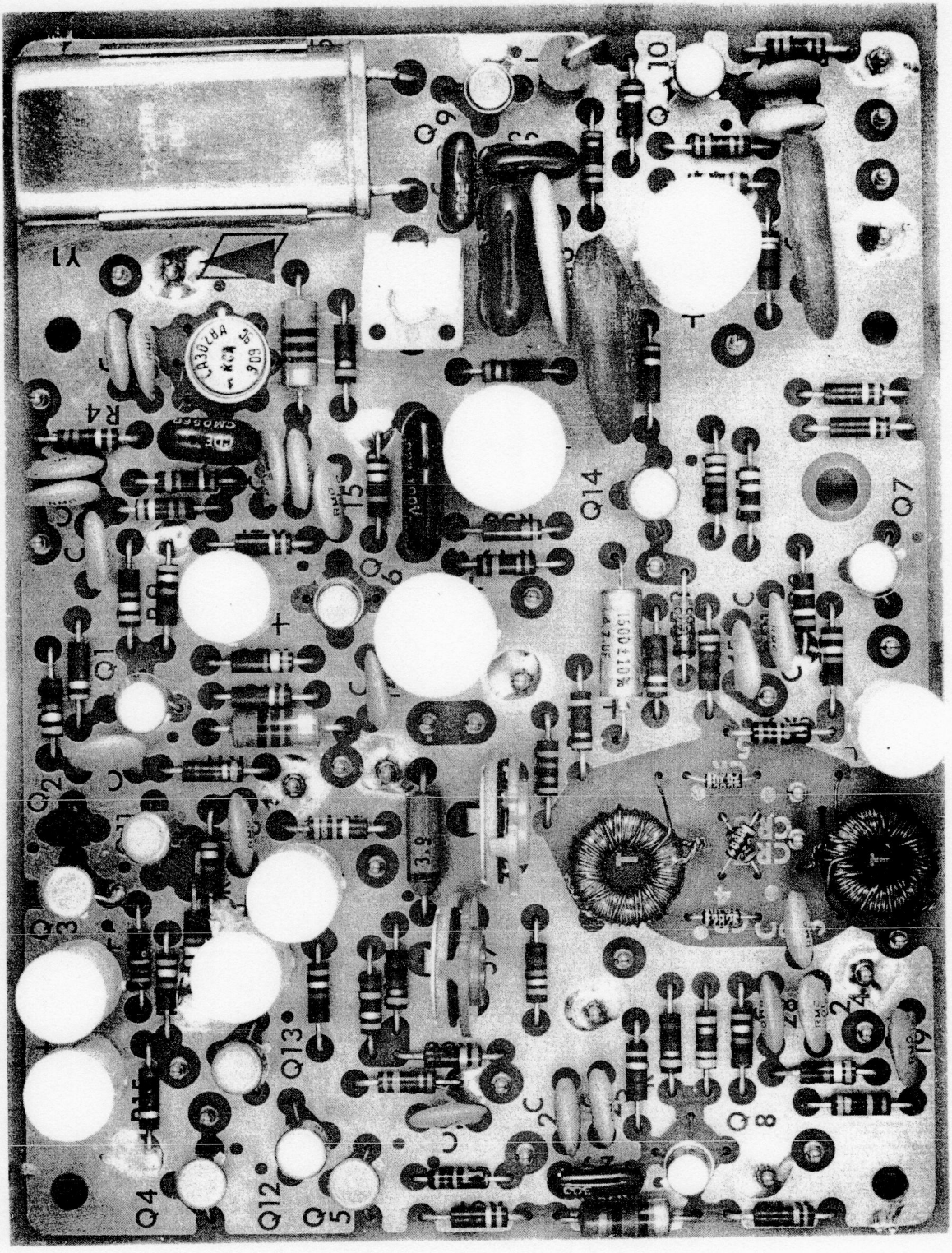


Figure 4-11. AGC/Detector Board (Sheet 1 of 2)

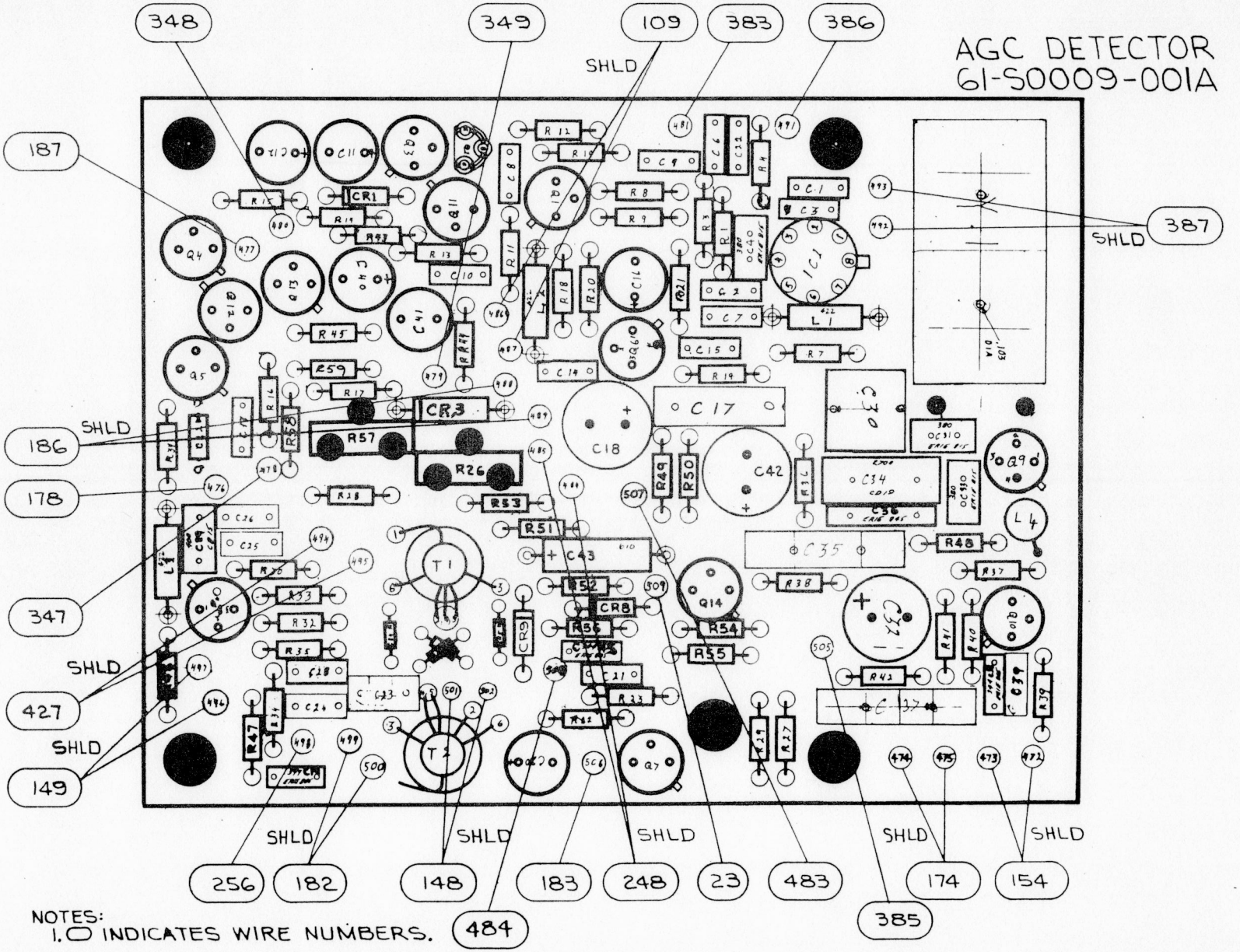


Figure 4-11. AGC/Detector Board (Sheet 2 of 2)

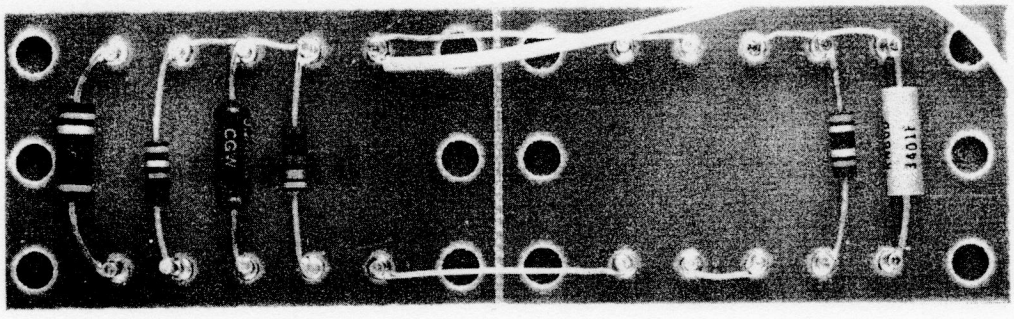


Figure 4-12a. TB1 Board

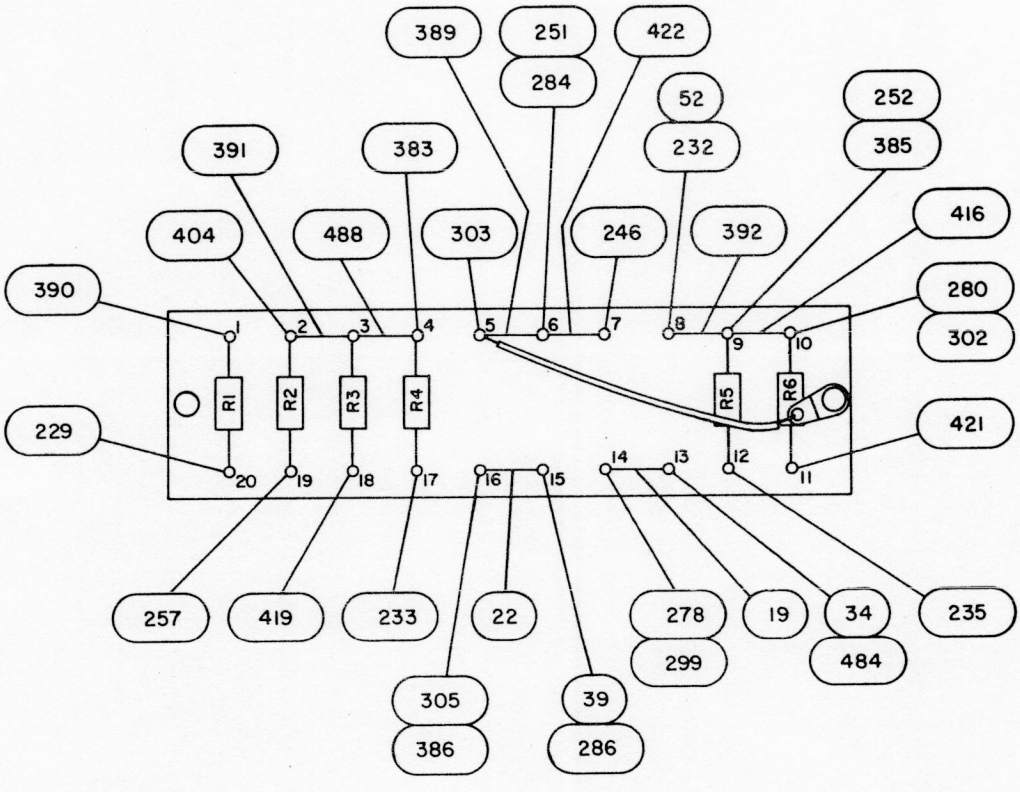


Figure 4-12b. TB1 Board

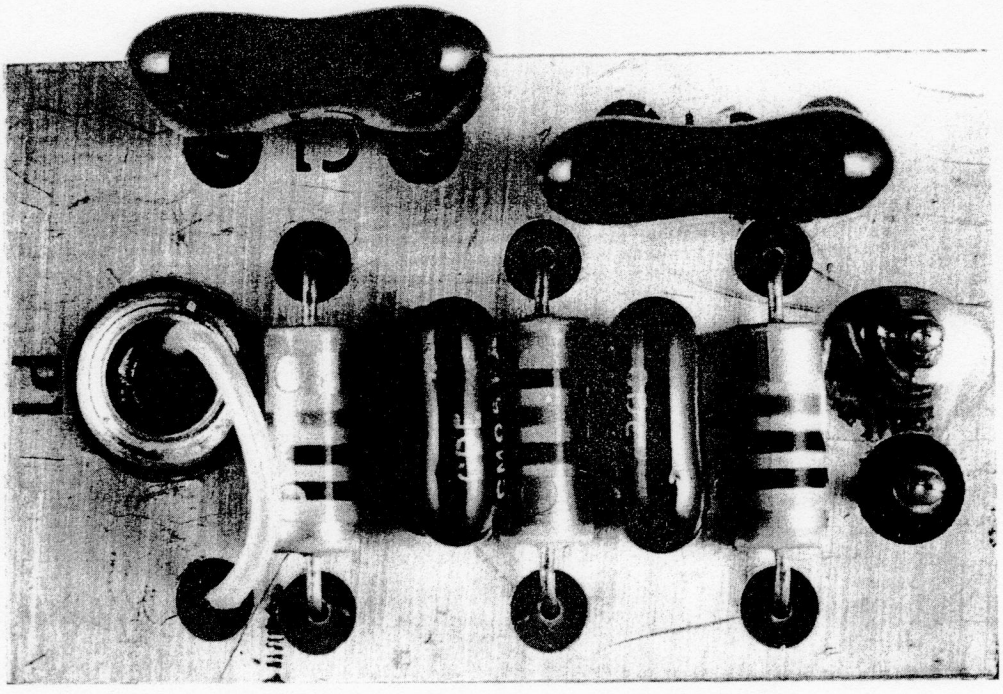


Figure 4-13a. Hi-Pass Filter Board

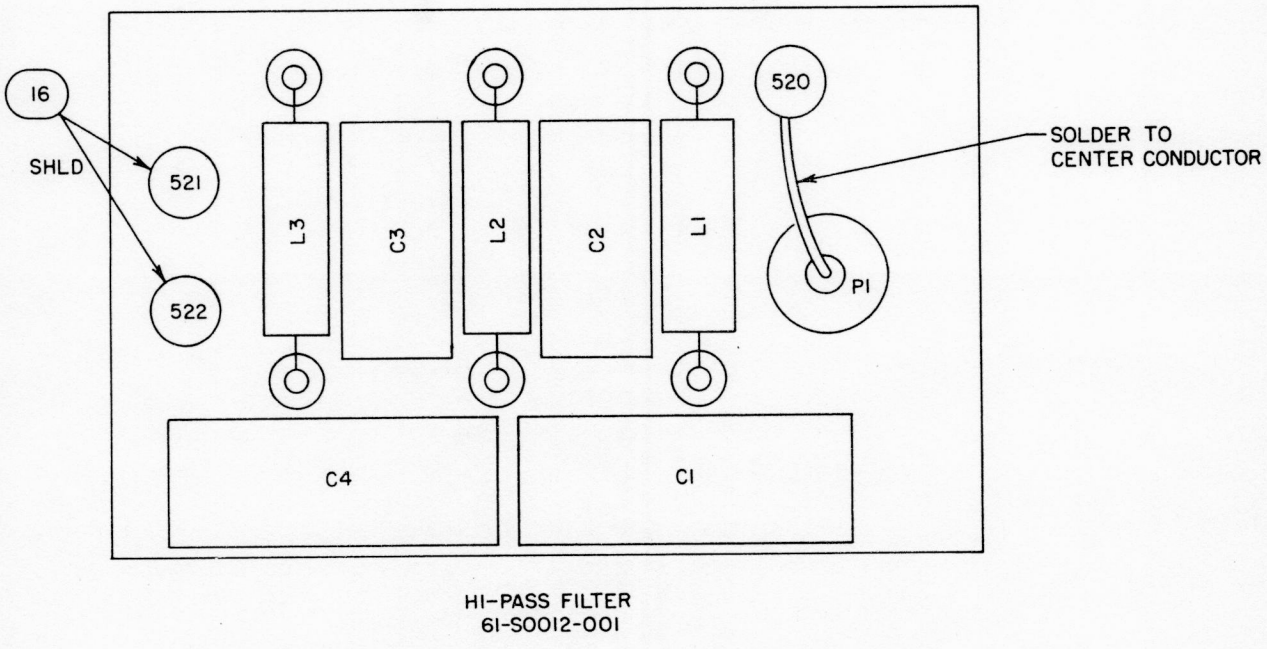


Figure 4-13b. Hi-Pass Filter Board

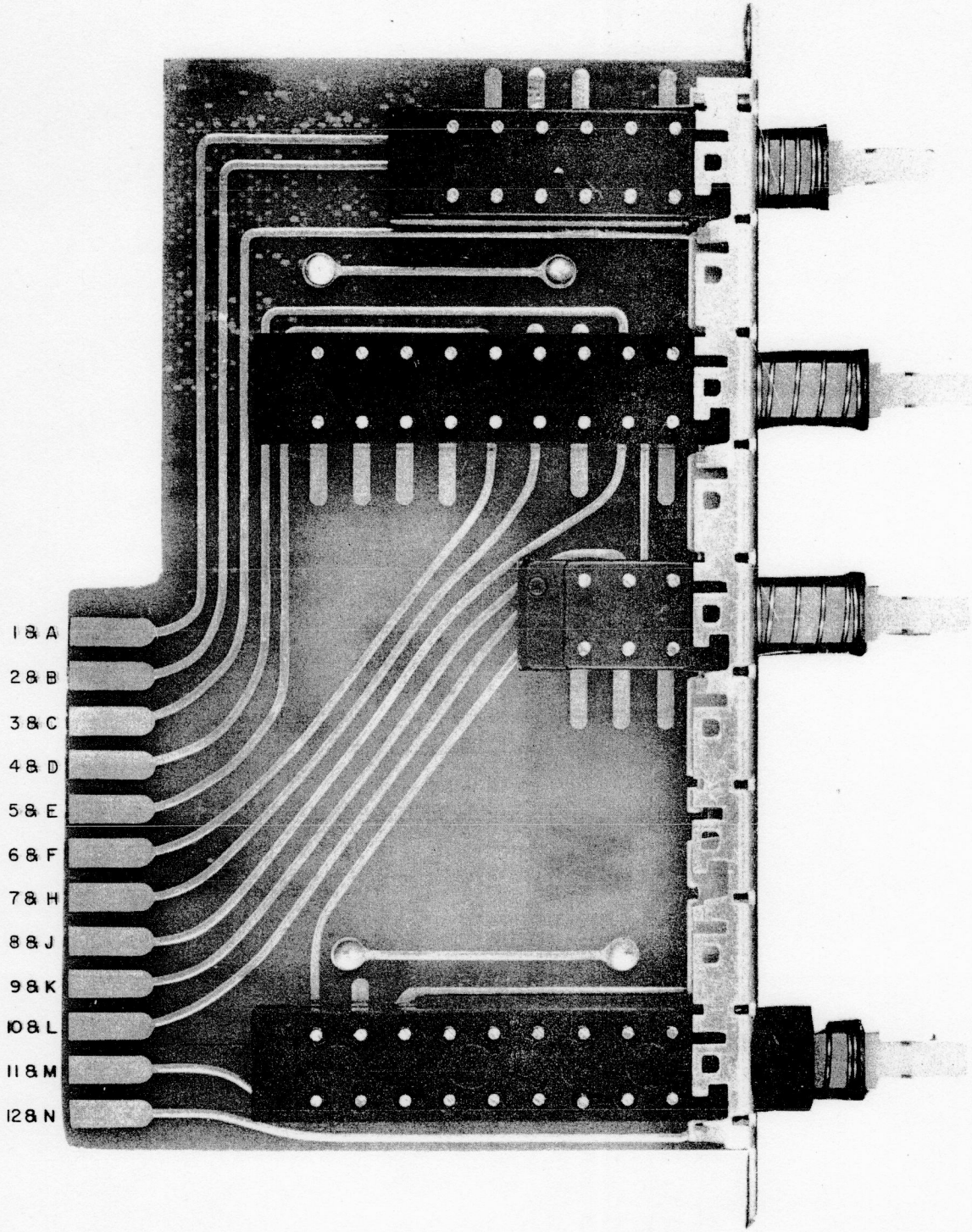


Figure 4-14. S2 Board

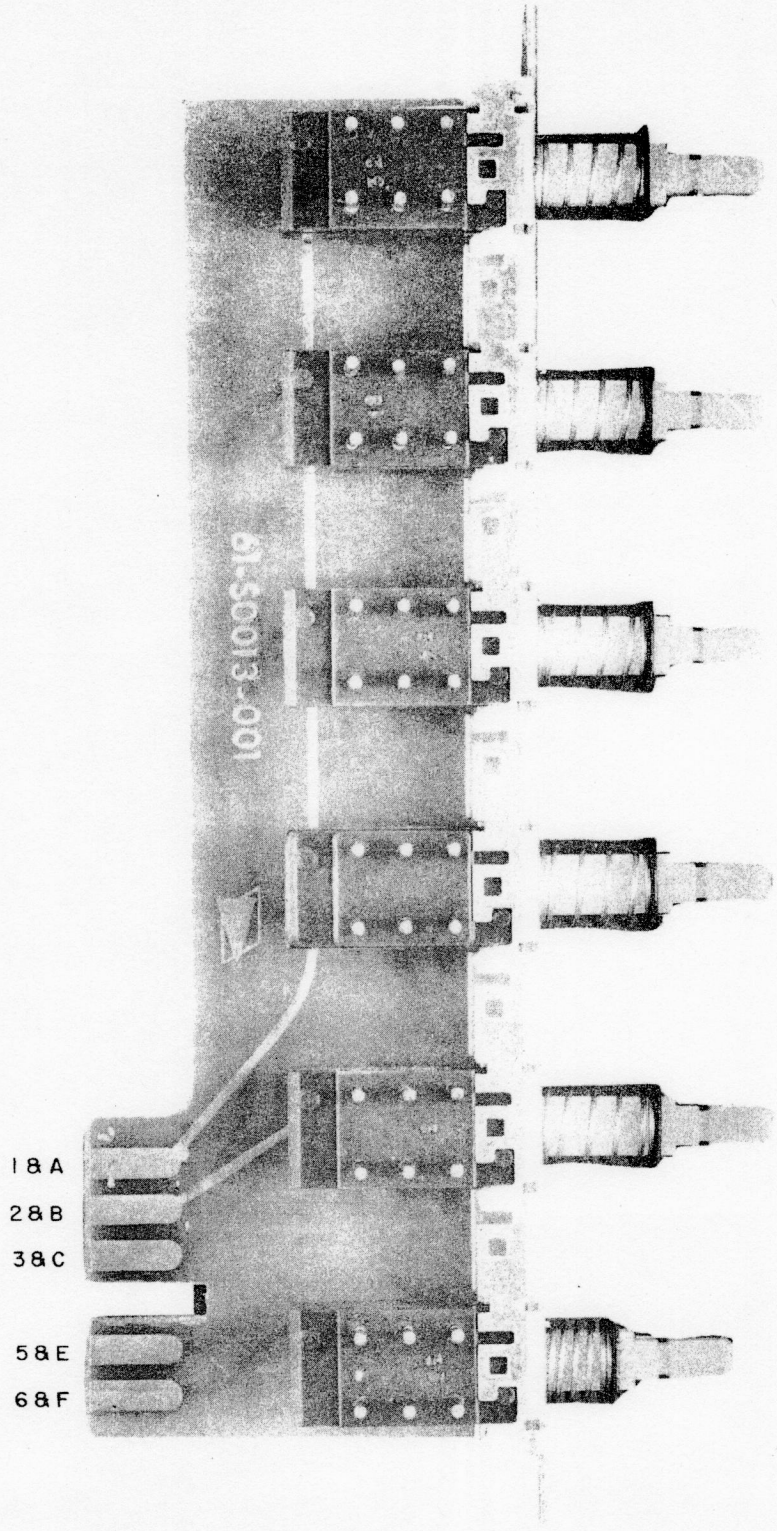


Figure 4-15. S3 Board

NOTES

4.4.2 Obtaining Replacement Parts

a. Standard Parts. All electrical and mechanical part replacements can be obtained through Signal/One. However, many of the standard electronic components can be obtained locally in less time. Before purchasing or ordering replacement parts, check the parts lists for value, tolerance, rating, and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance in the instrument, particularly at high frequencies. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect performance.

b. Special Parts. In addition to the standard electronic components, some special components are used. These components are manufactured or selected by Signal/One to meet specific performance requirements, or are manufactured for Signal/One in accordance with our specifications. Order all special parts directly from your local distributor or Signal/One.

c. Ordering Parts. When ordering replacement parts, include the following information:

1. Model number of equipment

2. Serial number of equipment

3. Description of the part (if electrical, include circuit number)

4. Signal/One part number.

4.4.3 Soldering Techniques

WARNING

Disconnect the Model CX7 from the power source before soldering.

a. Printed Circuit Boards. Use ordinary 60/40 solder and a 35-40-watt pencil type soldering iron on the printed circuit boards. The tip of the iron should be clean and properly tinned for best heat transfer to the solder joint. A higher voltage wattage soldering iron may separate the wiring from the base material.

