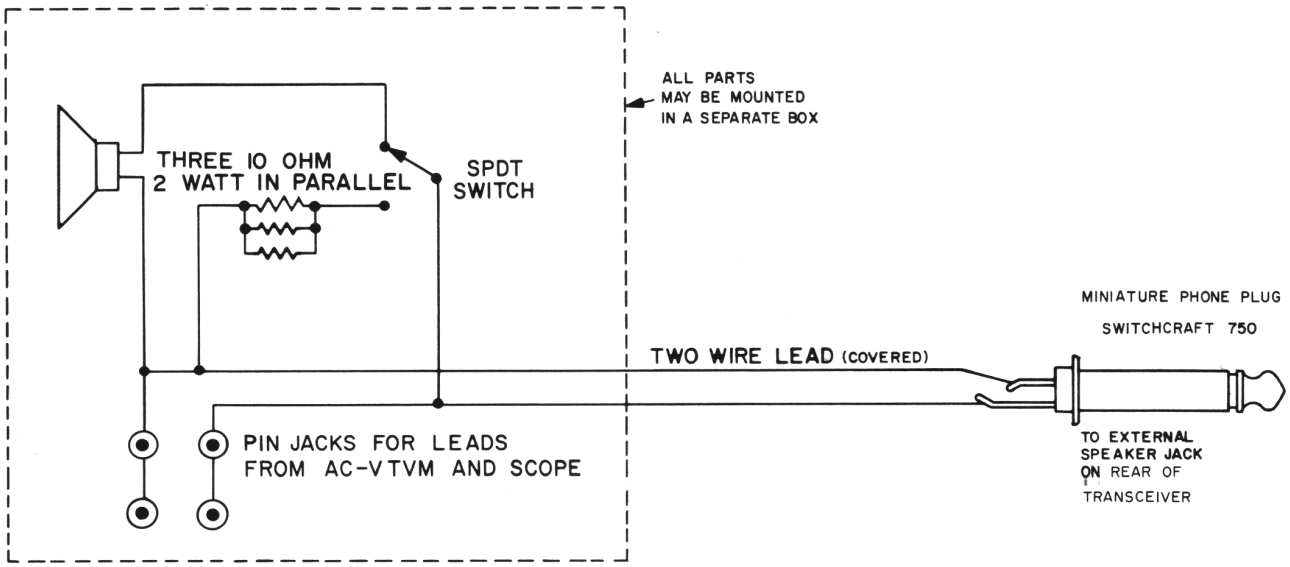
1. Access to the chassis is gained by removing the four screws at the rear of the cabinet.
2. Place the transceiver front panel down on a flat surface. Hold the front panel while carefully withdrawing the cabinet assembly from the chassis.

5.2.3 SPEAKER REMOVAL

1. The speaker is held in place by three screws



RECEIVER TEST INSTRUMENT CONNECTIONS
FIGURE 10



TEST ASSEMBLY
CONNECTING AC-VTVM AND SCOPE
FIGURE 11

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 μF 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.

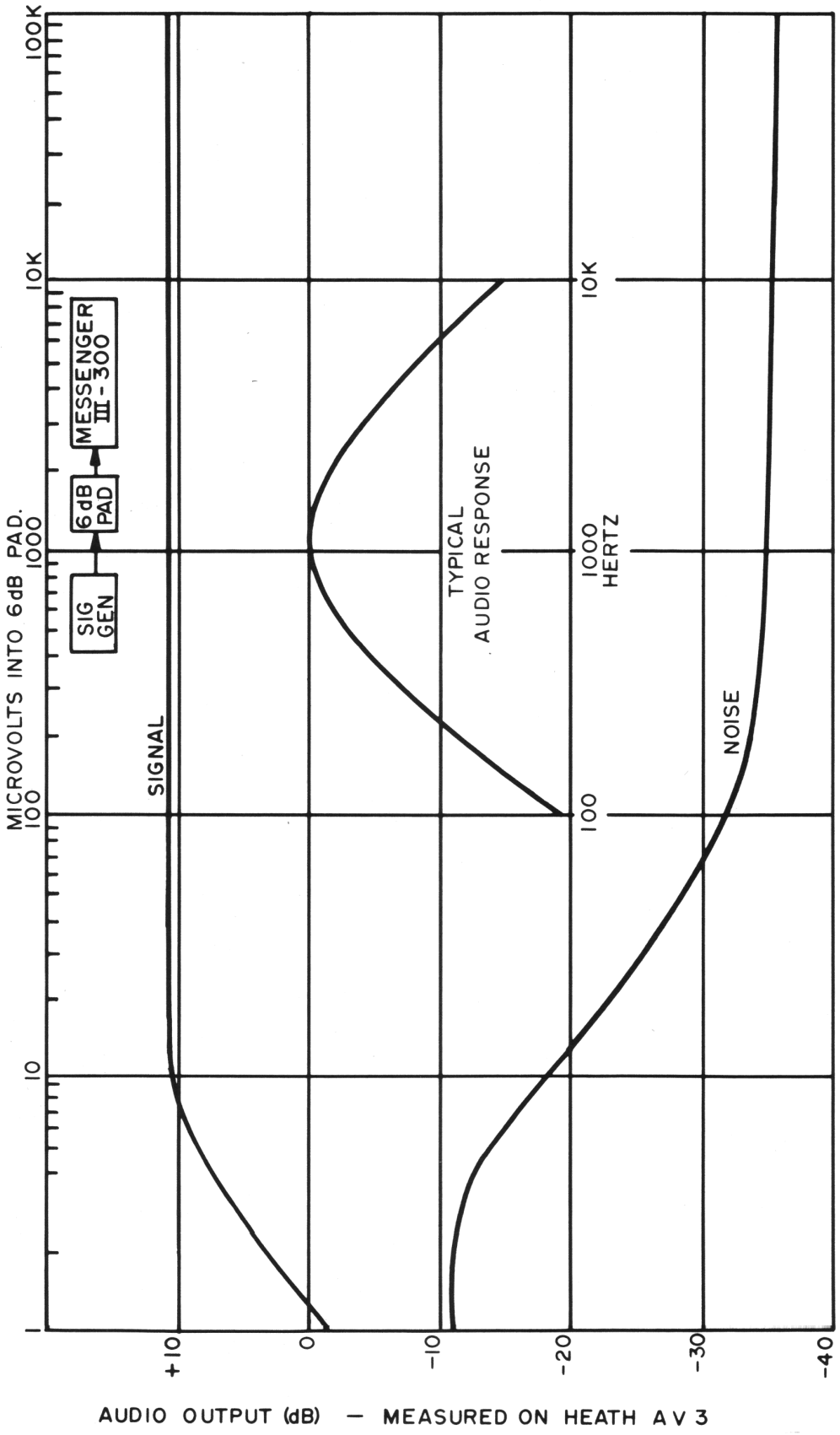
b. Set signal generator for 1 microvolt output. Modulate the generator with 1000 Hz at 30%.

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

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

5.2.7 AGC

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.

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 Unsquelched
0.5	0
1.5	+0.95
5	+2.0
15	+2.3
50	+2.0
150	+2.6
500	+2.7
1,500	+2.75
5,000	+2.8
15,000	+2.85

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.

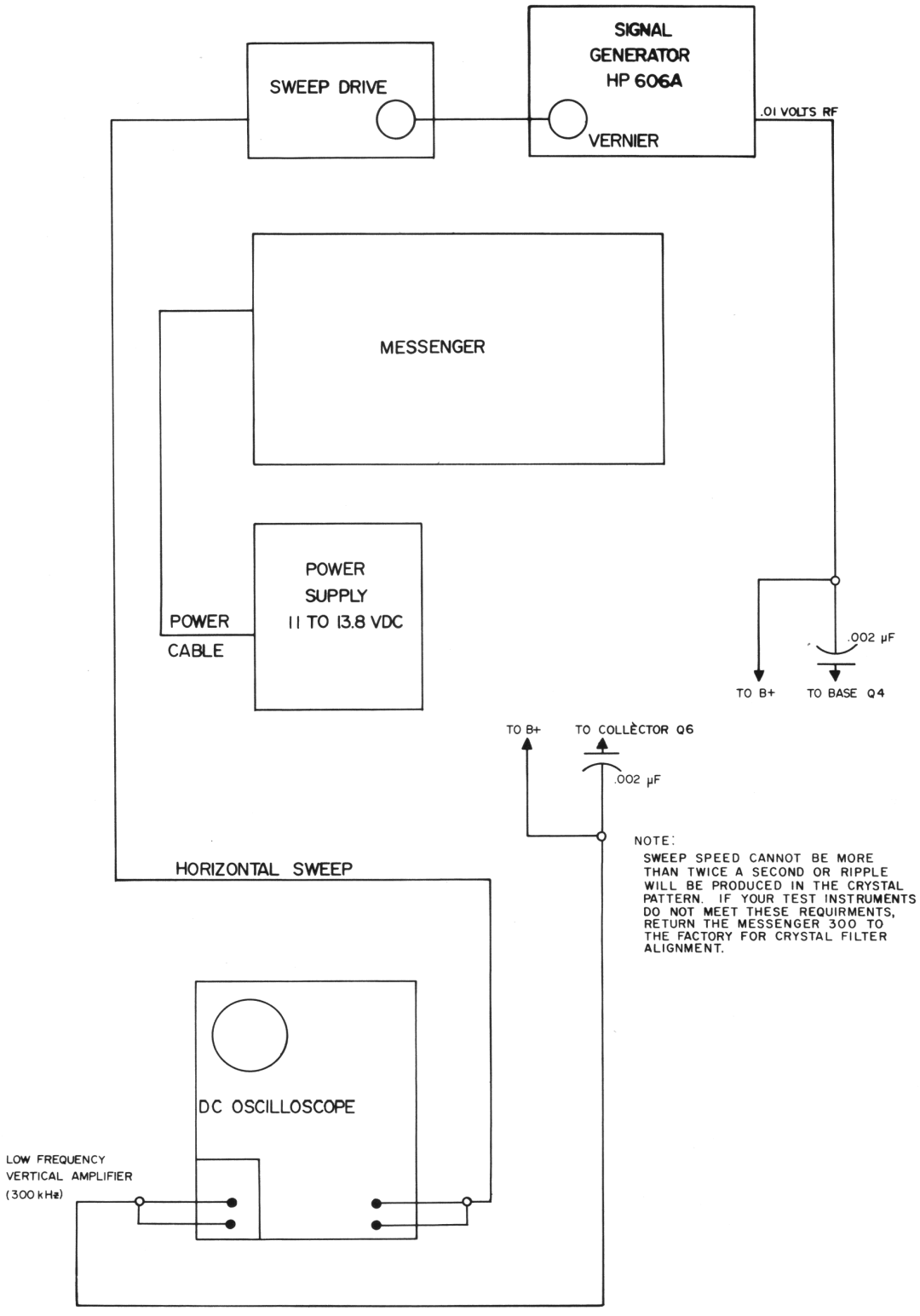
e. If D6 was not open, check the bias of Q10 and Q11.

