NAVSHIPS 93339

TECHNICAL MANUAL

for

RADIO SET AN/PRC-40

INDUSTRIAL RADIO CORPORATION
CHICAGO, ILLINOIS

DEPARTMENT OF THE NAVY
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Subj: Technical Manual for Radio Set AN/PRC-40, NAVSHIPS 93339.

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SECTION 1

GENERAL INFORMATION

1-1. INTRODUCTION.

This publication contains maintenance instructions and descriptive data for Radio Set AN/PRC-40. (See figure 1-1.) Radio Set AN/PRC-40 is manufactured by Industrial Radio Corporation, Chicago, Illinois. The complete portable Radio Set AN/PRC-40 illustrated in figure 1-1 is small in size, light in weight, and easily carried by the handle provided on top of the case.

1-2. FUNCTIONAL DESCRIPTION.

Radio Set AN/PRC40 is a portable wide-band (15 KC) FM transmitter-receiver. The receiver and transmitter are constructed on printed circuit boards, using plug-in units. Transistors are used throughout the receiver and in the majority of stages in the transmitter. Self-contained batteries supply the operating power for the transmitter-receiver.

Radio Set AN/PRC-40 operates in the 132 to 152 MC band and may be tuned to transmit and receive any single station within that band. Radio Set AN/PRC-40 has an effective range of one to ten miles depending on environmental conditions. Average operating conditions, however, permit voice communication at a distance of approximately two miles between two portable Radio Sets. The receiver-transmitter section is identified as Radio Receiver-Transmitter RT-507/PRC-40.

Radio Set AN/PRC-40 is normally resistant to dust and rain. A weather-proof canvas case is available for use during severe weather conditions. The canvas case is designed to protect the Radio Set without interfering with operation or control of the equipment. The canvas case is identified as Radio Set Case CY-2625/PRC.

1-3. QUICK REFERENCE DATA.

The following information is provided for a quick reference to Radio Set AN/PRC-40 characteristics.

a. Operation is in the 132 to 152 megacycle band using a single preset frequency.
b. Oscillators in the transmitter-receiver are all crystal controlled.
c. Emission and reception are type F3.
d. Minimum receiver output is 300 milliwatts, delivered into a 3.2 ohm 3 inch loudspeaker.
e. Double frequency conversion is employed in the receiver.
f. High IF frequency is 8.5 megacycles.
g. Low IF frequency is 300 kilocycles.
h. High frequency local oscillator crystal frequency is determined by the incoming signal.
i. Low frequency local oscillator crystal frequency is 8200.000 kilocycles.
j. Transmitter oscillator frequency stability is ±0.0025% over temperature range of minus 22° to plus 140° Fahrenheit.
k. Transmitter crystal frequency is 1/12th of the carrier frequency.
l. Minimum transmitter output is 1 watt.
m. Antenna is a 1/4 wave "whip" type.
n. Operating power is supplied by self-contained batteries.

Table 1-1 lists the replaceable electron tubes used in Z108 of the transmitter of Radio Set AN/PRC-40, table 1-2 lists the power supply battery complement, and table 1-3 lists the replaceable plug-in units in Radio Set AN/PRC-40.

TABLE 1-1. Z108 TUBE COMPLEMENT

REF DES	TYPE	FUNCTION
V101	6526	Doubler and driver
V102	6526	Final output
V103	6526	Final output

TABLE 1-2. RADIO SET AN/PRC-40 BATTERY COMPLEMENT

REF DES	MFR	TYPE	VOLTAGE
BT301	Burgess	XX50	75V
BT302	Burgess	D5	7.5V
BT303	Burgess	2D	1.5V
BT304	Burgess	XX50	75V
BT305	Burgess	D5	7.5V

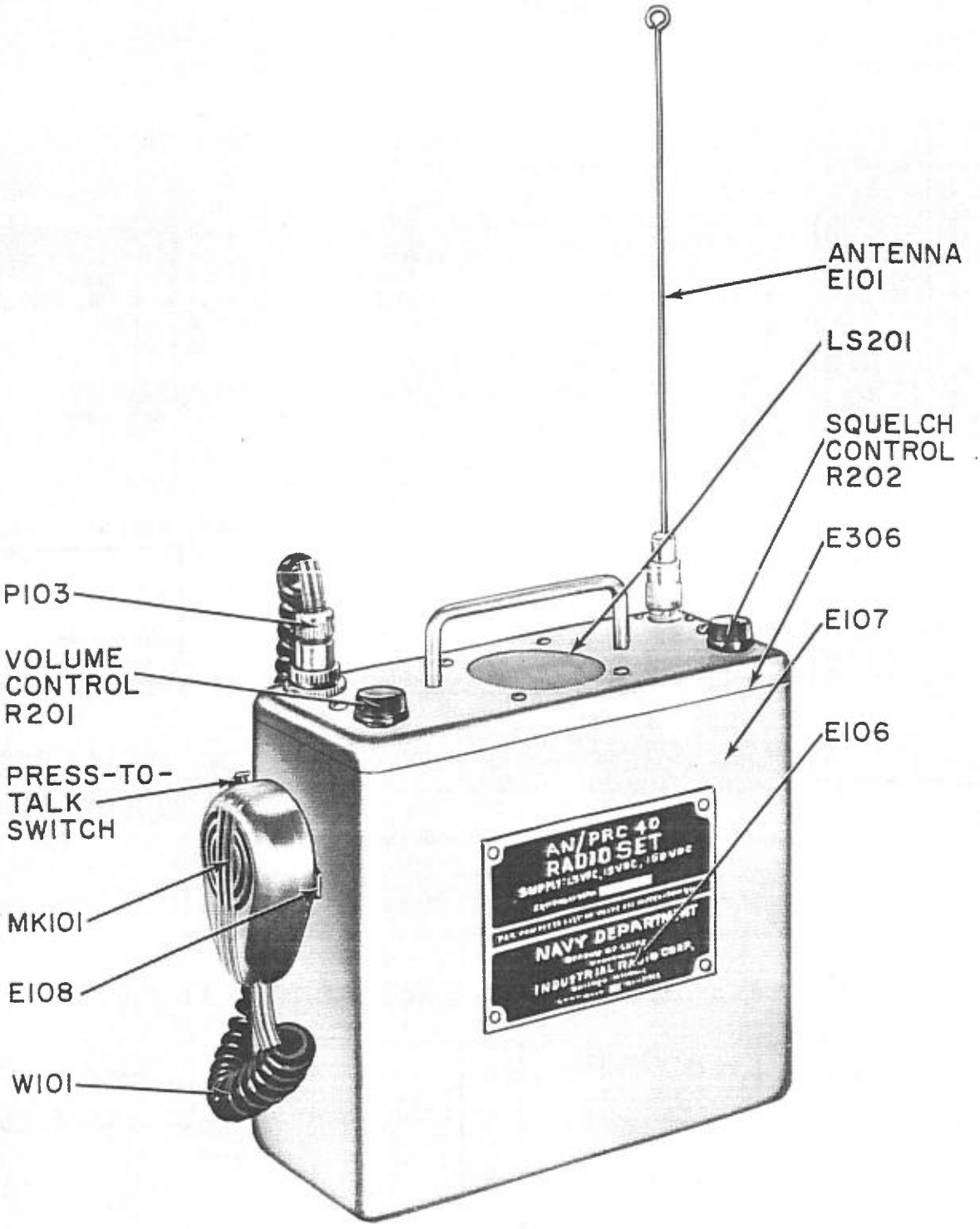


Figure 1-1. Radio Set AN/PRC-40, Overall View

TABLE 1-3. PLUG-IN UNITS USED IN RADIO SET AN/PRC-40

REF DES	INDUSTRIAL RADIO PART NUMBER	FUNCTION
Z101	2B0012	Transmitter oscillator circuit
Z102	2B0013	Audio deviation control
Z103	106A001	Phase modulator circuit
Z104	2B0014	Amplifier, oscillator frequency
Z105	2B0015	Frequency tripler
Z106	2B0016	Amplifier, tripler output frequency
Z107	2B0017	Frequency doubler
Z108	2C0076	Final output and doubler-driver
Z109	2B0019	Antenna and transmit-receive relay
Z201	2B0001	Antenna input and RF amplifier
Z202	2B0002	RF amplifier
Z203	2B0003	Mixer, high frequency IF
Z204	2B0004	Oscillator and multiplier, high IF
Z205	2B0005	Filter, 8.5 MC
Z206	2B0006	Oscillator and mixer, low frequency
Z207	2B0007	Filter, 300 KC bandpass
Z208	2B0008	Amplifier, Low IF frequency, 300 KC
Z209	2B0009	Discriminator and limiters
Z210	2B0010	Amplifier, audio frequency
Z211	2B0011	Squelch circuit

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

Radio Set AN/PRC-40 is shipped in a carton without the batteries. Open the carton and remove the microphone and antenna. Cardboard fillers are used to keep the equipment stationary in its carton. Remove the fillers and equipment from the carton.

No special precautions are required. Avoid rough handling and dropping of the equipment. Store the carton in a clean dry place for future use or reshipment.

2-2. INSTALLATION PROCEDURE.

Radio Set AN/PRC-40 is a self-contained equipment. Since it is portable, no fixed installation requirements exist for the equipment. Before operation is possible, however, batteries must be installed, and the microphone MK101 and the antenna E101 must be connected.

a. MICROPHONE.-The microphone is supplied with a coiled cable terminated with a connector plug P103. Insert plug P103 into the MICROPHONE receptacle J102 located on the top panel of Radio Set AN/PRC-40. Make sure the plug is firmly and properly seated. Screw the threaded locking ring onto the MICROPHONE receptacle. A bracket is mounted on the end of the Radio Set AN/PRC-40 cabinet for holding the MICROPHONE when not in use.

b. ANTENNA.-The 1/4 wave "whip" antenna E101 is supplied with a coaxial mounting connector attached to the base of the antenna. Insert the antenna into the coaxial ANTENNA receptacle J101, located on the top panel of Radio Set AN/PRC-40. Secure the antenna by screwing the connector locking ring firmly onto the ANTENNA receptacle.

c. BATTERIES.-The batteries required for operation are not supplied with the equipment. (See table 1-2.) The necessary batteries must be installed in the battery box located inside the AN/PRC-40 cabinet. Proceed as follows to install the batteries.

(1) Loosen the two captive screws in the bottom of the cabinet until they feel free.
(2) Grasp the handle in one hand and the cabinet in the other hand, holding Radio Set AN/PRC-40 in an upright (handle uppermost) position.
(3) Gently lift the handle upwards, separating the transmitter-receiver and battery box from the cabinet.
(4) Place the batteries (table 1-2) in the proper positions as illustrated in figure 5-4. The battery box is suspended below the transmitted and receiver printed circuit boards.
(5) Connect the snap fasteners to the 75 volt and the 7.5 volt batteries and insert the plug into the 1.5 volt battery. These fasteners are part of the cable W301.
(6) Lower the battery box and transmitter-receiver into the cabinet.
(7) Secure the cabinet by tightening the two captive screws in the bottom.

SECTION 3

OPERATORS SECTION

3-1. FUNCTIONAL DESCRIPTION.

Radio Set AN/PRC-40 is intended to provide voice communication at a distance of two miles under average conditions. Radio Set AN/PRC-40 contains a wideband (15 KC) FM receiver and transmitter. Dry batteries supply the required operating voltages.

3-2. PREPARATION FOR USE.

a. Turn set "off" by rotating VOLUME control R201 (figure 1-1) to its maximum counterclockwise position.
b. Assemble the microphone, antenna and batteries as explained in Section 2, paragraph 2-2.
c. Rotate the SQUELCH control R202 (figure 1-1) to its maximum counterclockwise position.
d. Turn VOLUME control slowly clockwise. This turns the set "on". A click will be heard when the switch closes.
e. Advance the VOLUME control until a loud hissing noise is heard from the loudspeaker LS201 (figure 1-1).
f. Slowly rotate the SQUELCH control clockwise until the hissing sound disappears. This is the correct operating position for the SQUELCH control.
g. Adjust the VOLUME control to a comfortable listening level for the given received signal.

3-3. OPERATING PROCEDURES.

Turn set "on" as discussed in paragraph 3-2 above.

a. TO TRANSMIT MESSAGE.-Hold the microphone MK101 (figure 1-1) with the hand in such a manner that the "press-to-talk" switch can be easily released as well as firmly depressed. Hold the microphone facing the mouth, a few inches from the lips. Depress the "press-to-talk" switch and speak into the microphone using a natural moderate speaking voice. Do not shout. Release the "press-to-talk" switch as soon as the message is completed.

NOTE

A message cannot be received when the "press-to-talk" switch is depressed.

b. TO RECEIVE MESSAGE.-The Radio Set will receive any incoming signal when the set is turned "on" and the "press-to-talk" switch on the microphone is not depressed. The message will be heard from the loudspeaker mounted in the center of the top panel. Position the Radio Set with the loudspeaker facing the listener for maximum efficiency. Adjust the volume control for the desired listening level. The squelch control, previously adjusted, will suppress most of the interfering noise.

3-4. OPERATOR'S MAINTENANCE.

Batteries require periodical replacement depending upon use and age. The batteries provide approximately forty hours operating time at an ambient temperature of 70° F. This time is figured for a normal operating day of 8 hours, during which time the transmitter is operated 10% of the time, the receiver is operated at full volume 10% of the time, and the receiver is operated in a standby condition with reduced volume during the remaining 80% of the time. Replace the batteries after forty hours of such usage, or when performance becomes noticeably degraded.

3-5. EMERGENCY MAINTENANCE.

Most of Radio Set AN/PRC-40 circuitry is contained in replaceable plug-in assemblies. This design feature permits rapid emergency repair during battle conditions. No technical knowledge of the circuitry is required other than location of the various plug-in assemblies.

Emergency repair is accomplished by substitution. The operator requires a complete set of plug-in assemblies (table 1-3) which are known to be good and which are prealigned for the frequency of operation.

NOTE

The alignment of Z201 through Z204 is affected by different frequencies of reception. Alignment of the other plug-in assemblies in the receiver is not affected by the frequency of reception. The alignment of all plug-in assemblies in the transmitter except Z102, Z103, and Z109 is affected by a change in operating frequency.

When trouble appears in the receiver, replace each plug-in assembly until the defective assembly is located. It may be necessary to "touch-up" the alignment of Z205 if Z201 through Z204 have been replaced.

When trouble appears in the transmitter, replace each of the plug-in assemblies, one at a time, until the defective assembly is located.

