TEL 2

INSTRUCTION MANUAL

FOR

TYPES 970A AND 975

RECEIVERS

-WATKINS-JOHNSON/CEI-
COMMUNICATION ELECTRONICS INCORPORATED
4908 HAMPDEN LANE, BETHESDA 14, MARYLAND • 301-654-8860

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300/3/27/64

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.

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Table 1-1. Types 970A and 975 Receivers, Specifications

Type of Reception	AM, FM, CW, or Pulse; CW available on 60 kc bandwidth only
Frequency Range	30-300 mc in two bands: Band A: 30-90 mc, Band B: 60-300 mc
Signal Inputs	Antenna input for Band A; Antenna input for Band B; Reference input for marker injection
Signal Outputs	Video output, audio output, signal monitor output, 21.4 mc IF output, local oscillator output
Noise Figure	Band A: 4.5 db, maximum, Band B: 7 db, maximum
Image Rejection	Band A: 60 db, minimum, Band B: 50 db, minimum
IF Rejection	Band A: 54 db, minimum to 40 mc, 60 db, minimum to 40-90 mc, Band B: 80 db, minimum
Oscillator Radiation at Input of Receiver	Band A: 15 μv, maximum, Band B: 15 μv, maximum to 260 mc, 25 μv, maximum, above 260 mc
Antenna Input Impedance	Band A: 50 Ω, nominal, Band B: 50 Ω, nominal
IF Bandwidth	60 kc, 300 kc, and 3 mc switchable from front panel
IF Frequencies	21.4 mc; 2.5 mc, 60 kc bandwidth only
Gain Control Characteristics	
Pulse AGC, 3-mc Bandwidth	Charge time is sufficiently short to permit pulse widths as narrow as 1 microsecond and as wide as a square wave. Discharge time is sufficiently long to operate with pulse repetition rates as low as 50 PPS.
Normal AGC	Charge time: 0.3 second, Discharge time: 0.3 second
Manual Control	All IF's
Over-all Pulse Response for 3-mc Bandwidth, Manual Operation	Rise time or decay time no greater than 0.35 μsec. Pulse sag no greater than 10% for an 800 μsec pulse width.
Sensitivity	
60-kc Bandwidth	AM: 2 μv input, modulated 50% at 1 kc rate, produces 10 db (s+n)/n, min. FM: 2 μv input, modulated at 1 kc rate with 15 kc deviation, produces 21 db (s+n)/n, min. FM Sensitivity: 0.7V per kc deviation, min. Pulse: -106 dbm tangential sensitivity, min.
300-kc Bandwidth	AM: 4 μv input, modulated 50% at 1 kc rate, produces 10 db (s+n)/n, min. FM: 4 μv input, modulated at 1 kc rate with 100 kc deviation, produces 21 db (s+n)/n, min. FM Sensitivity: 0.035V per kc deviation, min. Pulse: -99 dbm tangential sensitivity, min.
3-mc Bandwidth	AM: 13 μv input, modulated 50% at 1 kc rate, produces 10 db (s+n)/n, min. FM: 13 μv input, modulated at 1 kc rate with 750 kc deviation, produces 21 db (s+n)/n, min. FM Sensitivity: 0.007V per kc deviation, min. Pulse: -94 dbm tangential sensitivity, min.
Video Output	2V peak-to-peak across 100 Ω load
Video Amplifier Response	Within 3 db from 20 cps to 2 mc
FM Output Stability	Less than 2 db variation for inputs above 3.5 μv
AM Output Stability	Less than 10 db variation for 70 db input change above 3.5 μv
Audio Output	0.1 watt across 600 Ω, balanced or unbalanced
Signal Monitor Output Frequency	21.4 mc
Signal Monitor Output Level	4 μv at antenna input produces 50 μv at output
Signal Monitor Output Bandwidth	Compatible with CEI signal monitors to produce 3 mc display
21.4 mc IF Output	200 mv min. into 50 Ω load, available during 3-mc operation only
BFO	Tunable over ±10 kc, on 60 kc CW operation only
Local Oscillator Output	75 mv ± 25 mv across 50 Ω

Table 1-1. Types 970A and 975 Receivers, Specifications (cont.)