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 μF capacitor to the top of the volume control with an output of 0.0025 volts RMS ±10% at 1000 Hz (positive side to the generator). The ground lead is connected to the circuit common, B+.

b. Set audio control for +10 dB on the AC-VTVM and turn squelch to minimum. (CCW)



TEST EQUIPMENT SET-UP FOR
CRYSTAL FILTER TUNING
FIGURE 13

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 μV at the antenna terminals modulated at 80%, 1000 Hz.

Point	Volts RMS
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 μF 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 μF 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.

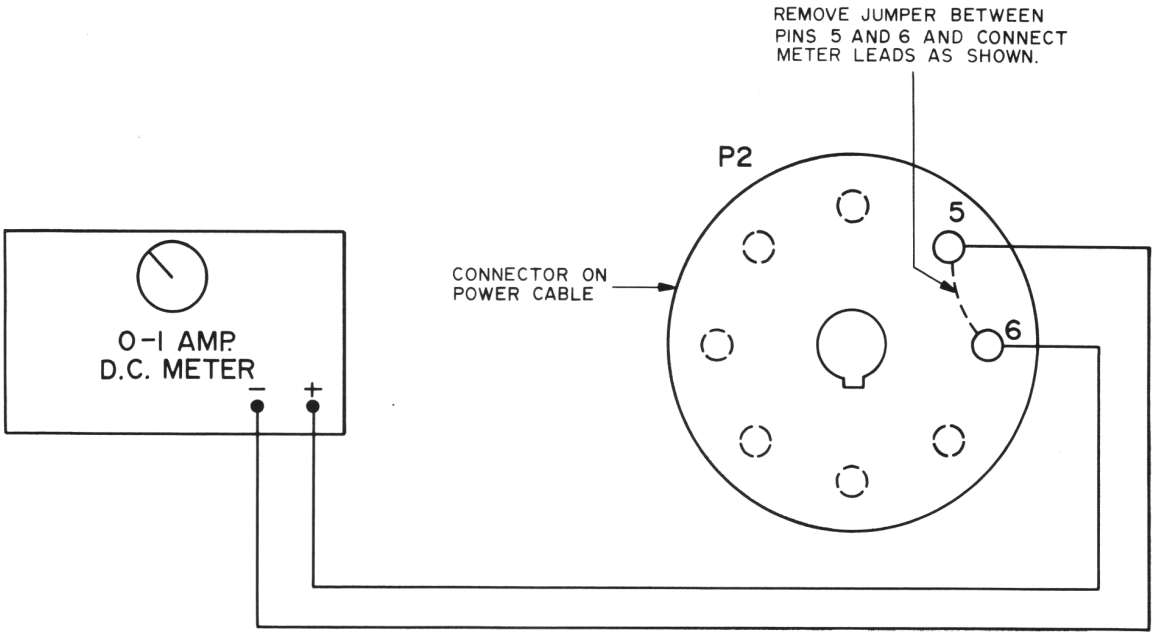
5.2.12 RF AMPLIFIER AND FIRST MIXER

a. Connect test equipment as shown in Figure 10 and outlined in Section 5.2.5.

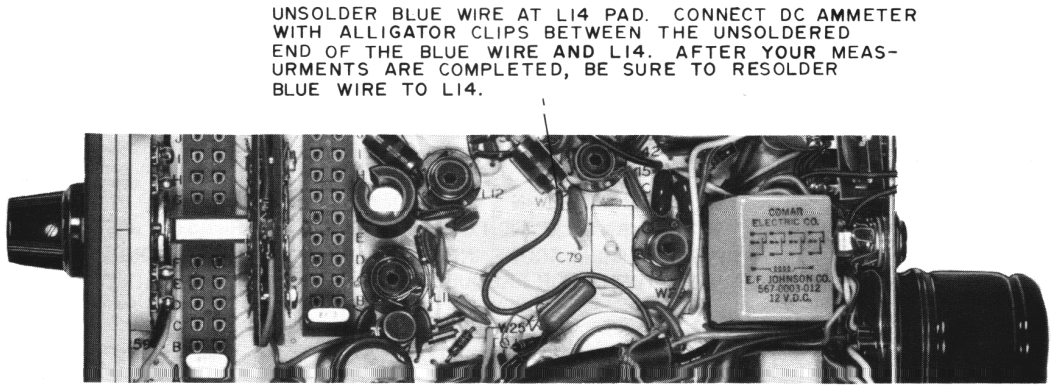
b. Set signal generator to the operating frequency and connect it to the antenna terminals.

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



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

scope and VTVM should be at least +5 dB undistorted audio.

e. 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.

f. If the oscillator operation appears normal, check the voltages at Q1 and Q4, and replace if necessary.

5.3 TRANSMITTER

5.3.1 TEST INSTRUMENTS REQUIRED

a. Regulated DC Power Supply, 13.8 volts at 1.5 amperes. Hewlett-Packard 6201A.

b. Oscilloscope - with RF pickup loop capable of direct connection to the vertical plates, see Figure 15.

c. 0-1 ampere DC ammeter

d. 50 ohm transmitter load with a power rating of at least 5 watts.

e. Audio generator - Heath IG-72 or equivalent

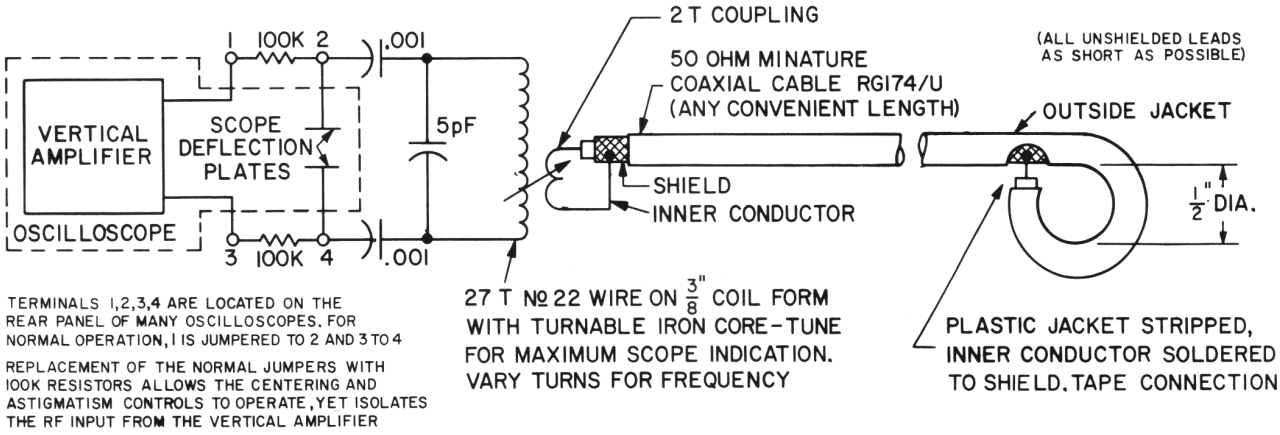
5.3.2 TEST INSTRUMENT CONNECTIONS

a. Connect the equipment as shown in Figure 17. Be sure to connect the 50 ohm dummy antenna.

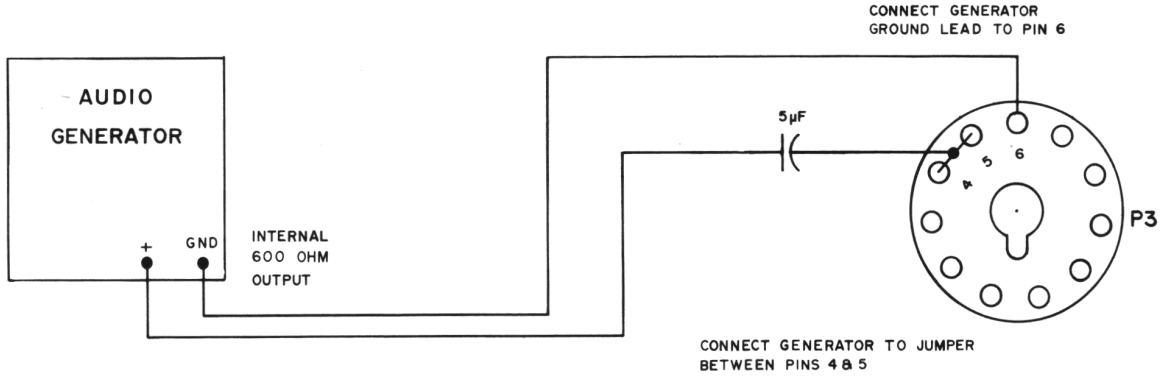
b. Couple RF pickup loop from the oscilloscope to L16 of the power amplifier stage.

c. 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.

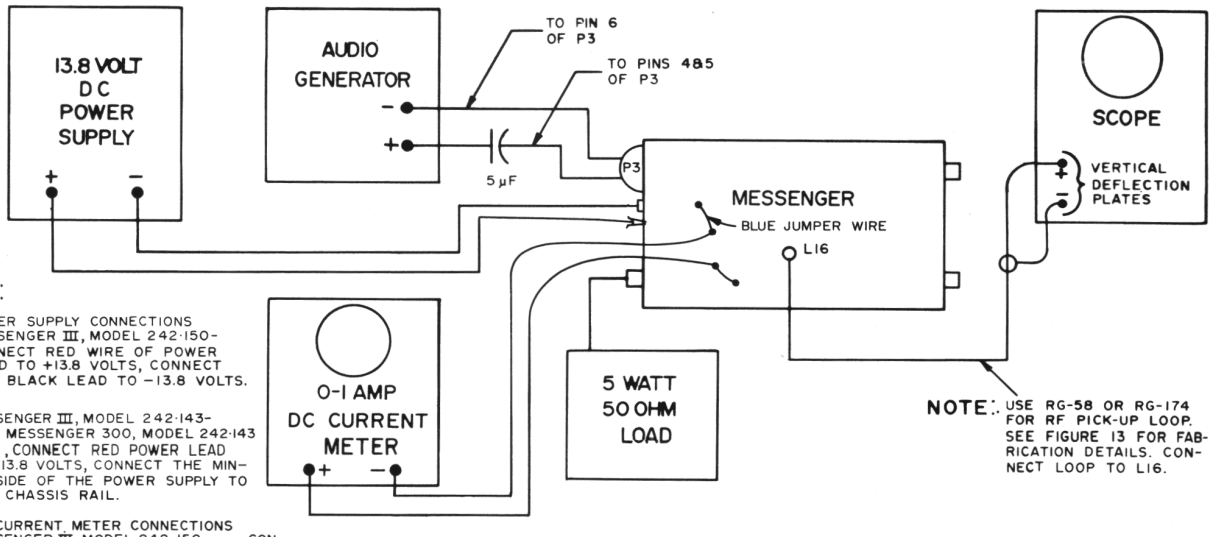
d. For the Messenger III, Model 242-143 and Messenger 300, Model 242-149, the DC ammeter is connected in series with the blue jumper wire located just below the speaker



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



AUDIO GENERATOR CONNECTOR TO P3
FIGURE 16



NOTES:

1. POWER SUPPLY CONNECTIONS
   a. MESSENGER III, MODEL 242-150- CONNECT RED WIRE OF POWER LEAD TO +13.8 VOLTS, CONNECT THE BLACK LEAD TO −13.8 VOLTS.
   b. MESSENGER III, MODEL 242-143- AND MESSENGER 300, MODEL 242-143 - , CONNECT RED POWER LEAD TO +13.8 VOLTS, CONNECT THE MINUS SIDE OF THE POWER SUPPLY TO THE CHASSIS RAIL.
2. DC CURRENT METER CONNECTIONS
   a. MESSENGER III, MODEL 242-150- , CONNECT THE METER IN SERIES WITH PINS 5 AND 6 OF THE POWER PLUG P2. SEE FIGURE 14.
   b. MESSENGER III, MODEL 242-143- AND MESSENGER 300 MODEL 242-149- , CONNECT THE METER IN SERIES WITH THE BLUE JUMPER WIRE LOCATED JUST BELOW THE SPEAKER. SEE FIGURE 14.

