SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. PURPOSE OF HANDBOOK.

1-2. This handbook provides service instructions for Radio Set AN/ARC-39, manufactured by Aircraft Radio Corporation, Boonton, New Jersey. (See figure 1-1.) The units of the radio set are as follows:

Qty per Installation	*Name*	*AN Type Designation*
1	Receiver-Transmitter	RT-427/ARC-30
1	Radio Set Control	C-2241 'ARC-39
1	Mounting	MT-605A APR-9

1-3. PURPOSE OF EQUIPMENT.

1-4. Radio Set AN/ARC-39 transmits and receives voice-modulated signals on any one of 12 preset channels in the 2.0 to 9.1 frequency range. Provision is made for remote operation.

1-5. OPERATING LIMITATIONS.

1-6. Radio Set AN ARC-39 operates satisfactorily at altitudes up to 25,000 feet, at temperatures between −55°C (−67°F) and +55°C (+131°F), and in relative humidity in excess of 95 percent.

1-7. FUNCTIONAL OPERATION OF EQUIPMENT.

1-8. Radio Set AN ARC-39 provides 12 preset operating channels. The desired operating channel is selected by a channel selector switch on the radio set control or on the receiver-transmitter. A retuner assembly in the receiver-transmitter automatically sets the receiver, transmitter, and antenna tuner circuits to operate on the frequency of the selected channel.

1-9. During transmission, the voice-modulated r-f signal from the transmitter is fed to the antenna through an antenna relay. For receiving, the antenna relay switches the antenna to the receiver terminals. The incoming signals are detected and the receiver output is fed to to the operator's headset. A gain control on the front panel of the radio set control controls the audio output level. Further details on the theory of operation of Radio Set AN/ARC-39 are given in Section IV.

1-10. LEADING PARTICULARS.

1-11. The leading particulars of Radio Set AN/ARC-39 are listed in table 1-1.

TABLE 1-1. LEADING PARTICULARS FOR RADIO SET AN/ARC-39

ELECTRICAL CHARACTERISTICS	
Frequency Range	2.0—9.1 mc covered in two bands as follows: Low Band: 2.0—4.270 mc in 6 preset crystal-controlled channels High Band: 4.270—9.1 mc in 6 preset crystal-controlled channels
Frequency Stability	Maximum frequency drift after 15 minute warm-up time is ±.01% of operating frequency
R-f Power Output	10 watts minimum into 10-ohm, 100 uuf load at all frequencies
Modulation	100% amplitude modulation, with modulation peak clipping adjustable from 0 to 15 db
Receiver Sensitivity	5 microvolts or better for 6 db S+N/N ratio at all frequencies
Receiver Audio Output	200 milliwatts with 1000-microvolt input signal, modulated 30% with 1000-cps sine wave, 800 milliwatts maximum
Receiver Bandwidth	8 kc at 6 db down points. Shape factor less than 3.5 (ratio of 60 db to 6 db bandwidth)
Input Power	28 volts dc, 9 amperes max
Tuning	Channel switch permits automatic selection and tuning of any of 12 preset receiver and transmitter channels

TABLE 1-1. LEADING PARTICULARS FOR RADIO SET AN/ARC-39 (Cont)

MECHANICAL CHARACTERISTICS				
Unit	*Overall Dimensions*			
	Weight (lb)	*Height (in.)*	*Width (in.)*	*Length (in.)*
Receiver-Transmitter	36.25	7-3/4	10-1/4	21-3/4
Mounting	2.75	2-3/4	11	22-5/8
Radio Set Control	1.0	2-1/2	5-3/4	3-1/2

1-12. ELECTRON TUBE COMPLEMENT.

1-13. Only the receiver-transmitter contains electron tubes. The quantities, types, and functions of these tubes are listed in table 1-2. The panel lamps in the control unit are also listed in this table.

1-14. EQUIPMENT SUPPLIED.

1-15. The equipment supplied with Radio Set AN/ARC-39 consists of Receiver-Transmitter RT-427/ARC-39, Radio Set Control C-2241/ARC-39, and Mounting MT-605A/APR-9.

1-16. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-17. The equipment required for operation of Radio Set AN/ARC-39, but which is not supplied, is listed in table 1-3. Note that no specific cable assembly for sup-

TABLE 1-2. ELECTRON TUBE AND LAMP COMPLEMENT

Quantity	*Type*	*Function*
1	5749/6BA6W	R-f amplifier
1	5749/6BA6W	1st i-f amplifier
1	5749/6BA6W	2nd i-f amplifier
1	5749/6BA6W	Transmitter oscillator
1	5750/6BE6W	Mixer
1	5814WA	Detector and noise limiter
1	5814WA	AGC amplifier and 1st audio amplifier
1	5814WA	1st speech amplifier
1	5814WA	Audio clipper
1	5686	2nd audio amplifier
1	5686	Power amplifier driver
1	5686	Power amplifier protective clamp
1	12AT7WA	Receiver oscillator cathode follower
1	12AT7WA	2nd speech amplifier and phase splitter
1	6159	Power amplifier
2	6159	Modulator
1	OB2WA	Modulator screen voltage dropping
2	GE#327	Control unit panel lamp

TABLE 1-3. EQUIPMENT REQUIRED BUT NOT SUPPLIED

Quantity per Installation	*Name*	*AN Type Designation*	*Characteristics*
1	Antenna		Fixed or trailing wire
1	Headset	H-1/AR	———
1	Microphone	M-3A/UR	———
1	Cable		Four No. 18 and 14 No. 22 wires (per Military Specification MIL-W-5086) length as required
1	Connector, Plug, Electrical	AN3106A-22-14S	———
1	Connector, Plug, Electrical	AN3106A-20-27S	———
2	Clamp	AN3057-12	———
1	D-C Power Source		28 volts, 9 amperes
1	Jack Box	J-502/ARC	Equivalent to Aircraft Radio Corp. Type J-10
12	Crystal, Quartz	CR-18/U	For transmitter. Frequencies to be specified by using activity; six frequencies to be in 2.0 to 4.270 mc range; six frequencies to be in 4.270 to 9.10 mc range.
12	Crystal, Quartz	CR-18/U	For receiver. Each crystal for frequency 750 kc higher than frequency of corresponding channel.

SECTION III

PREPARATION FOR USE AND RESHIPMENT

3-1. UNCRATING THE EQUIPMENT.

3-2. The components of Radio Set AN/ARC-39 are packed in cartons, and shipped in a steel-strapped crate. To unpack the equipment, proceed as follows:

a. Cut the metal bands encircling the crate and use a nail puller to remove the nails fastening top boards.

b. Lift out the inner cartons, slit the gummed tape seal, and remove the components. Be careful not to damage the controls or connectors.

c. Check the equipment against the packing list and the list of equipment supplied in paragraph 1-15.

d. Inspect the equipment carefully for any mechanical damage.

e. Examine the electron tubes, checking for secure mounting and for physical damage.

f. Save all packing material and cartons for use when repacking the equipment for shipment or storage.

3-3. PREPARING THE EQUIPMENT FOR USE.

3-4. Except for fabrication of the required length of interconnecting cable, installation of crystals, and presetting to the operating frequencies, no special procedures are involved in preparation of the equipment for use.

3-5. CABLE FABRICATION.

3-6. The cable assembly is fabricated in the field, as none is supplied with Radio Set AN/ARC-39. Cable fabrication instructions are outlined and illustrated in figure 3-1, and cable plug wiring is illustrated in figure 7-3. Length of the cable assembly will depend on the location of the equipment in the aircraft in which it is installed.

3-7. INSTALLING THE EQUIPMENT.

3-8. GENERAL. The location and installation of the equipment will depend on the aircraft in which the equipment is to be installed. Refer to the applicable aircraft maintenance handbook for specific instructions; however, observe the following points during installation:

a. Locate the radio set control at the operator's position with the controls readily accessible to facilitate operation.

b. Locate the receiver-transmitter as near as possible to the antenna feed-through insulator; the antenna lead-in should not be more than two feet long. Allow at least two feet between antenna lead-in and any cable or aircraft wiring.

c. Mount the receiver-transmitter so that it will be within 20 degrees of horizontal when the aircraft is in level flight.

d. Allow sufficient clearance on all sides of the receiver-transmitter for sway and ventilation, and enough space in front to permit easy removal.

e. Allow space in front of the receiver-transmitter and in back of the radio set control for cable connections. Leave sufficient slack in the cable so as not to restrict shock-mount travel of the receiver-transmitter, and to prevent cable strain.

f. Do not make sharp bends in the interconnecting cable.

g. Do not run the cable where it may be subjected to excessively high temperatures such as may exist near heaters or engine exhausts.

h. Anchor the cable securely.

i. Ground the receiver-transmitter to the aircraft skin by means of the four ground straps. (Refer to step b. of paragraph 3-9.)

3-9. MOUNTING THE RECEIVER-TRANSMITTER. The receiver-transmitter is mounted in the aircraft as follows:

a. Fasten Mounting MT-605A/APR-9 to its location in the aircraft with sixteen No. 10 binding head machine screws and nuts, using lockwashers under the nuts to prevent them from loosening under vibration. Locate the mounting as close as possible to the antenna feed-through insulator.

b. Secure the four ground straps on the underside of the mounting base to the clean bare metal of the aircraft, using No. 10 binding head screws.

c. Slide the receiver-transmitter into the mounting until the positioning holes located at the rear of the receiver-transmitter chassis mate with the corresponding positioning pins on the mounting.

d. Secure the receiver-transmitter in place by tightening the two clamp nuts on the front of the mounting.

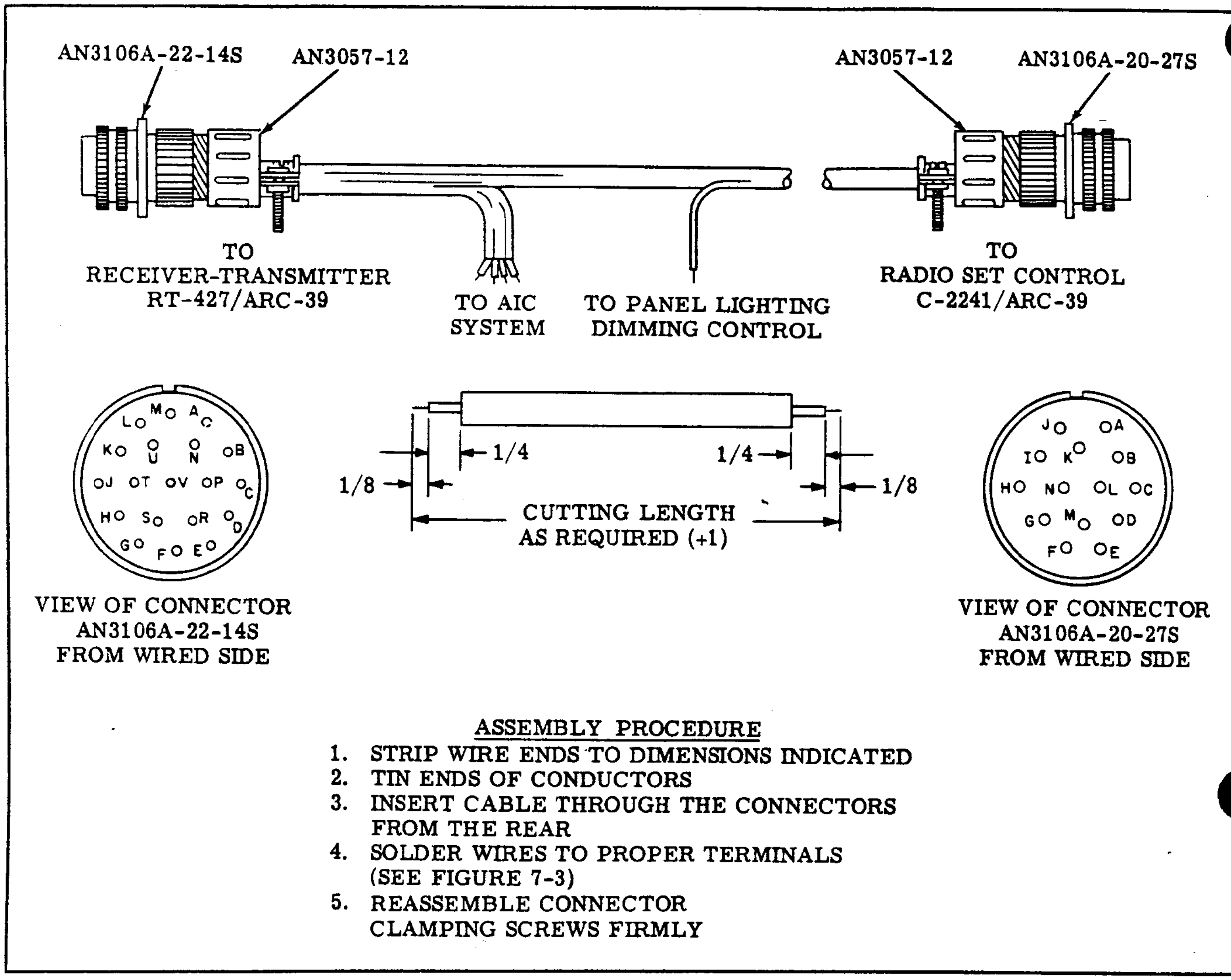


Figure 3-1. Cable Fabrication Diagram

3-10. MOUNTING THE RADIO SET CONTROL. Secure the radio set control to the instrument panel by turning the four Dzus fasteners on the front panel clockwise.

3-11. CABLING BETWEEN COMPONENTS. A single cable connects the receiver-transmitter and the radio set control. Attach connector AN3106A-22-14S to the receptacle marked J101 on the front panel of the receiver-transmitter. Attach connector AN3106A-20-27S at the other end of the cable to the receptacle on the rear of the radio set control. Observe the precautions outlined in paragraph 3-8. For cable fabrication instructions, refer to figures 3-1 and 7-3.

3-12. CHECKING THE COMPLETE INSTALLATION. After installation is completed, and before applying power to Radio Set AN/ARC-39, make the following checks:

a. Check that all cables are connected and that all connectors are tightened securely.

b. Examine all units to see that they are secure in their mountings.

c. Examine all shock mounts and ground connections and make sure they are secure.

3-13. ADJUSTMENTS AFTER INSTALLATION. After the installation of Radio Set AN/ARC-39 has been completed, preset the receiver-transmitter to the desired operating frequencies. There are four basic steps in the presetting procedure: crystal selection and installation, tuning the transmitter and receiver, matching the antenna to the transmitter, and resonating the receiver to the antenna.

3-14. PRELIMINARY INSTRUCTIONS. Perform the following steps before presetting the channels:

a. Connect microphone M-3A/UR to the MIC jack on the front panel of the receiver-transmitter.

b. Connect a headset to the TEL jack.

c. Connect the antenna to the ANT binding post.

d. Pull out the local-remote lever in the center of the CHANNEL selector knob of the radio set control to transfer channel selection control to the receiver-transmitter.

e. Apply power to the radio set by rotating the VOL control on the radio set control clockwise.

3-15. CRYSTAL SELECTION AND INSTALLATION. All crystals are mounted on panel Z109 of retuner Z112, which is accessible upon removal of the rectangular cover located on the front panel of the receiver-transmitter. The receiver-transmitter requires two crystals for each channel: one crystal for the transmitter and one for the receiver, making a total of 24 crystals. The transmitter crystals are marked with the channel frequency and are plugged into the upper row of crystal sockets. Each receiver crystal is 750 kc higher in frequency than the corresponding transmitter crystal. The receiver crystals are placed in the lower row of sockets. Do not interchange transmitter and receiver crystals since this will result in operation on separate, and wrong, frequencies. Crystal sockets for channels 1 through 6 are for channel frequencies of from 2.0 to 4.27 mc, and crystal sockets for channels 7 through 12 are for channel frequencies of from 4.27 to 9.1 mc. The procedure for inserting the crystals is as follows:

a. Remove the crystal compartment cover on retuner Z112 by loosening the two knurled attaching screws.

b. Insert the transmitter crystals into the upper row of crystal sockets. Make sure that the correct frequency crystal is plugged into the assigned channel crystal socket.

c. Insert the corresponding receiver crystals into the lower row of crystal sockets. Make sure that for a given channel, the receiver crystal is 750 kc higher than the corresponding transmitter crystal.

d. Replace the crystal compartment cover and tighten the two attaching screws.

3-16. CHANNEL TUNING AND PRESETTING. The channels of the receiver-transmitter are preset to the operating frequencies as follows:

a. Lock the ANT FINE, ANT TAP, PA LOAD, and TUNING controls on the front panel of the receiver-transmitter by turning their LOCK knobs fully clockwise. Then select any channel with the LOCAL SELECTOR knob on the front panel. These two steps ensure that the retuner will reset all tuned circuits.

b. Select the channel corresponding to the highest-frequency crystal in the low band (channels 1 through 6) by rotating the LOCAL SELECTOR knob. Unlock the ANT FINE, ANT TAP, PA LOAD, and TUNING controls by rotating their LOCK knobs counterclockwise.

c. Rotate the TUNING control to the center-of-noise peak as heard in the headset. If two noise peaks are heard, select the lower-frequency peak. Check that the TUNING dial reading for this peak agrees with the channel frequency.

d. Rotate the CH. 1-6 knob of the coaxial REC ANT control until the signal or noise heard through the earphones is at a maximum. Then readjust the TUNING control to center it on the noise peak.

e. Lock the TUNING control, set the PA LOAD control to 1, and set the G-K-A meter switch to G.

f. Press the microphone switch and keep it pressed during steps g. through f. Note the panel meter reading. The meter, which now indicates the power amplifier grid current, should read between 80 and 200.

g. Turn the G-K-A meter switch to K. The meter should now indicate less than 40 ma. If neither of these readings is obtained, the most probable causes of trouble are: either one of the two crystals is wrong in frequency, or the transmitter and receiver crystals are interchanged.

h. Set the PA LOAD and ANT FINE controls to 5. Rotate the ANT TAP control to the position which shows a rise in the meter reading. Leave the ANT TAP control in this position. Then adjust the ANT FINE control for a maximum reading, keeping the meter reading under 100 by simultaneously adjusting the PA LOAD control. If the ANT FINE control comes up against either end stop before a maximum is reached, try an adjacent position on either side of the one originally selected on the ANT TAP control and repeat this step.

i. When the peak has been found with the ANT FINE control, rotate the PA LOAD control until a meter reading of 100 is secured. If it is not possible to load up to 100 ma on some channels, use the maximum loading obtainable. This should be at least 80 ma.

Note

The ANT FINE control must always be tuned for maximum meter reading; it should never be used as a loading control.

j. Turn the G-K-A meter switch to A and note that a reading is obtained. Lock the PA LOAD, ANT FINE, and ANT TAP controls.

k. Release the microphone switch. The transmitter and receiver circuits are now alined to the highest channel frequency in the low band and resonated with the antenna. No further adjustment of the REC ANT trimmer is required to any other channel in the low band.

l. Check that all controls are locked, then select the remaining channels in the low band in turn with the LOCAL SELECTOR switch and, at each channel, repeat steps a. through l., omitting step d. of this procedure.

m. With the low-band channels preset, select the channel corresponding to the highest-frequency crystal in the high band (channels 7 through 12) by rotating the LOCAL SELECTOR switch. Unlock all controls.

n. Repeat step c. of this procedure. Then rotate the CH. 7-12 knob of the coaxial REC ANT control until the signal or noise heard through the earphones is at a maximum.

o. Repeat steps f. through l. of this procedure. The transmitter and receiver circuits are now alined to the highest channel frequency in the high band and resonated with the antenna. No further adjustment of the REC ANT trimmer is required for any other channel in the high band.

p. Lock all controls, then select the remaining channels in the high band in turn with the LOCAL SELECTOR switch and, at each channel, repeat steps f. through l. of this procedure.

q. The channel selecting mechanism is now preset. To check the channel selection and tuning, select each channel in turn with the LOCAL SELECTOR switch and note the meter readings for each of the three meter switch positions. G should read from 80 to 200, K should read 100, and A should read from 1 to 200.

CAUTION

If any control was left unlocked during channel selection, it will be necessary to reset that control as described in steps a. through m. of this procedure.

s. Restore control of channel selection to the radio set control by pushing in the local-remote lever on the CHANNEL selector knob.

3-17. SIDETONE LEVEL CHECK. Plug the microphone and headset into the aircraft AIC jack box, press the microphone switch and speak into the microphone. While speaking, check that the sidetone level produced in the headset is satisfactory. The sidetone level can be increased by clockwise rotation of the SIDE TONE adjustment located on the front panel of the receiver-transmitter.

3-18. OPERATIONAL CHECK. If possible, establish communication on at least one operational channel in each band. Adjust the receiver output level as desired with the VOL control on the radio set control. The LOCAL TEL control on the front panel of the receiver-transmitter adjusts the sound level heard in the headset when it is plugged into the TEL jack of the receiver-transmitter but does not affect the output level of the receiver to the AIC box.

3-19. PREPARING THE EQUIPMENT FOR SHIPMENT OR STORAGE.

3-20. After the equipment has been removed from its installation, repack it in the original cartons, reversing the procedure outlined in paragraph 3-2. If the original cartons are not available, the repacking procedure will depend upon the materials available, and the conditions under which the equipment is to be shipped. A procedure similar to that described below may be followed.

a. Place the receiver-transmitter in a corrugated carton having a cushioning liner, and place a cushioning pad on top of the unit. Allow sufficient clearance to prevent damage to the operating controls. Seal the carton with packing tape.

b. Wrap the radio set control in tissue paper and pack in a small cardboard box. Place cushioning material around the radio set control. Seal the box with packing tape.

c. Cushion the mounting base with corrugated cardboard, place it in a flat corrugated box, and seal the box with tape.

d. Place all three boxed units within an outer corrugated carton. Place cushioning material around and between the inner boxes to prevent movement. Seal all edges and corners of the outer carton with packing tape.

SECTION IV
THEORY OF OPERATION

4-1. GENERAL SYSTEM OPERATION.

4-2. INTRODUCTION. Radio Set AN/ARC-39 consists of two major operating units: Receiver-Transmitter RT-427/ARC-39 and Radio Set Control C-2241/ARC-39. The general theory of operation of these two units is described in the block diagram analysis of paragraphs 4-3 through 4-7. Detailed theory of operation of all sections of these units is described in paragraphs 4-8 through 4-71.

4-3. BLOCK DIAGRAM ANALYSIS. During reception an input signal from the antenna is applied to the preselector in the receiver-transmitter through the antenna relay. (See figure 4-1.) The preselector amplifies the signal and mixes it with the output of a local crystal-controlled oscillator (the receiver oscillator) to produce an i-f signal at 750 kc. The i-f output of the preselector is then amplified by the first and second i-f amplifiers and applied to the second detector where it is demodulated to produce an audio signal. The second detector output is filtered and amplified by an agc amplifier whose output is then applied to the r-f amplifier and mixer in the preselector and to the first i-f amplifier. The agc action maintains the audio output of the receiver at a constant level in spite of fluctuations in signal strength. The second detector audio output is also applied to a noise limiter to remove any noise on the audio signal. The noise-free audio is then amplified by the first and second audio amplifiers and applied to the operator's headset. The audio level to the headset is adjusted by a volume control in the radio set control.

4-4. During transmission, the antenna relay switches the antenna to the output of the antenna tuner. The transmitter signal is generated by a crystal-controlled oscillator, whose output is amplified at the signal frequency by the r-f driver and the r-f power amplifier to raise the signal to the desired output power level. A protective clamp tube prevents excessive overload currents from damaging the power amplifier should excitation from the driver stage fail.

4-5. The voice signal from the microphone is amplified and fed through an audio peak clipper and a filter to clip the voltage peaks from the audio signal and restrict the audio bandwidth. The filtered audio signal is then amplified again and passed through a phase splitter to the push-pull class AB_1 modulator that impresses the audio output signal upon the output of the r-f power amplifier.

4-6. The retuner automatically tunes the receiver and transmitter circuits to preset positions when the channel selector switch on the radio set control, or on the retuner itself, is turned to that channel. It switches the circuit for high- or low-band operation, selects the proper crystals, and resets the tuning capacitors to resonate the circuits at the desired frequencies. It also sets the controls that match the transmitter to the antenna characteristics.

4-7. The power supply for Radio Set AN/ARC-39 is a built-in dual output voltage dynamotor which operates off the +28-volt d-c input. Application of power is controlled by a power switch on the radio set control. During transmission, the output windings deliver high voltage and bias voltage for operating the tubes in the transmitter. During reception, a relay connects the dynamotor to deliver a reduced output voltage for the receiver. The relay that performs the switching operates when the push-to-talk switch on the microphone is pressed.

4-8. FUNCTIONAL OPERATION OF RADIO SET AN/ARC-39.

4-9. GENERAL. Radio Set AN/ARC-39 consists of two units: the receiver-transmitter and the radio set control. The receiver-transmitter has two major sections: a receiver section and a transmitter section. The receiver is basically a seven-tube superheterodyne circuit divided physically into two assemblies: a preselector and an i-f and audio assembly. The transmitter is divided into an r-f assembly, a modulator providing 100 percent plate modulation, and an antenna tuner assembly. The radio set control contains a volume control and power on-off switch assembly, a channel selector switch, and remote-local operation switch. The operation of both units is discussed in the following paragraphs.

4-10. As shown in figure 4-2, the signal enters the receiver through antenna relay K101, which is unenergized during reception. A short length of coaxial cable W101 connects the output of the antenna relay to the input of the receiver. The relay consists partly of a single-pole, double-throw vacuum switch S113 operated by an external solenoid. During transmission, the relay connects the output of the transmitter to the antenna, while simultaneously, additional contacts S114 and S115, also operated by the solenoid, ground the receiver input and the range receiver (RANGE REC) antenna post. A low-pass filter consisting of L101 and C101 permits the receiver section of the receiver-transmitter to operate simultaneously from a common antenna with a type

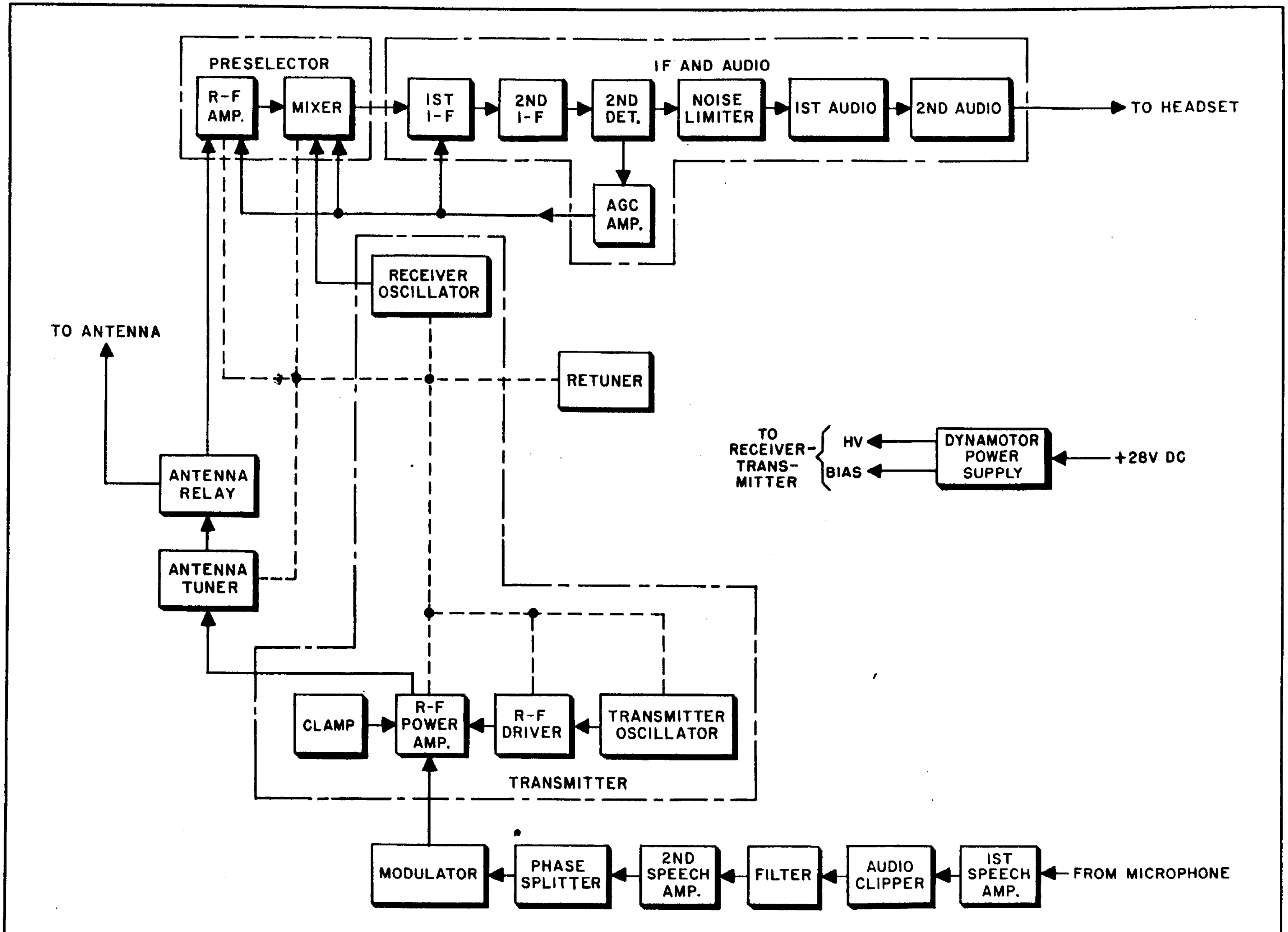
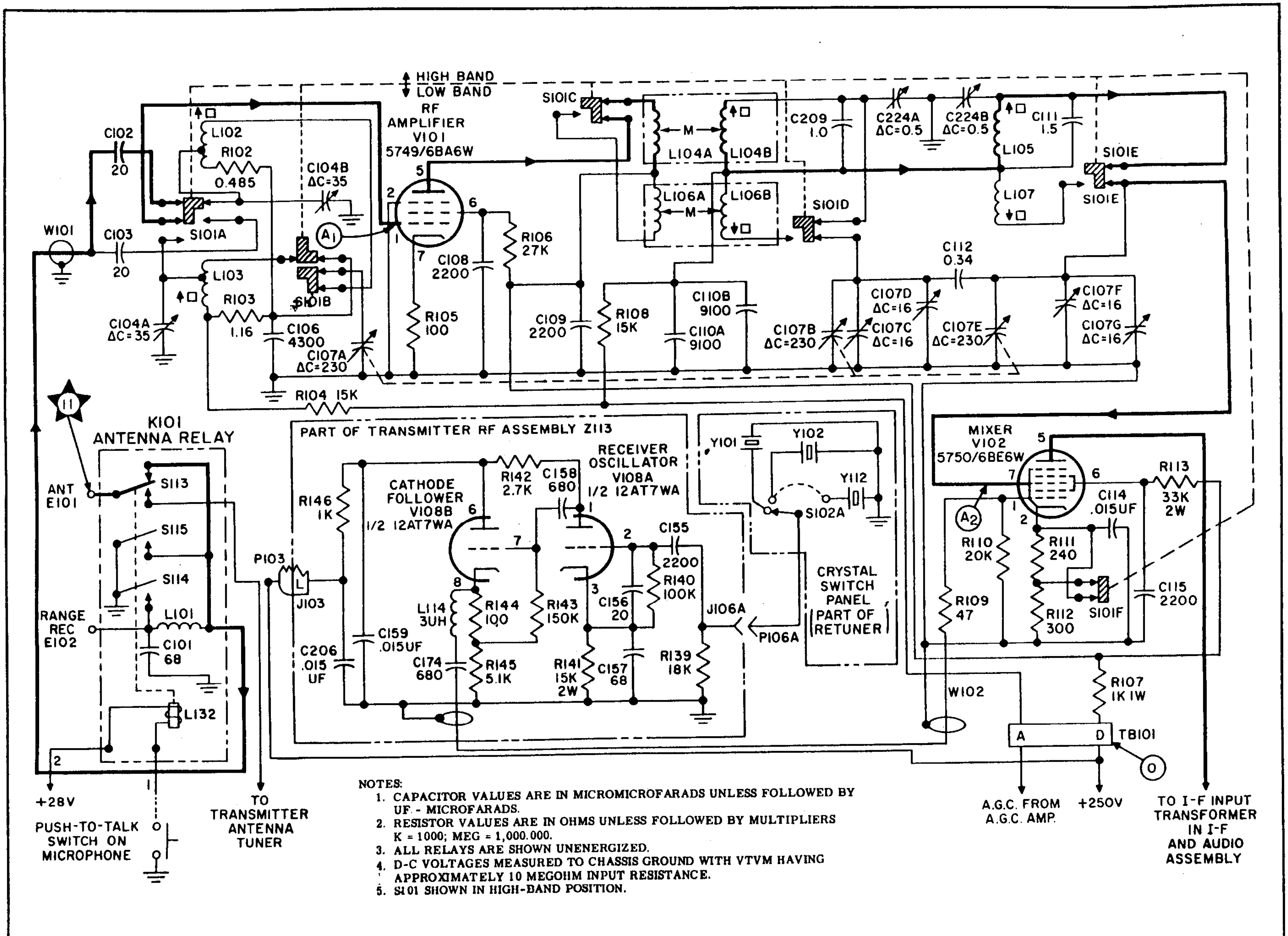


Figure 4-1. Radio Set AN/ARC-39, Block Diagram



NOTES:
1. CAPACITOR VALUES ARE IN MICROMICROFARADS UNLESS FOLLOWED BY UF - MICROFARADS.
2. RESISTOR VALUES ARE IN OHMS UNLESS FOLLOWED BY MULTIPLIERS K = 1000; MEG = 1,000,000.
3. ALL RELAYS ARE SHOWN UNENERGIZED.
4. D-C VOLTAGES MEASURED TO CHASSIS GROUND WITH VTVM HAVING APPROXIMATELY 10 MEGOHM INPUT RESISTANCE.
5. S101 SHOWN IN HIGH-BAND POSITION.

