INSTRUCTION MANUAL

FOR

TYPE 302 RECEIVER

COMMUNICATION ELECTRONICS, INC.

6006 EXECUTIVE BOULEVARD ROCKVILLE, MARYLAND, 20852

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200/9/25/64

WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised in working with the equipment with any of the protective covers removed.

ADDENDA

The following changes are required in the parts list and schematic diagrams for the 302 and S302 Receiver manuals.

Type 7169 RF Tuner, A1:

1) Change C1 to 68 pF, DM10-680J
2) Change C15 to 12 pF, DM10-120J
3) Change C25 to 150 pF, DM10-151F
4) Change C31 to 120 pF, DM10-121F
5) Change C26 to 47 pF, DM10-470J
6) Change C23 to 33 pF, DM10-330J
7) Change C9 to 68 pF, DM10-680J
8) Change C15 to 15 pF, DM10-150J
9) Delete R8
10) Add R8, (100K, 1/4W, CB1045) from T6 pin 2 to T6 pin 3
11) Add R6 (Same as R8) from E1 to ground
12) Add R4 (4.7K, 1/4W, CB4725) in series with C15 and S1D

Type 7247 IF Amplifier, A2:

1) Change C1 to 240 pF, DM15-241F
2) Change C30 to 220 pF, DM15-221F

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Table 1-1. Type 302 LF Receiver, Specifications

Type of Reception	AM and CW
Frequency Coverage	30-300 kc in three bands Band I: 30-60 kc Band II: 60-140 kc Band III: 140-300 kc
Input Impedance	75 ohm, unbalanced; Type BNC connector
Intermediate Frequency	455 kc
IF Bandwidth	2 kc
IF Rejection	60 db minimum
Image Rejection	70 db minimum
Sensitivity	0.4 microvolt input, modulated 50% at a 400 cps rate produces 15 db (s plus n)/n
Manual Gain Control Range	Greater than 100 db
Outputs	
Audio	1 volt rms into 2k-ohm load
IF	100 mv into 50-ohm load approximately
Audio Response	10 cps to 1000 cps in AGC/fast position 1 cps to 1000 cps in AGC/slow position 0 cps to 1000 cps in AGC/off position
Dial Accuracy	±1%
Power Input	115 volts, 50-400 cps
Power Consumption	4 watts, approximately
Weight	13.5 lbs
Over-all Dimensions	3.5-inches high x 19-inches wide x 16.75-inches deep

Figure 1-1. Type 302 LF Receiver, Front View

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

The CEI Type 302 receiver, an all solid state unit, is designed for AM and CW reception in the low-frequency range of 30 to 300 kc. These frequencies are tuned in three bands: 30-60 kc, 60-140 kc, and 140-300 kc. IF bandwidth is 2 kc. There are three modes of reception: AM-AGC, AM-Manual, and CW. When the receiver is in the AM-AGC mode, the AGC response may be set for either FAST or SLOW by means of a front-panel switch. An internal beat frequency oscillator is turned on when the CW mode is selected. The audio output from the receiver is available at a front-panel PHONES jack and at a terminal strip on the rear apron. The output from the IF strip is made available at a BNC connector on the receiver's rear apron. A dc path for the output of the AM detector is maintained through the AGC and audio amplifiers to the audio output terminal strip at the rear of the receiver. This permits attaching a recorder to the receiver which will follow the dc variations at the detector output. Table 1-1 gives pertinent specifications for the Type 302 receiver; the transistor complement is given in Table 1-2.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 Figure 1-1 shows the front panel of the Type 302 receiver. The SIGNAL STRENGTH meter, PHONES jack, BFO TUNING control, function switch, RF-IF GAIN and AUDIO GAIN controls, and the AGC FAST-SLOW, RANGE, and POWER switches are located on the front panel.

1.2.2 The rear apron of the receiver is shown in Figure 1-2. The antenna input jack, J1, and IF output jack, J3, are BNC-type connectors. The receiver's audio output is available at the terminal strip, TB1. In addition, the line fuse, F1, is located on the rear apron.

1.2.3 The main chassis, the front panel, and the top and bottom dust covers are made of aluminum. The RF tuner and IF strip are constructed as subassemblies which mount on the main chassis. Due to its large size, the tuning capacitor is mounted under a dust cover on the main chassis external to the RF tuner. The AGC amplifier, audio amplifier and power supply are plug-in modules which mount on top of the main chassis. The receiver is designed for mounting in a standard 19-inch rack. Over-all dimensions are 19-inches wide, 3.5-inches high, and 16.75-inches deep.

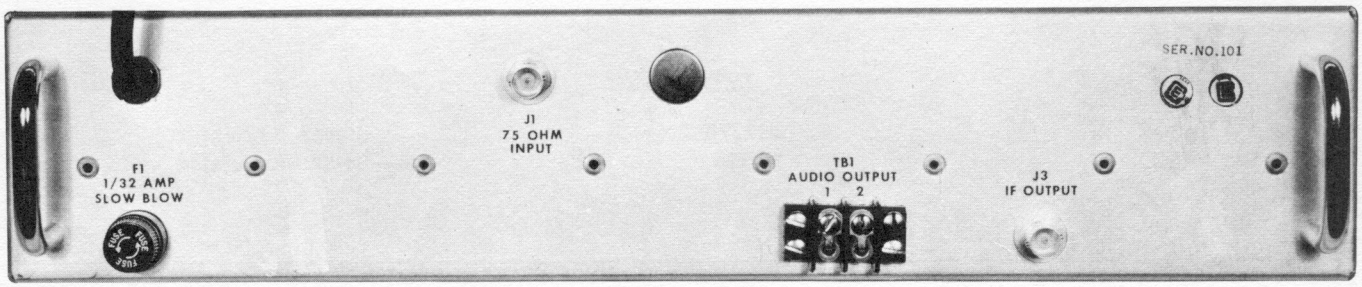


Figure 1-2. Type 302 LF Receiver, Rear View

Table 1-2. Type 302 LF Receiver, Transistor Complement

Ref. Desig.	Type	Function
	RF Tuner	
A1Q1	2N929	RF Amplifier
A1Q2	2N706	Mixer
A1Q3	2N706	Local Oscillator
A1Q4	2N706	Emitter Follower
	IF Amplifier	
A2Q1	2N706	1st IF Amplifier
A2Q2	2N706	2nd IF Amplifier
A2Q3	2N706	BFO
A2Q4	2N706	3rd IF Amplifier
A2Q5	2N706	BFO Amplifier
	AGC Amplifier	
A3Q1	2N697	Emitter Follower
A3Q2	2N697	Emitter Follower
A3Q3	2N697	Voltage Amplifier
A3Q4	2N697	Emitter Follower
	Audio Amplifier	
A4Q1	2N697	Voltage Amplifier
A4Q2	2N526	Power Amplifier
	Power Supply	
A5Q1	2N2270	Series Regulator
A5Q2	2N526	Series Regulator

Figure 2-1

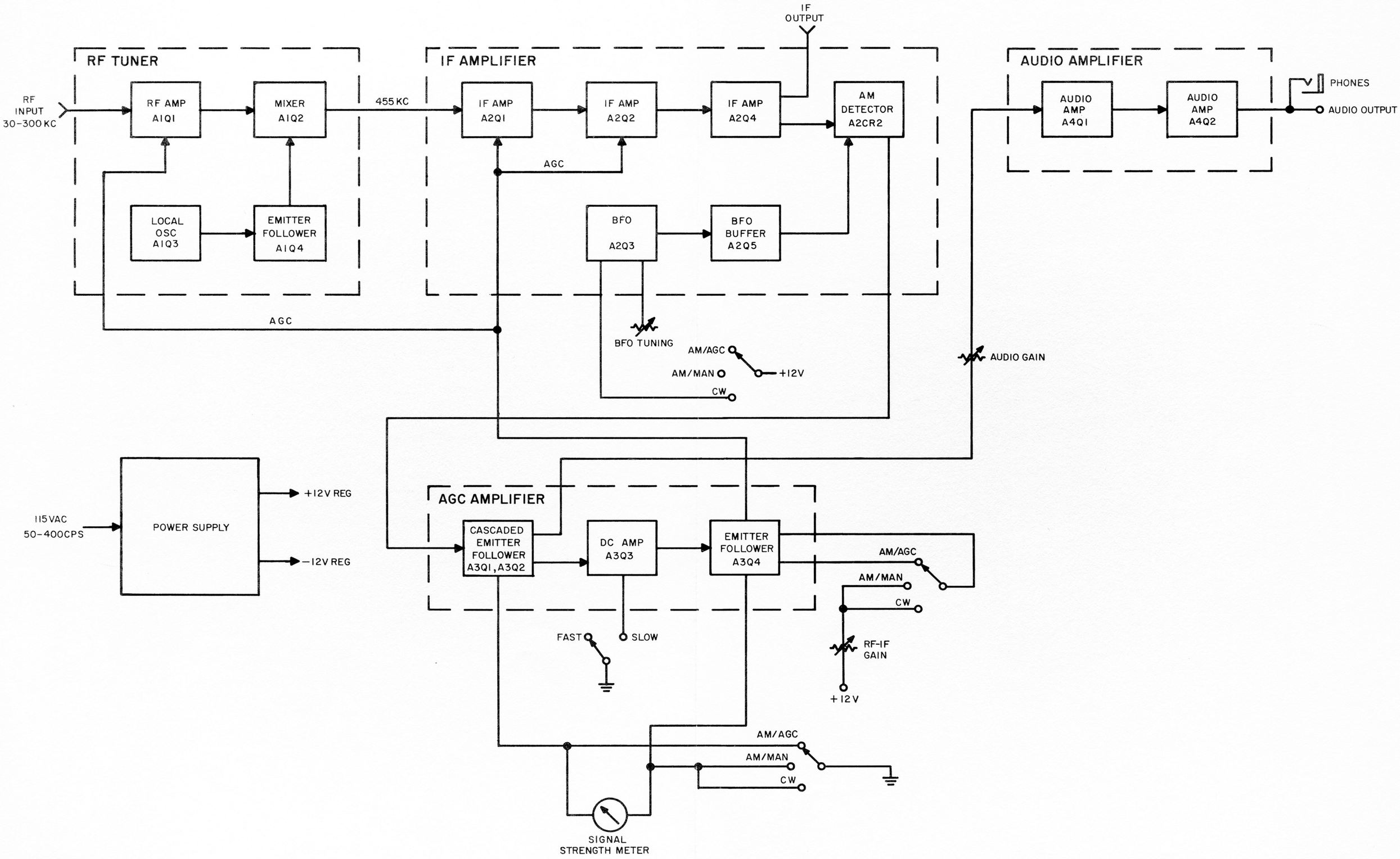


Figure 2-1. Type 302 LF Receiver, Functional Block Diagram

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

The operation of the CEI Type 302 LF receiver is explained using the functional block diagram, Figure 2-1, and the schematic diagrams included at the back of this manual. Note that the unit numbering system is used for electrical components. This means that parts on subassemblies and plug-in modules carry a prefix before the usual class letter and number for the item (such as A1R1 and A2C12). These subassembly prefixes are omitted in the text and on illustrations except where confusion might result from their omission.

2.2 FUNCTIONAL ANALYSIS

The Type 302 LF receiver is an all-solid state superheterodyne covering the frequency range of 30 to 300 kc in three bands. AM or CW signals may be received. With the function switch in the AM-AGC position, receiver gain is controlled by the AGC amplifier; with the switch in the AM-AGC or CW positions, the gain of the receiver is manually varied by the RF-IF GAIN control.

2.2.1 The receiver tuning range is determined by the position of the RANGE-KC switch: 30-60 kc, 60-140 kc, and 140-300 kc. Bandswitching is accomplished by changing antenna, RF amplifier, and oscillator coils in the RF tuner. Incoming signals are amplified by RF amplifier A1Q1 and fed to the mixer, A1Q2. The local oscillator, A1Q3, is tuned 455 kc above the incoming signal. Its output is fed through an emitter follower, A1Q4, to the mixer. The 455-kc difference frequency from the mixer is then passed to the IF strip.

2.2.2 The 455-kc mixer output signal is passed through three IF amplifier stages (A2Q1, A2Q2, and A2Q4) to the detector A2CR2. The detected signal is then fed into the AGC amplifier module. When the function switch is in the CW position, the BFO, A2Q3, is energized. The BFO signal is passed through a buffer stage, A2Q5, and mixed with the incoming carrier to produce an audible beat note. The output from the 3rd IF amplifier is available at a jack at the rear of the receiver.

2.2.3 When the function switch is in the AM-AGC position, the gain of the RF amplifier and the first two stages of the IF strip are controlled by the AGC amplifier. The output of the AGC amplifier is a dc voltage referenced to the average level of the incoming carrier; as the carrier level increases, the AGC voltages increase in the negative direction. Application of the AGC voltage to the RF amplifier is delayed until the input signal-to-noise ratio reaches approximately 25 to 30 db. Until this signal level is reached, the RF stage operates at maximum gain.

2.2.4 The audio output from the IF strip is fed to cascaded emitter followers A3Q1 and A3Q2 in the AGC amplifier module. The output from A3Q2 is fed to both the AGC dc amplifier A3Q3 and the audio amplifier. When the function switch is in the AM-MAN or CW positions, the output from A3Q2 also drives the signal strength meter. The output from A3Q3 is fed to emitter follower A3Q4 which provides AGC voltage for the IF strip directly, and drives a resistor-diode network to provide a delayed AGC voltage for the RF amplifier. The AGC FAST-SLOW switch provides a means of varying the response of the AGC amplifier for fast or slowly fading signals. With the switch in the SLOW position a large capacitor is shunted across the input to A3Q3, lengthening the RC time constant, thus slowing the response of the AGC amplifier to changes of the input signal. Placing the function switch in the AM-MAN or CW position removes A3Q4 from the circuit so that receiver gain must be manually varied by the RF-IF GAIN control. With the function switch in the AM-AGC position the signal strength meter is driven by A3Q4.

2.2.5 The audio amplifier consists of two directly-coupled voltage amplifier stages, A4Q1 and A4Q2. The audio output is available at the front-panel PHONES jack and at a terminal strip at the rear of the receiver.

2.2.6 A self-contained power supply provides all voltages required for the operation of the receiver. It has regulated outputs of +12 and -12 volts. Normal primary input power is 115 volts, 50-400 cps; power consumption is approximately 4 watts.

2.3 RF TUNER

The operation of the RF tuner is described in detail in the following paragraphs. Figure 6-1 is the schematic diagram for the tuner. A1 is the reference designation prefix for the tuner.

2.3.1 RF Amplifier. - The RF amplifier, Q1, is a type-2N929 low noise, high gain transistor. Separate transformers are switched into the base and collector circuits for each of the three tuning bands. Section A of the tuning capacitor, C1, tunes the base circuit, and Section B tunes the collector circuit. Due to its large size, C1 is mounted

external to the RF tuner assembly. Capacitor C15 feeds back an out-of-phase voltage from the secondary of the collector transformer to the base of Q1 to neutralize the stage. Base bias for Q1 is obtained from the AGC amplifier module through a voltage divider consisting of resistors R1 and R2. When the input signal-to-noise ratio reaches approximately 25 to 30 db, the AGC amplifier takes control of the gain of Q1, increasing the base bias in the negative direction with increasing signal strength. Until the signal-to-noise ratio reaches 25 to 30 db, the RF amplifier operates at maximum gain. The antenna input to the stage has a 75-ohm impedance on all three bands.

2.3.2 Mixer. - The mixer, Q2, is a type-2N706 transistor with its collector circuit tuned to 455 kc, the receiver's IF frequency. The base circuit of the transistor is untuned. Capacitor C21 couples the local oscillator signal into the emitter of Q2. When the RF tuner is connected to the IF strip, tuner output transformer T7 functions with transformer T1 in the IF strip to provide a double-tuned input to the IF amplifier.

2.3.3 Local Oscillator. - A type-2N706 transistor, Q3, is used as the local oscillator. The basic oscillator circuit is a Colpitts with base-to-emitter feedback taken at the junction of C41 and C42. The oscillator is maintained 455 kc above the frequency of the incoming signal. Separate oscillator coils are switched in for each band. Section C of the tuning capacitor shifts the oscillator frequency as the receiver is tuned. Capacitors C27, C33, and C38 which shunt oscillator coils L1, L2, and L3, respectively, have negative temperature coefficient to compensate for frequency drift due to ambient temperature changes. Oscillator output is taken at the junction of C42 and C43, and fed to emitter follower Q4. The emitter follower output for the local oscillator signal is necessary as a result of injecting the signal into the emitter of the mixer. The low-impedance output of Q4 is necessary to match the low impedance of the mixer emitter circuit.