TRANSMITTER TEST INSTRUMENT CONNECTIONS

FIGURE 17

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 μF 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 transceiver 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 defective 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.

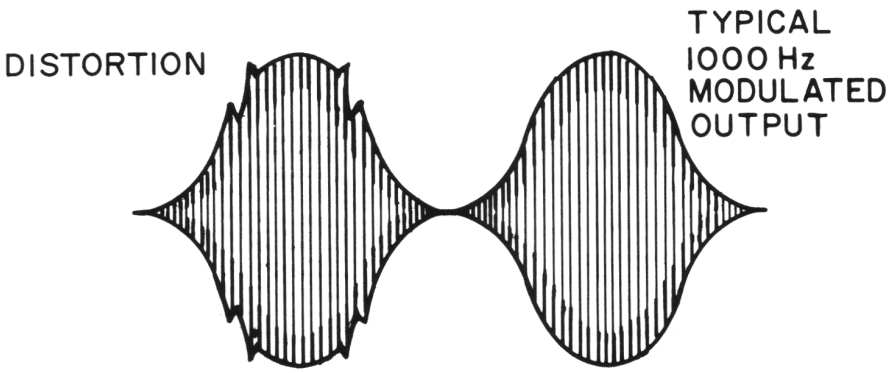
SECTION 6
ALIGNMENT

6.1 GENERAL

The transceivers are carefully aligned at the factory. Complete re-alignment is not recommended except by technicians familiar with transistorized transceivers, possessing a 2nd class FCC license and who have the necessary test equipment, then only if absolutely necessary. Replacement of defective components in any stage should require re-alignment of that particular stage only.

6.2 RECEIVER ALIGNMENT CHART

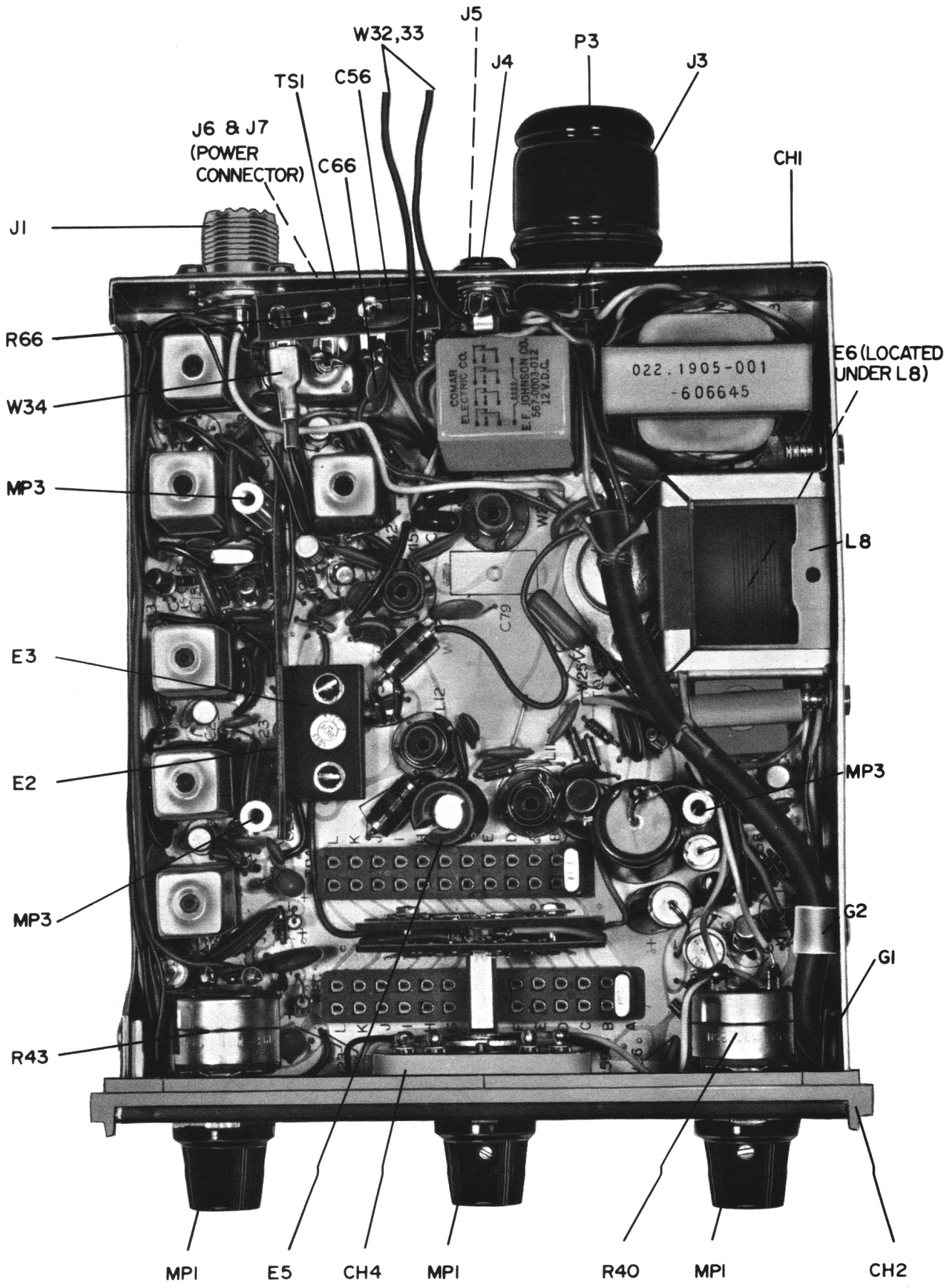
ALIGNMENT	CONNECTIONS AND SETTINGS	ADJUSTMENTS
455 kHz IF	Connect the test equipment as in Section 5.2.5. Set the output of the signal generator to about 10 dB signal-to-noise ratio. Inject modulated 455 kHz signal to base of Q6 through a 0.1 μF capacitor.	Peak L7, L6, and L5 top and bottom cores for maximum on the AC-VTVM. NOTE: For alignment purposes consider the component side of the circuit board as the top.
4.3 MHz IF	Connect the test equipment as in Section 5.2.5. Inject modulated 4.3 MHz signal to the base of Q4 through a 0.1 μF capacitor.	Tune top and bottom cores of L4 to the outside peak as viewed from the top and bottom, respectively, of the transceiver to obtain maximum output on the AC-VTVM.
1st Mixer	Connect the test equipment as in Section 5.2.5. Connect an RF probe to the emitter of Q4. Set channel selector to channel 11. Injection voltage on the emitter of Q3 should be 0.15 volt RF typical.	Adjust L3 to 1/8 of a turn beyond (into coil) the peak reading. Check for proper oscillator starting on the other existing channels.
RF Amplifier	Connect the test equipment as in Section 5.2.5. Set to channel 11 and set level to 1 microvolt modulated 30% at 1000 Hz. Increase volume control until 0.8 VAC on the AC-VTVM is obtained.	Peak L2 at point where the core is nearest the top of the coil form. For L1, turn the core to the second peak as viewed from the top of the transceiver. Detune L1 about 1 dB from peak on the maximum signal-to-noise side of resonance.



RF WAVEFORM DISTORTION
FIGURE 18

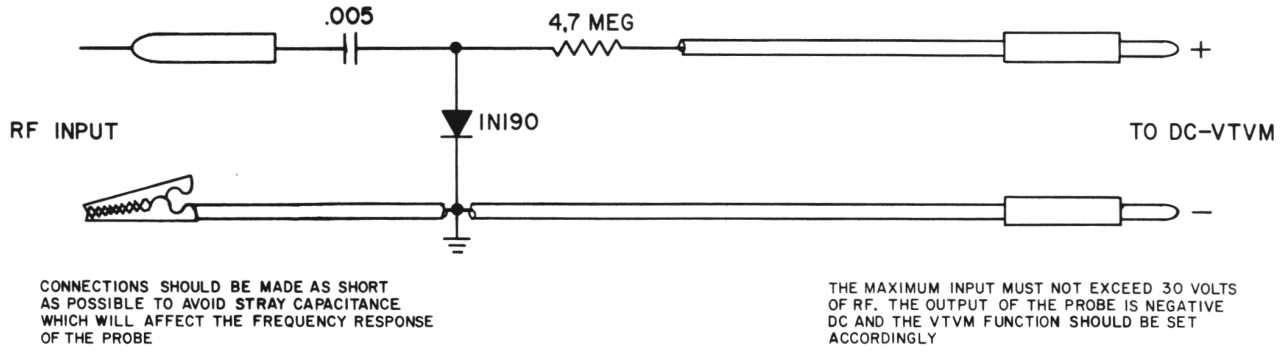
6.3 TRANSMITTER ALIGNMENT CHART

ALIGNMENT	CONNECTIONS AND SETTINGS	ADJUSTMENTS
Oscillator	Connect the circuit as in Section 5.3.2.	Adjust L11, if Q16 were replaced, to assure oscillator starting on all channels. Adjust L11 for absence of distortion (Figure 18). If distortion appears, refer to additional adjustments for notching at the end of this chart.
Driver-Power Amplifier	Connect the test equipment as in Section 5.3.2. Set audio generator to zero output.	Adjust C79 and L16 for peak power output. Adjust L12 for maximum power output. This is a broad adjustment, tune for center of maximum. Adjust L15, L16, and C79 for maximum power output while not exceeding 415 mA of Q18 collector current (See Figure 14 for DC Ammeter Connections). Adjust L15, L16, and C79 for maximum power output with minimum current -- see power curve, Figure 20.
Distortion Adjustment	Connect the test equipment as in Section 5.3.2. Set audio generator for 1000 Hz. Increase audio input level slowly to point of maximum modulation without clipping.	Readjust L11 and L12 to eliminate distortion. Check for symmetrical waveform and oscillator starting on all channels. NOTE: C79 has been deleted on late models to simplify tuning.