Figure 4-2. Preselector Schematic Diagram

R-23/ARC-5 range receiver, or with one having an equivalent input circuit.

4-11. PRESELECTOR. The r-f amplifier V101 and mixer V102 are grouped together in a preselector assembly. The signal from the antenna is coupled to the grid circuit of V101 through band switch S101 (shown in the high-band position). Section S101A switches the antenna from the high- to the low-band circuit; section S101B switches main tuning capacitor C107A and, when in the high-band position, short circuits the low-band antenna coil to avoid signal absorption. The high-band and low-band components for the r-f amplifier input circuit are as follows:

High Band	*Low Band*	*Function*
C102	C103	Antenna input capacitor
C104B	C104A	Antenna trimmer capacitor
L102	L103	Antenna input coil
R102	R103	Antenna circuit damping resistor

4-12. R-f amplifier V101 amplifies the input signal and applies its output to L104A, the untuned primary of high-band r-f transformer L104, which induces an r-f voltage across tuned secondary winding L104B. Antenna and r-f output circuit tuning is provided by sections A and B, respectively, of capacitor C107. The output of V101 is applied to low-band transformer L106 if operation on that band is desired. As shown in figure 4-3, the bottom end of L104B connects to the bottom end of L105. The r-f voltage appears across parallel coupling capacitors C110A and C110B, and is developed across L105. A small amount of additional coupling is also supplied by capacitor C112. The voltage appearing across L105 is then applied to the signal grid of mixer V102.

4-13. The r-f signal across the tuned grid circuit is fed into the No. 3 grid of the mixer tube, while at the same time an r-f voltage from the receiver oscillator is applied to the No. 1 grid. The receiver oscillator output is 750 kc higher in frequency than the input signal. These two signals combine to produce the 750-kc i-f signal, which is applied to the primary of the i-f input transformer.

4-14. RECEIVER OSCILLATOR. To keep the leads between the tube and the crystal socket as short as possible, the receiver oscillator V108 is mounted on the transmitter r-f assembly at the front of the chassis. The receiver-oscillator tube is a dual triode, with section V108A connected in a modified Pierce crystal-oscillator circuit. The desired crystal is selected by crystal switch S102A, which is geared to the channel selector in the retuner. The amount of feedback required to maintain oscillation is determined by the ratio of capacitors C156 and C157.

4-15. The output of the crystal oscillator is applied to cathode follower V108B. The cathode follower transforms the high impedance output of the crystal oscillator to a low impedance to permit use of shielded cable W102. The output of the cathode follower is fed through W102 to the No. 1 grid of mixer V102.

4-16. I-F AND AUDIO ASSEMBLY. The i-f and audio sections of the receiver (figure 4-4) are all contained in an assembly mounted on the main chassis of the receiver-transmitter. The output of mixer V102 is connected to Z101, the input transformer of the i-f amplifier, through jack J105, located on the front of the assembly chassis.

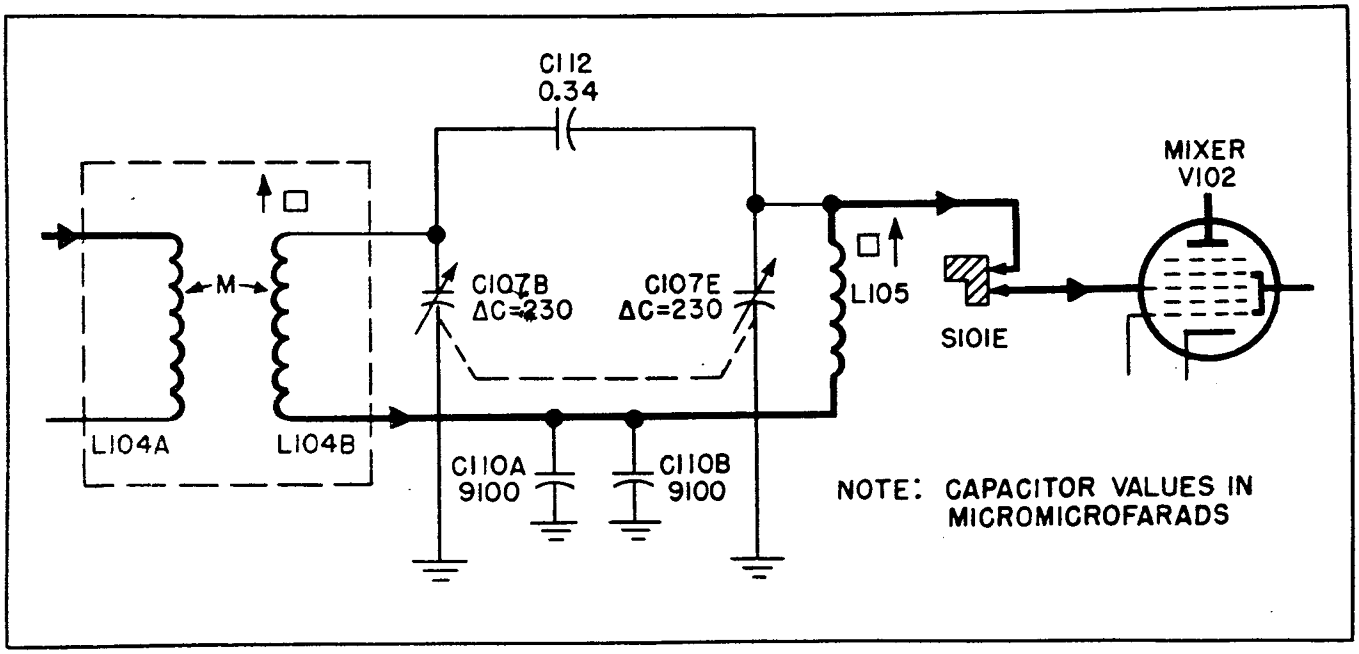


Figure 4-3. Preselector Coupling Circuit, Simplified Schematic Diagram

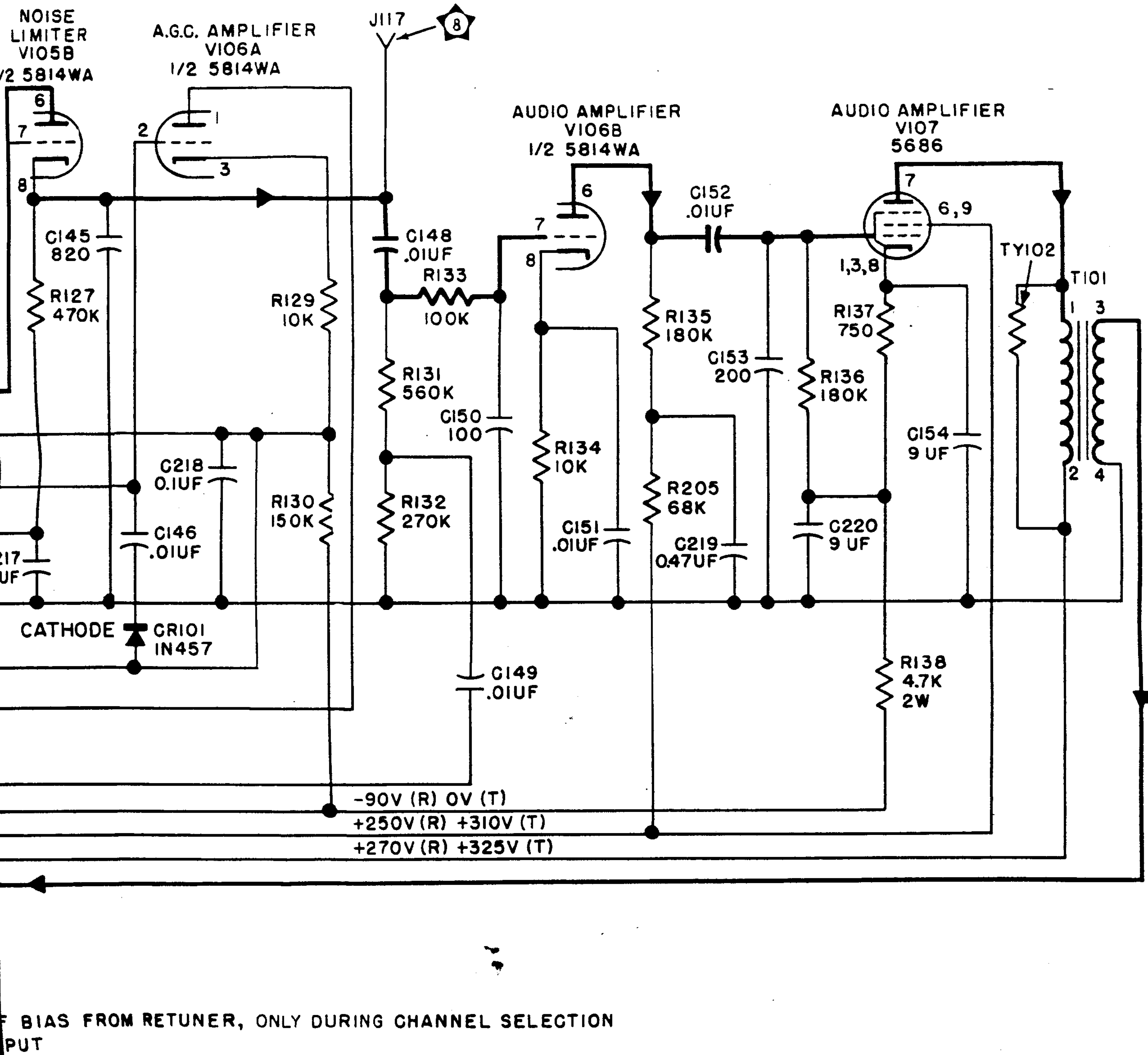
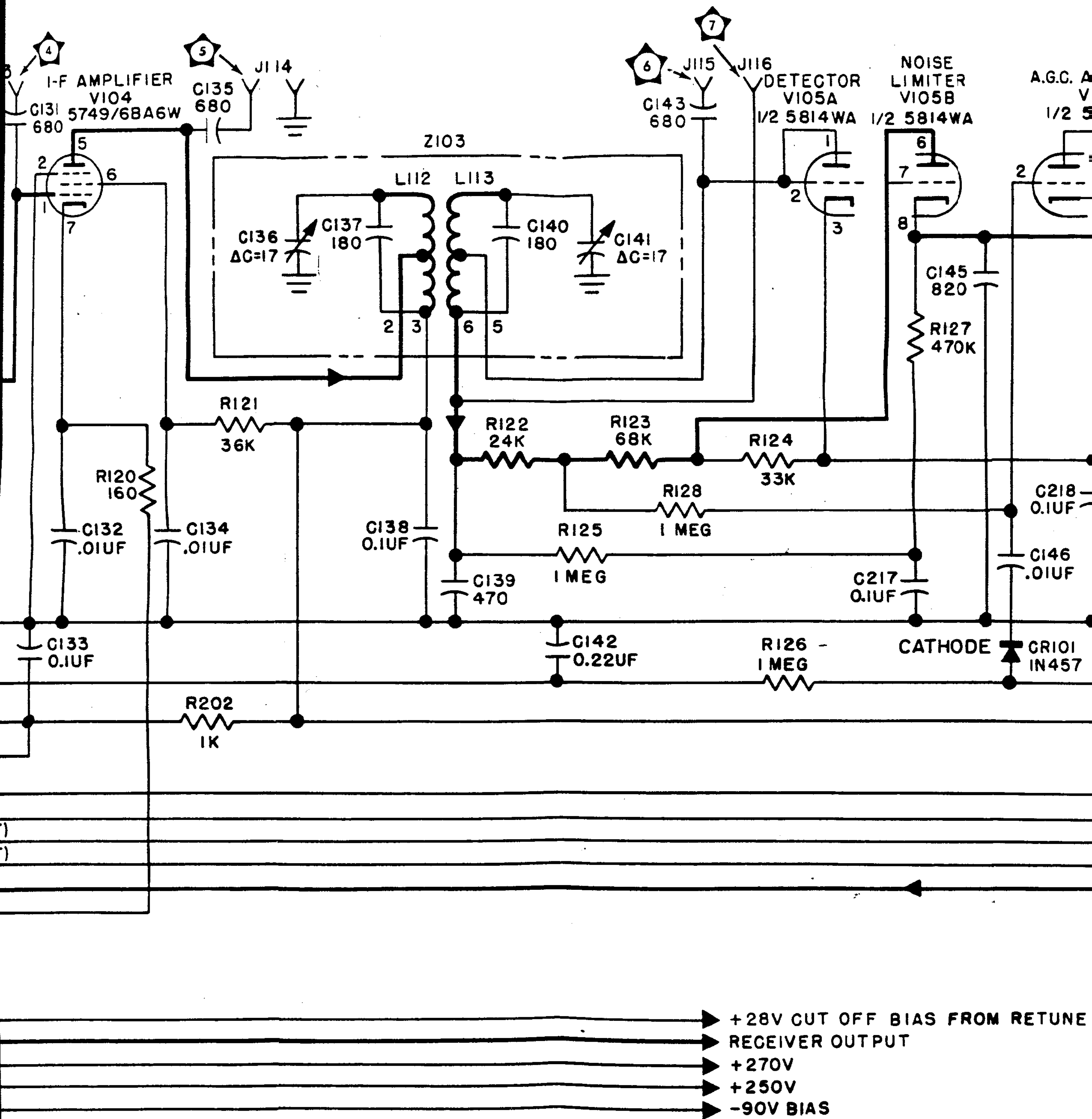
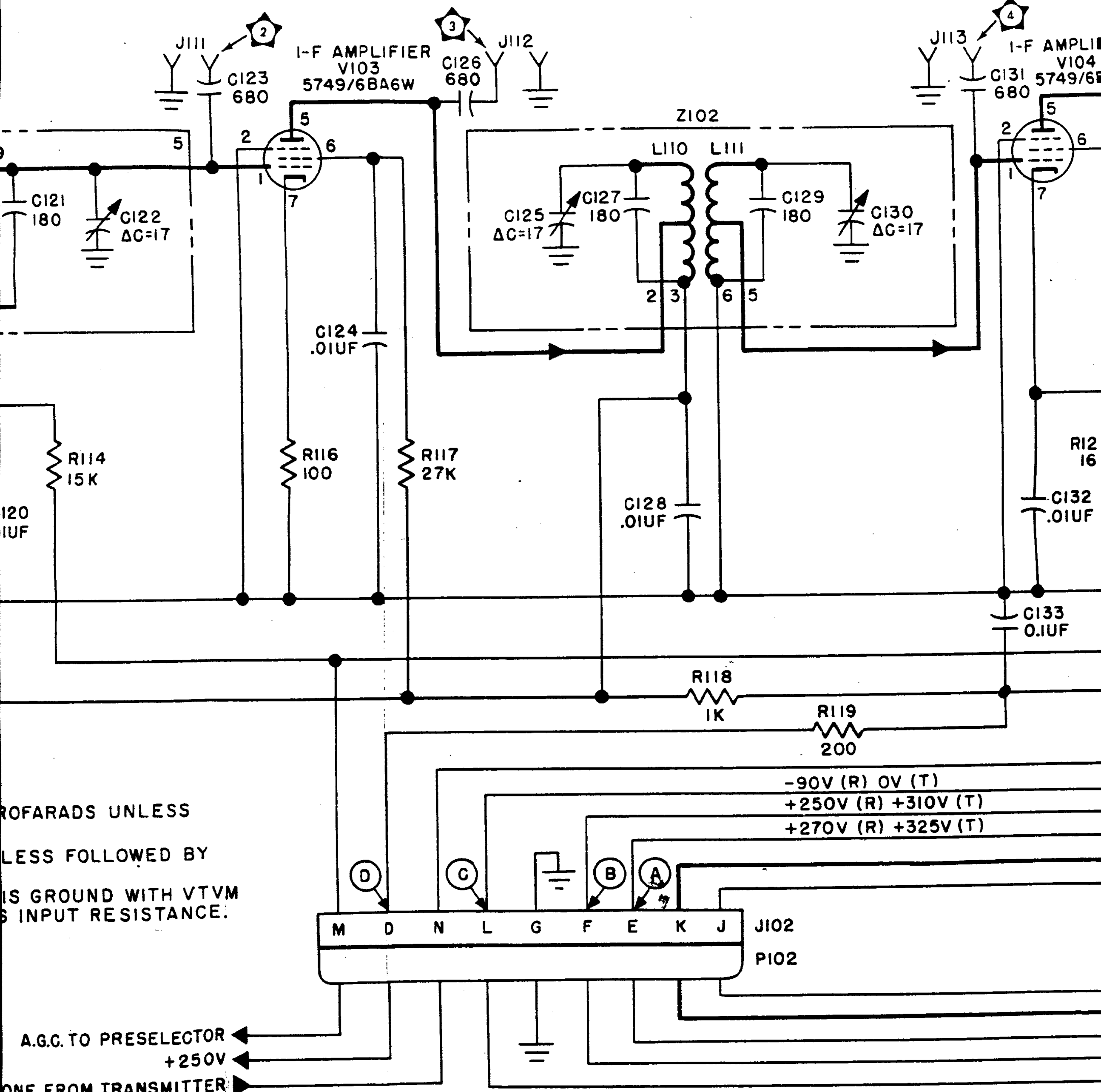


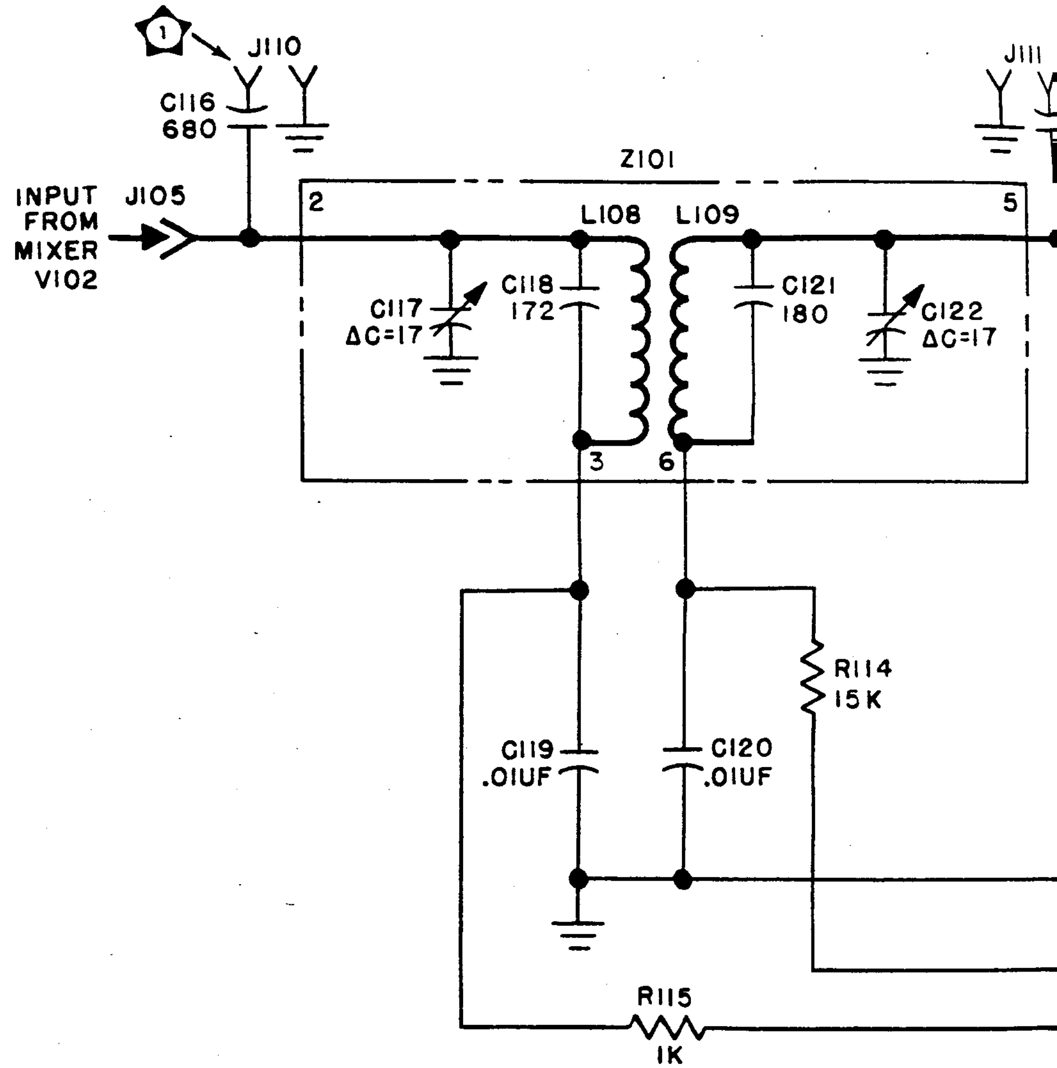
Figure 4-4. I-F and Audio Assembly, Schematic Diagram



I-F AMPLIFIER
V104
5749/6BA6W
C131
680
C135
680
J114
Z103
L112
L113
C136
ΔC=17
C137
180
C140
180
C141
ΔC=17
C143
680
J115
J116
DETECTOR
V105A
1/2 5814WA
NOISE
LIMITER
V105B
1/2 5814WA
A.G.C.
1/2
R121
36K
R120
160
C132
.01UF
C134
.01UF
C138
0.1UF
R122
24K
R123
68K
R124
33K
R128
1 MEG
R125
1 MEG
C139
470
C145
820
R127
470K
C217
0.1UF
C218
0.1UF
C146
.01UF
C133
0.1UF
C142
0.22UF
R126
1 MEG
CATHODE
CR101
IN457
R202
1K
+28V CUT OFF BIAS FROM RETUNE
RECEIVER OUTPUT
+270V
+250V
-90V BIAS



J111
C123
680
I-F AMPLIFIER
V103
5749/6BA6W
C126
680
J112
J113
I-F AMPLI
V104
5749/6
C131
680
Z102
L110
L111
C121
180
C122
ΔC=17
C125
ΔC=17
C127
180
C129
180
C130
ΔC=17
C124
.01UF
R114
15K
R116
100
R117
27K
C128
.01UF
120
1UF
R12
16
C132
.01UF
C133
0.1UF
R118
1K
R119
200
-90V (R) 0V (T)
+250V (R) +310V (T)
+270V (R) +325V (T)
ROFARADS UNLESS
LESS FOLLOWED BY
IS GROUND WITH VTVM
INPUT RESISTANCE.
D
C
B
A
M
D
N
L
G
F
E
K
J
J102
P102
A.G.C. TO PRESELECTOR
+250V
ONE FROM TRANSMITTER



NOTES:

1. CAPACITOR VALUES ARE IN MICROMICROFARADS UNLESS FOLLOWED BY UF-MICROFARADS.
2. RESISTOR VALUES ARE IN OHMS, UNLESS FOLLOWED BY K=1000; MEG=1,000,000.
3. D-C VOLTAGES MEASURED TO CHASSIS GROUND WITH VTV HAVING APPROXIMATELY 10 MEGOHMS INPUT RESISTANCE

A.G.C. TO PRESELECTOR

+250V

SIDE TONE FROM TRANSMITTER

4-17. I-F AMPLIFIER. The primary and secondary circuits of the i-f input transformer are tuned to 750 kc, the difference between the signal and oscillator frequencies fed into mixer V102. This 750-kc signal is amplified by first i-f amplifier V103 and coupled through interstage i-f transformer Z102 to second i-f amplifier V104, where it is amplified again. The output of V104 is then transformer-coupled to the plate of second detector V105A through i-f transformer Z103. To mute the receiver during channel selection, +28 volts is applied as cut-off bias to the cathode of V104.

4-18. SECOND DETECTOR. Detector V105A recovers the modulation from the input signal developing its output across load resistors R122, R123, and R124 connected in series between the secondary of i-f transformer Z103 and the cathode of the tube.

4-19. The audio voltage appearing across resistor R124 is applied to the plate of noise limiter V105B. Simultaneously, a portion of the audio voltage at pin 6 of i-f transformer Z103 is filtered by R-C network C139-R125-C217 and applied to the cathode of V105B. This R-C network has a long time-constant causing the d-c voltage applied to the cathode through R127 to be proportional to the average carrier level. During reception, the cathode becomes more negative than the plate and V105B conducts. The audio output voltage developed across R127 is coupled to the input of audio amplifier V106B. Any noise on the input signal is in the form of sharp pulses superimposed on the modulation. These pulses do not affect the average carrier level, and due to the long time-constant of the R-C network, the d-c cathode voltage still follows the carrier level. However, the plate voltage goes more negative than the cathode on the noise peaks. As a result the tube is cut off during each noise peak so that a noise-clipped audio signal is applied to V106B.

4-20. AGC AMPLIFIER. Amplifier V106A provides amplified automatic gain control to preselector tubes V101 and V102 and to i-f amplifier V103. A portion of the output voltage from detector V105A, obtained at the junction R122 and R123, is coupled through R128 to the grid of V106A. Resistor R128 and capacitor C146 filter the audio output voltage so that the voltage applied to V106A follows the average carrier level.

4-21. The agc output voltage is developed across cathode bias resistor R129. Resistor R130 is the load resistor for V106A and is connected between the −90-volt bias lead and resistor R129. When a signal is applied to second detector V105A, a negative voltage is applied to the grid of V106A, causing a negative voltage to appear at the cathode. A portion of this voltage at the junction of R129 and R130 is filtered by R126 and C142 and applied as agc voltage to the controlled tubes, V101, V102, and V103. In the absence of input signal, the agc line voltage tends to rise. Diode CR101 conducts producing a voltage drop across R130 preventing the line voltage from rising above approximately +1 volt. The agc control action is delayed until the strength of the received signal is sufficient to prevent CR101 from conducting, and thus prevents the agc from reducing the gain of the receiver on weak signals.

4-22. AUDIO AMPLIFIER. The output of the noise limiter is amplified by V106B and V107 connected in a conventional audio amplifier circuit. The audio signal is fed into the grid of V106B through capacitor C148. A second input circuit through C149 permits some of the demodulated output carrier voltage to be amplified as a side-tone signal during transmission. Transformer T101 matches the output of V107 to a 300-ohm load impedance.

4-23. Thyrite resistor TY102, connected across the primary of T101, protects the transformer from damage due to switching transients. (Thyrite is a nonlinear resistor whose resistance decreases as the voltage across it increases.)

4-24. TRANSMITTER R-F ASSEMBLY. The transmitter r-f section (figure 4-5) of the receiver-transmitter unit of Radio Set AN/ARC-39 consists of three stages operating at the same frequency. The output frequency is generated by a modified Pierce oscillator, V109. The operating frequency is determined by switching in the appropriate crystal from one of twelve mounted on the crystal switch panel. Switching is automatically accomplished by crystal switch S102B which is geared to the retuner assembly. The oscillator plate circuit is untuned, and the output is coupled to the grid of driver stage V110.

4-25. R-F DRIVER. The driver stage operates in Class C, with bias developed across grid leak resistor R154 and cathode resistor R155. When the transmitter operates in the low band (2.0 to 4.27 mc), coil L116A alone is the plate tank inductance. On the high band (4.27 to 9.1 mc), coil L117 is connected in parallel with L116A to reduce the total circuit inductance. The tank circuit is tuned by main tuning capacitor C169B. Output of the driver is coupled to the grid of power amplifier V112 through parasitic suppressor Z104.

4-26. POWER AMPLIFIER. The power amplifier is a neutralized pentode operating in Class C. The input signal causes grid current to flow through grid resistor R161, producing grid leak bias voltage. The tube output is coupled through parasitic suppressor Z105 to the shunt-fed plate tank circuit. Plate-to-ground voltage to the power amplifier is +325 volts, supplied through the secondary of modulation transformer T103. Since the cathode of V112 is returned to −75 volts, however, the total plate-to-cathode voltage is 400 volts.

4-27. In low-band operation, coil L120A (padded by C179) and tuning capacitor C169D comprise the plate tank circuit. During high-band operation L120A is shunted by L119 to lower the inductance, and padder C179 is removed from the circuit. Tuning capacitor C169C is ganged to C169B for simultaneous tuning of the power amplifier and driver.

4-28. Coil L120A is coupled to the antenna tuner through coupling coil L120B. This coupling coil is located inside L120A. The amount of coupling, and

NOTES:

1. CAPACITOR VALUES ARE IN MICROMICROFARADS UNLESS FOLLOWED BY UF - MICROFARADS.
2. RESISTOR VALUES ARE IN OHMS, UNLESS FOLLOWED BY K = 1000; MEG = 1,000,000.
3. D-C VOLTAGES MEASURED TO GROUND WITH VTVM HAVING APPROXIMATELY 10 MEGOHMS INPUT RESISTANCE.

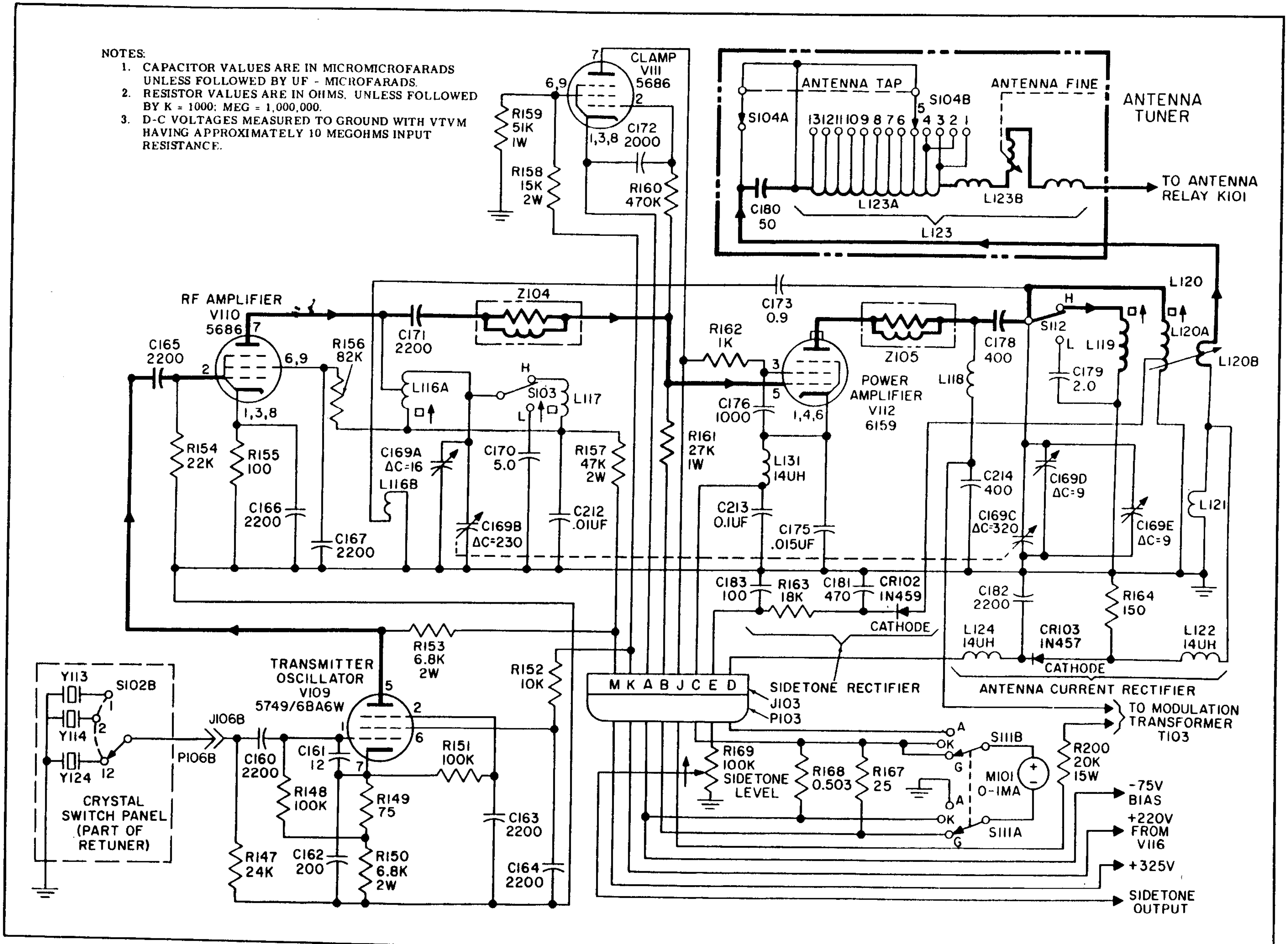


Figure 4-5. Transmitter R-F Assembly and Antenna Tuner, Schematic Diagram

thus the loading on the power amplifier, is adjusted by rotating L120B with the PA LOAD control on the front panel of the receiver-transmitter.