Carrier Operated Relay (Type 975 only)	
Sensitivity	Less than 1 μv
Range	Adjustable to operate over an input signal level range of 1 μv to greater than 500 μv
Release Time	Slow: 6 seconds, ±20%; Fast: less than 0.5 second
Output	SPDT contacts
Panel Meters	Signal strength and tuning
Dial Accuracy	Band A: 0.5%, Band B: 0.75%
Dial Resetability	Band A: 0.15%, Band B: 0.25%
Power	50-400 cps; 115V, 45 watts, approximately
Size	19-inches wide x 3.5-inches high x 16-inches deep, rack mounted

Figure 1-1. Type 970A Receiver, Front View

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

The CEI types 970A and 975 Receivers are designed for AM, FM, CW, and pulse reception in the VHF band. These superheterodyne receivers tune the range of 30 to 300 mc in two bands: 30 to 90 mc and 60 to 300 mc. Three IF bandwidths are available: 60-kc, 300-kc or 3-mc. The 60-kc IF includes a beat-frequency oscillator (BFO), and this strip must be selected when CW reception is desired. Four signal outputs are available from the receiver: a video output; a signal monitor output; a local oscillator output; and an IF output. In addition, the type 975 receiver has a COR (carrier operated relay) output. The receivers have signal strength and tuning meters, and a reference input for marker injection. Pertinent specifications for the units are included in Table 1-1; the tube and transistor complement is presented in Table 1-2.

1.2 MECHANICAL CHARACTERISTICS

A front view of the type 970A Receiver is shown in Figure 1-1.The IF BANDWIDTH switch, function switch, band switch, AGC-MAN switch, RF GAIN control, VIDEO GAIN control, AUDIO GAIN control, BFO TUNING, POWER switch, SIGNAL STRENGTH meter, TUNING meter and PHONES jack are mounted on the front panel. The COR SENSITIVITY control and COR DELAY switch are common only to the type 975 receiver. The tuning dials are calibrated in megacycles; 37 turns of the tuning knob are required to tune across the low band and 47 turns are required for the high band.

1.2.1 The rear apron of the receiver is shown in Figure 1-2. The antenna input jacks (one for each band) are type N connectors. The remaining rear apron jacks are type BNC connectors. The rear apron also contains the 1/2 AMP SLOW BLOW fuse, F1, and a power cord which is permanently connected.

1.2.2 The main chassis and front panel are constructed of aluminum as are the top and bottom dust covers. The grey front panel is overlaid with a black-anodized etched plate. The main chassis contains ten subassemblies. Five of these, the high band tuner, low band tuner, 60-kc IF strip, 300-kc/3-mc strip, and the local oscillator coupling network are built on silver-plated, gold-flashed brass chassis. The remaining five subassemblies are built on etched printed circuit boards. These are, the video amplifier, power supply, audio amplifier, AGC amplifier, and the COR amplifier (used in the 975 receiver only). The receivers are designed for mounting in a 19-inch rack. Over-all dimensions are: 19-inches wide, 3.5-inches high, and 16-inches deep.

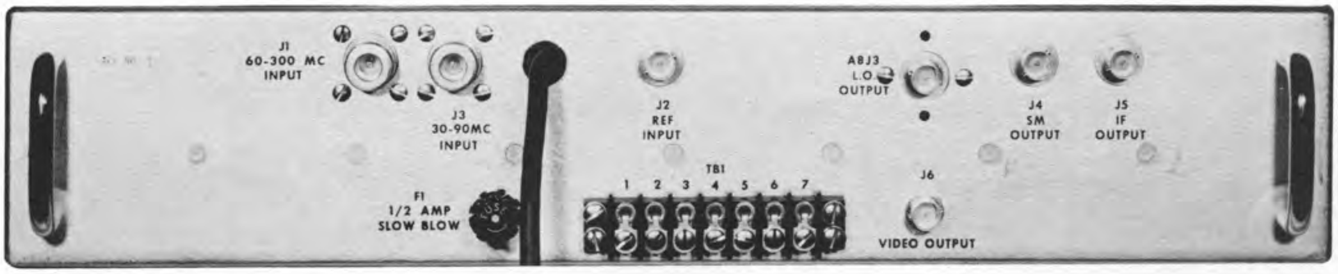


Figure 1-2. Type 970A Receiver, Rear View

Table 1-2. Types 970A and 975 Receivers, Tube and Transistor Complement

Ref. Desig.	Type	Function
	Main Chassis	
Q1	2N1544	Voltage Regulator
Q2	2N1308	Voltage Regulator
Q3	2N1700	Voltage Regulator
	30-90 mc Tuner	
A1V1	6CW4	RF Amplifier
A1V2	6CW4	RF Amplifier
A1V3	7587	Mixer
A1V4	6CW4	Local Oscillator
	60-300 mc Tuner	
A2V1	8058	RF Amplifier
A2V2	8058	RF Amplifier
A2V3	7587	Mixer
A2V4	6CW4	Local Oscillator
	300-kc/3-mc Bandwidth IF Strip	
A3Q1	2N335	Emitter Follower
A3Q2	2N335	Emitter Follower
A3Q3	2N335	Emitter Follower
A3Q4	2N335	Emitter Follower
A3V1	7587	IF Amplifier
A3V2	7587	IF Amplifier
A3V3	7587	IF Amplifier
A3V4	7587	Limiter
A3V5	7587	Limiter
A3V6	7587	IF Amplifier
A3V7	7587	IF Amplifier
A3V8	7587	IF Amplifier
A3V9	7587	Limiter
A3V10	7587	Limiter