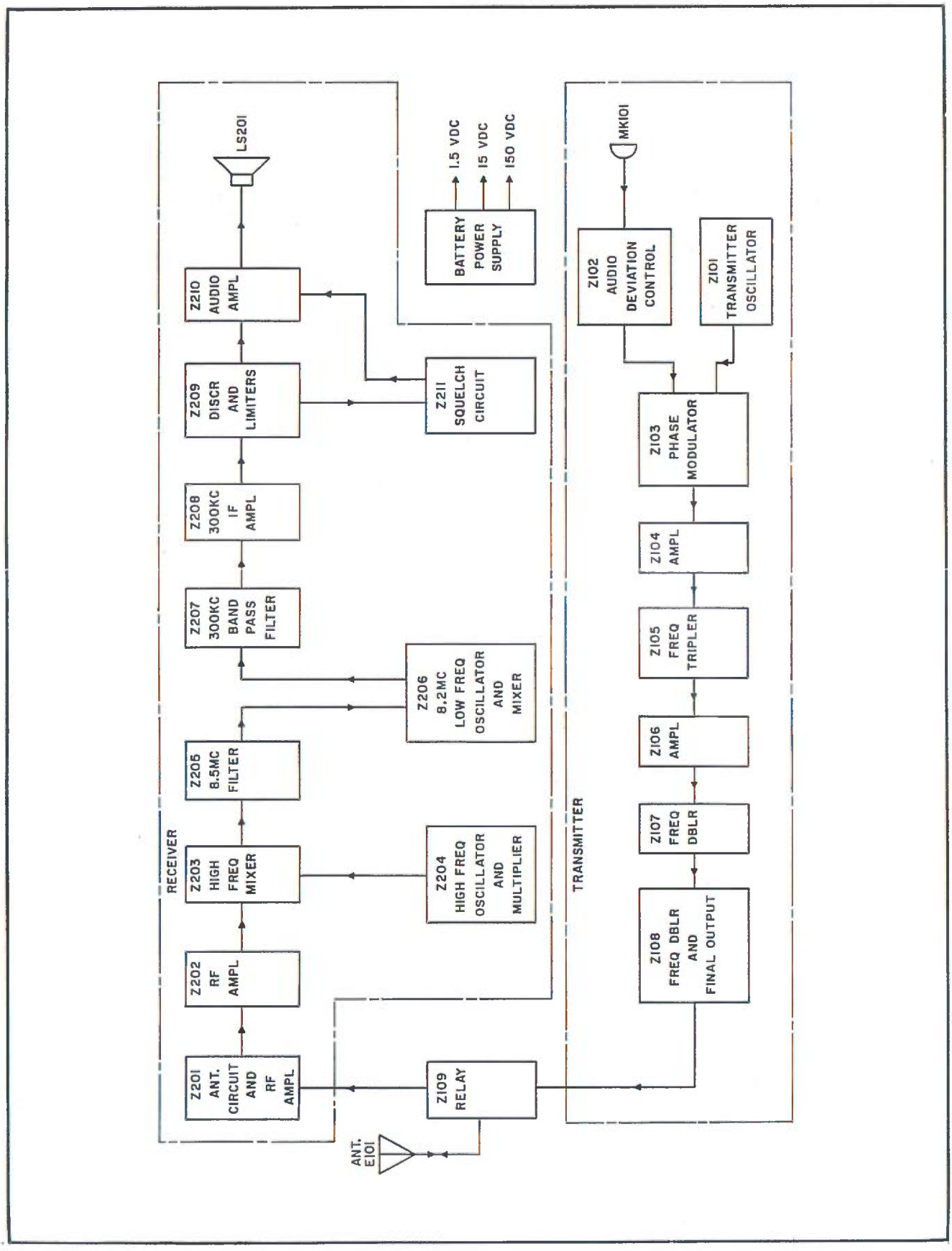


Figure 4-1. Block Diagram of Radio Set AN/PRC-40

SECTION 4

PRINCIPLES OF OPERATION

4-1. OVERALL FUNCTIONAL DESCRIPTION.

Radio Set AN/PRC-40 consists of three functional sections; transmitter, receiver, and battery power supply. The transmitter and receiver are constructed on separate printed circuit boards. Replaceable plug-in assemblies are used throughout the Radio Set. (See table 1-3.) A single antenna is used for both transmitting and receiving. Pushing the "press-to-talk" switch on the microphone actuates a relay which switches the antenna from receiver input to transmitter output. The same relay also switches operating voltages from the receiver to the transmitter. Figure 4-1 is a block diagram of the Radio Set AN/PRC-40. Each block in the receiver and transmitter represents a replaceable plug-in assembly.

a. TRANSMITTER.-The transmitter (figure 4-1) is a phase modulated or indirect FM type. The transmitter consists of nine replaceable plug-in assemblies (Z101 through Z109, including relay circuit Z109), antenna E101, and microphone MK101. Depressing the "press-to-talk" switch on MK101 energizes the relay Z109 which applies operating voltages to the transmitter and switches the antenna E101 to the transmitter output Z108. Speaking into the microphone applies an audio signal to the deviation control Z102. The audio signal is clipped and shaped in Z102 and then applied to phase modulator Z103 where it modulates the RF carrier. The RF carrier is generated in the transmitter oscillator Z101. The oscillator is crystal controlled. The output of the oscillator is applied to phase modulator Z103.

Modulation of the signal occurs in Z103. The modulated signal is then applied to amplifier Z104. After amplification the modulated signal is applied to frequency tripler Z105. Multiplication of the carrier frequency occurs in Z105. The carrier frequency at the output of Z105 is three times the input or oscillator frequency. The multiplied signal is then applied to amplifier Z106 for further amplification. The output of Z106 is applied to frequency doubler Z107. Multiplication of the carrier frequency again occurs in Z107. The carrier frequency at the output of Z107 is two times the input frequency or six times the oscillator frequency.

The output of Z107 is applied to Z108. This plug-in assembly is not sealed or transistorized. Z108 contains a frequency doubler which drives a push-pull final output stage. The output of Z108 is therefore applied to contacts of relay Z109 and to the antenna E101. The transmitted carrier frequency is the twelfth multiple of the oscillator frequency.

Releasing the microphone "press-to-talk" button de-energizes relay Z109. Releasing relay Z109 removes the 1.5 VDC from the transmitter, switches the 15 VDC from transmitter to receiver, and switches the antenna from the transmitter output to the receiver input.

b. RECEIVER.-The receiver operates when the "press-to-talk" button on the microphone is not depressed. The receiver consists of eleven plug-in assemblies (Z201 through Z211), loudspeaker LS201, relay circuit Z109, and antenna E101.

During operation, the received FM signal voltages produced in the antenna circuit are coupled to Z201 through contacts of relay Z109. The weak RF signal applied to amplifier Z201 is amplified. The output of Z201 is applied to RF amplifier Z202, where it is further amplified. The output of Z202 is applied to the high frequency mixer Z203.

The high frequency oscillator signal generated in Z204 is also applied to Z203. The oscillator in Z204 is crystal controlled.

The oscillator signal and the incoming RF signal are mixed together in Z203. The heterodyne action produces several frequencies at the output of Z203, among which is a difference frequency of 8.5 MC. The output of Z203 is applied to the 8.5 MC filter Z205. Filter Z205 is tuned to 8.5 MC and will develop maximum output voltage at this frequency.

An 8.5 MC signal therefore appears at the output of Z205. The 8.5 MC signal is applied to the low frequency oscillator and mixer assembly Z206. Plug-in assembly Z206 contains the 8.2 MC crystal controlled oscillator and the low frequency mixer. The output of Z206 contains the difference frequency of 300 KC. This 300 KC signal is the low frequency IF and is applied to the 300 KC filter Z207.

The 300 KC filter Z207 is a bandpass filter with a center frequency of 300 KC. The bandpass of Z207 is approximately 20 KC wide at 6 db down, and is between 60 KC and 120 KC wide at 80 db down.

The output of Z207 is applied to the 300 KC amplifier Z208. Plug-in assembly Z208 contains the low IF amplifier stages. The amplified 300 KC IF at the output of Z208 is applied to the limiters and discriminator Z209.

The 300 KC signal applied to Z209 is limited and detected. After detection, a stage of impedance matching is used to produce a low impedance output for Z209.

The audio signal appearing at the output of Z209 is applied through the volume control to the input of audio amplifier Z210. Audio amplifier Z210 provides both current amplification and power amplification. The output of Z210 is, therefore, an audio signal of sufficient power to operate loadspeaker LS201.

A squelch circuit Z211 is also used in Radio Set AN/PRC-40. Noise voltages exist in the discriminator output during the absence of an incoming signal. The noise voltages above 3000 cycles are applied through a high-pass filter to an output terminal on Z209. These noise voltages are applied through the squelch control to the input of squelch circuit Z211. Plug-in assembly Z211 amplifies the noise voltage and rectifies the amplified voltage. The output of Z211 is, therefore, a positive DC voltage. This DC voltage is applied to an input terminal of audio amplifier Z210, where it provides cutoff bias for silencing the receiver output during the absence of an incoming signal.

c. POWER SUPPLY.-Power for Radio Set AN/PRC-40 is supplied by self-contained batteries. The batteries are located in a tray attached beneath the printed circuit boards. The batteries supply three separate voltages to the transmitter and receiver. A 1.5 VDC source is supplied for heating the filaments of the electron tubes in the transmitter. A 15 VDC source is supplied for the transistors in both transmitter and receiver. A 150 VDC source supplies the high B+ voltage for the electron tubes in the transmitter.

4-2. DETAIL CIRCUIT THEORY.

Most of the circuitry in Radio Set AN/PRC-40 is contained in sealed plug-in assemblies. These plug-in assemblies, with the exception of Z108, are sealed and not repairable. The circuitry contained therein is discussed briefly and in sufficient detail to enable the reader to understand the function of each plug-in assembly and how it affects the operation of the equipment.

4-3. RECEIVER ANALYSIS. (See figure 6-1.)

The receiver is comprised of eleven sealed plug-in assemblies, loudspeaker, and antenna. The receiver is completely transistorized. (See figures 5-3 and 6-1.)

a. INCOMING SIGNAL.-The receiver in Radio Set AN/PRC-40 may be tuned to receive any single frequency between 132 and 152 MC. The incoming signal appears at the antenna E101 and travels to pin 14 of Z109. The "press-to-talk" switch on the microphone is not depressed and the relay is not energized. The incoming signal travels through closed contacts of the relay and out pin 15 of Z109 to pins 2 and 3 of Z201.

b. OPERATING VOLTAGE.-The relay in Z109 is not energized when Radio Set AN/PRC-40 is in the receive condition. The +15 VDC applied to pin 5 of Z109, therefore, appears at pin 9 of Z109 due to the normally closed contacts of the relay. The +15 VDC at pin 9 of Z109 is applied to the transistors in the receiver plug-in assemblies.

c. Z201, ANTENNA INPUT.-The incoming signal appears at pins 2 and 3 of Z201. The incoming signal is applied to a parallel resonant circuit consisting of L1 and C1, tuned to resonate at the incoming signal frequency. Impedance matching is obtained by connecting the antenna input at the proper point on coil L1.

The signal is removed from the resonant antenna circuit and capacitively coupled by C4 to the emitter of transistor Q1, which is connected in the grounded base configuration. The collector output of Q1 appears at pins 5 and 7 of Z201. Pin 6 of Z201 connects to the +15 VDC supply to obtain operating voltage for the stage. The RF signal at the output of Z201 is applied to pins 8 and 6 of Z202.

d. Z202, AMPLIFIER.-The RF signal at pins 8 and 6 of Z202 is applied to a parallel resonant circuit consisting of L1 and C1 in Z202. This parallel resonant circuit is tuned to resonate at the incoming signal frequency. The signal is capacitively coupled to the emitter of Q1, which Z202 is connected in the grounded base configuration. The collector output of Q1 appears at pins 5 and 7 of Z202. Pin 3 of Z202 is connected to the +15 VDC supply. The RF output of Z202 is applied to pins 6 and 8 of Z203.

e. Z203, MIXER.-This plug-in assembly contains the high frequency mixer stage. Two input signals are applied to Z203. The incoming RF signal is applied to pins 6 and 8 and the high frequency oscillator output (Z204) is applied to pin 2. These two signals are applied to a double tuned resonant circuit. The incoming RF signal is applied to the primary of the double tuned circuit, and the oscillator signal is applied to the secondary of the double tuned circuit where mixing occurs. Capacitors C1 and C2 of Z203 tune the double resonant circuit to the incoming RF signal frequency. The complex signal is removed from the secondary coil and capacitively coupled by C5 to the emitter of Q1 which is connected in the grounded base configuration.

The collector output appears at pin 7 of Z203. The output consists of several frequencies. Among the output frequencies is the desired difference frequency of 8.5 MC. Assume the antenna input signal is 140 MC. This signal appears at pins 6 and 8 of Z203. The oscillator signal applied to pin 2 of Z203 would be 131.5 MC which is 8.5 MC below the incoming frequency.

Regardless of the incoming signal frequency, the oscillator frequency applied to pin 2 of Z203 is always 8.5 MC lower than the incoming signal frequency.

f. Z204, HIGH FREQUENCY OSCILLATOR.-This plug-in assembly contains the high frequency oscillator less crystal, and a frequency multiplier stage. The crystal Y201 is mounted in a receptacle on the printed circuit board outside the sealed plug-in assembly.

The crystal is easily changed when the frequency of reception is changed. The third overtone mode of vibration of the crystal is utilized in the oscillator.

NOTE

The term overtone is used in place of the term harmonic because the overtone frequencies are not ordinarily in exact integral ratios to the fundamental. The third overtone, therefore, occurs at approximately, but not exactly, three times the resonant frequency of the crystal in the fundamental mode of vibration.

The third overtone crystal Y201 is connected in the base circuit of oscillator Q1. A series capacitor is provided in the crystal circuit for frequency adjustment.

The tuned circuit L1 in the collector circuit of Q1 is tuned to the third overtone frequency of crystal Y201. The oscillator frequency appearing at L1 is coupled by C4 to the base of frequency multiplier Q2. A parallel resonant circuit consisting of L2 and C5 in the collector circuit of Q2 is tuned to the third harmonic of the crystals third overtone frequency. The multiplied oscillator signal is tapped off L2 and applied to pin 3 of Z204. The signal at pin 3 is then connected to pin 2 of Z203, where it is mixed with the incoming information signal.

The two signals are mixed in Z203 and the output of Z203 is applied to pin 3 of Z205.

g. Z205, FILTER.-This plug-in assembly is an 8.5 MC filter. The output of the filter appears at pin 14 of Z205. The filter contains parallel resonant circuits tuned to the high IF frequency of 8.5 MC. This filter is used to reject the image frequencies. Since the high IF frequency remains 8.5 MC for any incoming signal, this filter is tuned to develop maximum output voltage at 8.5 MC. The 8.5 MC signal appearing at pin 14 of Z205 is applied to pin 3 of Z206.

h. Z206, LOW FREQUENCY OSCILLATOR.-This plug-in assembly contains both the low frequency local oscillator and the mixer. The oscillator Q1 is crystal controlled by crystal Y202. The crystal frequency is 8,200.000 KC at all times. The oscillator output of 8.2 MC is capacitively coupled by C3 to the emitter of the mixer Q2. The high IF signal of 8.5 MC appearing at pin 3 of Z206 is applied to the base of mixer Q2, producing the difference frequency of 300 KC in the collector circuit. The output of Q2 is connected to pin 8 of Z206 and then applied to pin 2 of Z207. The 300 KC difference frequency in the output of Z206 represents the low IF frequency.

i. LOW FREQUENCY IF.-The use of transistors in the IF and limiter stages requires consideration of a new system approach. Transistor limiters introduce instability problems when the limiting stage has both its input and output tuned. Severe limiting also causes a change in the transistor operating point, resulting in changes in transistor impedance levels with consequent changes in the selectivity of the limiter tuned circuits. This necessitates an unconventional type of IF system.