4-29. CLAMP CIRCUIT. Clamp tube V111 protects power amplifier V112 from damage in case r-f excitation fails. As long as excitation is present, the grid-leak bias developed across R161 keeps clamp tube V111 cut off so that it has no effect on circuit operation. If excitation should fail, V111 will draw heavy plate current producing a large voltage drop across screen resistor R200. The power amplifier screen voltage then falls to a very low value, preventing the plate current from rising to a value which might damage the tube.

4-30. METER SWITCH. Meter M101 monitors the power amplifier cathode and grid currents, and indicates the relative r-f output to the antenna. When switch S111 is at position G, M101 is connected across shunt resistor R167 to indicate the amount of grid current flowing through grid-leak resistor R161. At position K, the switch connects M101 across shunt resistor R168 to measure the total cathode current of the power amplifier. Setting S111 to position A connects the meter in series with diode CR103, which rectifies r-f voltage across L121 to provide an indication of antenna current.

4-31. SIDE TONE. A second diode, CR102, also rectifies a small portion of the power amplifier output, obtaining this voltage from a tap at the bottom end of L120A. This rectified voltage is filtered to remove the r-f component and fed to audio amplifier V106B in the receiver section. This signal is the side tone which permits the operator to hear and monitor transmissions. SIDE TONE level control R169 on the front panel of AN/ARC-39 permits adjustment of the side-tone level.

4-32. ANTENNA TUNER. At most frequencies within the tuning range of Radio Set AN/ARC-39, the majority of aircraft antennas are electrically short, presenting a capacitive reactance to the antenna terminal. The antenna tuner (figure 4-5) resonates the antenna by inserting a suitable value of inductance in series with the antenna between the antenna terminal and the r-f tank output coupling coil L120B. The series inductance consists of tapped inductor L123A which provides coarse steps of inductance change, and variometer L123B which provides continuous inductance variation over the small range between the steps on L123A. In those cases where the antenna is too long, as may happen at the higher-frequency end of the tuning range, S104A switches capacitor C180 in series with the antenna inductor L123 to decrease the electrical length of the antenna. Switch section S104B selects the portion of L123A to be used and short circuits the rest of the winding. Capacitor C180 is connected into the circuit by S104A at the lowest two inductance taps on the coil.

4-33. MODULATOR. The transmitter modulator amplifies the audio input signal and impresses this audio upon the r-f carrier output of the power amplifier.

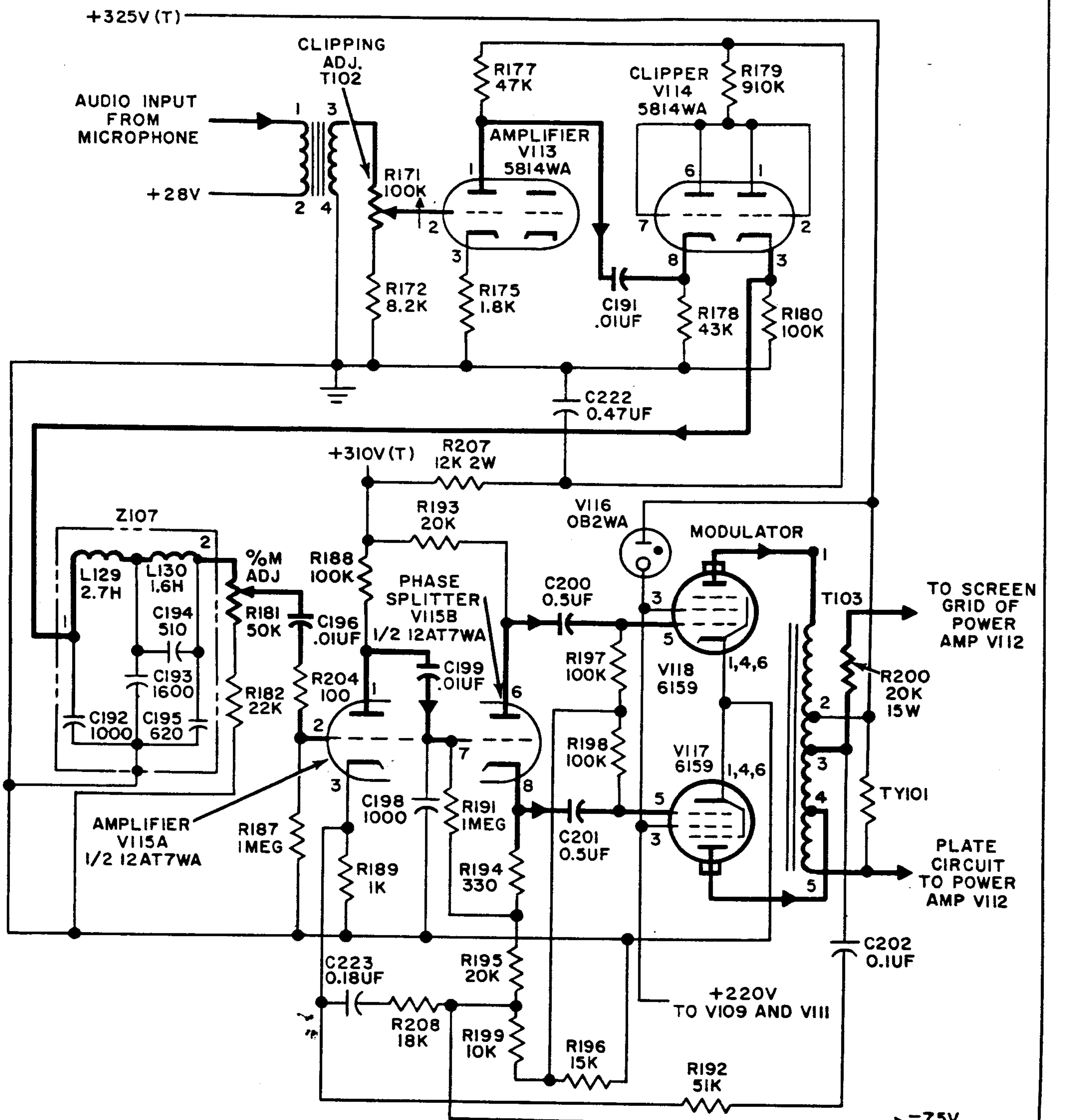
4-34. The transmitter modulator (figure 4-6) uses six tubes. An audio input signal from the microphone is coupled through microphone transformer T102 to the grid of V113. The tube amplifies the signal and couples its output through C191 to clipper tube V114.

4-35. CLIPPER. The clipper operates as follows: with no input signal the voltage at either cathode is approximately the same (about 3 volts) since the equivalent d-c cathode resistances are similar (R178 for V114A; R180 in parallel with series-connected R181 and R182 for V114B). Positive-going peaks of the input signal cause the cathode potential of V114A to rise, but as long as the peaks do not exceed approximately three volts, V114A continues to conduct. The plates of V114A and V114B are connected together and follow the cathode voltage rise; this rise appears across cathode resistor R180 of V114B. If the positive peak exceeds three volts, the cathode of V114A becomes more positive than the plates and that section of the tube stops conducting. Since the plates no longer follow the cathode voltage, the positive peaks are clipped, and this clipped voltage appears across the cathode resistor of V114B.

4-36. The negative peaks of the input signal merely drive the cathode of V114A more negative, and regardless of their amplitude V114A continues to conduct. However, the negative signal reduces the voltage on the plate of V114B, so that when the negative peaks exceed three volts the plate of V114B becomes more negative than the cathode and this tube section stops conducting. The negative peaks are thus clipped. Because both halves of the clipper circuit are symmetrical, both halves of the input signal are clipped equally. By adjusting the level of the signal applied to V113, potentiometer R171 effectively controls the amount the signal is clipped. The clipper output is applied to audio filter Z107.

4-37. AUDIO FILTER. Audio filter Z107 consists of a constant-K filter section terminated in an M-derived half-section, giving a sharp frequency cutoff beginning at 4000 cycles and reaching maximum signal attenuation at 5500 cycles. It thus restricts the upper audio frequency limit to that necessary for speech transmission, thereby eliminating unnecessary sidebands. The filter is particularly important with clipped audio signals, since clipping produces considerable high frequency harmonics of the speech frequencies.

4-38. AUDIO AMPLIFIER AND PHASE SPLITTER MODULATOR. The output of the filter goes to amplifier V115A through %M ADJ control R181 which controls the gain of the modulator (and thus the percentage modulation on the signal). The amplified output is then applied to phase splitter V115B which produces two audio voltages, 180 degrees out-of-phase with each other. These voltages are developed across plate load resistor R193 and cathode load resistors R194 and R195. Returning grid resistor R191 to the junction of R194 and R195, and the bottom end of R195 to the −75-volt bias lead, permits the phase splitter to handle the input signals necessary to produce the audio voltages required to drive the push-pull modulator. Capacitors C200 and C201 provide the coupling for V118 and V117 respectively.



NOTES:
1. CAPACITOR VALUES ARE IN MICROMICROFARADS UNLESS FOLLOWED BY UF-MICROFARADS
2. RESISTOR VALUES ARE IN OHMS UNLESS FOLLOWED BY MULTIPLIER: K=1000; MEG=1,000,000
3. D-C VOLTAGES MEASURED TO CHASSIS GROUND WITH VTVM HAVING APPROXIMATELY 10 MEGOHM INPUT RESISTANCE

Figure 4-6. Modulator, Schematic Diagram

4-39. MODULATOR TUBES. The modulator tubes, V117 and V118 operate in Class AB_1, with fixed bias applied to the grids by voltage divider R196 and R199. The screen grid voltage is maintained at 105 volts below the plate supply voltage by voltage dropping tube V116. This voltage is also supplied to the screen grids of the transmitter oscillator and clamp tube V111. The modulator tubes amplify the audio signal to the required power level, and modulation transformer T103 couples the modulator output to r-f amplifier V112. The modulation transformer is of the autotransformer type, and matches the modulator impedance to the power amplifier impedance for maximum audio power transfer. The audio output from a tap on the transformer winding modulates the screen grid of the power amplifier through R162 and screen dropping resistor R200. This audio output is also used for negative feedback through R192 and C202 to reduce modulator distortion. Thyrite resistor TY101 protects the modulation transformer from damage due to voltage peaks.

4-40. POWER SUPPLY. Heater power for all tubes is obtained from the +28-volt primary power source through dropping resistor R165 (figure 4-7). This insures that all tubes operate at rated heater potential with nominal supply voltage. The heaters are so wired that any tube may be removed from its socket without causing damage to other tubes or parts. Power is connected to the heaters through contacts 6 and 7 of relay K106 when the switch S303 on VOL control R301 is closed.

4-41. The input to the dynamotor passes through filter Z106, which prevents any dynamotor "hash" from feeding back onto the 28-volt supply line. Capacitors C225 and C226 provide r-f filtering. The dynamotor has two output windings: one winding delivering +325 volts and the other delivering −75 volts. The low-voltage winding is permanently connected and has its positive end grounded. During transmission, this winding supplies −75 volts and the high-voltage winding has its negative end grounded through terminals 9 and 10 on relay K105 to deliver +325 volts. During reception, relay K105 connects the two windings in series-opposing, joining the negative end of the high-voltage winding and the negative end of the low-voltage winding. Since the load on the windings is less during reception, the low voltage is −90 volts while the high-voltage output is +360 volts. During reception, therefore, the positive voltage with respect to ground is $360 - 90 = 270$ volts. The dynamotor high-voltage output is filtered by capacitor-input filter C184-L127-C185. Capacitor C188 filters the output of the −75-volt winding.

4-42. The positive dynamotor output voltage at the input side of the filter (junction of C185 and L127) supplies all the tubes in the transmitter r-f section, modulator tubes V117 and V118, and receiver output tube V107. The positive voltage for the remaining tubes in the receiver and modulator, and for the screen grid of the receiver output tube is taken from the output side of the high-voltage filter.

4-43. CONTROL CIRCUITS. Except for channel selection, described in paragraphs 4-48 through 4-71, the operation of the receiver-transmitter is controlled by three relays: K101. K105, and K106 (figure 4-7). Closing switch S303 (on VOL control R301 in the radio set control) completes the energizing circuit for relay K106. The relay closes, applying 28-volt power to the tube filaments and to dynamotor D101.

4-44. During reception, relays K101 and K105 are unenergized. Relay K101 connects the antenna to the input of the receiver. Contacts 10 and 11 on K105 connect the dynamotor windings to deliver +270 and −90 volts while contacts 13 and 14 connect the positive output voltage to the receiver circuits.

4-45. The audio output voltage of the receiver across the secondary of T101 is applied to LOCAL TEL potentiometer R203. It is also fed through contact pair 7-8 of K105 to the arm of VOL control R301 in the radio set control.

4-46. A microphone and push-to-talk key switch are connected from terminals T and J on J101 to ground. When the push-to-talk switch is closed, relays K101 and K105 are energized. Relay K101 switches the antenna to the output of the transmitter and short circuits the receiver antenna terminals. Simultaneously, K105 connects the dynamotor to deliver +325 volts output and switches the supply voltages from the receiver to the transmitter. The transmitter sidetone signal now appears across the secondary of T101 and is applied to terminal 7 of K105. Since K105 is energized, the signal is fed directly to the operator's headset.

4-47. NOISE FILTERS. Several filter circuits have been included in Radio Set AN/ARC-39 to prevent interference with other equipment by the AN/ARC-39 and to reduce its susceptibility to interference entering along the power and signal leads. Capacitors C207, C208, and C211 provide bypassing on those leads subject to interference. R173, R206, C189, and C221 (microphone filter elements), and C223 and R208 (hum-bucking circuit elements) reduce the susceptibility to audio-frequency interference.

4-48. RETUNER. The retuner assembly is the mechanism which automatically positions the circuit elements of the receiver-transmitter to previously determined positions for operation on any particular channel.

4-49. The retuner mechanism consists basically of five parts: a channel selector drum, and four circuit tuning shaft assemblies which are driven by the channel selector drum. The channel selector drum itself is driven by a geared-down motor through a slip clutch. An index pawl, operating in a notched index plate attached to the drum, accurately positions the drum to the desired channel position. There are twelve notches and each notch corresponds to a separate channel. With the drum accurately set, the circuit tuning shaft assemblies are then automatically adjusted to predetermined settings. A crystal switch geared to the selector drum selects the crystal for the desired channel.

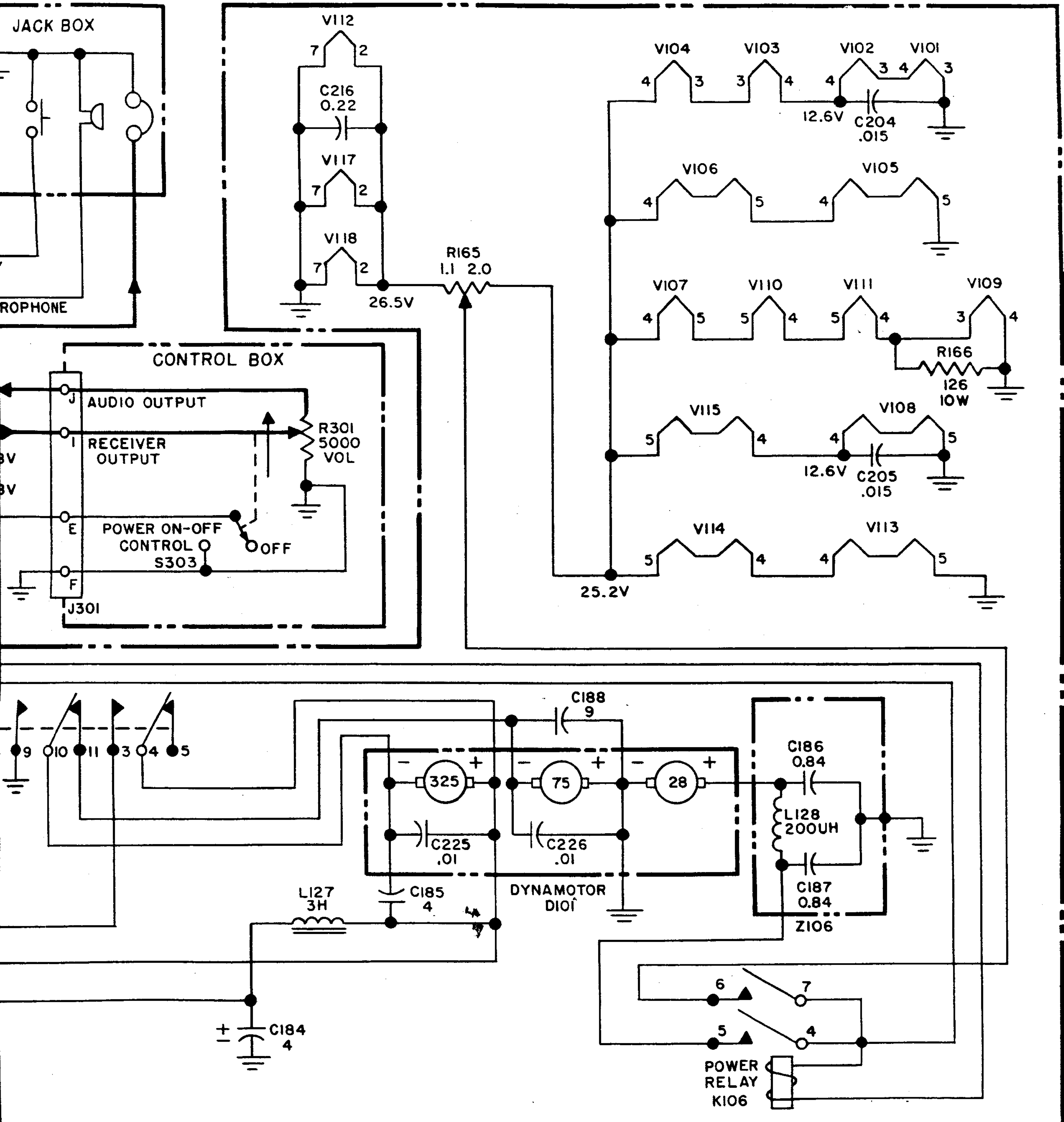
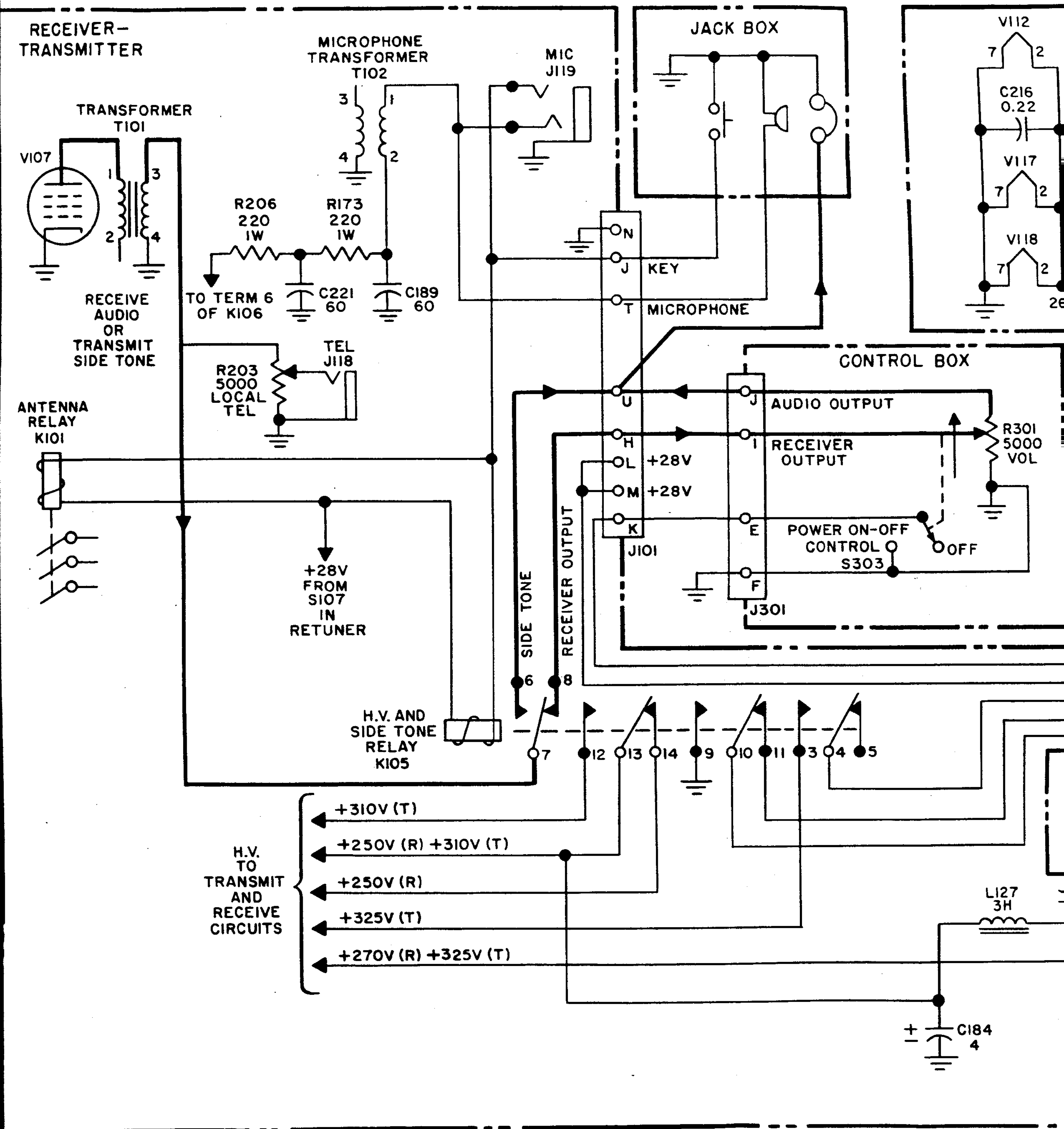
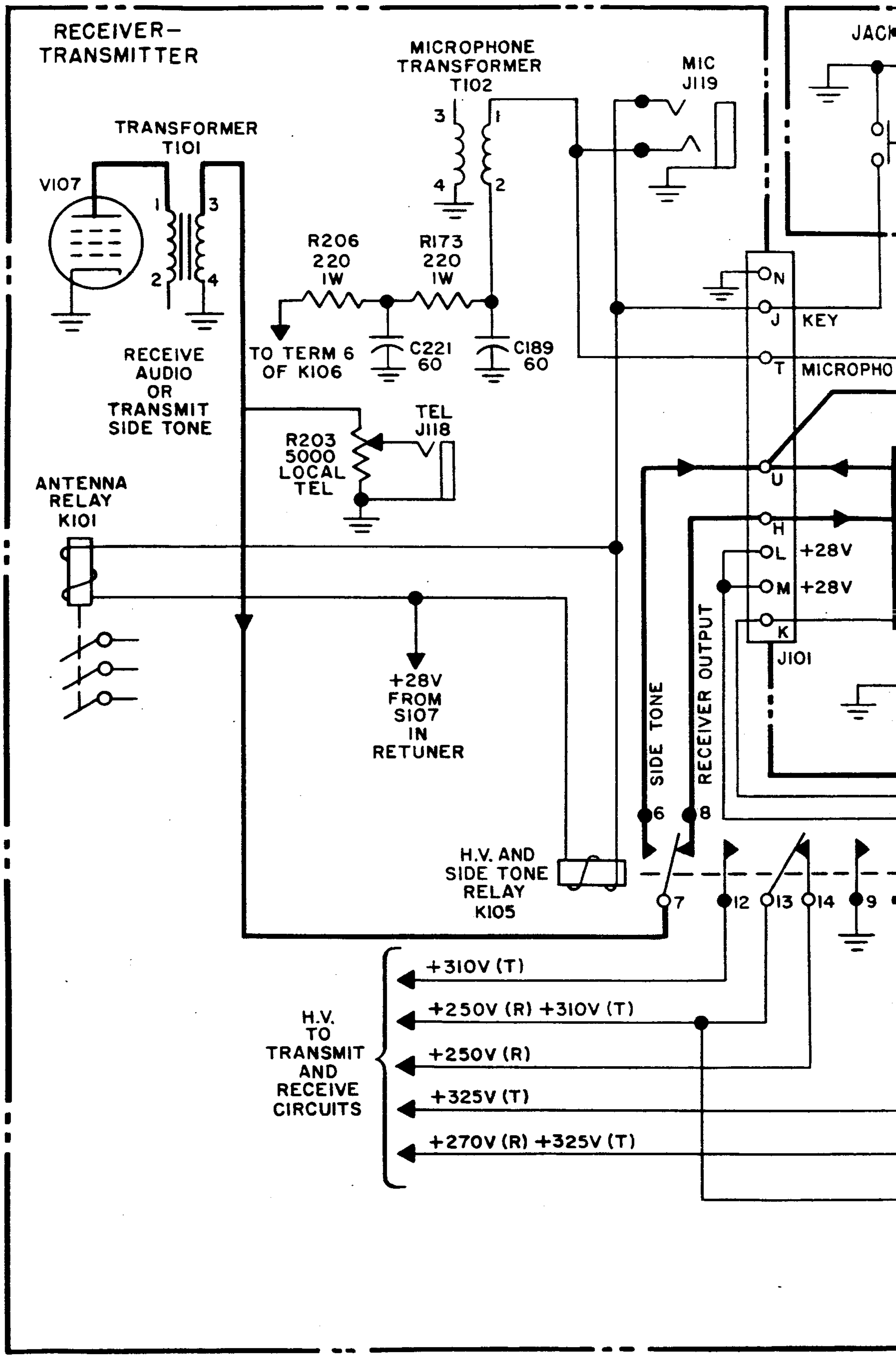


Figure 4-7. Power and Control Circuit, Simplified Schematic Diagram


RECEIVER-TRANSMITTER
TRANSFORMER T101
V107
RECEIVE AUDIO OR TRANSMIT SIDE TONE
MICROPHONE TRANSFORMER T102
R206 220 1W
R173 220 1W
TO TERM 6 OF K106
C221 60
C189 60
MIC J119
TEL J118
R203 5000 LOCAL TEL
ANTENNA RELAY K101
+28V FROM S107 IN RETUNER
JACK BOX
KEY
MICROPHONE
J101
+28V
+28V
SIDE TONE
RECEIVER OUTPUT
CONTROL BOX
AUDIO OUTPUT
RECEIVER OUTPUT
R301 5000 VOL
POWER ON-OFF CONTROL S303
OFF
J301
V112
C216 0.22
V117
V118
H.V. AND SIDE TONE RELAY K105
H.V. TO TRANSMIT AND RECEIVE CIRCUITS
+310V (T)
+250V (R) +310V (T)
+250V (R)
+325V (T)
+270V (R) +325V (T)
L127 3H
C184 4

Figur



RECEIVER–
TRANSMITTER
MICROPHONE
TRANSFORMER
T102
MIC
J119
JACK
TRANSFORMER
T101
V107
R206
220
1W
R173
220
1W
TO TERM 6
OF K106
C221
60
C189
60
KEY
MICROPHO
RECEIVE
AUDIO
OR
TRANSMIT
SIDE TONE
TEL
J118
R203
5000
LOCAL
TEL
ANTENNA
RELAY
K101
+28V
+28V
J101
+28V
FROM
S107
IN
RETUNER
SIDE TONE
RECEIVER OUTPUT
H.V. AND
SIDE TONE
RELAY
K105
+310V (T)
+250V (R) +310V (T)
+250V (R)
+325V (T)
+270V (R) +325V (T)
H.V.
TO
TRANSMIT
AND
RECEIVE
CIRCUITS

4-50. The operation of the retuner is best understood by a study of the channel selection system shown in figure 4-8. This figure, together with simplified diagrams, figures 4-9 and 4-10, show the electrical and mechanical features which ensure that the selector drum and tuned circuits will always be set to the desired channel. The principles of retuner operation are discussed in the following paragraphs.

4-51. Twelve-position rotary switch S109 is attached to the channel selector drum shaft. The contacts of this switch and of S301, which is electrically identical to S109, are connected in parallel. Because of the contact arrangement, the switches require only four wires and a common ground between them to form a 12-position, open-seeking homing circuit.

4-52. The channel selection mechanism is shown in a basic four-channel form in figure 4-9. When the retuner is not selecting or is at rest, the circuit to solenoid L126 is open. If switch S301 is set to a different position, channel 4 for example, it completes the circuit through switch S109 to solenoid L126. The energized solenoid withdraws the index pawl from the slot in the index plate, and as the pawl is withdrawn, the solenoid also closes the contacts of relay K104. The closing of the relay contacts energizes hermetically-sealed relay K107 which, in turn, applies power to drive motor B101 which rotates the index plate and switch S109 through the slip clutch, with S109 seeking an open circuit. When the open slot on S109 reaches the channel 4 position, the solenoid circuit opens. A return spring drops the index pawl into the channel 4 slot of the index plate. The de-energized solenoid opens K104 which, in turn, opens K107, stopping the drive motor.

4-53. The channel selector switches used for S109 and S301 together set up different combinations of closed and open circuits as they are turned through a complete revolution; however, the complete open circuit required occurs only when both switches are set to the same channel position.

4-54. In the retuner operation (figure 4-8), the new channel is selected by setting S301 on the radio set control to the desired channel position. (Remote-local switch S302 is at remote.) For example, if S301 is reset to the channel 4 position from channel 12, the circuit to L126 is completed through the contacts of K102. The energized solenoid withdraws the index pawl from the index plate. The solenoid closes contacts 1-2 and 4-5 of relay K104 simultaneously, thus energizing relay K107, closing contacts 2-8 and 4-7, and applying power to drive motor B101.

4-55. With the index pawl withdrawn, motor B101 rotates the selector drum counterclockwise. As the drum starts to rotate, the actuator pin on the drive gear is disengaged from the limit switch actuator, thus releasing home limit switch S107. The closing of the normally closed contacts on S107 applies +28 volts to contact 6 of K107; however, this has no effect since K107 is in the energized position. The selector drum continues to rotate, driving S109 until it reaches the channel 4 position at which S301 had been set (where S109 finds an open circuit). The circuit between S109 and S301 opens at this position, de-energizing L126, causing the solenoid to release the index pawl. Released, the index pawl engages the channel 4 notch in the index plate and stops any further rotation of the selector drum. The drum is now accurately indexed at channel 4.

4-56. Although the drum has stopped, the slip clutch permits motor B101 to continue turning the drive gear. Eventually, the actuator pin on the drive gear engages the opposite side of the limit switch actuator, causing the actuator to operate reversing limit switch S108. When the normally closed contacts of S108 open, the energizing circuit of reversing relay K104 is broken, causing the relay to release and reverse the connections to the drive motor. The motor circuit is now completed through the normally closed contacts on home limit switch S107. The reversed connections energize channel selector relay K102, causing it to keep the operating circuit of L126 open until the drive motor reaches the "home" position. The motor now turns the drive gear in the opposite direction toward the "home" position. When it reaches "home", the limit switch actuator operates home limit switch S107, breaking the motor circuit. The retuner has now been set to the new channel.

4-57. The anti-backlash pawl, operating in the notch opposite to that controlled by the index pawl, prevents backward rotation of the index plate while the index pawl is withdrawn. Switch S106, actuated by the anti-backlash pawl, maintains the circuit to the coil of reversing relay K104. This prevents relay K104 from falling back to the unenergized position, deenergizing relay K107, and reversing the motor rotation until both pawls have been engaged in the index plate. Diode CR104 is connected across the coil of relay K104 to prevent chattering which, in turn, would cause relay K107 to chatter, resulting in damaged contacts and erratic operation.

4-58. Relay K102 prevents malfunction of the retuner during the "homing" phase of the selection cycle. The relay coil is energized and its contacts are open during "homing", so that solenoid L126 is unenergized. Once the retuner has started "homing", any further attempt at channel selection has no effect until the originally desired channel has been selected. The retuner must actually reach "home" before the new channel selection cycle can begin. Thyrite resistor TY103, connected across the coil of L126, protects the solenoid from damage due to switching transients. (Thyrite is a nonlinear resistor whose resistance decreases as the voltage across it increases.)

4-59. In the returner operation described above, all channel selections are made remotely at the radio set control, and LOCAL SELECTOR switch S110 is inoperative. If local selection at the receiver-transmitter is desired, local-remote switch S302 must be set to the local position. The local channel selector switch consists of two concentric rotors insulated from each other. The outer rotor is a ring having a wiper blade and is geared directly to the selector drum shaft. The inner rotor has an open notch and is attached to a manual selector knob.