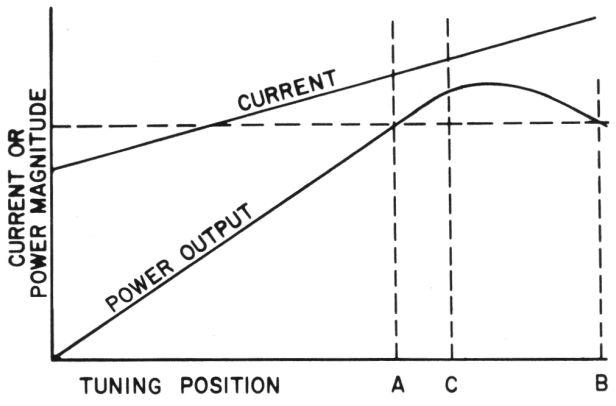


TOP VIEW SHOWING PARTS NOT LISTED ON THE TRANSPARENCY

FIGURE 22



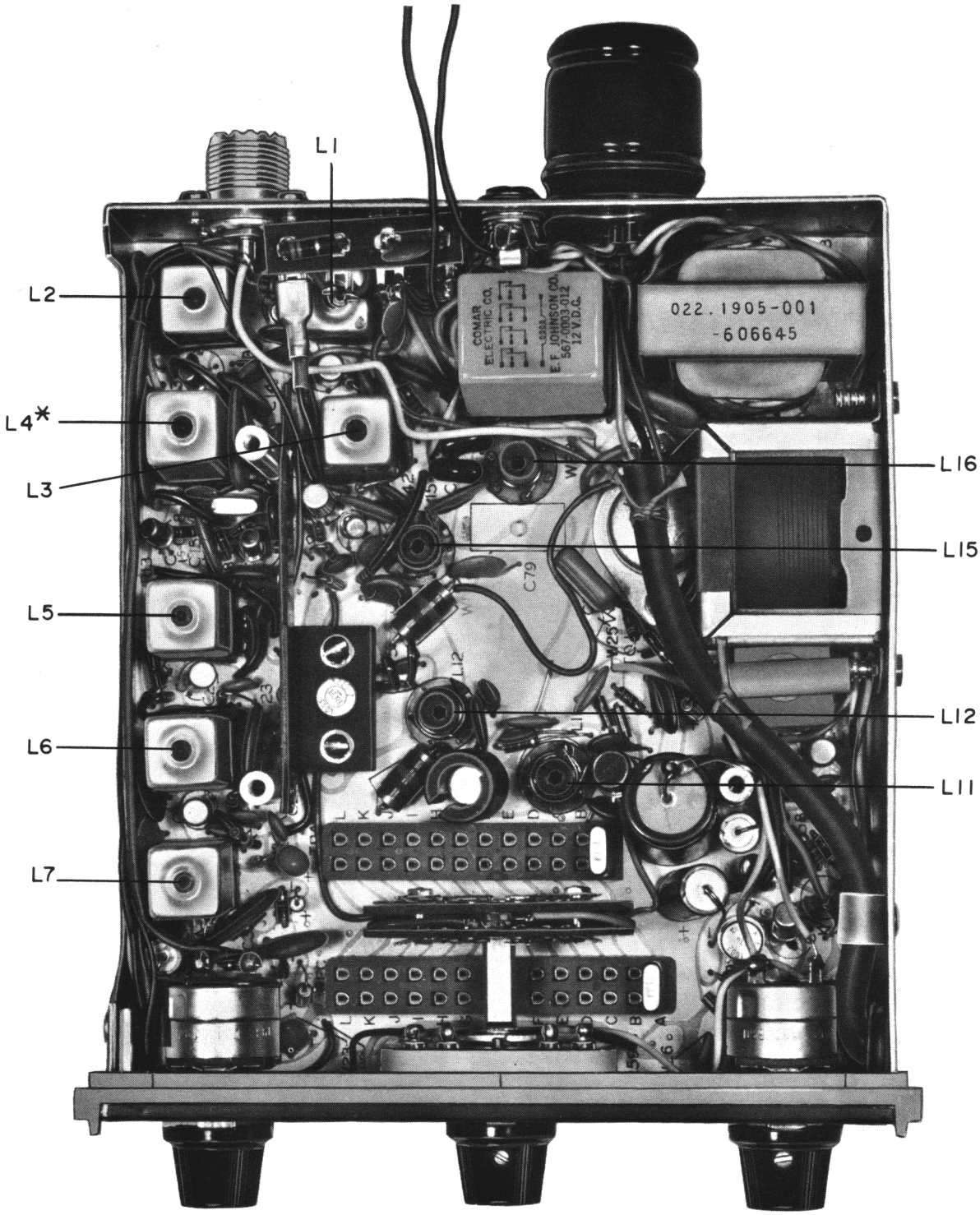
RF PROBE FOR DC-VTVM
FIGURE 19



TRANSMITTER
CURRENT–POWER CURVE
FIGURE 20

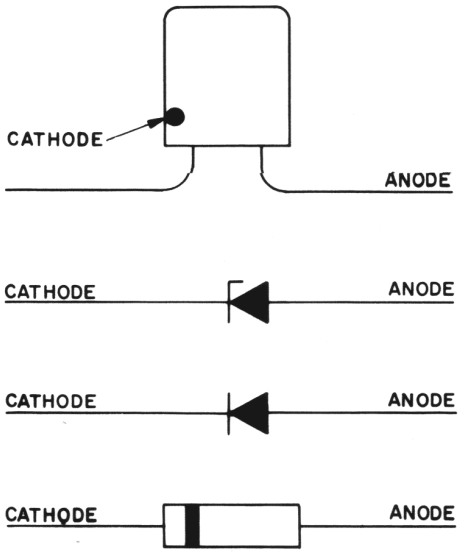
NOTE:

This illustration shows two points (A and B) which give the same power output. One point (B) requires more input current or input power than the other (A) for the same amount of output power. Therefore point A is more efficient than point B. Point C shows the place where maximum efficiency is obtained.



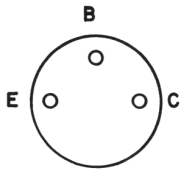
* REPLACED BY CRYSTAL FILTER IN MESSENGER 300, MODEL 242-149

ALIGNMENT POINTS
FIGURE 21

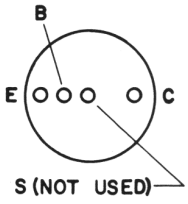


DIODES

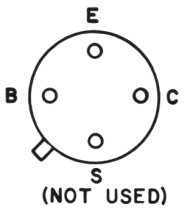
4006
4001
4011
1002
1003
1009
3010



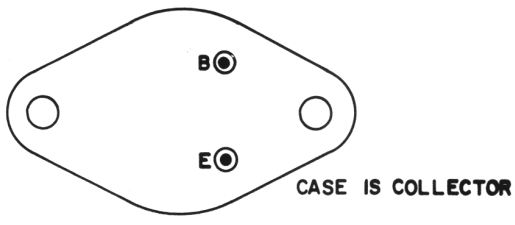
3008
3009



3008
3009



2002



SEMICONDUCTOR CASE DIAGRAMS (BOTTOM VIEW)

SECTION 7
PARTS LIST

SCHEMATIC SYMBOL NO.	DESCRIPTION	PART NO.
	BRACKET	
	Mobile mounting bracket assembly includes:	023-1648-001
	Dash mounting bracket	017-1249-001
	Cushion washer	018-0822-001
	CAPACITORS	
C1	0.005 ±20% μF - 125 VAC disc	510-3001-502
C2	100 pF ±5% N150 disc	510-3016-101
C3	0.01 +80% -20% μF - 50 V	510-3003-103
C4	0.01 +80% -20% μF - 50 V	510-3003-103
C5	0.01 +80% -20% μF - 50 V	510-3003-103
C6	100 pF ±5% N150 disc	510-3016-101
C8	0.01 +80% -20% μF - 50 V	510-3003-103
C9	0.01 +80% -20% μF - 50 V	510-3003-103
C10	0.22 ±20% - 50 V (Alternate * 510-3051-224)	510-1004-224
C11	330 pF ±5% N150, 200 V (for Messenger III, Models 242-143 and 242-150)	510-3016-331
C12	430 pF ±5% N150, 200 V (for Messenger III, Models 242-143 and 242-150)	510-3016-431
C13	0.01 +80% -20% μF - 50 V	510-3003-103
C14	0.05 +80% -20% μF - 25 V	510-3007-503
C15	0.05 +80% -20% μF - 25 V	510-3007-503
C16	270 pF ±5%	510-0001-271
C17	270 pF ±5%	510-0001-271
C18	0.01 +80% -20% μF - 50 V	510-3003-103
C19	0.01 +80% -20% μF - 25 V	510-3007-103
C20	1 μF - 35 V	510-2005-109
C21	0.22 +80% -20% μF - 3 V	510-3009-224
C22	190 ±5% pF N080 - 200 V	510-3015-191
C22	210 pF ±5% N080 (Messenger 300, Model 242-149 only)	510-3015-211
C23	190 ±5% pF N080 - 200 V	510-3015-191
C23	210 pF ±5% N080 (Messenger 300, Model 242-149 only)	510-3015-211
C24	0.01 +80% -20% μF - 25 V	510-3007-103
C25	0.01 +80% -20% μF - 25 V	510-3007-103
C26	0.22 +80% -20% μF - 3 V	510-3009-224
C27	0.01 +80% -20% μF - 25 V	510-3007-103
C28	5.6 μF - 35 V	510-2005-569
C30	50 μF +100% -10% - 25 V	510-4008-006
C31	190 ±5% pF N080 - 200 V	510-3015-191
C31	210 pF ±5% N080 (Messenger 300, Model 242-149 only)	510-3015-211
C32	0.1 +80% -20% μF - 25 V .600" dia. max.	510-3007-104
C33	190 ±5% pF N080 - 200 V	510-3015-191
C33	210 pF ±5% N080 (Messenger 300, Model 242-149 only)	510-3015-211
C34	0.05 +80% -20% μF - 25 V	510-3007-503
C35	0.03 ±20% disc	510-3010-303
C36	1 μF - 35 V	510-2005-109
C37	1 μF - 35 V	510-2005-109
C38	0.05 +80% -20% μF - 25 V	510-3007-503
C39	18 pF ±5% N750 disc	510-3020-180
C40	6.8 pF ±5% N750 disc	510-3020-689
C41	39 pF ±5% N750 disc	510-3020-390
C42	0.01 +80% -20% μF - 50 V	510-3003-103
C43	0.01 +80% -20% μF - 50 V	510-3003-103
C44	0.05 +80% -20% μF - 25 V	510-3007-503
C45	150 ±10% pF - 50 V	022-1803-001
C45	39 pF ±5% NPO (Messenger 300, Model 242-149)	510-3013-390
C46	330 pF ±5%	510-0001-331
C47	68 ±5% pF N150 disc	510-3016-680
C47	150 pF ±5% mica (for Messenger 300)	510-0001-151
C48	0.01 +80% -20% μF 25 V	510-3007-103
C49	0.01 +80% -20% μF 25 V	510-3007-103
C50	500 μF - 2.5 V	510-4001-006