By placing all the selectivity in one filter network (Z207), the need for tuned interstage-coupling networks throughout the IF and limiter stages is removed. This allows the use of simple RC-coupled limiters and IF amplifier stages, eliminating the fear of instability and the tedious alignment procedures required by cascaded tuned stages using transistors. This lumped selectivity (Z207) is placed between the mixer Z206 and the IF amplifier Z208.

j. Z207, FILTER.-This plug-in assembly is a 300 KC pass band filter which provides all the selectivity for the low frequency IF amplifier and limiter. The low frequency mixer Z206 output is applied directly to pin 2 of filter Z207. The filter is designed to have a steep attenuation on either side of the pass band with relatively flat pass band response and minimum insertion loss. The pass band response of Z207 is approximately 20 KC wide at 6 db down and between 60 KC and 120 KC wide at 80 db down. The insertion loss is approximately 6 db. The filter is tuned and then sealed to maintain maximum accuracy and stability. The output of the filter appears at pin 16 of Z207 and is applied to pin 16 of Z208.

k. Z208, AMPLIFIER.-This plug-in assembly contains the 300 KC low frequency IF amplifiers. Three RC-coupled amplifier stages are used. The total gain of Z208 is approximately 90 db. The output appears at pin 2 of Z208 and is connected to pin 16 of Z209.

l. Z209, DISCRIMINATOR.-This plug-in assembly contains the limiters, the discriminator, and an emitter follower for impedance matching. The amplified 300 KC IF signal appearing at pin 16 of Z209 is applied to two RC-coupled limiters Q1 and Q2. After limiting, the signal is detected by the discriminator. The resulting audio information is coupled to the base of transistor Q3 operating as an emitter follower. This stage is used for impedance matching and power gain. The audio output is coupled from the emitter of Q3 to pin 1 of Z209. The audio information appearing at pin 1 of Z209 is applied to volume control R201.

m. VOLUME CONTROL.-The volume control R201 is located on the top panel of the AN/PRC-40. The audio information at pin 1 of Z209 is applied through plug P201 and cable W201 to one end of the volume control R201. The other end of R201 is connected to ground, placing the total resistance of the control across the output of Z209 at all times. The desired audio amplitude is removed by the center arm of the control and applied to pin 14 of Z210.

n. Z210, AUDIO AMPLIFIER.-This plug-in assembly contains an audio amplifier and push-pull output stage. The output of Z210 appears at pin 1. The audio information is then applied to the loudspeaker LS201 through cable W204 and plug P204. Another input voltage is applied to Z210 in addition to the audio information from the volume control. During a no-signal condition, a squelch voltage from Z211 is applied to pin 2 of Z210.

o. Z211, SQUELCH CIRCUIT.-The squelch circuit is required because of the practical limitations to limiter design. When no signal is being received, the limiter input voltage consists only of noise voltages. Most of these noise voltages are below the limiter saturation level. Under these conditions the limiters will act as normal voltage amplifiers in which amplitude variations, up to saturation level, will be recognized. The discriminator will detect both FM and AM signals. The resultant AM noise voltages present at the limiter output will be detected, amplified, and heard at the speaker. The squelch circuit is inserted to eliminate this noise output from the speaker during a no-signal condition.

A high-pass filter is placed in the output of the discriminator (Z209). This high-pass filter applies noise voltages above 3000 cycles to pin 9 of Z209. The noise voltage is then applied to one end of SQUELCH control R202 through cable W202 and plug P202. The SQUELCH control is located on the top panel of the AN/PRC-40. The desired amplitude of noise voltage is removed by the center arm of the control and applied to pin 1 of Z211. The noise voltage is amplified by Q1 in Z211 and then applied to a voltage doubler and rectifier consisting of CR1 and CR2. The output appearing at pin 6 of Z211 is therefore a positive DC voltage. The magnitude of this DC voltage is dependent upon the noise present and the setting of SQUELCH control R202. This positive DC squelch voltage appearing at pin 6 of Z211 is applied to pin 2 of Z210. In Z210 the DC squelch voltage is used to bias the first audio amplifier Q1. Proper adjustment of SQUELCH control R202 will produce sufficient bias to cut off audio amplifier Q1 in Z210, thereby eliminating the noise output from the speaker.

When a signal is being received, the various noise voltages are superimposed on the IF carrier. The carrier, with the noise superimposed on the envelope, is now of sufficient amplitude to saturate the first limiter. A saturated limiter stage has sufficient input signal to produce constant amplitude output with a varying amplitude input. The output of the first limiter is then an RF signal essentially free of amplitude variation. As a result, no significant AM noise voltage above 3000 cycles will appear in the discriminator output. The squelch circuit is inoperative and the desired audio signal is heard at the loudspeaker.

4-4. TRANSMITTER ANALYSIS. (See figure 6-2.)

The transmitter is comprised of nine plug-in assemblies, the microphone MK101, and antenna E101. Transistors are used in most of the plug-in assemblies. Two of the plug-in assemblies contain electron tubes. Z107 contains one electron tube which is not replaceable because of the sealed construction. Z108 contains three electron tubes which are replaceable. These plug-in assemblies (Z107 and Z108) and the relay Z109 are mounted on printed circuit board E103. (See figures 5-2 and 5-4.) All electron tubes and their necessary voltages are confined to this printed circuit board. This design allows for future improvement and ease of modification when transistors capable of replacing the electron tubes are available.

a. Z101, OSCILLATOR.-This plug-in assembly contains the transmitter oscillator. The oscillator is controlled by crystal Y101 which is mounted on the printed circuit board outside Z101. A series capacitor C1 is provided for slight adjustments to the crystal frequency. The crystal is connected in the base circuit of transistor Q1 through pins 4 and 6 of Z101. The collector circuit of Q1 contains a parallel resonant circuit consisting of C5 and L1. Coil L1 is tuned to resonate at the crystal frequency. The oscillator signal is applied to pin 5 of Z101, and then to pin E of phase modulator Z103.

The oscillator frequency at pin 5 of Z101 is multiplied several times before it reaches the antenna. The transmitter of Radio Set AN/PRC-40 contains one frequency tripler and two frequency doubler stages. The total frequency multiplication is twelve times, therefore the crystal Y101 frequency is 1/12 the final carrier frequency.

b. Z102, AUDIO DEVIATION CONTROL.-This plug-in assembly controls the amount of deviation of the transmitted signal. The assembly contains a clipper Q1, a low-pass filter, a variable resistor R8 for setting the amount of deviation, and two stages of wave shaping. Depressing the "press-to-talk" switch on microphone MK101 and speaking into the microphone applies the voice frequency signal from the microphone to pin 2 of Z102 via P103, J102, W101, and P101.

The voice information is clipped by Q1 and then passed through a low-pass filter and a variable resistor for adjusting the amount of frequency deviation. The audio signal is reshaped, amplified, and applied to audio transformer T1 in Z102. The voice modulating signal appears at pin 14 of Z102 and is applied to pin B of Z103.

c. Z103, PHASE MODULATOR.-This plug-in assembly is the phase modulator. The phase modulator is an electrically variable delay line, varied by the audio modulating signal. The audio modulating signal is applied across one coil (pins B and A). The other coil is in series with the RF signal path. The phase modulator is so designed that the audio amplitude at pin B of Z103 affects a phase shift in the RF signal at pins E and D of Z103 and the frequency of the audio affects the rate of phase shift in the RF signal. The phase shift is a result of the varying delay time. The resultant output is an indirect FM signal in which the amplitude of the audio determines the amount of frequency deviation and the frequency of the audio determines the rate of frequency deviation.

The FM signal appears at pin D of Z103. The signal must now be amplified and multiplied. Frequency multiplication is required to increase the carrier frequency and also to increase the amount of frequency deviation. The signal appearing at pin D of Z103 is applied to pin 15 of Z104.

d. Z104, AMPLIFIER.-This furnishes one stage of RF amplification. The signal appearing at pin 15 of Z104 is applied to a parallel resonant circuit consisting of L1, C1, and C2. This circuit is tuned by L1 to resonate at the crystal Y101 frequency (11 MC to 12.7 MC). The signal is removed at the intersection of C1 and C2 and applied to amplifier Q1. The collector circuit of Q1 contains a parallel resonant circuit consisting of L2, C4, and C5. The circuit is also tuned to the crystal frequency. The signal is removed from the resonant circuit and applied to pin 1 of Z104. The output appearing at pin 1 of Z104 is then connected to pin 16 of Z105.

e. Z105, FREQUENCY TRIPLER.-This plug-in assembly is a frequency tripler stage. The modulated RF applied to pin 16 of Z105 has a center frequency equal to the frequency of crystal Y101. This signal is applied to Q1 in Z105. The collector circuit of Q1 contains a parallel resonant circuit consisting of L1 and C2, tuned by L1 to resonate at the third harmonic of the input or crystal frequency. The output of Z105 appears at pin 3 and is then applied to pin 9 of Z106.

f. Z106, AMPLIFIER.-This plug-in assembly contains an amplifier stage which amplifies the output of tripler Z105. The input signal at pin 9 of Z106 is capacitively coupled to Q1 in Z106. The collector circuit of Q1 contains a parallel resonant circuit consisting of L1 and C4. This circuit is tuned by L1 to resonate at the input frequency appearing at pin 9 of Z106. This frequency is the third harmonic of the crystal Y101 frequency. No multiplication occurs in Z106. The output of Z106 appears at pin 2 and is applied to pin 8 of Z107.

g. Z107, FREQUENCY DOUBLER.-This sealed plug-in assembly contains an electron tube in a frequency doubler stage. The input at pin 8 of Z107 is applied to the grid of VI. The plate circuit of VI contains a parallel resonant circuit, consisting of L1 and C4, tuned by L1 to resonate at the second harmonic of the input frequency at pin 8 of Z107. The output appearing at pin 14 of Z107 is therefore the sixth harmonic of the crystal frequency. The output of Z107 is applied to pin 5 of Z108.

h. Z108, FINAL OUTPUT.-This plug-in assembly is not enclosed by a metal cover. The assembly contains three electron tubes. One of the tubes (V101) operates as a driver and doubler for the output stage. The other two tubes (V102 and V103) operate as a push-pull final output stage. The RF input signal appears at pin 5 of Z108 and is applied to the grid of V101. The plate circuit of V101 contains a double-tuned transformer T101. The secondary of T101 is center tapped to provide the inputs to the push-pull output stage. Both primary and secondary of T101 are tuned to resonate at the second harmonic of the input frequency to V101 (or the twelfth multiple of the crystal frequency).

The grids of V101 and V102 are driven 180° out of phase by the secondary of T101 at the final output frequency. The plate circuits of V102 and V103 contain the push-pull output tank T102. The primary of T102 is tuned by a variable split stator capacitor C110. The secondary of T102 is designed to match the antenna impedance. The two windings of T102 are intermeshed. The coupling between the two windings may be physically adjusted by moving the secondary in or out of the primary to obtain maximum power output. The output of Z108 appears at pin 9 and is applied to pin 16 of Z109.

i. Z109, RELAY.-This plug-in assembly contains the relay which switches operating voltage from receiver to transmitter and which switches the antenna from receiver to transmitter. The relay is controlled by the "press-to-talk" switch on the microphone MK101. In the receive position, the volume control switch is closed and the "press-to-talk" switch is not depressed. The relay is not energized, and the relay contacts are in the position illustrated in figure 6-2. The receiver signal path from antenna to receiver is closed from pins 14 to 15 of Z109, and a current path is closed between pins 5 and 9 of Z109 which applies the +15 VDC to the receiver. The receiver is in the operating condition.

The "press-to-talk" switch is depressed to operate the transmitter. Depressing this switch closes a current path from the +15 VDC at pin 4 of P301, to pin 1 of P203, to pin 5 of Z109, through the coil of the relay, to pin 11 of Z109, to pin 1 of P103, to the microphone carbon button and switch, through the switch, and finally through pin 3 of P101 to ground. This current produced by the +15 VDC supply energizes the relay in Z109. The antenna is now connected through contacts of the relay to pin 16 of Z109, applying the transmitter output signal appearing at pin 16 of Z109 to the antenna for transmission. The +15 VDC at pin 5 of Z109 is switched from pin 9 (receiver) to pin 6 (transmitter). This applies the +15 VDC to the transistorized transmitter stages and removes it from the receiver. The +1.5 VDC at pin 3 of Z109 is applied to pin 1 through a closed contact of the relay. This supplies the +1.5 VDC filament voltage to the transmitter stages containing electron tubes.

The +150 VDC voltage for the electron tubes is not controlled by the relay. This voltage is applied at all times while the equipment is turned on. This is possible because no significant current will flow when the tube filaments are not heated. The +150 VDC is controlled by a switch on the volume control R201.

SECTION 5

TROUBLE-SHOOTING

5-1. GENERAL.

This section furnishes information for isolating troubles in Radio Set AN/PRC-40 quickly. The process of trouble-shooting is greatly simplified by the use of sealed plug-in assemblies. These replaceable assemblies plug into the printed circuit boards, and are easily accessible by removing the cabinet.

Trouble-shooting and repair of the Radio Set AN/PRC-40 may be accomplished in emergencies without test equipment. All that is required is a complete set of plug-in assemblies that are known to be good and are pre-tuned for the correct operating frequency. Simply change one plug-in assembly at a time in the transmitter or receiver until normal operation is restored. This check-by-substitution method is made possible by the use of sealed plug-in assemblies. When a set of plug-in assemblies is not available for performing the check-by-substitution, the defect may be located by use of the techniques given in this section.

5-2. TEST EQUIPMENT AND SPECIAL TOOLS.

A special tool is required for removing the plug-in assemblies from the printed circuit boards. This tool is manufactured by Industrial Radio Corporation and listed as part number 2B0115. The plug-in assemblies contain spring clips which engage in slots in the printed circuit boards. The tool is used to depress the spring clip. Figure 5-5 illustrates the tool and the method of using to depress the spring clip.

Table 5-1 lists the test equipment required for trouble-shooting Radio Set AN/PRC-40.

TABLE 5-1. TEST EQUIPMENT

NAME	AN TYPE	ALTERNATE
Volt-Ohm-Milliammeter (20,000 ohms per volt) or VTVM.	AN/PSM-4	Simpson Electric model 260
RF Signal Generator	AN/URM-26	Measurements model 80
RF Wattmeter	AN/URM-43A	Bird Electronic Corp, model 61
Deviation Meter		A.R.F. Products Inc., model AR1-A
Frequency Meter	TS-186/UP	Gertch model FM 3

5-3. OVERALL TROUBLE-SHOOTING.

Overall trouble-shooting consists of localizing the trouble to a functional section. Radio Set AN/PRC-40 consists of three functional sections; the receiver, the transmitter, and the battery power supply.

a. PRELIMINARY CHECK.-Visual inspection is the first step in trouble-shooting. Inspect all cables and wiring for broken connections, frayed insulation and shorted wires. Inspect connectors (plugs and receptacles) for tight connections. Inspect printed circuit boards for breaks or cracks in etched wiring. Make sure all plug-in assemblies are free from mechanical damage and are securely seated. Check battery and antenna connections. Inspect the entire chassis for signs of burns and mechanical damage.

b. CONTROL SETTINGS.-Place VOLUME control R201 in approximately the center of its rotational travel limits. This will automatically turn the equipment "ON". Place the SQUELCH control R202 in its maximum counterclockwise position.

c. OVERALL TROUBLE-SHOOTING CHART.-Table 5-2 lists steps to be performed to localize the trouble to the battery power supply, the receiver, or the transmitter.

5-4. FUNCTIONAL SECTION TROUBLE-SHOOTING.

Having localized the defect to a functional section, tables are furnished to help isolate the trouble to the replaceable part within the functional section. No table is furnished for the power supply becuase of its simplicity. The only check necessary is to measure the voltages at P301. The functional section at fault (receiver or transmitter) is generally discovered by lack of, or faulty reception or transmission. Table 5-3 is a trouble-shooting chart for the receiver and table 5-4 is a trouble-shooting chart for the transmitter. The voltage readings in the NORMAL INDICATION column may vary ±20%.

5-5. TYPICAL TROUBLES.

Table 5-5 is a list of typical troubles which may be encountered in Radio Set AN/PRC-40. Column 1 lists various troubles, column 2 lists the nature of the trouble, and column 3 lists the symptoms of the trouble.