4-60. Change of channel merely requires turning the inner rotor to the desired position. This action completes the energizing circuit through the outer ring to solenoid L126, thus starting the retuner operation. The selector drum shaft then rotates the outer ring until the wiper blade reaches the open space on the inner rotor which corresponds to the desired channel. When it reaches this space, the selector drum stops turning and the retuner completes its operation as described above. Switches S109 and S301 have no effect on the operation since they are now completely out of the circuit.

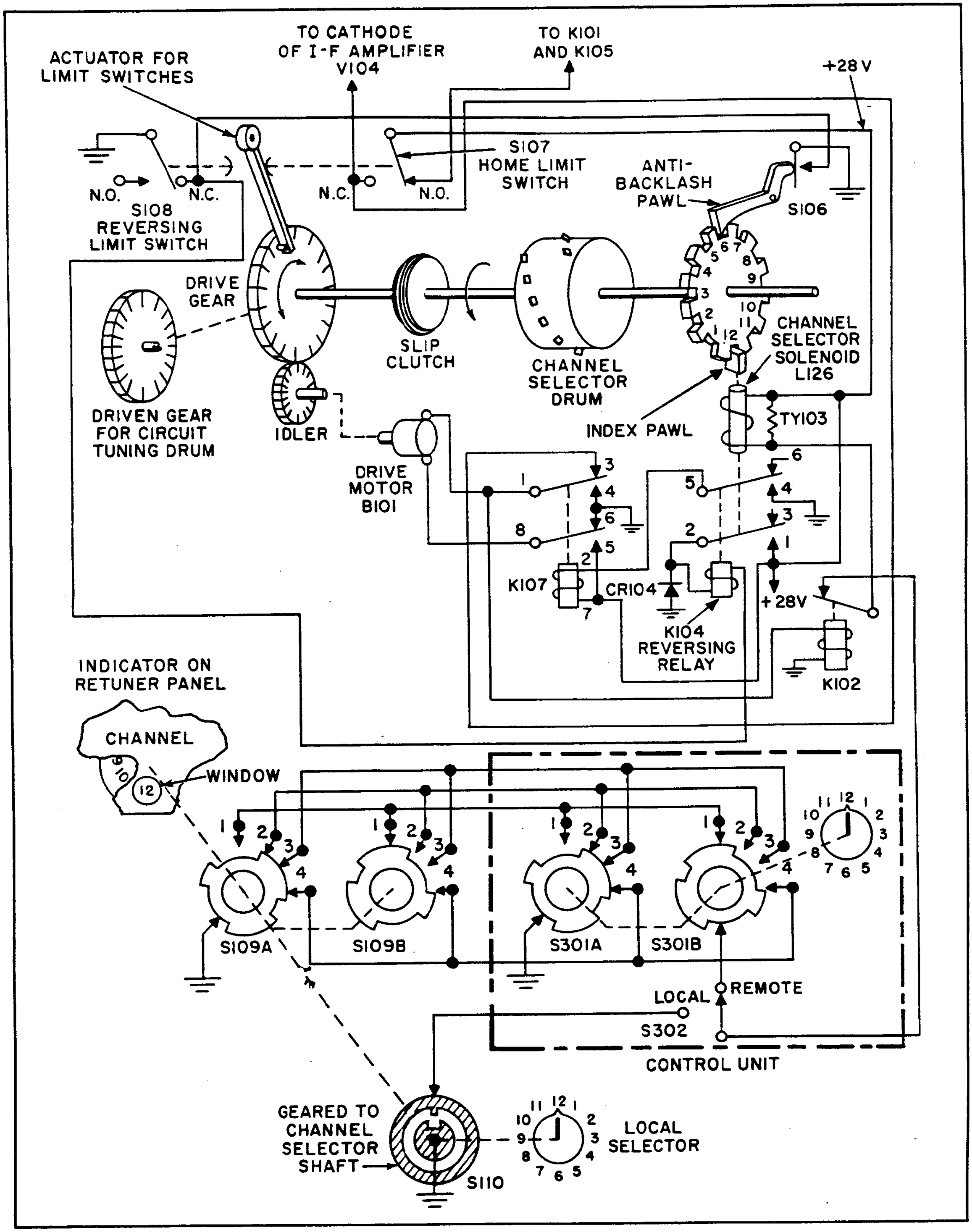


Figure 4-8. Retuner, 12-Channel Selection System

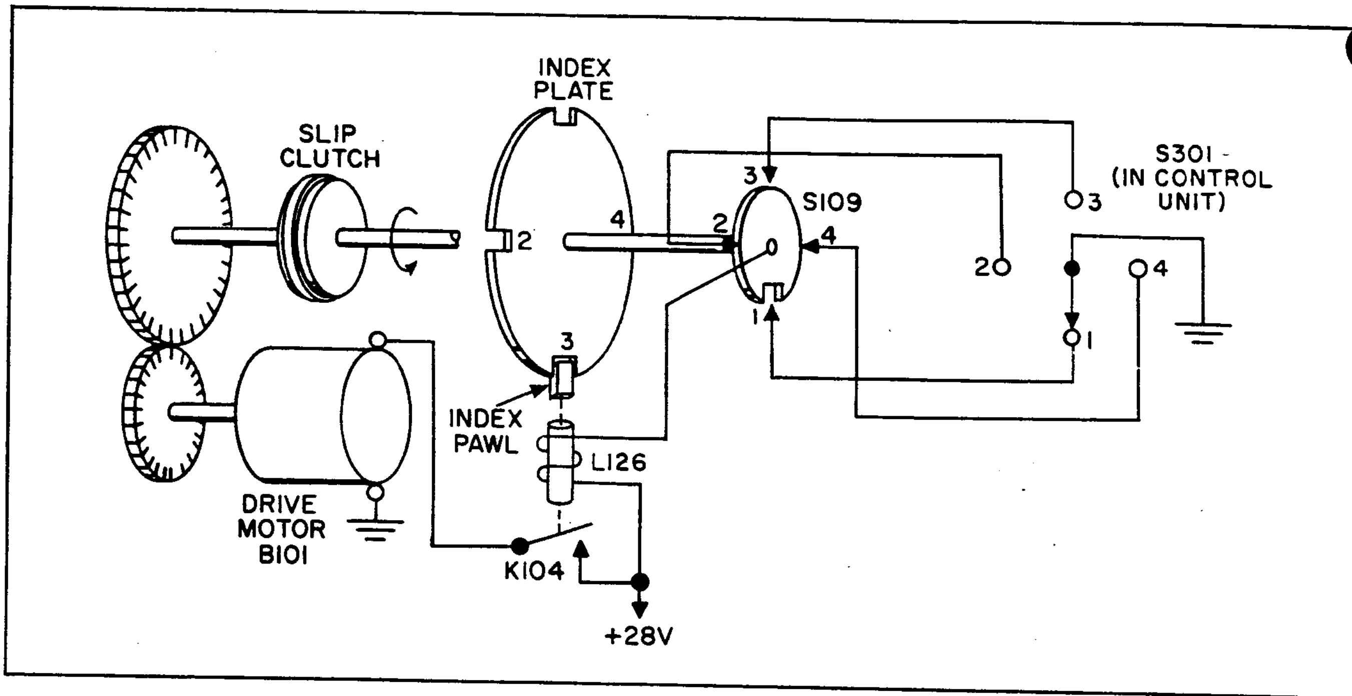


Figure 4-9. Retuner, Basic 4-Channel Selection System

4—61. As described in paragraph 4-52, the selector drum is driven by motor B101 through a gear train and slip clutch. The slip clutch permits the motor to continue turning after the selector drum has been stopped by the index pawl dropping into the selected channel slot on the index plate.

4-62. While the selector drum is being set to the desired channel, the tuner shaft assemblies driven by the selector drum gear are simultaneously resetting the circuits in the receiver-transmitter to the preset positions for that channel.

4-63. How the tuned circuits are reset may be seen by examining the mechanical operation of a four-channel retuner (figure 4-10) which controls two tuned circuits. The frequencies to which the tuned circuits are set are determined by the amount of rotation of the circuit tuning shafts. Except for the smaller number of channels and fewer tuning shafts, this retuner is identical in operation to the 12-channel retuner in the receiver-transmitter.

4-64. In the retuner, the tuner shaft assemblies are geared to the selector drum gear through slip clutches, and all drums turn simultaneously. If any tuner shaft assembly stops rotating, its slip clutch permits the others to continue turning. Each tuner shaft (figure 4-10) consists of a pile-up of stopping plates separated by spacer washers. The stopping plates are free to rotate on the tuner shaft while the spacer washers are keyed to the shaft to prevent rotation. A screw-operated clamp, controlled by a rectangular LOCK knob on the front of the retuner, compresses the pile-up to fix the angular positions of the stopping plates tightly on the shaft. When the clamp is loosened, the stopping plates are free to rotate individually; however, the spacer washers prevent any one stopping plate from disturbing the position of its neighbor.

4-65. The selector drum consists of two sections, each containing two spring-loaded locking plates. These plates project radially from the surface of the drum in positions which line up with the index notches on the index plate. Since there are four channels, the locking plates are spaced 90 degrees apart. They are also spaced along the selector drum shaft in positions which line up with the axial positions of the stopping plates on the tuner shafts.

4-66. The tuner shafts are alined parallel to the selector drum, with the distance between these drums such that the locking plates will engage the notches on the stopping plates. At each indexed position of the selector drum, the locking plates corresponding to that position point toward the tuner shafts. When a tuner shaft is rotated, the stopping plate corresponding to that particular channel slides over and engages the locking plate, thus preventing that stopping plate from any further rotation. When this happens, the tuner shaft cannot be turned until the clamping screw is loosened. If the clamp is loosened, the engaged stopping plate remains locked in position by the fixed locking plate, but the tuner shaft may now be repositioned for optimum circuit tuning. After the tuning shaft has been positioned, the clamp screw is tightened to prevent further rotation.

4—67. The retainer in figure 4-10 is shown set to channel 1, with locking plates A and B engaging the channel 1 stopping plates. If channel 2 operation is desired, for example, solenoid L126 withdraws the index pawl from the index plate, and motor B101 rotates the selector

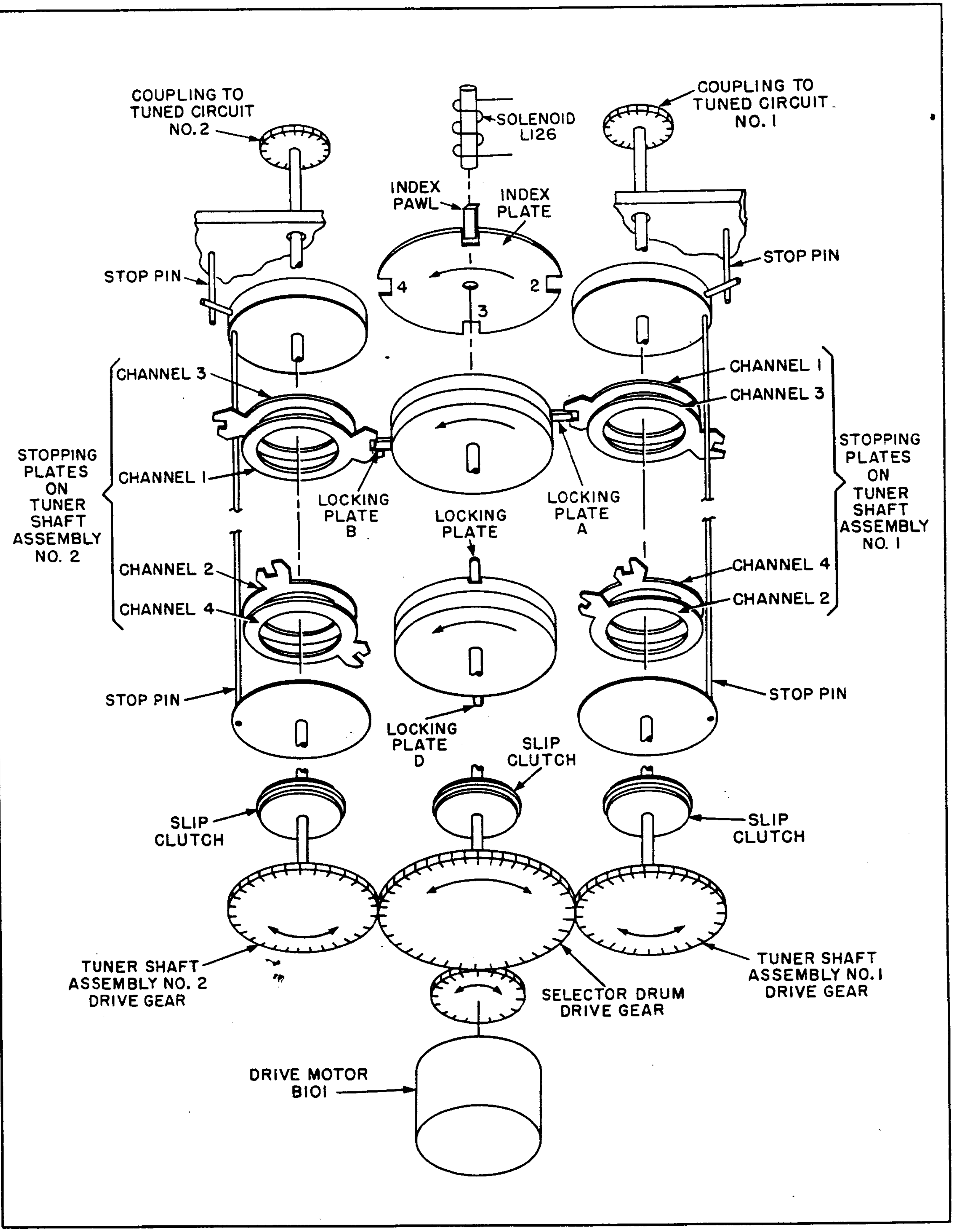


Figure 4-10. Retuner Tuning Shaft Assembly Operation

drum to the channel 2 position. At this point the index pawl drops into the channel 2 slot, stopping the selector drum.

4-68. The selector drum drive gear rotates counterclockwise and is meshed with the tuner shaft assembly gears which rotate clockwise. The tuner shaft assembly gears have fewer teeth than the selector drum drive gear, causing them to turn at a faster rate. As the tuner shaft assemblies rotate, locking plates A and B are disengaged from the stopping plate notches. Since channel 2 operation is desired, the selector drum rotates only 90 degrees and stops, with locking plates C and D now pointing at the tuning drums. Because of the selector drum slip clutch however, the selector drum drive gear continues to rotate the tuner assembly shafts. Each tuner assembly shaft rotates until its channel 2 stopping plate slides over and engages the locking plate pointing toward it. Since the positions of the stopping plates have been fixed by the tightened clamp screw, the tuner shaft assembly itself can no longer rotate, however, the slip clutch still permits the gear to turn. All the gears continue to rotate in the forward direction until reversing switch S108 is actuated (paragraph 4-56) and causes the motor to reverse its rotation. The motor then drives the selector drum gear and the tuner shaft assembly drive gears toward the "home" position.

4-69. If operation on channel 3 had been desired, the selector drum would have rotated 180 degrees. Locking plates A and B would still be used but now they would engage the channel 3 stopping plates.

4-70. The total angle through which the tuner shaft assembly rotates before it locks depends upon the setting of the stopping plate at the beginning of channel selection. If the stopping plate moves away from the latch tooth at the beginning of the selection cycle, the tuner shaft assembly will continue to rotate until it comes to its end stop, at which time its clutch will slip. Then as soon as the selector drum drive gear starts on the homing portion of the selection cycle, the tuner shaft assembly rotates in reverse direction until the stopping plate engages the locking plate. As before, with the locking plate engaged, the tuner shaft assembly stops. The clutch permits the gears to turn until "home" position is reached. The faster turning rate of the tuner assembly shafts ensures that they always reach the end stop before reversing direction.

4-71. Since the end stop prevents the tuner shaft assembly from rotating a full 360 degrees, a stop pin running down the length of the assembly prevents the stopping plates from reaching a position where they could not be engaged by the locking plates.

SECTION V
ORGANIZATIONAL MAINTENANCE

5-1. TEST POINT IDENTIFICATION SYMBOLS.

5-2. GENERAL. A system of test point identification symbols are referenced on the overall schematic diagram of Radio Set AN/ARC-39. (Refer to Section VII.) The symbols are divided into three categories: major, secondary, and minor. Test point identification symbols are assigned consecutively and are not repeated for any other point.

5-3. MAJOR TEST POINTS. Major test points are used to identify and designate the test points used in checking the overall function of Radio Set AN/ARC-39, and for localizing troubles to units, assemblies, and various parts. These test points are always identified on schematic diagrams by an Arabic numeral enclosed in a star, for example 1, and are referred to in the text as test point 1, test point 2, etc.

5-4. SECONDARY TEST POINTS. Secondary test points are used to identify and designate the test points used in trouble shooting within a specific assembly. These points are indicated on the schematic diagrams by a capital letter enclosed in a circle, for example A, and are referred to in the text as test point A, test point B, etc.

5-5. MINOR TEST POINTS. Minor test points are used to identify and designate the test points used in finding trouble within a specific circuit. These points are identified in the schematic diagram by a capital letter and an Arabic numeral subscript enclosed in a circle, for example A_1, and are referred to in the text as test point A1, test point A2, etc.

5-6. EQUIPMENT MINIMUM PERFORMANCE STANDARDS.

5-7. GENERAL. An overall equipment performance check of Radio Set AN/ARC-39 requires the bench test set-up shown in figure 5-1. The test equipment required for making the bench test is listed in table 2-1. The procedure for performing the bench test is outlined in table 5-1, and the bench test equipment and radio set are interconnected as shown in figure 5-1.

WARNING

Application of power to the equipment results in voltages which are dangerous to life. Personnel must observe safety regulations at all times.

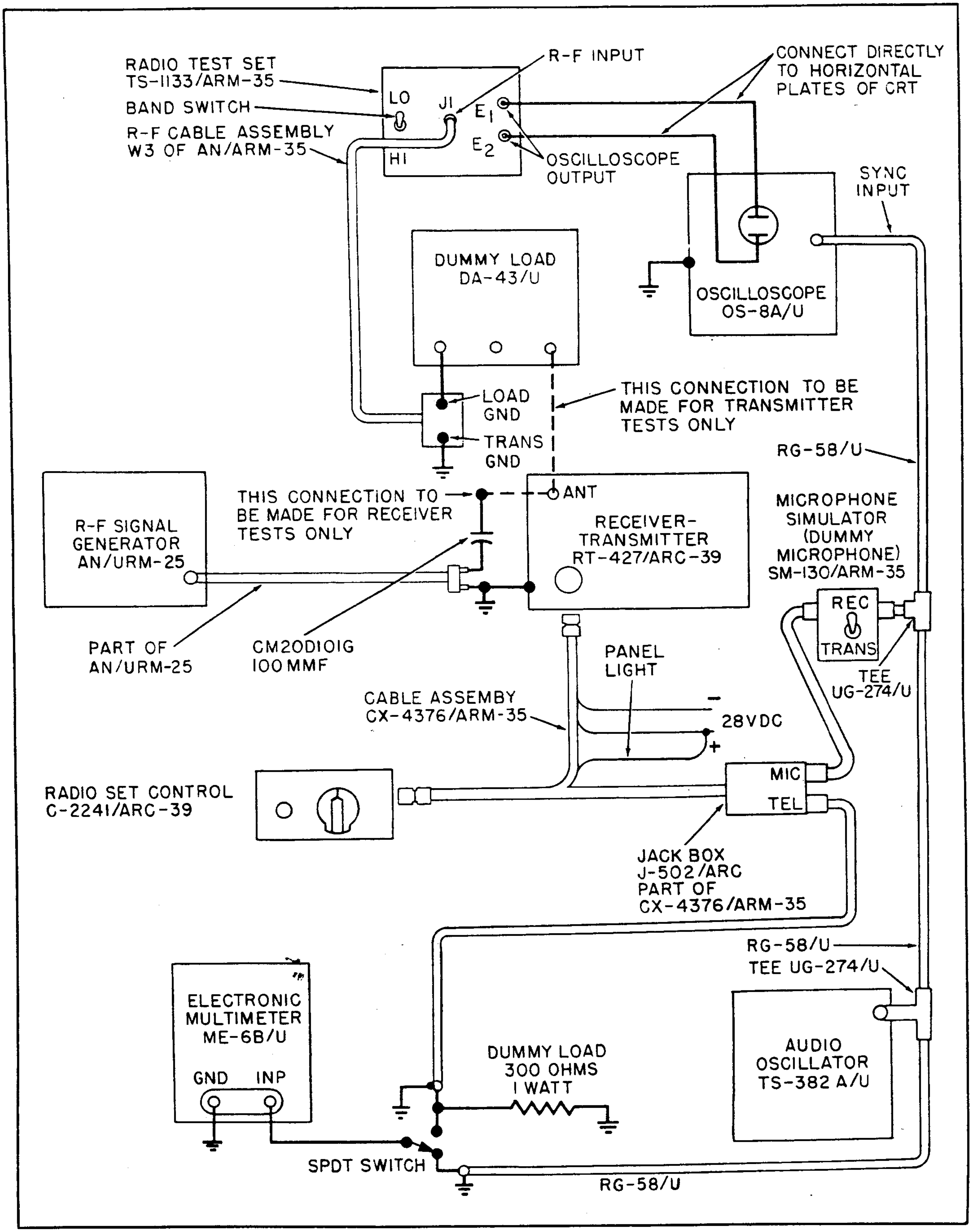


Figure 5-1. Bench Test Diagram

TABLE 5-1. EQUIPMENT MINIMUM PERFORMANCE STANDARDS

Step	Procedure	Normal Indication or Comment
1	Interconnect Radio Set AN/ARC-39 and test equipment as shown in figure 5-1.	
2	Turn VOL control on the radio set control clockwise.	Dynamotor should run.
3	Rotate CHANNEL selector switch on the radio set control and select each channel in turn.	Corresponding channel number should appear in window on front panel of receiver-transmitter.
4	Pull out the local-remote lever in center of CHANNEL selector knob and rotate LOCAL SELECTOR switch, on front panel of receiver-transmitter, selecting each channel in turn.	Same as step 3.
5	Install the desired crystals as described in paragraph 3-15. Be sure that the receiver crystal is 750 kc in frequency higher than the corresponding transmitter crystal.	
6	Adjust Dummy Load DA-43/U to function as a 10-ohm, 100-uuf dummy antenna.	
7	Preset all the channels as described in paragraph 3-16.	
8	Set toggle switch on Microphone Simulator SM-130/ARM-35 to TRANSMIT and note power output reading on meter of dummy load.	Meter reading should be 1 amp or more.
9	Adjust Radio Test Set TS-1133/ARM-35 for maximum indication on Oscilloscope OS-8A/U, with dummy load adjusted as in step 6. Adjust Audio Oscillator TS-382A/U for an output signal of 0.18 volt 1000 cps into the microphone simulator, as indicated on Multimeter ME-6B/U. Observe the modulation envelope pattern on the oscilloscope.	Adjust the CLIPPING ADJ. control until peak flattening just begins, as seen on modulation pattern.
10	Adjust the %M ADJ. control on the top of the receiver-transmitter chassis to obtain 80-percent modulation.	Observe envelope pattern on the oscilloscope and determine percent modulation by the following formula: $\%M = \frac{\text{Peak amplitude} - \text{trough amplitude}}{\text{Peak amplitude} + \text{trough amplitude}} \times 100.$
11	Disconnect the microphone simulator from Jack Box J-502/ARC and plug microphone M-3A/UR in its place. Talk into microphone. If bright spots appear in center of envelope pattern on oscilloscope turn the %M ADJ. adjustment counterclockwise until they just disappear. Observe the envelope pattern on the oscilloscope.	With modulation the peak amplitude should be approximately double the amplitude of the unmodulated signal. There should be no bright spots in center of envelope pattern.
12	Disconnect 300-ohm dummy audio load resistor from Jack Box J-502/ARC and plug H-1/AR or equivalent headset in its place. Turn LOCAL TEL adjustment on front panel of receiver-transmitter fully clockwise and talk into microphone. Listen to level of side-tone output through headset.	If side-tone level is not as desired, turn the SIDE TONE adjustment on the front panel of the receiver-transmitter until the level is satisfactory.
13	Reconnect the 300-ohm dummy load resistor in place of the headset. Connect Electronic Multimeter ME-6B/U across this resistor. Adjust R-f Signal Generator AN/URM-25 to generate a 5-microvolt signal, modulated 30-percent at 1000 cps. Connect output of the signal generator in series with a 100-uuf capacitor	With signal generator modulation applied, ME-6B/U indicates not less than 3.46 volts. Ratio of ME-6B/U indications (with and without signal generator modulation) is not less than 2:1.

TABLE 5-1. EQUIPMENT MINIMUM PERFORMANCE STANDARDS (Cont)

Step	*Procedure*	*Normal Indication or Comment*
13 (Cont)	to ANT binding post. Tune the AN/URM-25 for maximum output on the ME-6B/U. Note ME-6B/U reading. Remove modulation of signal generator and again note ME-6B/U reading.	
14	Vary output level of the AN/URM-25 between 10 and 100,000 microvolts, with the signal generator modulated 30-percent at 1000 cps. Measure the receiver audio output voltage across the 300-ohm dummy audio load resistor with the ME-6B/U.	Voltage ratio should not be greater than 2:1 over this range of input signal. For a 1000-microvolt input, the ME-6B/U reading should be between 6.7 and 9.5 volts with LOCAL TEL and VOL controls turned fully clockwise. These results should be obtained on each channel.

5-8. PRELIMINARY INSPECTION. Table 5-2 lists the items to be checked during a preliminary inspection of Radio Set AN/ARC-39.

TABLE 5-2. PRELIMINARY INSPECTION

Part or Assembly	*Inspection*	*Remedy*
	RECEIVER-TRANSMITTER	
Retuner	Check for smooth retuner operation on all channels during channel selection in both remote and local operation. Check for positive tuning and clutch action. Check for retention of preset positions during tune-up and operation. Inspect crystal sockets for tight grip on crystal terminals.	Retuner repairs should be made at field maintenance. Replace defective retuner with known good one.
Preselector assembly	Inspect tubes for cracks, corroded pins, and tightness in sockets. Check resistors and capacitors for signs of overheating. Remove coil cover and inspect coils for overheating or deterioration. Check smooth rotation of antenna trimmer capacitor. Inspect ceramic terminal boards for cracks. Check band switch for smooth operation.	Repairs to band switch, coil replacement and alinement should be made at field maintenance.
I-f and audio assembly	Check tubes for tightness in sockets, cracked envelopes, corroded pins. Remove assembly from main chassis of AN/ARC-39 and inspect parts mounted on bottom. Check for signs of overheating, or deterioration, or fungus accumulation. Inspect terminal boards for secure mounting, freedom from cracks or dirt, secure solder joints.	Except for tube replacement, and removal of dust, fungus, and corrosion, repairs to the i-f and audio assembly should be made at field maintenance where alinement facilities are available. If i-f and audio assembly is defective, replace with known good one.

TABLE 5-2. PRELIMINARY INSPECTION (Cont)

Part or Assembly	*Inspection*	*Remedy*
	RECEIVER-TRANSMITTER (Cont)	
Transmitter assembly	Check for loose tubes in sockets, bent or corroded terminal pins. Check that power amplifier plate cap grips plate terminal securely. Inspect driver and power amplifier tank coils and parasitic suppressors for signs of overheating. Examine all mounting screws for tightness. Check PA load gears and coupling to retuner for tightness.	Except for replacement of tubes, resistors, capacitors, and crystals, repairs to the transmitter r-f assembly should be made at field maintenance.
Antenna tuner	Examine contacts on switch for pitting or burning. Check padder capacitor for cracks or corroded terminals. Inspect drive gears for adequate lubrication and for evidence of binding.	Replace any defective parts.
Antenna relay	Inspect solenoid for free action. Check vacuum switch for cracks or breaks in glass envelope. Examine contacts of S114 and S115 for pitting or burning.	Replace antenna relay if switch or solenoid is defective. Clean contacts of S114 and S115 if dirty or corroded.
Dynamotor	Check dynamotor mountings and terminal connections for tightness. Inspect for corrosion at terminals. Remove brushes and measure length.	Clean dynamotor terminal connections if corroded. Replace brushes if they have worn down to 1/4 inch in length.
Modulator	Examine all tubes for tight fit in sockets. Check for loose plate caps, broken or corroded terminals.	Replace any defective parts.
Lock nuts, capacitors, etc.	Check tightness of lock nuts on potentiometers. Examine tuning capacitor gearing for tightness and freedom from backlash. Check tuning meter for freedom of movement. Inspect capacitors and resistors for signs of deterioration. Check fit of all interconnecting plugs. Check wiring for wear and abrasion. Clean any dust accumulations from tuning capacitors.	Tighten any loose screws. Replace defective parts or wiring. Remove dust accumulations with compressed air or soft clean brush.
	Inspect cabinet and chassis for signs of physical damage such as broken welds, dents, and bent parts. Inspect paint for flaking or chipping.	Use fine sandpaper or crocus cloth to remove any corrosion or fungus. Also use sandpaper to remove the chipped or damaged paint, and refinish cabinet. Dents in the cabinet can generally be removed by striking the high side of the dent with a soft hammer. A bent chassis can often be straightened by forcing the bent parts back into position with clamps.

TABLE 5-2. PRELIMINARY INSPECTION (Cont)

Part or Assembly	*Inspection*	*Remedy*
	RADIO SET CONTROL	
Potentiometer, switches, panel lamp	Check VOL control R301 and switch S302 for smooth, noise-free operation. Check operation of panel lamps. Check operation of local-remote switch by lifting operating lever. Check S301 for proper detent action at each setting. Examine connector J301 for bent or defective terminal pins.	Replace any defective parts found during inspection. Tighten all loose screws and nuts.

5-9. SYSTEM TROUBLE ANALYSIS.

WARNING

High d-c voltages exist within the chassis of Radio Set AN/ARC-39 during transmission and reception, and a high r-f voltage appears at the antenna terminal during transmission. Make sure the power is off, or exercise extreme caution before touching any connections.

5-10. GENERAL. Trouble shooting at the organizational level includes localizing the trouble to a particular unit or assembly by visual inspection, by voltage and resistance measurements, or by indications of misalinement.

5-11. TROUBLE-SHOOTING PROCEDURES. The first step in trouble shooting is to trace the fault to the unit or assembly responsible for abnormal operation. The next step is to localize the fault to the defective part responsible for the abnormal operation. Some faults, such as burned-out resistors, arcing, shorted transformers or dynamotors can often be found by sight, smell, hearing, or touch. Most faults, however, must be localized by checking voltages and resistances.

5-12. CHECK-OUT OR ANALYSIS.

5-13. BENCH TEST SET-UP. To check Radio Set AN/ARC-39 to determine the defective unit, interconnect the receiver-transmitter and radio set control with the bench test interconnecting cables, as shown in figure 5-1.

5-14. TROUBLE-SHOOTING CHART. Use of the trouble-shooting chart (table 5-3) will help to determine the unit or assembly of Radio Set AN/ARC-39 that is not functioning properly. When a unit or assembly is assumed to be defective, replace it with a known good one, and recheck the operation.

Note

Before resorting to trouble shooting or testing for defects, first make sure that the malfunction is not due to incorrect tune-up or other misadjustment of the operating controls. Making this check first may often make unnecessary an actual trouble-shooting procedure.

TABLE 5-3. TROUBLE-SHOOTING CHART

Step	*Control Settings and Instructions*	*Trouble*	*Probable Cause*	*Remedy*
1	VOL control on radio set control turned fully clockwise.	All tubes do not light.	Switch S303 on VOL control R301 defective.	Replace VOL control assembly R301/S303.
			Relay K106 defective.	Replace relay.
			Resistor R165 defective.	Replace resistor.