2.4 IF AMPLIFIER

The IF amplifier has a center frequency of 455-kc and a bandwidth of 2 kc. The subassembly contains three IF amplifier stages, a BFO and BFO buffer stage, and the AM detector, all mounted on an etched circuit board. Figure 6-2 is the schematic diagram for the subassembly; A2 is its reference designation prefix.

2.4.1 IF Amplifiers. - Type-2N706 transistors are used for the three IF amplifiers Q1, Q2, and Q4. Double-tuned coupling is used between the mixer and Q1, and between Q1 and Q2. Single-tuned coupling is used between Q2 and Q4, and between Q4 and the AM detector, CR2. Base bias for Q1 and Q2 is obtained from the AGC amplifier module, which also controls the gain of these first two IF stages. The IF signal is picked up by winding 6-7 on the secondary of IF output transformer T5 and made available at jack J3 on the rear of the receiver. Diode CR2 detects the AM signal which is then fed into the AGC amplifier module. A dc path for the detector output is maintained through the AGC amplifier and audio amplifier to the audio output. This enables a recorder to be attached to TB1 at the rear of the receiver which will follow the dc variations at the detector output. Capacitor C37 and C38 and resistor R28 form a pi filter to remove IF signal components from the output of CR2. Resistors R26 and R27 form a voltage divider which is held at approximately +2 volts at the junction of the resistors with no signal input. This voltage is to compensate for the voltage drop across the base-emitter junctions of the two cascaded emitter followers at the input to the AGC amplifier. This is done to maintain the audio output terminals at zero vdc under no-signal conditions.

2.4.2 Beat Frequency Oscillator. - The BFO is energized when the function switch is placed in the CW position. A type-2N706 transistor, Q3, is used for the BFO. The basic oscillator circuit is a Colpitts with base-to-emitter feedback voltage taken at the junction of capacitors C25 and C26. Capacitor C35 holds the collector of Q3 at RF ground potential. The frequency of the BFO may be varied approximately ±2 kc each side of the 455-kc center frequency by means of the BFO TUNING control, potentiometer, R3. Varying R3 varies the voltage across varactor CR1 which, in turn, varies the frequency of the oscillator. A varactor is a semiconductor device whose capacitance varies inversely with the voltage applied across it. Thus as the voltage across CR1 increases, its capacitance decreases, and the BFO frequency increases. The BFO signal is taken at the junction of capacitors C26 and C27, and fed to buffer-amplifier Q5. A buffer is necessary to prevent the BFO from locking on to the IF frequency. Amplification of the BFO output is needed to provide sufficient BFO output at the detector to assure a strong beat note for CW reception. The collector of Q5 is tuned to 455 kc by adjusting inductor L2. Capacitor C36 couples the BFO signal to the detector.

2.5 AGC AMPLIFIER

2.5.1 The AGC amplifier is a plug-in module which mounts on top of the main chassis. It controls the gain of the IF amplifier, and, when the input carrier is of sufficient strength, it controls the gain of the RF amplifier. The signal strength meter is driven by the module, and the audio signal from the AM detector is fed through the input emitter followers of the AGC amplifier before going to the audio amplifier. Figure 6-3 is the schematic diagram for the AGC amplifier; its reference designation prefix is A3. All transistors used by the module are type 2N697.

2.5.2 The audio output from the AM detector is fed through cascaded emitter followers Q1 and Q2 to dc amplifier Q3. The audio signal is taken at pin 4 of the module and fed to the AUDIO GAIN control. Resistor R4 and capacitor C1 form a modulation filter to remove audio variations from the signal so that the base of Q3 receives a dc voltage which varies in direct proportion to the average value of the input carrier to the receiver. The amplified dc voltage from the collector of Q3 is fed to emitter follower Q4 which supplies the AGC voltage for the IF strip and RF tuner. With the function switch, S3, in the AM-AGC position, pin 9 of the AGC module is connected to pin 11 through Section B of the switch. AGC voltage for the IF strip is obtained directly from the emitter of Q4 through pin 10. As the input signal strength to the receiver increases, the base bias on Q3 becomes more positive, and its collector becomes less positive. The emitter of Q4, in turn, also becomes less positive, decreasing the gain of the IF amplifier. The RF tuner is connected to the emitter of Q4 through diode CR3. Until the input signal-to-noise ratio reaches 25 to 30 db, CR3 does not conduct, and the junction of CR3 and R9 is fixed at approximately +6 volts. Once the required S/N ratio is reached, CR3 conducts, pulling down the tuner AGC voltage with the emitter of Q4, and thus reducing the gain of the tuner. With the AGC SLOW-FAST switch in the SLOW position, capacitor C2 is shunted across C1, increasing the RC time constant of the circuit. As a result, the response of the AGC amplifier is slowed down so that it will follow the fluctuations of slowly fading signals.

2.5.3 With the function switch in the AM-AGC position, the signal strength meter is driven by Q4. Placing the switch in the AM-MAN or CW position reverses the input to the signal strength meter, and it is now driven by the output of Q2. Silicon diodes CR1 and CR2 in series with the signal strength meter lead for the AM-MAN and CW positions are used to equalize the voltage drop across the base-emitter junctions of silicon transistors Q1 and Q2. This is done so that the meter will read "zero" with no signal input to the receiver.

2.6 AUDIO AMPLIFIER

2.6.1 The audio amplifier provides sufficient output to drive headphones or a recorder. A dc path is maintained through the amplifier to TB1 at the rear of the receiver. The amplifier is a plug-in module which mounts on top of the main chassis. Figure 6-4 is the schematic diagram for the audio amplifier; its reference designation prefix is A4.

2.6.2 Input to the amplifier is obtained from the AGC amplifier module through AUDIO GAIN potentiometer R5. The audio amplifier circuit uses a type-2N697 NPN transistor, Q1, and a type-2N526 transistor, Q2, in a complementary configuration. Negative feedback from the collector of Q2 to the emitter of Q1 is obtained through resistor R4. Output for the headphones jack is coupled through capacitor C2. High frequency response of the amplifier is determined by capacitor C1.

2.7 POWER SUPPLY

The power supply provides regulated outputs of +12 vdc and -12 vdc needed to operate the receiver. Its schematic diagram is Figure 6-5, and the reference designation prefix is A5. The power transformer, T1, has two secondary windings. Winding 6-7 operates the dial lamp; center-tapped winding 3-4-5 is connected to the power supply plug-in module to supply the regulated voltages. Silicon diodes CR1 and CR2 in a full-wave circuit rectify the input voltage for the positive supply; CR3 and CR4 perform the same function for the negative supply. A type-2N2270 NPN transistor, Q1, is used as a series regulator for the positive supply, and a type-2N526 PNP transistor is the series regulator for the negative output voltage. Zener diodes CR5 and CR6 are the reference elements for Q1 and Q2, respectively. Silicon diode CR6 is used to compensate for the voltage drop across the base-emitter junction of silicon transistor Q1. This compensation is not needed for Q2, as it is a germanium transistor.

2.8 LOW PASS FILTER

An optional low pass filter is available which connects between the antenna and RF tuner to suppress interference from signals above 300 kc, particularly the subharmonics of broadcast stations. The filter utilizes m-derived end sections and three constant-k mid sections to provide greater than 70-db attenuation of signals in the stop band region above 400 kc. Cut off begins slightly above 300 kc. Insertion loss is less than 0.5 db. Input and output impedance is 75 ohms. Figure 6-6 is the schematic diagram for the filter, its reference designation prefix is A6.

SECTION III

INSTALLATION AND OPERATION

3.1 INSTALLATION

The Type 302 receiver is designed for installation in a standard 19-inch rack. It requires 3-1/2 inches of vertical space and will project 16-3/4 inches back into the rack.

3.1.1 Power Connections. - Plug the power cord into a 115-volt, 50-400 cycle source. The third pin of the power cord grounds the receiver. If a three-pin receptacle is not available, use the adapter provided.

3.1.2 Antenna Connection. - Connect the antenna to BNC jack J1 at the rear of the receiver. The antenna input has a 75-ohm impedance, unbalanced.

3.1.3 Audio Output Connection. - The receiver's audio output may be obtained at terminal strip TB1 at the rear of the receiver. This output will deliver approximately 1 volt rms into a 2k-ohm load. The audio output is also available at the front-panel PHONES jack.

3.1.4 IF Output Signal. - A 455-kc IF output is available at the IF OUTPUT jack, J3, at the rear of the receiver. J3 is a BNC-type connector. This output will deliver approximately 100 mv into a 50-ohm load.

3.2 OPERATION

The use of the operating controls on the front panel of the receiver is explained in the following paragraphs. These controls are shown in Figure 1-1 which shows the front of the unit.

3.2.1 Range Switch. - Set the RANGE switch to the frequency range to be received: 30-60 kc, 60-140 kc, or 140-300 kc.

3.2.2 Power Switch. - Place the POWER switch in the ON position to energize the receiver.

3.2.3 Function Switch. - Set the function switch to the AM-AGC, AM-MAN, or CW position as desired. If the AM-MAN or CW positions are selected, the gain of the receiver must be manually adjusted using the RF-IF GAIN control.

3.2.4 RF-IF Gain Control. - The RF-IF GAIN control is used to control the gain of the receiver when the function switch is in the AM-MAN or CW position. Turning the control clockwise increases the gain of the receiver. With the function switch in the AM-AGC position this control is inoperative.

3.2.5 Audio Gain Control. - The AUDIO GAIN control is used to set the level of the audio signal at the PHONES jack and at terminal strip TB1 at the rear of the receiver.

3.2.6 BFO Tuning Control. - The BFO TUNING control is used to vary the pitch of the audio signal when in the CW mode.

3.2.7 AGC Fast-Slow Switch. - This switch determines the response time of the receiver's AGC to changes in the input carrier level. Place the switch in the position which is most effective in counteracting fluctuations in the receiver's output. When the function switch is in the AM-MAN or CW positions the AGC FAST-SLOW switch is disabled.

3.2.8 Signal Strength Meter. - The SIGNAL STRENGTH meter indicates the relative magnitude of the incoming RF carrier. The meter is not calibrated in any particular units.

SECTION IV

MAINTENANCE

4.1 GENERAL

The Type 302 LF receiver is designed to give trouble-free service. However, should trouble occur, it is important that maintenance personnel be familiar with Section II, in which the circuits are described. In addition, use should be made of Figures 6-1 through 6-7, the schematic diagrams for the receiver, and Table 4-1 which gives pin voltages for all transistors. The receiver presents no special problems, and normally requires no care beyond being kept clean. Field maintenance should be confined to cleaning and the replacement of fuses and plug-in modules. All other maintenance and repair work should be carried on in a well equipped shop, and performed only by trained and experienced personnel.

4.2 PLUG-IN MODULES

The plug-in modules can be easily removed by pulling them up and out of the receptacles into which they are fitted. The numbers on the pins coming out of the modules correspond to the numbers indicated on the main chassis schematic diagram at the points where the connecting leads pass through the lines outlining each module.

4.3 TROUBLESHOOTING

Initial troubleshooting should be directed toward localizing the trouble to a specific section of the receiver. In the case of plug-in modules, a quick check can be made by plugging in a new module known to be good. If these substitutions do not cure the trouble, then the audio and AGC amplifiers, and the power supply rectifiers and regulating circuits are functioning properly, leaving only the RF tuner and IF strip to be checked. To check out the RF tuner and IF strip, feed a signal into the antenna jack, and trace it through the subassemblies with an oscilloscope. Once the defective stage is located, voltage and resistance measurements will usually pin point the defective part. Table 4-1, which gives typical voltages at all transistor elements, is included as an aid in troubleshooting.

4.4 TUNING DIAL ALIGNMENT

Should it be necessary to align the RF tuner, the gear train and tuning dial must first be checked for mechanical alignment. The gear train uses friction drive, and relies on the tuning capacitor reaching the limits of its high and low frequency rotation to halt the rotation of the gear train. To check dial alignment, switch to the 30-60 kc band, and rotate the tuning knob until the tuning capacitor reaches the end of its travel at the low frequency end of the band. The dial mark just below 30 should be under the hair line. If it is not, release the Allen-head set screws on one side of the coupling between the gear train and the tuning capacitor shaft. Rotate the dial until the hair line is over the first mark below 30. Now tighten the set screws, and turn the dial to the high frequency end until rotation stops. The hair line should now be at the mark just above 60.

4.5 IF AND RF ALIGNMENT

4.5.1 General. - The alignment procedures given here are suitable for performance in the field when making periodic performance checks, or when making adjustments after replacing transistors or components. Only those controls specifically referred to within a series of steps given for aligning a particular circuit affect the alignment of that circuit. Those controls not mentioned in any one series of steps may be left in any position. The alignment of this receiver should be performed only with suitable equipments by technicians thoroughly familiar with the receiver. If the limits and tolerances specified in the following procedures cannot be obtained during a field alignment, then a factory alignment is necessary.

4.5.2 Equipments Required. - The following equipments, or their equivalents, are required to perform the complete receiver alignment:

(1) Signal Generator, Hewlett-Packard Type 606

(2) Test Oscillator, Hewlett-Packard Type 200CD

(3) AC VTVM, Hewlett-Packard Type 400H

(4) Oscilloscope, Tektronix Type 503

(5) Assorted cables, connectors, and alignment tools

(6) Frequency Counter, Computer Measurements Corp. Type 738A

Table 4-1. Transistor Element Voltages

Ref. Desig.	Collector	Base	Emitter
A1Q1	11.5	0.91	0.38
A1Q2	11.5	0.86	0.60
A1Q3	11.7	7.10	7.70
A1Q4	11.7	1.86	1.20
A2Q1	10.7	3.00	2.35
A2Q2	11.1	3.10	2.45
A2Q3*	11.8	8.50	8.35
A2Q4	11.8	3.40	2.75
A2Q5*	11.8	2.75	2.05
A3Q1	11.8	2.00	1.50
A3Q2	11.8	1.50	0.97
A3Q3	11.0	0.95	2.15
A3Q4	11.8	11.0	10.5
A4Q1	10.8	0.86	0.29
A4Q2	-1.80	10.8	11.0
A5Q1	17.5	12.5	11.8
A5Q2	-18.8	-11.9	-11.7

Test Conditions: All voltages are positive dc with respect to chassis unless otherwise indicated. Readings taken with RCA WV-98B VTVM with 115 vac applied to receiver. No signal input. Function switch in AM-AGC position except where noted.

Note: *Function switch in CW position for these measurements.

NOTE

To insure the accurate alignment of this receiver to within ±1% of the dial reading, all signal generator frequencies must be checked with a frequency counter before using the generator for alignment.

4.5.3 IF Amplifier Alignment. - Proceed as follows:

(1) Set up equipment as shown in Figure 4-1.