The following techniques should be used to replace a component on a circuit board. Most parts can be replaced without completely removing the boards from the Model CX7.

1. Grip the part lead with long-nose pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board. When the solder begins to melt, pull the lead gently out. If the previous method is impracticable, utilize wicking wire to first remove the solder. This can be accomplished by moistening the end portion of the wicking wire with liquid flux, placing it against the solder joint and then heating both the wicking wire and the solder joint simultaneously. The solder from the solder joint will absorb into the wicking wire.

2. This should leave a clean hole in the board. If not, the hole can be cleaned by additional wicking or reheating the solder and placing a sharp object such as a toothpick into the hole to clean it out. A vacuum-type desoldering tool can also be used for this purpose.

3. Bend the leads of the new part to fit the holes in the board. If the part is replaced while the board is mounted in the Model CX7, cut the leads so they will just protrude through the board. Insert the leads into the holes in the board so the part is firmly seated against the board (or as positioned originally). If it does not seat properly, heat the solder and gently press the part into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint; do not apply too much solder. To protect heat-sensitive parts, hold the lead between the part body and the solder joint with a pair of long nose pliers or other heat sink.

5. Clip the excess lead that protrudes through the board.

6. Clean the area around the solder connection with a flux-remover solvent. Be careful not to remove information printed on the board.

b. Metal Terminals. When soldering metal terminals (e.g., switch terminals, potentiometers, etc.), ordinary 60/40 solder can be used. Use a soldering iron with a 40-to 75-watt rating and 1/8-inch wide wedge-shaped tip.

Observe the following precautions when soldering metal terminals:

1. Apply only enough heat to make the solder flow freely.

2. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.

3. If a wire extends beyond the solder joint, clip off the excess.

4. Clean the flux from the solder joint with alcohol or chlorothene-nu.

4.4.4 Component Replacement

WARNING

Disconnect the Model CX7 from the power source before replacing components.

4.4.4.1 Printed Circuit Board Replacement. If a printed circuit board is damaged beyond repair, the entire assembly including all soldered-on parts can be replaced. Part numbers are given in the Parts List for the board. Most of the parts mounted on the printed circuit boards can be replaced without removing the boards from the chassis. Observe the soldering precautions given under Soldering Techniques in this section. However, if the bottom side of the board must be reached or if the board must be moved to gain access to other areas, only the mounting screws need to be removed. The interconnecting wires on most of the boards are long enough to allow the board to be moved out of the way or turned without disconnecting all of the pin connectors. Most of the connections to the circuit boards are made with pin connections; however, special cases exist where connections are soldered.

To unplug the single-wire pin connectors, grip the connector with a long-nose pliers and pull. Do not unplug the connection by pulling the wire. The connectors should fit tightly. Reconnect them using the reverse method. If the connectors fit loosely, unplug and squeeze the female connector with the pliers to slightly decrease its diameter and then reconnect. Interconnecting wires are identified by either color of insulation, numbered tags or numbers marked on the insulation. The wire identification is noted on the applicable printed circuit board shown in Figures 4-3 through 4-15. The location of the Model CX7 printed circuit boards is shown in Figures 4-1 and 4-2.

a. Front End Board

1. Set the front panel "MHZ" band selector switch to the "1" position.

2. Loosen the four Allen setscrews (use a 0.050 and a 1/16 Allen wrench) in the coupling collar shown in Figure 4-16. Pull the "MHZ" knob, with it still attached to the shaft, directly out of the front panel.

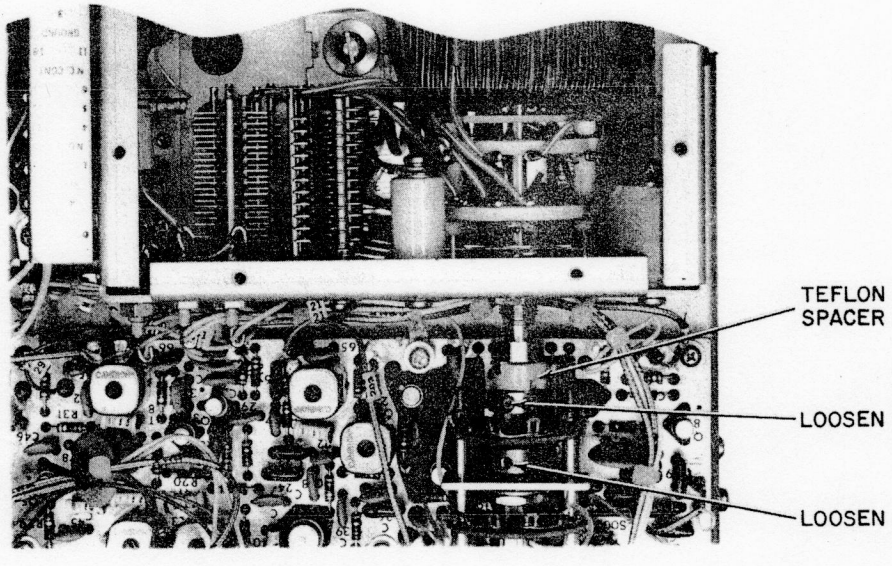


Figure 4-16. Coupling Collars for Front End Board "MHZ" Selector Switch

3. Without unsoldering the wires, remove the front panel "PHONES" and "MIKE" plugs so that they will not obstruct Front End board removal.

4. Unplug wire #190 from the bottom of the Front End board. This wire may be reached through the cut-out on the top of the Model CX7 chassis.

5. Unplug the wires from the top of the Front End board.

6. Remove the seven Phillips-head screws (located on the inside corner, four outside corners, and middle back-side) and washers from the top of the Front End board.

7. Carefully lift out the Front End board. Note that the white teflon, notched spacer may drop off. The spacer must be manually held on the shaft when reinstalling the board.

8. When reinstalling board, do not omit the ground strap connections.

b. PTO A or B Module

1. Loosen the two setscrews in the applicable "VFO A" or "VFO B" knob (use 5/64 Allen wrench) and remove knob.

2. Unsolder the wires from the six feedthru terminals on the rear of the applicable PTO (see Figure 4-17) and remove the Phillips-head screw retaining the ground strap.

3. Remove the three Phillips-head screws near the applicable PTO A or B shaft.

PTO B Removal: Carefully lift out PTO B. (See caution note.)

PTO A Removal: Carefully lift out PTO A. It may be necessary to gently pry PTO A out of the chassis cut-out using a thin blade screwdriver.

CAUTION

Use caution when lifting out the PTO so as not to break the leaf spring that grounds the PTO shaft.

4. To remove the PTO cover, loosen the two Phillips-head screws located on the top and bottom of the cover and slide off cover.

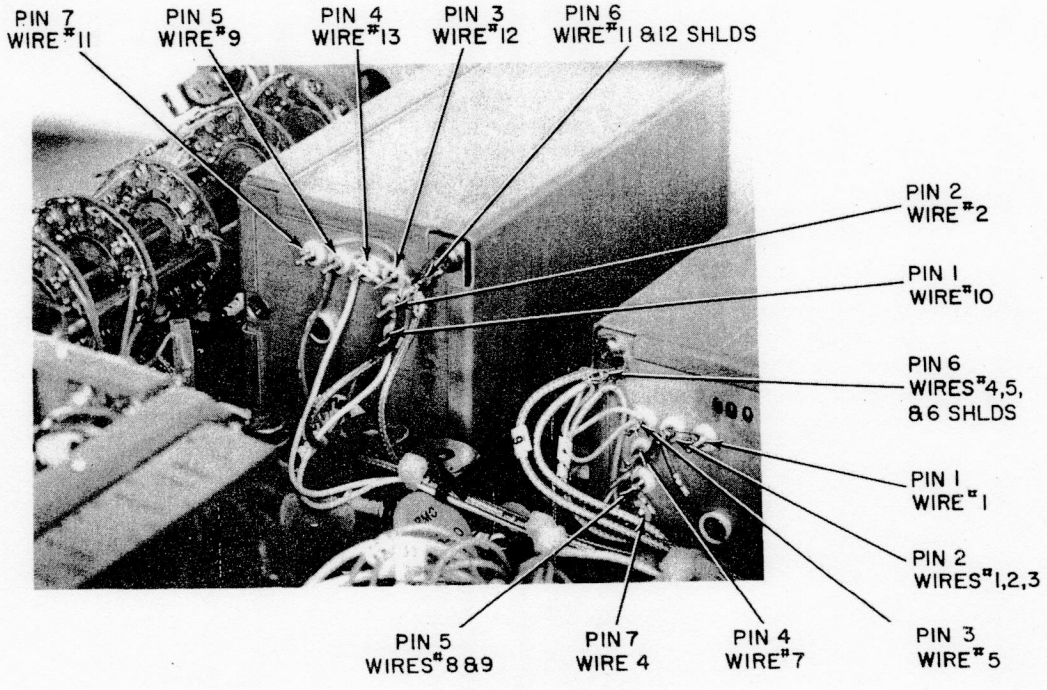


Figure 4-17. PTO Terminals

c. IF Board

1. Set the "MODE" selector switch to the "CW1" position, and loosen the Allen setscrew (use a .050 Allen wrench) in the coupling collar shown in Figure 4-18.

2. Set the "MODE" selector switch to the "AM" position and loosen the associated Allen setscrew. Pull the "MODE" knob, with it still attached to the shaft, directly out of the front panel.

3. Unplug the wires from the top of the IF board.

4. Unplug the interboard wires that are attached to the "MODE" switch wafers and remove the four Phillips-head screws that retain the switch assembly to the IF board. Lift out the switch assembly.

5. Remove the five Phillips-head screws (located in the middle and on the four corners) and washers from the top of the IF board.

6. Carefully slide the IF board out from underneath "GAIN" potentiometer.

7. When reinstalling board, do not omit the ground strap connection.

d. Power Supply Board

WARNING

Charged capacitors may cause high voltage to exist on some terminals even with the Model CX7 removed from the power source. Momentarily short each Power Supply board pin to ground using a metal screwdriver with an insulated handle.

1. Unplug the wires from the Power Supply board.

2. Unsolder the interboard wires attached to the Power Supply board terminals.

3. Remove the four Phillips-head screws (located in each corner) and washers from the top of the board.

4. Lift out the Power Supply board.

5. When reinstalling board, do not omit the ground strap connections.

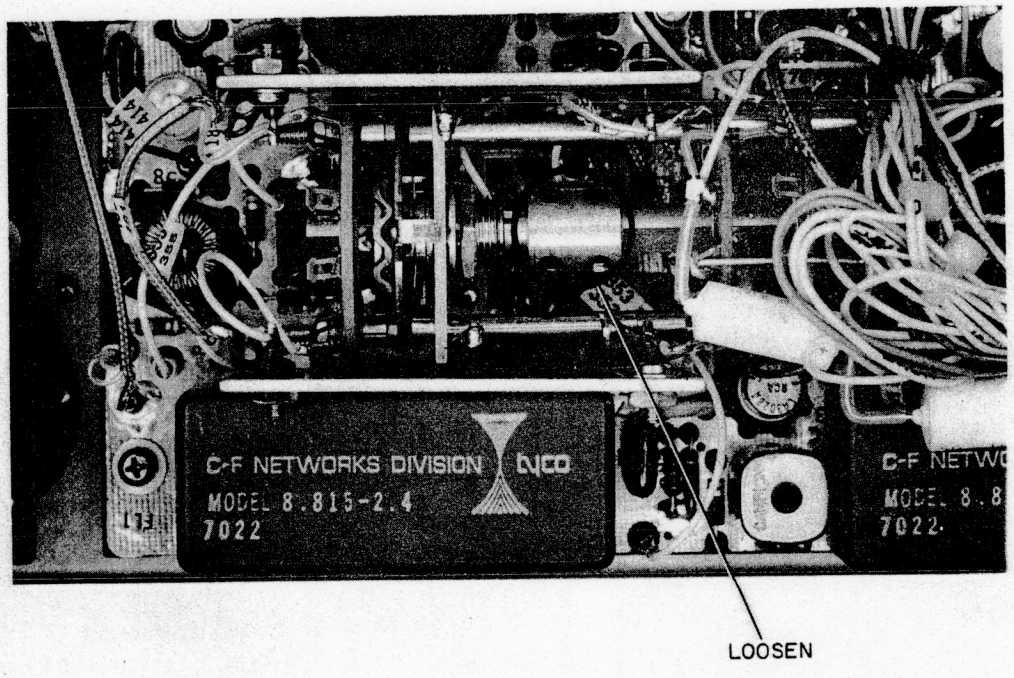


Figure 4-18. Coupling Collar for IF Board "MODE" Selector Switch

e. RF Driver Board

1. Unplug the wires from the RF Driver board.

2. Remove the four Phillips-head screws (located on each corner) and washers from the top of the board.

3. Remove the three Phillips-head screws and washers on the opposite side of the chassis (located between the two PTO modules, nearest PTO A. See Figure 4-19). Note that one of the screws is located under the Front End board near L4. It is necessary to partially remove or lift the Front End board to reach this screw.

4. Set the front panel "PRESELECTOR" control to the "1" position so that the rotor plates will not obstruct RF Driver board removal.

5. Carefully slide the RF Driver board out from underneath the loading capacitor shaft.

6. Prior to reinstalling board, apply a new layer of silicon heat-sink compound (Dow Corning #340) on the outside of the heat sink plate located on the bottom of the RF Driver board.

WARNING

Handle silicon heat-sink compound with care, avoid getting the compound in the mouth or eyes.

7. When reinstalling the board, do not omit the ground strap connections.

f. Counter Board

1. Remove the four Phillips-head screws and washers located on the lip of the Counter board cover.

2. Lift off Counter board cover.

3. Unplug the wires from the Counter board.

4. Remove the four Phillips-head screws (located on each corner) and washers from the top of the board.

5. Lift out the Counter board.

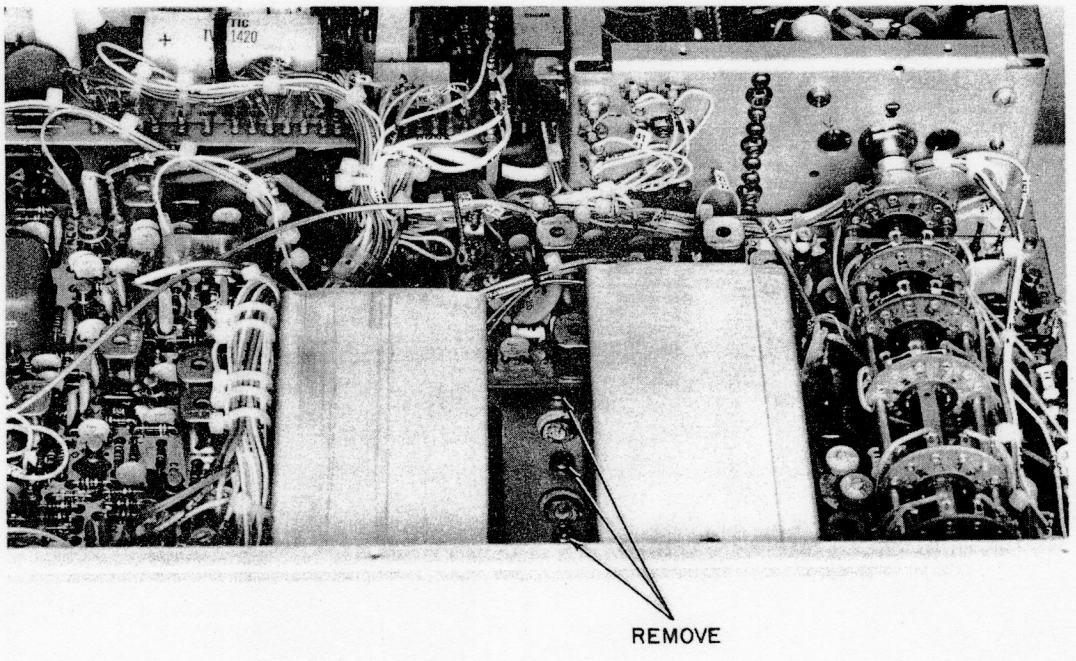


Figure 4-19. Location of Screws Retaining Bottom of RF Driver Board

g. AGC Detector Board

1. Unplug the wires from the AGC Detector board.

2. Remove the four Phillips-head screws (located on each corner) and washers from the top of the board.

3. Lift out the AGC Detector board.

4. When reinstalling board, do not omit the ground strap connections.

h. Audio Board

1. Remove the AGC Detector board.

2. Unplug the wires from the Audio board.

3. Unscrew the four standoffs that held the AGC Detector board.

4. Lift out the Audio board.

5. When reinstalling the board, do not omit the ground strap connection.

i. BFO Board

1. Remove the AGC Detector board and the Audio board.

2. Remove the four Phillips-head screws and washers located on the lip of the BFO cover.

3. Lift off BFO board cover.

4. Unplug the wires from the BFO board.

5. Remove the four Phillips-head screws (located on each corner) and washers from the top of the board.

6. Lift out the BFO board.

4.4.4.2 Miscellaneous Part Replacement

a. Field-Effect Transistors. Precautions must be taken to prevent static electricity from damaging the new part. This can be accomplished by temporarily shorting all the leads together until they have been soldered to the circuitry.

b. TAB Transistors. TAB transistors which are mounted on the rear panel or a printed circuit board ground-plane use silicon heat sink

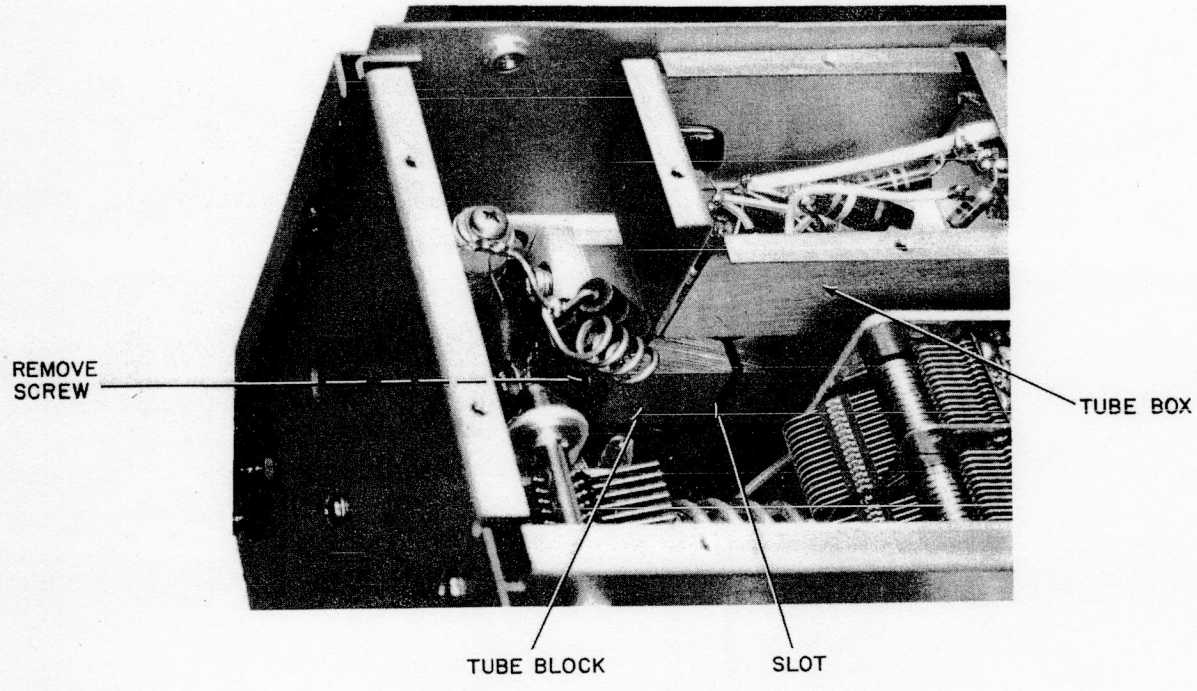


Figure 4-20. Power Amplifier Tube Removal

compound (Dow Corning #340) to increase heat transfer. Replace the heat sink compound when replacing the transistor.