TABLE 5-3. TROUBLE-SHOOTING CHART (Cont)

Step	Control Settings and Instructions	Trouble	Probable Cause	Remedy
2	Same as 1.	Dynamotor not running. All tubes lit.	Relay K106 defective.	Replace relay.
			Choke L128 defective.	Replace choke.
			Dynamotor D101 defective.	Replace dynamotor.
3	Same as 1.	All tubes except V101 through V104 light.	V101, V102, V103 or V104 defective.	Replace defective tube.
4	Same as 1.	All tubes except V105 and V106 light.	V105 or V106 defective.	Replace defective tube.
5	Same as 1.	All tubes except V107, V109, V110 and V111 light.	V107, V109, V110 or V111 defective.	Replace defective tube.
6	Same as 1.	All tubes except V108 and V115 light.	V108 or V115 defective.	Replace defective tube.
7	Same as 1.	All tubes except V113 and V114 light.	V113 or V114 defective.	Replace defective tube.
8	Same as 1.	All tubes except either V112, V117 or V118 light.	V112, V117 or V118 defective.	Replace defective tube.
9	Install receiver crystals. Connect signal generator to ANT post. Tune signal generator to receiver frequency. Plug headset into TEL jack test point 9.	No audible signal in headset.	LOCAL TEL control R203 at minimum.	Rotate R203 clockwise.
			LOCAL TEL control R203 defective.	Replace R203.
			No d-c power, dynamotor D101 not rotating.	Refer to step 2.
			Dynamotor D101 defective.	Check dynamotor output voltages at test points N (325V) and M (—75V). Replace dynamotor if these voltages cannot be obtained.
			Preselector Assembly Z111 defective.	Replace defective Z111.
			Receiver-oscillator of Transmitter R-F Assembly Z113 defective.	Replace defective Z113.
			I-F and Audio Assembly Z110 defective.	Replace defective assembly.
10	Same as 9.	No audible signal in headset but signal present when 750 kc modulated signal is applied at test point 1.	V101 or V102 defective.	Replace defective tube.
			Preselector Assembly Z111 defective.	Replace defective Z111.

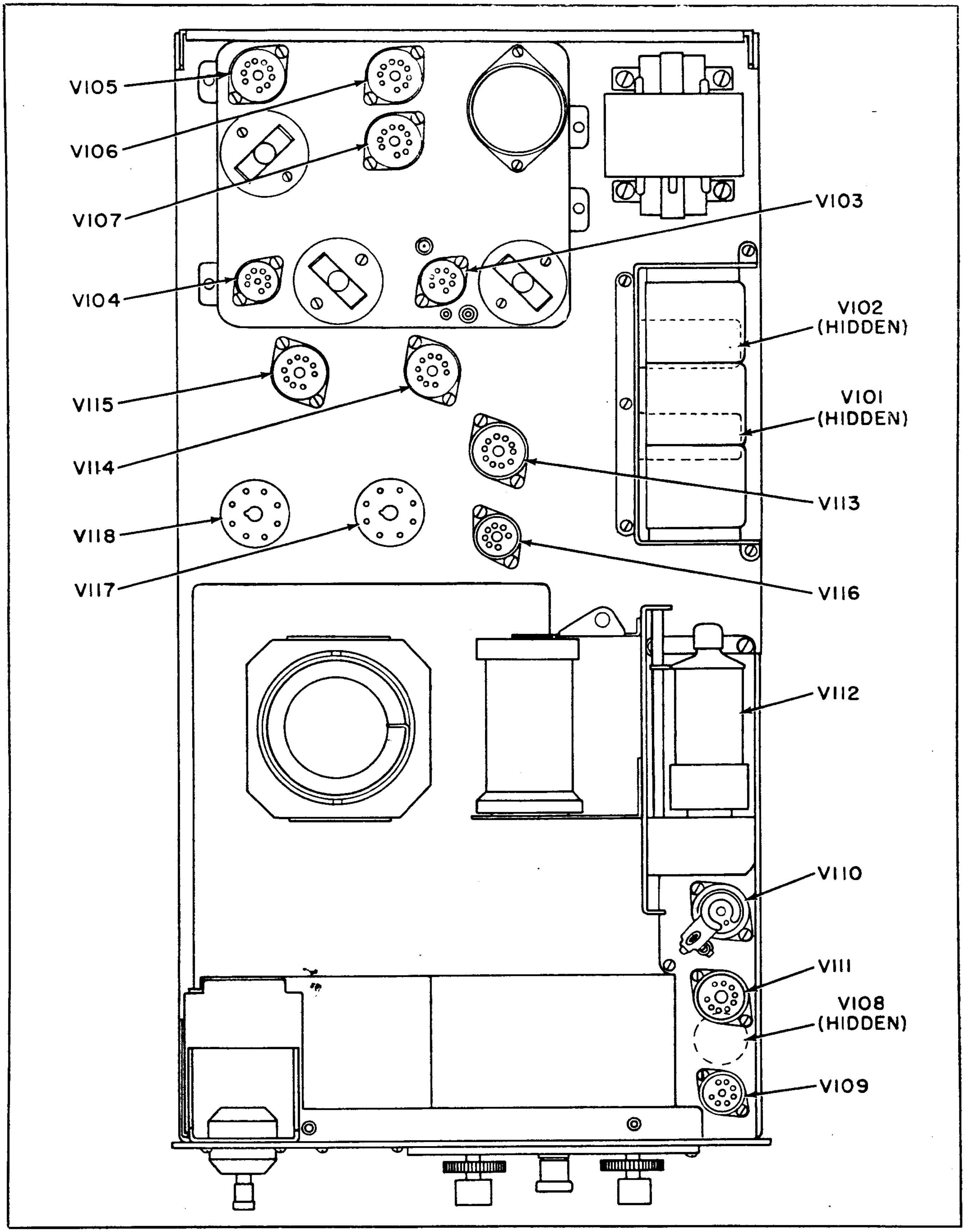


Figure 5-3. Tube Location Diagram

g. Remove the six binding head screws that attach retuner panel to main front panel of receiver-transmitter.

h. Slide the retuner out from the panel.

5-23. REMOVAL OF CRYSTAL SWITCH PANEL Z109. To remove crystal switch panel, proceed as follows:

a. Unplug P106A and P106B from bottom of transmitter r-f assembly.

b. Remove crystal switch panel cover by loosening the two captive screws.

c. Remove the four screws that attach the switch panel to the retuner, and lift the panel free from the retuner.

5-24. REMOVAL OF ANTENNA TUNER ASSEMBLY Z108. To remove the antenna tuner assembly, proceed as follows:

a. Unsolder the lead to low-band tank coil L120 in the transmitter r-f assembly, and the lead to antenna relay K101.

b. Remove the intermediate gear that drives ANT FINE coil L123B, and then unhook the anti-backlash spring.

c. Loosen the two captive screws which fasten the front plate of the antenna tuner to the retuner. These screws are located on the front panel of the retuner.

d. Remove the nine screws from the bottom of the antenna tuner which attach it to the main chassis.

e. Remove the antenna tuner by sliding it back slightly to disengage the retuner gears and lifting it from the bottom of the chassis.

5-25. REMOVAL OF THE I-F AND AUDIO ASSEMBLY Z110. To remove the i-f and audio assembly, proceed as follows:

a. Disconnect P102 from J102 and P105 from J105.

b. Remove the four mounting screws holding the assembly to the main chassis.

c. Lift the i-f and audio assembly from the chassis.

5-26. REMOVAL OF PRESELECTOR ASSEMBLY Z111. If it is found necessary to remove the preselector assembly, proceed as follows:

a. Remove the side cover plate from the transmitter r-f assembly. Using a Bristo (spline) wrench, loosen the setscrew in the hub of the center coaxial antenna trimmer shaft. Remove the two screws holding the trimmer-shaft retaining plate on the front panel, and withdraw the coaxial shaft assembly.

b. Unhook the spring between the transmitter and receiver band switch pusher arms.

c. Remove P105 from J105.

d. Unsolder the three leads from ceramic terminal board TB101, the three leads from tuning capacitor C107, oscillator-to-mixer coaxial cable W102, and antenna cable W101. Remove the screw holding the antenna cable clamp and the five screws holding the preselector assembly to the main chassis.

e. Refer to paragraphs 6-21 through 6-31 for alinement procedures.

5-27. REMOVAL OF TRANSMITTER R-F ASSEMBLY Z113. If it is found necessary to remove the transmitter r-f assembly, proceed as follows:

a. Remove the side cover plate from the transmitter r-f unit.

b. Loosen setscrews in the hub of the center coaxial antenna trimmer shaft, remove screws from the trimmer shaft retaining plate on the front panel, and withdraw the coaxial shaft assembly.

c. Disconnect P103 from J103, and P106A and B from J106, on the bottom of the assembly.

d. Unsolder oscillator-to-mixer coaxial cable W102, remove the screw holding the cable in place, and withdraw the cable.

e. Unhook the spring pressing the transmitter band switch operating arm against the band switch pusher shaft protruding from the retuner.

f. Unhook the spring between the transmitter and receiver band-switch pusher arms.

g. Unsolder the lead from coil L120B to the antenna tuner, and the two leads to tuning capacitor C169 and C169C.

h. Remove ten screws which hold the transmitter r-f assembly in place. These are located as follows:

Two on front panel above antenna trimmer shaft hole.

Two in depressions on right-hand side of chassis next to cut out.

Two on top of chassis at rear of r-f unit.

One on foot of coil support bracket near rear face of retuner (accessible upon removal of cover over antenna current and side-tone rectifiers).

One securing r-f unit to rear of retuner.

One accessible from bottom of chassis in front of tuning capacitor C169.

One to lower left of driver high-band tank coil L117.

i. Carefully lift out the transmitter r-f assembly.

j. Refer to paragraphs 6-32 through 6-36 for alinement procedures.

5-28. REMOVAL OF DYNAMOTOR. To remove the dynamotor, proceed as follows:

a. Disconnect P105 and P102 from the i-f and audio assembly.

b. Remove the four mounting screws which attach the i-f and audio assembly to the main chassis and remove i-f and audio assembly.

c. Remove the dyamotor cover plate from the bottom of the chassis.

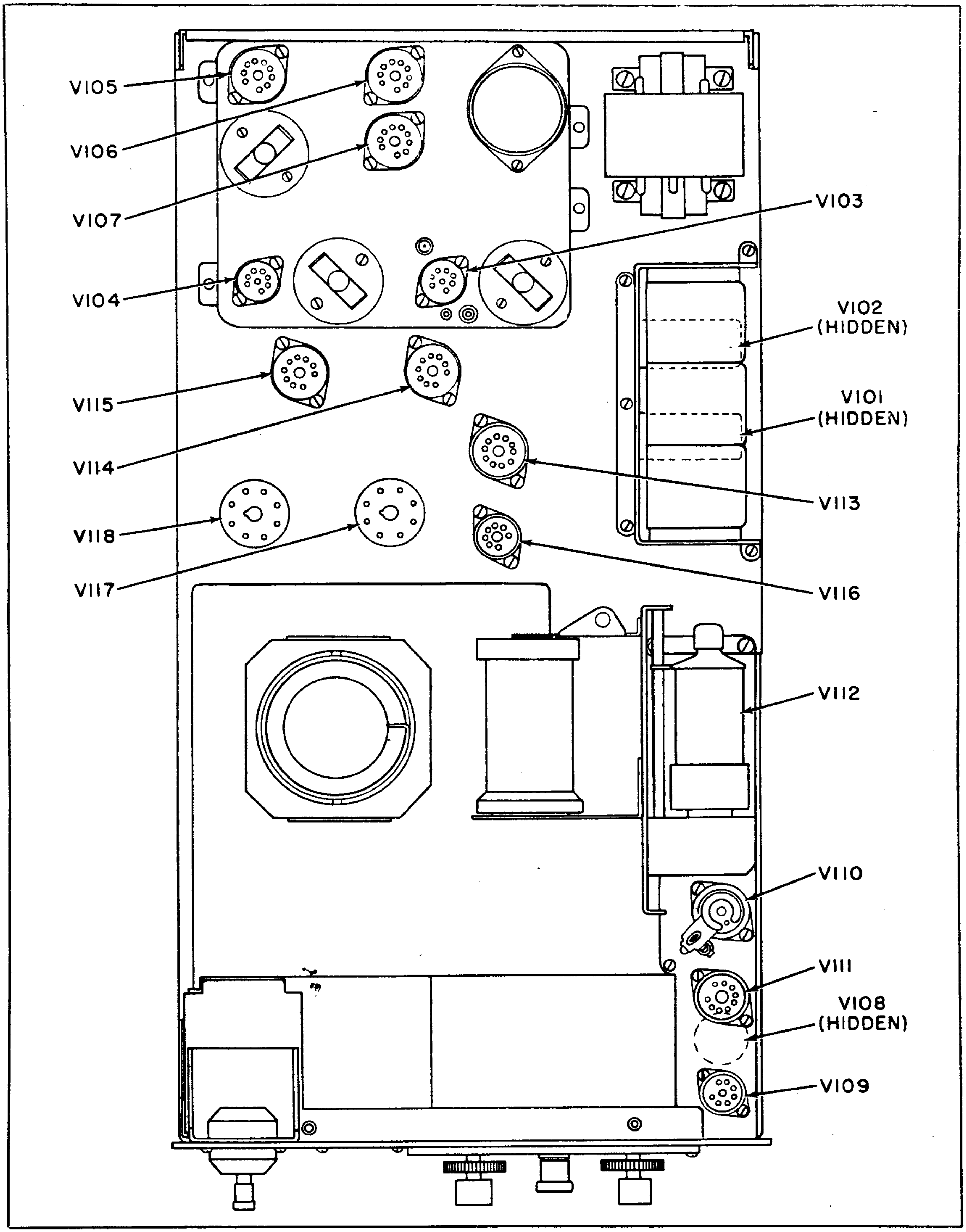


Figure 5-3. Tube Location Diagram

d. Loosen the six screws holding dynamotor connector to terminal board TB103, and remove connector.

e. Remove the two dynamotor mounting screws on top of the main chassis (these are accessible with the i-f and audio assembly removed), and the two mounting screws on the rear of the main chassis. Lift out the dynamotor.

5-29. REPLACEMENT OF ASSEMBLIES.

5-30. The assemblies removed as described above may be replaced by reversing the removal procedures. When replacing the retuner, it is important to take care that the correct anti-backlash adjustment and meshing is maintained on the various gears. The correct procedures for reassembly of these components are as follows:

a. Aline the ANT FINE shaft by setting the rotor of variometer L123B to a horizontal position, with the crossover lead on the inside of the rotor located at the right-hand side of the coil, as viewed from the front panel. The front panel ANT FINE dial on the retuner should be set to "1".

b. Aline the ANT TAP shaft with the arm of switch S104B set vertically upward and with the ANT TAP dial reading "1".

c. Aline the PA LOAD shaft with the drilled hole on the bakelite gear of the rotor of coil L120B pointing toward the terminal of neutralizing capacitor C173, which extends through the rear wall of the transmitter r-f unit. The drilled hole may be seen by looking through the hole through which the terminal of C173 passes.

5-31. If the driving gear and shaft assembly that couples the motion of the retuner TUNING shaft to the main tuning capacitor has been removed, sections C169 and C107 will be able to turn independently. Both sections must be realined mechanically, so that the positions of the mechanical stop on the capacitor and the retuner dial will coincide. Without this adjustment, proper tracking of the receiver and transmitter is impossible, and TUNING dial calibrations will not agree with the tuning capacitor position.

5-32. To aline the TUNING shaft of the retuner with the capacitors, proceed as follows:

a. Insert a short 1/8-inch-diameter rod through holes provided in the gears attached to the shafts of capacitors C107 and C169. The capacitors should first be rotated until fully unmeshed. At this point the rod should just pass through the middle pair of three pairs of holes in the gears, and should rest on the gang capacitor frames.

b. Remove the rod and mesh the capacitors slightly until the rod can just be inserted into the next pair of holes. With the rod inserted, mesh the capacitor sufficiently to make the rod rest on the capacitor frames. Hold the gang capacitors driving shaft in this position, set the TUNING dial so that the fiducial mark adjacent to it lines up with the dot appearing above the "9" of the "9.1" mc calibration, and secure the shaft coupler. (Note that there is also a second dot above the period of "9.1", and that the previous adjustment allows approximately 1/32 inch additional clockwise rotation of the tuning dial before reaching a positive mechanical stop, after the alinement rod has been removed.)

5-33. When replacing the crystal switch panel on the retuner, make sure that the bakelite drive gear of crystal switch S102 is alined to set S102 to the numbered crystal socket which agrees with the channel number appearing in window on the front of the retuner. The switch rotor segments must also be centered within the selected contact clips.

5-34. LUBRICATION.

5-35. Radio Set AN/ARC-39 requires little lubrication during normal use. The retuner drive motor B101 has permanently lubricated bearings and needs no further maintenance. The transmitter antenna tuner, preselector antenna trimmer, and main tuning capacitor drive gears may occasionally require a small amount of grease (Military Specification MIL-G-7118) on the gear teeth for smooth operation. The bearings of dynamotor D101 contain sufficient lubricant for approximately 1000 hours of operation. The bearings should be inspected at the end of this time and the lubricant renewed if necessary.

5-36. To inspect the bearings, remove the dynamotor as described in paragraph 5-28, and take off the end bells. Remove the bearing covers. If the bearing grease is dirty, dry, or insufficient, remove as much of the old grease as possible with a clean cloth or clean stiff brush. Add just enough grease (Military Specification MIL-G-18709) to cover the bearing, and reassemble dynamotor.

CAUTION

Do not pack the bearings, or allow grease to get on the commutators. Keep dust and dirt away from the grease. Do not use substitute lubricant.

SECTION VI
FIELD MAINTENANCE

6-1. GENERAL.

6-2. This section includes testing procedures, detailed performance standards, trouble analysis charts, and alinement and adjustment procedures for Radio Set AN/ARC-39. Repairs to the radio set covered in this section include replacement of defective parts, electrical and mechanical realinement, and all adjustments. The repairs to the retuner in Receiver-Transmitter RT-427/ARC-39 cover the replacement of relays and adjustment of their mechanical tolerances to the correct value; retuners which cannot be repaired at field maintenance level should be sent to an overhaul depot for such maintenance.

6-3. MINIMUM PERFORMANCE STANDARDS.

6-4. GENERAL. The minimum performance check chart, table 6-1, describes and lists the procedures for checking and analyzing the performance of Radio Set AN/ARC-39.

6-5. RECEIVER SENSITIVITY MEASUREMENTS. The receiver sensitivity is determined by measuring the amount of input voltage required to produce a 2-volt output across a 300-ohm dummy load resistor connected to the receiver output terminals as shown in figure 5-1, and measured as described in table 6-1. Typical values for receiver sensitivity measurements are listed in table 6-1. These values are to be used only as a guide, and apply to undamaged and perfectly alined receivers. These are the desired values to be obtained, if possible, when adjusting the equipment after overhaul or long service use. Departures from these values by factors as great as 2:1 do not necessarily indicate defective equipment. An inaccurately calibrated signal generator or below-standard vacuum tubes may also contribute to widely varying results.

6-6. TRANSMITTER OUTPUT MEASUREMENT. The transmitter output is measured by connecting Dummy Load DA-43/U, as shown in figure 5-1, between the antenna terminal and ground and measuring the r-f output current at several different frequencies. If the dummy load is not available, connect a 100-uuf capacitor, a 10-ohm (25-watt) non-inductive resistor, and a 0- to 3-ampere r-f ammeter in series between the antenna terminal and ground. Tune the transmitter to the frequencies listed in table 6-1 and measure the r-f output current. After these measurements have been completed, replace the 100-uuf capacitor and 10-ohm resistor with a 60-uuf capacitor, and measure the r-f output current again, but at 2.00 mc only. The minimum values of r-f current for the dummy loads at several different frequencies within the transmitter tuning range are also listed in table 6-1.

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS

Step	*Test Procedure*	*Test Point*	*Normal Indication*	
1	Interconnect Radio Set AN/ARC-39 and bench test equipment as shown in figure 5-1.	None		
2	Turn VOL control on radio set control clockwise to apply power to radio set.	None	Dynamotor operates. Electron tubes and panel lamps light.	
3	Using VTVM TS-375/U, or one having input impedance of at least 10 megohms, measure voltages at test points indicated.		Operating Condition of AN/ARC-39	
			Receive (volts)	*Transmit (volts)*
		L	+27.5	+27.5
		M	−90	−80
		N	+275	+330

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS (Cont)

Step	*Test Procedure*	*Test Point*	*Normal Indication*	
			Operating Condition of AN/ARC-39	
			Receive (volts)	*Transmit (volts)*
3 (Cont)		B	+275	+330
		C	+250	+330
		H	+250	−1.5
		D	−90	0
		F	−90	+330
		G	−65	+230
		K	−90	−80

R-F SENSITIVITY

Step	*Test Procedure*	*Test Point*	*Input Frequency*	*Band*	*Series Capacitor*	*Input Microvolts Required*
4	Adjust Signal Generator AN/URM-25 for 30-percent 1000-cps modulated r-f signal to produce audio output of 2 volts across 300-ohm dummy load. (See figure 5-1.) Measure audio output voltage with voltmeter ME-6B/U. Apply signal generator output to test points listed. Receiver sensitivity determined by input r-f microvolts required.	11 Ant Post E101	2.0 mc 3.0 mc 4.27 mc 4.27 mc 6.0 mc 9.1 mc	Low Low Low High High High	100 uuf 100 uuf 100 uuf 100 uuf 100 uuf 100 uuf	2.2 1.7 1.7 1.5 1.5 2.2
5	Same as 4, above except that AN/URM-25 disconnected from antenna terminal and connected to test points as indicated.	A_1, pin 1 of V101	2.0 mc 3.0 mc 4.27 mc 4.27 mc 6.0 mc 9.1 mc	Low Low Low High High High	10,000 uuf 10,000 uuf 10,000 uuf 10,000 uuf 10,000 uuf 10,000 uuf	5 9 18 4 9 25
5a	Same as 5.	A_2, pin 7 of V101	2.0 mc 3.0 mc 4.27 mc 4.27 mc 6.0 mc 9.1 mc	Low Low Low High High High	10,000 uuf 10,000 uuf 10,000 uuf 10,000 uuf 10,000 uuf 10,000 uuf	140 110 85 55 55 50
5b	Same as 5 (except crystals removed).	A_2, pin 7 of V101	750 kc 750 kc	Low High	10,000 uuf 10,000 uuf	70 18
5c	Same as 5b.	A_3, crystal socket pin 3	750 kc	Low	None	30

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS (Cont)

Step	*Test Procedure*	*Test Point*	*Normal Indication*			
		R-F SENSITIVITY (Cont)				
5c (Cont)			*Input Frequency*	*Band*	*Series Capacitor*	*Input Microvolts Required*
		(A4), crystal socket pin 9	750 kc	High	None	20
		I-F SENSITIVITY				
5d	Adjust Signal Generator AN/URM-25 for 30-percent 1000-cps modulated r-f signal to produce 2 volts across 300-ohm dummy load. (See figure 5-1.) Measure audio output with Voltmeter ME-6B/U. Apply signal generator output to test points listed. I-f sensitivity is determined by input microvolts required. (See figure 6-3 for test point location.)	1 J110	750 kc	Low	None	1000
		2 J111	750 kc	Low	None	1200
		3 J112	750 kc	Low	None	45,000
		4 J113	750 kc	Low	None	65,000
		5 J114	750 kc	Low	None	72 V
		6 J115	750 kc	Low	None	72 V
6	Connect Audio Oscillator TS-382A/U to test points indicated. Use Voltmeter TS-375/U to measure input voltage required to produce 2 volts across 300-ohm dummy load. (See figure 5-1.)	7 J116	1 kc	Low	10,000 uuf	1.1 V
		8 J117	1 kc	Low	10,000 uuf	0.15 V
		TRANSMITTER ANTENNA CURRENT				
			Frequency (mc)		*Antenna Current (amperes)*	
7	Connect Dummy Load DA-43/U (or 100-uuf capacitor, 10-ohm resistor, and 0- to 3-ampere r-f ammeter) between ANT terminal and ground. Tune transmitter for maximum antenna current.		2.00 3.0 5.0 9.1		1.0 1.1 1.1 1.1	
8	Connect 60-uuf capacitor and 0- to 3-ampere r-f ammeter between ANT terminal and ground.		2.0		1.4	

6-7. ELECTRONIC AND MECHANICAL TROUBLE ANALYSIS.

6-8. TROUBLE-SHOOTING CHART. When a breakdown of Radio Set AN/ARC-39 occurs, there will be definite symptoms which point to a particular section where the trouble may be. The trouble-shooting chart, table 6-2, lists several symptoms of equipment failure, possible causes of such failure, and the remedial measures to be taken. Before attempting to trouble shoot Radio Set AN/ARC-39, maintenance personnel should familiarize themselves with the operation of all portions of the equipment by referring to Section IV and the schematic and block diagrams. The locations of the various parts of the receiver-transmitter and the radio set control are shown in figures 6-1 through 6-5.

TABLE 6-2. TROUBLE-SHOOTING CHART

Symptom	*Probable Cause*	*Remedy*
RETUNER MOTOR RUNS CONTINUOUSLY OR SELECTS WRONG CHANNEL	Defective or incorrectly wired interconnecting cable or defective wiring in receiver-transmitter.	Repair cable. See figure 7-3. Check or repair wiring.
	Defective channel selector switch S301 in radio set control, or switch S109 in retuner, if trouble is only in remote channel selection.	Replace defective switch.
	Defective limit switch S107 or S108, if trouble is in local and remote channel selection.	Replace defective switch.
	Index pawl, actuated by solenoid L126. fails to seat due to jamming of band switch pusher arm on retuner.	Free pusher arm and adjust band-switch mechanism.
	Pawl switch S106 defective or incorrectly adjusted.	Readjust or replace S106.
	Defective gear in gear box.	Replace retuner.
RETUNER HUNTS BACK AND FORTH	Contacts of relay K104 are defective or incorrectly adjusted.	Adjust contacts or replace relay K104, as required.
	End thrust screw of solenoid L126 incorrectly adjusted.	Readjust screw and lock in place.
	Contacts of relay K107 are defective or incorrectly adjusted.	Replace relay K107 (hermetically sealed).
LOCAL SELECTOR SWITCH KNOB ROTATES WHEN CHANNELS ARE REMOTELY SELECTED	Switch contact on S110 jammed.	Clear jammed switch. If switch continues to jam, replace retuner.
CHANNELS CANNOT BE SELECTED BY CHANNEL KNOB ON RADIO SET CONTROL, BUT ONLY BY LOCAL SELECTOR KNOB ON RECEIVER-TRANSMITTER	Lever in CHANNEL knob pulled out.	Push lever in.
	CHANNEL knob not fully seated on S301.	Push CHANNEL knob firmly onto S301 shaft, and tighten setscrew.
	Defective wire in cable between J101 and J104.	Correct defective wiring.
	Local-remote switch S302 in radio set control not positioned correctly on S301, resulting in S302 not being actuated by operating lever.	Readjust position of S302.

TABLE 6-2. TROUBLE-SHOOTING CHART (Cont)

Symptom	*Probable Cause*	*Remedy*
NO RECEIVER OR TRANSMITTER OUTPUT ON ANY CHANNEL.	Power not applied.	Check for disconnected power source or defective cable.
	Tuning lock not tightened after channel set up.	Set up channels and secure tuning lock as described in paragraph 3-16.
	Defective lock or slip clutch on tuner shaft assembly in retuner.	Replace retuner.
	Jammed locking plate on selector drum assembly in retuner.	Replace retuner.
	Plugs P106A and P106B not mated to jacks J106A and J106B.	Reconnect plugs and jacks.
DYNAMOTOR NOT RUNNING.	Dynamotor not running due to open input filter Z106, defective power relay K106, worn brushes, or defective switch S103 in radio set control.	Replace defective parts.
DYNAMOTOR RUNNING BUT NO OUTPUT VOLTAGE.	Worn brushes, open output filter choke L127, shorted filter capacitors C184 or C185, open dynamotor field winding.	Replace defective parts or dynamotor as required.
RECEIVER AND TRANSMITTER WORK ON SOME CHANNELS BUT NOT ON OTHERS.	Tuning not set up on inoperative channels.	Set up tuning.
	Crystals not installed on inoperative channels.	Install crystals.
	Defective band switch (when either all high- or all low-band channels are inoperative).	Repair band switch mechanism.
NO TRANSMITTER OUTPUT ON ANY CHANNEL BUT RECEIVER IS OPERATIVE ON ALL CHANNELS.	If no current indication with meter switch set to G position, transmitter crystals not installed or transmit relay not operating.	Check microphone switch, cabling to receiver-transmitter for open lead, or open coil on relay K105. Replace defective parts.
	If no current indication with meter in G position, crystal selector switch S102B or lead to it may be defective.	Check wiring; replace defective parts.
	If meter indication normal in G position. ANT TAP, ANT FINE, or PA LOAD adjustment not set up.	Set up adjustments as described in paragraph 3-16.
	If meter reading in position G normal. but no loading possible, antenna relay inoperative, screen resistor R200 open, or modulation transformer T103 open.	Replace defective part.
	Oscillator tube V109, driver tube V110, or power amplifier tube V112 defective.	Replace defective tube.

TABLE 6-2. TROUBLE-SHOOTING CHART (Cont)

Symptom	*Probable Cause*	*Remedy*
TRANSMITTER OUTPUT LOW.	Supply voltage is too low.	If supply voltage is too low, replace with different power source.
	If meter reading at position G is normal but low at position K, power amplifier tube is defective.	Replace power amplifier V112.
TRANSMITTER DELIVERS OUTPUT BUT NO MODULATION.	Microphone connections poor.	Repair defective cables or replace defective plugs.
	Tube V113, V114, V115, V116, V117, or V118 defective.	Replace defective tube.
	Defective modulation transformer T103.	Replace transformer.
RECEIVER INOPERATIVE BUT TRANSMITTER DELIVERS OUTPUT.	Receiver crystals not installed.	Install receiver crystals.
	Crystal selector switch S102A defective.	Replace defective switch.
	Tube V101, V102, V103, V104, V105, V106, V107, or V108 defective.	Replace defective tube.
	I-F transformer Z101, Z102, or Z103 defective.	Replace defective transformer.
	Defective contact on receiver band switch S101.	Replace receiver preselector unit.
	Defective contact in antenna relay K101.	Replace defective antenna relay.
RECEIVER SENSITIVITY POOR ON SOME CHANNELS BUT SATISFACTORY ON OTHERS.	TUNING not properly adjusted for channels which give poor sensitivity.	Preset TUNING as described in paragraph 3-16.
RECEIVER SENSITIVITY POOR ON ALL CHANNELS OF ONE BAND.	Antenna trimmer C104 incorrectly adjusted.	Adjust antenna trimmer C104.
	Band switch S101 making poor contact.	Clean and adjust contacts on S101.
RECEIVER SENSITIVITY POOR ON ALL CHANNELS OF BOTH BANDS.	Trimmer capacitors C107C, C107D, C107F, or C107G in preselector misadjusted.	Realine preselector unit.
	Trimmer capacitors C117, C122, C125, C130, C136, or C144 in i-f amplifier misadjusted.	Realine i-f amplifier.
NO RECEIVER OUTPUT ON HIGH BAND.	Defective coil L102, L104, or L105.	Replace defective coil.
NO RECEIVER OUTPUT ON LOW BAND.	Defective coil L103, L106, or L107.	Replace defective coil.
RECEIVER AUDIO OUTPUT AND TRANSMITTER SIDE-TONE OUTPUT LOW OR ABSENT.	Tube V106 or V107 defective.	Replace defective tube.
	Transformer T101 defective.	Replace defective transformer.