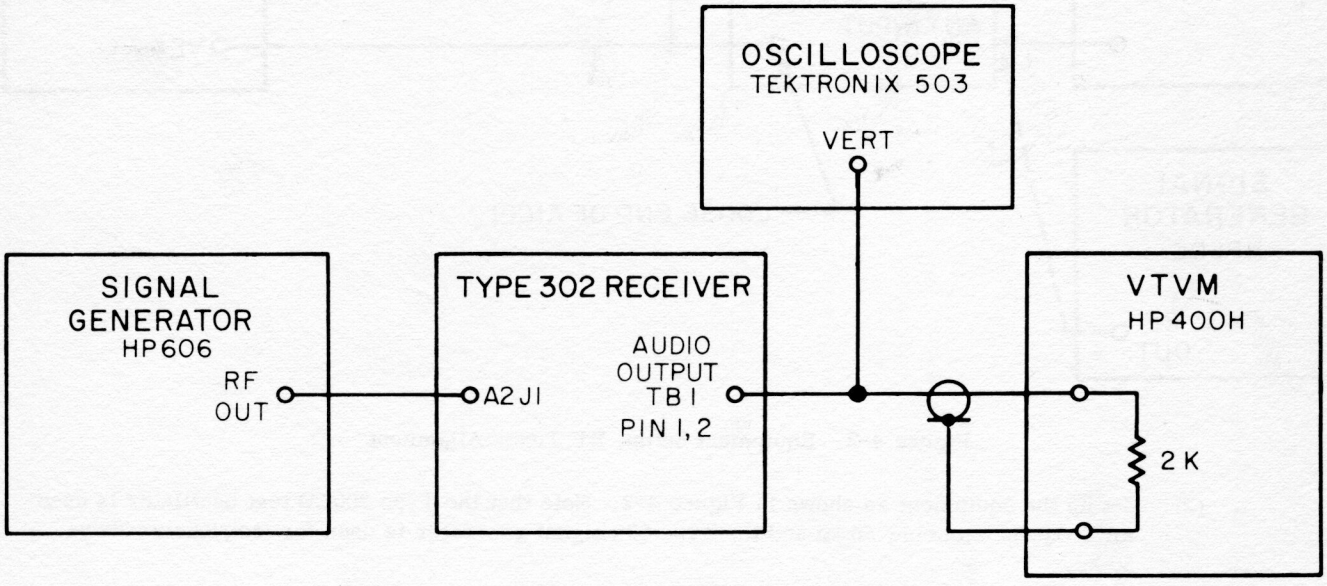


Figure 4-1. Equipment Setup, IF Amplifier Alignment

(2) Make the following initial control settings:

a. Receiver: Function switch to AM-MAN, RF-IF GAIN to maximum clockwise.

b. Signal Generator: 455-kc CW output, adjust output level as needed.

c. Oscilloscope: Adjust vertical sensitivity and horizontal sweep as needed.

d. VTVM: Adjust range as needed.

(3) Tune capacitors A2C31, A2C20, A2C13, A2C9, and A2C4 in the order given for maximum reading on the VTVM. It will be necessary to decrease the signal generator output as the capacitors are tuned. Monitor the oscilloscope for signs of signal distortion.

4.5.4 BFO Alignment. - Proceed as follows:

(1) Set up equipment as shown in Figure 4-1.

(2) Initial control settings for equipments are the same as those in paragraph 4.5.3 except that receiver function switch is placed in the CW mode, BFO PITCH control set to midrange, and AUDIO GAIN control is set to maximum clockwise.

(3) Adjust A2L1 for zero beat and A2L2 for maximum amplitude of the zero beat.

4.5.5 RF Tuner Alignment. - Proceed as follows:

(1) Remove the tuner cover, and disconnect the local oscillator from the mixer by unsoldering A2C21 from the emitter of A1Q4.

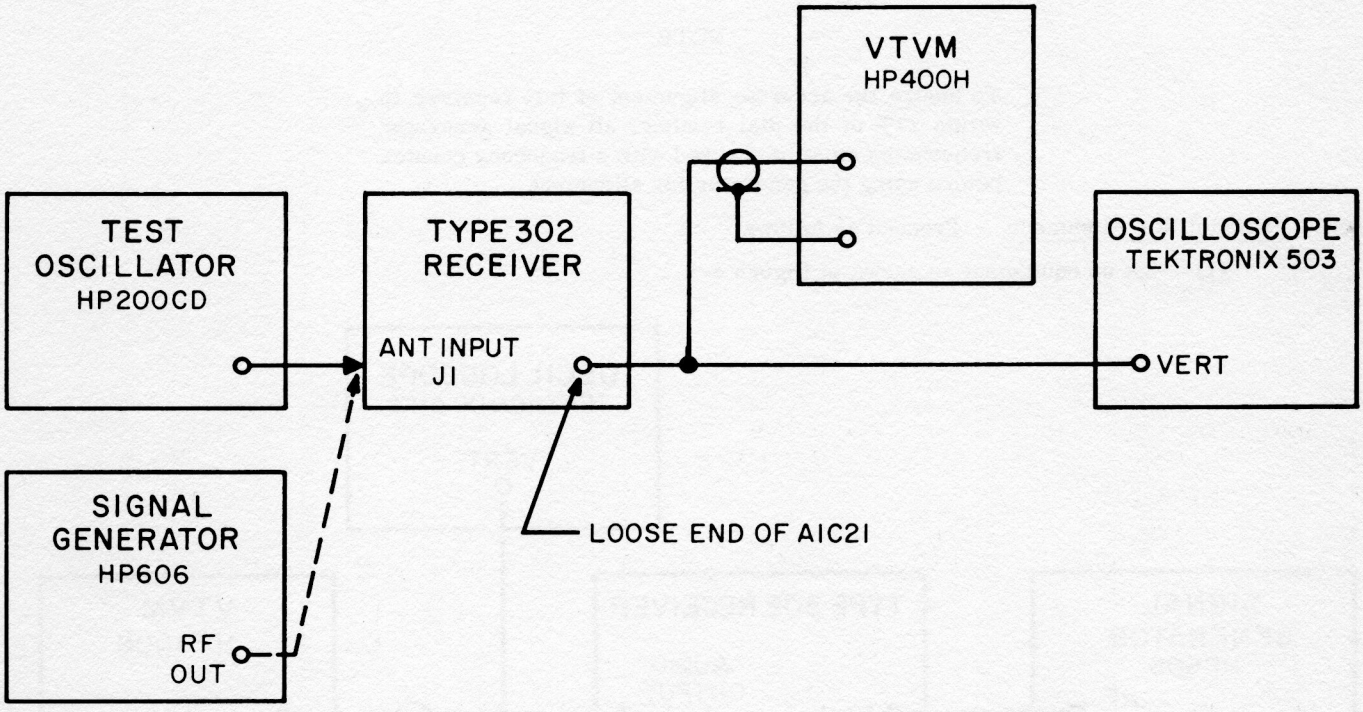


Figure 4-2. Equipment Setup, RF Tuner Alignment

(2) Set up the equipment as shown in Figure 4-2. Note that the Type 200CD test oscillator is used for frequencies below 50 kc and the Type 606 signal generator is used for frequencies above 50 kc.

(3) Make the following initial control settings:

a. Receiver: 30-60 kc band, tune to 30 kc, RF-IF GAIN to maximum clockwise.

b. Test Oscillator: Set to 30 kc, adjust amplitude for an indication on the VTVM.

c. Oscilloscope: Adjust vertical sensitivity and horizontal sweep as needed.

d. VTVM: Adjust as needed.

(4) Tune A1T1 and A1T4 for a maximum indication on the VTVM.

(5) Attach the Type 606 Signal Generator, and tune both the generator and receiver to 60 kc. Peak A1C10 and A1C2 as indicated by the VTVM. Recheck the receiver at both the 30 kc and 60 kc positions.

(6) Switch the receiver to the 60-140 kc band, and tune the signal generator and receiver to 60 kc.

(7) Peak A1T2 and A1T5 for a maximum indication on the VTVM.

(8) Tune both the signal generator and receiver to 140 kc.

(9) Tune A1C12 and A1C4 for a maximum reading on the VTVM. Recheck both the 60 kc and 140 kc positions.

(10) Switch the receiver to the 140-300 kc band, and set both the signal generator and receiver to 140 kc.

(11) Tune A1T3 and A1T6 for a maximum reading on the VTVM.

(12) Tune the signal generator and receiver to 300 kc.

(13) Adjust A1C14 and A1C6 for a maximum reading on the VTVM. Recheck both the 140 kc and 300 kc positions.

4.5.5.1 Mixer Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-3. Note that the mixer output, A1J3, is connected to the IF input, A2J1.

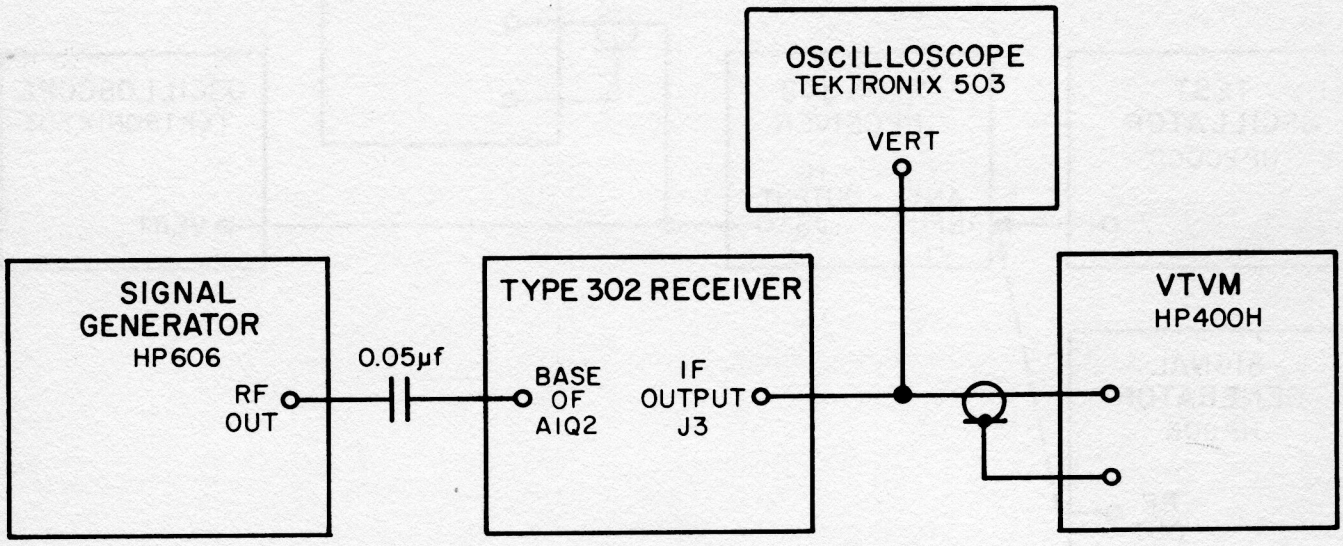


Figure 4-3. Equipment Setup, Mixer Alignment

(2) Make the following control settings:

a. Receiver: Function switch to AM-MAN position, RF-IF GAIN control maximum clockwise position.

b. Signal Generator: 455 kc CW output, adjust amplitude as needed.

c. Oscilloscope: Adjust vertical sensitivity and horizontal sweep as needed.

d. VTVM: Adjust range as needed.

(3) Adjust A1C18 for a maximum reading on the VTVM.

(4) Resolder A1C21 to the emitter of A1Q4.

4.5.5.2 Local Oscillator Alignment. - Proceed as follows:

(1) Set up equipment as shown in Figure 4-4.

(2) Make the following equipment settings:

a. Receiver: Function switch to AM-MAN position, bandswitch to 30-60 kc position, tune to 30 kc, RF-IF GAIN control maximum clockwise.

b. Test Oscillator: Set for 30-kc output, adjust level as necessary.

c. Oscilloscope: Adjust vertical sensitivity and horizontal sweep as needed.

d. VTVM: Adjust range as needed.

(3) Adjust A1L1 for maximum reading on VTVM.

(4) Connect the Type 606 Signal Generator to receiver. Tune both to 60 kc.

(5) Tune A1C28 for peak reading on VTVM. A1L1 and A1C28 may interact, so it is necessary to readjust both until the least amount of interaction is obtained.

(6) Switch receiver to 60-140 kc band, and tune both receiver and signal generator to 65 kc.

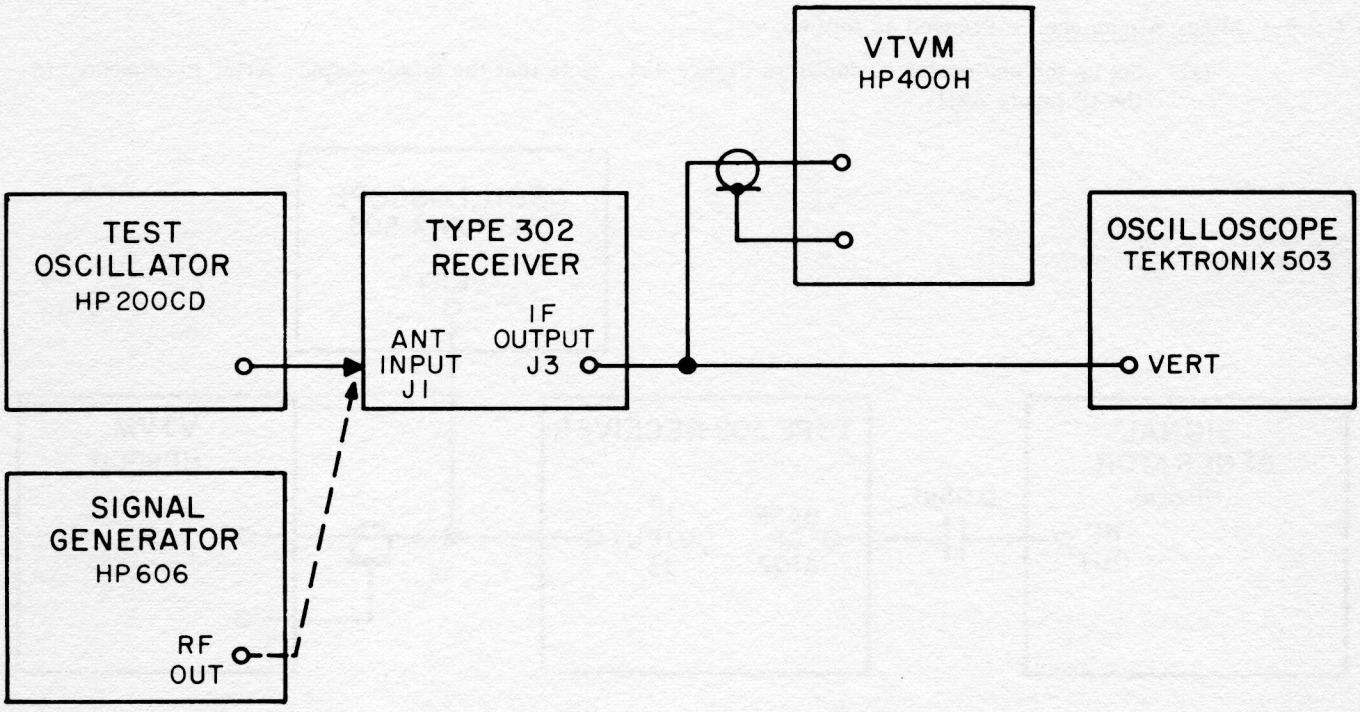


Figure 4-4. Equipment Setup, Local Oscillator Alignment

(7) Adjust A1L2 for maximum reading on VTVM.

(8) Tune both receiver and signal generator to 135 kc.

(9) Adjust A1C34 for peak reading on VTVM. Readjust A1L2 and A1C34 for minimum interaction between the two.

(10) Switch the receiver to the 140-300-kc band. Tune both the receiver and signal generator to 145 kc.

(11) Adjust A1L3 for a peak reading on the VTVM.

(12) Tune both the receiver and signal generator to 290 kc.

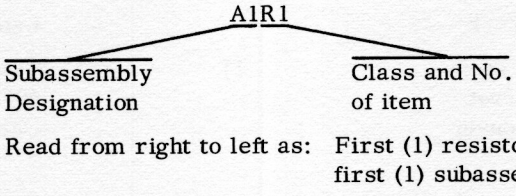
(13) Adjust A1C39 for a maximum reading on the VTVM. Readjust both A1L3 and A1C39 for minimum interaction between the two.

SECTION V

REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies (and modules), and parts. An example of the unit method follows:



As shown on the main chassis schematic, components which are an integral part of the main chassis have no subassembly designation.

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on drawings and illustrations following the notation "REF DESIG PREFIX".