WARNING

Handle silicon heat sink compound with care. Avoid getting the compound in the mouth and eyes. Wash hands thoroughly after use.

The TAB transistors are insulated from the chassis or ground plane by thin mica wafers and teflon washers.

WARNING

Omission of the mica wafer or teflon washer during replacement will cause the transistor to be damaged when the Model CX7 is energized.

c. Diodes. Diodes are heat sensitive. During replacement, use a heat sink as directed in paragraph 4.4.3.a.4.

4.4.4.3 Power Amplifier Tube Replacement.

a. Remove the top cover from the upper PA assembly.

WARNING

Charged capacitors may cause high voltage to exist within the power amplifier assembly, even with the Model CX7 removed from the power source. Momentarily short the tube block (see Figure 4-19) to ground using a metal screwdriver with an insulated handle.

b. Remove the two Phillips-head screws that hold the tube box to the upper PA assembly.

c. Without unsoldering the interconnecting wires that are attached to the tube box, lift the tube box off the base of the power amplifier tube and out of the upper power amplifier assembly.

d. Remove the Allen screw (use 9/64 Allen wrench) in the tube block shown in Figure 4-20.

e. Using a large, flat-bladed screwdriver, gently spread the tube block slot and lift out the power amplifier tube.

NOTE

Prior to replacing the power amplifier tube, apply a new layer of silicon heat sink compound (Dow Corning #340) on portions of the tube that make contact with the tube block.

WARNING

Handle silicon heat sink compound with care, avoid getting the compound with care, avoid getting the compound in the mouth and eyes.

f. To reassemble, first plug the tube into the socket, then spread the tube block while positioning the tube in the tube block. The tube is properly seated in the tube block when the tube box is level and the step (b) mounting holes are aligned.

4.5 TROUBLESHOOTING AIDS

4.5.1 General

Troubleshooting aids consist of information that can be utilized to determine component or lead, contact or terminal identification or otherwise may be helpful to the technician during servicing the Model CX7.

NOTE

Electrical measurements covered herein are not absolute and may vary slightly between Model CX7s.

4.5.2 Location of Modules

Refer to Figures 4-1 and 4-2 for the location of modules and other chassis-mounted components.

4.5.3 Location of Electrical Parts and Terminals on Modules

Refer to Figures 4-3 through 4-15 for the location of electrical parts and terminals on modules. Information in parentheses pertain to the number of the interconnecting wire that connects to the terminal.

4.5.4 Electrical Part Lead or Contact Identification

Refer to Figures 4-23 through 4-28 to determine the location of applicable leads of the various types of transistors, diodes, integrated circuits, tubes, contacts of switches, and potentiometers that are utilized by the Model CX7.

4.5.4.1 Chassis Wiring Color Code. Table 4-1 lists the wire insulation colors that have been designated for DC power, T/R, and R/T distribution.

4.5.5 Signal Tracing and Test Point Information

a. Power Supply. Table 4-2 lists voltages and resistance measurements on input and output connections on the Model CX7 power supply circuit performed under the following conditions:

1. All measurements conducted with a VTVM and unless otherwise noted in the table, switches and controls were positioned as listed in table 2-1.

2. Resistances of less than 0.9 ohm listed as zero.

3. Resistance measurements performed with primary power plug disconnected.

4. When two or more resistances are given for the same pin, the first is valid when the negative ohmmeter lead is connected to the chassis and the second is when the positive ohmmeter lead is connected to the chassis.

WARNING

Positive 1500 volts DC is present on rear power connector J7 and inside on pin 162 of the power supply card. Prior to resistance measurements, discharge these points to chassis ground using an insulated handle screwdriver not sooner than approximately 30 seconds after the transceiver has been turned off.

Insulation Color	Wire Function
Red	+15 VDC
Blue	-15 VDC
Brown	+5 VDC
Orange	+34 VDC
Violet	+300 VDC
Green	T/R command (+0.3 VDC/-13.5 VDC)
Gray	R/T command (+0.3 VDC/-13.5 VDC)

Table 4-1. Chassis Wiring Color Code

Pin	Parameter	Scale	Voltage and Resistance
101	D-C V		+0.4 ±0.2 VDC
	A-C V		
	Ohms	X 1/X 10	5 to 10 Ohms/100 to 200 Ohms
106	D-C V		-13.5 ±0.3 VDC
	A-C V		
	Ohms	X 1/X 10	5 to 10 Ohms/100 to 250 Ohms
111	D-C V		+15.0 ±0.20 VDC
	A-C V		Less than 50 MVPP ripple*
	Ohms	X 1/X 10	20 to 40 Ohms/15 to 35 Ohms
116	D-C V		
	A-C V		Less than 50 MVPP ripple*
	Ohms	X 1/X 10	Greater than 1K/Greater than 1.5K
117	D-C V		-50 to -60 VDC
	A-C V		
	Ohms	X 1/X 10	Greater than 60 Ohms/Greater than 6K
118	D-C V		-15.0 VDC (can be adjusted by R-16)
	A-C V		
	Ohms	X 1	20 to 30 Ohms
132	D-C V		+340 ±0.5 VDC
	A-C V		Less than 50 MVPP ripple*
	Ohms	X 10	200 to 600 Ohms/50 to 400 Ohms
152	D-C V		+310 ±20 VDC
	A-C V		
	Ohms	X 1K	Greater than 10K/Greater than 6K

*Measured with calibrated oscilloscope.

Table 4-2. Power Supply Voltage and Resistance Measurements (Sheet 1 of 3)

Pin	Parameter	Scale	Voltage and Resistance
162	D-C V		High Voltage - See J7 last test in table
	A-C V		
	Ohms	X 1/X 10	Greater than 350K**/Greater than 350K**
124	D-C V		+22.5 ±1.5 VDC
	A-C V		Less than 50 MVPP ripple
	Ohms	X 1	Greater than 100K/--
The following transistors are located on the rear panel			
Q1	D-C V		
Case	A-C V		
	Ohms	X 10	Greater than 100K/--
Q2	D-C V		
Case	A-C V		
	Ohms	X 10	---/Greater than 100K
Q3	D-C V		
Case	A-C V		
	Ohms	X 10	Greater than 100K/---
Q4	D-C V		
Case	A-C V		
	Ohms	X 10	Greater than 100K/---
136	D-C V		+5.0 ±0.4 VDC
	A-C V		Less than 50 MVPP ripple
	Ohms		
**See warning note - measured after ohmmeter charged capacitor.			

Table 4-2. Power Supply Voltage and Resistance Measurements (Sheet 2 of 3)

Pin	Parameter	Scale	Voltage and Resistance
For the following, depress the CONTROL-TUNE pushbutton			
101	D-C V		-13.5 ±0.3 VDC
106	D-C V		0.4 ±0.2 VDC
J7***	D-C V		1500 to 1600 VDC
***Located on rear panel marked "H.V."			

Table 4-2. Power Supply Voltage and Resistance Measurements (Sheet 3 of 3)

b. Transmit/Receive Mode Keyline Measurements. Table 4-3 lists the measurement points and the required voltage for transmit or receive mode enabling. If desired, these checks can be conducted concurrently with receiver or transmitter signal tracing. Refer to the applicable Figures 4-3 through 4-10 for the location of pins. Measurements were performed using a voltmeter. All values are nominal and may vary ±20% without degrading performance.

c. Transmitter Signal Tracing. Table 4-4 lists connection points and signal levels. Refer to the applicable Figures 4-3 through 4-13 for location of specified measurement points. All measurements were performed with the "MODE" switch set to the "USB" position, using an X10 probe with a Tektronix type 453 oscilloscope (50 MHz response).

d. Receiver Signal Tracing. Table 4-5 lists connection points and normal signal levels. Refer to the applicable Figures 4-3 through 4-13 for location of specified measurement points. A 14.2 MHz signal is applied to the antenna connector. The signal must be properly tuned-in and the "PRESELECTOR" peaked for each measurement.

Measurement Point	Voltage	
	Receive	Transmit
The following measurement points are located on the Power Supply board		
Pins 101 thru 105	+0.3 VDC	-13.5 VDC
Pins 106 thru 110, 116	-13.5 VDC	+0.3 VDC
The following measurement point is located on the BFO board		
Pin 213	-13.5 VDC	+0.3 VDC
The following measurement points are located on the IF board		
Pin 416	-13.5 VDC	+0.3 VDC
Pin 449	+0.3 VDC	-13.5 VDC
Pin 432	+0.3 VDC	-13.5 VDC
Pin 466	-13.5 VDC	+0.3 VDC
The following measurement points are located on the Front End board		
Pin 65	+0.3 VDC	-13.5 VDC
Pin 67	-13.5 VDC	+0.3 VDC
The following measurement point is located on the Power Amplifier assembly		
Pin 2	+34 VDC	-11 VDC
The following measurement points are located on the AGC Detector board		
Pin 491	-13.5 VDC	+0.3 VDC
Pin 508	+0.3 VDC	-13.5 VDC
The following measurement points are located on the Audio board		
Pin 326	-13.5 VDC	+0.3 VDC
Pin 327	+0.3 VDC	-13.5 VDC

Table 4-3. Transmit/Receive Keyline Measurements

Measurement Point	Frequency	Output Level With Drive
The following signal application and measurement points are located on the Audio board:		
Apply a 1 kHz signal at 100 MVP-P to Pin 301.		
Q1 Gate	1 kHz	100 MVP-P
Q1 Drain	1 kHz	600 MVP-P
Q2 Base (See NOTE 1.)	1 kHz	Depends on setting of R12
Q2 Collector	1 kHz	300 MVP-P
Q3 Base	1 kHz	300 MVP-P
Q3 Emitter	1 kHz	300 MVP-P
Pin 330	1 kHz	300 MVP-P
The following measurement points are located on the AGC Detector board.		
Pin 501	1 kHz	300 MVP-P
Pin 500	8.8 MHz	2 VP-P
The following measurement points are located on the IF board.		
Pin 435	8.8 MHz DSB	400 MVP-P
Q14 Gate 1 (See NOTE 2.)	8.8 MHz DSB	200 MVP-P
Q14 Drain	8.8 MHz DSB	60 MVP-P
Q11 Gate 1	8.8 MHz DSB	50 MVP-P
Q11 Drain	8.8 MHz DSB	500 MVP-P
IC 3 Pin 2	8.8 MHz SSB	30 MVP-P
IC 3 Pin 6	8.8 MHz SSB	1.0 VP-P
Pin 459	8.8 MHz SSB	150 MVP-P
Pin 453	8.8 MHz SSB	150 MVP-P
Q8 Gate 1	8.8 MHz SSB	150 MVP-P
Q8 Drain	39.5 MHz SSB	300 MVP-P
Pin 421	39.5 MHz SSB	50 MVP-P

NOTES: 1. Adjust R12 for 300 MVP-P at Audio board Pin 330.
2. Adjust "CLIPPING" control for 1 VP-P at IF board integrated circuit IC3 Pin 6.

Table 4-4. Transmitter Signal Levels (Sheet 1 of 2)

Measurement Point	Frequency	Output Level With Drive
The following measurement points are located on the Front End board.		
Pin 68	39.5 MHz	40 MVP-P
Q4 Gate 1	39.5 MHz	40 MVP-P
Q4 Drain	39.5 MHz	200 MVP-P
IC1 Pin 1	39.5 MHz	50 MVP-P
IC1 Pin 2	54.0 MHz	500 MVP-P
IC1 Pin 6	14.150 MHz	1 VP-P
Q5 Base	14.150 MHz	500 MVP-P
Q5 Emitter	14.150 MHz	500 MVP-P
Pin 59	14.150 MHz	500 MVP-P
The following measurement points are located on the RF Driver board.		
Pin 267 (See NOTE 3.)	14.150 MHz	180 MVP-P
IC1 Pin 2 (See NOTE 4.)	14.150 MHz	180 MVP-P
IC1 Pin 6	14.150 MHz	600 MVP-P
IC1 Pin 5	D-C V	(See NOTE 5.)
Q1 Gate	14.150 MHz	700 MVP-P
Q1 Drain	14.150 MHz	1.5 VP-P
Q2 Base	14.150 MHz	600 MVP-P
Q2 Collector	14.150 MHz	1.5 VP-P
Q3 Base	14.150 MHz	600 MVP-P
Q3 Collector	14.150 MHz	15 VP-P
Q4 Base	14.150 MHz	8 VP-P
Pin 269	14.150 MHz	40 VP-P
The following measurement points are located on the Power Amplifier Assembly.		
Pin 11	14.150 MHz	50 VP-P
V1 Pin 3	14.150 MHz	50 VP-P

NOTES:
3. Set the "OUTPUT" control to the midrange position.
4. On the RF Driver board, adjust the ALC control for 600 MVP-P at the base of Q2 with the +34 VDC line disconnected. All measurements up to the base of Q2 are performed with the +34 VDC line disconnected.
5. This measurement point is ALC voltage. It must be within ±100 MVP-P of the voltage present at IC1 Pin 1.

Table 4-4. Transmitter Signal Levels (Sheet 2 of 2)

RF Input Level at Antenna	Measurement Point	Frequency	Output Level With Signal
The following measurement points are located on the Front End board.			
30 MVP-P	Pin 76 (See NOTE 1.)	14.2 MHz	30 MVP-P
30 MVP-P	Q1 Gate 1 (See NOTE 1.)	14.2 MHz	90 MVP-P
30 MVP-P	Q1 Drain (See NOTE 1.)	14.2 MHz	200 MVP-P
30 MVP-P	Q2 Gate 1 (See NOTE 1.)	14.2 MHz	200 MVP-P
30 MVP-P	Q2 Gate 2	54.0 MHz	1.5 VP-P
30 MVP-P	Q2 Drain	39.5 MHz	250 MVP-P
30 MVP-P	Q3 Gate 1	39.5 MHz	250 MVP-P
30 MVP-P	Q3 Drain	39.5 MHz	800 MVP-P
30 MVP-P	Pin 68	39.5 MHz	800 MVP-P
The following measurement points are located on the IF board.			
30 MVP-P	Pin 42	39.5 MHz	800 MVP-P
30 MVP-P	Q10 Gate 1	39.5 MHz	800 MVP-P
30 MVP-P	Q10 Drain	8.8 MHz	1000 MVP-P
1 MV	Q11 Gate 1	8.8 MHz	120 MVP-P
100 UV	Q11 Drain	8.8 MHz	150 MVP-P
100 UV	IC3 Pin 2	8.8 MHz	50 MVP-P
100 UV	IC3 Pin 6	8.8 MHz	600 MVP-P
100 UV	IC4 Pin 2	8.8 MHz	100 MVP-P
100 UV	IC4 Pin 6	8.8 MHz	200 MVP-P
1 UV	Q16 Base	8.8 MHz	100 MVP-P
1 UV	Q16 Emitter	8.8 MHz	100 MVP-P
1 UV	Pin 465	8.8 MHz	100 MVP-P

NOTE: 1. Measured with Front End board wire number 14 disconnected.

Table 4-5. Receiver Signal Levels (Sheet 1 of 2)

RF Input Level at Antenna	Measurement Point	Frequency	Output Level With Signal
The following measurement points are located on the AGC Detector board.			
1 UV	Pin 493	8.8 MHz	100 MVP-P
1 UV	IC1 Pin 2	8.8 MHz	100 MVP-P
1 UV	IC1 Pin 6	8.8 MHz	1 VP-P
1 UV	Q6 Gate 1	8.8 MHz	200 MVP-P
1 UV	Q6 Drain	Audio	400 MVP-P
1 UV	Pin 485	Audio	400 MVP-P
The following measurement points are located on the Audio board.			
1 UV	Pin 308 (See NOTE 2.)	Audio	400 MVP-P
1 UV	Q9 Gate	Audio	150 MVP-P
1 UV	Q9 Drain	Audio	800 MVP-P
1 UV	Q18 Drain	Audio	800 MVP-P
1 UV	Q18 Source	Audio	800 MVP-P
1 UV	Q19 Gate	Audio	800 MVP-P
1 UV	Q19 Drain	Audio	6 VP-P
1 UV	Pin 313	Audio	6 VP-P
The following measurement points are located on the Power Supply board.			
1 UV	Pin 125	Audio	6 VP-P
1 UV	IC1 Pin 14	Audio	1.5 VP-P
1 UV	IC1 Pin 7	Audio	20 VP-P
1 UV	Pin 130	Audio	20 VP-P
The following measurement point is located on the rear panel.			
1 UV	J3	Audio	5 VP-P

NOTE: 2. Set the "AF-GAIN" control to the "10" position.

Table 4-5. Receiver Signal Levels (Sheet 2 of 2)

4.6 STRAPPING OPTIONS FOR 115/230 VAC OPERATION

4.6.1 115 Vac Operation

The strapping option connections for 115 VAC operation is shown in Figure 4-21. Two separate jumper wires must be connected. Connect one jumper wire between Power Supply board input pins 166 and 164. Connect the other jumper wire between Power Supply board input pins 163 and 165.

4.6.2 230 Vac Operation

Only one jumper wire is utilized for 230 VAC operation. The jumper wires shown in Figure 4-21 must be removed and Power Supply board input pins 163 and 164 must be connected by a jumper wire.

4.7 OPTIONAL FILTER AND CRYSTAL INSTALLATION

4.7.1 Optional Filters

Two filter brackets are provided for the installation of optional filters. The filter brackets located on the IF board, are shown in Figure 4-22. The applicable "MODE" switch position and filter location is listed in Table 4-6.

The filters may be installed using the following procedure.

a. If necessary, trim the filter leads so that the lead length is 3/16 inch.

b. Remove the hardware from the filter bracket holes that accept the applicable filter mounting studs. Save the nuts and washers for use in the following steps.

c. Prior to plugging the filter into the bracket, place flat washers over each plug-in lead. The inside of the washers must not be permitted to touch the lead or the glass seal at the base of the lead. This prevents damage to the glass seal when the filter is being secured to the bracket.

d. Insert the filter into the applicable filter bracket.

e. Place the ground lugs over the mounting studs and tighten nuts.

f. Perform the installation checkout given in paragraph 5.4.1 of Section V.

4.7.2 Optional Crystals

a. Install the applicable crystal listed in table 4-7 in the applicable Front End board socket shown in Figure 4-23.

b. Perform the installation checkout given in paragraph 5.4.2 of Section V.

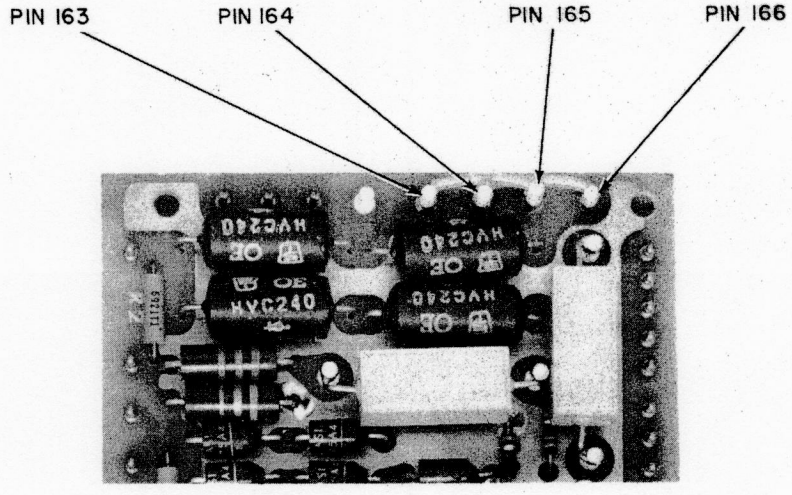


Figure 4-21. Strapping Option Pins Located on Power Supply Board

Filter	Part No.	"MODE" Switch Position	Location
Deluxe CW*	08-S0007-001	CW2	Above FL3 (I.F.BD.)
Standard CW*	08-S0004-001	CW2	Above FL3 (I.F.BD.)
FSK	08-S0006-001	FSK, CW3	Above FL1 (I.F.BD.)
*If both of these filters are required, install the standard filter (08-S0004-001) above FL1 (I.F.BD.). "MODE" switch position for this filter is now CW3, and FSK.			