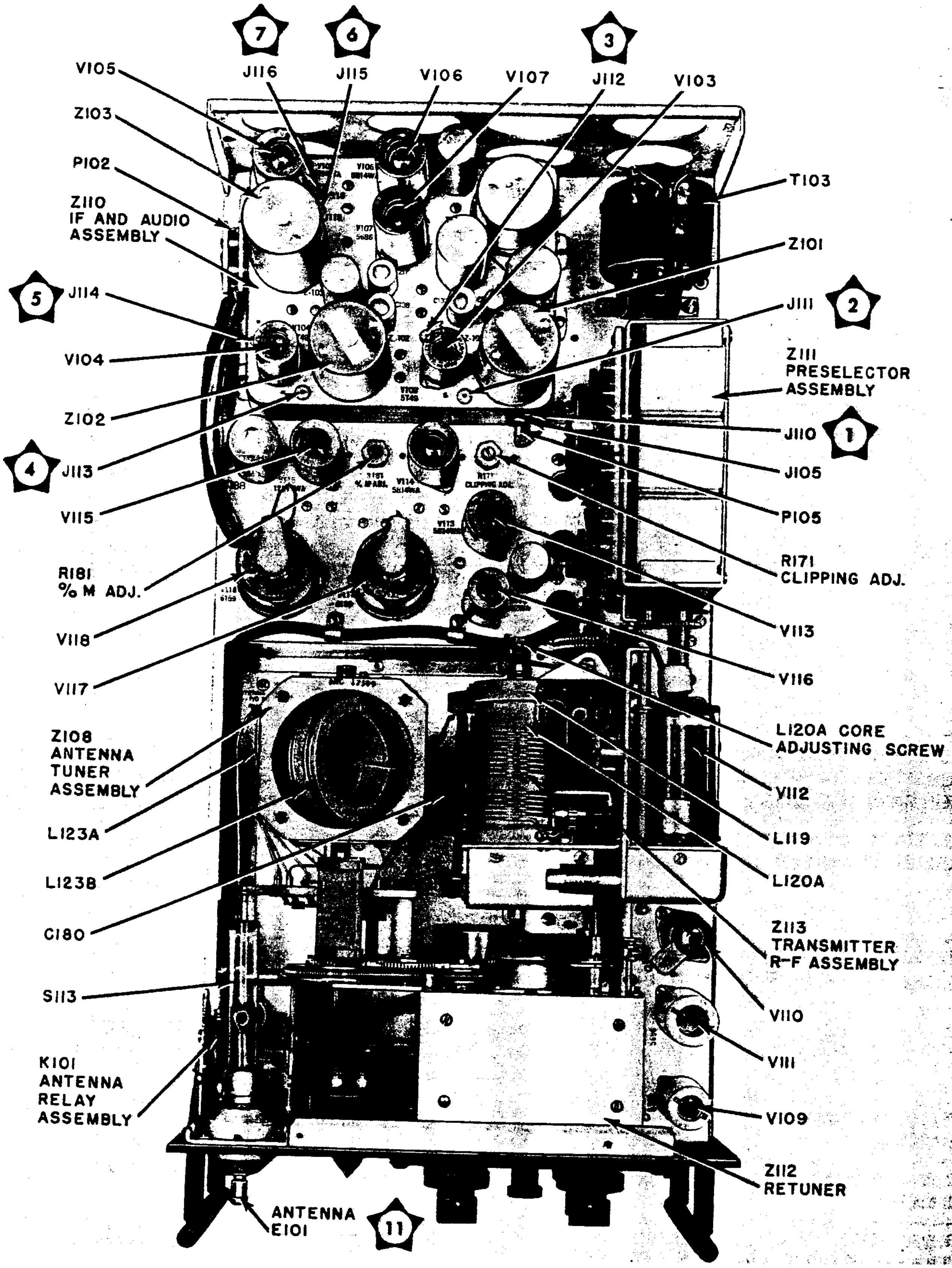


Figure 6-1. Receiver-Transmitter, Top View

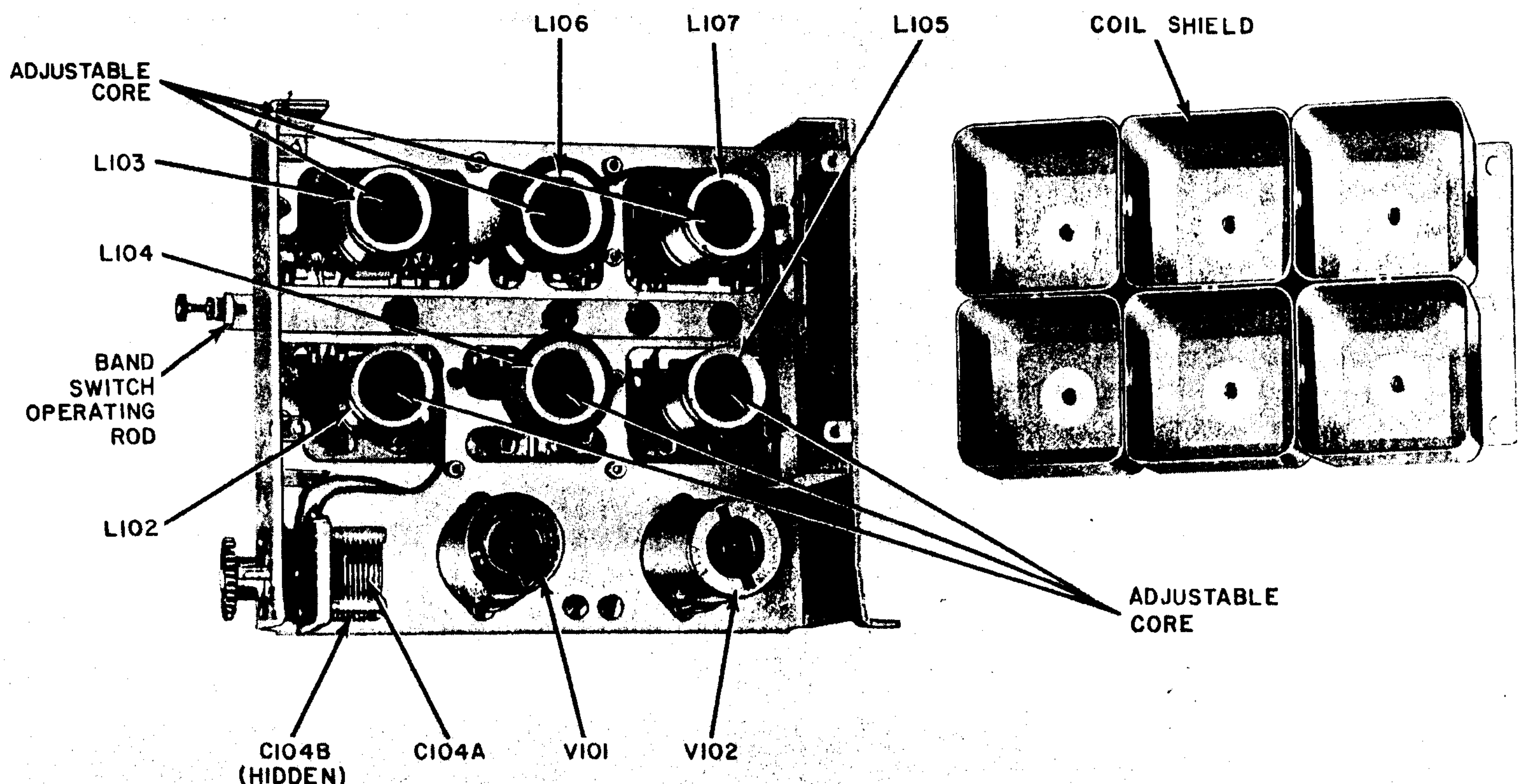


Figure 6-4. Preselector, Right-Side View

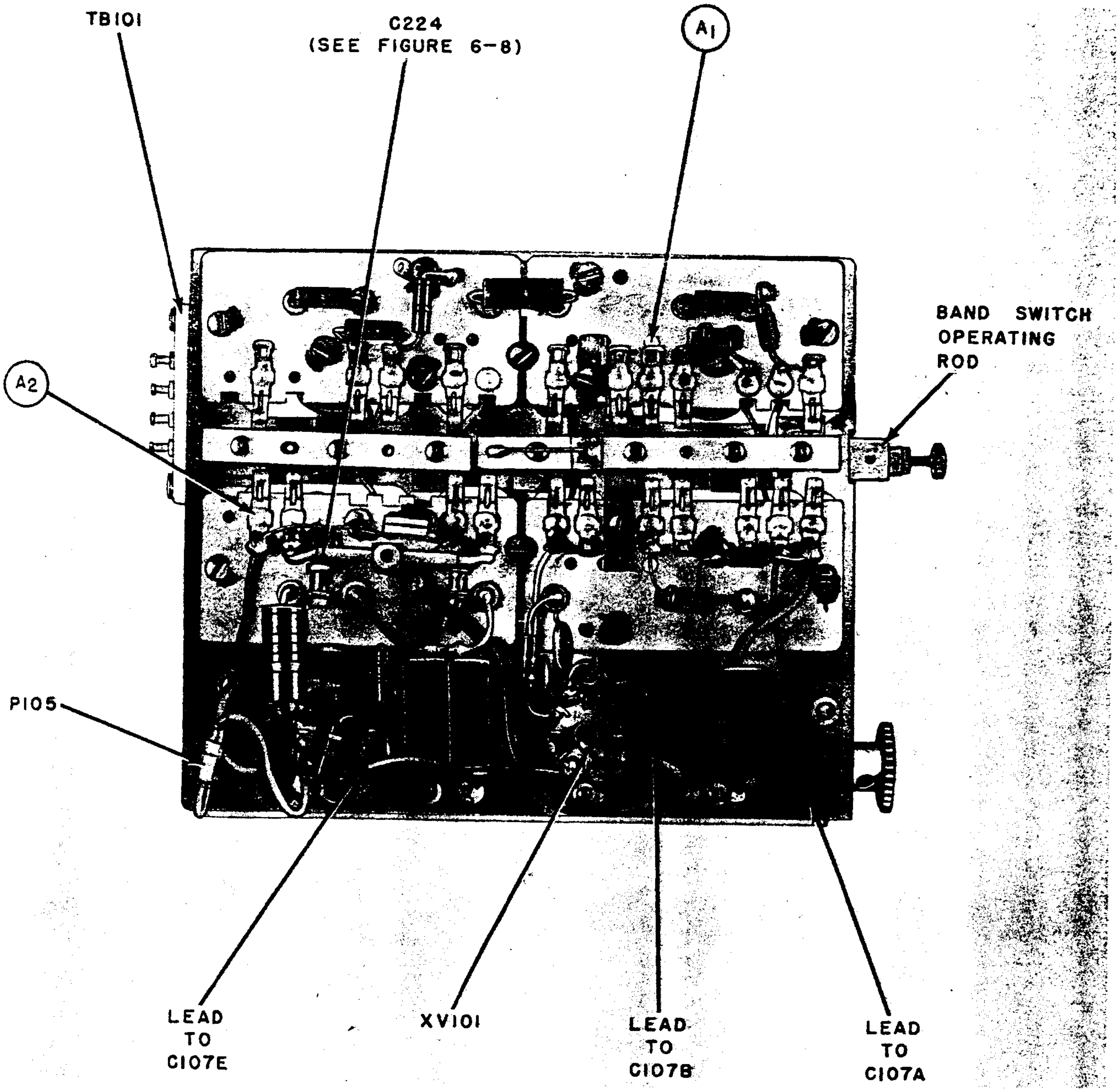


Figure 6-5. Preselector, Left-Side View

6-9. RETUNER TROUBLE SHOOTING. Before replacing a malfunctioning retuner, it is important to determine whether the malfunction is actually caused by a defect within the retuner, or is in the wiring between retuner receptacle J104 and receptacle J101 on the front panel of the receiver-transmitter. To make this test, disconnect P104 from J104, and P101 from J101, and interconnect the retuner and P101 with Wiring Harness W1 of Bench Test Equipment AN/ARM-35, thus bypassing the receiver-transmitter internal wiring. If the retuner now operates correctly, check the receiver-transmitter for defective wiring.

6-10. VOLTAGE AND RESISTANCE MEASUREMENTS. Table 6-3 lists the voltage and resistance measurements for all connector and tube socket terminals in Receiver-Transmitter RT-427/ARC-39. The values shown are typical of those which may be encountered in a normally-operating equipment. However, variations in voltage and resistance of approximately 10 percent may be due to tolerances in part values and do not necessarily mean that the equipment is defective.

TABLE 6-3. VOLTAGE AND RESISTANCE MEASUREMENTS

Notes:

1. All voltage values are d-c, measured with a VTVM having approximately 10 megohms input impedance.
2. All resistance values are in ohms. Multipliers: K = 1000 ohms; MEG = 1,000,000 ohms.
3. All measurements made with equipment set to Channel 9.
4. Antenna post grounded.
5. Mating connector connected for connector measurements.
6. Mating connector disconnected for connector measurements.
7. Bias developed ranges from 1.5 volts to 3.5 volts, depending on frequency.
8. Bias is approximately 4.5 volts on low band, 2.0 volts on high band.

Reference Design.	*Terminal Number*	*Volts-Receive (See Note 4)*	*Volts-Transmit (See Note 4)*	*Ohms (See Note 5)*	*Ohms (See Note 6)*
J101	A	0	0	DATA NOT APPLICABLE	0
	B	0	0		0
	C	0	0		∞
	D	0	0		0
	E	0	0		0
	F	0	0		0
	G	0	0		∞
	H	0	0		80
	J	+27.5	0		150
	K	0	0		∞
	L	+27.5	+27.5		∞
	M	+27.5	+27.5		∞
	N	0	0		0
	P	+27.5	+27.5		29
	R	+27.5	+27.5		
	S	0	0		0
	T	+27.5	+7		470
	U	0	0		∞
	V	0	0		∞
J102	A	+12.6	+12.6	3.6	28
	B	+18.9	+18.9	3.3	25
	C	+25.2	+25.2	2.3	23
	D	+250	−1.5	—	∞
	E	+275	+330	180	∞
	F	+250	+330	—	∞
	G	0	0	0	0
	H	—	—	—	—
	J	0	0	3.2	∞
	K	0	0	80	80
	L	−90	0	—	∞
	M	+0.6	−2	1.2 MEG	∞
	N	0	0	0	∞
J103	A	−90	−80	—	∞
	B	−90	−80	85	∞
	C	−90	−80	60	∞
	D	0	0	210	—
	E	0	+18	80 K	—
	F	+26.5	+26.5	3	19
	G	+12.6	+12.6	6.5	11
	H	+18.9	+18.9	3.2	8
	J	−90	+18	—	∞
	K	−65	+230	68 K	68 K
	L	+250	−1.5	—	∞
	M	−90	+330	—	∞
	N	—	—	—	—

TABLE 6-3. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont)

Reference Design.	*Terminal Number*	*Volts-Receive (See Note 4)*	*Volts-Transmit (See Note 4)*	*Ohms (See Note 5)*	*Ohms (See Note 6)*
J104	A	0	0	0	0
	B	0	0	0	0
	C	0	0	∞	∞
	D	0	0	0	0
	E	0	0	0	0
	F	+27.5	+27.5	∞	∞
	G	+27.5	+27.5	3.2	∞
	H	+27.5	+27.5	32	∞
	J	+27.5	+27.5	3.2	∞
	K	+0.4	0	3.2	3.2
	L	0	0	0	0
	M	—	—	—	—
	N	+0.4	0	3.2	3.2
J105	1	+230	−1.5	—	—
J106	A	0	0	18 K	18 K
	B	0	0	24 K	24 K
J116	1	−0.3	−0.6	270 K	—
J117	1	+1.2	+0.4	1.8 MEG	—
K105	1	+27.5	+0.2	150	DATA NOT APPLICABLE
	2	+27.5	+27.5	3.2	
	3	−90	+330	∞	
	4	+275	+330	—	
	5	+275	0	—	
	6	0	0	∞	
	7	0	0	80	
	8	0	0	80	
	9	0	0	0	
	10	−90	0	—	
	11	−90	−80	—	
	12	−90	+315	∞	
	13	+250	+315	—	
	14	+250	−1.5	—	
K106	1	+27.5	+27.5	∞ P101 Removed	DATA NOT APPLICABLE
	2	0	0	∞	
	3	0	0	∞	
	4	+27.5	+27.5	∞	
	5	+27.5	+27.5	1.2	
	6	+27.5	+27.5	3.2	
	7	+27.5	+27.5	∞	
	8	0	0	∞	
P102	A	+12.6	+12.6	3.6	6.5
	B	+18.9	+18.9	3.3	8
	C	+25.2	+25.2	2.3	5
	D	+250	−1.5	—	—
	E	+275	+330	180	180
	F	+250	+330	—	—
	G	0	0	0	0
	H	—	—	—	—
	J	0	0	3.2	3
	K	0	0	80	5100
	L	−90	0	—	—
	M	+0.6	−2	1.2 MEG	∞
	N	0	0	0	0

TABLE 6-3. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont)

Reference Design.	*Terminal Number*	*Volts-Receive (See Note 4)*	*Volts-Transmit (See Note 4)*	*Ohms (See Note 5)*	*Ohms (See Note 6)*
P103	A	−90	−80	—	—
	B	−90	−80	85	85
	C	−90	−80	60	60
	D	0	0	210	∞
	E	0	+18	80 K	100 K
	F	+26.5	+26.5	3	4.5
	G	+12.6	+12.6	6.5	18
	H	+18.9	+18.9	3.2	6.4
	J	−90	+18	∞	∞
	K	−65	+230	68 K	∞
	L	+250	−1.5	—	600
	M	−90	+330	∞	∞
	N	—	—	—	—
P104	A	0	0	0	∞
	B	0	0	0	∞
	C	0	0	∞	∞
	D	0	0	0	∞
	E	0	0	0	0
	F	+27.5	+27.5	∞	∞
	G	+27.5	+27.5	3.2	∞
	H	+27.5	+27.5	32	∞
	J	+27.5	+27.5	3.2	3.2
	K	+0.4	0	3.2	∞
	L	0	0	0	∞
	M	—	—	—	—
	N	+0.4	0	3.2	∞
P105	1	+230	−1.5	—	∞
P106	A	0	0	18 K	∞
	B	0	0	24 K	∞
TB101	A	+0.6	−2	1.2 MEG	—
	B	+12.6	+12.6	3.6	—
	C	0	0	∞	—
	D	+250	−1.5	—	—
TB103	A	+27	+27	— Dynamotor Connected	∞ Dynamotor Disconnected
	B	0	0	0	0
	C	0	0	0	0
	D	−90	−80	—	25 K
	E	+275	+330	—	∞
	F	−90	0	—	25 K
XV101	1	+0.6	−2	1.2 MEG	
	2	0	0	0	
	3	0	0	0	
	4	+6.3	+6.3	2.6	
	5	+230	−1.5	—	
	6	+110	−1.5	30 K	
	7	+1.8	0	100	
XV102	1	(See Note 7)	−0.4	20 K	
	2	(See Note 8)	0	300	
	3	+6.3	+6.3	2.6	
	4	+12.6	+12.6	3.6	
	5	+230	−1.5	—	
	6	+80	−1.5	34 K	
	7	+0.6	−2	1.2 MEG	

TABLE 6-3. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont)

Reference Design.	*Terminal Number*	*Volts-Receive (See Note 4)*	*Volts-Transmit (See Note 4)*	*Ohms (See Note 5)*	*Ohms (See Note 6)*
XV103	1	+0.6	−2	1.2 MEG	
	2	0	0	0	
	3	+18.9	+18.9	3.6	
	4	+12.6	+12.6	3.6	
	5	+230	−1.5	—	
	6	+110	−1.5	29 K	
	7	+1.7	0	100	
XV104	1	0	0	1	
	2	0	0	0	
	3	+18.9	+18.9	3.6	
	4	+25.2	+25.2	2.3	
	5	+230	−1.5	—	
	6	+105	−1.5	39 K	
	7	+2.1	0	160	
XV105	1	−0.3	−0.6	270 K	
	2	−0.3	−0.6	270 K	
	3	+0.6	−0.3	150 K	
	4	+12.6	+12.6	6.5	
	5	0	0	0	
	6	+0.4	−0.3	180 K	
	7	+0.4	−0.3	180 K	
	8	+1.2	+0.4	1.8 MEG	
	9	+6.3	+6.3	4.4	
XV106	1	+230	−1.5	—	
	2	+0.3	−1.0	1.27 MEG	
	3	+12.5	−0.3	160 K	
	4	+25.2	+25.2	2.3	
	5	+12.6	+12.6	6.5	
	6	+100	+140	250 K	
	7	0	0	1 MEG	
	8	+6	+8	10 K	
	9	+18.9	+18.9	5.5	
XV107	1	+21	+110	6 K	
	2	+6	+95	180 K	
	3	+21	+110	6 K	
	4	+25.2	+25.2	2.3	
	5	+18.9	+18.9	3.3	
	6	+250	+330	—	
	7	+255	+320	—	
	8	+21	+110	6 K	
	9	+250	+330	—	
XV108	1	+230	−1.5	—	
	2	+76	−0.6	115 K	
	3	+78	0	15 K	
	4	+12.6	+12.6	7	
	5	0	0	0	
	6	+240	−1.5	—	
	7	+42	−0.6	155 K	
	8	+45	0	5200	
	9	+6.3	+6.3	5.5	

TABLE 6-3. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont)

Reference Design.	*Terminal Number*	*Volts-Receive (See Note 4)*	*Volts-Transmit (See Note 4)*	*Ohms (See Note 5)*	*Ohms (See Note 6)*
XV109	1	−0.3	+69	107 K	
	2	0	+77	107 K	
	3	+6.3	+6.3	2.3	
	4	0	0	0	
	5	−90	+290	∞	
	6	−65	+200	76 K	
	7	0	+77	6900	
XV110	1	0	+1.8	100	
	2	0	−4.4	22 K	
	3	0	+1.8	100	
	4	+12.6	+12.6	3.3	
	5	+18.9	+18.9	3.3	
	6	−90	+120	∞	
	7	−90	+250	∞	
	8	0	+1.8	100	
	9	−90	+120	∞	
XV111	1	−90	−80	—	
	2	−90	−170	500 K	
	3	−90	−80	—	
	4	+6.3	+6.3	2.3	
	5	+12.6	+12.6	3.3	
	6	−65	+180	51 K	
	7	−90	+18	∞	
	8	−90	−80	—	
	9	−65	+180	51 K	
XV112	1	−90	−80	—	
	2	+26.5	+26.5	3	
	3	−90	+1.5	∞	
	4	−90	−80	—	
	5	−90	−175	29 K	
	6	−90	−80	—	
	7	0	0	0	
	8	0	0	0	
	Top Cap	−90	—	∞	
XV113	1	−90	+150	∞	
	2	0	0	700	
	3	0	+5.7	1800	
	4	+12.6	+12.6	5.9	
	5	0	0	0	
	6	0	0	∞	
	7	0	0	∞	
	8	0	0	∞	
	9	+6.3	+6.3	4.4	
XV114	1	−90	+7	∞	
	2	−90	+7	∞	
	3	0	+7.2	42 K	
	4	+12.6	+12.6	5.9	
	5	+25.2	+25.2	2.3	
	6	−90	+7	∞	
	7	−90	+7	∞	
	8	0	+7.2	43 K	
	9	+18.9	+18.9	5.5	

TABLE 6-3. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont)

Reference Design.	*Terminal Number*	*Volts-Receive (See Note 4)*	*Volts-Transmit (See Note 4)*	*Ohms (See Note 5)*	*Ohms (See Note 6)*
XV115	1	−90	+135	∞	
	2	−0.5	0	1 MEG	
	3	0	+2.1	1 K	
	4	+12.6	+12.6	7.1	
	5	+25.2	+25.2	2.3	
	6	−90	+220	∞	
	7	−90	+24	1 MEG	
	8	−90	+30	20 K	
	9	+18.9	+18.9	6.2	
XV116	1	−90	+330	∞	
	2	−65	+230	66 K	
	3	—	—	∞	
	4	−65	+230	66 K	
	5	−90	+330	∞	
	6	—	—	∞	
	7	−65	+230	66 K	
XV117	1	0	0	0	
	2	+26.5	+26.5	3	
	3	−65	+230	66 K	
	4	0	0	0	
	5	−53	−48	110 K	
	6	0	0	0	
	7	0	0	0	
	8	0	0	0	
	Top Cap	−90	+330	∞	
XV118	1	0	0	0	
	2	+26.5	+26.5	3	
	3	−65	+230	66 K	
	4	0	0	0	
	5	−53	−48	110 K	
	6	0	0	0	
	7	0	0	0	
	8	0	0	0	
	Top Cap	−90	+330	∞	

6-11. Volts-receive measurements are made with the receiver operating; volts-transmit measurements are made with the switch on the dummy microphone (figure 5-1) set to TRANSMIT, or with a microphone plugged into MIC jack J119 and the switch pressed. The transmitter is tuned to channel 9 and operated unloaded. Resistance measurements are made with the power turned off and with no external connections to the equipment. The control settings for making the measurements are as follows:

Control	*Position*
Local Selector	9
ANT FINE	Any
PA LOAD	1
ANT TAP	Any

Control	*Position (Cont)*
TUNING	As required for channel 9
REC ANT	Any
SIDE TONE	Maximum counterclockwise
LOCAL TEL	Maximum clockwise
% M ADJ	Any
CLIPPING ADJ	Maximum clockwise
Meter Switch	K
LOCAL SELECTOR	9
CHANNEL (on radio set control)	9
Local-Remote Switch	Lever pulled out from body of channel knob

6-12. ALINEMENT INSTRUCTIONS.

6-13. GENERAL. Alinement of Radio Set AN/ARC-39 is divided into two parts: alinement of the receiver, and alinement of the transmitter. To aline the radio set, interconnect the receiver-transmitter, the radio set control, and the required test equipment as shown in figures 5-1 and 6-6, and proceed as described in the following paragraphs.

CAUTION

Do not attempt to aline the receiver trimmer capacitors without the proper test equipment. The preselector coil trimming adjustment cores have all been correctly set at time of manufacture and should not be readjusted unless a coil or the entire preselector is replaced.

6-14. If a repair required removal or replacement of the main tuning capacitor or the retuner before beginning electrical alinement, check that the receiver-transmitter tuning dial on the retuner, and tuning capacitor mechanical stop are correctly set-up as described in paragraphs 5-31 and 5-32. This mechanical adjustment is important since correct tuning of the receiver and transmitter is otherwise impossible.

6-15. RECEIVER ALINEMENT. Alinement of the receiver consists of two parts: i-f amplifier alinement, and preselector alinement. Alinement begins at the last stage of the i-f amplifier and works backwards to the receiver at the antenna post. The alinement procedure is described in the following paragraphs.

6-16. I-F AMPLIFIER ALINEMENT. Interconnect the radio set and test equipment as shown in figure 6-6. The i-f amplifier is alined by adjusting the i-f trimmer capacitors C117, C122, C125, C130, C136, and C141, located inside i-f transformers Z101, Z102, and Z103. These capacitors are accessible by rotating the dust shields on the top of these i-f transformers. (See figure 6-1.) The primary circuit trimmer of each transformer is identified by the number "1" stamped in the top of the transformer case, and the secondary trimmer is identified by the number "2". For optimum results, replacement of tubes V102, V103, V104, and V105 may require slight adjustment of corresponding trimmer capacitors. In general, the trimmers should not require adjustment unless an i-f transformer is replaced or a general overall alinement of the receiver is required.

6-17. The i-f transformers are overcoupled to provide a flat-topped band-pass characteristic centered around 750 kc. To aline the i-f amplifier, turn on the radio set and connect Multimeter ME-6B/U across the 300-ohm dummy load resistor. Connect R-f Signal Generator AN/URM-25 to one of the receiver crystal sockets in place of the crystal, with R-f Cable Assembly W2 of Radio Test Set AN/ARM-35, and select the channel corresponding to that crystal socket. (See figure 6-2.) A plug at the end of this cable has terminal pins with the same spacing as a CR-18/U crystal. The grounded terminal of each receiver crystal socket is the upper one. Observe correct polarity in connecting the signal generator. Set the signal generator to exactly 750 kc. amplitude modulated 30 percent at 1000 cps, and to an output level sufficient to produce 0.1 volt across the dummy load resistor.

6-18. Table 6-4 lists the trimmer capacitors in their order of alinement. Before adjusting a trimmer, short circuit the corresponding jacks with Shorting Tool MX-2400/ARM-35, to avoid spurious resonance points. Adjust each trimmer capacitor for maximum receiver output voltage, as indicated on Multimeter ME-6B/U. During adjustment of trimmers, adjust signal generator output to maintain the receiver output at 0.1 volt.

TABLE 6-4. USE OF TRIMMERS AND JACKS FOR ALINEMENT

Step	*I-F Transformer*	*Trimmer*	*Trimmer Number*	*Jack to be Short-Circuited (See figure 6-2)*
1	Z103	C141	2	J114 (Test Point 5)
2	Z103	C136	1	J115 to J116 (Test Point 6 to Test Point 7)
3	Z102	C127	2	J112 (Test Point 3)
4	Z102	C125	1	J113 (Test Point 4)
5	Z101	C122	2	J110 (Test Point 1)
6	Z101	C117	1	J111 (Test Point 2)

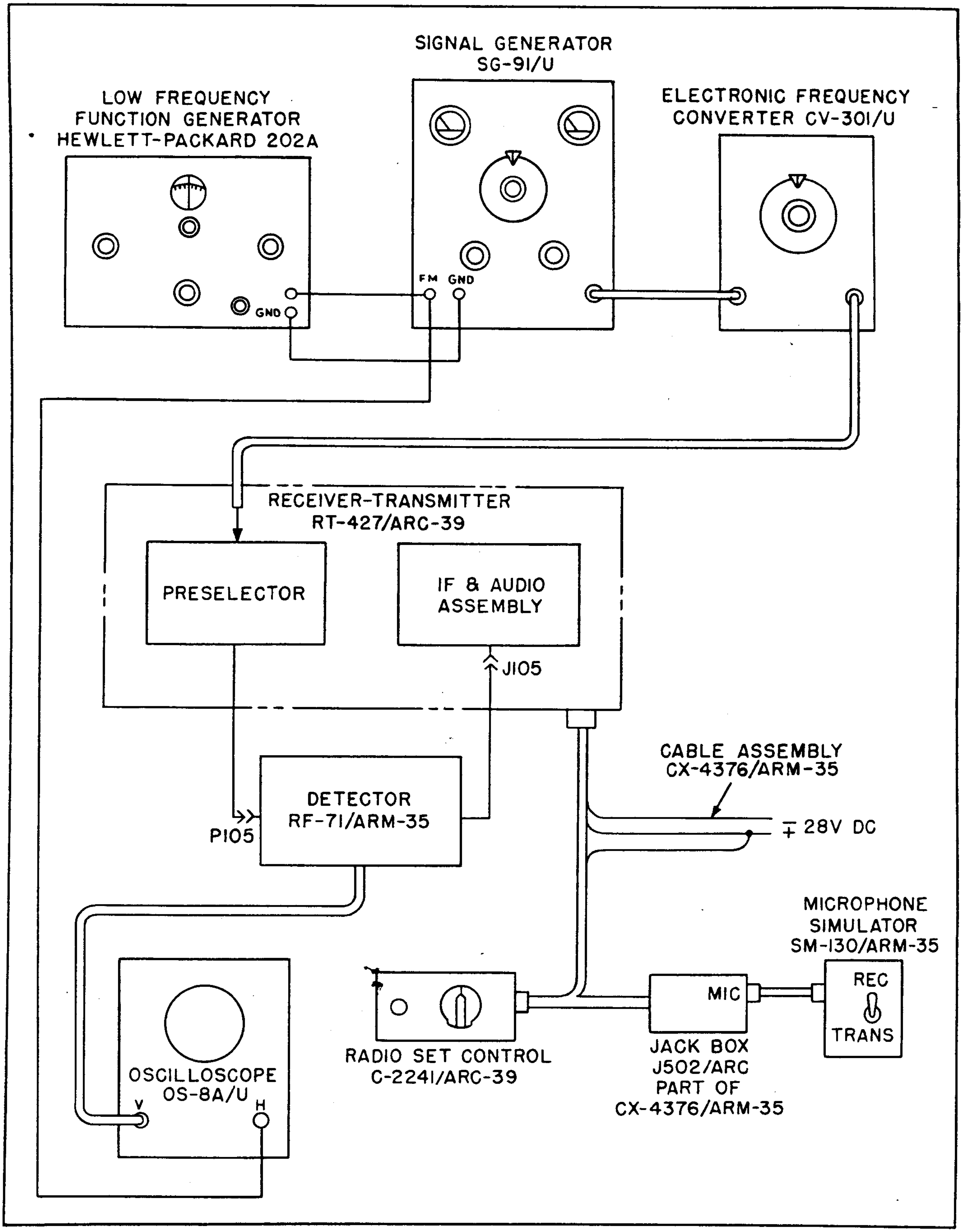


Figure 6-6. Bench Test Set-Up for Band Pass Alinement

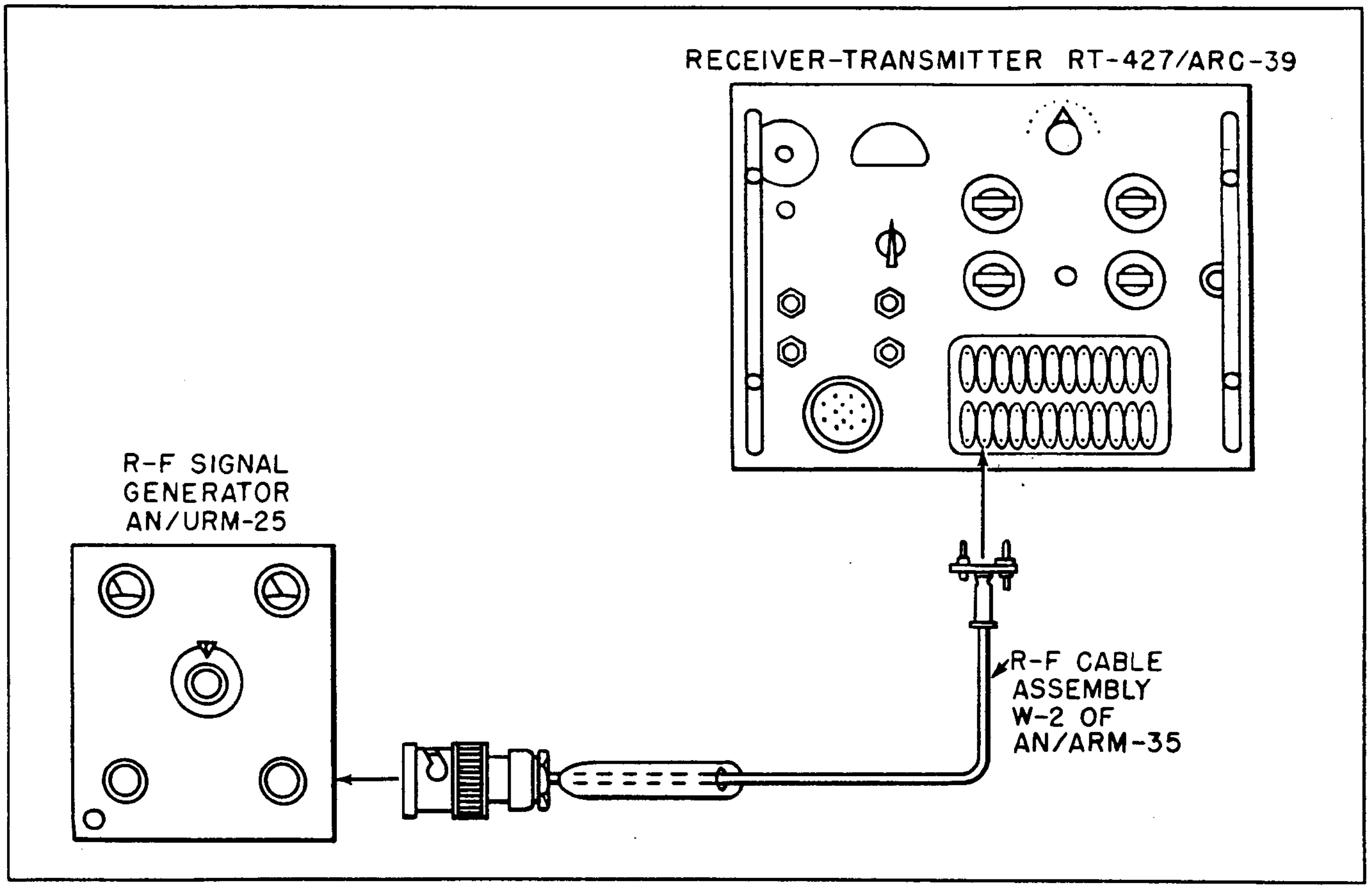


Figure 6-7. Bench Test Set-Up for I-F Amplifier

6-19. Check the i-f pass band after completing the alinement. Maintain the signal generator output voltage constant, and vary its output frequency 10 kc above and below the 750-kc center frequency. The output meter should indicate flat response or two slight peaks, one approximately 3 kc above the center frequency, and one about 3 kc below. The peaks should be of approximately equal amplitude, and the peak amplitude should not exceed the valley amplitude by more than 10 percent. If values obtained are not within this limit, check the alinement.