5.3 LIST OF MANUFACTURERS

Abbreviation	Name and Address
Air-O-Tronics	Air-O-Tronics P.O. Box K Morrisville, New York
A-B	Allen-Bradley Co. 136 W. Greenfield Avenue Milwaukee, Wisconsin
FXR	Amphenol-Borg Electronics 33 E. Franklin Street Danbury, Connecticut
Arco	Arco Electronics, Inc. Community Drive Great Neck, New York
Buss	Bussman Manufacturing Co. University at Jefferson Street St. Louis, Missouri
CRL	Centralab 900 East Keefe Avenue Milwaukee, Wisconsin
CM	Chicago Miniature Lamp Works 1500 N. Ogden Avenue Chicago 10, Illinois
Cinch	Cinch-Jones Manufacturing Co. 1026 S. Homan Avenue Chicago, Illinois
Erie	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania
GE	General Electric Co. 777 14th Street, N.W. Washington, D. C.
Oak	Oak Manufacturing Co. Crystal Lake Illinois
PSI	Pacific Semiconductors, Inc. 10451 W. Jefferson Boulevard Culver City, California
RC	Radio Condenser Co. Davis and Copewood Streets Campden 3, New Jersey
RCA	Radio Corp. of America 415 South Fifth Street Harrison, New Jersey
RMC	Radio Materials Corp. 4242 W. Bryn Mawr Avenue Chicago 46, Illinois
Sprague	Sprague Electric Co. 91 Marshall Street North Adams, Massachusetts

Abbreviation	Name and Address
CEI	Communication Electronics, Inc. 6006 Executive Boulevard Rockville, Maryland
CD	Continental Devices Corp. 12515 Chadion Avenue Hawthorne, California
Cornish	Cornish Wire Co. 50 Church Street New York, New York
C-H	Cutler-Hammer, Inc. 321 North 12th Street Milwaukee, Wisconsin
Switch	Switchcraft, Inc. 5555 North Elston Avenue Chicago, Illinois
Sylvania	Sylvania Electric Products, Inc. 1740 Broadway New York, New York
Taurus	Taurus Corporation 8 Coryell Street Lambertville, New Jersey
TI	Texas Instruments, Inc. 6000 Lemmon Avenue Dallas, Texas

5.4 PARTS LIST

When ordering replacement parts from CEI, specify the type and serial number of the equipment, and the reference designation and description of each part ordered. The Vendors and Vendor Part Numbers listed are included as a guide to the user of the equipment in the field and do not necessarily agree with the parts installed in the equipment. Except in those cases specifically noted, the replacement part may be obtained from any vendor as long as the physical and electrical parameters of the part selected agree with the original part.

5.4.1 Main Chassis

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A1	RF TUNER	7169	CEI
A2	IF AMPLIFIER	7247	CEI
A3	AGC AMPLIFIER	7809	CEI
A4	AUDIO AMPLIFIER	7404	CEI
A5	POWER SUPPLY	7607	CEI
A6	LOW PASS FILTER (Optional)	7934	CEI
C1A,B,C	VARIABLE CONDENSER: 11-603 pf	882717-A	RC
C2	CAPACITOR, PAPER, THRU-PASS: .01 μf, 600V	102P515	Sprague
C3	Same as C2		
DS1	LAMP, MINIATURE BAYONET: 6.3V, .15 Amp	47	CM
F1	FUSE, 3 AG, slow-blow: 1/32 amp	MDL-1/32	Buss
J1	RECEPTACLE, Part of W1	17825	FXR
J2	NOT USED		
J3	Same as J1, Part of W4		
J4	JACK, PHONE, OPEN-CIRCUIT	C-11	Switch
M1	METER, SIGNAL STRENGTH: 0-50 μA, DC	1632	CEI
P1	POWER CORD AND PLUG	01753-001	Cornish
P2	CONNECTOR, PLUG, MB SERIES, Part of W1	44950	FXR
P3	Same as P2 (Optional), Part of W2		
P4	CONNECTOR, PLUG, MB SERIES, RIGHT ANGLE, Part of W3	45775	FXR
P5	Same as P2, Part of W3		
P6	Same as P2, Part of W4		
P7	Same as P2 (Optional), Part of W2		
R1	RESISTOR, VARIABLE, COMPOSITION: 10K, ±10%, 2W	RV4NAYSD103A	A-B
R2	RESISTOR, FIXED, COMPOSITION: 2K, ±5%, 1/4W	CB2025	A-B
R3	Same as R1		
R4	RESISTOR, FIXED, COMPOSITION: 5.1K, ±5%, 1/4W	CB5125	A-B
R5	RESISTOR, VARIABLE, COMPOSITION: 100K, ±10%, 2W	RV4NAYSD104A	A-B
S1	SWITCH, TOGGLE, SPST	8280-K16	C-H
S2	Same as S1		
S3A,B,C	SWITCH, ROTARY: 4 pole, 2-6 position	399225A	Oak
T1	TRANSFORMER, POWER	10280	CEI
TB1	TERMINAL BOARD	2-140-Y	Cinch
W1	CABLE AND CONNECTOR ASSEMBLY		CEI
W2	CABLE AND CONNECTOR ASSEMBLY (Optional)		CEI

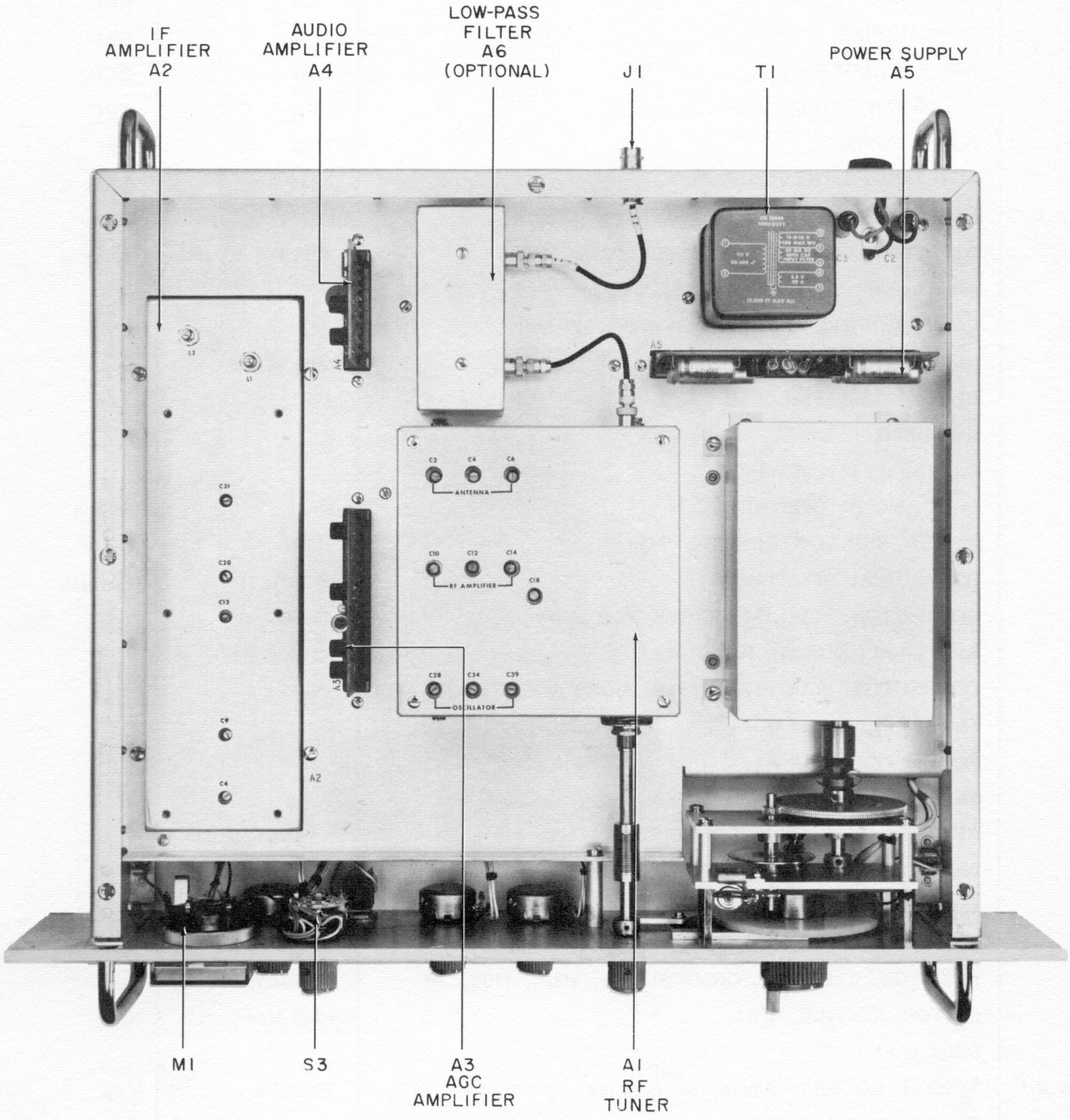


Figure 5-1. Type 302 LF Receiver, Top View

Ref. Desig.	Description	Vendor Part No.	Vendor Name
W3	CABLE AND CONNECTOR ASSEMBLY		CEI
W4	CABLE AND CONNECTOR ASSEMBLY		CEI

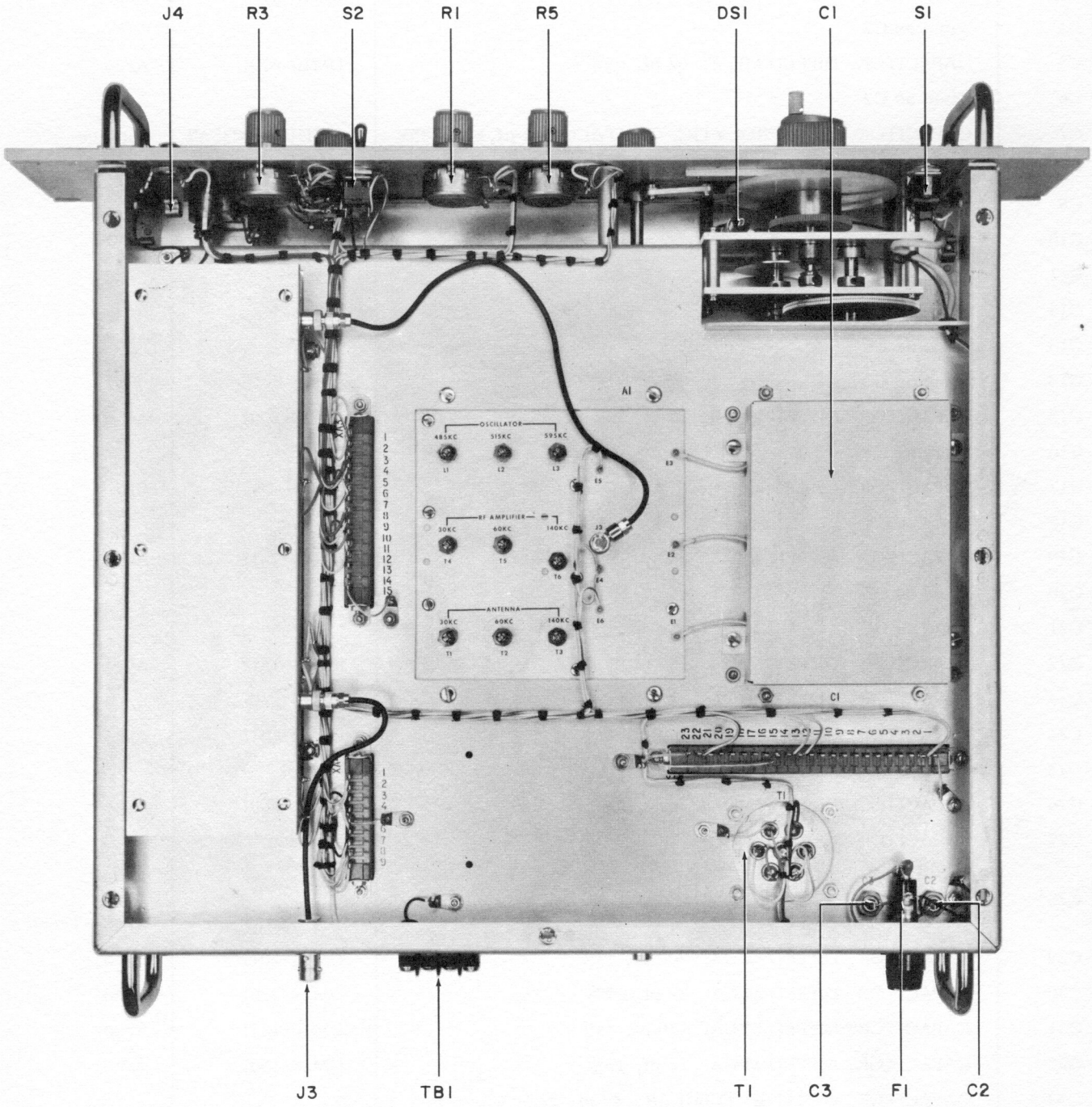


Figure 5-2. Type 302 LF Receiver, Bottom View

5.4.2 30-300 KC Tuner, Type 7169 Ref. Desig. Prefix A1

Ref. Desig.	Description	Vendor Part No.	Vendor Name
C1	CAPACITOR, DIPPED MICA: 82 pf, ±5%	DM10-820J	Arco
C2	CAPACITOR, CERAMIC, TRIMMER: 10-40 pf (Temp. Comp. N750)	10S-TR1K0-06	Air-O-Tronics
C3	CAPACITOR, DIPPED MICA: 30 pf, ±5%	DM10-300J	Arco
C4	Same as C2		
C5	CAPACITOR, DIPPED MICA: 62 pf, ±5%	DM10-620J	Arco
C6	Same as C2		
C7	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μf, ±10%, 35V	150D105X9035A2	Sprague
C8	CAPACITOR, CERAMIC, DISC: .1 μf, +80 -20%, 10V	UK10-104	CRL
C9	Same as C1		
C10	Same as C2		
C11	Same as C3		
C12	Same as C2		
C13	Same as C5		
C14	Same as C2		
C15	CAPACITOR, DIPPED MICA: 20 pf, ±5%	DM10-200J	Arco
C16	Same as C7		
C17	CAPACITOR, CERAMIC, DISC: .05 μf, +80 -20%, 20V	UK20-503	CRL
C18	Same as C2		
C19	CAPACITOR, DIPPED MICA: 240 pf, ±1%	DM15-241F	Arco
C20	Same as C7		
C21	Same as C17		
C22	CAPACITOR, DIPPED MICA: 150 pf, ±1%	DM10-151F	Arco
C23	CAPACITOR, DIPPED MICA: 24 pf, ±5%	DM10-240J	Arco
C24	CAPACITOR, DIPPED MICA: 100 pf, ±5%	DM10-101J	Arco
C25	Same as C22		
C26	CAPACITOR, DIPPED MICA: 36 pf, ±5%	DM10-360J	Arco
C27	CAPACITOR, CERAMIC, TUBULAR: 100 pf, ±5% (Temp. Comp. N750)	N750A	Erie
C28	CAPACITOR, CERAMIC, TRIMMER: 3-12 pf (Temp. Comp. N470)	10S-TR1K0-06	Air-O-Tronics
C29	CAPACITOR, DIPPED MICA: 200 pf, ±1%	DM10-201F	Arco
C30	CAPACITOR, DIPPED MICA: 27 pf, ±5%	DM10-270J	Arco
C31	CAPACITOR, DIPPED MICA: 130 pf, ±1%	DM10-131F	Arco
C32	CAPACITOR, DIPPED MICA: 15 pf, ±5%	DM10-150J	Arco
C33	CAPACITOR, CERAMIC TUBULAR: 82 pf, ±2% (Temp. Comp. N750)	TCN-82	CRL