PARTS LIST (cont'd)

SCHEMATIC SYMBOL NO.	DESCRIPTION	PART NO.
C51	0.02 ±20% μF - 50 V	510-3002-203
C52	5.6 μF - 35 V	510-2005-569
C53	0.05 ±20% μF - 25 V Y5S	510-3010-503
C55	1000 +100% -10% μF - 16 V	510-4006-005
C56	0.01 +80 -20% μF - 50V	510-3003-103
C57	0.02 ±20% μF - 50 V	510-3002-203
C58	0.01 ±20% μF - 25 V	510-3010-103
C59	22 μF - 15 V	510-2003-220
C60	22 pF ±5% NPO disc	510-3013-220
C61	50 μF +100% -10% - 25 V	510-4008-006
C62	5.6 μF - 35 V	510-2005-569
C63	0.02 ±20% μF - 50 V	510-3002-203
C64	56 μF - 6 V	510-2001-560
C66	0.01 +80 -20% μF - 50V	510-3003-103
C67	22 pF ±5% NPO disc	510-3013-220
C68	150 pF ±5% N750 disc	510-3020-151
C69	0.005 +80% -20% μF - 500 V	510-3005-502
C70	0.001 ±20% μF - 50 V	510-3002-102
C71	0.005 +80% -20% μF - 500 V	510-3005-502
C72	47 pF ±5% NPO disc	510-3013-470
C73	33 pF ±5% N150 disc	510-3016-330
C74	0.005 +80% -20% μF - 500 V	510-3005-502
C75	0.001 ±20% μF - 1kV, Y5S	510-3061-102
C76	27 pF ±5% NPO disc	510-3013-270
C77	100 pF ±5% N150 disc	510-3016-101
C78	390 pF ±5% 500 V mica	510-0004-391
C80	330 pF ±5% 500 V mica	510-0004-331
C81	0.05 +80% -20% μF - 25 V	510-3007-503
C82	0.05 +80% -20% μF - 50 V	510-3003-503
C83	470 pF ±20%, 500 V, Y5U	510-3004-471
	CHASSIS PARTS	
CH1	Chassis rail (for Messenger III, Model 242-150)	017-1242-002
CH1	Chassis rail (for Messenger 300, Model 242-149)	017-1242-012
CH1	Chassis rail (for Messenger III, Model 242-143)	017-1242-032
CH2	Front panel assembly includes:	023-1644-001
	Front panel die casting	015-0722-003
	Light bulb - clear	549-3001-003
	Light bulb - red	549-3001-004
	Bulb holder	018-0844-001
	Feedthru	260-0202-001
	Flatwasher #4 NPB	029-0060-002
	Shaft index assembly	022-1934-002
	Machine screw #4-40 BDG. HD. NPB	011-0012-006
	Internal Tooth lockwasher #4 NPB	029-0116-003
CH3	Overlay (Messenger III)	023-1694-001
CH3	Overlay (Messenger 300)	023-1694-006
CH4	Channel indicator assembly includes:	023-2207-001
	Dial, channel indicator	032-0149-001
	Label, channel indicator	559-3006-001
CH6	Cabinet assembly includes:	023-1643-001
	Cabinet shell	017-1247-001
	Cabinet end wall	017-1248-001
	Captive nut	013-1003-002
	Insulation sheet	018-0817-001
	DIODES	
D1	1N67A	523-1000-067
D2	1N67A	523-1000-067
D3	1N881	523-1000-881
D4	1N881	523-1000-881
D5	1N2326	523-1002-326
D6	1N67A	523-1000-067
D7	1N67A	523-1000-067
D8	1N67A	523-1000-067
D9	1N881	523-1000-881
D10	10 V zener	523-2003-100
	HEAT SINKS	
E2	Heat sink base (Q18)	016-1539-001
E3	Heat sink cover (Q18)	016-1540-001
E5	Heat sink (Q17)	013-1074-001

PARTS LIST (cont'd)

SCHEMATIC SYMBOL NO.	DESCRIPTION	PART NO.
E6	Clamp, heat sink: for D5	017-1288-001
	GROMMET	
G1	Rubber grommet (Mic cable through chassis rail)	574-0002-007
	CLAMP	
G2	1/4" cable clamp (Mic cable to chassis rail)	572-0001-003
	HARDWARE	
HW	Rivet, 1/8 dia x 3/8" long (Heat sink to posts) (Solder terminal to post)	031-0182-001
HW	#6-32 x 1/8" BH CPS machine screw (cabinet to rail)	011-0280-004
HW	#4-40 x 1/4 RH NPB machine screw (Antenna connector)	011-0011-008
HW	#4-40 x 5/16 RH NPB machine screw (Heat sink cover)	011-0011-010
HW	#4-40 x 1/4 BH NPB machine screw (Transistors to board)	011-0012-008
HW	#4-40 x 3/16 BH NPB machine screw (Board to rails & casting -3)	011-0012-006
HW	#6-32 x 5/16 RH NPB machine screw (Posts to board)	011-0016-010
HW	#6-32 x 3/16 BH CPS machine screw (Rail to casting -4) (Cabinet to rail -4)	011-0280-006
HW	#6-32 x 3/8 BH CPS machine screw (Choke to rail)	011-0280-012
HW	#6-32 x 5/16 BH NPB machine screw (Speaker to posts -3) (Cable clamp -1)	011-0114-010
HW	1/4-20 x 3/8" hex head cap screw CPS (Dash mounting bracket)	011-0322-012
HW	#8-32 x 3/16 set screw (Knobs)	011-0022-006
HW	Solder terminal (Antenna connector) (C55)	586-0005-006
HW	#4-40 NPB hex nut (Antenna connector -2) (Transistors -4)	012-0001-001
HW	#6-32 NPB hex nut (Cable clamp)	012-0002-001
HW	3/8-32 NPB hex nut (Potentiometers)	012-0040-003
HW	Retainer ring	515-0004-001
HW	3/8 x 11/16 x .020 NPB flatwasher (Potentiometers)	029-0098-002
HW	Screw, #8-18 x 3/8 CPS sheet metal (L8 to chassis rail)	011-0823-012
HW	#4 NPB internal tooth lockwasher (All #4 screws except at solder terminal)	029-0116-003
HW	#6 NPB internal tooth lockwasher (Between board & posts -3) (Cable clamp -1) (Heat sink to posts -2)	029-0069-003
HW	Shoulder bushing (Phono jacks - outside)	029-0209-001
HW	Insulating washer (Phono jacks - inside)	029-0213-001
HW	Spacer washer (Between channel dial and overlay)	029-0426-001
	NOTE: BH - Binding Head RH - Round Head NPB - Nickel Plated Brass CPS - Cadmium Plated Steel	
	JACKS	
J1	Antenna	515-3003-001
J2	8 pin male (with ring) (Messenger III, Model 242-150 only)	515-0004-001
J3	11 pin male plug	515-0005-011
J4	Phono	515-2001-002
J5	Phono (circuit opening)	515-2001-001
J6	Terminal bushing (Messenger III, Model 242-143 and Messenger 300, Model 242-149 only)	
J7	Terminal tab, solder type (Messenger III, Model 242-143 and Messenger 300, Model 242-149 only)	

PARTS LIST (cont'd)

SCHEMATIC SYMBOL NO.	DESCRIPTION	PART NO.
	TRANSFORMERS AND CHOKES	
L1	27 MHz - input	592-5016-001
L2	27 MHz - output	592-5016-002
L3	27 MHz - oscillator	592-5016-003
L4	4.3 MHz - interstage	592-5016-004
L4	4.3 MHz interstage (for Messenger III, Models 242-143 and 242-150)	592-5016-004
L5	455 kHz - input	592-5016-005
L6	455 kHz - interstage	592-5016-006
L7	455 kHz - output	592-5016-007
L8	20 mH filter choke	542-5007-001
L11	Oscillator coil	592-5014-001
L12	Driver coil	592-5014-002
L13	13 μH coil	542-3003-001
L14, 17	13 μH coil	542-3003-001
L15	Series output coil	542-1005-010
L16	Pi-output coil	542-1005-004
T1	Driver	592-1007-004
T2	Audio output and modulation	592-1013-003
	SPEAKER	
LS	3" x 5" speaker	589-1005-001
	MICROPHONE	
M	Microphone	023-2708-003
	MECHANICAL PARTS	
MP1	Knobs channel selector, squelch and volume)	547-0001-004
MP2	Speaker post with holes	014-0564-002
MP3	Spacer rod (speaker post)	014-0564-004
MP4	Standoff stud	013-1013-002
	JUMPER PLUG	
P3	11 pin jumper plug	023-1659-001
	TRANSISTORS	
Q1	3008	576-0003-008
Q2	3010	576-0003-010
Q3	3008	576-0003-008
Q4	3009	576-0003-009
Q5	3010	576-0003-010
Q6	3025 (Messenger 300 only)	576-0003-025
Q6	3025 (Alternate*576-0003-009)	576-0003-025
Q7	3009	576-0003-009
Q8	3010	576-0003-010
Q9	3010	576-0003-010
Q10	1002 squelch	576-0001-002
Q11	1003 audio	576-0001-003
Q12	1013 audio	576-0001-013
Q13	1013 driver	576-0001-013
Q14	2002 audio output	576-0002-002
Q15	2002 audio output	576-0002-002
Q16	4006 oscillator	576-0004-006
Q17	4004 driver	576-0004-004
Q18	4005 power output	576-0004-005
	* Transistor number 3025 calls out a special size 3009. Number 3025 cannot be substituted with a 3009 in the Messenger 300. Numbers 3009 and 3025 can be interchanged in the Messenger III.	
	RESISTORS	
R1	33,000 ±10% ohm 1/4 W	569-1002-333
R2	3900 ±10% ohm 1/4 W	569-1002-392
R3	39,000 ±10% ohm 1/4 W	569-1002-393
R4	680 ±10% ohm 1/4 W	569-1002-681
R5	470 ±10% ohm 1/4 W	569-1002-471
R6	4700 ±10% ohm 1/4 W	569-1002-472
R7	39,000 ±10% ohm 1/4 W	569-1002-393
R8	1000 ±10% ohm 1/4 W	569-1002-102
R9	4700 ±10% ohm 1/4 W	569-1002-472
R11	33,000 ±10% ohn 1/4 W	569-1002-333
R12	1000 ±10% ohm 1/4 W	569-1002-102