6-20. To permit a visual check on the i-f pass band (after alinement) connect the output of jack J116 (test point 7) to the vertical input terminals on Oscilloscope OS-8A/U through a 47,000-ohm resistor, and bypass the vertical amplifier of the oscilloscope with a 0.01-uf capacitor. Connect the oscilloscope horizontal amplifier to a low-frequency sweep voltage source of approximately 5 cps. This prevents a possibly poor transient response of the i-f amplifier from affecting the pass band display. The low-frequency source may be a Hewlett-Packard Model 202A Low Frequency Function Generator; a 5-cps motor-generator, ARC Part No. 16164, or any instrument having equivalent output characteristics.

Note

> Perform initial alinement of the i-f amplifier as described in paragraphs 6-16 through 6-19. The visual method is not recommended for initial alinement due to the difficulty of determining the exact center frequency of the amplifier pass band.

6-21. RECEIVER PRESELECTOR ALINEMENT. The extent of alinement of the receiver preselector is dependent upon the maintenance procedures required and can be divided into two groups: Minor alinement, where no repairs or replacements are made; Major alinement, where extensive maintenance has been performed.

6-22. MINOR RECEIVER PRESELECTOR ALINEMENT. If the receiver preselector has not been replaced, or if none of the coils or gang capacitors has been repaired or replaced, alinement involves merely the adjustment of r-f trimmer capacitors C107C, C107D, C107F, and C107G. These capacitors are accessible from the right-hand side of the receiver-transmitter chassis. (See figure 6-3.)

6-23. Minor preselector alinement is performed at 4.27 mc on the low band. Install a 5.02-mc crystal in the channel 6 receiver crystal socket and select channel 6 with the CHANNEL switch on the radio set control. Set the TUNING knob of the retuner to the dot above the period of the 9.1 marking on the outer scale and lock the knob. (This dot corresponds with the 4.27-mc point on the low band.)

CAUTION

Do not set the TUNING knob to the dot above the 9 of the 9.1 marking. This point is only for mechanical alinement of the tuning shaft. (Refer to paragraph 5-32.)

6-24. Connect Signal Generator AN/URM-25 to the antenna terminal of the receiver-transmitter through a 100-uuf capacitor as shown in figure 5-1. Adjust the signal generator output to approximately 5 microvolts at 4.27 mc, modulated 30 percent at 1000 cps.

6-25. Trimmer capacitor C107F is in parallel with C107G; C107C is in parallel with C107D. Adjust C107F and C107C, in turn, for a maximum reading on Multimeter ME-6B/U. If a maximum meter reading occurs at either a maximum or a minimum capacity setting of a trimmer, this indicates that the trimmer in parallel with it has either too little or too much capacitance. Close or open the plates of the second trimmer as required, and then readjust the first trimmer for a maximum indication on the output meter. Since the receiver output voltage tends to rise as the preselector is alined, reduce the signal generator output voltage to keep the receiver output at approximately 2 volts.

6-26. MAJOR RECEIVER PRESELECTOR ALINEMENT. The inductance of the preselector coils does not require any adjustment unless the entire preselector assembly has been replaced, the gang capacitors have been replaced, or one or more of the coils in the preselector assembly has been repaired or replaced. For proper tracking of the receiver circuits, complete alinement of the entire preselector, including all trimmer capacitors, is required when the coil inductance is adjusted. This procedure is described in the following paragraphs.

6-27. Take out the screws holding the preselector shield cover in place and remove the cover to expose the six coils. (See figure 6-4.) With a pair of thin pliers, remove the thin bakelite locking plates from inside each coil. These plates prevent the adjustable cores from moving after their final position has been set.

6-28. Place Coil Shield Assembly MX-2399/ARM-35 over the coils. This shield is similar to the original coil shield removed above, except that holes are provided above each coil to permit access to the adjustable cores.

6-29. Disconnect preselector output plug P105 from J105 on the i-f and audio assembly. Plug Detector RF-71/ARM-35 into J105 and plug P105 into the detector as shown in figure 6-6. Clip the detector ground lead to the preselector chassis, and plug the preselector output cable into the vertical amplifier input terminal of Oscilloscope OS-8A/U. Connect the horizontal amplifier input of the oscilloscope and the FM input of Signal Generator SG-91/U to the output of the low-frequency generator. Connect the output of Signal Generator SG-91/U to the input of Electronic Frequency Converter CV-301/U. Set the low-frequency generator to deliver a 5-cps sine wave output and adjust Signal Generator SG-91/U to deliver an FM signal of 50- to 100-kc frequency deviation. The resulting output of the signal generator is thus frequency-modulated at 5 cps and has a bandwidth of from 50 to 100 kc. This output is applied to Electronic Frequency Converter CV-301/U. The frequency converter converts the high-frequency input from Signal Generator SG-91/U to a lower frequency, by mixing this input with a 150-mc signal from an internal oscillator.

6-30. Insert 2.00-mc, 4.27-mc, 4.27-mc, and 9.1-mc crystals in the channel 1, channel 6, channel 7, and channel 12 receiver crystal sockets, respectively, on the crystal switch panel of the retuner. The corresponding calibration points on the TUNING knob are as follows:

Channel	*Frequency (mc)*	*Calibration Point*
1	2.00	Dot above "2" of "4.27" marking on outer scale of TUNING knob.
6	4.27	Dot above "period" of "9.1" marking on outer scale of TUNING knob.
7	4.27	Dot above "2" of "4.27" marking on outer scale of TUNING knob.
12	9.10	Dot above "period" of "9.1" marking on outer scale of TUNING knob.

These frequencies are used to aline the receiver. The crystals are used to provide markers on the oscilloscope during alinement. Set the TUNING knob for each of the four marker frequencies by selecting the channel, unlocking the TUNING knob, setting the knob to the proper calibration point, and locking the knob.

Note

The marker-frequency amplitude must be adjusted to avoid distortion of the band-pass pattern. To do this, short-circuit the oscillator output by connecting a lead between the end of coaxial cable W102 at the socket of oscillator V108 and ground, and note the marker amplitude on the oscilloscope. (See figure 6-3.) If the amplitude is still too great, shorten the lead. Making the lead too short, however, will eliminate the marker entirely.

6-31. The preselector is alined first on the low band and then on the high band. Alinement is accomplished as follows:

a. Turn on the receiver-transmitter and select channel 6. Tune Signal Generator SG-91/U to approximately 154.27 mc for an output frequency of 4.27 mc from the frequency converter.

b. Connect the output lead of Electronic Frequency Converter CV-301/U to the control grid (terminal 1) of r-f amplifier tube V101 through a .01 uf capacitor. This point is test point A1 and is accessible as the third fixed contact from the front on the upper section of the band switch. (See figure 6-5.)

c. Adjust tuning of signal generator and trimmer capacitors C107C and C107F (paragraph 6-25) to produce best response pattern centered on the 4.27-mc marker.

d. Select channel 1 and tune Signal Generator SG-91/U to about 152 mc. Insert an insulated plastic screwdriver through the holes in the coil shield and adjust signal-generator tuning and the cores of L106B and L107 to obtain best response centered at 2.00 mc.

e. Alinement of the circuit at one end of the band affects alinement at the other end. Recheck the high and low ends of the band alternately, therefore, and adjust trimmers and cores until no further adjustment is necessary.

f. Select channel 7, tune the signal generator to about 154.27 mc, and adjust signal-generator tuning and the cores of L104B and L105 for best response centered at 4.27 mc.

g. Select channel 12, tune the signal generator to about 159.1 mc and adjust signal-generator tuning and trimmer capacitors C224A and C224B for best response centered at 9.1 mc.

Note

Capacitor C224 consists of a short metal tube mounted on one of the ceramic plates that make up the band switch of the preselector. (See figure 6-8.) The capacitances of C224A and C224B are varied by pulling out or pushing in (with an insulated rod) the white Teflon-insulated wires in each end of the tube.

h. To check the adjustment of C224A and C224B, slightly vary trimmer capacitor C107C or C107F. If adjustment of C224A and C224B is optimum, no improvement will result. Readjust C107C and C107F at channel 6 setting; then, if necessary, touch up adjustment of C224A and C224B at channel 12 setting.

i. Alternately make channel 6 and channel 12 adjustments until no further adjustment is needed. The last adjustment must be made at the channel 6 setting.

j. Disconnect the output of the frequency converter from test point A1 and connect it to test point 11 (antenna terminal of receiver-transmitter) through a 100-uuf capacitor.

k. Select channel 6, tune the signal generator to 154.27 mc, and adjust REC ANT trimmer capacitor C104A (CH. 1-6 knob) for maximum symmetrical response at 4.27 mc as indicated by the oscilloscope.

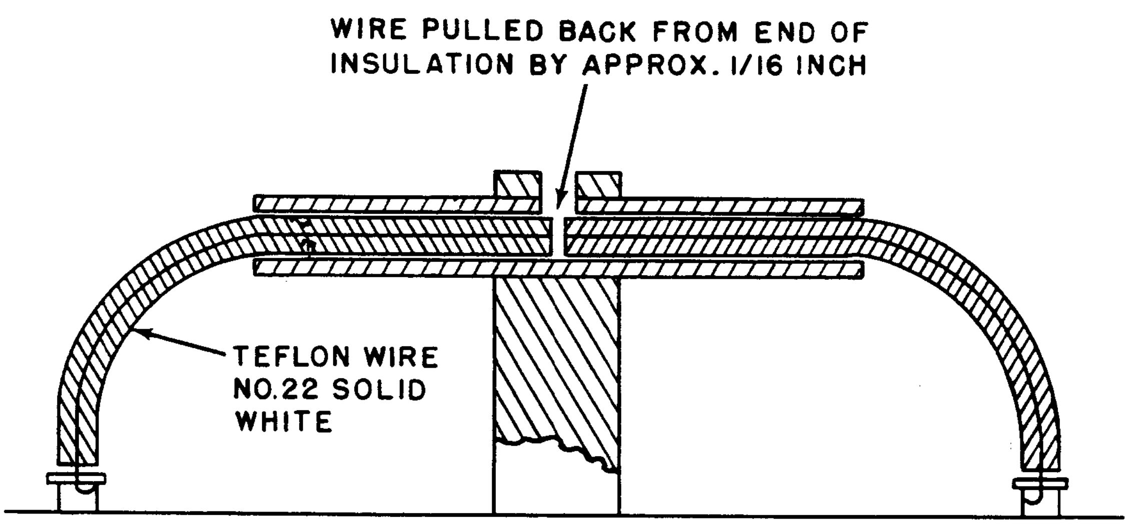


Figure 6-8. Detail of Preselector Capacitor C224

l. Select channel 1, tune the signal generator to 152 mc and adjust the core of L103 for maximum symmetrical response at 2.00 mc.

m. Alternately adjust C104A and the core of L103 (at channels 6 and 1, respectively) until no further adjustment is needed.

n. Select channel 12, tune the signal generator to 159.1 mc, and adjust REC ANT trimmer capacitor C104B (CH. 7-12 knob) for maximum symmetrical response at 9.1 mc.

o. Select channel 7, tune the signal generator to 154.27 mc, and adjust the core of L102 for maximum symmetrical response at 4.27 mc.

p. Alternately adjust C104B and the core of L102 (at channels 12 and 7, respectively) until no further adjustment is needed.

q. Insert the locking plates on the adjustable cores and replace the coil shield cover.

Note

Use caution in inserting locking plates to avoid cutting coil wires.

r. After all adjustments have been made, select channel 3, unlock the TUNING knob, and slowly tune the receiver over the full tuning range of the low band, keeping in step with the signal generator to observe the band-pass over the entire range. Lock the TUNING knob, select channel 9, and repeat the operation for the high band.

s. Check the receiver sensitivity, as outlined in paragraph 6-5, and compare the sensitivity measurements with those listed in table 6-1.

6-32. TRANSMITTER ALINEMENT. Except for the use of Cable Assembly CX-4376/ARM-35, and Microphone Simulator SM-130/ARM-35 connected as in figure 5-1, no external test equipment is required for transmitter alinement. The transmitter oscillator comprises the test signal source, and meter M101 on the front panel indicates when alinement and tuning is correct.

6-33. MINOR TRANSMITTER ALINEMENT. If the transmitter r-f assembly has not been replaced, or if none of the coils or gang capacitors has been repaired or replaced, alinement involves merely the adjustment of trimmer capacitors C169A, and C169E. These capacitors are accessible from the right-hand side of the receiver-transmitter chassis. (See figure 6-3.)

6-34. The trimmer capacitors are adjusted at 4.27 mc on the low band. To make these adjustments, proceed as follows:

a. Install a 4.27-mc crystal in the channel 6 transmitter crystal socket and select channel 6 on the retuner.

b. Set and lock the TUNING knob at the dot above the period of the 9.1 marking on the outer scale of the knob. (This dot corresponds with the 4.27-mc point on the low band.) Set the PA LOAD knob to "1" and the meter switch to "G".

c. Turn on the transmitter by setting the switch on the microphone simulator to TRANSMIT. With the transmitter operating, adjust trimmer C169A for *maximum* meter reading. This reading should be at least 120.

d. Turn off the transmitter by setting the microphone simulator switch to RECEIVE, set the meter switch to "K", and turn the transmitter on again. Adjust trimmer C169D for a *minimum* meter reading of 30 or less. Trimmer C169E is in parallel with C169D and in most instances will not require adjustment.

e. Recheck the settings of C169A and C169D by repeating steps c. and d., until no further adjustment is required.

6-35. MAJOR TRANSMITTER ALINEMENT. Complete alinement of the transmitter is accomplished as follows:

a. Remove the side cover of the transmitter r-f assembly (paragraph 5-27) and the coaxial tuning shaft assembly. Using thin pliers, remove the bakelite locking plates from the adjustable cores of L116 and L117. (See figure 6-3.)

b. Insert 2.00-mc, 4.27-mc, 4.27-mc and 9.1-mc crystals in the channel 1, channel 6, channel 7, and channel 12 transmitter crystal sockets, respectively, on the crystal switch panel of the retuner. The corresponding calibration points on the TUNING knob are as follows:

Channel	*Frequency (mc)*	*Calibration Point*
1	2.00	Dot above "2" of "4.27" marking on outer scale of TUNING knob.
6	4.27	Dot above period of "9.1" marking on outer scale of TUNING knob.
7	4.27	Dot above "2" of "4.27" marking on outer scale of TUNING knob.
12	9.10	Dot above period of "9.1" marking on outer scale of TUNING knob.

Set the TUNING knob for each of the four channels by selecting the channel, unlocking the knob, setting the knob to the proper calibration point, and locking the knob.

c. Using a screw driver, adjust cores of the power-amplifier tank coils, L119 and L120A, (figure 6-1), to approximately the middle of their inductance ranges. These core-adjusting screws have hexagonal heads protruding from the ends of the coils adjacent to the plate cap of V112.

d. Select channel 6 and set the meter switch to "G". Key the transmitter and quickly adjust trimmer capacitor

C169A (figure 6-3) for maximum meter reading. Set the meter switch at "K" and quickly adjust C169D (figure 6-3) for minimum meter reading. This step helps avoid overloading the power-amplifier tube during the remaining alinement procedure.

e. Select channel 1, and adjust core of L116 for maximum meter reading at "G" setting of meter switch.

f. Alternately select channels 1 and 6, readjusting L116 and C169A until no further adjustment is needed.

g. Select channel 7. With meter switch set to "G", adjust core of L116 for maximum meter reading.

h. Select channel 12 and check that the meter reading is greater than 120.

i. Insert locking plates inside the coils.

Note

Use caution in inserting locking plates to avoid cutting coil wires.

j. Set PA LOAD knob at "1", and set meter switch at "K".

k. Select channel 1, and adjust core of L120A for minimum meter reading. The core-adjusting screw has a hexagonal head and protrudes from the end of the coil adjacent to the plate cap of V112.

l. Select channel 6, and adjust C169D and C169E for minimum meter reading.

m. Alternately select channels 1 and 6, readjusting L120A and C169D and C169E until no further adjustment is needed.

n. Select channel 7, and adjust the core of L119 for minimum meter reading.

o. Select channel 12, and check that meter reading is less than 30.

p. Replace coaxial tuning shaft assembly and the side cover of the transmitter r-f assembly.

6-36. NEUTRALIZATION. After all adjustments have been made on the transmitter, check for neutralization of the power-amplifier tube as follows:

a. Set meter switch at "G". For each of the four channels used for alinement, key the transmitter, remove the corresponding crystal, and observe that the meter reading drops to zero. Repeat several times for each channel. With crystal removed from transmitter crystal socket, meter reading should remain at zero.

b. In each band, select any channel not used in the alinement procedure. Do not insert crystal. Unlock TUNING knob and slowly tune over the entire range of each band (stop-to-stop) while keying the transmitter intermittently. Meter reading should remain at zero.

c. If at any frequency there is a meter reading greater than zero, carefully bend the plates of C173 with a plastic screwdriver until meter reads zero over the entire tuning range of each band.

6-37. RETUNER REPAIRS AND ADJUSTMENTS.

6-38. GENERAL. Field maintenance of the retuner is limited to replacement of defective switches and relays, and adjustment of switch and relay movement tolerances. All other repairs are to be performed at overhaul maintenance. The switches which may be replaced in the retuner at field maintenance are S106, S107, S108, and S109. The relays which may be replaced include K102, K104, and K107. Solenoid L126 may also be replaced. Hermetically-sealed relay K107 is mounted in the back of the rear plate. To remove K107, unsolder the six leads and remove nut and washer. No adjustment can be made on K107.

6-39. REPLACEMENT OF SWITCHES AND RELAYS. Switch S106 is mounted on the rear plate of the retuner, above and to the left of the drive motor. To remove it, take out the two mounting screws holding it to the rear plate and unsolder the two wires, after labeling them. Install and rewire the new switch and then adjust the opening and closing of its contacts, as illustrated in figure 6-9.

6-40. Switches S107 and S108, and relay K104 comprise a subassembly mounted between the front and rear plates of the retuner. To replace any of these parts, first remove the three screws holding the subassembly to the front plate. Two of these screws are accessible through holes in the rear plate on either side of solenoid L126. After the subassembly is free, remove the defective part by taking out the mounting screws and unsoldering the wires.

6-41. No adjustment of tolerances is required when S107 or S108 is replaced. If relay K104 is replaced, however, its armature travel limits must be adjusted to the tolerances illustrated in figure 6-10.

6-42. Solenoid L126 is mounted on a diamond-shaped plate attached to the rear plate by two screws. To replace L126, take out the two mounting screws and unsolder the two leads from terminals 4 and 5 of S109. Loosen the two setscrews holding the index pawl operating lever assembly to the solenoid arm and take off the lever assembly. Remove the nuts and lockwashers from the studs holding the solenoid to the mounting plate and take off the solenoid. Then remove the nut and setscrew from the solenoid arm. Install the new solenoid in reverse order, but do not tighten the index pawl operating lever setscrews before mounting the solenoid assembly on the rear plate. After mounting the assembly, adjust the index-pawl operating lever, and solenoid arm travel limits to the tolerances illustrated in figures 6-9 and 6-10.

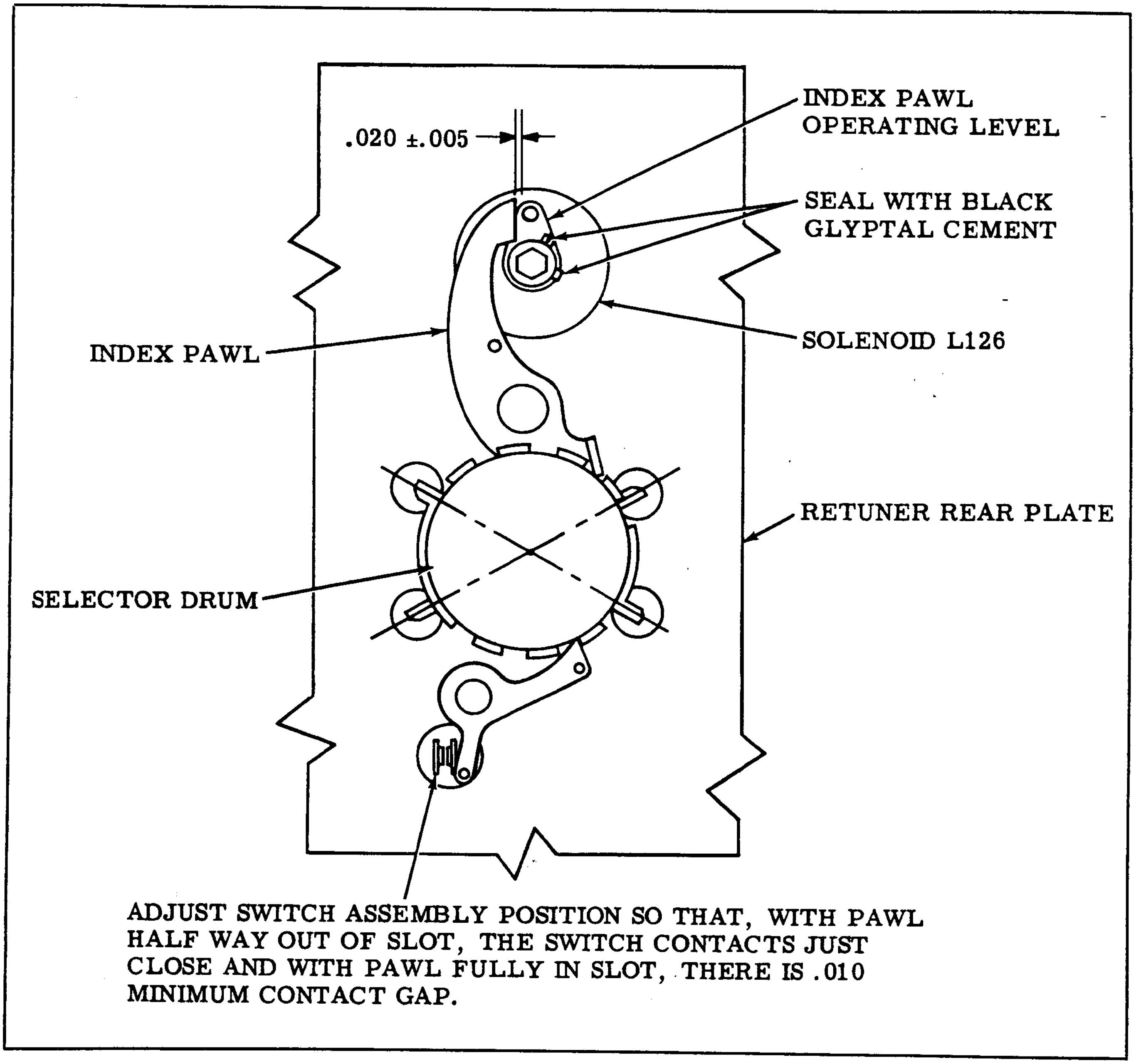


Figure 6-9. Retuner, Switch S106 Adjustment

6-43. Wafer switch S109 is mounted on studs attached to the rear plate of the retuner. Remove this switch after carefully noting the position of the rotor and the terminals, labeling each lead as it is unsoldered. Install the new wafer switch with the rotor and terminals in the same position as the original, and resolder the leads. Use care in resoldering the leads; an error in lead connection will cause the retuner to be inoperative or to select the wrong channels.

6-44. DYNAMOTOR REPAIRS AND ADJUSTMENTS.

6-45. The dynamotor brushes are located within the end bells of the dynamotor housing. To inspect or replace the brushes, it is necessary to remove the dynamotor from the mounting as described in paragraph 5-28.

6-46. To reach the low-voltage input brushes, remove the screened end bells and cooling fan from the fan-end of the dynamotor. The four high-voltage brushes may be reached by removing the solid end bell from the dynamotor.

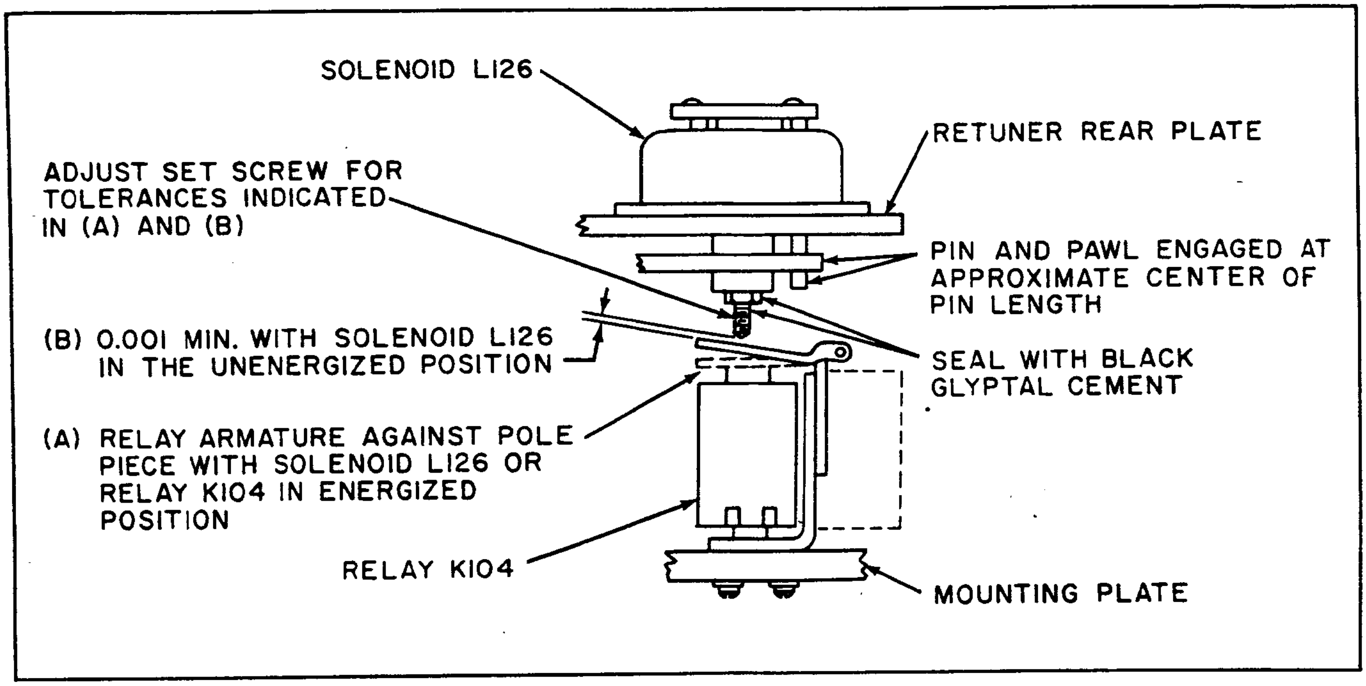


Figure 6-10. Retuner Solenoid Adustment

6-47. The low-voltage brushes have a life expectancy of approximately 1000 hours and the high-voltage brushes have a life expectancy of approximately 2000 hours. A brush which is worn down to 1/4 inch must be replaced To install new brushes proceed as follows:

a. Sand the commutator with No. 0000 sandpaper. Clean the commutator with Dry-Cleaning Solvent, Federal Specification P-S-661, and a clean cloth or clean bristle brush.

b. Insert new brushes, making certain that they are of the correct type and that they slide smoothly into their slots. Check that they seat firmly in position with the caps.

c. Remove the brushes and fasten a close-fitting strip of No. 0000 sandpaper around the commutator. Reseat the brushes in their slots so that their faces bear up against the sandpaper. Rotate the armature by hand until the brush face assumes the proper shape. Remove the sandpaper and blow out all accumulated dust with compressed air. Run the dynamotor until approximately 80 percent of each brush face makes contact with the commutator.

6-47A. REMOVAL AND DISASSEMBLY OF RADIO SET CONTROL C-2241/ARC-39.

6-47B. REMOVAL. Radio Set Control C-2241/ARC-39 is a single-assembly unit that requires no removal instructions.

6—47C. DISASSEMBLY. The procedure for disassembly of the radio set control into its detail parts is generally obvious upon inspection. When disassembling the control, refer to the exploded view, figure 6-11. The exploded view is indexed numerically in the order of disassembly except for attaching parts which are listed immediately following the parts they attach. The following instructions describe special disassembly procedures.

a. Unlatch the two turnlock fastener studs (1) at rear of control unit, and remove cover (3).

b. Remove four screws (5), nuts (6) and washers (7), and remove connector (4) from plate (16).

c. Remove screw (11), washer (12) and lug terminal (10).

d. Remove three screws (13) and plate (16) from mounting posts (63) of panel (64).

e. Remove two screws (18), nuts (19) and washers (20), and slip out sensitive switch (24) from brackets (17 and 25).

f. Remove nuts (21 and 26), washers (22 and 27), and remove brackets (17 and 25) along with washers (23 and 28) from rotary switch (55).

g. Loosen two setscrews (30) and remove knob (29).

Note

All setscrews are sealed with enamel. To facilitate removal, it may be necessary to use an enamel thinner (Federal Specification TT-T-306).

h. Loosen setscrew (31), and remove knob assembly (consisting of items 31 through 40) from shaft of rotary switch (55). Remove setscrew (31) and pin (32); separate lever (33) and spring (34) from knob (38). Remove setscrew (35), spring (36) and plunger (37) from knob

(38). Remove two screws (39) and separate knob (38) from plate (40).

i. Unscrew hex nuts (41) and washers (42). Remove red lens caps (43) from lamp holders (45). Extract lamps (46), and remove washers (44).

j. Remove lamp holders (45).

k. Remove two screws (48), two washers (49) and separate plastic panel (47) from panel (64).

l. Remove nut (51) and washer (52); then remove variable resistor (50).

m. Withdraw shaft (54), and remove nut (55) and two washers (57). Remove rotary switch (55) from panel (64).

6-47D. CLEANING. Clean the radio set control as outlined in table 6-5.

TABLE 6-5. CLEANING PROCEDURE

RADIO SET CONTROL C-2241/ARC-39

Part	*Procedure*
Rotary Switch (55, figure 6-11)	Clean contacts and wafer with brush and Dry-Cleaning Solvent, Federal Specification P-S-661. Lubricate contacts with Dow Corning DC-510 Silicone fluid, 500 Centistoke viscosity.
Variable Resistor (50, figure 6-11)	Apply a small amount of carbon tetrachloride, with a syringe or hypodermic needle, into the opening near the three lug terminals of the variable resistor. Turn knob back and forth to clean.
Plastic Panel (47, figure 6-11)	Remove surface dirt with dry cloth, or water-dampened cloth and mild soap. **CAUTION** Do not use an abrasive cleaner on plastic panel.

6-47E. INSPECTION. Inspect the radio set control as outlined in table 6-6.