5-6. VOLTAGE MEASUREMENTS.

a. RF VOLTAGES.-Radio Set AN/PRC-40 is designed for ease in servicing. Several of the plug-in units contain half-wave diode rectifiers which supply DC voltage test points. These diodes rectify the RF voltage at the output of the plug-in assembly. The recti-

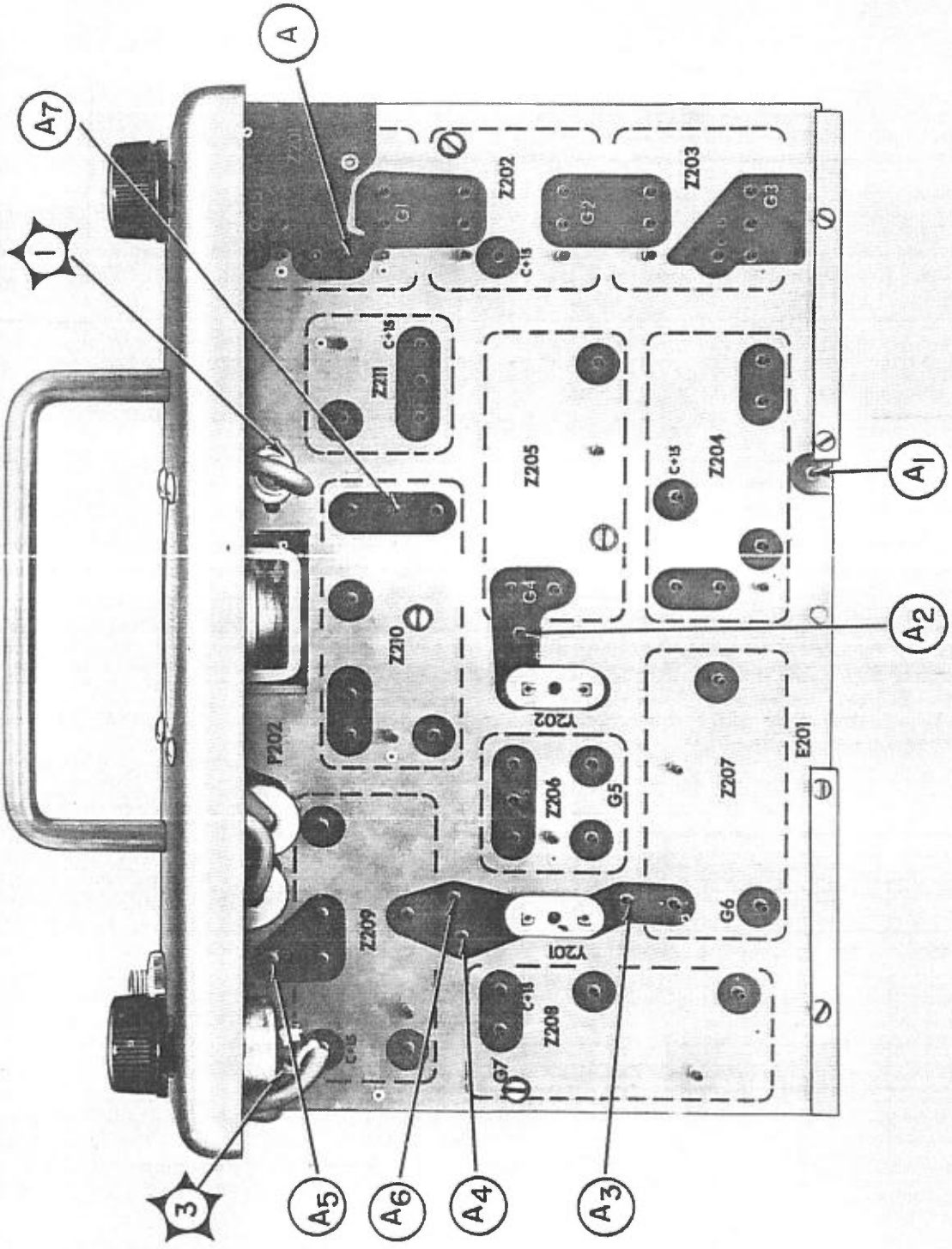


Figure 5-1. Receiver Printed Circuit Board

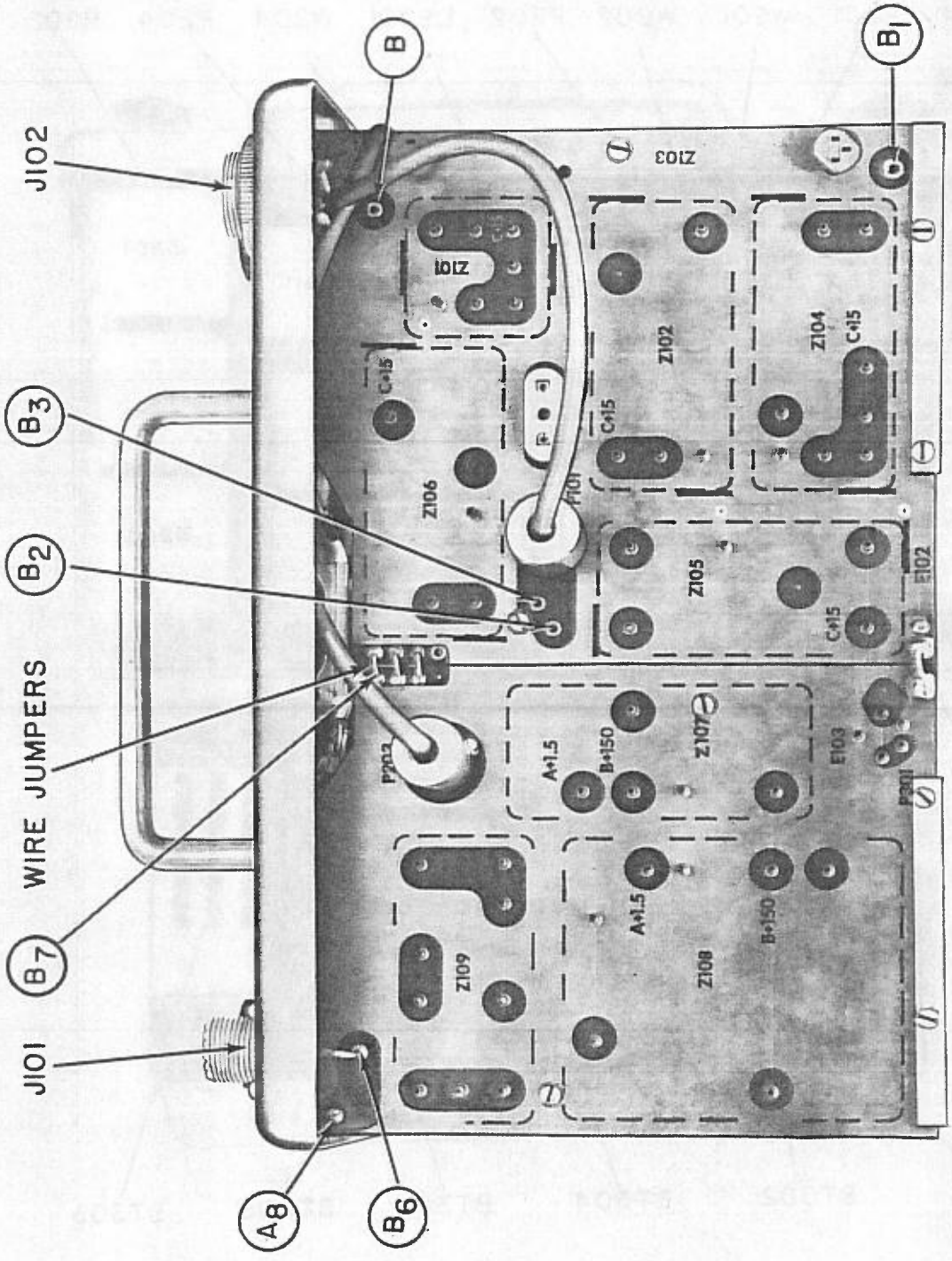


Figure 5-2. Transmitter Printed Circuit Board

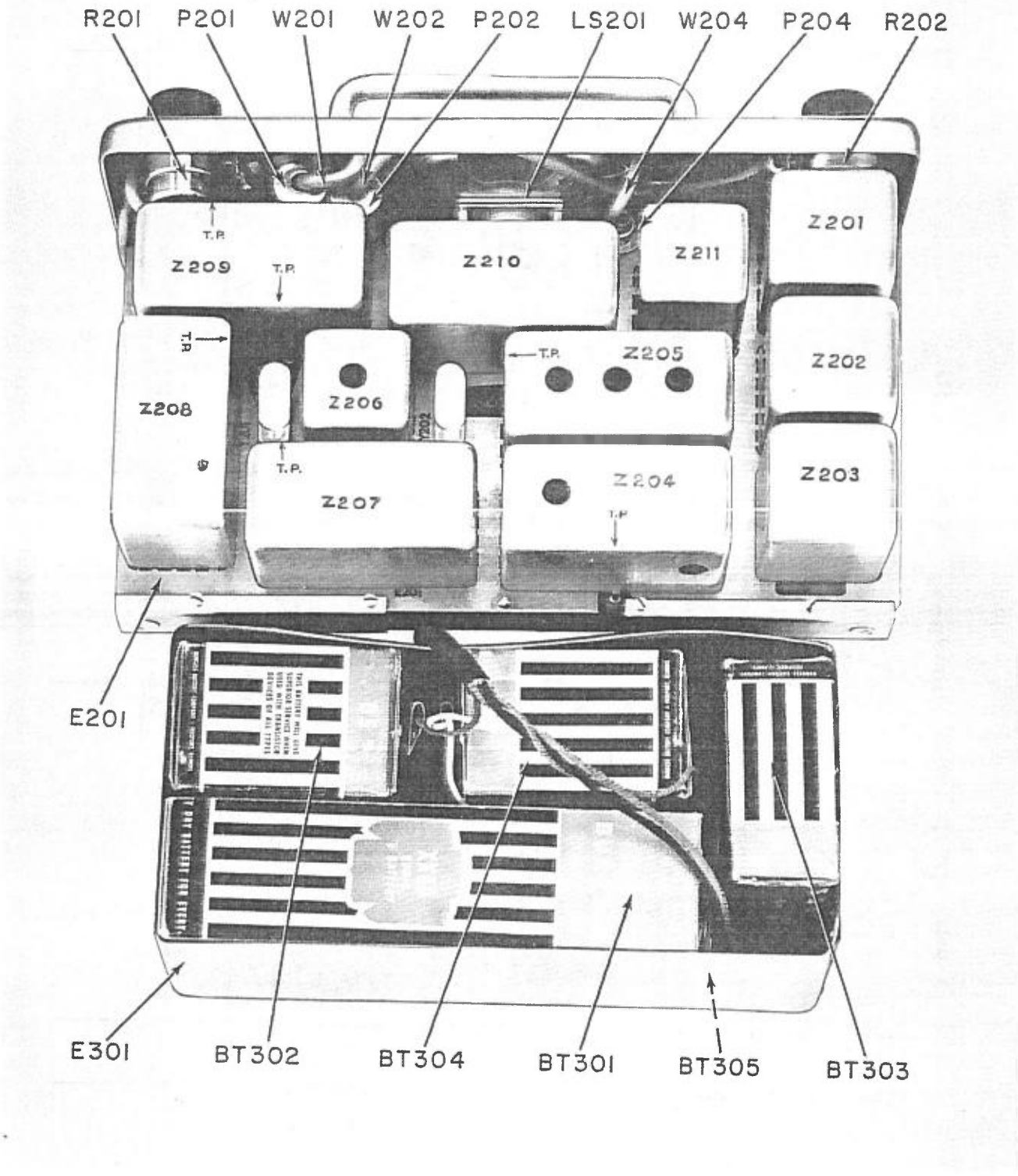


Figure 5-3. Receiver with Power Supply

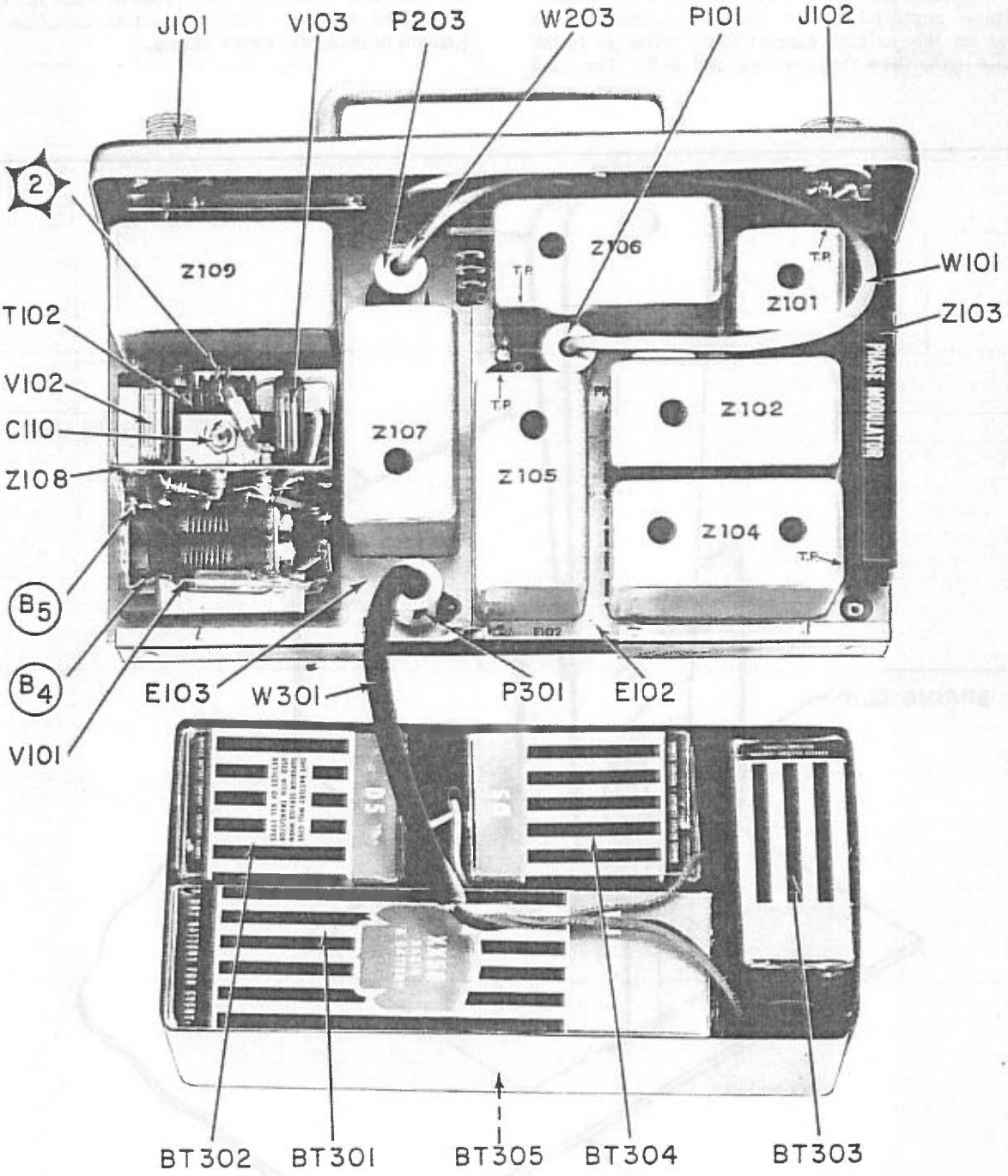


Figure 5-4. Transmitter with Power Supply

fied output is supplied as a positive DC voltage to a separate pin on the printed circuit board and identified by T.P. on top of the applicable plug-in assembly. The voltage measured at these test points indicate the existence and relative amplitude of RF voltages without special RF probes or RF voltmeters.

b. DC POWER SUPPLY VOLTAGES.-The positive DC voltage supplied to the plug-in assemblies is screened on the printed circuit board adjacent to the applicable pin. (See figures 5-1 and 5-2.) The +1.5 VDC is labeled as the A voltage, the +150 VDC is labeled as the B voltage, and the +15 VDC is labeled as the C voltage. To determine the presence of the supply voltage at a plug-in assembly, remove the plug-in assembly from the printed circuit board. The pin at which the supply voltage will be measured is identified by an alphabetical symbol, A, B, or C, and the existing voltage, +1.5, +150, or +15. All DC voltages are positive with respect to common chassis ground unless otherwise stated.