PARTS LIST (cont'd)

SCHEMATIC SYMBOL NO.	DESCRIPTION	PART NO.
R13	1000 ±10% ohm 1/4 W	569-1002-102
R14	8200 ±10% ohm 1/4 W	569-1002-822
R15	180,000 ±10% ohm 1/4 W	569-1002-184
R16	680 ±10% ohm 1/4 W	569-1002-681
R17	1000 ±10% ohm 1/4 W	569-1002-102
R18	4700 ±10% ohm 1/4 W	569-1002-472
R19	22,000 ±10% ohm 1/4 W	569-1002-223
R20	6800 ±10% ohm 1/4 W	569-1002-682
R21	4000 ohm resistor thermistor assembly includes:	023-2042-002
	8000 ohm thermistor	569-3001-001
	8200 ohm resistor	569-1002-822
R22	680 ±10% ohm 1/4 W	569-1002-681
R23	5600 ±10% ohm 1/4 W	569-1002-562
R24	5600 ±10% ohm 1/4 W	569-1002-562
R26	75,000 ±5% ohm 1/4 W	569-1001-753
R27	5600 ±10% ohm 1/4 W	569-1002-562
R28	10,000 ±10% ohm 1/4 W	569-1002-103
R29	15,000 ±10% ohm 1/4 W	569-1002-153
R30	10,000 ±10% ohm 1/4 W	569-1002-103
R31	2700 ±10% ohm 1/4 W	569-1002-272
R32	470 ±10% ohm 1/4 W	569-1002-471
R33	680 ±10% ohm 1/4 W	569-1002-681
R34	1000 ±10% ohm 1/4 W	569-1002-102
R35	1000 ±10% ohm 1/4 W	569-1002-102
R36	4700 ±10% ohm 1/4 W	569-1002-472
R37	12,000 ±10% ohm 1/4 W	569-1002-123
R38	3300 ±10% ohm 1/4 W	569-1002-332
R39	1000 ±10% ohm 1/4 W	569-1002-102
R40	10,000 ohm potentiometer with SPST switch	562-0001-006
R42	330,000 ±10% ohm 1/4 W	569-1002-334
R43	5,000 ohm potentiometer with SPDT switch	562-0001-007
R45	10,000 ohm resistor-thermistor assembly includes:	023-2042-001
	8000 ohm thermistor	569-3001-001
	1800 ohm resistor	569-1002-182
R46	3300 ±10% ohm 1/4 W	569-1002-332
R47	120 ±10% ohm 1/4 W	569-1002-121
R48	62 ±5% ohm 1/2 W	569-1003-620
R49	10,000 ±10% ohm 1/4 W	569-1002-103
R50	22,000 ±10% ohm 1/4 W	569-1002-223
R51	3900 ±10% ohm 1/4 W	569-1002-392
R52	680 ±10% ohm 1/4 W	569-1002-681
R53	22,000 ±10% ohm 1/4 W	569-1002-223
R54	2700 ±10% ohm 1/4 W	569-1002-272
R55	330 ±10% ohm 1/4 W	569-1002-331
R56	470 ±10% ohm 1/4 W	569-1002-471
R57	1500 ±10% ohm 1/4 W	569-1002-152
R58	2.2 ±10% ohm 1/2 W	569-2003-229
R59	22 ±10% ohm 1/4 W	569-1002-220
R60	47,000 ±10% ohm 1/4 W	569-1002-473
R61	510 ±5% ohm 1/4 W	569-1001-511
R62	5100 ±5% ohm 1/4 W	569-1001-512
R63	51 ±5% ohm 1/4 W	569-1001-510
R64	120 ±10% ohm 1/4 W	569-1002-121
R65	47 ±10% ohm 1/4 W	569-1002-470
R66	33 ohm ±10% 1/2 W (for Messenger III, Model 242-143 and 300)	
R69	4.7 ±10% ohm 1/4 W	569-1002-479
	RELAY	
RY	Relay	567-0003-012
	SWITCH	
SW	Printed circuit switch, Msgr III Model No. 242-050	583-2027-001
SW	Printed circuit switch, Msgr III, Model No. 242-143, and Msgr 300	583-2027-004
	TERMINAL STRIP	
TS1	Terminal strip, 4 terminal, 1 mounting foot (for Messenger III, Model 242-143 and 300)	586-1001-023
	WIRE	
W32, W33	Speaker lead assembly	022-2336-001

PARTS LIST (cont'd)

SCHEMATIC SYMBOL NO.	DESCRIPTION	PART NO.
W34	Quick-disconnect	022-2336-002
	SOCKETS	
XY1	Relay socket	515-9002-003
XY2	11 position crystal socket (Messenger III, Model 242-150 only)	126-0110-002
XY3	11 position crystal socket (Messenger III, Model 242-150 only)	126-0110-003
XY2	12 position crystal socket Messenger III, Model 242-143 and Messenger 300, Model 242-149 only)	126-0110-005
XY3	12 position crystal socket Messenger III, Model 242-143 and Messenger 300, Model 242-149 only)	126-0110-006
	CRYSTALS	
YR	4.755 MC crystal	519-0012-001
	CRYSTAL FILTER ASSEMBLY	
Z1	Crystal filter assembly (Messenger 300 only) includes:	023-2041-001
	Printed circuit board, PC2	035-0021-001
	Capacitor, foil trimmer, C86	512-3001-002
	Capacitor, variable foil C85 & 88	512-3001-004
	Capacitor, .01 +80% -20%, C83	510-3003-103
	Crystal set, YF1, 2	519-0007-001
	Crystal set, YF3, 4	519-0007-001
	Resistor, 6800 ohm ±10%, 1/4 W, R25	569-1002-682
	Toroid, input, T3	592-9002-001
	Toroid, output, T4	592-9002-002
	ACCESSORY PACKAGE ITEMS	
	Operating Manual, Messenger III	002-0046-001
	Operating Manual, Messenger 300	002-0037-001
	Part 95 - FCC Rules - Citizens Radio Service	022-1635-001
	FCC Form 505 - License Application form	022-1636-001
	FCC identification card	022-1598-004
	Warranty registration card	041-0419-014
	Power lead assembly (Fused) (for Messenger III, Model 242-143 and 300) NOTE: See battery cables for Messenger III, Model 242-150	023-1652-001
	Microphone holder (with extra 1/4" dia hole)	537-9004-002
	Screws for microphone holder #4 sheet metal)	011-0807-006
	Channel number stickers	022-2327-001
	Screws for dash mtg. bracket	011-0229-020
	Nuts for dash mtg. bracket	012-0109-002
	Internal tooth lockwashers	029-0001-003
	Tap connector package	023-2209-001
	NOTE: A complete accessory package may be ordered under the following part numbers:	
	023-1661-004 - Messenger III, Model 242-143	
	023-1661-003 - Messenger 300, Model 242-149	
	The Messenger III, Model 242-150 has been discontinued; its accessory package is no longer available	
	12 VDC battery cable assembly Positive ground (for Messenger III, Model 242-150) includes:	023-1658-001
	8 pin noval socket	515-1005-008
	Wire, black, plastic #18, stranded copper	071-0912-050
	Wire, black, plastic #18, stranded copper	071-0912-050
	Fuseholder for 1/4 dia x 1 1/4 L fuse	534-1004-005
	Fuse, 2 ampere	534-0003-024
	0.01 μF disc capacitor, 50 VDC	510-3003-103
	RF choke	542-3003-001
	Tag	559-4014-002
	33 ±10% ohm 1/4 W resistor	569-1002-330
	Socket shell	515-6002-003
	12 VDC battery cable assembly Negative ground (for Messenger III, Model 242-150 includes:	023-1657-001
	8 pin socket	515-1005-008
	Wire, red plastic #18, stranded copper	071-0912-042
	Wire, red plastic #18, stranded copper	071-0912-042
	Fuseholder for 1/4 dia x 1 1/4 L fuse	534-1004-005

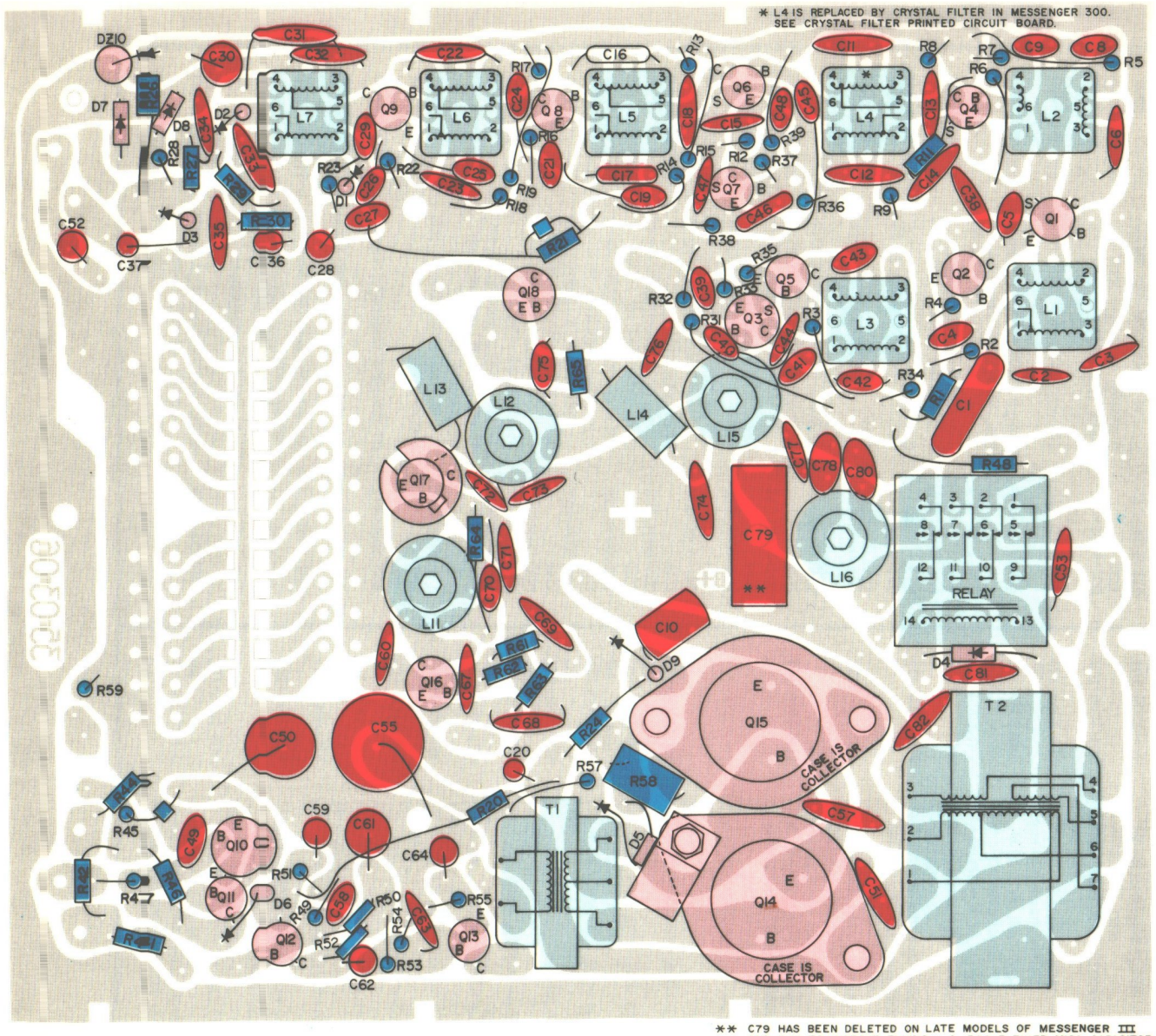
PARTS LIST (cont'd)