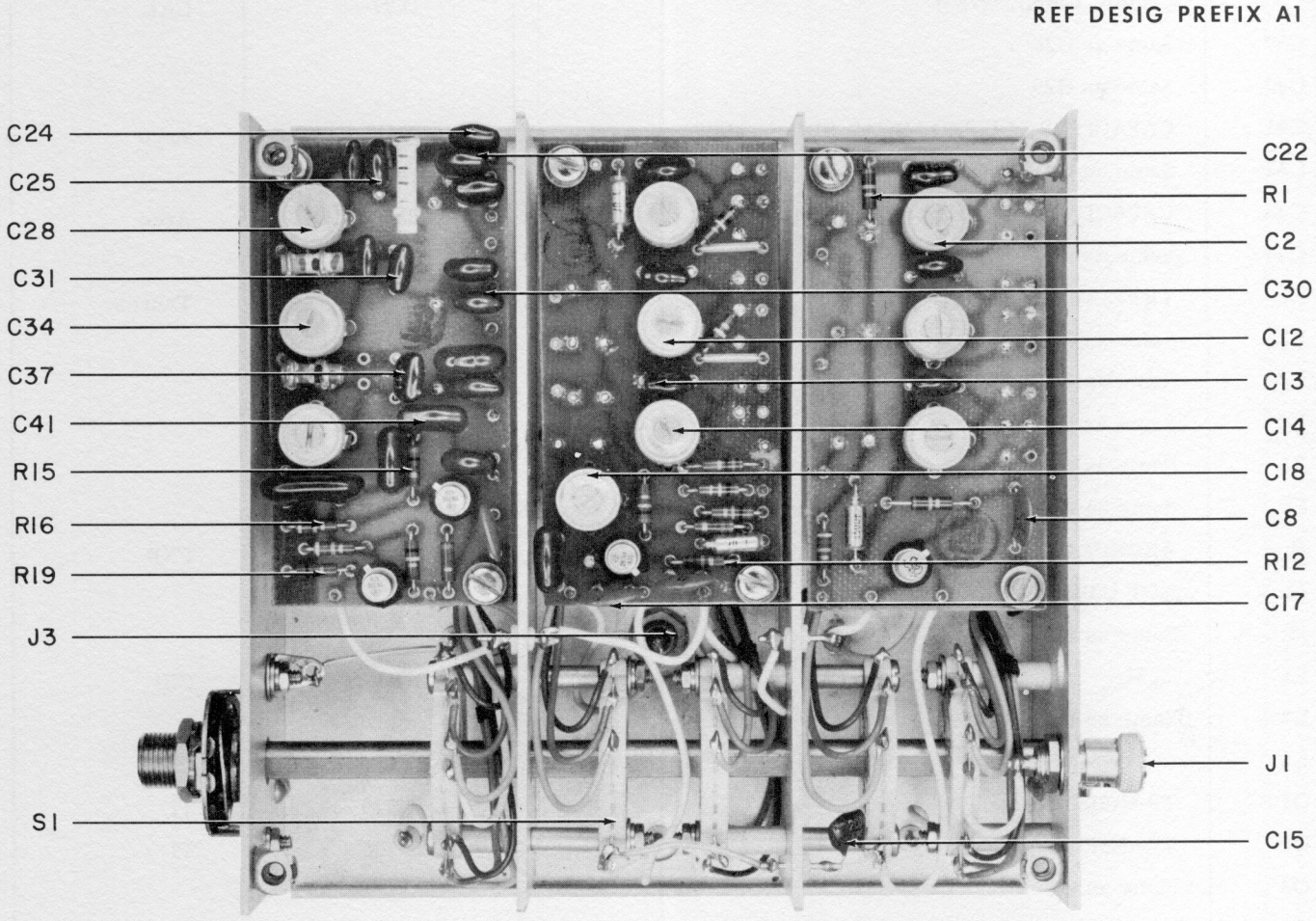


Figure 5-3. Type 7169 RF Tuner, Component Locations

Ref. Desig. Prefix A1

Ref. Desig.	Description	Vendor Part No.	Vendor Name
C34	Same as C28		
C35	CAPACITOR, DIPPED MICA: 360 pf, ±1%	DM15-361F	Arco
C36	Same as C26		
C37	CAPACITOR, DIPPED MICA: 91 pf, ±5%	DM10-910J	Arco
C38	CAPACITOR, CERAMIC, TUBULAR: 68 pf, ±2% (Temp. Comp. N750)	TCN-68	CRL
C39	Same as C28		
C40	Same as C29		
C41	CAPACITOR, DIPPED MICA: 510 pf, ±1%	DM15-511F	Arco
C42	Same as C41		
C43	CAPACITOR, DIPPED MICA: 1500 pf, ±5%	DM19-152J	Arco
C44	Same as C17		
E1	TEFLON FEEDTHRU	SFU-16	Taurus
E2	Same as E1		
E3	Same as E1		
E4	Same as E1		
E5	Same as E1		
E6	Same as E1		
J1	RECEPTACLE, MB SERIES	46025	FXR
J2	NOT USED		
J3	Same as J1		
L1	COIL	2784-7	CEI
L2	Same as L1		
L3	COIL	2784-8	CEI
Q1	TRANSISTOR	2N929	TI
Q2	TRANSISTOR	2N706	TI
Q3	Same as Q2		
Q4	Same as Q2		
R1	RESISTOR, FIXED, COMPOSITION: 15K, ±5%, 1/4W	CB1535	A-B
R2	RESISTOR, FIXED, COMPOSITION: 47K, ±5%, 1/4W	CB4735	A-B
R3	Same as R1		
R4	NOT USED		
R5	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	A-B
R6	NOT USED		
R7	Same as R5		
R8	RESISTOR, FIXED, COMPOSITION: 16 Ω, 5%, 1/4W	CB1605	A-B

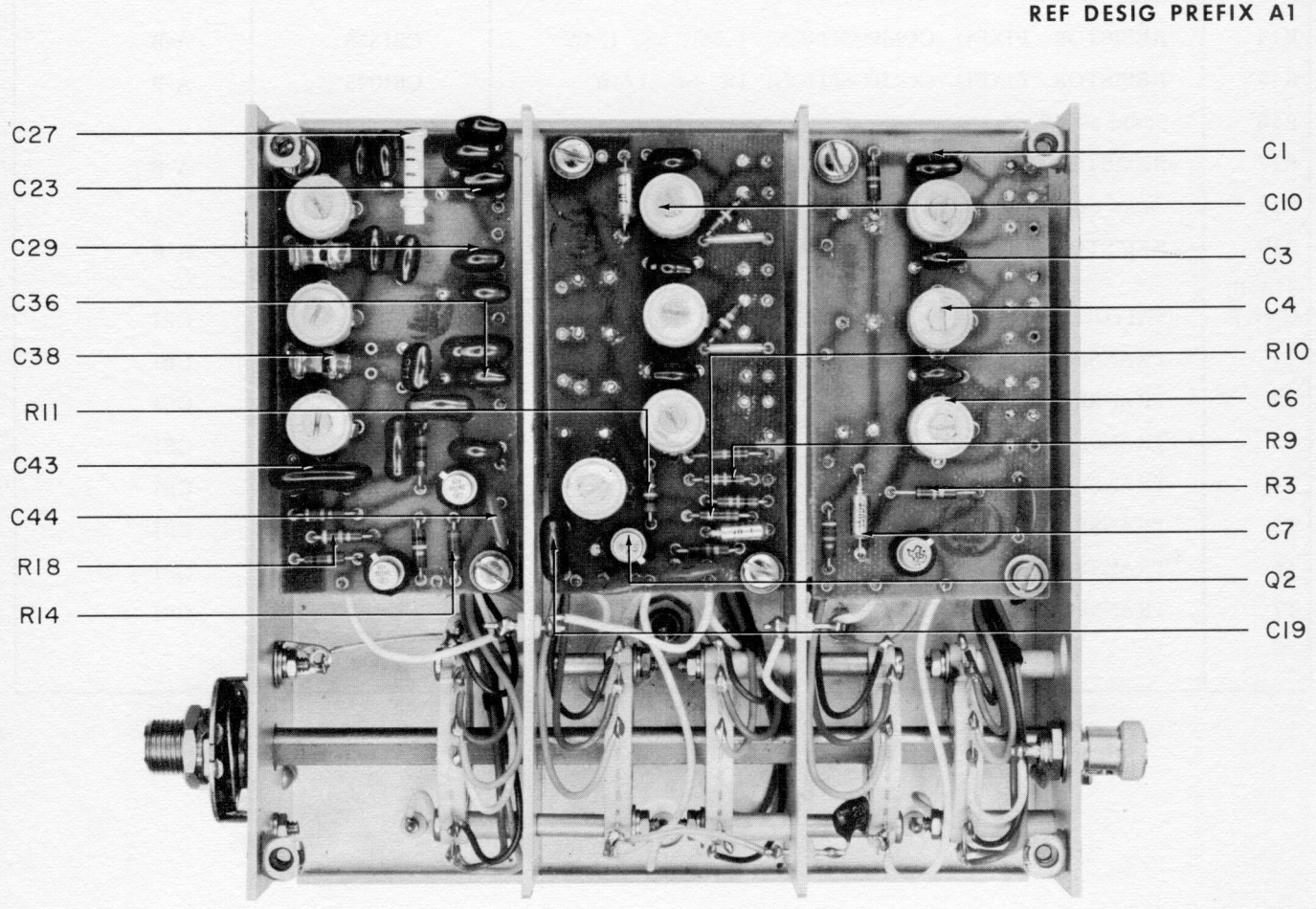


Figure 5-4. Type 7169 RF Tuner, Component Locations

Ref. Desig. Prefix A1

Ref. Desig.	Description	Vendor Part No.	Vendor Name
R9	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	CB1035	A-B
R10	RESISTOR, FIXED, COMPOSITION: 1.1M, 5%, 1/4W	CB1045	A-B
R11	Same as R5		
R12	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	CB2235	A-B
R13	Same as R9		
R14	RESISTOR, FIXED, COMPOSITION: 1.5M, 5%, 1/4W	CB1555	A-B
R15	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	CB1025	A-B
R16	Same as R2		
R17	RESISTOR, FIXED, COMPOSITION: 200K, 5%, 1/4W	CB2045	A-B
R18	Same as R2		
R19	RESISTOR, FIXED, COMPOSITION: 2K, 5%, 1/4W	CB2025	A-B
S1A,B, C,D,E	SWITCH, ROTARY	2672	CEI
T1	TRANSFORMER	2784-4	CEI
T2	TRANSFORMER	2784-5	CEI
T3	TRANSFORMER	2784-6	CEI
T4	TRANSFORMER	2784-1	CEI
T5	TRANSFORMER	2784-2	CEI
T6	TRANSFORMER	2784-3	CEI
T7	TRANSFORMER	2768-2	CEI

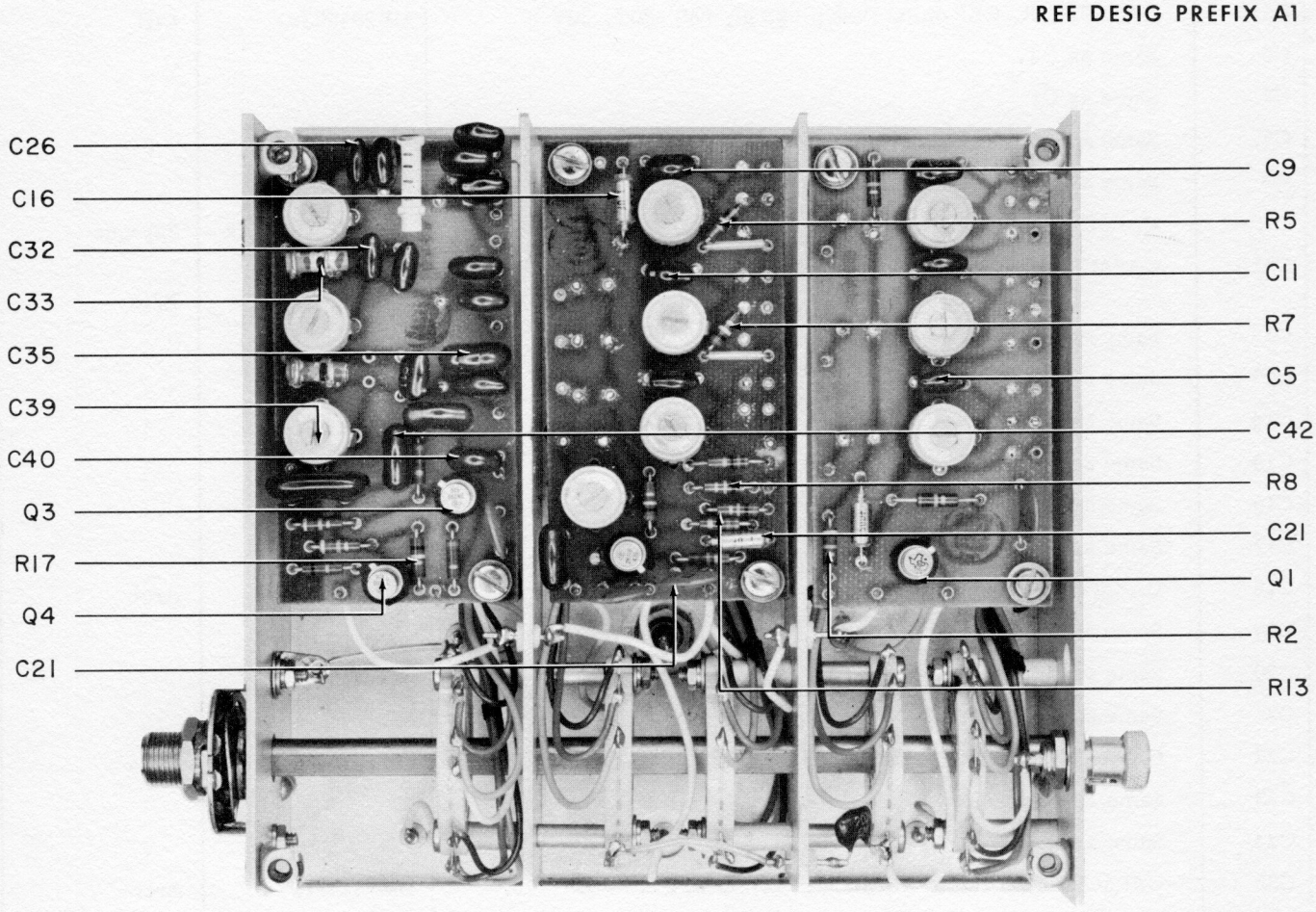


Figure 5-5. Type 7169 RF Tuner, Component Locations

5.4.3 455-KC IF Strip, Type 7247 Ref. Desig. Prefix A2

Ref. Desig.	Description	Vendor Part No.	Vendor Name
C1	CAPACITOR, DIPPED MICA: 220 pf, ±1%	DM15-221F	Arco
C2	CAPACITOR, CERAMIC, DISC: .025 μf, +80 -20%, 50V	CK-253	CRL
C3	CAPACITOR, CERAMIC, TUBULAR: 18 pf, ±5% (Temp. Comp. N750)	N750A	Erie
C4	CAPACITOR, VARIABLE, CERAMIC: 10-40 pf (Temp. Comp. N750)	10S-TR1K0-06	Air-O-Tronics
C5	CAPACITOR, CERAMIC DISC: .05 μf, +80 -20%, 20V	UK20-503	CRL
C6	Same as C3		
C7	Same as C1		
C8	Same as C5		
C9	Same as C4		
C10	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μf, ±10%, 35V	150D105X9035A2	Sprague
C11	CAPACITOR, CERAMIC, TUBULAR: 8.2 pf, ±.5 pf	301-000-COHO-829D	Erie
C12	Same as C1		
C13	Same as C4		
C14	Same as C3		
C15	Same as C5		
C16	Same as C3		
C17	Same as C5		
C18	CAPACITOR, DIPPED MICA: 240 pf, 1%	DM15-241F	Arco
C19	Same as C5		
C20	Same as C4		
C21	Same as C10		
C22	CAPACITOR, DIPPED MICA: 33 pf, ±5%	DM10-330J	Arco
C23	Same as C5		
C24	Same as C1		
C25	CAPACITOR, DIPPED MICA: 510 pf, ±1%	DM15-511F	Arco
C26	Same as C25		
C27	CAPACITOR, CERAMIC, DISC: .001 μf, GMV	SM	RMC
C28	Same as C3		
C29	Same as C5		
C30	Same as C1		
C31	Same as C4		
C32	CAPACITOR, DIPPED MICA: 330 pf, ±5%	DM15-331J	Arco
C33	Same as C5		
C34	Same as C10		