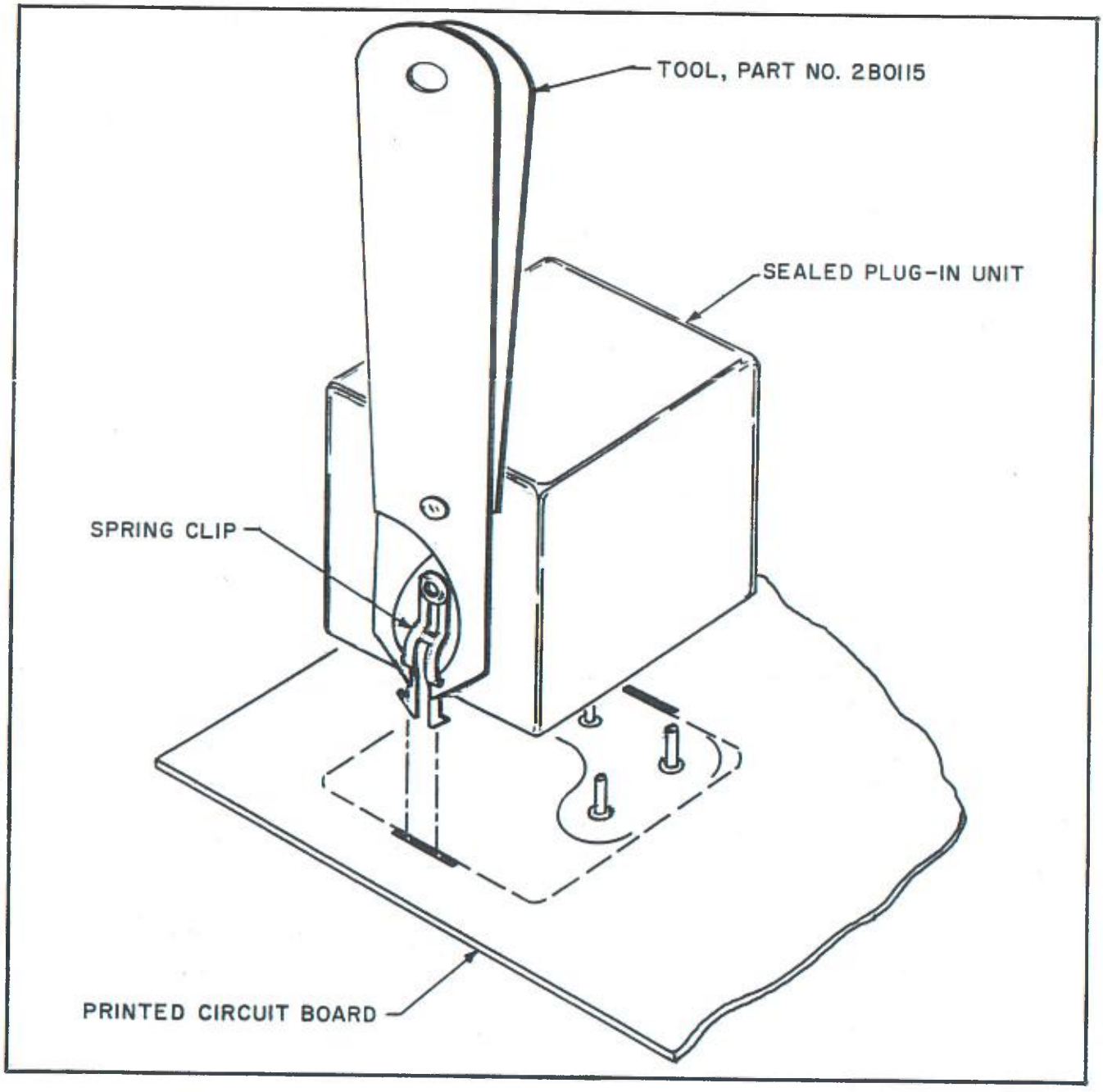


Figure 5-5. Removing Plug-in Assembly

TABLE 5-2. OVERALL TROUBLE-SHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1.	(B7) Figures 5-2 and 6-2	Turn equipment "on". Set VOM for +50 VDC. Connect common lead to chassis. Measure voltage at test point while holding the microphone "press-to-talk" switch depressed.	VOM reads +15 VDC while "press-to-talk" switch is depressed.	If indication is abnormal, check Z109, P301, BT302, BT303, and printed circuit. Proceed to next step if indication is normal.
2.	(3) Figures 5-1 and 6-2	Set VOM for +250 VDC and measure voltage at test point. This test point is the DPST switch on R201. One set of contacts will have +1.5 VDC. Depress the "press-to-talk" switch while measuring the voltage.	VOM reads +150 VDC while "press-to-talk" switch is depressed.	If indication is abnormal, check power supply, switch, cabling, and printed circuit.
		Move VOM probe to other set of switch contacts. Set VOM for +2.5 VDC. Depress the "press-to-talk" switch while measuring the voltage.	VOM reads +1.5 VDC while "press-to-talk" switch is depressed.	If indication is abnormal, check power supply, switch, cabling, and printed circuit. Proceed to next step if indication is normal.
3.	Loudspeaker	Turn volume control R201 to clockwise position. Turn squelch control R202 to maximum counterclockwise position.	Noise is audible from the loadspeaker LS201 when no signal is being received.	If noise is not heard, check receiver. Proceed to step 4 if indication is normal.
4.	Loudspeaker	Slowly advance the squelch control while listening to the speaker output.	Noise disappears as squelch cutoff is reached.	If noise is not squelched, check receiver circuit. Proceed to next step 5 if indication is normal.
5.	(B6) Figures 5-2 and 6-2	Rotate squelch control to maximum counterclockwise position. Set RF-signal generator to the frequency of reception (132 to 152 MC). Connect the generator output to the antenna. Set the signal output at 1 μv.	The noise disappears with input signals of 1 μv or greater due to increased signal to noise ratio.	If noise does not disappear, check receiver. Proceed to step 6 if indication is normal.
6.	(B6) Figures 5-2 and 6-2	Remove the signal generator. Connect the antenna receptacle to an RF power meter. Depress the "press-to-talk" switch.	The RF power meter reads 1 watt minimum.	If indication is abnormal, check transmitter. Proceed to step 7 if indication is normal.

TABLE 5-2. OVERALL TROUBLE-SHOOTING CHART (CONT)

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
7.	(2) Figures 5-2 and 6-2	Loosely couple the frequency meter to the antenna link and depress the "press-to-talk" switch. Check the frequency.	Frequency must be the desired frequency of transmission (132 MC to 152 MC).	If indication is abnormal, check C1 of Z101. Check alignment. Proceed to step 8 if indication is normal.
8.	(2) Figures 5-2 and 6-2	Remove the frequency meter and loosely couple the deviation meter to antenna link. Depress the "press-to-talk" switch and speak loudly into the microphone.	The frequency deviation reads 15 KC maximum or lower as determined by R8 in Z102.	If abnormal indication, adjust R8 of Z102. Check microphone and connections.

TABLE 5-3. RECEIVER TROUBLE-SHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1.	(A_8) Figures 5-2 and 6-1	Turn the set on. Set VOM for +15 VDC and measure voltage at test point.	VOM reads +15 VDC.	If indication is abnormal, check Z109, volume control switch, power supply, and printed circuit.
2.	(A_1) Figures 5-1 and 6-1	Set VOM for +10 VDC and connect to test point at Z204.	VOM reads +6.9 VDC.	If indication is abnormal, check crystal Y101 and Z204.
3.	(A_3) Figures 5-1 and 6-1	Set the signal generator to the receiver frequency (132 to 152 MC) at a 1 μv output. Connect the generator output to the antenna. Set the VOM for +50 VDC and connect to the test point for pin 14 of Z207.	VOM reads +12 VDC.	If indication is abnormal, check Z201 through Z207.
4.	(A_4) Figures 5-1 and 6-1	Set VOM for +10 VDC and connect to test point for pin 8 of Z208.	VOM reads +4.4 VDC.	If indication is abnormal, check Z208.
5.	(A_5) Figures 5-1 and 6-1	Set VOM for +2.5 VDC and connect to test point for pin 6 of Z209.	VOM reads +0.9 VDC.	If indication is abnormal, check Z209.
6.	Loudspeaker	Remove signal generator. Rotate squelch control to maximum counterclockwise position. Rotate volume control R201 to maximum clockwise position.	A loud hissing noise is heard from the loudspeaker LS201.	If indication is abnormal, check Z209, R201, Z210, and LS201.
		Slowly rotate squelch control to the maximum clockwise position.	Hissing noise disappears.	If indication is abnormal, check R202, Z209, and Z211.

TABLE 5-4. TRANSMITTER TROUBLE-SHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1.	(B7) Figures 5-2 and 6-2	Set VOM for +50 VDC. Depress the "press-to-talk" switch and measure voltage at test point (top jumper wire).	VOM reads +15 VDC.	If indication is abnormal, check power supply, switch or volume control, Z109, and printed circuit.
2.	(B) Figures 5-2 and 6-2	Set VOM for +10 VDC and connect to test point. Depress the microphone "press-to-talk" switch.	VOM reads +3.5 VDC.	If indication is abnormal, check Y101 and Z101.
3.	(B1) Figures 5-2 and 6-2	Connect VOM to test point. Depress "press-to-talk" switch.	VOM reads approximately +6.5 VDC.	If indication is abnormal, check Z103 and Z104.
4.	(B2) Figures 5-2 and 6-2	Set VOM for +2.5 VDC and connect to test point. Depress "press-to-talk" switch.	VOM reads +0.75 VDC.	If indication is abnormal, check V105.
5.	(B3) Figures 5-2 and 6-2	Connect VOM to test point. Depress "press-to-talk" switch.	VOM reads -0.2 VDC.	If indication is abnormal, check Z106.
6.	(B4) Figures 5-4 and 6-2	Connect VOM to test point at intersection of R106 and R107 in Z108. Depress "press-to-talk" switch.	VOM reads +0.4 VDC.	If indication is abnormal, check Z107.
7.	(B5) Figures 5-4 and 6-2	Connect VOM to test point at intersection of R102 and R108. Depress "press-to-talk" switch.	VOM reads -1.4 VDC.	If indication is abnormal, check V101 and T101.
8.	(B6) Figures 5-2 and 6-2	Connect RF wattmeter to antenna receptacle J101. Depress "press-to-talk" switch.	Power output reads 1 watt minimum.	If indication is abnormal, check V102, V103, coupling transformer T102, and alignment.
9.	(2) Figures 5-4 and 6-2	Loosely couple the deviation meter to test point at link. Hold "press-to-talk" switch depressed and speak loudly into microphone.	Deviation reads maximum of 15 KC, or less if desired depending upon setting of R8 in Z102.	If indication is abnormal, check Z102, Z103, and microphone.

TABLE 5-5. RADIO SET AN/PRC-40, TYPICAL TROUBLES

TROUBLE	NATURE OF TROUBLE	SYMPTOM
Subnormal transmitter operation	Detuned transmitter, incorrect antenna length, or weak tubes in Z108.	Reduced transmitter output when operating voltages are normal.
Subnormal receiver operation	Detuned receiver or defective plug-in assembly.	Reduced receiver sensitivity when operating voltages are normal.
Transmitter RF carrier not being modulated.	Defective microphone, deviation control Z102, or phase modulator Z108.	Transmitter operating, RF carrier present without modulation.
Squelch circuit inoperative	Defective control R202, squelch circuit Z211, or discriminator Z209.	Noise heard from speaker during no input signal condition.
Both receiver and transmitter completely dead.	Defective switch on volume control or defective power supply.	No sound at loudspeaker and no transmission.
Microphone "press-to-talk" switch does not function.	Defective "press-to-talk" switch or defective relay Z109.	Receiver operates but does not shut off when "press-to-talk" switch is depressed.

SECTION 6

REPAIR

6-1. FAILURE REPORT.

Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. The importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment identification plate), the type number and serial number of the major unit (from the major unit identification plate), and the type number and reference designation of the particular defective part (from the technical manual). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember - there are two sides to the failure report -

"YOUR SIDE"

Every FAILURE REPORT is a boost for you:
1. It shows that you are doing your job.
2. It helps make your job easier.
3. It insures available replacement.
4. It gives you a chance to pass your knowledge to every man on the team.

"BUREAU SIDE"

The Bureau of Ships uses the information to:
1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
4. Prepare field changes.
5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest District Publications and Printing Office.

6-2. GENERAL.

Included in this section are instructions for reassembly and alignment of transmitter and receiver. Data are provided for alignment, adjustment, and calibration to obtain optimum performance. All slug tuned coils accessible for alignment contain threaded plastic locking plugs. These plugs are tightened against the core to prevent detuning caused by vibration. The plastic locking plugs must be removed before alignment and replaced after alignment.

6-3. RECEIVER ALIGNMENT.

a. GENERAL.-The radio receiver can be aligned to receive any frequency within the 132 to 152 MC band. Unless otherwise noted, the unit is factory aligned for an input frequency of 136.560 or 150.090 MC. The high IF frequency is 8.5 MC. By employing crystals of different frequencies and realigning the receiver, any frequency within the entire above mentioned band may be received. The low IF frequency is 300 KC. The second local oscillator uses an 8200.000 KC crystal, Y202.

b. CALCULATING CRYSTAL FREQUENCY.-The following formula is used to calculate the third overtone frequency of crystal Y201 required to receive any input frequency within the band of 132 to 152 MC.

$$FY201 = \frac{(\text{Rec Input Frequency in MC minus } 8.5)}{3}$$

Where: FY201 = Third overtone frequency of crystal Y201 in MC.

c. CALCULATING INPUT FREQUENCY.-Use the following formula to calculate the input frequency in MC which can be received with a given crystal Y201.

$$\text{Rec Input Frequency} = 3\ FY201 + 8.5$$

Where: FY201 = Third overtone frequency of Y201 in MC.

The number 8.5 appearing in the above formulae represents the high IF frequency in megacycles.

d. RECEIVER ALIGNMENT EQUIPMENT.-Table 6-1 lists the test equipment required for alignment of the receiver.

TABLE 6-1. TEST EQUIPMENT FOR RECEIVER ALIGNMENT

NAME	AN TYPE	ALTERNATE
Volt-Ohm-Milliammeter (20,000 ohm-per-volt)	AN/PSM-4	Simpson Electric model 260
RF Signal Generator	* AN/URM-26	*Measurements model 80

*Requires accurate alignment. Dial accuracy is less than that of crystal.

e. ALIGNMENT PROCEDURE.-The step-by-step alignment procedure is given in Table 6-2. Keep test leads as short as possible and provide good RF grounds for all test equipment. Check and calibrate test equipment frequently. Unless otherwise specified, use only as much signal generator output voltage as required for a good readable indication on a low meter range. Location of assemblies and test points may be found on figures 5-1 and 5-3.

TABLE 6-2. RECEIVER ALIGNMENT TABLE

STEP	PROCEDURE	VOM CONNECTION		ADJUST	NOTES
		TEST POINT	RANGE		
1.	Remove Z203. Set Signal generator for 8.5 MC. Inject signal at pin 7 of Z203 (G3).	(A4) Pin 8 of Z208	+10 VDC	L1, L2 and L3 of Z205 for max peak.	Calibrate signal generator with a freq meter at 8.5 MC.
2.	Same as for step 1. Voltage at test point may be positive or negative. Set function switch of meter to keep indicator on scale.	(A6) Pin 8 of Z209	+2.5 VDC or -2.5 VDC	C1 of Z206 for zero voltage. With function switch on meter at both +2.5 VDC and -2.5 VDC.	If a zero reading cannot be obtained with C1, recalibrate the signal generator at 8.5 MC.
3.	Replace Z203. Set generator at the desired frequency of reception (132 to 152 MC). Inject the signal at the antenna E101. Use high generator output.	(A1) Pin 5 of Z204	+50 VDC	L1 of Z204 for max peak.	Calibrate signal generator with a freq meter each time frequency is changed.
4.	Same as Step 3.	(A4) Pin 8 of Z208	+10 VDC	C5 of Z204, C1 of Z201, C1 of Z202, then C1 and C2 of Z203 for max peak.	Make adjustments in the order listed.
5.	Set generator output at approximately 1 microvolt.	(A6) Pin 8 of Z209	+2.5 VDC	C2 of Z204 for zero voltage.	If a zero reading cannot be obtained with C2, recalibrate the signal generator with a freq meter.
6.	Repeat the alignment procedure from step 1 through 5.				This provides a more accurate alignment due to interaction of tuned circuits.