SCHEMATIC SYMBOL NO.	DESCRIPTION	PART NO.
	Fuse, 2 ampere	534-0003-024
	33 ±10% ohm 1/4 W resistor	569-1002-330
	0.01 μF disc capacitor, 50 VDC	510-3003-103

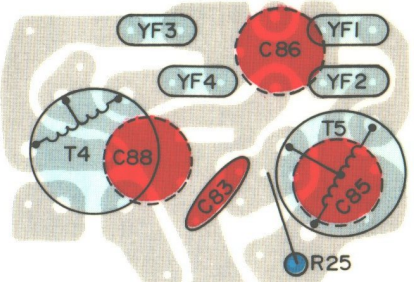
SCHEMATIC SYMBOL NO.	DESCRIPTION	PART NO.
	RF choke	542-3003-001
	Tag	559-4014-001
	Socket shell	515-6002-003

CRYSTALS

CHANNEL	OPERATING FREQUENCY MEGAHERTZ	Y2 TRANSMITTER CRYSTAL PART NO.	Y1 RECEIVER CRYSTAL PART NO.	CHANNEL	OPERATING FREQUENCY MEGAHERTZ	Y2 TRANSMITTER CRYSTAL PART NO.	Y1 RECEIVER CRYSTAL PART NO.
1	26.965	519-0011-001	519-0011-101	13	27.115	519-0011-013	519-0011-113
2	26.975	-002	-102	14	27.125	-014	-114
3	26.985	-003	-103	15	27.135	-015	-115
4	27.005	-004	-104	16	27.155	-016	-116
5	27.015	-005	-105	17	27.165	-017	-117
6	27.025	-006	-106	18	27.175	-018	-118
7	27.035	-007	-107	19	27.185	-019	-119
8	27.055	-008	-108	20	27.205	-020	-120
9	27.065	-009	-109	21	27.215	-021	-121
10	27.075	-010	-110	22	27.225	-022	-122
11	27.085	-011	-111	23	27.255	-023	-123
12	27.105	-012	-112				



MESSENGER III / 300
PRINTED CIRCUIT BOARD



C85, C86, C88 ON SOLDER SIDE OF CIRCUIT BOARD

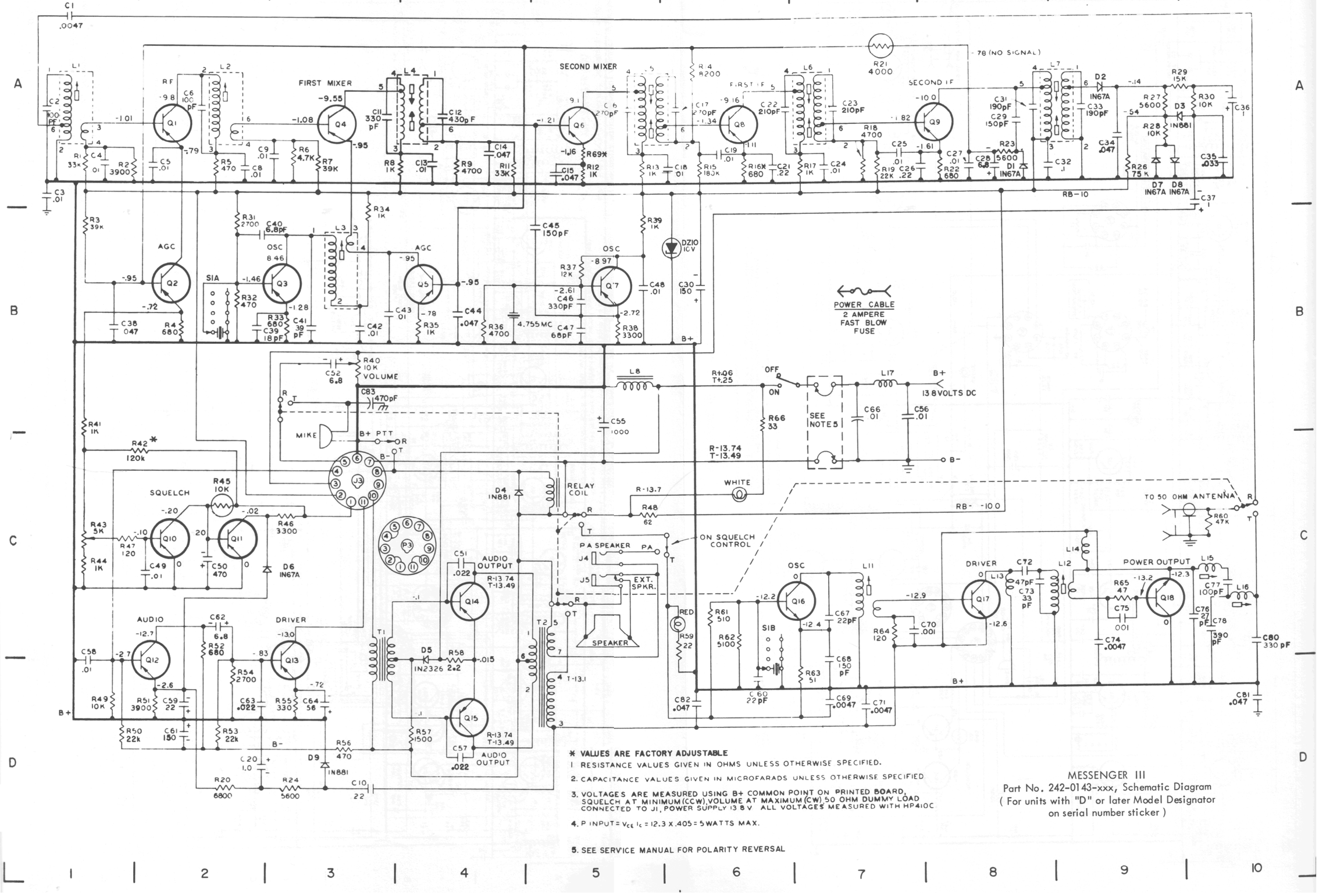
CRYSTAL FILTER
PRINTED CIRCUIT BOARD
MESSENGER 300 ONLY
(REPLACES L4)