Table 4-6. Optional Filters

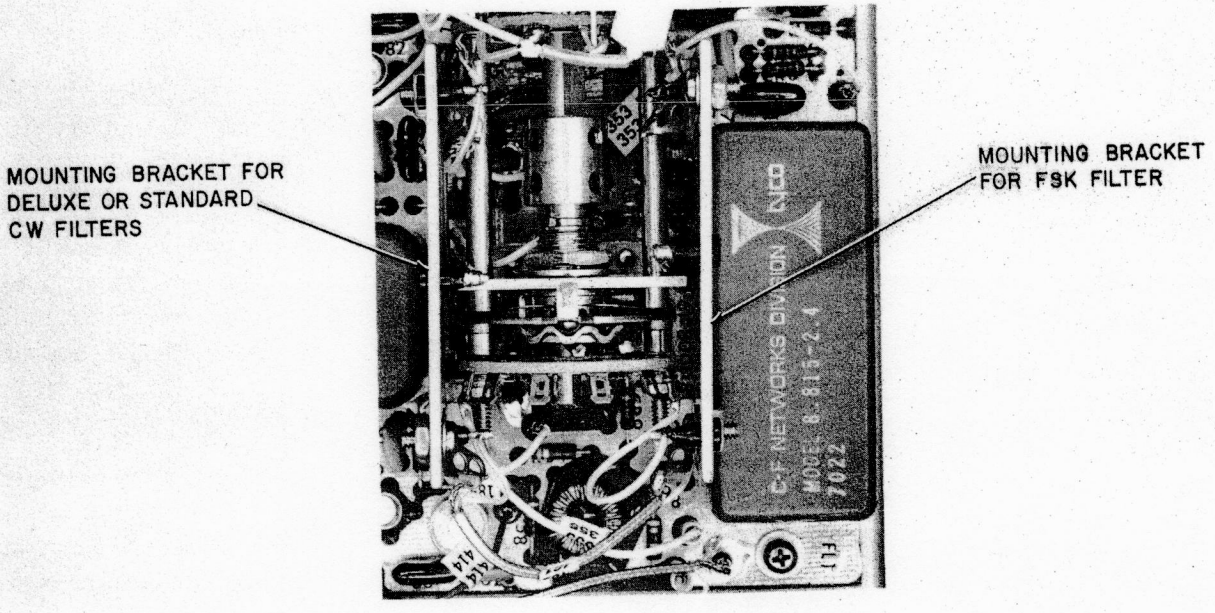


Figure 4-22. Installation Location for Optional Filters

Crystal Frequency (MHz)	Crystal Socket	Bandswitch Position	Operating Frequency (MHz)
42.0	YSA	A	2 - 3
44.0	YSB	B	4 - 5
45.0	YSB	B	5 - 6
46.0	YSB	B	6 - 7
48.0	YSC	C	8 - 9
49.0	YSC	C	9 - 10
50.0	YSC	C	10 - 11
51.0	YSC	C	11 - 12
52.0	YSC	C	12 - 13
53.0	YSC	C	13 - 14

Table 4-7. Optional Crystal Installation

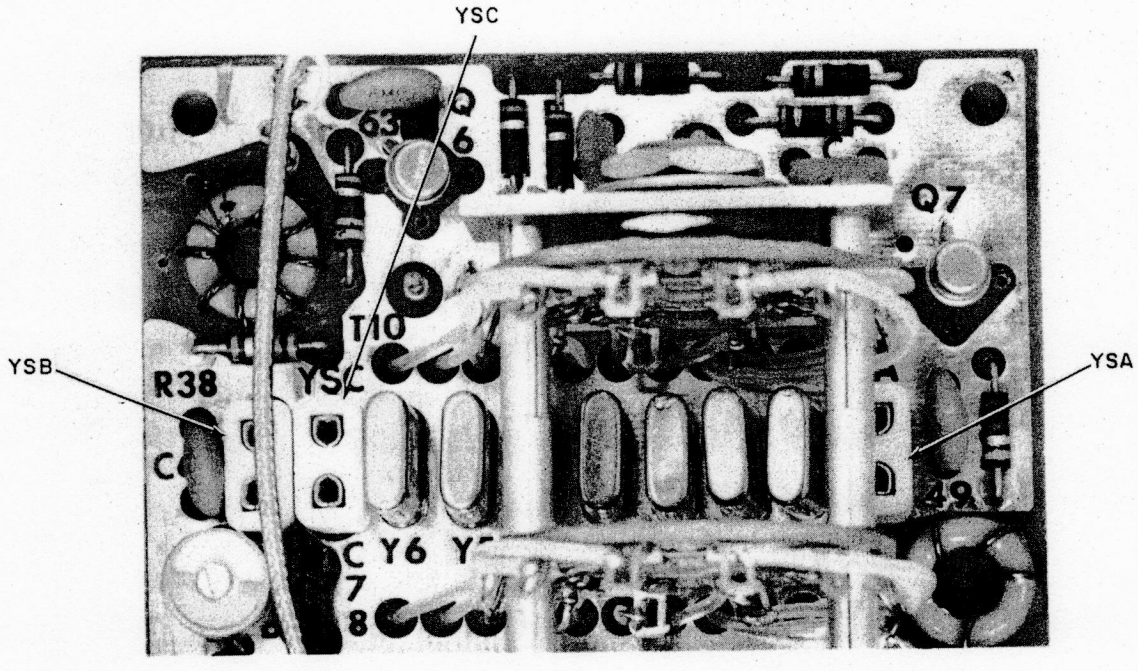


Figure 4-23. Location of Sockets for Optional Crystals

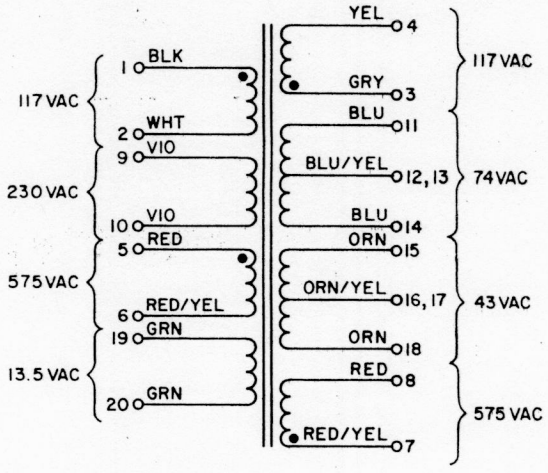


Figure 4-24. Power Transformer Lead Identification

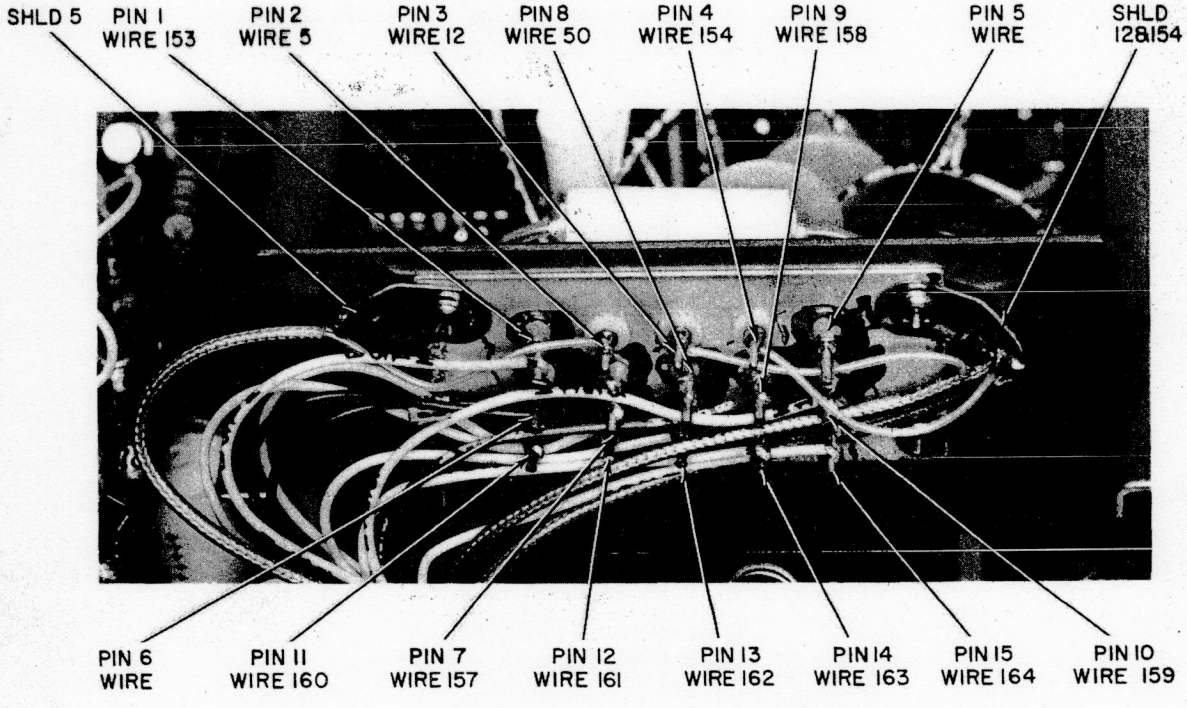


Figure 4-25. Location of Counter Assembly Terminals

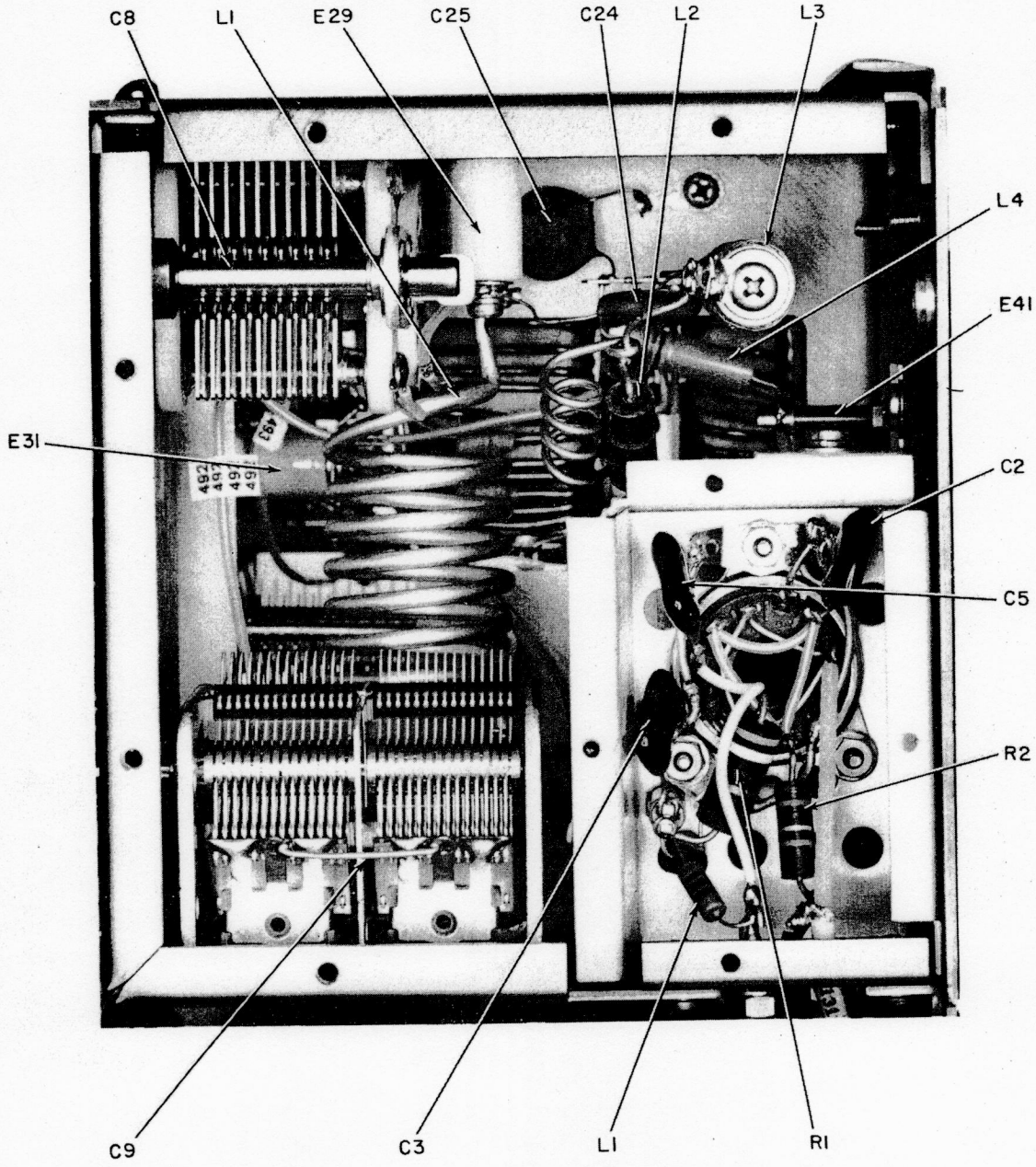


Figure 4-26. Location of Parts in Upper PA Assembly

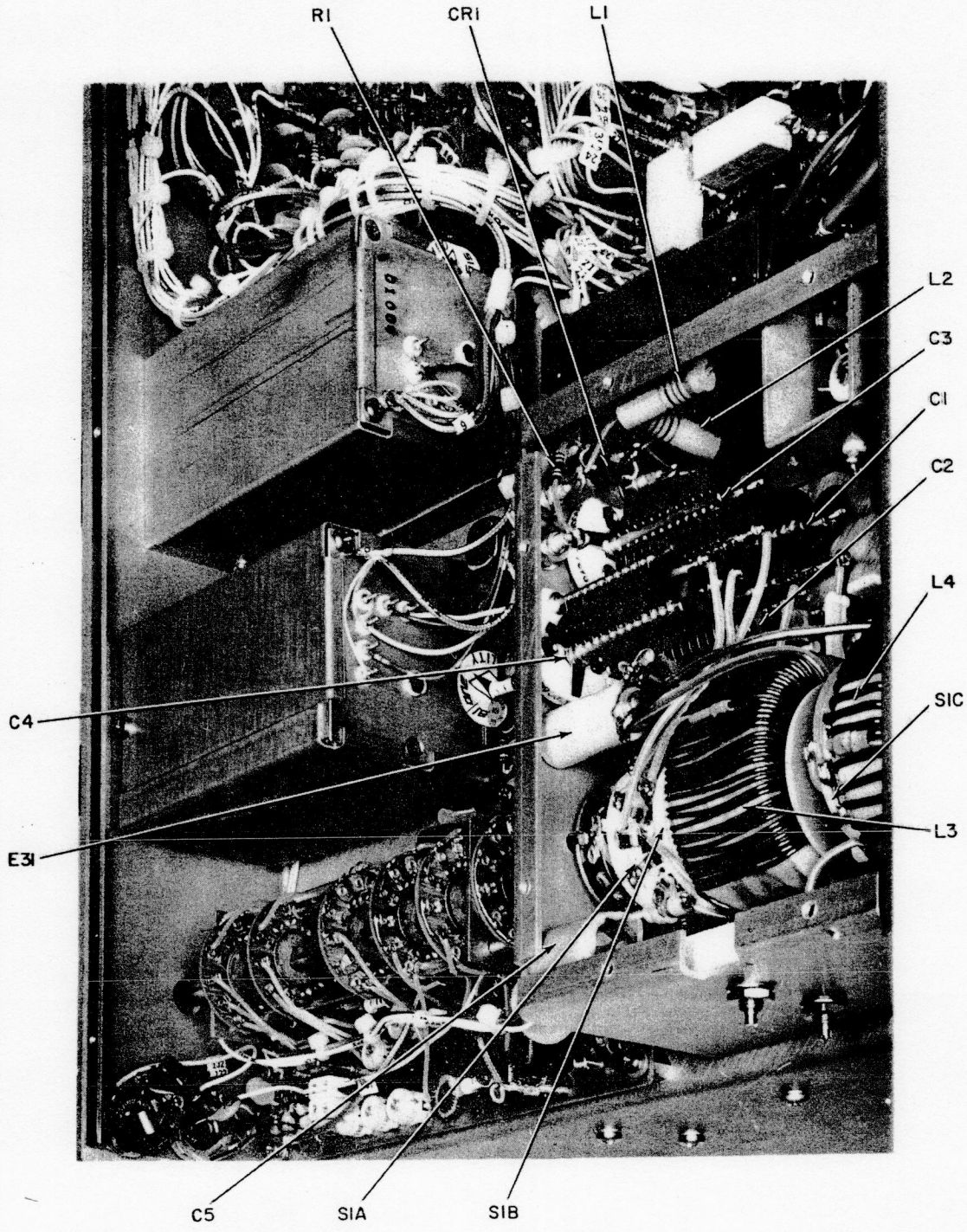


Figure 4-27. Location of Parts in Lower PA Assembly

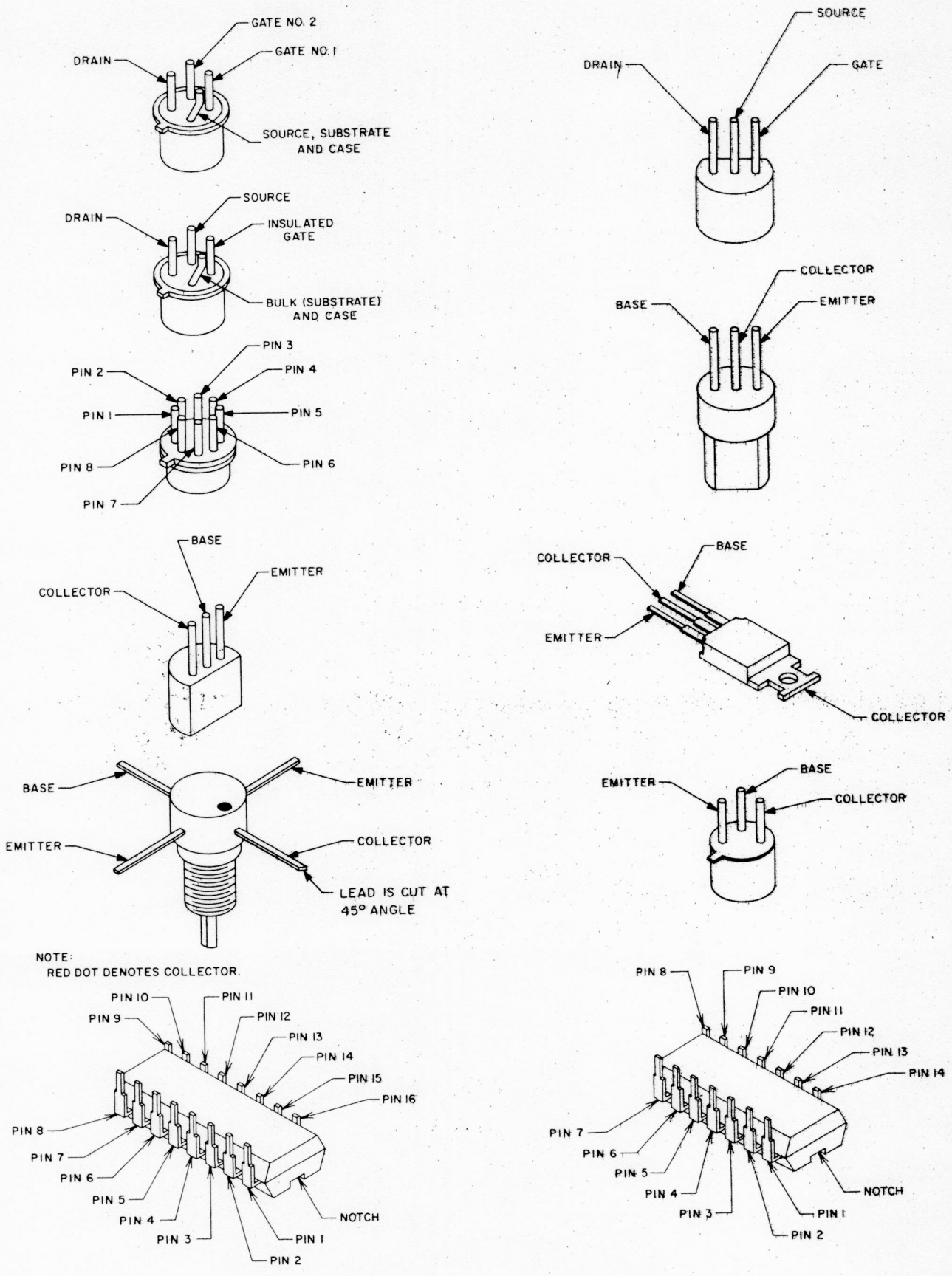
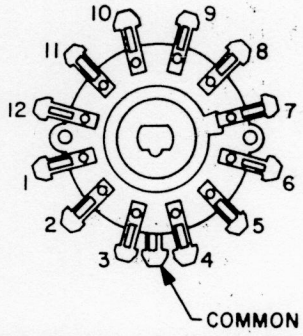
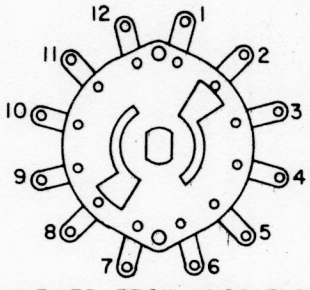


Figure 4-28. Electrode Configuration for Semiconductor Devices



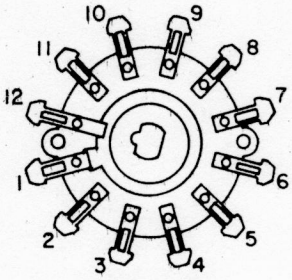
WAFERS A&C SIMILAR EXCEPT
WAFER C ROTATED 180°
REAR VIEW

Switch A2S1



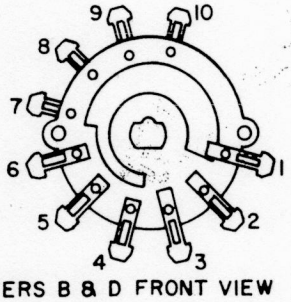
VIEWED FROM KNOB END

Switch S6



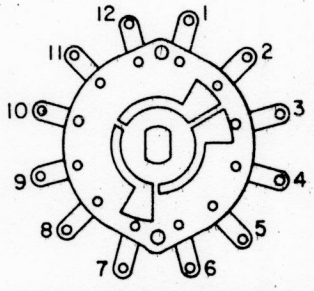
REAR VIEW
WAFER D ROTATED 180°

Switch S7



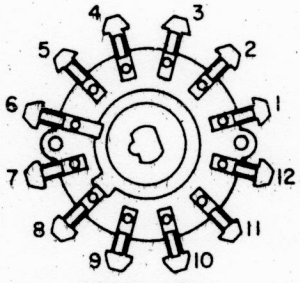
WAFERS B & D FRONT VIEW

Switch A2S1



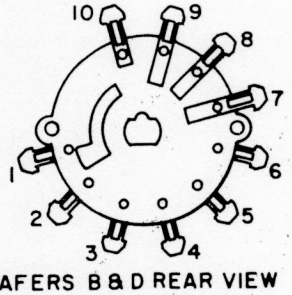
VIEWED FROM KNOB END

Switch S5



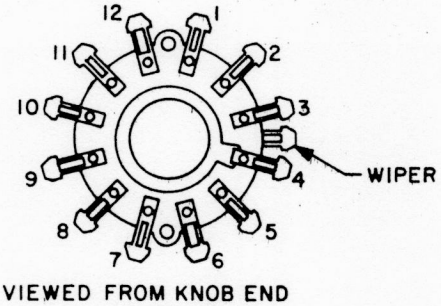
REAR VIEW

Switch S8



WAFERS B & D REAR VIEW

Switch A2S1



VIEWED FROM KNOB END

Switch A1S1

Figure 4-29. Switch Contact Identification

SECTION V

PERFORMANCE CHECK AND ALIGNMENT

5.1. GENERAL

This section consists of simple performance checks for the receive and transmit circuits. Also included in this section are alignment instructions for all the internal potentiometers, variable capacitors, and transformers.