REF DESIG PREFIX A2

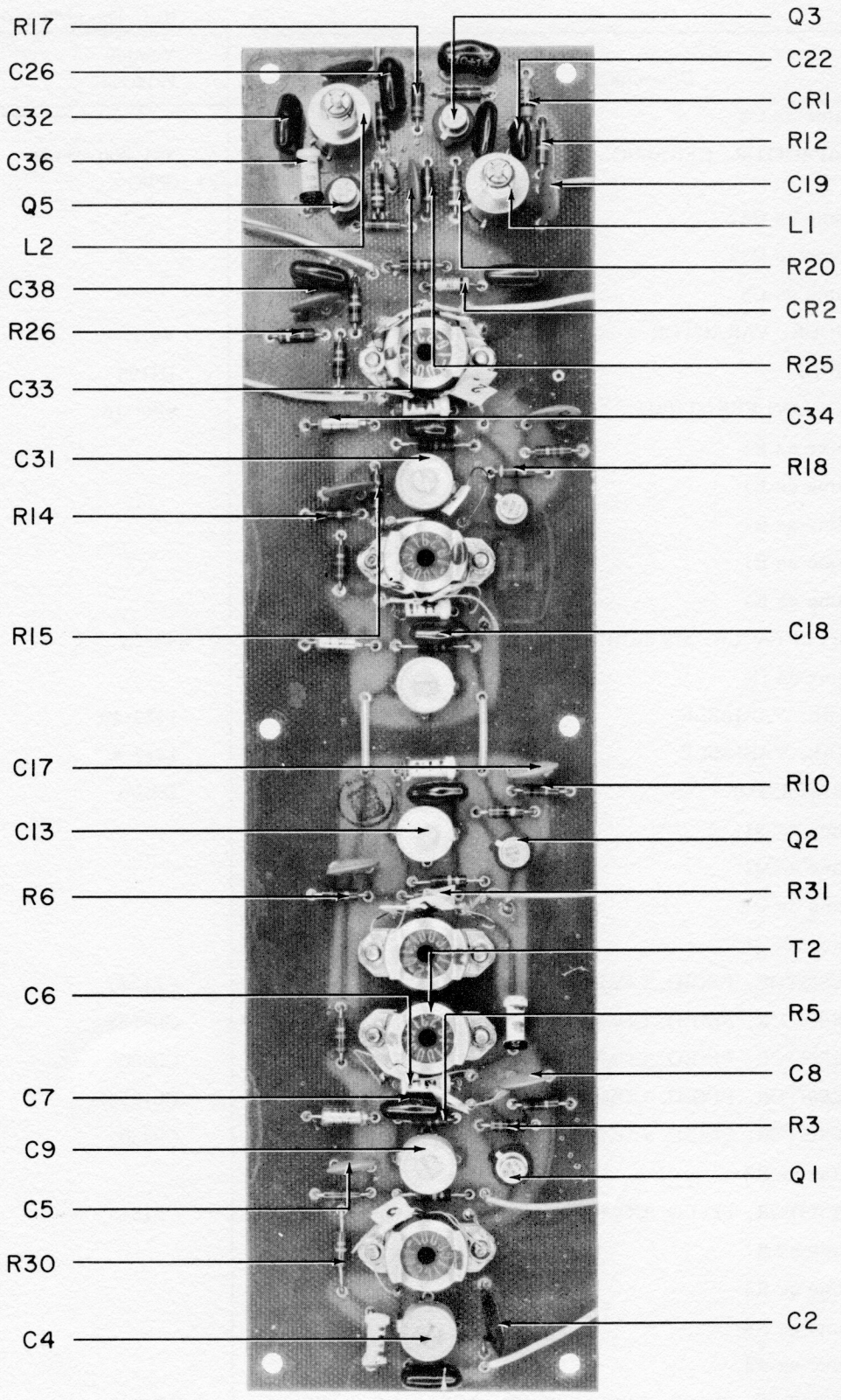


Figure 5-6. Type 7247 IF Amplifier, Component Locations

Ref. Desig. Prefix A2

Ref. Desig.	Description	Vendor Part No.	Vendor Name
C35	Same as C5		
C36	CAPACITOR, CERAMIC, TUBULAR: 3.3 pf, ±.25 pf	301-000-COJO-339C	Erie
C37	Same as C32		
C38	Same as C32		
C39	Same as C5		
CR1	DIODE, VARACTOR	V47E	PSI
CR2	DIODE	1N198	Sylvania
E1	TEFLON FEEDTHRU	SFU-16	Taurus
E2	Same as E1		
E3	Same as E1		
E4	Same as E1		
E5	Same as E1		
E6	Same as E1		
J1	RECEPTACLE, MB SERIES	46025	FXR
J2	Same as J1		
L1	COIL, VARIABLE	1472-10	CEI
L2	COIL, VARIABLE	1472-9	CEI
Q1	TRANSISTOR	2N706	TI
Q2	Same as Q1		
Q3	Same as Q1		
Q4	Same as Q1		
Q5	Same as Q1		
R1	RESISTOR, FIXED, COMPOSITION, 12K, ±5%, 1/4W	CB1235	A-B
R2	RESISTOR, FIXED, COMPOSITION: 5.1K, ±5%, 1/4W	CB5125	A-B
R3	RESISTOR, FIXED, COMPOSITION: 68 Ω, ±5%, 1/4W	CB6805	A-B
R4	RESISTOR, FIXED, COMPOSITION: 1K, ±5%, 1/4W	CB1025	A-B
R5	RESISTOR, FIXED, COMPOSITION: 22K, ±5%, 1/4W	CB2235	A-B
R6	Same as R2		
R7	RESISTOR, FIXED, COMPOSITION: 150 Ω, ±5%, 1/4W	CB1515	A-B
R8	Same as R1		
R9	Same as R3		
R10	Same as R4		
R11	Same as R5		
R12	RESISTOR, FIXED, COMPOSITION: 150K, ±5%, 1/4W	CB1545	A-B
R13	Same as R7		

REF DESIG PREFIX A2

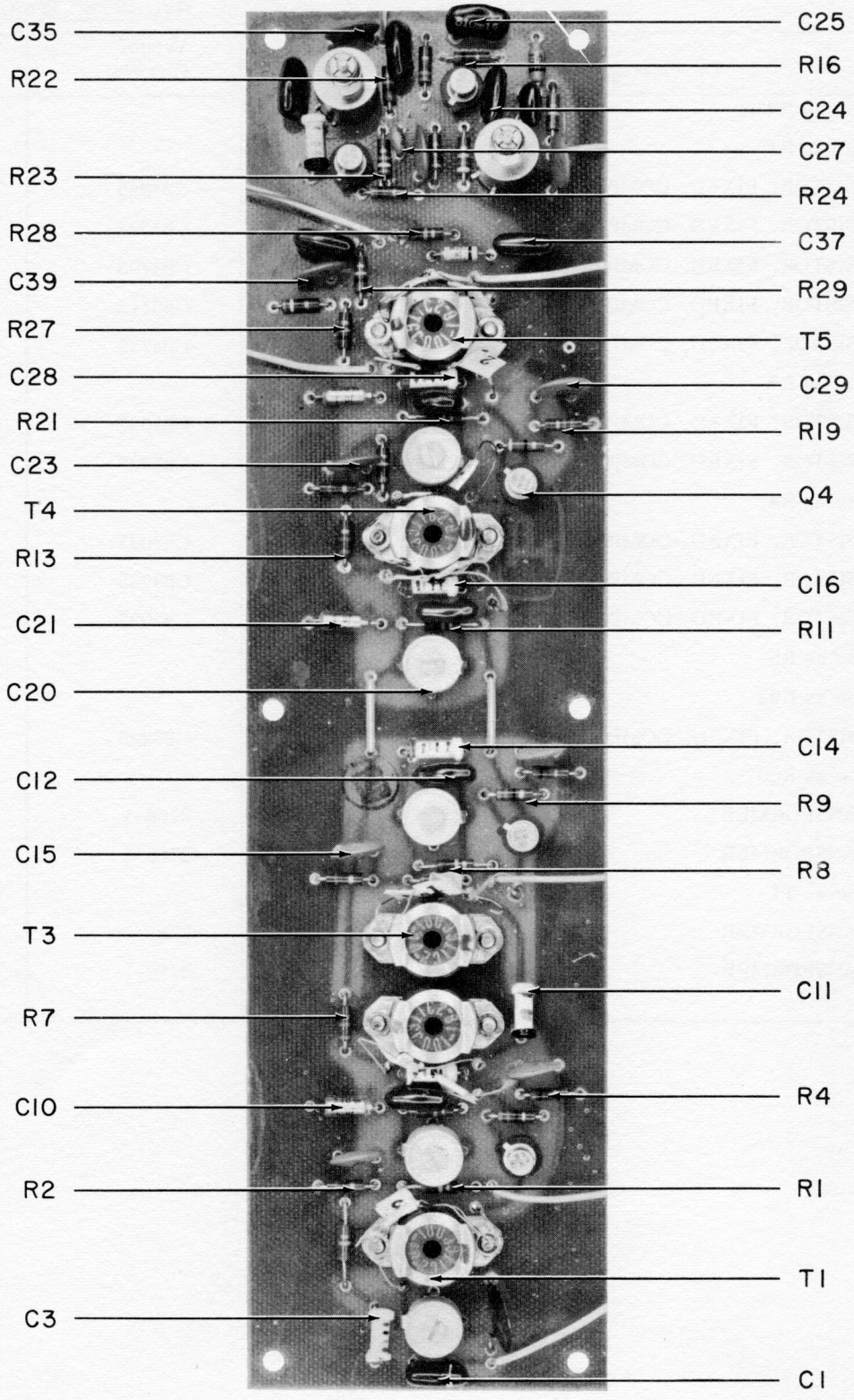


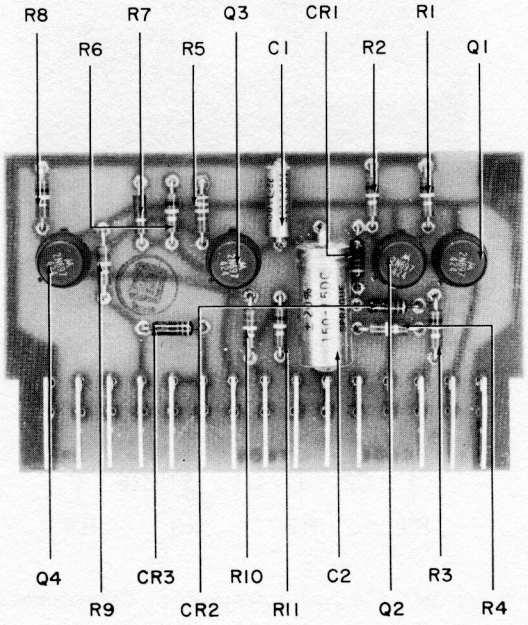
Figure 5-7. Type 7247 IF Amplifier, Component Locations

Ref. Desig. Prefix A2

Ref. Desig.	Description	Vendor Part No.	Vendor Name
R14	Same as R2		
R15	Same as R1		
R16	RESISTOR, FIXED, COMPOSITION: 1M, ±5%, 1/4W	CB1055	A-B
R17	RESISTOR, FIXED, COMPOSITION: 3.3K, ±5%, 1/4W	CB3325	A-B
R18	RESISTOR, FIXED, COMPOSITION: 47 Ω, ±5%, 1/4W	CB4705	A-B
R19	RESISTOR, FIXED, COMPOSITION: 510 Ω, ±5%, 1/4W	CB5115	A-B
R20	RESISTOR, FIXED, COMPOSITION: 47K, ±5%, 1/4W	CB4735	A-B
R21	Same as R5		
R22	RESISTOR, FIXED, COMPOSITION: 100K, ±5%, 1/4W	CB1045	A-B
R23	RESISTOR, FIXED, COMPOSITION: 39K, ±5%, 1/4W	CB3935	A-B
R24	Same as R4		
R25	RESISTOR, FIXED, COMPOSITION: 3K, ±5%, 1/4W	CB3025	A-B
R26	RESISTOR, FIXED, COMPOSITION: 3.9K, ±5%, 1/4W	CB3925	A-B
R27	RESISTOR, FIXED, COMPOSITION: 20K, ±5%, 1/4W	CB2035	A-B
R28	Same as R5		
R29	Same as R22		
R30	RESISTOR, FIXED, COMPOSITION: 82K, ±5%, 1/4W	CB8235	A-B
R31	Same as R30		
T1	TRANSFORMER	2768-1	CEI
T2	TRANSFORMER	2768-2	CEI
T3	Same as T1		
T4	TRANSFORMER	2769-1	CEI
T5	TRANSFORMER	2770-1	CEI

5.4.4 AGC Amplifier, Type 7809 Ref. Desig. Prefix A3

Ref. Desig.	Description	Vendor Part No.	Vendor Name
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μf, ±20%, 15V	150D226X0015B2	Sprague
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 150 μf, ±20%, 15V	150D157X0015S2	Sprague
CR1	DIODE	1N462A	CD
CR2	Same as CR1		
CR3	Same as CR1		
Q1	TRANSISTOR	2N697	TI
Q2	Same as Q1		
Q3	Same as Q1		
Q4	Same as Q1		
R1	RESISTOR, FIXED, COMPOSITION: 100K, ±5%, 1/4W	CB1045	A-B
R2	RESISTOR, FIXED, COMPOSITION: 10K, ±5%, 1/4W	CB1035	A-B
R3	Same as R1		
R4	RESISTOR, FIXED, COMPOSITION: 150K, ±5%, 1/4W	CB1545	A-B
R5	RESISTOR, FIXED, COMPOSITION: 33K, ±5%, 1/4W	CB3335	A-B
R6	Same as R2		
R7	RESISTOR, FIXED, COMPOSITION: 2.2K, ±5%, 1/4W	CB2225	A-B
R8	Same as R1		
R9	RESISTOR, FIXED, COMPOSITION: 62K, ±5%, 1/4W	CB6235	A-B
R10	RESISTOR, FIXED, COMPOSITION: 180K, ±5%, 1/4W	CB1845	A-B
R11	RESISTOR, FIXED, COMPOSITION: 200K, ±5%, 1/4W	CB2045	A-B



REF DESIG PREFIX A3

Figure 5-8. Type 7809 AGC Amplifier, Component Locations

5.4.5 Audio Amplifier, Type 7404 Ref. Desig. Prefix A4

Ref. Desig.	Description	Vendor Part No.	Vendor Name
C1	CAPACITOR, CERAMIC, DISC: .01 μf, ±20%, 500V	SM	RMC
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μf, ±10%, 35V	150D105X9035A2	Sprague
C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μf, ±20%, 15V	150D226X0015B2	Sprague
Q1	TRANSISTOR	2N697	TI
Q2	TRANSISTOR	2N526	GE
R1	RESISTOR, FIXED, COMPOSITION: 4.3M, ±5%, 1/4W	CB4355	A-B
R2	RESISTOR, FIXED, COMPOSITION: 6.2K, ±5%, 1/4W	CB6225	A-B
R3	RESISTOR, FIXED, COMPOSITION: 2.2K, ±5%, 1/4W	CB2225	A-B
R4	RESISTOR, FIXED, COMPOSITION: 36K, ±5%, 1/4W	CB3635	A-B
R5	RESISTOR, FIXED, COMPOSITION: 390 Ω, ±5%, 1/4W	CB3915	A-B
R6	RESISTOR, FIXED, COMPOSITION: 4.7K, ±5%, 1/4W	CB4725	A-B
R7	RESISTOR, FIXED, COMPOSITION: 100 Ω, ±5%, 1/4W	CB1015	A-B
R8	RESISTOR, FIXED, COMPOSITION: 22K, ±5%, 1/4W	CB2235	A-B
R9	RESISTOR, FIXED, COMPOSITION: 2K, ±5%, 1/4W	CB2025	A-B

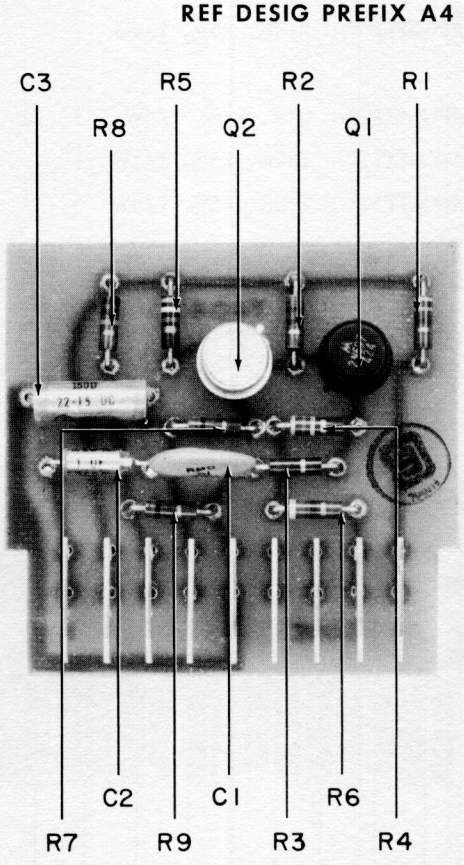


Figure 5-9. Type 7404 Audio Amplifier, Component Locations

5.4.6 Power Supply Module, Type 7607 Ref. Desig. Prefix A5

Ref. Desig.	Description	Vendor Part No.	Vendor Name
C1	CAPACITOR, ELECTROLYTIC: 100 μf, 25V	30D107G025DH4	Sprague
C2	Same as C1		
C3	CAPACITOR, ELECTROLYTIC: 50 μf, 25V	30D506G025DD4	Sprague
C4	Same as C3		
C5	Same as C3		
C6	Same as C3		
CR1	DIODE, RECTIFIER	1N3253	RCA
CR2	Same as CR1		
CR3	Same as CR1		
CR4	Same as CR1		
CR5	DIODE, SILICON, ZENER: 12V	1N759A	CD
CR6	DIODE, SILICON	1N462A	CD
CR7	Same as CR5		
Q1	TRANSISTOR	2N2270	TI
Q2	TRANSISTOR	2N526	GE
R1	RESISTOR, FIXED, COMPOSITION: 1.5K, ±5%, 1/4W	CB1535	A-B
R2	Same as R1		
R3	Same as R1		
R4	Same as R1		