Ref. Desig.	Type	Function
	60-kc Bandwidth IF Strip	
A4Q1	2N335	Emitter Follower
A4Q2	2N335	Emitter Follower
A4Q3	2N335	BFO
A4V1	7587	IF Amplifier
A4V2	7587	Mixer
A4V3	6CW4	18.9 mc Oscillator
A4V4	7587	IF Amplifier
A4V5	7587	Limiter
A4V6	7587	Limiter
	Video Amplifier	
A5Q1	2N335	Emitter Follower
A5Q2	2N697	Amplifier
A5Q3	2N1131	Output Amplifier
	Audio Amplifier	
A6Q1	2N335	Voltage Amplifier
A6Q2	2N335	Driver
A6Q3	2N1700	Power Amplifier
	AGC Amplifier	
A7Q1	2N697	Emitter Follower
A7Q2	2N697	Emitter Follower
A7Q3	2N697	Emitter Follower
A7Q4	2N697	Voltage Amplifier
A7Q5	2N1305	Regulator
A7Q6	2N1305	Driver Amplifier
	Carrier Operated Relay (COR)*	
A9Q1	2N335	DC Amplifier
A9Q2	2N335	DC Amplifier
A9Q3	2N697	Relay Driver

* Type 975 Receiver only

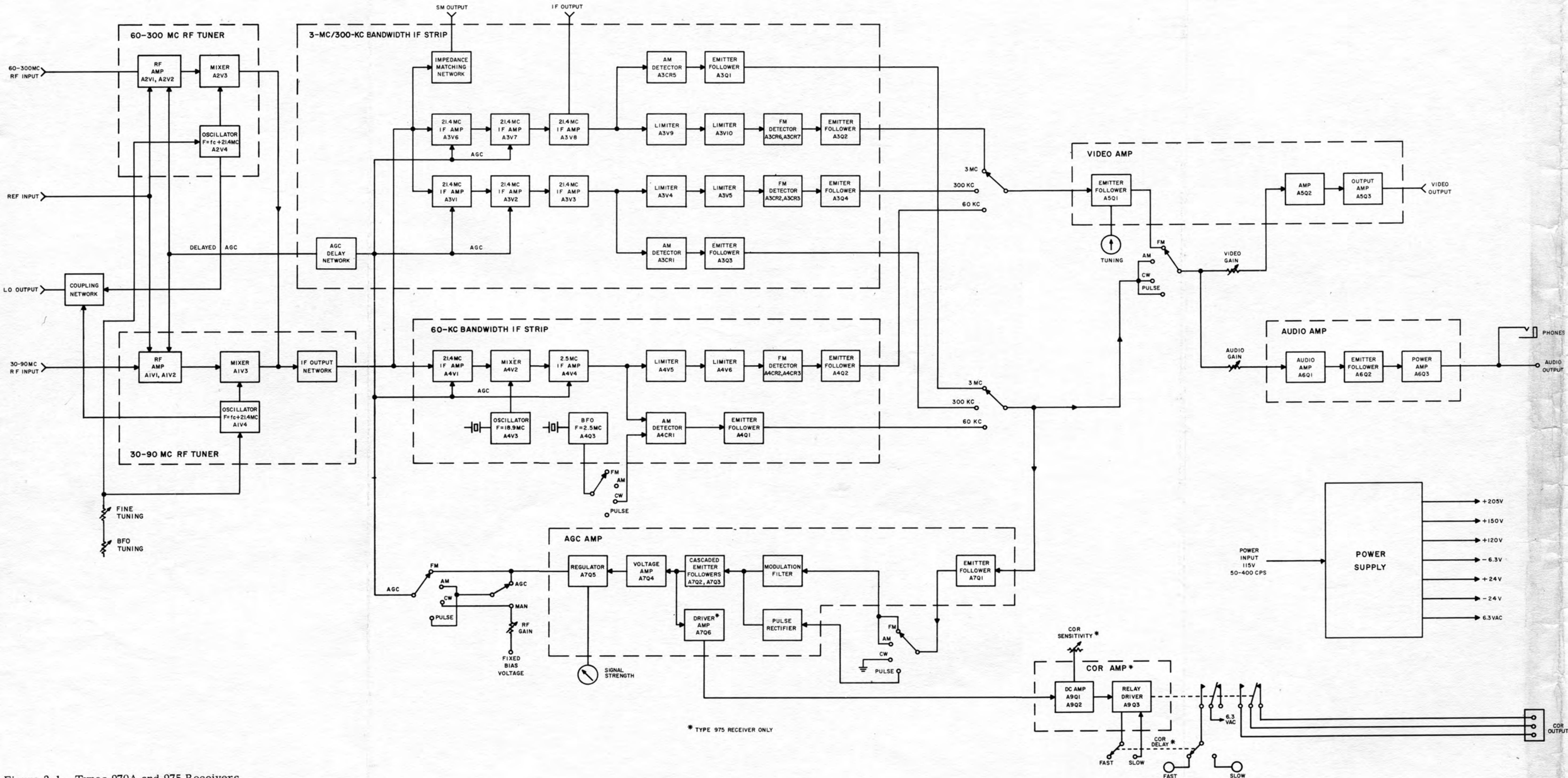


Figure 2-1. Types 970A and 975 Receivers, Functional Block Diagram

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

The operation of the various stages in the Type 970A and 975 Receivers is explained using the functional block diagram, Figure 2-1, and the schematic diagrams, Figures 6-1 through 6-12. Note that the unit numbering system is used for the electrical components which means that parts on subassemblies and modules carry a prefix before the usual class letter and number of the item (such as A1R1 and A9Q1). The subassembly prefixes are omitted on illustrations and in the text except in those cases where confusion might result from their omission.

2.2 FUNCTIONAL ANALYSIS

The type 970A Receiver is a superheterodyne type covering the frequency range of 30 to 300 mc in two bands and providing reception of AM, FM, CW, and pulse signals. The three available IF bandwidths are: 3 mc, 300 kc, and 60 kc. The receiver employs single conversion to 21.4 mc when the 3 mc or 300 kc bandwidths are in use; double conversion is used with the 60 kc IF bandwidth, first to 21.4 mc and then to 2.5 mc.

2.2.1 An incoming RF signal to the low-band tuner is amplified in A1V1 and A1V2 and applied to the mixer stage, A1V3. The local oscillator in the tuner, A1V4, operates 21.4 mc higher than the incoming RF signal. The 21.4 mc difference frequency from the mixer is connected to the IF strip in operation.

2.2.2 A signal received in the 60-300 mc range by the high band tuner passes through a cascode RF amplifier (A2V1 and A2V2) to the mixer stage A2V3. The local oscillator in the high band tuner, A2V4, operates 21.4 mc higher than the incoming signal with the oscillator output applied to the mixer stage. The 21.4-mc output from the mixer is coupled into the common IF output network located in the low-band tuner.