CAUTION

Unless otherwise specified herein, all the performance checks and alignments are to be performed with a dummy load connected to the Model CX7.

5.2 PERFORMANCE CHECK

5.2.1 Transmitter. A check on the operation of the transmitter circuitry can be achieved by performing the transmit mode operating procedures covered in paragraphs 2.4 through 2.4.6 of Section II to the desired extent, in all applicable modes, and in all applicable bands while observing for satisfactory operational characteristics.

5.2.2 Receiver. A check on the operation of the receiver circuitry can be achieved in a similar manner, as the transmitter performance check, by performing the operating procedure covered in paragraphs 2.3 through 2.3.4.2 of Section II and and then conducting the following sensitivity and audio gain check.

a. Sensitivity Check

1. Tune the Model CX7 to 29,500.0 kHz. Set "RF GAIN" to "10" and "AF GAIN" to "5."

2. Connect an AC VTVM across the speaker terminals.

WARNING

Do not key the transmitter with the signal generator connected to the antenna.

3. Tune an RF signal generator to 29.5 MHz, adjust its output for 3 microvolts, and apply this signal to the Model CX7 antenna connector. Fine tune the RF signal generator for a peak "S" meter indication on the Model CX7. Adjust the Model CX7 "PRESELECTOR" for a peak "S" meter indication.

4. Note the indication on the AC VTVM. (The Model CX7 "AF GAIN" control may be adjusted to produce an even increment indication on the AC VTVM for a reference point.)

5. Tune the RF signal generator off-frequency and note the indication on the AC VTVM.

6. Note that the difference in audio level indications in steps 4 and 5 is a minimum of 10 DB.

7. Repeat steps 3 through 6 with the RF signal generator output adjusted for 0.3 microvolts.

8. Repeat previous steps 2 through 6 for the following input frequencies and RF signal generator output level. Confirm a minimum audio level increase of 10 DB for each.

Input Frequency (MHz)	RF Signal Generator Output Level (Microvolts)
28.5	0.3
21.3	0.3
14.2	0.3
7.2	1.0
3.8	1.0
1.9	1.0

9. Remove the signal generator from the antenna and reconnect the dummy load.

b. Audio Gain Check

1. Pull out the "PULL-TO-CALIBRATE" control.

2. Tune the applicable "VFO" control until a strong audio signal from the calibrator is monitored.

3. Substitute a 4.7-ohm, 2-watt resistor in place of the speaker or headphone.

4. Increase the settings of the "RF GAIN" and "AF GAIN" controls to the maximum positions.

5. Measure the AC voltage drop across the resistor and confirm that it is a minimum of 1.7 VRMS. (Sidetone audio gain may be checked in a similar manner, but with the "CALIBRATOR" off, by keying the transmitter with the telegraph key and advancing the rear panel "SIDETONE" control to the maximum position.)

6. Return the "RF GAIN," "AF GAIN," and "PULL-TO-CALIBRATE" controls to their original positions and remove the 4.7-ohm resistor.

5.3 ALIGNMENT PROCEDURES

Alignment procedures are divided into two groups as determined by the nature of the adjustments. Those adjustments that are classified as touch-up are covered in paragraph 5.3.1. Capacitors, resistors, inductors, and transformer adjustments that are touched-up should not be varied more than a few degrees in either direction of their original setting. If the adjustments require varying by an appreciable amount, check for the presence of a defect other than alignment. Adjustments that require exact frequency settings, with the aid of an external electronic counter, and bandpass alignments are covered in paragraph 5.3.2. In order to gain access to some of the adjustments, the AGC Detector board and Audio board will have to be physically repositioned (being careful to avoid shorts) without removing any of the electrical interconnections.

5.3.1 Touch-Up Adjustments

NOTE

The adjustments in paragraphs 5.3.1 a. through h. are performed with the Model CX7 in the receive mode.

a. -15 Vdc Regulator

1. With a VTVM connected to Power Supply board pin 118 (see Figure 5-1), adjust Power Supply board resistor R16 (see Figure 5-1) for an indication of exactly -15.0 VDC. When the

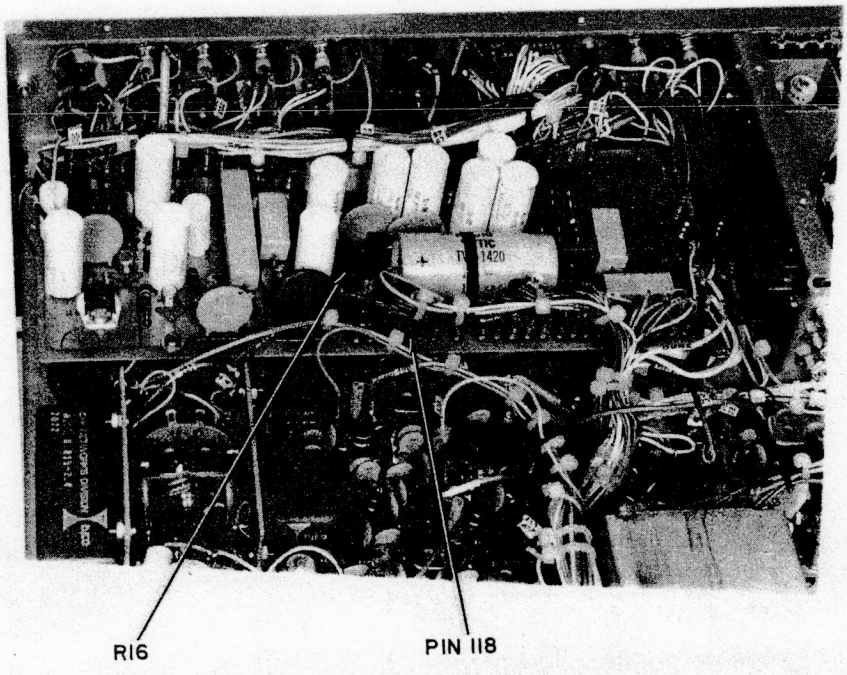


Figure 5-1. Location of R16 on Power Supply Board

-15 VDC regulator is properly adjusted all other regulator voltages will lie in the following range:

+5 VDC	±0.40 VDC
+15 VDC	±0.20 VDC
+34 VDC	±0.50 VDC
+22.5 VDC	±1.50 VDC

b. 100 kHz Oscillator Calibration

1. Set the "MHZ" band selector to the "14" position.

2. Set the "MODE" selector to the "USB" position.

3. Adjust the "IF SHIFT" control to the "-1.5" position.

4. Tune the applicable "VFO A" or "VFO B" control until WWV is monitored on the high end of the band. WWV is at 15.00 MHz, however the CX7 counter may not indicate exactly ".000.0" until calibration has been completed.

5. Pull out the "PULL-TO-CALIBRATE" control. (Do not rotate.)

6. Adjust AGC Detector board capacitor C30 (see Figure 5-2) for a zero beat between the 100 kHz oscillator output and the carrier of WWV. If the "KHZ" frequency display does not indicate ".000.0," proceed with paragraph 5.3.1.c.

c. 43.1 MHz Oscillator Calibration

1. Check that the "MODE" selector is set to the "USB" position.

2. Check that the "IF SHIFT" is set to the "-1.5" position.

3. Check that the "PULL-TO-CALIBRATE" control is in the "OUT" position. (Do not rotate.)

4. Tune the applicable "VFO A" or "VFO B" control for a "000.0" "KHZ" display and confirm that a zero beat between the VFO and the 100 kHz oscillator can be obtained for the 1, 3, 7, 14, 21, 28, and 29" band switch positions.

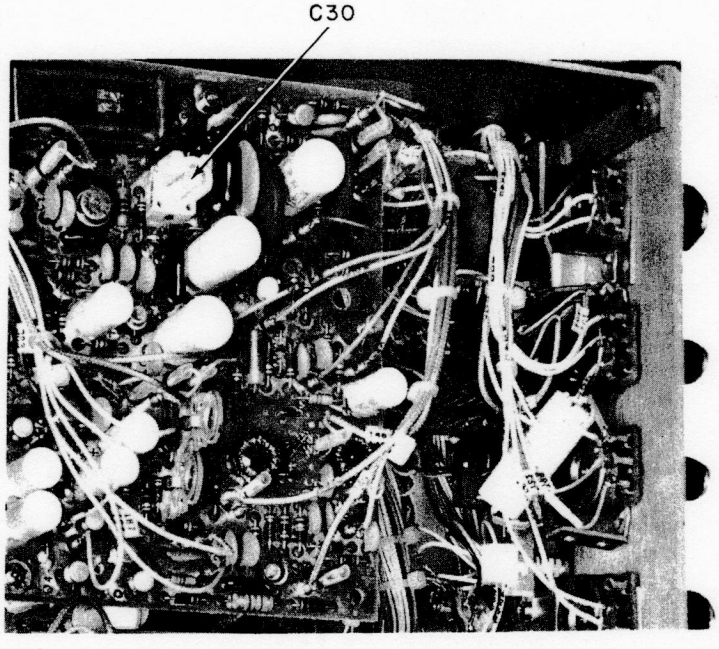


Figure 5-2. Location of C30 on AGC Detector Board

NOTE

If the majority of the bands can be calibrated, then the appropriate trimmer must be adjusted on the Front End board. If not, then capacitor C31 on the BFO board must be adjusted in accordance with step 5. Under rare circumstances, both BFO board capacitor C31 and also the Front End board trimmers may have to be adjusted.

5. Slightly adjust capacitor C31 (see Figure 5-3(a)) on the BFO board, as necessary, but not more than a few degrees in either direction. (Do not remove BFO cover to adjust C31. The AGC Detector and Audio boards will have to be positioned to gain access to C31.) Note: If any channels are still out of calibration, their applicable Front End board oscillator trimmer may have to be slightly adjusted.

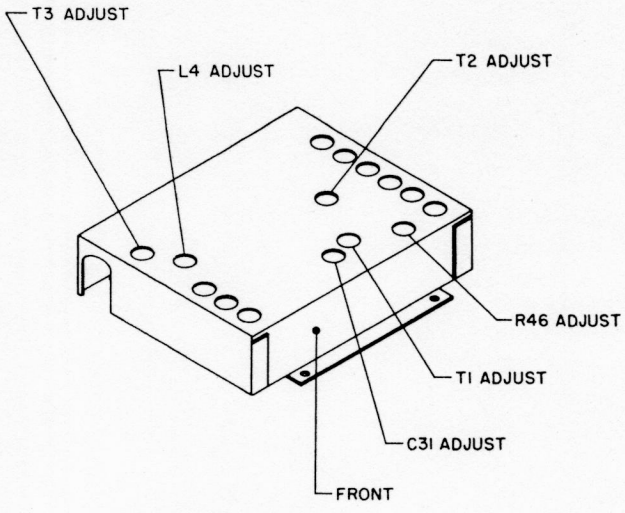


Figure 5-3(a). BFO Cover

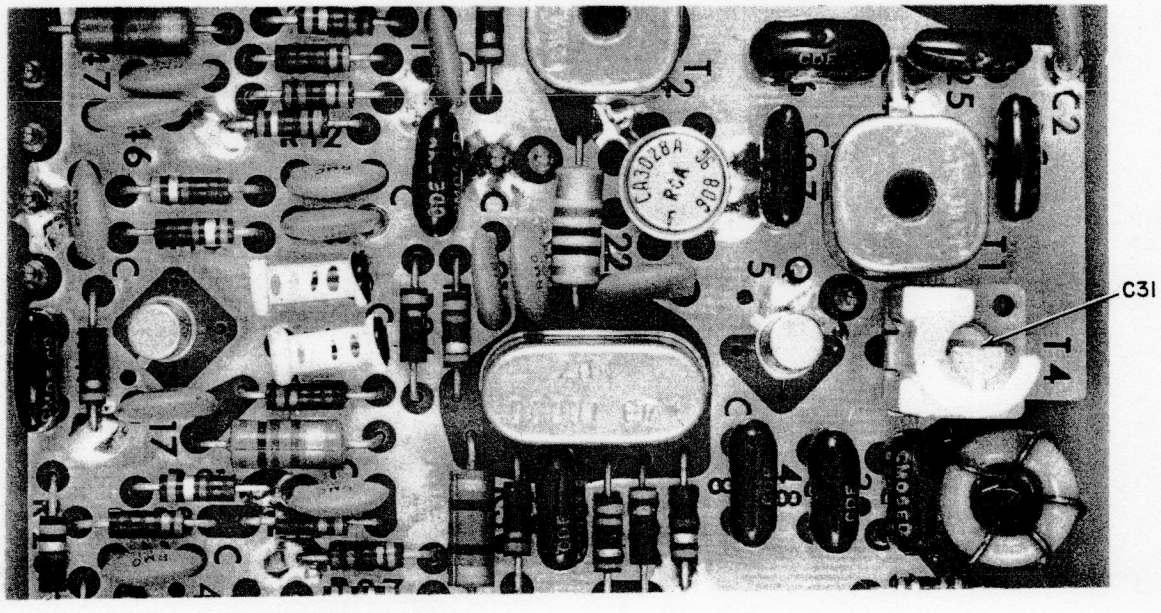


Figure 5-3(b). Location of C31 with BFO Cover Removed

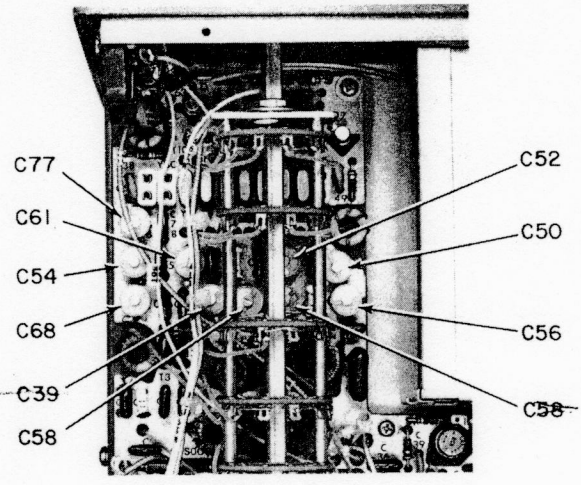


Figure 5-4. Location of Front End Board Trimmers

d. Front End Oscillator Calibration

1. Perform the touch-up adjustments covered in 5.3.1.a., b., and c. (Omit if just previously accomplished.)

2. Set the "MHZ" band switch to the position that is still out of calibration and slightly adjust the applicable trimmer (see Figure 5-4) for a zero beat.

Band Switch Position	Trimmer
1	C50
A	C56
3	C52
B	C68
7	C54
C	C77
14	C61
21	C59
28	C58
29	C57

3. If a trimmer is adjusted, check that the RF output level at the Front End board pin 71 is between 400 and 700 MVRMS. (Use an RF voltmeter.)

e. Offset 34.2 MHz Oscillator Calibration

NOTE

The offset 34.2 MHz oscillator calibration does not have to be performed if a zero beat between VFO A and offset VFO A can be achieved with the "TRANSMITTER OFFSET" control set to within ±30° of midrange. The zero beat is between the offset 34.2 MHz oscillator and the normal 34.2 MHz source. The offset oscillator is adjusted while in the receive mode. (Do not key the transmitter.) The AGC Detector and Audio boards will have to be positioned to gain access to the BFO board adjustments.

1. Perform the touch-up adjustments covered in paragraph 5.3.1.a., b., c., and d. using receive channel A. (Omit if just previously accomplished.)

2. Tune "VFO A" for a "500.0" "KHZ" display.

3. Depress the transmit VFO "A/T.O." switch to the latched-in position.

NOTE

The adjustments in steps 4 through 7 are performed with the "SPOT" pushbutton depressed and held-in.

4. Position the "SPOT LEVEL" control for a comfortable audio level while positioning the "TRANSMITTER OFFSET" control for a strong low frequency tone.

5. Adjust inductor L4 (see Figure 5-5b) and transformer T3, both on the BFO board, for a peak audio level (or 200 MVRMS or more at IF board pin 405 (see Figure 5-5a) as measured with an RF voltmeter.)

6. Position the "TRANSMITTER OFFSET" control for a zero beat between VFO A and the offset VFO. If the zero beat occurred at a setting greater than ±30° from midrange, proceed to step 7.

7. Position the "TRANSMITTER OFFSET" control to midrange and adjust BFO board resistor R43 (see Figure 5-5b) for a zero beat. If necessary, repeat steps 5 through 7.

NOTES

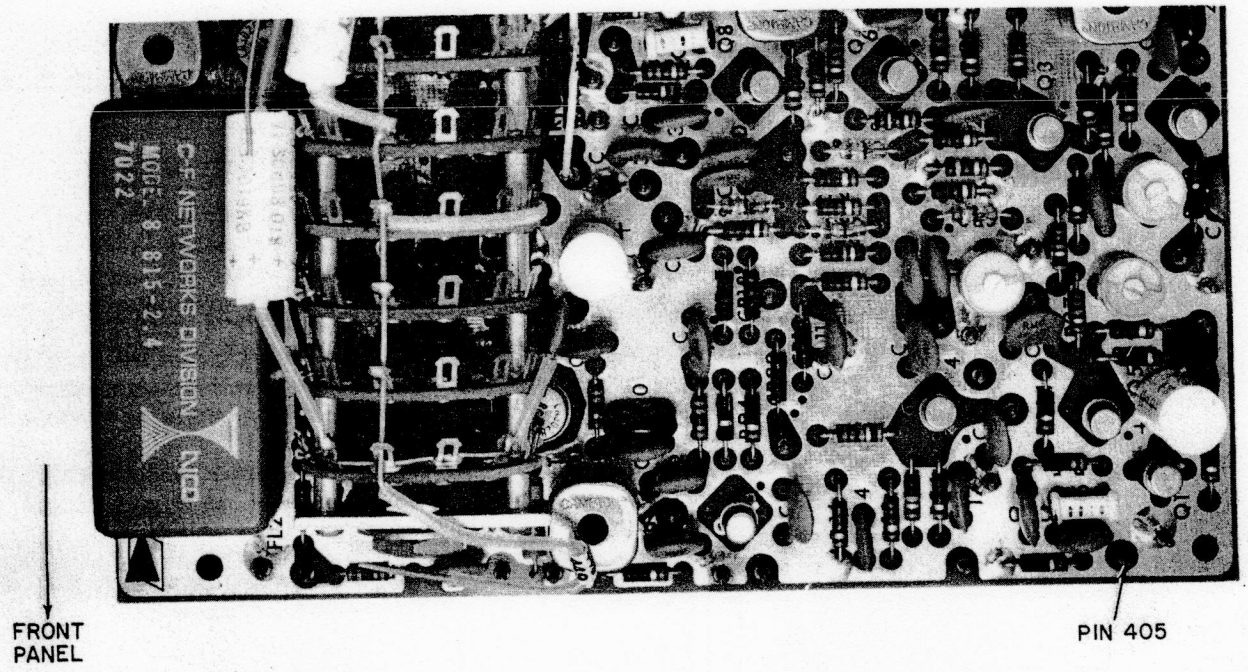


Figure 5-5(a). Location of Pin 405 on IF Board

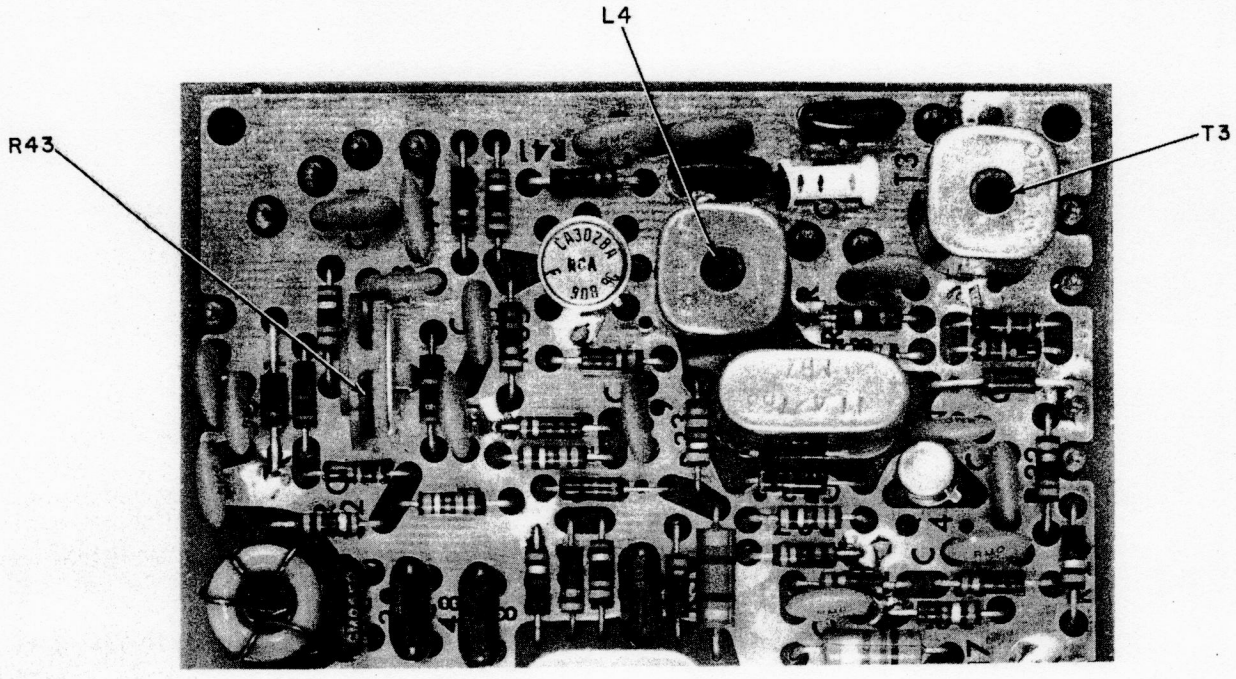


Figure 5-5(b). Location of L4, T3, and R43 on BFO Board

NOTES

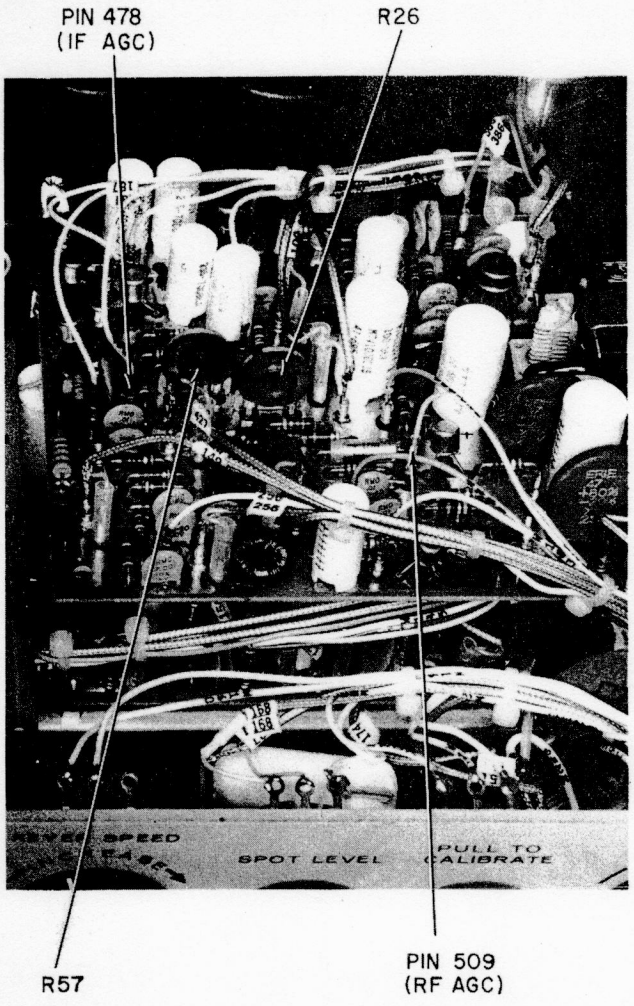


Figure 5-6. Location of AGC and "S" Meter Calibration Adjustments on AGC Detector Board

f. AGC

1. Tune the Model CX7 to 14,200.0 kHz. Set "RF GAIN" to "10" and "AF GAIN" to "5."

WARNING

Do not key the transmitter with the signal generator connected to the antenna.