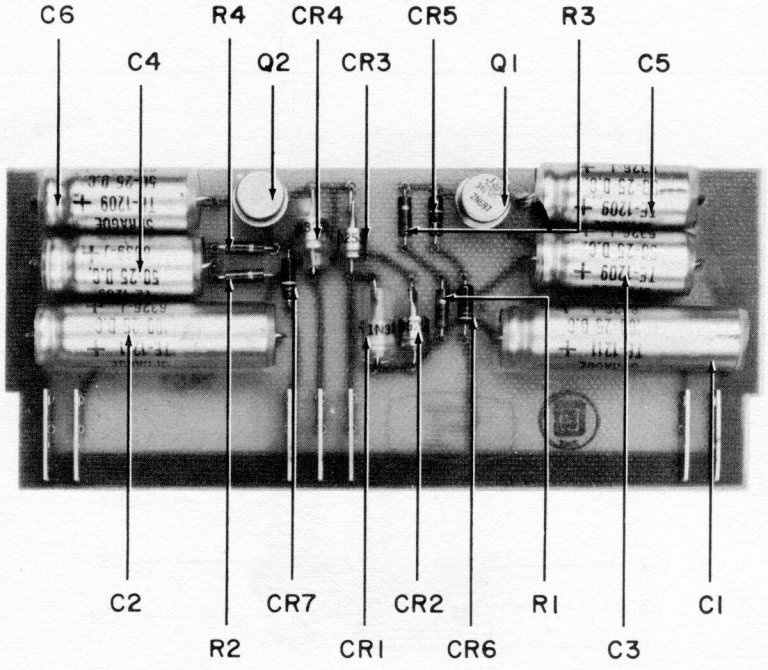


Figure 5-10. Type 7607 Power Supply Module, Component Locations

5.4.7 Low Pass Filter, Type 7934 (Optional) Ref. Desig. Prefix A6

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A1	PRINTED CIRCUIT BOARD	10828	CEI
J1	CONNECTOR, RECEPTACLE, SERIES MB	46025	FXR
J2	Same as J1		

5.4.7.1 Printed Circuit Board, Part No. 10828 Ref. Desig. Prefix A6A1

Ref. Desig.	Description	Vendor Part No.	Vendor Name
C1	CAPACITOR, DIPPED MICA: 5100 pf, 2%	DM19-512G	Arco
C2	CAPACITOR, DIPPED MICA: 200 pf, 5%	DM15-201J	Arco
C3	CAPACITOR, DIPPED MICA: 270 pf, 5%	DM15-271J	Arco
C4	CAPACITOR, DIPPED MICA: 8200 pf, 2%	DM19-822G	Arco
C5	CAPACITOR, DIPPED MICA: 620 pf, 5%	DM15-621J	Arco
C6	CAPACITOR, DIPPED MICA: 10,000 pf, 2%	DM19-103G	Arco
C7	Same as C6		
C8	Same as C5		
C9	Same as C4		
C10	Same as C3		
C11	Same as C1		
C12	Same as C2		
L1	COIL, FIXED	1131-58	CEI
L2	COIL, FIXED	1131-57	CEI
L3	Same as L2		
L4	Same as L2		
L5	Same as L1		

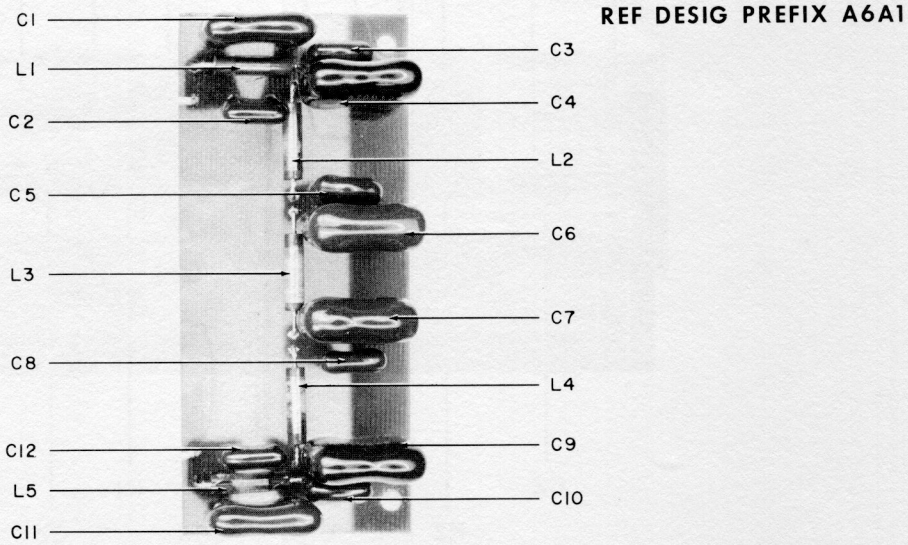
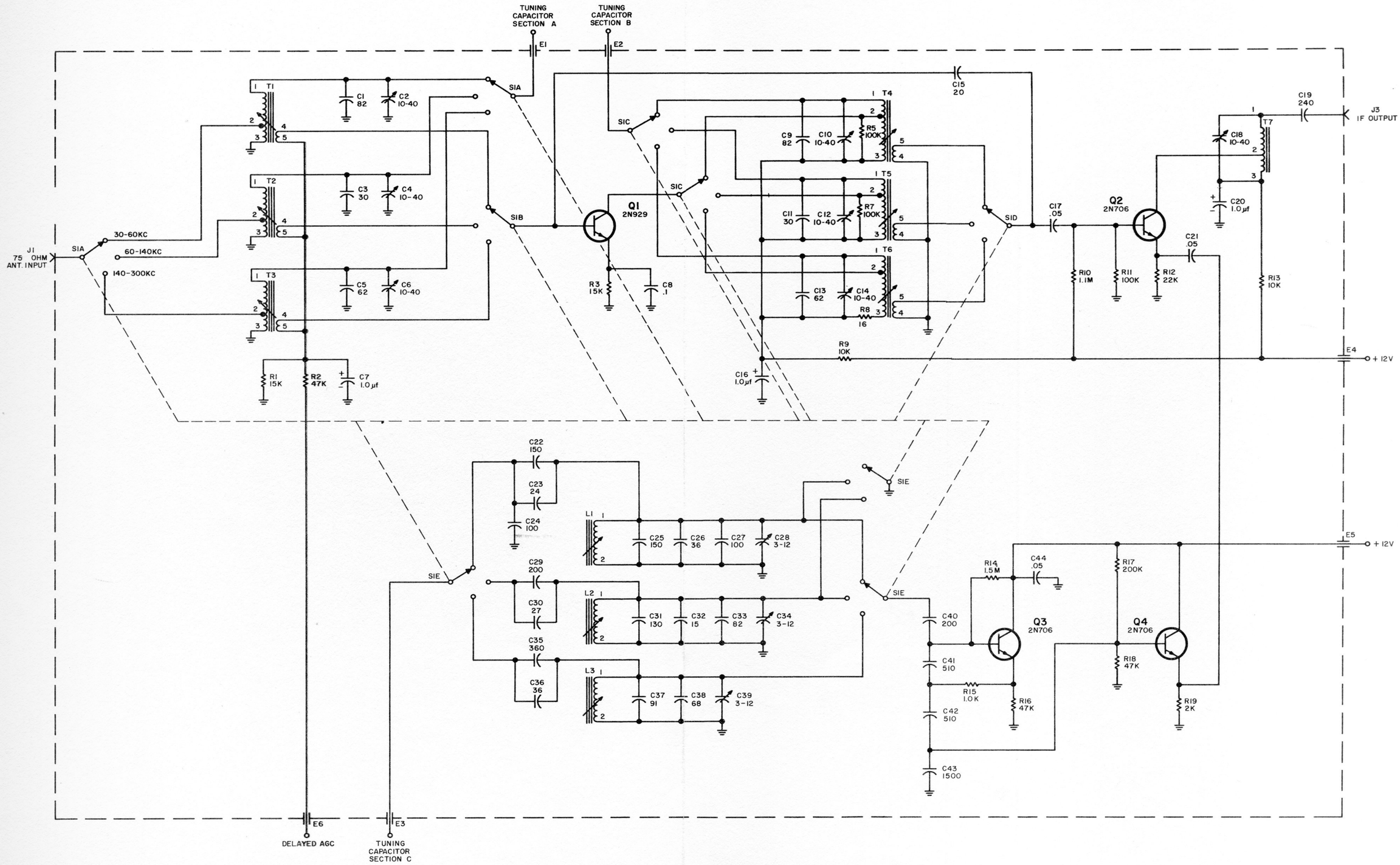


Figure 5-11. Printed Circuit Board, Part 10828, Component Locations

SECTION VI

SCHEMATICS

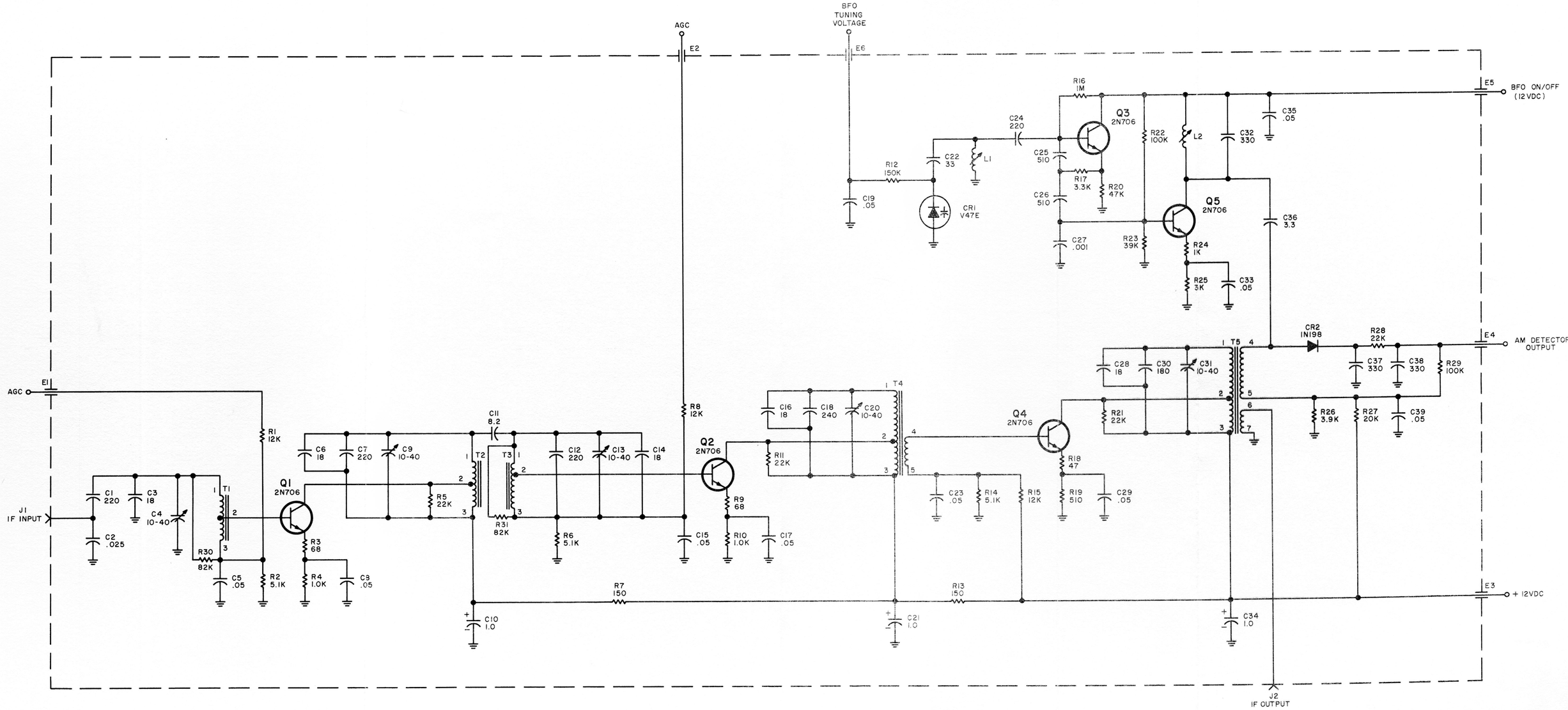
REF DESIG PREFIX A1



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ± 5%, 1/4 W.
   b) CAPACITANCE IS MEASURED IN pf.