6-4. SENSITIVITY TEST.

a. GENERAL.-The sensitivity of the receiver signifies how effectively the receiver is operating. One of the principle influences in the sensitivity of an FM receiver is the requirement that the receiver should not be responsive to AM effects. This is determined by the limiter and detector stages. The discriminator type detector is responsive to AM changes, and therefore requires a limiter system to "clip" any AM effects that may be present in the received FM signal. With no input signal, AM noise voltages will be present at the discriminator.

The sensitivity of a receiver is the characteristic which decides the minimum strength of signal input needed to produce sufficient limiting action to reduce the noise voltage output a specified amount. Becuase an increase in signal strength reduces the AM noise output, the reduction is calculated in db and termed "quieting action". A one microvolt signal at the antenna of the Radio Set AN/PRC-40 receiver will produce 20 db or better of quieting action.

b. TEST EQUIPMENT.-The test equipment listed in table 6-1 plus a sensitive milli-voltmeter is required for checking the sensitivity of the receiver. Use a milli-voltmeter such as the Ballantine Laboratories, Inc., model 300.

c. SENSITIVITY TEST PROCEDURE.-The following step-by-step procedure will determine the sensitivity of the receiver.

(1) Connect the signal generator to the antenna input connector (J101).
(2) Set the milli-voltmeter for AC volts and connect across the loudspeaker LS201 voice coil.
(3) Adjust signal generator accurately to the receiver signal frequency and rotate attenuator for zero signal output.
(4) Turn "on" receiver and rotate SQUELCH control to maximum counterclockwise position.
(5) Rotate receiver VOLUME control R201 for a 0.5 volt reading on the voltmeter. This represents the noise voltage.
(6) Rotate the signal generator attenuation control

until the noise voltage indicated by the milli-voltmeter decreases to 0.05 volts.

(7) Check the signal generator output voltage. This should be one microvolt, or less, if the receiver is correctly adjusted and operating properly.

(8) A db scale may also be used. With zero generator output, adjust volume control for 20 db on the meter. Increase generator output until meter reads 0 db. Generator output should be one microvolt or less.

6-5. TRANSMITTER ALIGNMENT.

a. GENERAL.-The transmitter may be tuned to radiate any single frequency between 132 and 152 megacycles, provided that the correct frequency crystal (Y101) is used for the transmitter oscillator. The frequency of the crystal required can be determined by dividing the desired output carrier frequency by 12.

b. CALCULATING CRYSTAL FREQUENCY.-The following formula is used to determine the crystal frequency FY101 required to transmit any desired frequency within the band of 132 and 152 MC.

$$FY101 = \frac{(\text{Xmtr Carrier Frequency in MC})}{12}$$

Where: FY101 = Crystal Y101 frequency in MC.

From the above formula it may be seen that the transmitter crystal Y101 frequency must be within 11000.000 KC and 12666.666 KC to transmit within the band of 132 to 152 MC.

c. TRANSMITTER ALIGNMENT EQUIPMENT.-Table 6-3 lists the test equipment required for alignment of the transmitter.

d. ALIGNMENT PROCEDURE.-The alignment of the transmitter is accomplished by use of the step-by-step procedure in table 6-4. During the tuning operation, heavy currents are drawn from the batteries and the transmitter tubes are subjected to overload conditions. The transmitter should therefore be turned on only during the actual tuning periods.

NOTE

Perform the transmitter tuning procedure in an RF shielded enclosure or with the antenna removed and the RF wattmeter connected to J101 as a dummy load.

TABLE 6-3. TEST EQUIPMENT FOR TRANSMITTER ALIGNMENT

NAME	AN TYPE	ALTERNATE
Volt-Ohm-Milliammeter (20,000 ohms per volt)	AN/PSM-4	Simpson Electric, model 260
Deviation meter		A.R.F. products Inc., model AR1-A
RF Wattmeter	AN/URM-43A	Bird electronics Corp., model 61
Frequency meter or counter	TS-186/UP	Gertch model FM 3

6-6. ANTENNA LENGTH.

Radio Set AN/PRC-40 may be aligned to transmit and receive on any frequency within the 132 to 152 MC band. To obtain optimum performance, the antenna E101 must be cut to resonate at the frequency for which the Radio Set is aligned. Table 6-5 lists the overall length of the antenna required for different frequencies in steps of 1 MC. The length given in table 6-5 is the total overall length of the antenna, measured from the top of the wire loop to the bottom of coaxial connector center terminal. The wire loop must be reconstructed in the antenna after cutting. The loop has an inside diameter of approximately 5/16 inches. Allow sufficient length to reconstruct the loop in the end; about 1/2 inch in addition to the length given in table 6-5.

TABLE 6-4. TRANSMITTER ALIGNMENT TABLE

STEP	TEST POINT	PROCEDURE	ADJUST	NOTES
1.		Remove the antenna E101 and the final output Z108.	C1 of Z101 to approximate middle position.	
2.	(B)	Connect the voltmeter set for +10 VDC to test point for pin 3 of Z101.	L1 of Z101 for maximum voltage.	Depress "press-to-talk" switch while making adjustment.
3.	(B_1)	Connect voltmeter set for +2.5 VDC to test point for pin 14 of Z104.	L1 and L2 of Z104 for maximum voltage.	Same as step 2
4.	(B_2)	Connect voltmeter set for +2.5 VDC to test point for pin 1 of Z105.	L1 of Z105 for maximum voltage.	Same as step 2

TABLE 6-4. TRANSMITTER ALIGNMENT TABLE (CONT)

STEP	TEST POINT	PROCEDURE	ADJUST	NOTES
5.	(B3)	Connect voltmeter set for +2.5 VDC to test point for pin 1 of Z106.	L1 of Z106 for maximum voltage.	Same as step 2
6.	(B6)	Replace final output Z108. Connect the RF wattmeter to antenna receptacle J101.		
7.	(B4)	Connect voltmeter set for +2.5 VDC to test point at junction between R106 and R107 on Z108.	L1 of Z107 for maximum voltage.	Same as step 2
8.	(B5)	Connect voltmeter set for +2.5 VDC to test point at junction between R102 and R108 on Z108.	Primary and secondary of T101 for maximum voltage.	Same as step 2
9.		Set RF wattmeter, connected to the antenna receptacle J101, for low watt range.	C110 of Z108 for maximum power.	Same as step 2
10.	2	Same as step 9.	Physically position the secondary coil of T102 in Z108 for maximum power output.	Use an insulated tool and move the secondary winding in or out of the primary winding to vary the coupling for maximum power.
11.	2	Loosely couple the frequency meter to the test point at the secondary of T102 in Z108.	C1 in Z101 for correct frequency of transmission.	Same as step 2
12.	2	Remove the frequency meter and loosely couple the deviation meter to the test point at the secondary of T102. Depress the "press-to-talk" switch and speak loudly into the microphone while observing the deviation meter.	Adjust R8 in Z102 for the desired frequency deviation. Maximum permissable deviation is 15 KC.	
13.		Repeat the alignment procedure from step 2 through step 12.		This will provide a more accurate alignment due to interaction of tuned circuits.

TABLE 6-5. OVERALL ANTENNA LENGTH VS FREQUENCY

FREQUENCY IN MC	LENGTH IN INCHES	FREQUENCY IN MC	LENGTH IN INCHES
132	20-52/64	143	19-17/64
133	20-43/64	144	19-8/64
134	20-34/64	145	18-63/64
135	20-25/64	146	18-54/64
136	20-16/64	147	18-45/64
137	20-7/64	148	18-36/64
138	19-62/64	149	18-27/64
139	19-53/64	150	18-18/64
140	19-44/64	151	18-9/64
141	19-35/64	152	18
142	19-26/64		

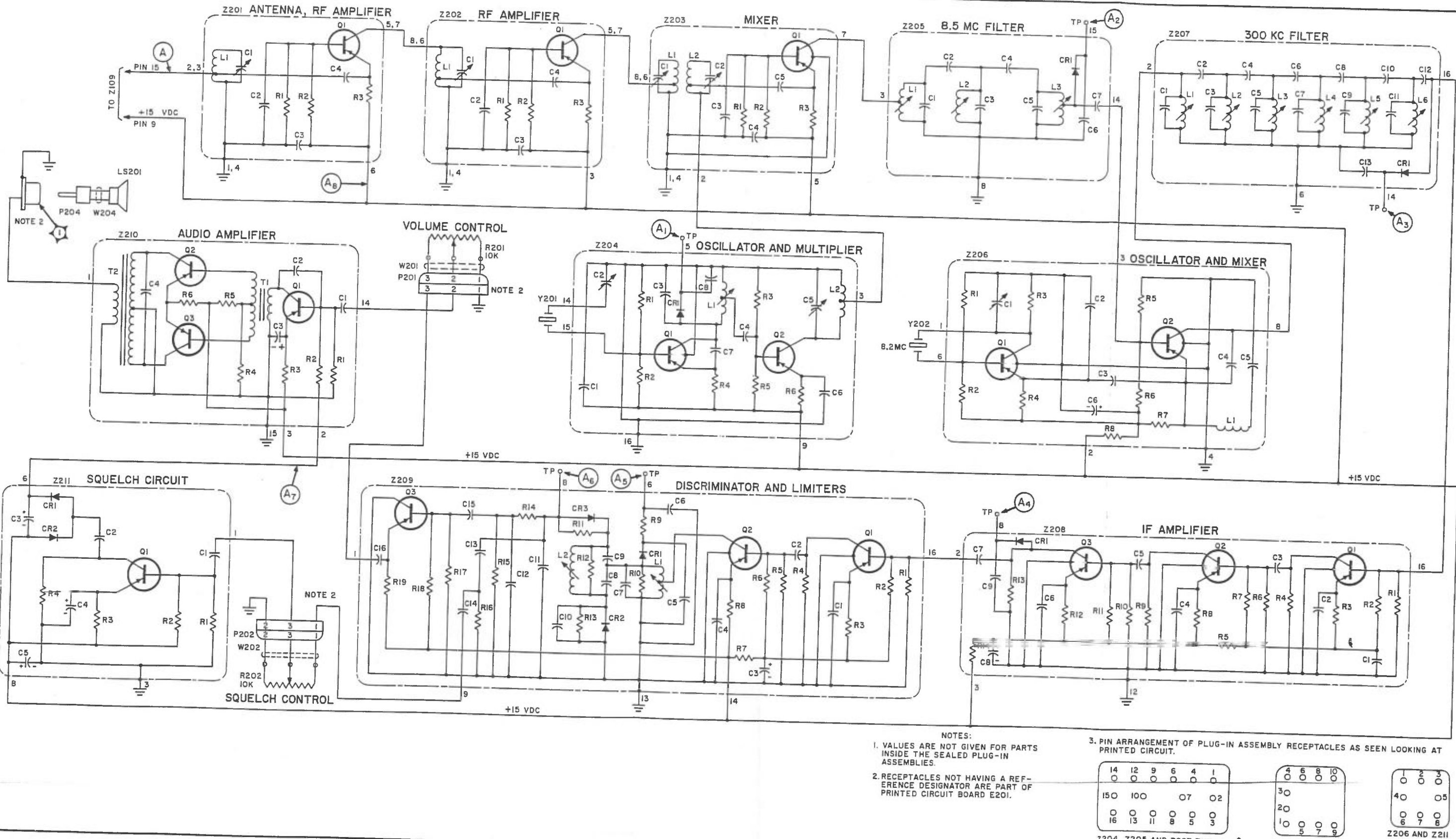
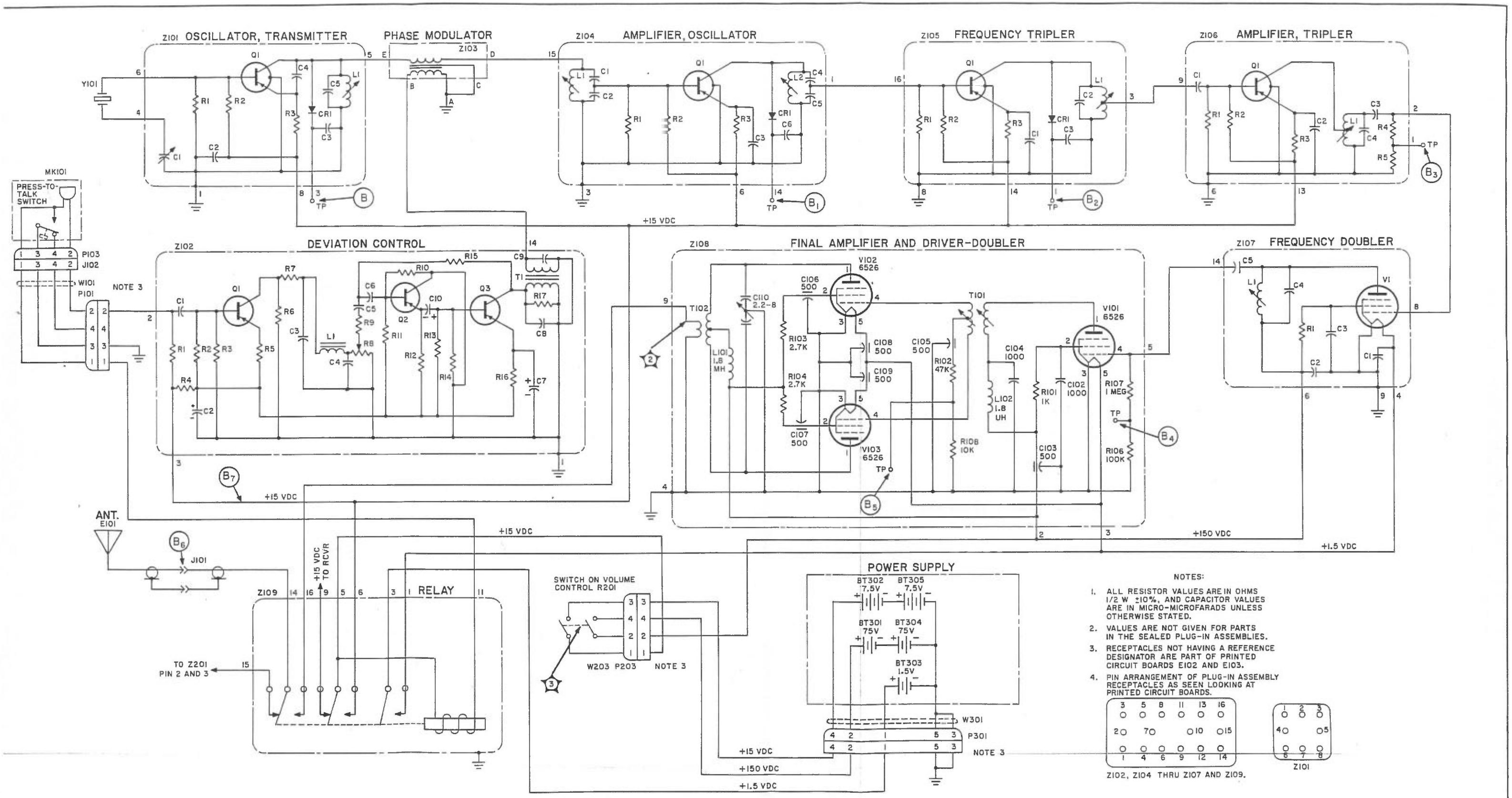


Figure 6-1. Radio Set AN/PRC-40, Receiver, Schematic Diagram



NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS 1/2 W ±10%, AND CAPACITOR VALUES ARE IN MICRO-MICROFARADS UNLESS OTHERWISE STATED.
2. VALUES ARE NOT GIVEN FOR PARTS IN THE SEALED PLUG-IN ASSEMBLIES.
3. RECEPTACLES NOT HAVING A REFERENCE DESIGNATOR ARE PART OF PRINTED CIRCUIT BOARDS E102 AND E103.
4. PIN ARRANGEMENT OF PLUG-IN ASSEMBLY RECEPTACLES AS SEEN LOOKING AT PRINTED CIRCUIT BOARDS.