2. Tune an RF signal generator to 14.2 MHz, adjust its output for 100 millivolts, and apply the signal to the Model CX7 antenna connector. Tune the Model CX7 "VFO" and "PRESELECTOR" for a peak "S" meter indication.

3. Momentarily, reduce the signal generator to 1 microvolt and set the "AGC" switch to the "OFF" position. There should be an audio output level across the 4-ohm resistor plugged into the speaker jack of at least 1.7 VRMS. If this is not present, check for a defect other than in the AGC circuit. Set "AF GAIN" to "10."

4. Set the "AGC" switch to "SLOW."

5. Adjust AGC Detector board resistor R26 (see Figure 5-6) for a voltage of +2.75 to +3.0 VDC measured at AGC Detector board pin 478 and -0.15 to -0.9 VDC measured on the AGC Detector board pin 509 (see Figure 5-6).

6. The signal generator may remain connected to the antenna connector for "S" meter calibration.

g. "S" Meter Calibration

1. Perform the AGC adjustment covered in paragraph 5.3.1.f. (Omit if just previously accomplished.)

2. Apply a 50-microvolt signal to the antenna connector. Tune the Model CX7 "VFO" and "PRESELECTOR" for a peak "S" meter indication.

3. Adjust AGC Detector board resistor R57 (see Figure 5-6) for an "S" meter indication of "S-9."

4. Remove the signal generator from the antenna and reconnect the dummy load.

h. Control Grid Fixed Bias

1. Check that only the dummy load is connected to the antenna connector.

2. Adjust the "OUTPUT" control to the "0" (full counterclockwise) position.

3. Depress the "PLATE" meter switch to the latched-in position.

4. Depress the "TUNE" switch to the latched-in position.

5. Adjust RF Driver board resistor R31 (see Figure 5-7) for a plate meter indication of "1" (100 MA) on the black scale.

6. Adjust RF Driver board resistor R34 (see Figure 5-7) for zero VDC on the collector of transistor Q5 (also on the RF Driver board) as measured with a VOM, or VTVM.

i. ALC

1. Perform the control grid fixed bias adjustment covered in paragraph 5.3.1.h. (Omit if just previously accomplished.)

2. Tune-up the transmitter for maximum power output at 29.3 MHz using the tune mode operating procedure covered in paragraph 2.4.2.r of Section II.

NOTE

RF Driver board resistor R19 (see Figure 5-7) may have to be adjusted to obtain a minimum output power of 130 watts at 29.3 MHz.

3. Depress the "DRIVE" meter switch to the latched-in position.

4. Vary the "OUTPUT" control while observing the meter needle rate of movement. If the movement is excessive, adjust RF Driver board resistor R19 (see Figure 5-7) so that the needle does not violently peg on right-hand side of the meter.

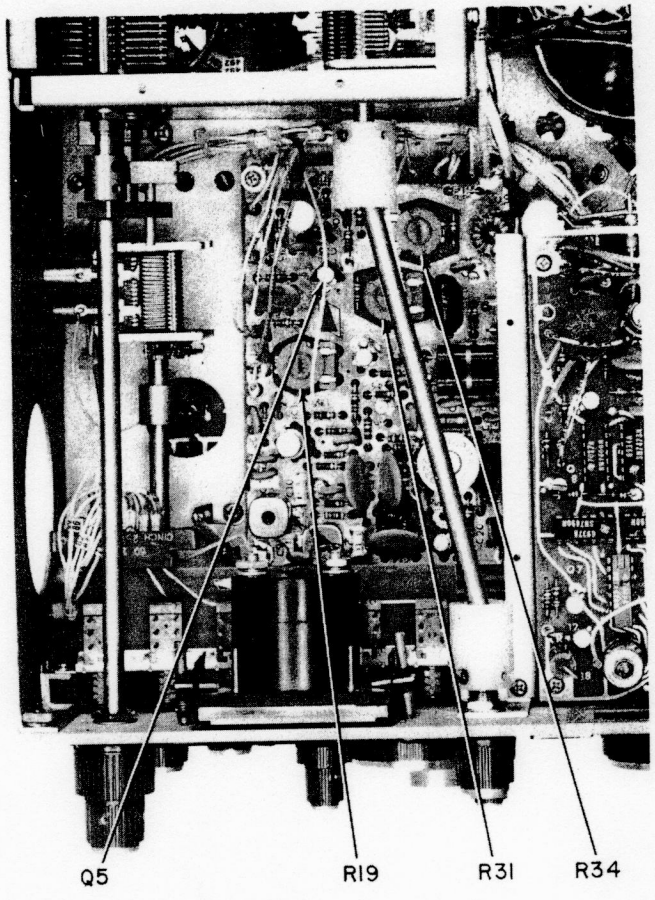


Figure 5-7. Location of Control Grid Fixed Bias and ALC Adjustments on RF Driver Board

j. Microphone Gain Adjust

NOTE

Perform the following adjustment with the Model CX7 in the receive mode so that RF interference is not present.

1. Connect an AC voltmeter to the AGC Detector board input pin 501 (see Figure 5-8a).

2. Apply a 10 MVRMS, 1 kHz signal to the "MIKE" connector.

3. Adjust Audio board resistor R12 (see Figure 5-8b) for a 30 MVRMS indication on the AC voltmeter. In some cases a microphone may have an extremely high or low gain therefore it may be necessary to adjust R12 for the appropriate amount of compensation.

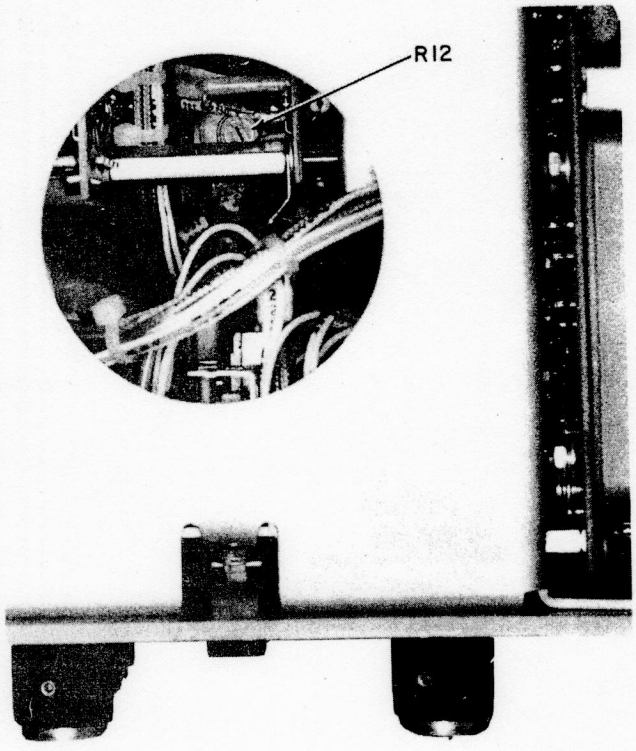


Figure 5-8(b). Location of R12 on Audio Board

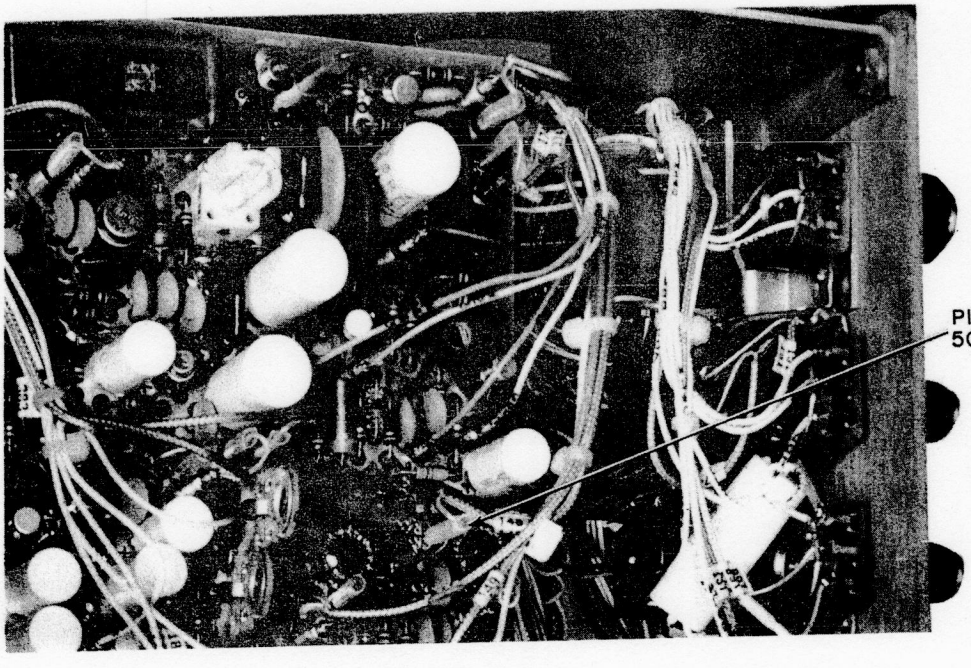


Figure 5-8(a). Location of Pin 501 on AGC Detector Board

k. Power Amplifier Broadband Adjustments

NOTE

Power amplifier broadband adjustments are performed with a dummy load and external wattmeter connected to the main antenna connector. The lower PA assembly cover must be removed to gain access to some adjustments. The "MODE" switch is set to "USB" and the "CLIPPING" control to "0." Use a fan with its air flow directed at the rear panel heat sink during the broadband adjustments.

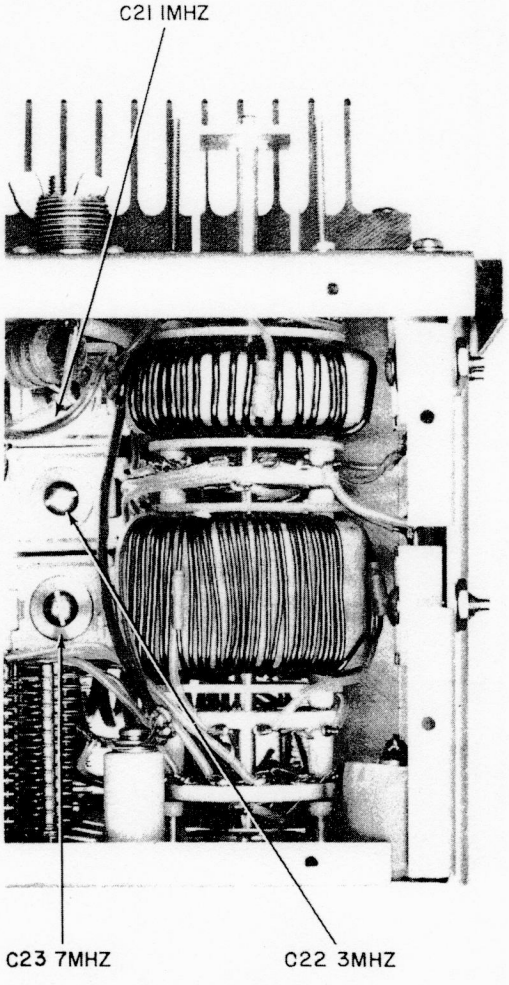


Figure 5-9(a). Location of Power Amplifier Assembly Adjustments

WARNING

High voltage is always present in the power amplifier assembly. Use a nonmetallic screwdriver to perform adjustments.

1. Set the "OUTPUT" control to the "0" position.

2. Establish the receive mode.

3. Set the "BROADBAND/MANUAL" switch to the "MANUAL" position.

4. Set the "MHZ" bandswitch to the "1" position (1.875 MHz).

5. Tune the applicable "VFO A" or "VFO B" control for a "KHZ" display of 875.0 (1.875 MHz).

6. Set the "BROADBAND/MANUAL" switch to the "BROADBAND" position.

7. Depress the "TUNE" switch to the latched-in position.

8. Adjust the "OUTPUT" control for a forward power indication of 150 watts or less.

WARNING

In the following steps, do not permit the screen current to exceed 20 MA. During tune-up, it is normal for the screen current to go negative.

9. Adjust capacitor C21 (see Figure 5-9a) for a peak power and minimum screen current indication. Normal screen current should be between 2 and 12 MA for 150 watts or more output.

10. Repeat steps 1 through 8 for 3.650 MHz.

11. Adjust capacitor C22 (see Figure 5-9a) for a peak power and minimum screen current indication.

12. Use the procedure covered in above steps 1 through 9 to select the applicable frequency and the procedure covered in paragraph 2.4.2.r of Section II to adjust the applicable loading and tuning capacitor (in place of the front panel "PA TUNING" and "LOADING" control) listed in Table 5-1.

13. Establish the receive mode and replace the lower PA assembly cover.

Transmit Frequency (MHz)	Loading Capacitor	Tuning Capacitor
7.125	C23 (See Fig. 5-9a)	C1 (See Fig. 5-9b)
14.150	C9 (See Fig. 5-9c)	C7 (See Fig. 5-9b)
21.175	C8 (See Fig. 5-9c)	C3 (See Fig. 5-9b)
28.500	C11 (See Fig. 5-9c)	C2 (See Fig. 5-9b)
29.300	C10 (See Fig. 5-9c)	C4 (See Fig. 5-9b)

Table 5-1. Power Amplifier Broadband Adjustments

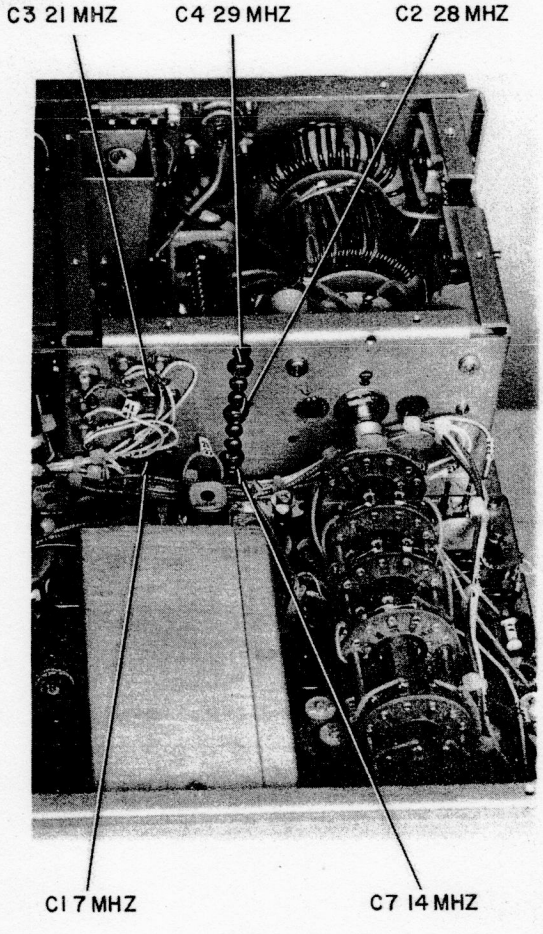


Figure 5-9(b). Location of Power Amplifier Assembly Adjustments

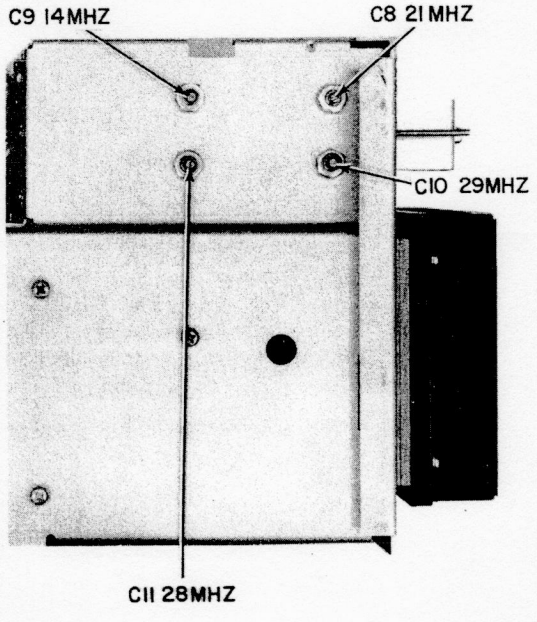


Figure 5-9(c). Location of Power Amplifier Assembly Adjustments

1. Reflectometer Calibration

NOTE

Reflectometer calibration is performed with a dummy load and external wattmeter connected to the main antenna connector. The lower PA assembly cover must be removed to gain access to the adjustments.

WARNING

High voltage is always present in the power amplifier assembly and reflectometer assembly. Use a nonmetallic screwdriver to perform adjustments.

1. Set the "OUTPUT" control to the "0" position.

2. Establish the receive mode.

3. Set the "BROADBAND/MANUAL" switch to the "MANUAL" position.

4. Set the "MHZ" bandselector to the "7" position.

5. Tune the applicable "VFO A" or "VFO B" control for a "KHZ" display of "200.0" (7.200 MHz).

6. Depress the "TUNE" switch to the latched-in position.

7. Use the procedure covered in paragraph 2.4.2.r of Section II to manually tune the transmitter for 150 watts as indicated on the external wattmeter.

8. Depress the "REV PWR" switch to the latched-in position.

9. Adjust reflectometer assembly capacitor C3 (see Figure 5-10) for a "0" indication on the CX7 front panel meter.

10. Depress the "FWD PWR" switch to the latched-in position.

11. Adjust reflectometer assembly capacitor C4 (see Figure 5-10) for a "4.2" indication on the CX7 front panel meter.

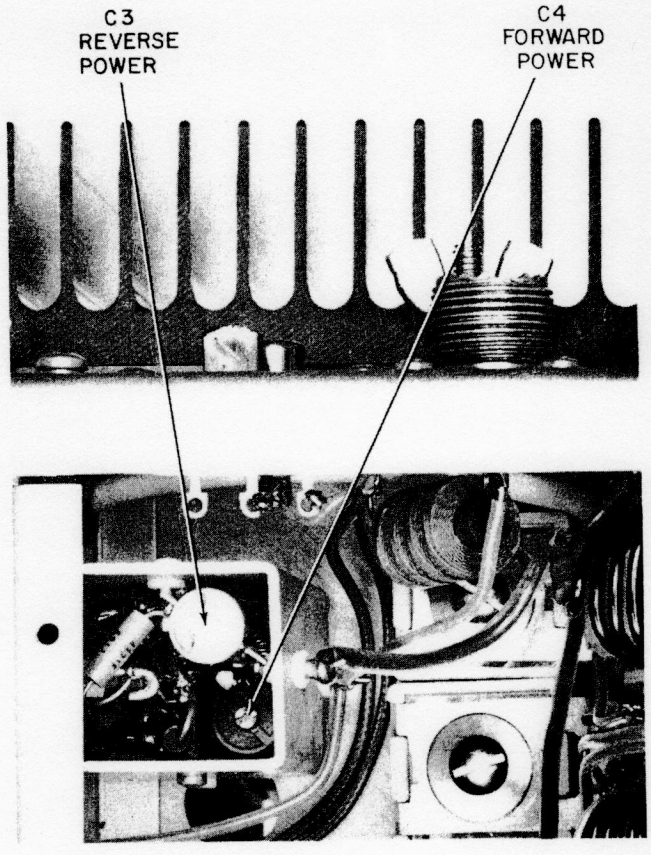


Figure 5-10. Reflectometer Adjustments

12. Establish the receive mode and replace the lower PA assembly cover.

NOTE

The adjustments on the following pages require the aid of an electronic counter for exact frequency settings.