CAPACITORS

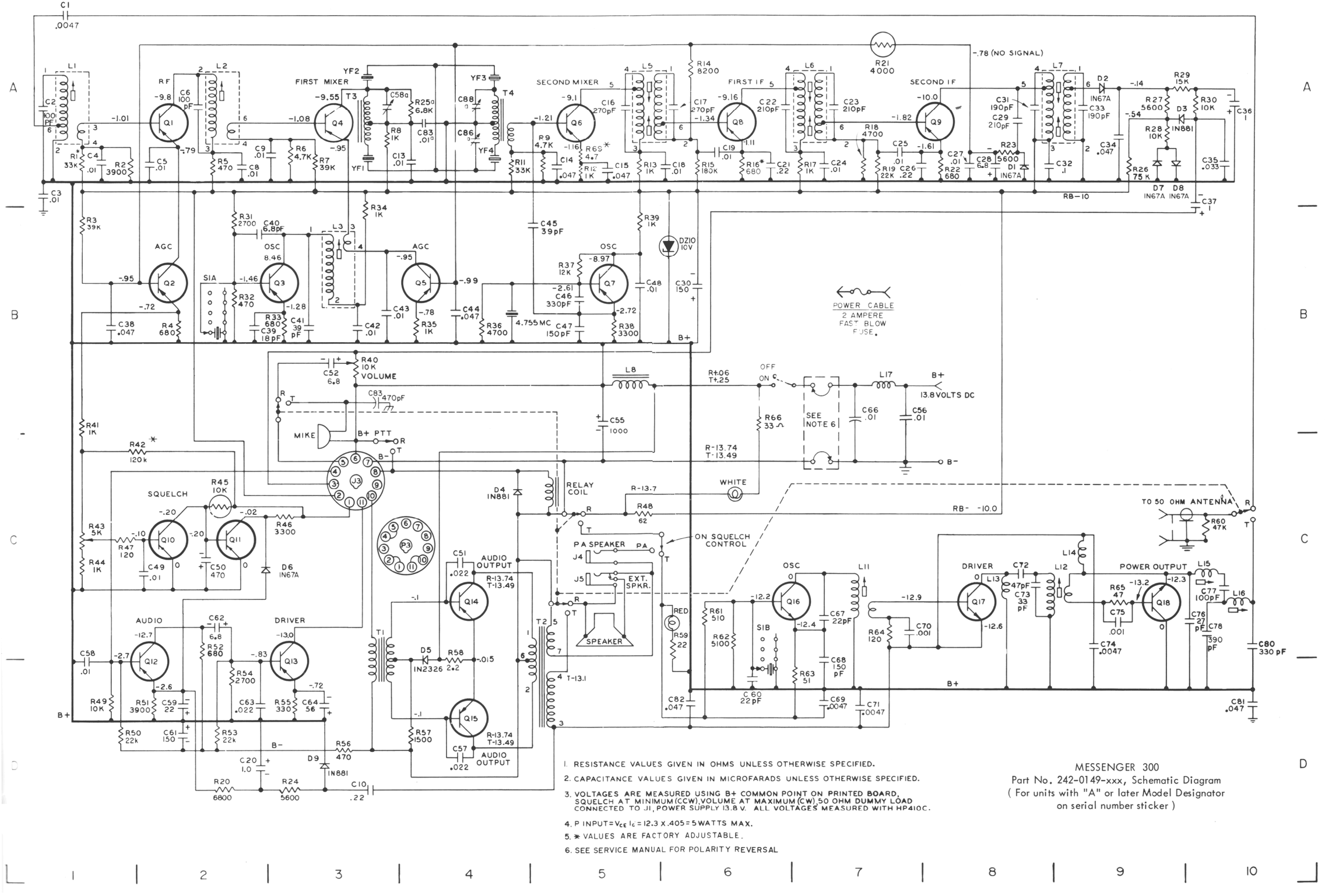
COILS, CRYSTALS RELAY, AND TRANSFORMERS

RESISTORS

TRANSISTORS AND DIODES

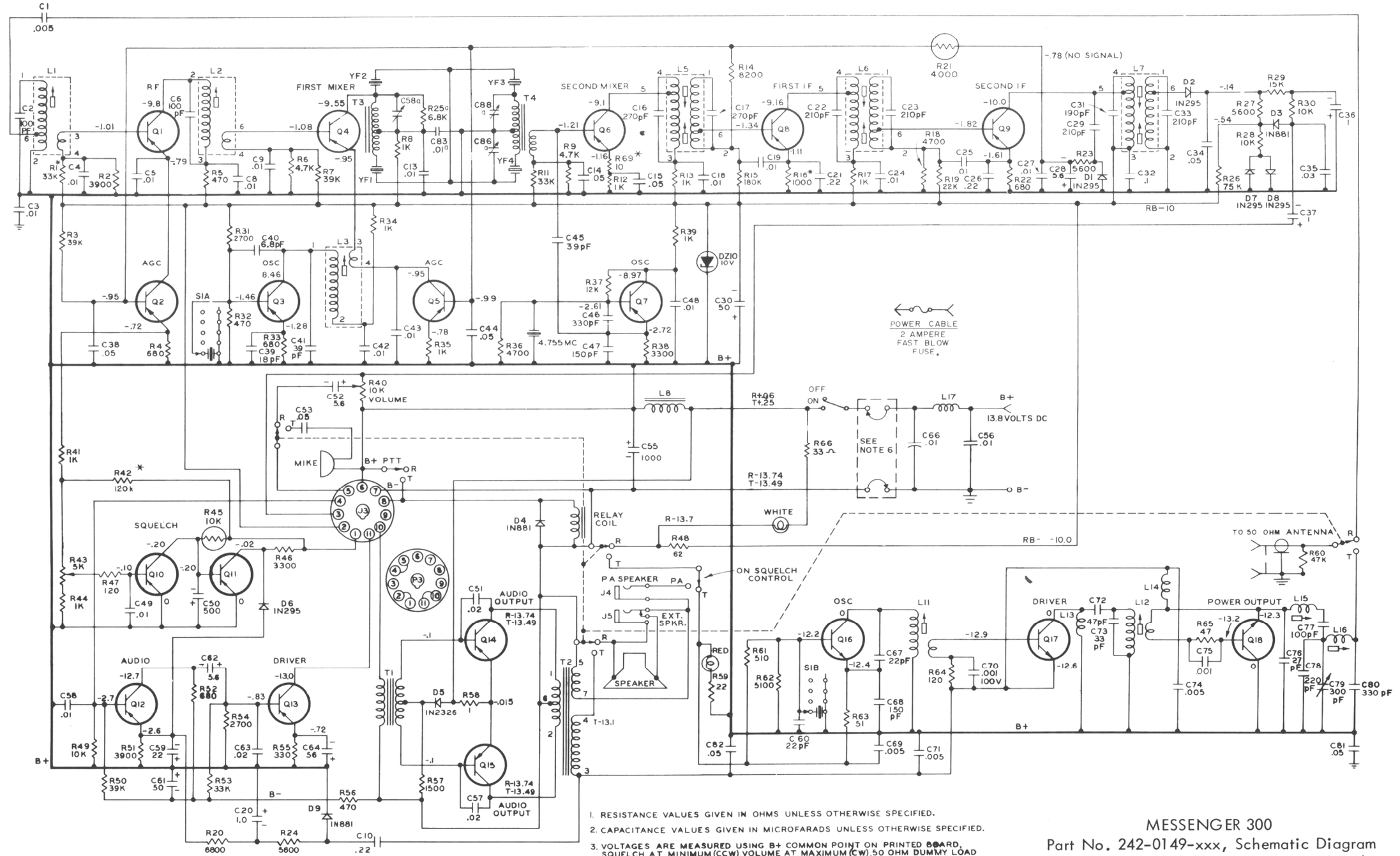


MESSENGER III
Part No. 242-0143-xxx, Schematic Diagram
(For units with "D" or later Model Designator
on serial number sticker)



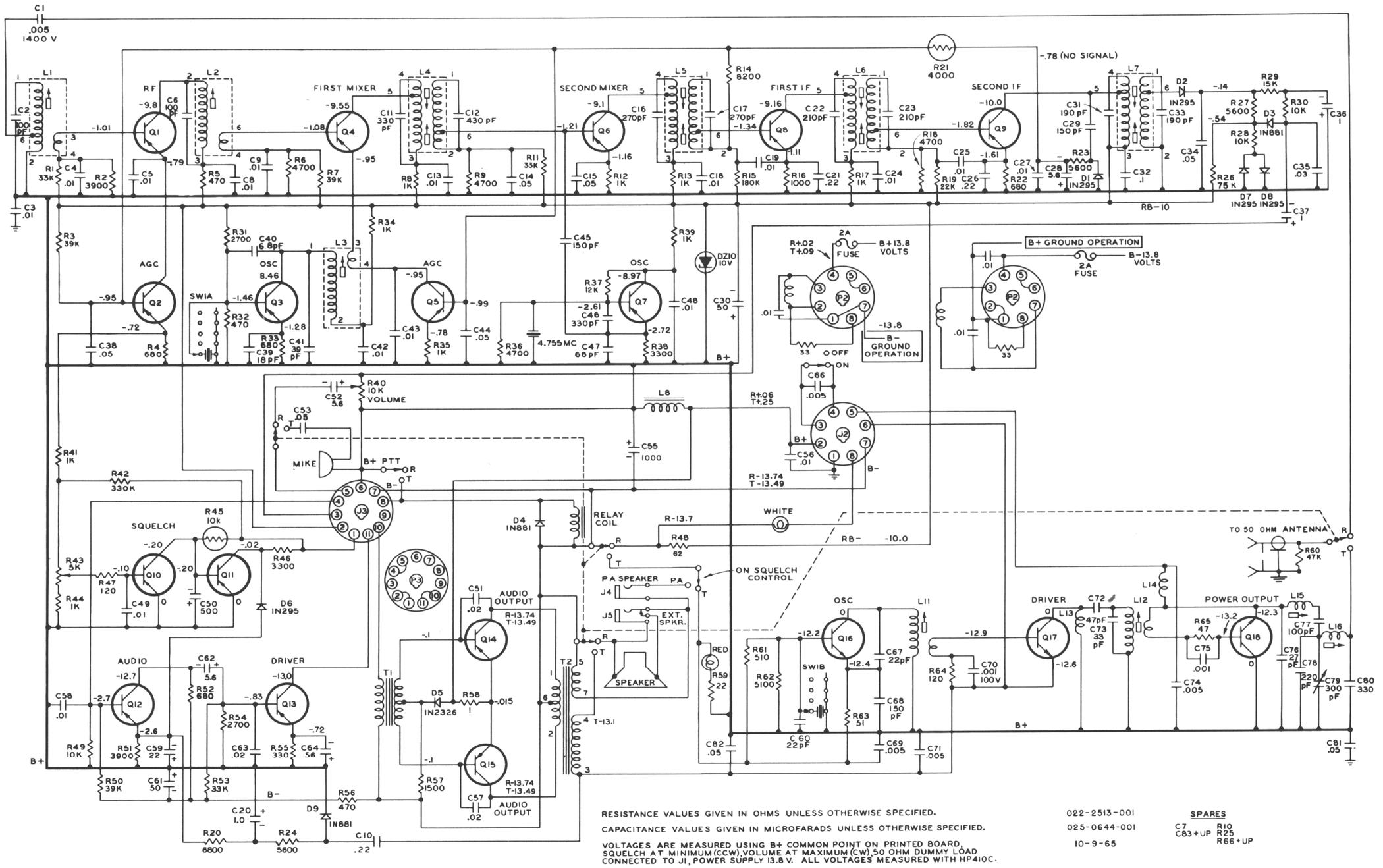
1. RESISTANCE VALUES GIVEN IN OHMS UNLESS OTHERWISE SPECIFIED.
2. CAPACITANCE VALUES GIVEN IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. VOLTAGES ARE MEASURED USING B+ COMMON POINT ON PRINTED BOARD, SQUELCH AT MINIMUM (CCW), VOLUME AT MAXIMUM (CW), 50 OHM DUMMY LOAD CONNECTED TO J1, POWER SUPPLY 13.8 V. ALL VOLTAGES MEASURED WITH HP410C.
4. P INPUT = V_{CE} I_C = 12.3 X .405 = 5 WATTS MAX.
5. * VALUES ARE FACTORY ADJUSTABLE.
6. SEE SERVICE MANUAL FOR POLARITY REVERSAL

MESSENGER 300
Part No. 242-0149-xxx, Schematic Diagram
(For units with "A" or later Model Designator on serial number sticker)



1. RESISTANCE VALUES GIVEN IN OHMS UNLESS OTHERWISE SPECIFIED.
2. CAPACITANCE VALUES GIVEN IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. VOLTAGES ARE MEASURED USING B+ COMMON POINT ON PRINTED BOARD, SQUELCH AT MINIMUM (CCW), VOLUME AT MAXIMUM (CW), 50 OHM DUMMY LOAD CONNECTED TO J1, POWER SUPPLY 13.8 V. ALL VOLTAGES MEASURED WITH HP410C.
4. P INPUT = V_{CE} I_C = 12.3 X .405 = 5 WATTS MAX.
5. * VALUES ARE FACTORY ADJUSTABLE.
6. SEE SERVICE MANUAL FOR POLARITY REVERSAL

MESSENGER 300
Part No. 242-0149-xxx, Schematic Diagram
(For units without serial number stickers)



RESISTANCE VALUES GIVEN IN OHMS UNLESS OTHERWISE SPECIFIED.

CAPACITANCE VALUES GIVEN IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

VOLTAGES ARE MEASURED USING B+ COMMON POINT ON PRINTED BOARD, SQUELCH AT MINIMUM (CCW), VOLUME AT MAXIMUM (CW), 50 OHM DUMMY LOAD CONNECTED TO J1, POWER SUPPLY 13.8 V. ALL VOLTAGES MEASURED WITH HP410C.

P INPUT = V_{CE} I_C = 12.3 X .405 = 5 WATTS MAX.

022-2513-001
025-0644-001
10-9-65

SPARES

C7 R10
C83+UP R25
R66+UP

MESSENGER III

Part No. 242-0150-xxx, Schematic Diagram

QUALITY ELECTRONIC PRODUCTS SINCE 1923

E. F. JOHNSON COMPANY
WASECA, MINNESOTA 56093

PART NO. 001-0046-001 7-71FJ PRINTED IN U.S.A.