Figure 6-2. Radio Set AN/PRC-40, Transmitter, Schematic Diagram

SECTION 7

PARTS LIST

7-1. INTRODUCTION.

Reference designations have been assigned to identify all maintenance parts of the equipment. They are used for making the equipment and are included on drawings, diagrams, and the parts list. The letters of a reference designation indicate the kind of part, such as resistor, inductor, electron tube, etc. The number differentiates between parts of the same generic group. Replaceable parts of the transmitter are numbered 101 to 199. Parts of the receiver are numbered 201 to 299, and parts of the power supply are numbered 301 to 399.

NOTE

New Stock Number Identification Tables (SNITS) issued by the Electronics Supply Office include Federal Stock Numbers and Source Maintenance and Recoverability Codes. Therefore, reference shall be made to the SNIT for this information.

7-2. MAINTENANCE PARTS LIST.

Table 7-1 lists the maintenance parts of Radio Set AN/PRC-40. Column 1 lists the reference designations of the various parts in alphabetical and numerical order. Column 2 allows space for explanatory notes. Column 3 gives the name and describes the various components. Column 4 indicates how the part is used and gives its functional location in the equipment.

7-3. LIST OF MANUFACTURERS.

Table 7-2 lists manufacturers of parts used in Radio Set AN/PRC-40. The first column includes the abbreviations used in the Maintenance Parts List to identify manufacturers.

TABLE 7-1. RADIO SET AN/PRC-40, MAINTENANCE PARTS LIST

REF DES	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
BT301		BATTERY, DRY CELL: 75 volt, Burgess type xx50, Ind Radio pt no. 8A001	Part of +150 VDC supply
BT302		BATTERY, DRY CELL: 7.5 volt, Burgess type D5, Ind Radio pt no. 8A002	Part of +15 VDC supply
BT303		BATTERY, DRY CELL: 1.5 volt, Burgess type 2D, Ind Radio pt no. 8A003	+1.5 VDC filament supply voltage
BT304		Same as BT301	Same as BT301
BT305		Same as BT302	Same as BT302
C101		Not used	
C102		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 $\mu\mu$f GMV (mfd by Radio Material Corporation) Ind Radio pt no. 20A252	Screen bypass capacitor for tube V101
C103		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 $\mu\mu$f ±20% 500 VDCW, (mfd by Centralab Co part no. MFT 500)	Screen decoupling capacitor for tube V101
C104		Same as C102	Plate decoupling capacitor for V101
C105		Same as C103	Center tap grounding capacitor for L102
C106		Same as C103	Filament decoupling capacitor for tube V102
C107		Same as C103	Filament decoupling capacitor for tube V103

TABLE 7-1 RADIO SET AN/PRC-40, MAINTENANCE PARTS LIST (CONT)

REF DES	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
C108		Same as C103	Screen decoupling capacitor for tube V102
C109		Same as C103	Screen decoupling capacitor for tube V103
C110		CAPACITOR, VARIABLE, AIR DIELECTRIC: 2.2 to 8 $\mu\mu$f, 1100 volts breakdown voltage (mfd by E. F. Johnson Co, part no. 9MB11) Ind Radio part no. 20A002	Tank circuit capacitor for output of V102 and V103
C111		Not used	
E101		ANTENNA: 130 to 156 MC frequency range, Ind Radio pt no. 3B001	RF reception and transmission
E102		PRINTED CIRCUIT BOARD: Including socket and pins, Ind Radio pt no. 2C0021	Inter-circuit connections for part of Transmitter
E103		PRINTED CIRCUIT BOARD: Including pins, Ind Radio pt no. 2C0022	Circuit connections for part of transmitter containing electron tubes.
E104		CORE, ADJUSTABLE TUNING: 0.248 in. dia, 1/2 in. lg, no. 11 material, mfd by Radio Cores Inc, Ind Radio pt no. 22A001	Tuning slug for Z205
E105		COVER, CANVAS: Mfd by Buhrke Mfg Co, Ind Radio pt no. 16D1010	Protection
E106		PLATE, IDENTIFICATION: Ind Radio pt no. 53A001	Outside cover identification
E107		HOUSING, RADIO SET: Ind Radio pt no. 40C001	
E108		HANGER, MICROPHONE: Ind Radio pt no. 5A939	
E109		HANDLE: mfd by Stallion Industries pt no. 1010, Ind Radio pt no. 105A001	
E110		ELEMENT, MICROPHONE: Carbon type, (mfd by Kellogg pt no. 75555-2)	Part of MK101
E111		CONTACT ASSEMBLY, ELECTRICAL: Contact arrangement 2A, Ref Dwg Group 4, (mfd by Switchcraft Inc pt no. 2S1236)	Part of MK101
E112		CORE, ADJUSTABLE TUNING: 0.248 in. dia, 5/8 in. lg, no. 11 material (mfd by Radio Cores Inc) Ind Radio part no. 22A002	Tuning slug for Z101 and Z104
E113		CORE, ADJUSTABLE TUNING: 0.248 in. dia, 1/2 in. lg, no. 8 material (mfd by Radio Cores Inc) Ind Radio part no. 22A003	Tuning slug for Z105, Z106, Z107, Z108, and Z204
E114		PLUG, THREADED, COIL LOCKING: Plastic, no. 1/4-28 thd (mfd by Peerless Products Industries) Ind Radio part no. 55A004	Locking plug for tuning cores
E115		FASTENER, COIL: 5/32 in. dia hole size (mfd by The Palnut Co, part no. 2810 type 2) Ind Radio part no. 52A002	Holds coils in place

TABLE 7-1. RADIO SET AN/PRC-40, MAINTENANCE PARTS LIST (CONT)

REF DES	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
E201		PRINTED CIRCUIT BOARD: Including socket and pins, Ind Radio pt no. 2D0020	Inter-circuit connections for receiver
E202		KNOB, SQUELCH CONTROL: Press fit type, black phenolic, 1 in. dia, 1/2 in. h, 3/32 in. thk, mfd by Harry Davies Co, pt no. 1475U Ind Radio pt no. 45A146	Operates squelch control
E203		KNOB, VOLUME CONTROL: Press fit type, black phenolic, 1 in. dia, 1/2 in. h, 3/32 in. thk, mfd by Harry Davies Co, pt no. 1475T Ind Radio pt no. 45A145	Operates volume control
E301		HOUSING, BATTERY: Ind Radio pt no. 15C001	
E302		BATTERY CLIP ASSY: Ind Radio pt no. 2A0065	
E303		BATTERY CLIP ASSY: Ind Radio pt no. 2A0066	
E304		CLIP, FEMALE: part of BATTERY CLIP ASSY, United Carr Fastener pt no. BS12209, Ind Radio part no. 21X842	
E305		CLIP, MALE: part of BATTERY CLIP ASSY, United Carr Fastener pt no. BS12303, Ind Radio pt no. 21X841	
E306		COVER, RADIO SET: Ind Radio pt no. 18C001	
H101		TOOL, PLUG-IN EXTRACTOR: Spring steel, dim. per Ind Radio dwg 90B001, Ind Radio pt no. 2B0115	Depress spring clip for removing plug-in units
J101		CONNECTOR, RECEPTACLE, ELECTRICAL: 1 contact, 1 mating end, Ind Radio pt no. 21A220	Receives antenna plug
J102		CONNECTOR, RECEPTACLE, ELECTRICAL: 4 contacts, 1 mating end, (mfd by Amphenol pt no. 91-PC4F) Ind Radio pt no. 21A72	Receives mike
L101		COIL, RF: Ind Radio pt no. 98A001	RF choke in plate circuit of V103 and V102.
L102		Same as L101	RF choke in plate circuit of V101
LS201		LOUDSPEAKER: 3 in. dia in 3 in. sq frame, 3.2 ohm at 400 cycle voice coil, Oakton Industries pt no. S-3124, Ind Radio pt no. 76A001	Produces audio output
MK101		MICROPHONE: Carbon, with press-to-talk switch, Ind Radio pt no. 50B001 (mfd by Turner Co. pt no. 9004)	Develops audio voltage for modulation
P101		CONNECTOR, PLUG, ELECTRICAL: 4 contacts, Ind Radio pt no. 55A001 (mfd by Amphenol pt no. 91-MPF4S	Plugs W101 into printed circuit board
P102		Not Used	
P103		CONNECTOR, PLUG, ELECTRICAL: 4 contacts, 1 mating end, (mfd by Turner Co. pt no. BS3231)	Part of W102
P201		CONNECTOR, PLUG, ELECTRICAL: 3 contacts, Ind Radio pt no. 55A003 (mfd by Amphenol pt no. 91-MPF3S)	Connects volume control to printed circuit board

TABLE 7-1. RADIO SET AN/PRC-40, MAINTENANCE PARTS LIST (CONT)

REF DES	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
P202		Same as P201	Connects squelch cont to printed circuit board
P203		Same as P101	Plugs W203 into printed circuit board
P204		CONNECTOR, PLUG, ELECTRICAL: 1 contact, 1 mating end, Cinch Mfg Corp pt no. 13269, Ind Radio pt no. 21A970	Connects W204 into printed circuit board
P301		CONNECTOR, PLUG, ELECTRICAL: 5 contacts, 1 mating end, Amphenol pt no. 91-MPF5S, Ind Radio pt no. 55A002	Connects DC voltage to circuit
P302		CONNECTOR, PLUG, ELECTRICAL: 2 contacts, 1 mating end, Cinch pt no. 2744, Ind Radio pt no. 21A139	Connects 1-1/2 volt battery to circuit
R101		RESISTOR, FIXED, COMPOSITION: 1000 ohm ±10%, 1/2 w, RC20GF102K per MIL-R-11, Ind Radio pt no. 64A257	Screen dropping resistor for V101
R102		RESISTOR, FIXED, COMPOSITION: 47 K ±10%, 1/2 W, RC20GF473K per MIL-R-11, Ind Radio pt no. 64A262	Grid bias resistor for V102 and V103
R103		RESISTOR, FIXED, COMPOSITION: 2700 ohm ±10%, 1/2 w, RC20GF272K per MIL-R-11, Ind Radio pt no. 64A258	Screen dropping resistor for V102
R104		Same as R103	Screen dropping resistor for V103
R105		Not used	
R106		RESISTOR, FIXED, COMPOSITION: 100K ±10%, 1/2 w, RC20GF104K per MIL-R-11, Ind Radio pt no. 64A263	Grid bias resistor for V101 and test point voltage divider
R107		RESISTOR, FIXED, COMPOSITION: 1 Meg ±10%, 1/2 w, RC20GF105K per MIL-R-11, Ind Radio pt no. 64A267	Grid bias resistor for V101
R108		RESISTOR, FIXED COMPOSITION: 10K ±10%, 1/2 w, RC20GF103K per MIL-R-11, Ind Radio pt no. 64A260	Grid bias resistor for V102 and V103, and test point voltage divider
R201		RESISTOR, VARIABLE W/SWITCH: 10 K ±20%, 1/2 W Ind Radio pt no. 56A001 (mfd by Centralab)	Volume control and dpst on-off switch
R202		RESISTOR, VARIABLE, LINEAR TAPER: 10 K ±20%, 1/2 W, Centralab pt no. BA11, Ind Radio pt no. 56A002	Squelch control
TB101		TERMINAL BOARD AND BRACKET: Including terminals, Ind Radio pt no. 2B0039	Supports and connects Driver and Final Amplifiers in Z108
T101		TRANSFORMER, RF: Ind Radio pt no. 26A00004-26A00003	Couples V101 driver to output
T102		TRANSFORMER, RF: Ind Radio pt no. 26A00002-26A00001	Plate tank circuit of push-pull output
V101		ELECTRON TUBE: Sub miniature type, Raytheon pt no. CK6526, Ind Radio pt no. 83A903	RF Driver and doubler

TABLE 7-1. RADIO SET AN/PRC-40, MAINTENANCE PARTS LIST (CONT)

REF DES	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
V102		Same as V101	Transmitter push-pull output
V103		Same as V101	Transmitter push-pull output
W101		CABLE ASSEMBLY, TELEPHONE: 4 cond, 6 in. lg, both ends stripped and tinned, Belden Wire Co pt no. 8444 in bulk, Ind Radio pt no. 19A001	Cabling from mike receptacle to printed circuit board
W102		CABLE ASSEMBLY, TELEPHONE: Retractable, including connector, (mfd by Turner Co. pt no. B9041A)	Cable and connector for microphone
W103		CABLE ASSEMBLY, TELEPHONE: Retractable, excluding connector, (mfd by Turner Co. pt no. DS2008-3)	Part of W102
W201		CABLE ASSEMBLY, SPECIAL PURPOSE: 3 cond, 4 in. lg, both ends stripped and tinned, Belden Wire Co pt no. 8735 in bulk, Ind Radio pt no. 19A004	Cabling from the volume control to the printed circuit board
W202		CABLE ASSEMBLY, SPECIAL PURPOSE: 3 cond, 7-1/2 in. lg, both ends stripped and tinned, Belden Wire Co pt no. 8735 in bulk, Ind Radio pt no. 19A005	Cabling from the squelch control to the printed circuit board
W203		CABLE ASSEMBLY, SPECIAL PURPOSE: 4 cond, 12-1/2 in. lg both ends stripped and tinned, Belden Wire Co pt no. 8444 in bulk, Ind Radio pt no. 19A003	Cabling from on-off switch to printed circuit board
W204		CABLE ASSEMBLY, TELEPHONE: 2 cond, 4-1/2 in. lg, both ends stripped and tinned, Belden Wire Co pt no. 8411 in bulk, Ind Radio pt no. 19A002	Cabling from LS201 to printed circuit board
W301		CABLE ASSEMBLY, POWER, ELECTRICAL: 5 cond, incl fittings, Ind Radio pt no. 2B0052	Cabling from batteries to printed circuit board
Y101		CRYSTAL: 11.0 to 13.0 MC frequency, HC-6/U holder, Ind Radio pt no. 107A001	Frequency control for transmitter oscillator
Y201		CRYSTAL: Frequency range 41.0 MC to 48.0 MC, 3rd overtone type, HC-6/U holder, Ind Radio pt no. 107A003	Oscillator for high frequency mixer
Y202		CRYSTAL: 8200.000 KC frequency HC-6/U holder, Ind Radio pt no. 107A002	Oscillator for low frequency mixer
Z101		PLUG-IN UNIT, OSCILLATOR: 10.8 to 12.8 MC frequency range, 15 VDC input power required, without controlling crystal, Ind Radio pt no. 2B0012	Developes basic RF signal for transmitter
Z102		PLUG-IN UNIT, DEVIATION CONTROL: 15 VDC power required, Ind Radio pt no. 2B0013	Audio input
Z103		PLUG-IN UNIT, PHASE MODULATOR: 15 VDC power required, Ind Radio pt no. 106A001 (mfd by General Electric Co.)	Produces Phase modulation of Z101 output
Z104		PLUG-IN UNIT, AMPLIFIER OSCILLATOR: 10.8 MC to 12.8 MC frequency range, 15 VDC power required, Ind Radio pt no. 2B0014	Amplifies
Z105		PLUG-IN UNIT, TRIPLER: 10.8 to 12.8 MC input frequency, 32.5 to 38.5 MC output frequency, 15 VDC power required, Ind Radio pt no. 2B0015	Multiplies RF output of Z104

TABLE 7-1. RADIO SET AN/PRC-40, MAINTENANCE PARTS LIST (CONT)