5.3.2 Exact Frequency and Bandpass Adjustments

a. PTO A

1. Establish the receive mode.

2. Set the "RECEIVE CHANNEL" switch to the "A" position.

3. Adjust the "VFO A" control to the full CCW position.

4. Remove the PTO A cover.

5. Connect an electronic counter to PTO A output pin 3 (see Figure 5-11a).

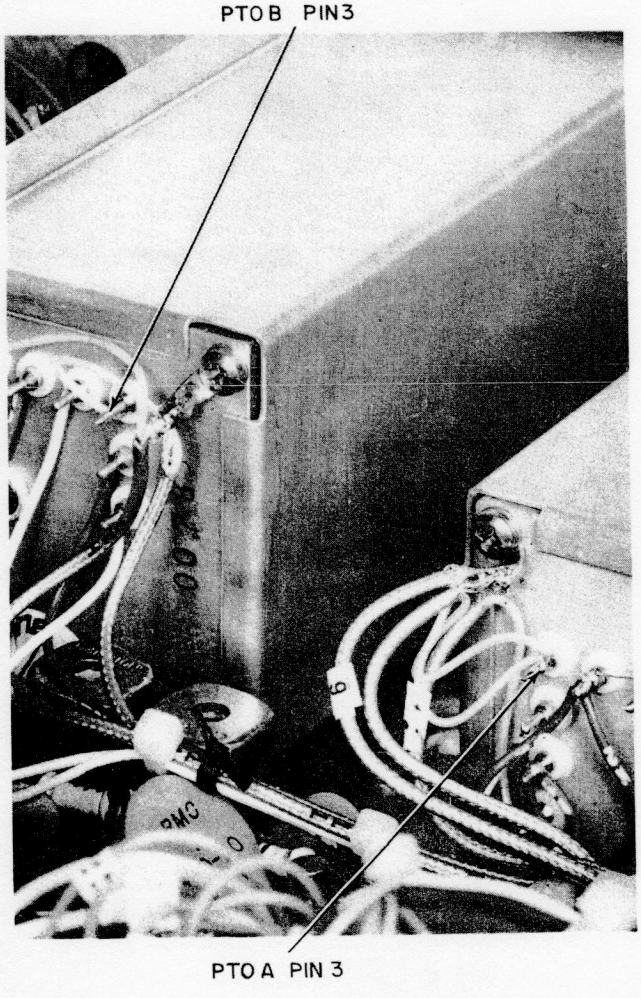


Figure 5-11(a). Location of PTO Module Pin 3

6. Adjust PTO A board capacitor C16 (see Figure 5-11b) for an indication on the electronic counter between 3040 and 3050 kHz.

7. Repeat measurement with PTO A cover in place, as the cover will affect the final PTO frequency.

b. PTO B

1. Establish the receive mode.

2. Set the "RECEIVE CHANNEL" switch to the "B" position.

3. Adjust the "VFO B" control to the full CCW position.

4. Remove the PTO B cover.

5. Connect an electronic counter to PTO B output pin 3 (see Figure 5-11a).

6. Adjust PTO B board capacitor C16 (see Figure 5-11b) for an indication on the electronic counter between 3040 and 3050 kHz.

7. Repeat measurement with PTO B cover in place, as the cover will affect the final PTO frequency.

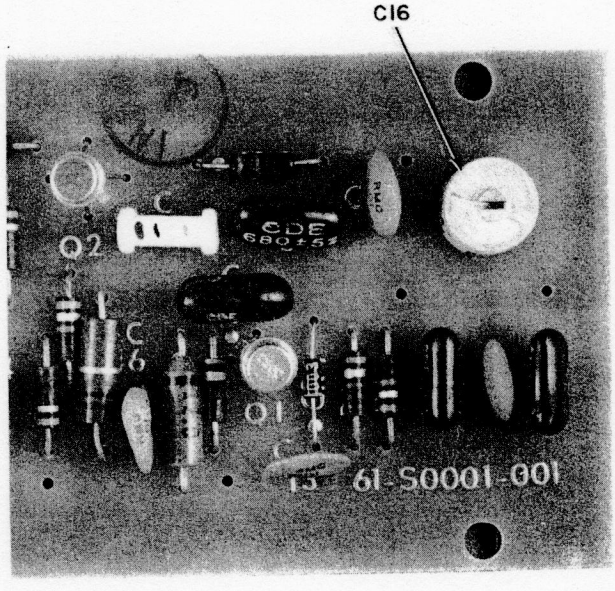


Figure 5-11(b). Location of C16 on PTO Board

c. 8.8 MHz Carrier Adjust

NOTE

The 8.8 MHz carrier adjust is performed with a dummy load connected to the main antenna connector. The following may be accomplished without repositioning the AGC Detector and Audio boards.

1. Establish the receive mode.

2. Set the "MHZ" bandswitch to the "1" position.

3. Set the "IF SHIFT" control to the mid-range position.

4. Set the "MODE" selector to the "USB" position.

5. Set the "OUTPUT" control to the "0" position.

6. While listening to the pitch of the hiss, adjust the "IF SHIFT" control to the position where the pitch is the same in both the "USB" and "LSB" position of the "MODE" switch.

7. Without disturbing the setting of the "IF SHIFT" control, loosen the knob setscrews, set the knob pointer to "0" and tighten the knob setscrews.

8. Recheck the requirement in step 6.

9. Set the "MODE" switch to the "USB" position.

10. Measure the frequency at AGC Detector board input pin 487 (see Figure 5-12a) and note it for reference in step 12.

11. Depress the "CONTROL-TUNE" pushbutton to the latched-in position.

12. Measure the frequency at AGC Detector board input pin 495 (see Figure 5-12a). The frequency should be within ±20 Hz of the frequency noted in step 10. If not, adjust BFO board resistor R46 through the access hole on the AGC Detector board.

13. Establish the receive mode.

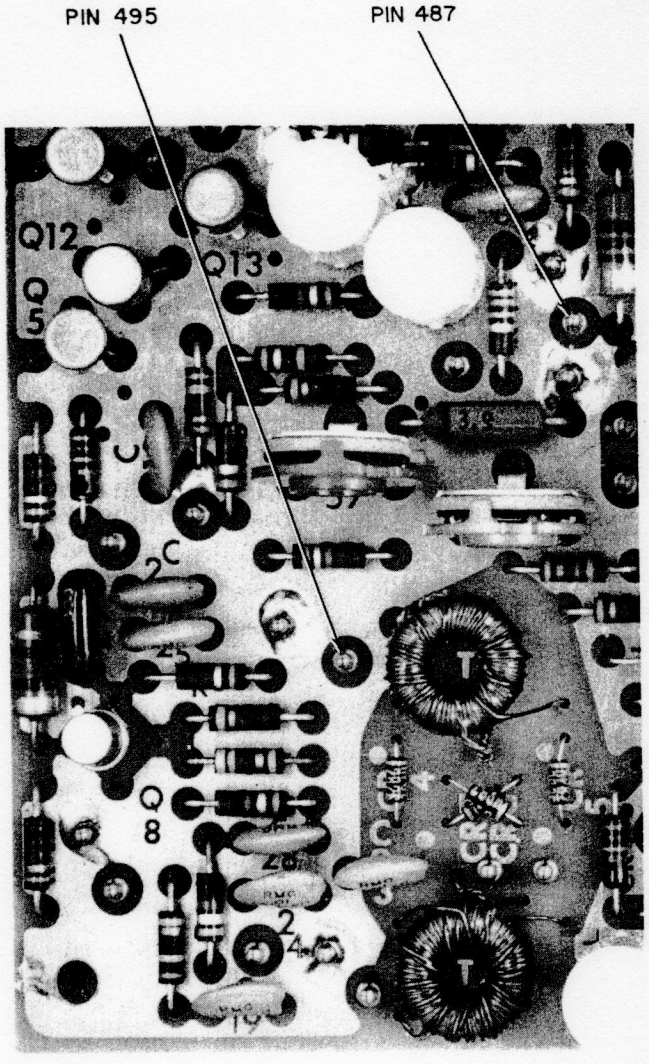


Figure 5-12(a). Location of Pins 487 and 495 on AGC Detector Board

d. Normal 34.2 MHz Adjust

NOTE

The AGC Detector and Audio boards will have to be positioned to gain access to BFO board adjustments. Perform adjustments with BFO board cover in place.

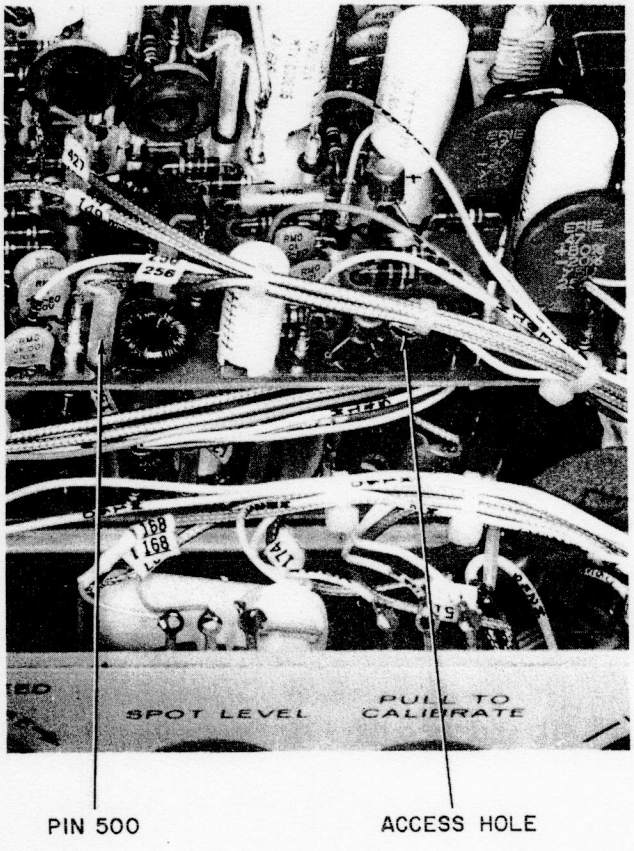


Figure 5-12(b). Location of Pin 500 and Access Hole on AGC Detector Board

1. Perform the 8.8 MHz carrier adjust covered in paragraph 5.3.2.c. (Omit if just previously accomplished.)

2. Establish the receive mode.

3. Set the "MODE" selector to the "USB" position.

4. Set the "PULL-TO-CALIBRATE" control to the midrange position (do not pull out).

5. Connect the electronic control to AGC Detector board input pin 487 (see Figure 5-13a).

6. Adjust the "IF SHIFT" control for a frequency indication of 8.8165 MHz ±50 Hz.

7. Set the "MODE" switch to the "LSB" position. The frequency indication should change to 8.8136 MHz ±100 Hz.

8. Connect the RF millivoltmeter to IF board input pin 407 (see Figure 5-13b).

9. Adjust BFO board transformers T1 and T2 (see Figure 5-13c) for a maximum output indication on the RF millivoltmeter. The output level must be greater than 200 MVRMS.

10. Set the "PULL-TO-CALIBRATE" control to the full CCW position.

11. Connect the electronic counter to IF board input pin 407 (see Figure 5-13b).

12. Adjust BFO board capacitor C31 (see Figure 5-13c) for a frequency indication of 34.2820 MHz ±100 Hz.

13. Adjust the "PULL-TO-CALIBRATE" control for a frequency indication of 34.2835 MHz ±100 Hz.

e. Offset 34.2 MHz Adjust

NOTE

The AGC Detector and Audio boards will have to be positioned to gain access to BFO board adjustments. Perform adjustments with BFO board cover in place.

1. Establish the receive mode.

2. Depress the transmit VFO "A/T.O." switch to the latched-in position.

3. Adjust the "TRANSMITTER OFFSET" control to the midrange position.

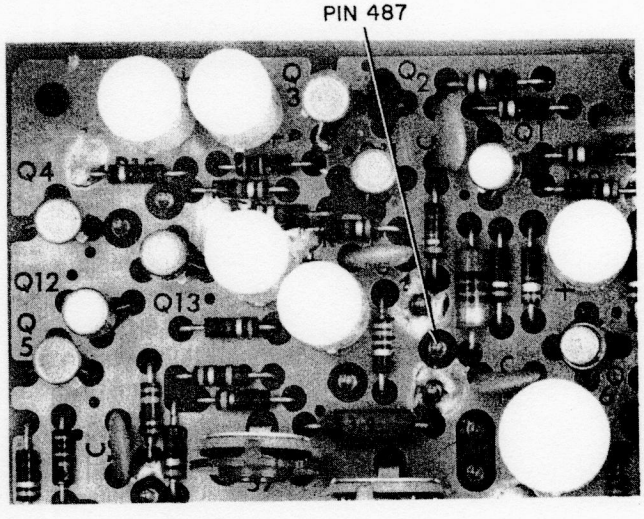


Figure 5-13(a). Location of Pin 487 on AGC Detector Board

4. Connect an RF millivoltmeter to IF board output pin 405 (see Figure 5-13b).

5. Adjust BFO board inductor L4 and transformer T3 (see Figure 5-13c) for a maximum output indication on the RF millivoltmeter. The level must be greater than 200 MVRMS.

6. Connect an electronic counter to IF board output pin 405 (see Figure 5-13b).

7. Adjust BFO board resistor R43 (see Figure 5-13c) for a 34.2835 MHz ±200 Hz indication on the electronic counter. If necessary, readjust inductor L4 and transformer T3 to meet the requirement.

8. Return the AGC Detector and Audio boards to their original positions.

f. 30.2 to 31.2 MHz Mixer Bandpass

1. Establish the receive mode.

2. Set the "RECEIVE CHANNEL" switch to the "A" position.

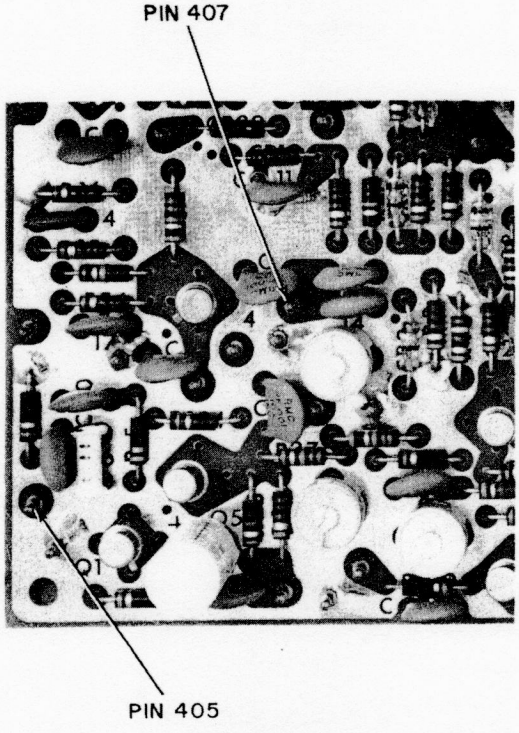


Figure 5-13(b). Location of Pins 407 and 405 on IF Board

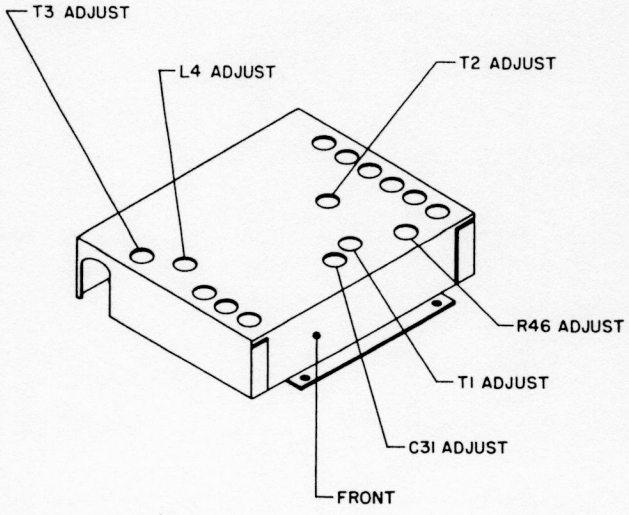


Figure 5-13(c). Location of Adjustment Holes on BFO Cover

3. Set the "IF SHIFT" control to the mid-range position.

4. Set the "AGC" switch to the "OFF" position.

5. Set the "BLANKER" to the "OFF" position.

6. Disconnect wire no.4 from IF board input pin 403. (PTO A input to IF board, see Figure 5-14.)

7. Connect the sweep generator output to IF board input pin 403.

8. Connect an RF detector probe and oscilloscope to IF board output pin 415 (30.2 to 31.2 MHz test point, see Figure 5-14).

9. Tune IF board transformer T1, T2, and inductor L1 (see Figure 5-14) for the response curve shown in Figure 5-15.

10. Remove the sweep generator from IF board input pin 403 and reconnect wire no.4.

11. Tune the "VFO A" control for a CX7 counter indication of "500.0."

12. Connect the RF millivoltmeter to IF board output pin 415 (see Figure 5-14).

13. Adjust IF board capacitor C3 (see Figure 5-14) for a 600 MVRMS indication on the RF millivoltmeter.

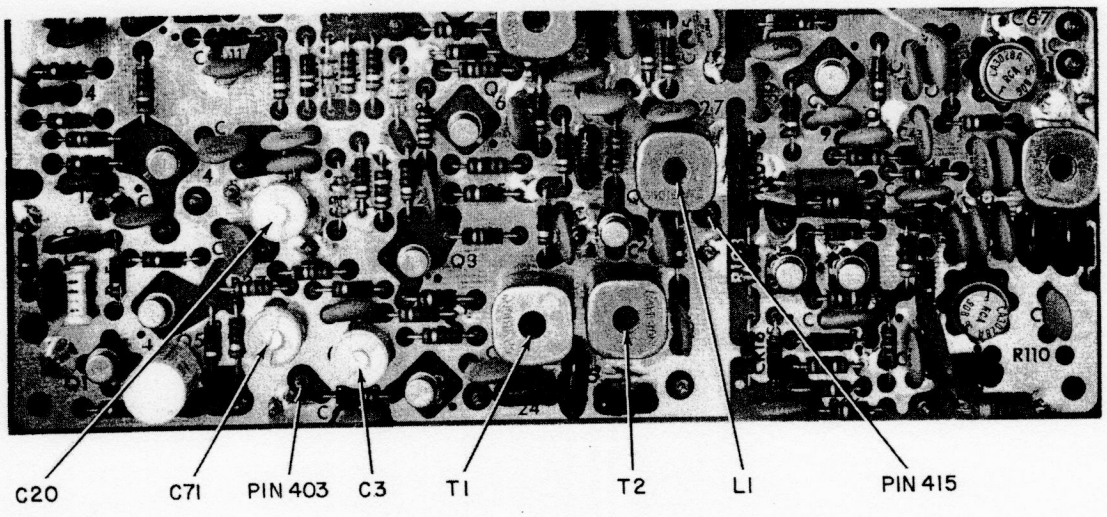


Figure 5-14. Location of Pins and Adjustments on IF Board

14. Set the "RECEIVE CHANNEL" switch to the "B" position.

15. Adjust IF board capacitor C20 (see Figure 5-14) for a 600 MVRMS indication on the RF millivoltmeter.

16. Set the "OUTPUT" control to the "0" position.

17. Check that a dummy load is connected to the main antenna connector.

18. Depress the transmit VFO "A/T.O." switch to the latched-in position.

19. Depress the "TUNE" switch to the latched-in position.

20. Adjust IF board capacitor C71 (see Figure 5-14) for a 600 MVRMS indication on the RF millivoltmeter.

21. Establish the receive mode.

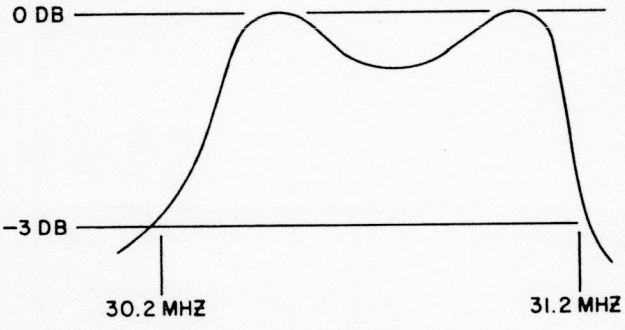


Figure 5-15. Response Curve for 30.2 to 31.2 MHz Bandpass Adjustments

5.3.2.1 Transmit and Receive Bandpass

NOTE

Unless otherwise specified, transmit and receive bandpass adjustments are performed in the receive mode with a sweep generator connected to the rear panel "HI-IF" test jack.

a. Perform the 30.2 to 31.2 MHz mixer bandpass alignment covered in paragraph 5.3.2.f. (Omit if just previously performed.)

b. Set the "RECEIVE CHANNEL" switch to the "A" position.

c. Set the "IF SHIFT" control to the midrange position.

d. Set the "AGC" switch to the "OFF" position.

e. Set the "BLANKER" to the "OFF" position.

f. Connect the sweep generator output to the rear panel "HI-IF" jack and adjust its output for 20 DB. Insert an appropriate amount of attenuation to yield a display of approximately 1.5 volts from the reference base line to the peak of the bandpass response.

g. Unplug wire no.15 from Front End board pin 71. (Wire no.15 remains disconnected until paragraph 5.3.2.1.k.) Switch wire no.203 from Front End board pin 63 to pin 71. (See Figure 5-16a).

h. Connect the RF detector probe of the oscilloscope to the IF board transistor Q10 Gate no.1 (see Figure 5-16b).

i. Connect the RF detector probe of the oscilloscope to IF board pin 465.

j. Tune Front End board transformers T6, T7, T8 (see Figure 5-16a) and IF board transformer T3 (see Figure 5-16b) for the response curve shown in Figure 5-17.

k. Switch wire no.203 from Front End board pin 71 to 63 and reconnect wire no.15 to Front End board pin 71 (see Figure 5-16a).

l. Disconnect the sweep generator from the Model CX7.