Figure 6-1. Type 7169 RF Tuner, Schematic Diagram

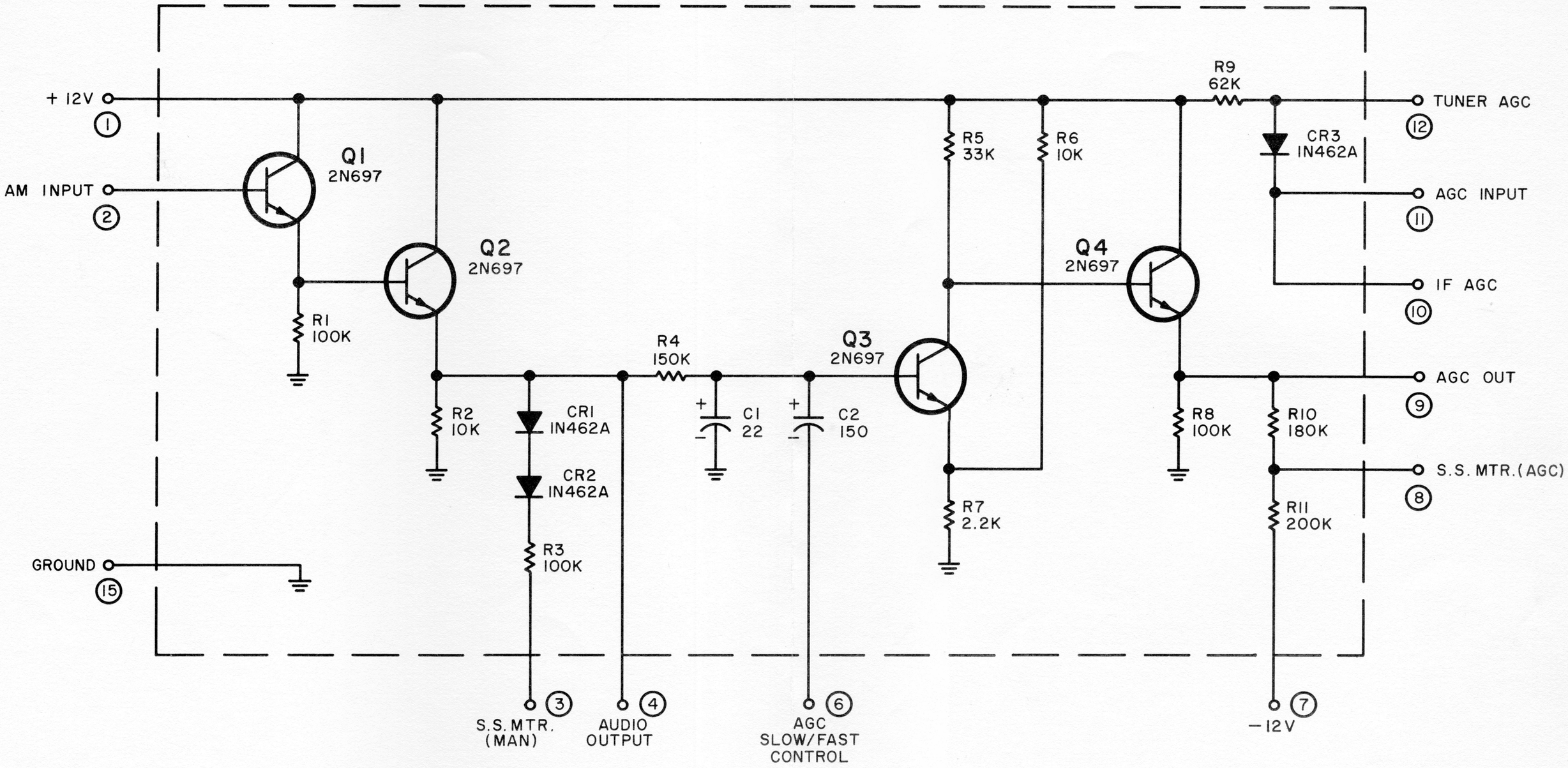
REF DESIG PREFIX A2



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN pf

Figure 6-2. Type 7247 IF Amplifier, Schematic Diagram

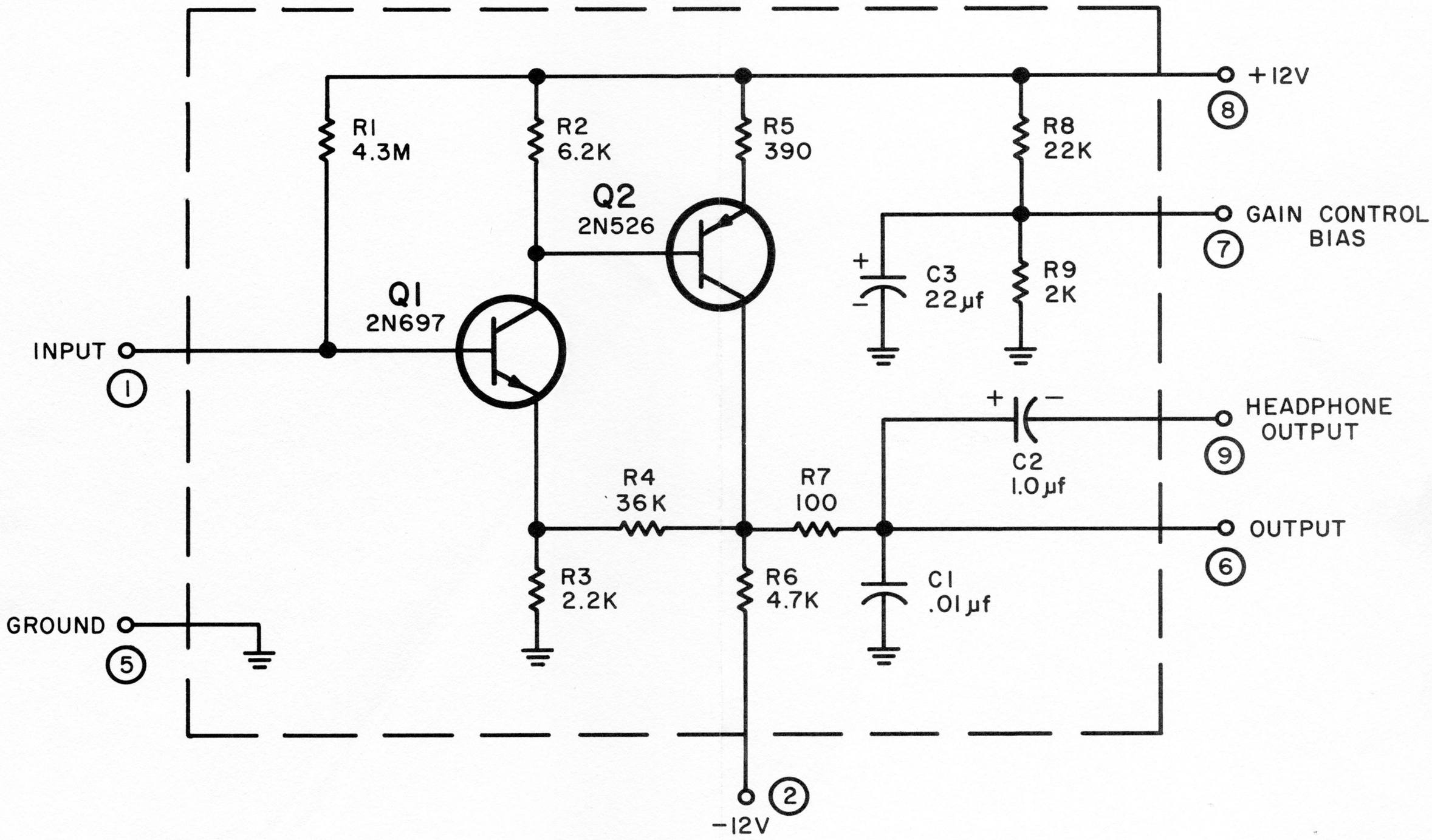
REF DESIG PREFIX A3



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ± 5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μf.

Figure 6-3. Type 7809 AGC Amplifier, Schematic Diagram

REF DESIG PREFIX A4

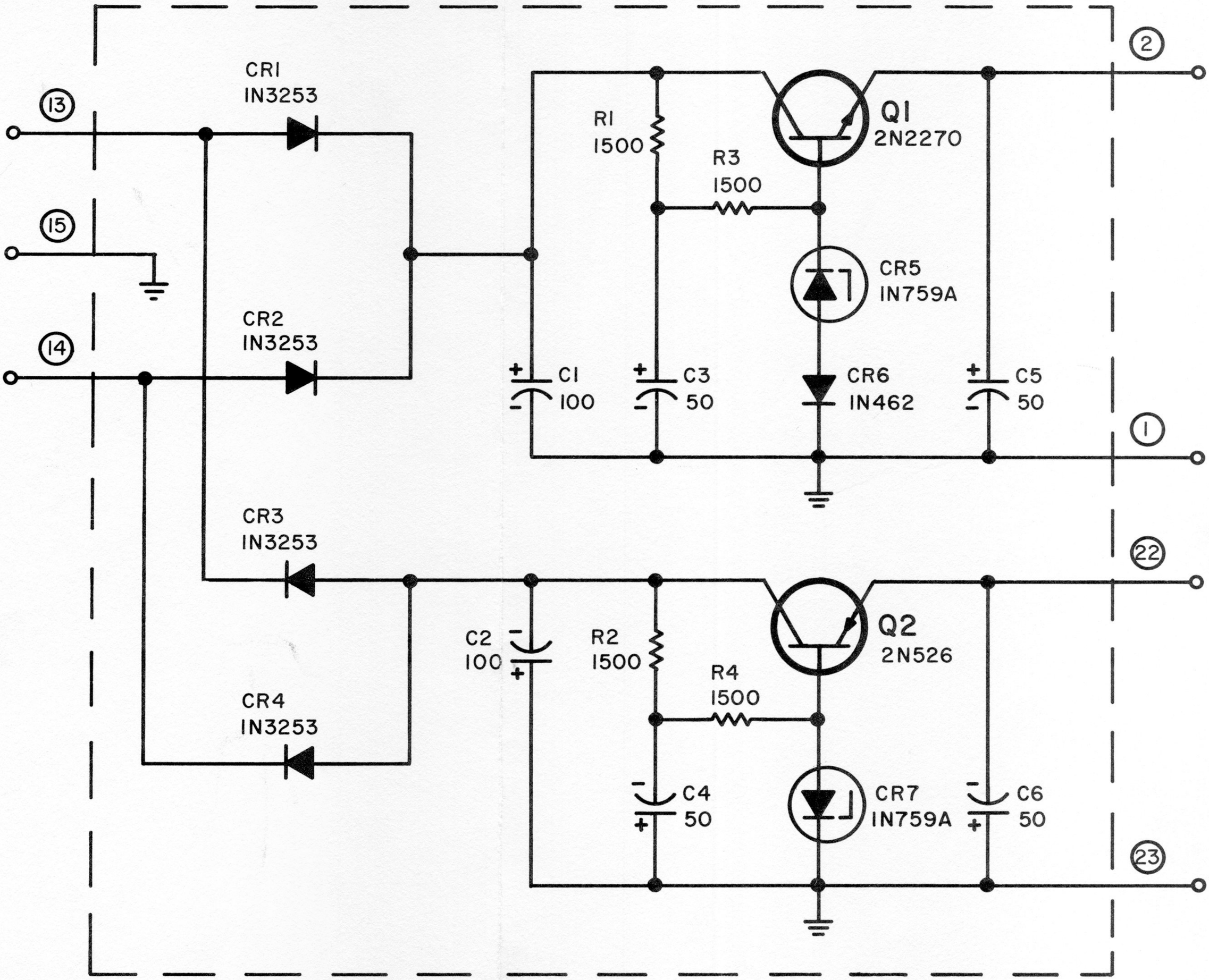


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pf.

Figure 6-4. Type 7404 Audio Amplifier, Schematic Diagram

REF DESIG PREFIX A5

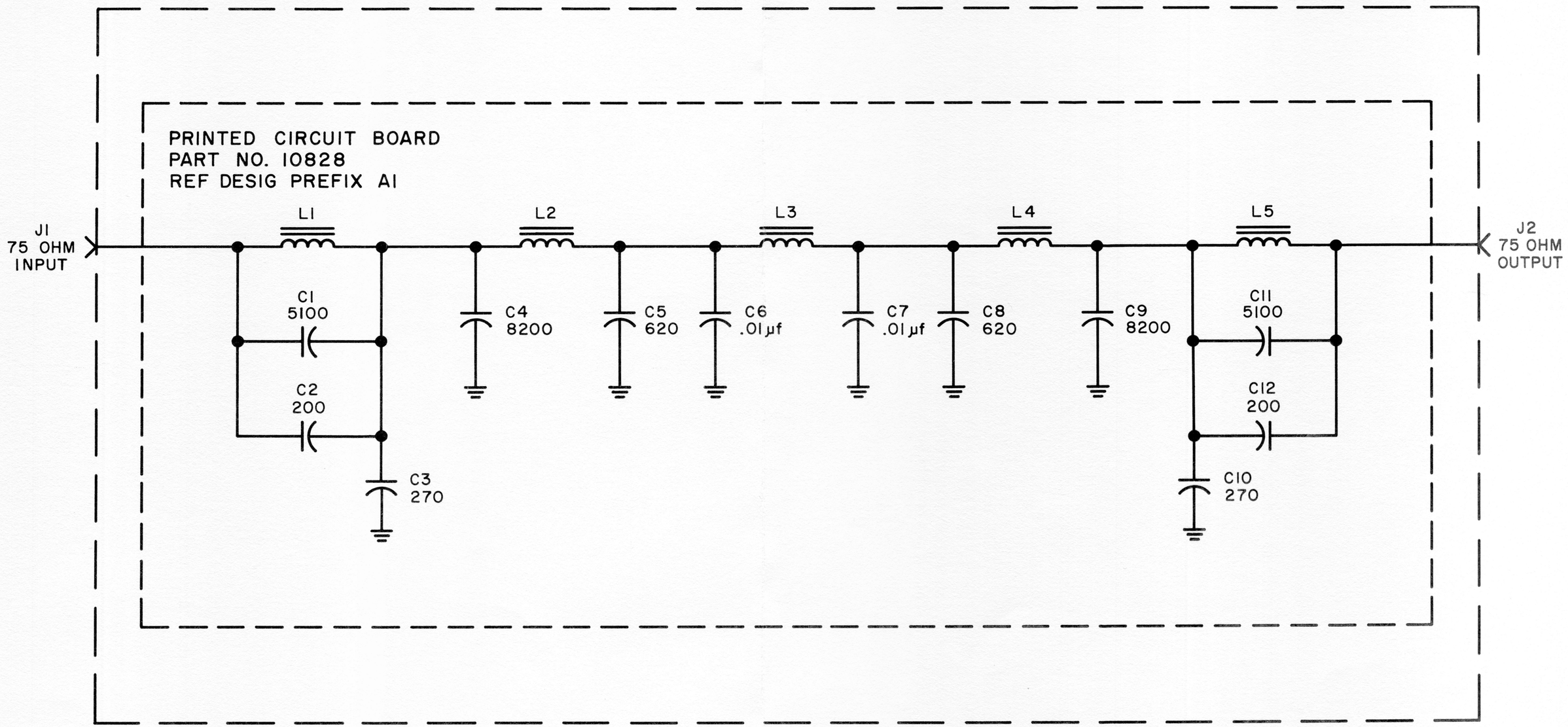


NOTES

1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, 1/4W, ±5%.
   B. CAPACITANCE IS MEASURED IN µf.
2. MODULE PIN NUMBERS ARE ENCIRCLED.

Figure 6-5. Type 7607 Power Supply, Schematic Diagram

REF DESIG PREFIX A6



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) CAPACITANCE IS MEASURED IN pf.

Figure 6-6. Type 7934 Low-Pass Filter, Schematic Diagram

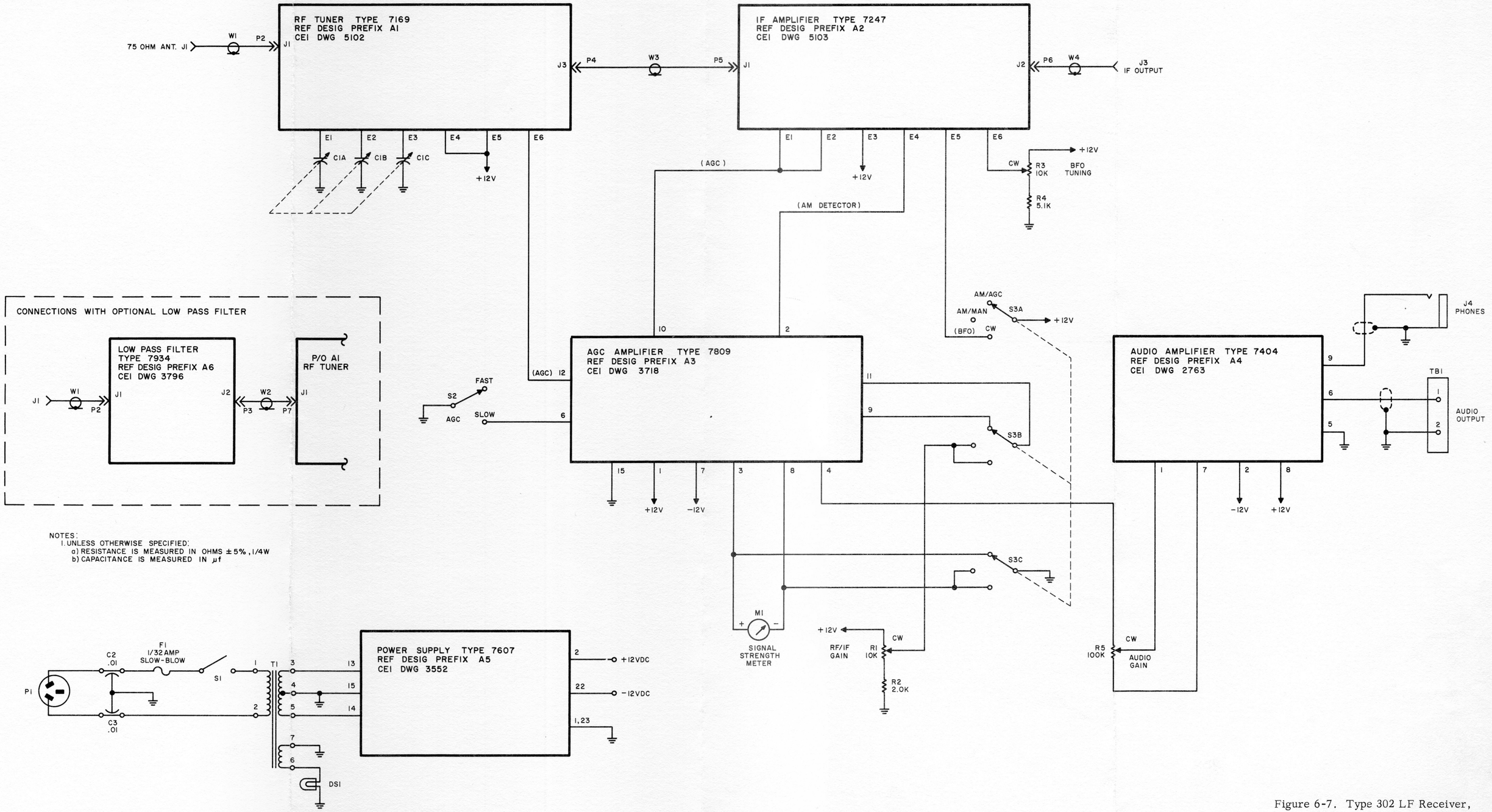


Figure 6-7. Type 302 LF Receiver, Main Chassis Schematic Diagram