TABLE 6-6. INSPECTION PROCEDURE

RADIO SET CONTROL C-2241/ARC-39

Part	*Inspection*
Lamp (46, figure 6-11)	Check whether lamp lights.
Variable Resistor (50, figure 6-11)	With Multimeter AN/PSM-4, check for smooth, non-interrupted action from zero to 5,000 ohms. Check switch for positive action with multimeter. Check for dirty, deformed, or corroded terminal lugs.
Rotary Switch (55, figure 6-11)	Check for dirty or insecure terminals and contacts, and for cracked or broken wafer section. Check switch for positive action with Multimeter AN/PSM-4.
Connector (4, figure 6-11)	Check for loose terminals, cracked insulation, corrosion, or stripped threads.
Knobs (29 and 38, figure 6-11)	Check for stripped threads in setscrew holes.

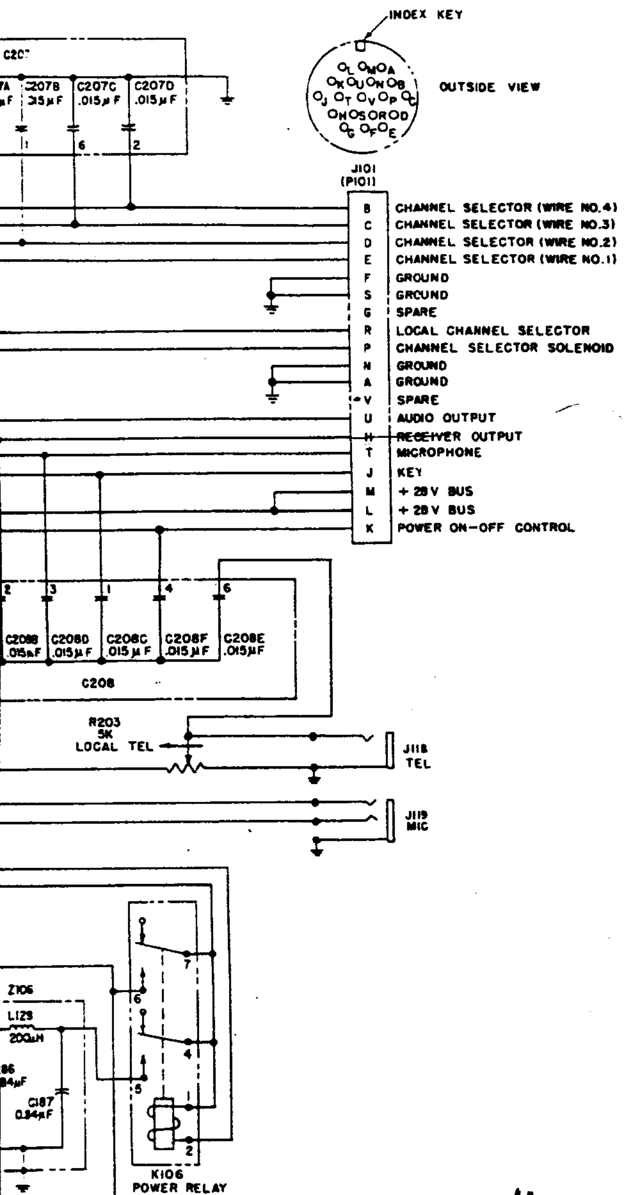
6-47F. REASSEMBLY. When reassembling the radio set control, refer to figure 6-11 and proceed essentially in the reverse of the order of disassembly. The following instructions describe special reassembly procedures.

a. When placing knob (29) on variable resistor (50), make certain that there is a minimum clearance of 0.005 inch and a maximum clearance of 0.020 inch between the knob and panel (47). Tighten setscrew (30) securely.

b. When placing knob assembly (items 31 through 38) on rotary switch (55), make certain that there is a minimum clearance of 0.015 inch and a maximum clearance of 0.040 inch between the knob assembly and panel (47).

Key to Figure 6-11

1. Stud
2. Grommet
3. Cover
4. Connector
5. Screw
6. Nut
7. Washer
8. Identification plate
9. Screw
10. Lug terminal
11. Screw
12. Washer
13. Screw
14. Lockspring
15. Rivet
16. Plate
17. Bracket
18. Screw
19. Nut
20. Washer
21. Nut
22. Washer
23. Washer
24. Sensitive switch
25. Bracket
26. Nut
27. Washer
28. Washer
29. Knob
30. Setscrew
31. Setscrew
32. Pin
33. Lever
34. Spring
35. Setscrew
36. Spring
37. Plunger
38. Knob
39. Screw
40. Plate
41. Nuts
42. Washers
43. Red lens cap
44. Washer
45. Lamp holder
46. Lamp
47. Plastic panel
48. Screw
49. Washer
50. Variable resistor
51. Nut
52. Washer
53. Washer
54. Shaft
55. Rotary switch
56. Nut
57. Washer
58. Washer
59. Cup
60. Fastener
61. Spring
62. Insert
63. Post
64. Panel



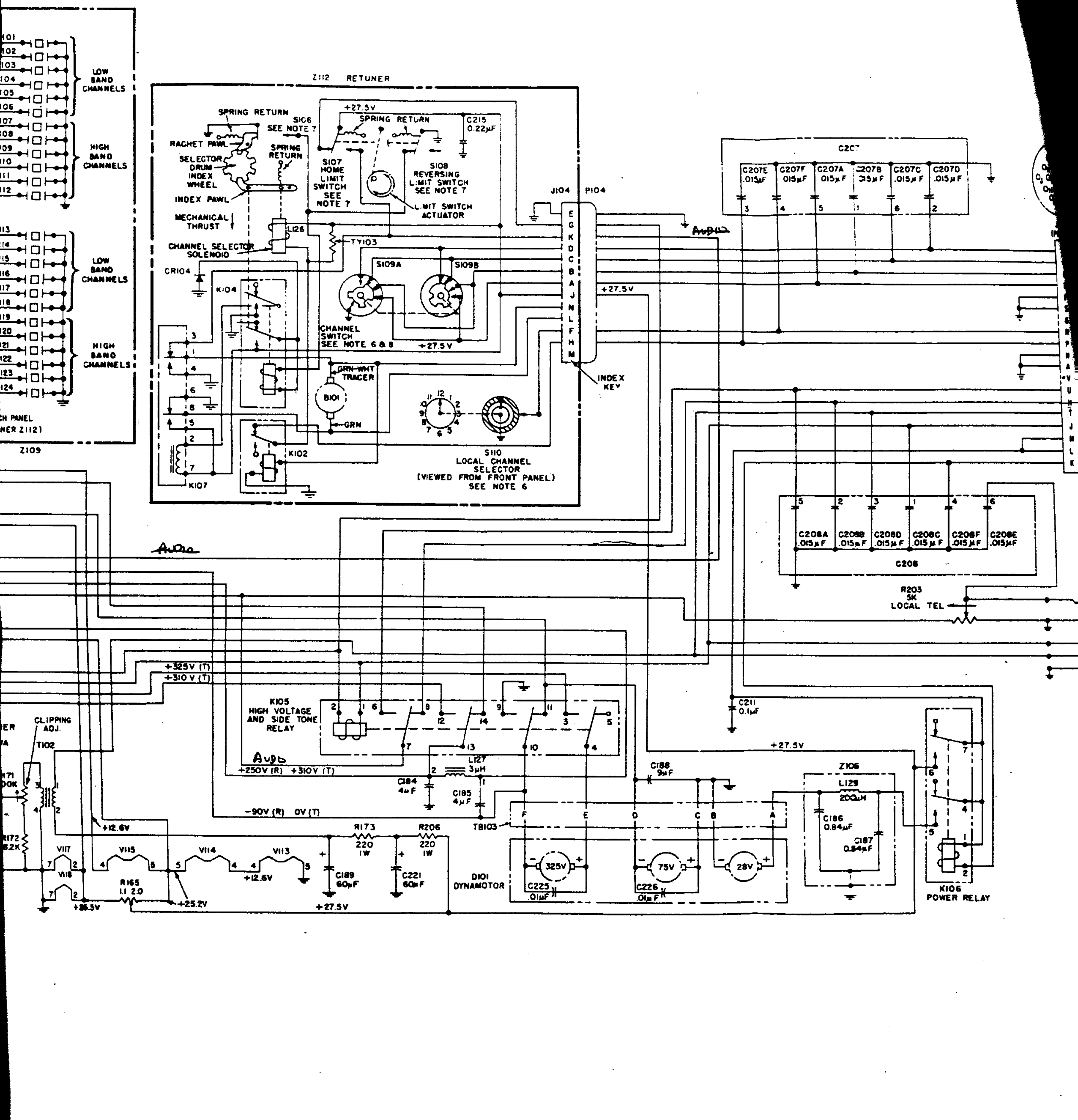
NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS. MULTIPLIERS: K = 1000; MEG = 1,000,000.
2. ALL CAPACITOR VALUES ARE IN MICROMICROFARADS (UUF), UNLESS OTHERWISE NOTED.
3. ALL VOLTAGES ARE APPROXIMATE AND ARE MEASURED WITH AN INPUT OF 27.5 VOLTS DC FROM TERMINALS L AND M OF J101 TO GROUND. THE SYMBOL "(R)" FOLLOWING A VOLTAGE VALUE INDICATES THAT THE MEASUREMENT IS MADE WITH THE EQUIPMENT IN RECEIVE CONDITION; THE SYMBOL "(T)" INDICATES THAT THE MEASUREMENT IS MADE UNDER TRANSMIT CONDITIONS.
4. THE RADIO SET CONTROL "CHANNEL" SWITCH GROUNDS TERMINALS B, C, D, AND E OF J101, AS TABULATED, LEAVING THE REMAINING TERMINALS OPEN.

TERMINAL OF J101	CHANNEL NO.											
	1	2	3	4	5	6	7	8	9	10	11	12
B			X			X	X		X	X	X	
C				X			X	X		X	X	X
D	X				X			X	X		X	X
E	X	X				X			X	X		X

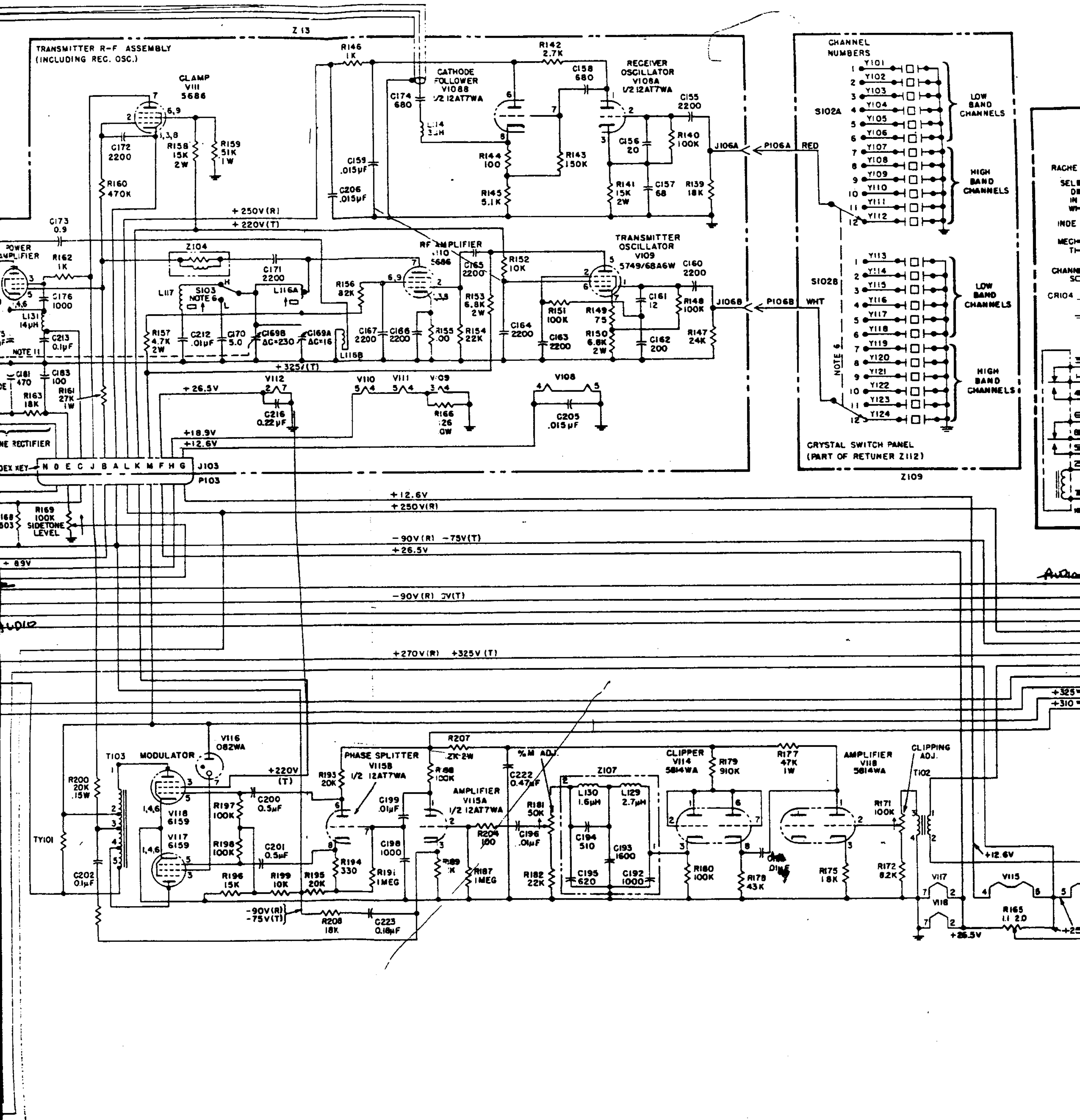
5. FOR LOCAL CONTROL OPERATION, WITHOUT USING THE RADIO SET CONTROL MAKE THE FOLLOWING CONNECTIONS TO P101 (NOT SHOWN) WHICH MATES WITH J101:
   A. CONNECT A JUMPER WIRE BETWEEN TERMINALS P AND R.
   B. CONNECT A POWER SOURCE CONTROL SWITCH BETWEEN TERMINALS K AND N.
   C. CONNECT +28 VOLTS DC TO TERMINALS L AND M.
   D. CONNECT -28 VOLTS DC (GROUND) TO TERMINALS F AND S.
6. SWITCHES S101, S102, S103, S109, S110, AND S112 ARE SHOWN IN POSITION FOR OPERATION ON CHANNEL NO. 12. SWITCHES S101, S103, and S112 ARE GANGED TOGETHER AND REMAIN IN THE POSITION SHOWN FOR OPERATION ON THE HIGH-BAND CHANNELS, NO. 7 THROUGH NO. 12; THEY ARE MOVED TO THE OTHER POSITION FOR OPERATION ON THE LOW-BAND CHANNELS, NO. 1 THROUGH NO. 6, BY MEANS OF A CAM IN RETUNER Z112.
7. SWITCHES S106, S107, AND S108, IN RETUNER Z112, ARE SHOWN FOR THE HOME POSITION OF Z112.
8. CHANNEL SWITCH S109 IS SHOWN AS VIEWED FROM THE REAR OF RETUNER Z112. IN THIS POSITION, THE S109A SIDE OF THE WAFER IS NEAREST TO THE PANEL, AND THE S109B SIDE IS VISIBLE TO THE OBSERVER.
9. METER SWITCH S111 IS SHOWN IN POSITION FOR MEASUREMENT OF GRID CURRENT. THE LETTER IDENTIFICATION OF THE SWITCH POSITIONS IS AS FOLLOWS:
   "G" - GRID CURRENT OF V112
   "K" - CATHODE CURRENT OF V112
   "A" - ANTENNA CURRENT
10. ALL RELAYS ARE SHOWN IN UNENERGIZED POSITION.
11. GANG CAPACITOR SECTIONS C107A, C107B, AND C107E, AND C169B AND C169C ARE GANGED TOGETHER AND OPERATED BY THE "TUNING" SHAFT IN RETUNER Z112.
12. SWITCH S104A, B IS OPERATED BY THE "ANT TAP" SHAFT IN RETUNER Z112. S104A IS OPEN IN TAP POSITIONS 1 AND 2 OF S104B, AND IS CLOSED IN TAP POSITIONS 3 THROUGH 13.
13. VARIOMETER L123B IS OPERATED BY THE "ANT FINE" SHAFT IN RETUNER Z112.
14. VARIOMETER L120B IS OPERATED BY THE "PA LOAD" SHAFT IN RETUNER Z112.

Figure 7-1. Receiver-Transmitter RT-427/ARC-39, Schematic Diagram

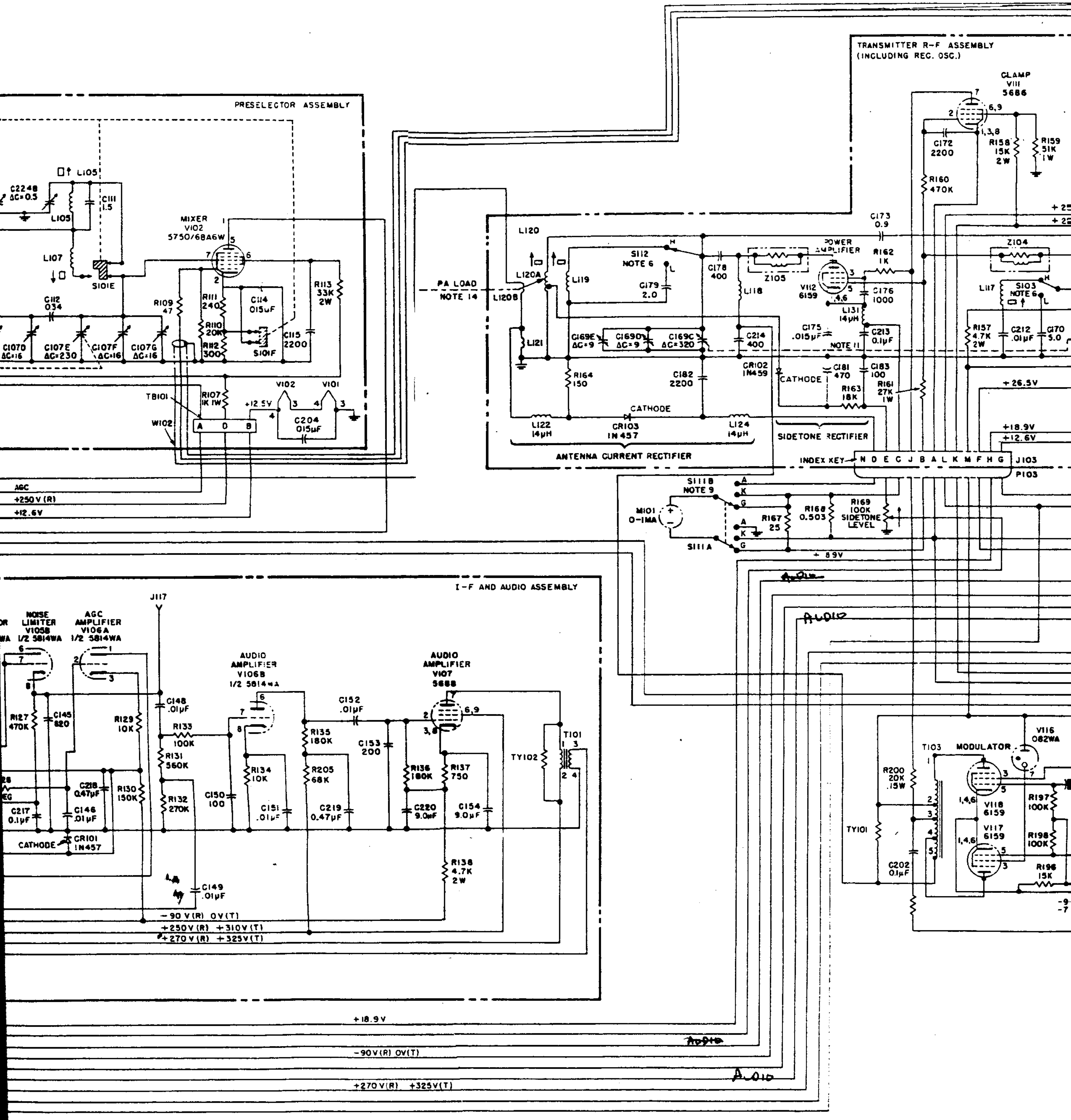


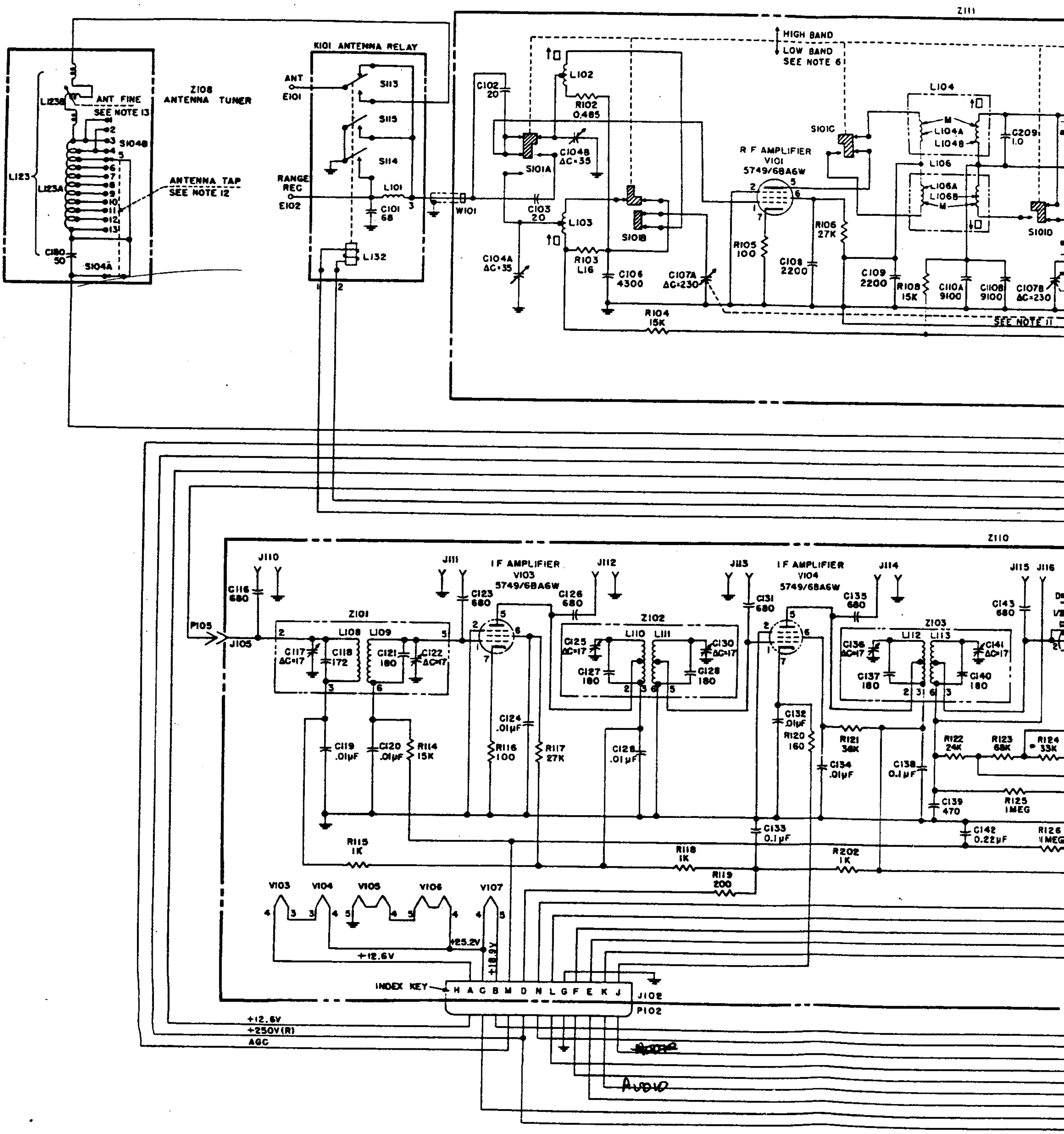
Z112 RETUNER
SPRING RETURN
S106 SEE NOTE 7
RACHET PAWL
SELECTOR DRUM INDEX WHEEL
SPRING RETURN
INDEX PAWL
MECHANICAL THRUST
CHANNEL SELECTOR SOLENOID
L126
CR104
K104
S107 HOME LIMIT SWITCH SEE NOTE 7
S108 REVERSING LIMIT SWITCH SEE NOTE 7
LIMIT SWITCH ACTUATOR
C215 0.22μF
+27.5V
TY103
S109A
S109B
CHANNEL SWITCH SEE NOTE 6 & 8
GRN-WHT TRACER
B101
GRN
K102
K107
S110 LOCAL CHANNEL SELECTOR (VIEWED FROM FRONT PANEL) SEE NOTE 6
J104
P104
INDEX KEY
LOW BAND CHANNELS
HIGH BAND CHANNELS
Z109
C207
C207E .015μF
C207F .015μF
C207A .015μF
C207B .015μF
C207C .015μF
C207D .015μF
C208
C208A .015μF
C208B .015μF
C208D .015μF
C208C .015μF
C208F .015μF
C208E .015μF
R203 5K LOCAL TEL
C211 0.1μF
K105 HIGH VOLTAGE AND SIDE TONE RELAY
+325V (T)
+310V (T)
+250V (R) +310V (T)
L127 3μH
C184 4μF
C185 4μF
-90V (R) 0V (T)
TB103
C188 9μF
Z106
L129 200μH
C186 0.84μF
C187 0.84μF
K106 POWER RELAY
D101 DYNAMOTOR
325V
75V
28V
C225 .01μF
C226 .01μF
R173 220 1W
R206 220 1W
C189 60μF
C221 60μF
+27.5V
CLIPPING ADJ.
T102
R172 8.2K
V117
V118
V115
V114
V113
R165 L1 2.0
+12.6V
+25.2V
+26.5V

Figur



Z 13
TRANSMITTER R-F ASSEMBLY (INCLUDING REC. OSC.)
CLAMP V111 5686
CATHODE FOLLOWER V108B 1/2 12AT7WA
RECEIVER OSCILLATOR V108A 1/2 12AT7WA
RF AMPLIFIER V110 5686
TRANSMITTER OSCILLATOR V109 5749/6BA6W
POWER AMPLIFIER
CHANNEL NUMBERS
S102A
S102B
LOW BAND CHANNELS
HIGH BAND CHANNELS
NOTE 6
NOTE 11
J106A
P106A
RED
J106B
P106B
WHT
CRYSTAL SWITCH PANEL (PART OF RETUNER Z112)
Z109
Z104
S103 NOTE 6
+250V(R)
+220V(T)
+325V(T)
+26.5V
+18.9V
+12.6V
J103
P103
R169 100K SIDETONE LEVEL
+12.6V
+250V(R)
-90V(R) -75V(T)
+26.5V
-90V(R) 0V(T)
+270V(R) +325V(T)
T103
MODULATOR
V116 OB2WA
V118 6159
V117 6159
TY101
PHASE SPLITTER V115B 1/2 12AT7WA
AMPLIFIER V115A 1/2 12AT7WA
%M ADJ.
Z107
CLIPPER V114 5814WA
AMPLIFIER V118 5814WA
CLIPPING ADJ.
T102
+12.6V
+26.5V
+325V
+310V


PRESELECTOR ASSEMBLY
MIXER V102 5750/6BA6W
TRANSMITTER R-F ASSEMBLY (INCLUDING REC. OSC.)
CLAMP V111 5686
POWER AMPLIFIER V112 6159
PA LOAD NOTE 14
ANTENNA CURRENT RECTIFIER
SIDETONE RECTIFIER
INDEX KEY
J103
P103
R169 100K SIDETONE LEVEL
M101 0-1MA
I-F AND AUDIO ASSEMBLY
NOISE LIMITER V105B 1/2 5814WA
AGC AMPLIFIER V106A 1/2 5814WA
AUDIO AMPLIFIER V106B 1/2 5814WA
AUDIO AMPLIFIER V107 5688
MODULATOR
V116 OB2WA
V118 6159
V117 6159
AGC
+250V (R)
+12.6V
-90 V(R) OV(T)
+250V (R) +310V (T)
+270 V (R) +325V (T)
+18.9V
+26.5V
+12.6V
+89V



Revised 15 August 1960

IS SHOWN AS VIEWED FROM
ITION.
)1 IS IN THE "REMOTE"
TE" LEVER CLOSED INTO
N THE "LOCAL" POSITION,
KNOB, CONTROL IS TRANS-
' CONTROL ON RECEIVER-

/ER-TRANSMITTER

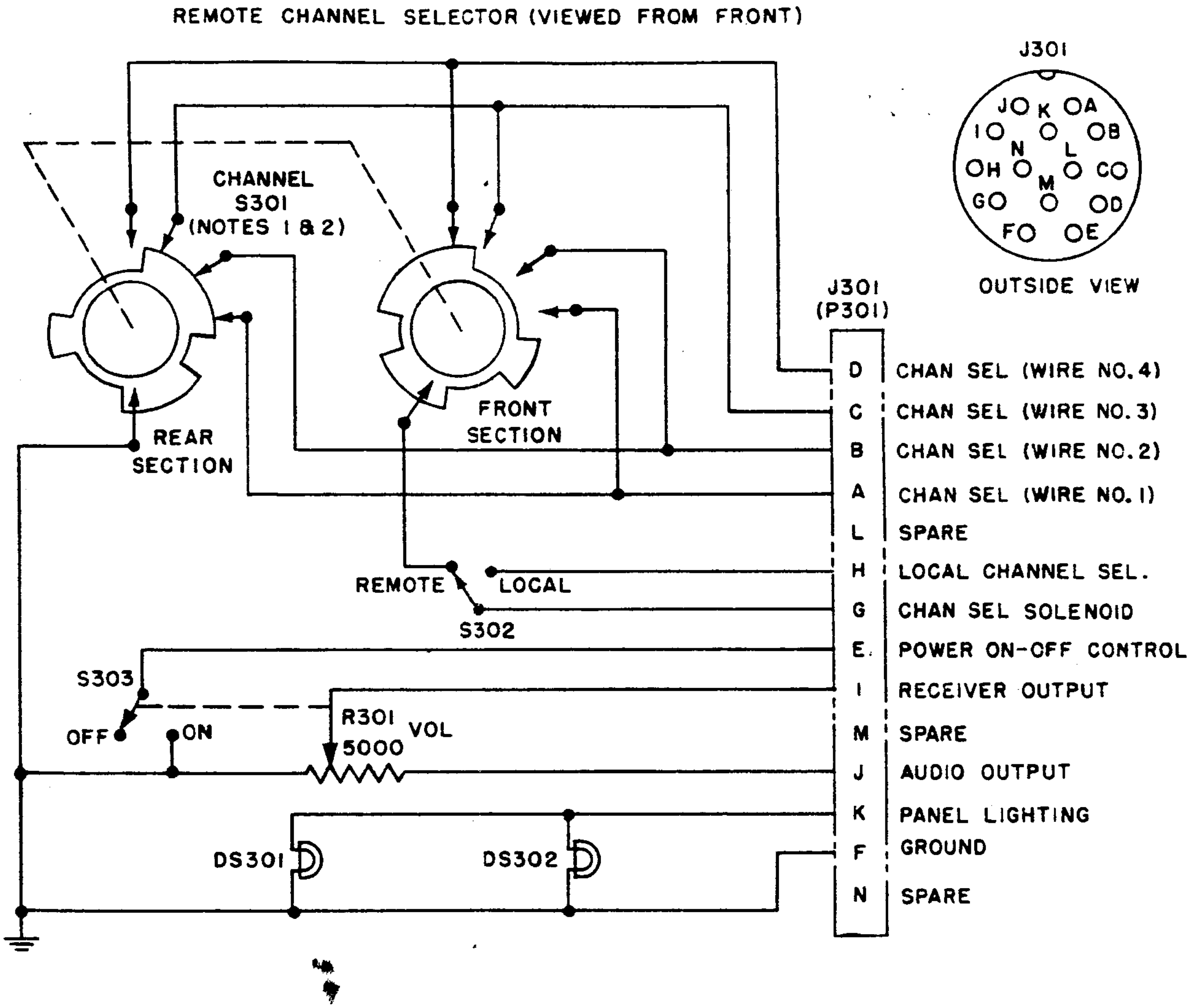


Figure 7-2. Radio Set Control C-2241/ARC-39, Schematic Diagram

NOTES:

1. "CHANNEL" SELECTOR SWITCH S301 IS SHO
FRONT, AND IN CHANNEL NO. 12 POSITION.
2. CHANNEL SELECTION IS MADE BY S301 IS IN
POSITION, WITH THE "LOCAL-REMOTE" LI
THE "CHANNEL" KNOB. WITH S302 IN THE
PULLED OUT FROM THE "CHANNEL" KNOB
FERRED TO THE "LOCAL SELECTOR" CON
TRANSMITTER RT-427/ARC-39
3. FOR SCHEMATIC DIAGRAM OF RECEIVER-T
RT-427/ARC-39 SEE FIGURE 7-1