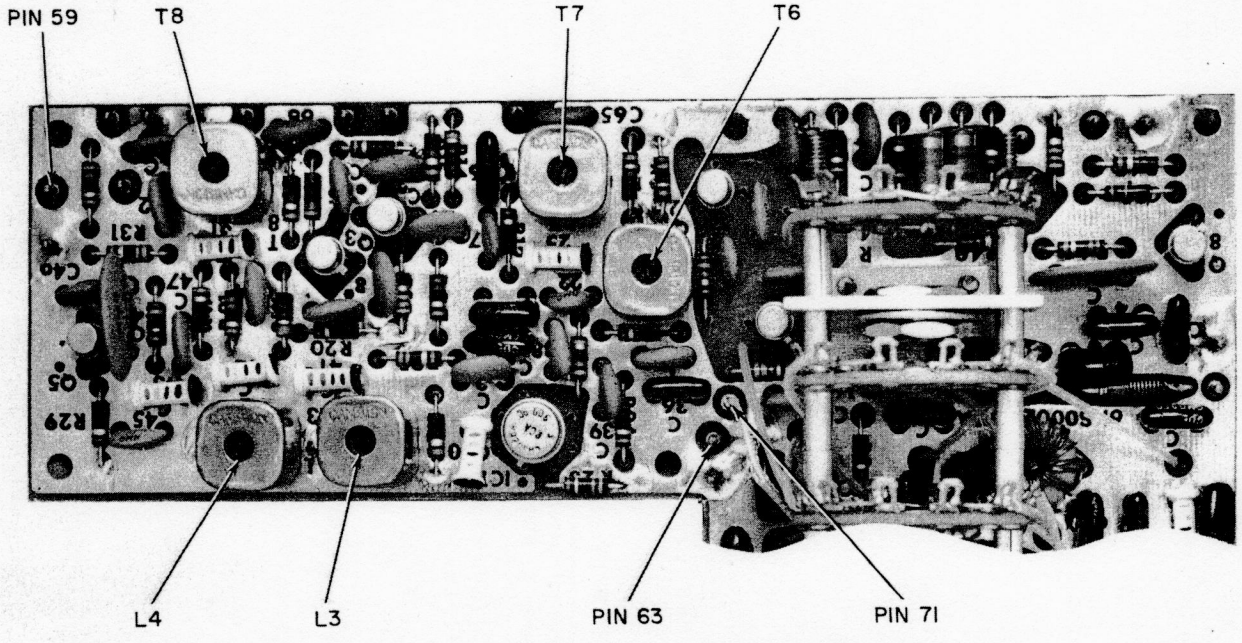


Figure 5-16(a). Location of Pins and Adjustments on Front End Board

m. Tune an RF signal generator to 14.2 MHz, adjust its output for 1 microvolt and apply the signal to the Model CX7 antenna connector. Set the "MHZ" bandswitch to "14", tune the "VFO" and "PRESELECTOR" for a peak "S" meter indication.

n. Set the "AGC" switch to the "OFF" position.

o. Connect an RF millivoltmeter to AGC Detector board input pin 493 (see Figure 5-16c).

p. Tune IF board capacitors C40, C41, C42, transformers T8 and T10 (see Figure 5-16b) for a maximum RF millivoltmeter indication.

q. Connect an RF millivoltmeter to IF board input pin 425. (See Figure 5-16b.)

r. Set the "BLANKER" control to the full clockwise position.

s. Tune IF board transformer T6 (see Figure 5-16b) for a maximum RF millivoltmeter indication.

t. Disconnect the signal generator from the Model CX7 antenna connector.

u. Adjust the Model CX7 for approximately 50 watts of forward power at 29.5 MHz in the tune mode.

v. Peak Front End board inductors L3 and L4 (see Figure 5-16a) for maximum power output.

w. Peak RF Driver board inductors L1 and L2 (see Figure 5-16c) for maximum power output.

x. Depress the "PTT" switch to the latched-in position.

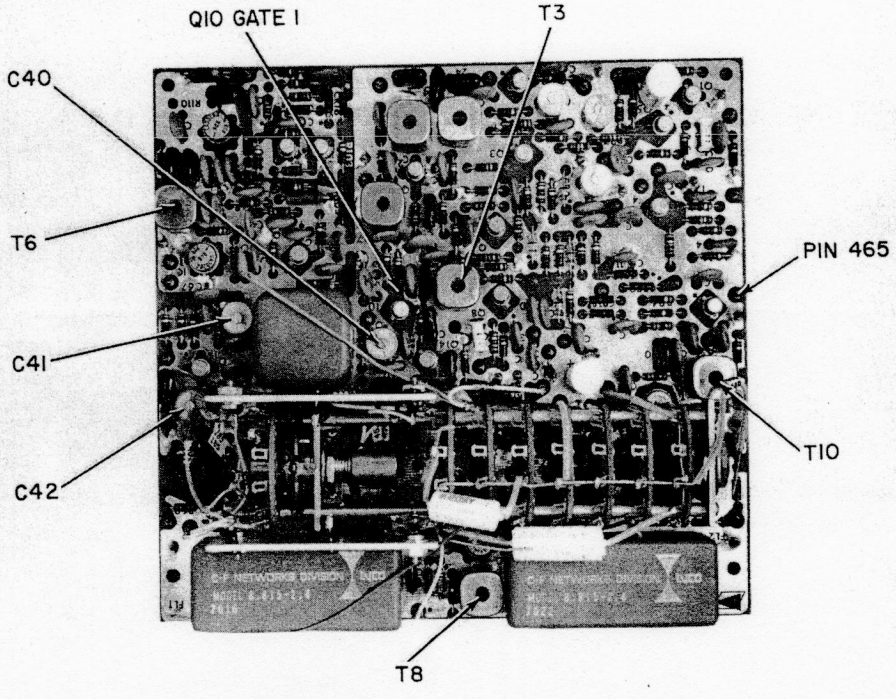


Figure 5-16(b). Location of Pins and Adjustments on IF Board

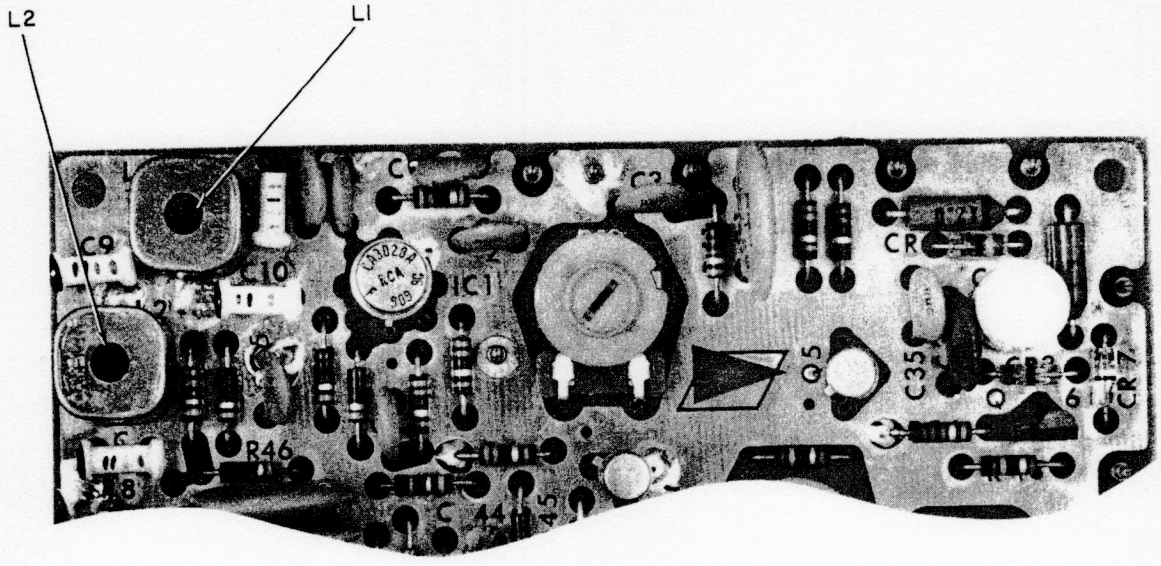


Figure 5-16(c). Location of L1 and L2 on RF Driver Board

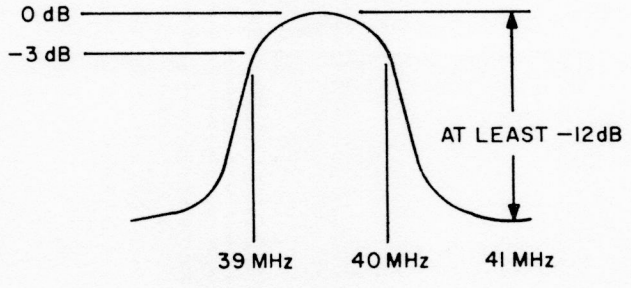


Figure 5-17. Response Curve for the Transmit and Receive Bandpass Adjustments

5.4 OPTIONAL FILTER AND CRYSTAL INSTALLATION CHECKOUT

5.4.1 Optional Filters

a. Set the "IF SHIFT" control to the "0" position.

b. Set the "MODE" switch to the "CW1" position.

c. Perform the sensitivity check covered in paragraph 5.2.2.a (only at 7.2 MHz).

d. Repeat the sensitivity check with the optional filters switched into the circuit by the "MODE" switch ("CW2", "CW3", or "FSK" position). With the signal properly tuned to the center passband of the applicable filter, the audio output difference between off and on-frequency measurements, of the sensitivity check; should not be less than 10 DB.

e. Do not disconnect the RF signal generator or VTVM.

f. Connect an electronic counter to the output of the RF signal generator.

g. With the optional filters switched into the circuit by the "MODE" switch ("CW2", "CW3", or "FSK" position), monitor the audio output level and counter indication and confirm the following 6 DB bandwidths:

Filter	6 DB Bandwidth
Deluxe CW	200 to 300 Hz
Standard CW	350 to 450 Hz
FSK	1150 to 1250 Hz

5.4.2 Optional Crystals

a. Set the "MODE" selector to the "USB" position.

b. Set the "IF SHIFT" control to the "-1.5" position.

c. Set the "PULL-TO-CALIBRATE" control to the "OUT" position. (Do not rotate.)

d. Set the "KHZ" bandswitch to the applicable position ("A", "B", or "C" position).

e. Tune the "VFO A" or "VFO B" control for a "000.0" display on the "KHZ" counter.

f. Tune the applicable trimmer capacitor (see Figure 5-18) listed in Table 5-2 for a zero beat with the calibrator output.

g. For each newly installed crystal, perform the sensitivity check covered in paragraph 5.2.2. a. at points 100 kHz from the band ends, i.e., X.100 MHz and X.900 MHz. Where X = (crystal frequency (MHz) - 40 MHz). The audio output difference between off and on-frequency measurements of the sensitivity check should not be less than 10 DB.

h. Connect the dummy load to the Model CX7.

i. Check that the Model CX7 can be manually tuned-up using the procedure covered in paragraph 2.4.2.r of Section II at the following frequencies for each of the newly installed crystals.

Transmit Frequency (MHz)	Screen Current (MA)	Drive
X.100	3 to 8	2 to 3
X.900	3 to 8	2 to 3

X = (crystal frequency (MHz) - 40 MHz)

Crystal Frequency (MHz)	Bandswitch Position	Operating Frequency (MHz)	Trimmer Designation
42.0	A	2 - 3	C56
44.0	B	4 - 5	C68
45.0	B	5 - 6	C68
46.0	B	6 - 7	C68
48.0	C	8 - 9	C77
49.0	C	9 - 10	C77
50.0	C	10 - 11	C77
51.0	C	11 - 12	C77
52.0	C	12 - 13	C77
53.0	C	13 - 14	C77

Table 5-2. Optional Crystal Adjustments

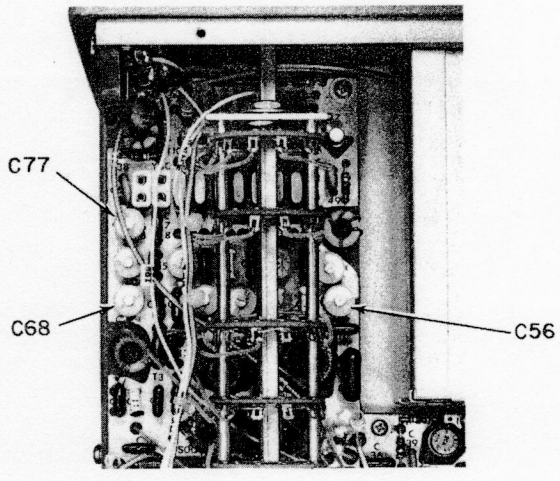


Figure 5-18. Location of C56, C68, and C77 on Front End Board

Wire No.	Color	From	To
1	BLUE	A1A-1	A1A-2
2	BLUE	A1A-2	A1B-2
3	BLUE	A1A-2	A3-118
4	COAX	A1A-7	A8-403
4-SHLD		A1A-6	A8-404
5	COAX	A1A-3	E56
5-SHLD		A1A-6	GND
6	COAX	A1A-3	J5-24
6-SHLD		A1A-6	J5-23
7	WHITE	A1A-4	J5-22
8	RED	A1A-5	A3-113
9	RED	A1A-5	A1B-5
10	WHITE	A1B-1	R1-2
11	COAX	A1B-7	A8-409
11-SHLD		A1B-6	A8-410
12	COAX	A1B-3	E55
12-SHLD		A1B-6	A7-16
13	WHITE	A1B-4	P3-J
14	WHITE	A2-52	J6-11
15	COAX	A2-53	A2-71
15-SHLD		A2-54	A2-72
16	COAX	A2-76	A12-521
16-SHLD		A2-77	A12-522
17	COAX	A2-78	J8-1
17-SHLD		A2-79	J8-2
18	WHITE	A2-58	A2-66
19	NOT USED		
20	NOT USED		
21	GRAY	A2-65	A3-101
22	NOT USED		
23	WHITE	A2-66	A9-509
24	GREEN	A2-67	A3-107
25	COAX	A2-68	A8-421
25-SHLD		A2-69	A8-422
26	NOT USED		
27	BLUE	A2-61	A3-119
28	COAX	A2-59	R9-4
28-SHLD		A2-60	R9-6
29	RED	A2-70	A3-114
30	NOT USED		
31	WHITE	A10-1	J17
32	GRAY	A3-102	J5-16
33	GRAY	A3-103	A6-327
34	GRAY	A3-104	TB1-13
35	GRAY	A3-105	A8-432

Table 6-1. Wire Run List (Sheet 1 of 12)

Wire No.	Color	From	To
36	GREEN	A3-106	A4-213
37	GREEN	A3-108	A6-326
38	GREEN	A3-109	A8-466
39	GREEN	A3-110	TB1-15
40	GREEN	A3-110	J5-15
41	WHITE	A3-116	A10-2
42	YELLOW	A3-117	A5-261
43	RED	A3-114	A4-200
44	RED	A3-113	A5-266
45	RED	A3-111	A8-401
46	RED	A3-112	A6-305
47	NOT USED		
48	BLUE	A3-120	A5-256
49	BLUE	A3-120	A6-328
50	BLUE	A3-121	C45
51	BLUE	A3-121	A8-451
52	BLUE	A3-122	TB1-8
53	WHITE	A3-123	R11-3
54	NOT USED		
55	COAX	A3-125	A6-313
55-SHLD		A3-126	A6-314
56	WHITE	A3-127	C2-1
57	NOT USED		
58	NOT USED		
59	NOT USED		
60	WHITE	A3-130	R11-1
61	ORANGE	A3-132	J6-12
62	ORANGE	A3-131	Q4-3
63	WHITE	A3-133	Q4-1
64	WHITE	A3-135	C2-1
65	BROWN	A3-136	Q3-3
66	WHITE	A3-138	Q3-1
67	WHITE	A3-137	Q3-2
68	WHITE	A3-139	C6-2
69	WHITE	A3-141	C9-1
70	WHITE	A3-142	Q2-2
71	WHITE	A3-143	Q2-1
72	WHITE	A3-144	Q1-1
73	WHITE	A3-145	Q1-2
74	NOT USED		
75	BLUE	A3-147	Q2-3
76	WHITE	A3-148	C6-2
77	WHITE	A3-149	C9-1
78	RED	A3-150	Q1-3
79	NOT USED		

Table 6-1. Wire Run List (Sheet 2 of 12)

Wire No.	Color	From	To
80	VIOLET	A3-152	C3-1
81	NOT USED		
82	WHITE	A3-154	P4-B
83	WHITE	A3-155	C3-2
84	NOT USED		
85	WHITE	A3-157	C7-2
86	WHITE	A3-158	P4-C
87	NOT USED		
88	NOT USED		
89	NOT USED		
90	NOT USED		
91	NOT USED		
92	NOT USED		
93	NOT USED		
94	NOT USED		
95	NOT USED		
96	NOT USED		
97	NOT USED		
98	NOT USED		
99	WHITE	A4-201	R8-2
100	WHITE	A4-202	R2-2
101	WHITE	A4-203	R2-3
102	WHITE	A4-204	R8-1
103	WHITE	A4-205	R3-8
104	BLUE	A4-206	P3-6
105	COAX	A4-207	A8-405
105-SHLD		A4-208	A8-406
106	WHITE	A4-209	R8-3
107	WHITE	A4-210	R2-1
108	NOT USED		
109	COAX	A4-215	A9-487
109-SHLD		A4-214	A9-486
110	WHITE	A4-216	S8B-6
111	RED	A8-427	S8B-8
112	BLUE	S8F-1	S8B-1
113	WHITE	A4-217	R6-2
114	WHITE	A4-218	R6-3
115	WHITE	A4-219	P3-L
116	BLUE	A4-220	A3-118
117	WHITE	A4-221	P3-H
118	WHITE	A4-222	R6-1
119	COAX	A4-224	A8-407
119-SHLD		A4-225	A8-408
120	ORANGE	A5-251	J6-13
121	WHITE	A5-252	P4-2

Table 6-1. Wire Run List (Sheet 3 of 12)

Wire No.	Color	From	To
122	WHITE	A5-257	S8G-4
123	WHITE	A5-258	A6-329
124	WHITE	A5-259	J5-2
125	WHITE	A5-260	S8C-1
126	YELLOW	A5-262	A10A3-9
127	WHITE	A5-263	A5-265
128	WHITE	A5-264	A3-155
129	WHITE	A5-265	J18
130	COAX	A5-267	R9-5
130-SHLD		A5-268	R9-6
131	COAX	A5-269	XV1-11
131-SHLD		A5-270	A10A3E1
132	COAX	A6-301	J2-1
132-SHLD		A6-302	J2-2
133	WHITE	J5-1	J18
134	COAX	A6-304	R10-3
134-SHLD		A6-305	E4
135	COAX	A6-306	R13-2
135-SHLD		A6-307	R13-3
136	COAX	A6-308	R14-5
136-SHLD		A6-309	R14-6
137	COAX	A6-310	R3-2
137-SHLD		A6-311	E6
138	NOT USED		
139	WHITE	A6-319	S8D-6
140	COAX	A6-316	R13-1
140-SHLD		A6-315	R13-3
141	COAX	A8-423	S1D-2
141-SHLD		A8-424	S1D-8
142	COAX	A6-320	R11-2
142-SHLD		A6-321	E52
143	COAX	A6-322	S1E-2
143-SHLD		A6-323	S1E-1
144	COAX	A6-324	R12-3
144-SHLD		A6-325	R12-2
145	WHITE	A6-329	S8E-6
146	WHITE	A5-260	S1D-5
147	WHITE	A8-430	P4-F
148	COAX	A6-330	A9-501
148-SHLD		A6-331	A9-502
149	COAX	S1D-3	A9-496
149-SHLD		S1D-8	A9-497
150	COAX	A6-335	J11-1
150-SHLD		A6-334	J11-2
151	COAX	A2-74	S4-2

Table 6-1. Wire Run List (Sheet 4 of 12)

Wire No.	Color	From	To
151-SHLD		A2-73	E51
152	COAX	A6-336	R10-1
152-SHLD		A6-337	E4
153	WHITE	C43	P3-11
154	COAX	A9-473	E57
154-SHLD		A9-472	GND
155	NOT USED		
156	NOT USED		
157	BROWN	A3-136	C36
158	VIOLET	C3-1	C46
159	WHITE	C47	P3-C
160	WHITE	C42	R4-1
161	WHITE	C41	R4-2
162	WHITE	C40	J12-3
163	WHITE	C39	J12-1
164	WHITE	C38	S8C-1
165	WHITE	A8-402	P3-6
166	WHITE	A8-411	P3-5
167	WHITE	A8-412	P3-4
168	COAX	A8-413	R3-1
168-SHLD		A8-414	REMOVED
169	COAX	A8-453	A8-459
169-SHLD		A8-452	A8-460
170	WHITE	A8-417	P3-9
171	WHITE	A8-418	R7-1
172	WHITE	A8-419	P3-2
173	WHITE	A8-420	R7-3
174	COAX	A9-475	S4-1
174-SHLD		A9-474	E51
175	NOT USED		
176	WHITE	A8-428	S8F-6
177	WHITE	A8-431	J5-17
178	WHITE	A9-476	J5-11
179	NOT USED		
180	COAX	A8-454	A8-456
180-SHLD		A8-455	REMOVED
181	NOT USED		
182	COAX	A8-435	A9-500
182-SHLD		A8-436	A9-499
183	WHITE	A9-506	P4-E
184	WHITE	A8-471	S8G-6
185	WHITE	A8-467	S8H-6
186	COAX	A9-489	R14-4
186-SHLD		A9-488	R14-6
187	WHITE	A9-477	S6-11

Table 6-1. Wire Run List (Sheet 5 of 12)