REF DES	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
Z106		PLUG-IN UNIT, AMPLIFIER, TRIPLER: 32.5 to 38.5 MC frequency range, 15 VDC power required, Ind Radio pt no. 2B0016	Amplifies RF output of tripler Z105
Z107		PLUG-IN UNIT, DOUBLER: 32.5 MC to 38.5 MC input frequency, 65 to 77 MC output frequency, 150 V power required, Ind Radio pt no. 2B0017	Multiplies RF output of Z106 by two
Z108		PLUG-IN UNIT, FINAL TANK AND DRIVER: Driver and push-pull output, complete unsealed plug-in unit, Ind Radio pt no. 2C0076	Multiplies by two and amplifies RF output of Z107
Z109		PLUG-IN UNIT, RELAY, SOLENOID: Contact arrangement 1A2C. Ref Dwg Group 4, actuates on 15 VDC Ind Radio pt no. 2B0019	Transmit-receive switching relay
Z201		PLUG-IN UNIT, ANTENNA: 130 to 156 MC frequency range, 15 VDC power required, 10 DB gain, Ind Radio pt no. 2B0001	Antenna input, RF amplifier
Z202		PLUG-IN UNIT, AMPLIFIER, RADIO FREQUENCY: 130 to 156 MC frequency range, 15 VDC power required, 10 DB gain, Ind Radio pt no. 2B0002	RF amplifier
Z203		PLUG-IN UNIT, MIXER: 130 to 156 MC input frequency, 15 VDC power required, -6 DB conversion gain, Ind Radio pt no. 2B0003	First mixer for high IF
Z204		PLUG-IN UNIT, MULTIPLIER AND OSCILLATOR, HI FREQUENCY: 41.0 to 48.0 MC input frequency, 123.0 to 144 MC output frequency, 0.25 V injection voltage, crystal not included, Ind Radio pt no. 2B0004	Provides high frequency beat signal for first mixer
Z205		PLUG-IN UNIT, FILTER, 8.5 MC: 8.5 MC input and output frequency, 6 DB insertion loss, Ind Radio pt no. 2B0005	Couples 8.5 MC output of first mixer to second mixer and attenuates image frequency
Z206		PLUG-IN UNIT, MIXER AND OSCILLATOR, LOW FREQUENCY: 8.5 MC frequency input, 300 KC frequency output, 15 VDC power required, Ind Radio pt no. 2B0006	Develops low IF
Z207		PLUG-IN UNIT, FILTER, 300 KC: 300 KC input and output frequency, 6 DB insertion loss, Ind Radio pt no. 2B0007	Provides selectivity for low IF and couples 300 KC signal from second mixer to IF amplifier
Z208		PLUG-IN UNIT, 300 KC AMPLIFIER: 300 KC input and output frequency, 90 DB gain, Ind Radio pt no. 2B0008	Amplifies Z207 output signal
Z209		PLUG-IN UNIT, DISCRIMINATOR AND LIMITERS: 300 KC input frequency, AF output frequency, 15 VDC power required, Ind Radio pt no. 2B0009	Removes AM from signal and changes IF to AF
Z210		PLUG-IN UNIT, AUDIO AMPLIFIER: Class A driver, 25 MV input sensitivity, and 500 MW class B push-pull power output, Ind Radio pt no. 2B0010	Drives speaker
Z211		PLUG-IN UNIT, SQUELCH: 30 DB noise gain, 15 VDC power required, Ind Radio pt no. 2B0011	Provides cutoff bias for audio driver in Z210 when no signal is present

TABLE 7-2. LIST OF MANUFACTURERS

ABBREVIATION	NAME	ADDRESS
Amphenol	Amphenol Electronics Corp.	Chicago, Illinois
	Belden Wire Co.	Chicago, Illinois
Buhrke Mfg. Co.	Buhrke, R. H., Co.	Chicago, Illinois
Burgess	Burgess Battery Co.	Freeport, Illinois
Centralab Co.	Centralab Division of Globe Union Inc.	Milwaukee, Wisconsin
Cinch	Cinch Manufacturing Corp.	Chicago, Illinois
	Davies, Harry, Co.	Chicago, Illinois
	General Electric Co.	Schenectady, N.Y.
Ind. Radio	Industrial Radio Corp.	Chicago, Illinois
Kellogg	Kellogg Switchboard and Supply Co.	Chicago, Illinois
	Oaktron Industries	Monroe, Wisconsin
	Palnut Co., The	Irvington, New Jersey
	Peerless Products Industries	Chicago, Illinois
	Radio Material Corp.	Chicago, Illinois
	Radio Cores Inc.	Oak Lawn, Illinois
Raytheon	Raytheon Mfg Co., Receiving Tube Division	Newton, Mass.
	Stallion Industries	Chicago, Illinois
	Switchcraft Inc.	Chicago, Illinois
	Turner Co.	Cedar Rapids, Iowa
	United Carr Fastener Corp.	Chicago, Illinois

TEMPORARY CORRECTION T-1 TO TECHNICAL MANUAL FOR
RADIO SET AN/PRC-40 NAVSHIPS 93339

The purpose of this temporary correction is to correct errors made in the original publication dated 14 May 1959.

Make the following pen and ink corrections. Insert this temporary correction in the technical manual immediately after the front cover.

PAGE NO.	CHANGE IN EFFECT	PARA TABLE-STEP FIG.	LINE COLUMN LOCATION	ACTION
1-1	Orig.	1-2	1	Add "BT306" on line below BT305.
1-1	Orig.	1-2	2	Add "Burgess" on line with BT306.
1-1	Orig.	1-2	3	Add "2D" on line with "BT306 Burgess".
1-1	Orig.	1-2	4	Add "1.5V" on line with "BT306 Burgess 2D".
2-1	Orig.	2-2.c.(5)	3	Change "battery" to "batteries".
4-2	Orig.	4-3.d.	6	Delete "Z202".
4-4	Orig.	4-3.o. pt 2	10	Insert "and Q2" after "by Q1".
4-4	Orig.	4-4.a. pt 1	9	Insert a comma and then "C6" after C5.
4-5	Orig.	4-4.i. pt 2	5	Change "pin 11" to "pin 6".
4-5	Orig.	4-4.i. pt 2	13	Change "pin 6" to "pin 11".
5-2	Orig.	5-1	upper left	Change A5 to A6.
5-2	Orig.	5-1	upper left	Change A6 to A5.
5-7	Orig.	5-2, 2	3	Change "+1.5 VDC" to "+15 VDC".
5-7	Orig.	5-2, 2	3	Change "+2.5 VDC" to "+50 VDC". Delete last sentence starting with "Depress".
5-7	Orig.	5-2, 2	4	Change "+1.5 VDC" to "15 VDC".
5-8	Orig.	5-3, 5	3	Change "pin 6" to "pin 8".
6-2	Orig.	6-2, 2	3	Change "pin 8" to "pin 6".
6-2	Orig.	6-2, 5	3	Change "pin 8" to "pin 6".
7-1	Orig.	7-1, 5.1	1	Add "BT306" after "BT305".
7-1	Orig.	7-1, 5.1	3	Add "Same as BT303" on line with BT306.
7-1	Orig.	7-1, 5.1	4	Add "Same as BT303" on line with BT306.
7-3	Orig.	7-1, 14	3	Change "Same as L101" to "Not used".
7-3	Orig.	7-1, 14	4	Delete "RF choke in plate circuit of V101".
7-4	Orig.	7-1, 5.1	1	Add "P303" on line below P302.
7-4	Orig.	7-1, 5.1	3	Add "Same as P302" on line with P303.

PAGE NO.	CHANGE IN EFFECT	PARA TABLE-STEP FIG.	LINE COLUMN LOCATION	ACTION
7-4	Orig.	7-1, 7	3	Change "47 K" to "10 K", "RC20GF473K" to "RC20GF103K" and "64A262" to "64A260".
7-4	Orig.	7-1, 8	3	Change "2700" to "270", "RC20GF272K" to "RC20GF271K" and "64A258" to "64A975".
7-4	Orig.	7-1, 11	3	Change "100K" to "47K", "RC20GF104K" to "RC20GF473K" and "64A263" to "64A262".
7-4	Orig.	7-1, 12	3	Change "1 Meg" to "470 K", "RC20GF105K" to "RC20GF474K" and "64A267" to "64A266".

Make appropriate entries on Correction Page.

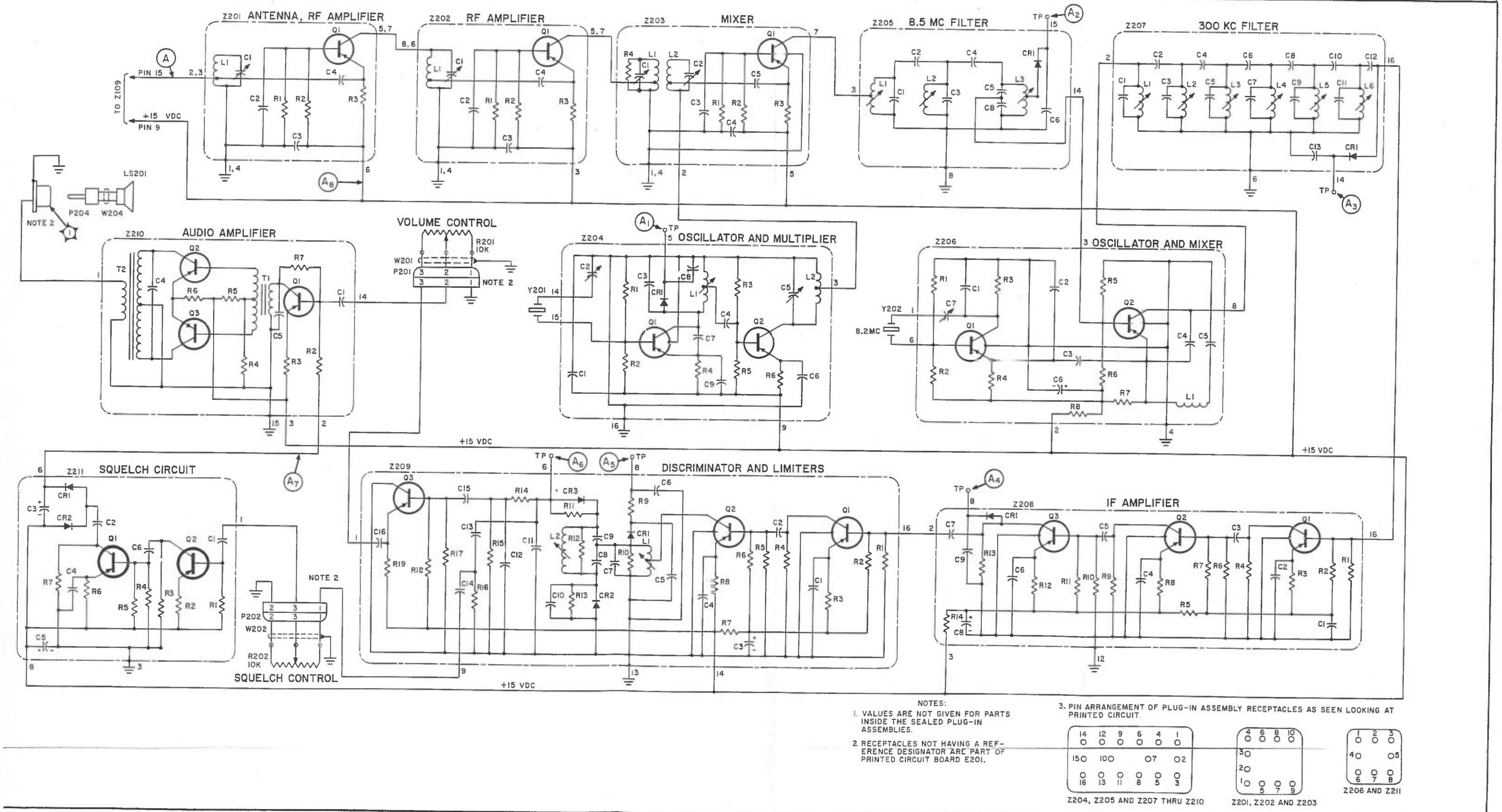


Figure 6-1. Radio Set AN/PRC-40, Receiver, Schematic Diagram

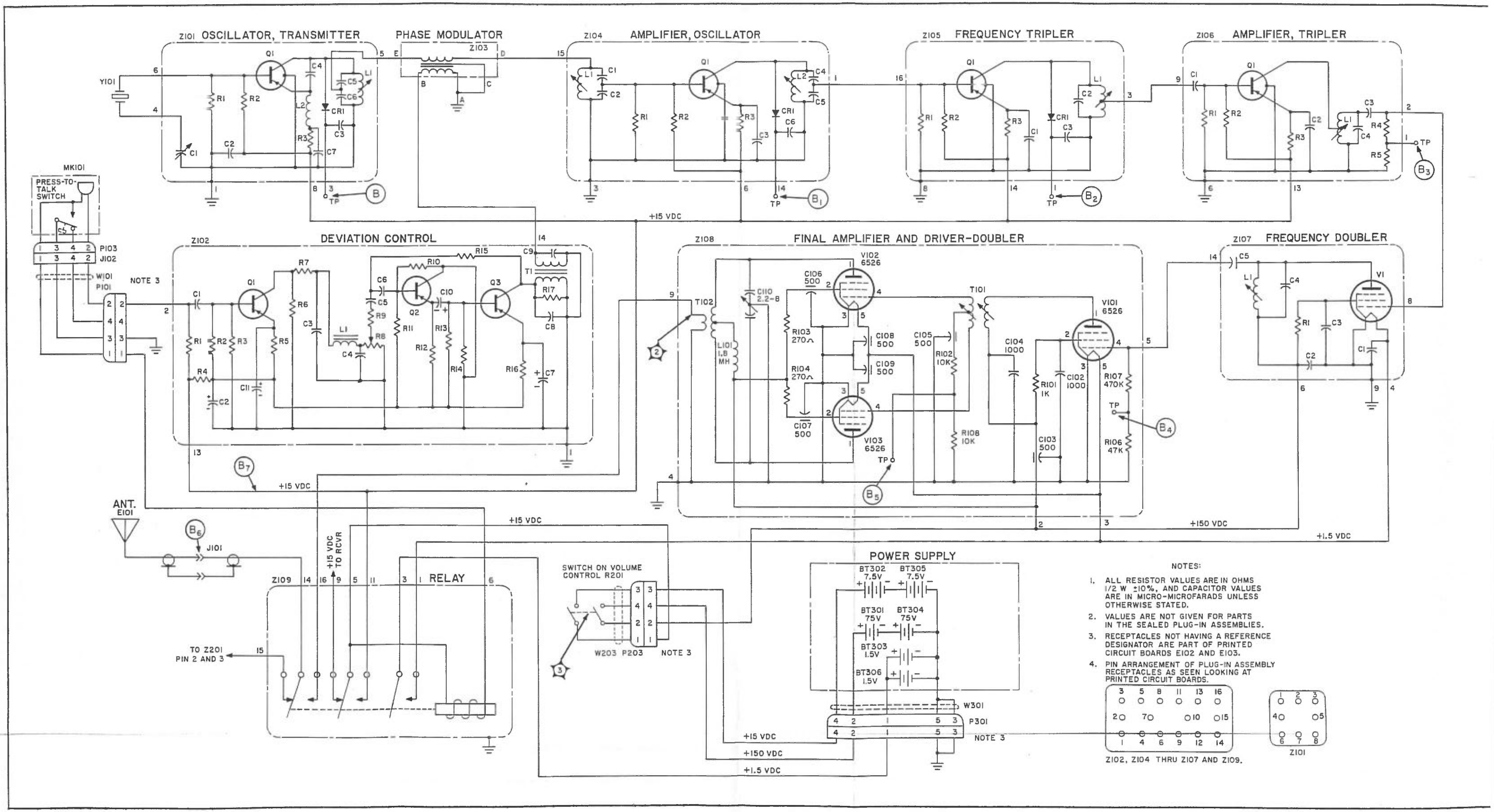


Figure 6-2. Radio Set AN/PRC-40, Transmitter, Schematic Diagram