2.2.3 The LO OUTPUT (local oscillator output) is derived from a coupling network which is connected to the oscillators in both tuners. The BFO TUNING control changes the pitch of the CW-audio signal when in the CW mode of operation. This control funtions by varying the frequency of the local oscillator in the tuners. The REF INPUT (reference input) is loosely coupled to the RF sections in both tuners and is used to inject an external marker.

2.2.4 The 21.4 mc signal applied to the IF strip is coupled through a broadband transformer to the control grid of the IF amplifiers in operation and, through a resistive network to the signal monitor output. The front panel BANDWIDTH switch determines which IF amplifier stages are in operation. All three IF strips, when in operation, provide simultaneous AM and FM outputs to subsequent circuitry in the receiver. In addition, when the 3-mc strip is in operation, an IF OUTPUT at 21.4 mc is provided from the third IF amplifier, A3V8. The 60-kc strip must be selected for CW reception since this is the only IF strip with a BFO. The SM OUTPUT (signal monitor output) is derived from the input to the IF strip through an impedance matching network located on the 300-kc/3-mc bandwidth subassembly.

2.2.5 The 300-kc IF strip and the 3-mc IF strips are functionally analogous. Each strip provides three stages of 21.4 mc amplification after which the signal is applied both to an AM detector and to two limiter stages. The output from the AM detector is applied to an emitter follower; the output from the limiters is coupled to an FM demodulator and then to an emitter follower.

2.2.6 The 60-kc IF strip contains a single 21.4-mc IF amplifier, A4V1. The IF signal from A4V1 is heterodyned in the mixer, A4V2, with an 18.9 mc signal from the crystal controlled oscillator, A4V3. The 2.5-mc difference frequency from the mixer is amplified by A4V4, a 2.5-mc IF amplifier. The output of A4V4 is applied both to an AM detector and to limiter stages as in the 300-kc and 3-mc IF strips. When the receiver is in the CW operating mode, the 2.5-mc output from the BFO stage, A4Q3, is injected into the AM detector and beats with the 2.5-mc IF signal.

2.2.7 The FM outputs from the emitter followers in the three IF strips are connected through an IF BANDWIDTH switch section to an emitter follower, A5Q1, on the video amplifier module. If the function switch is in the FM position, the video signal from transistor A5Q1 is connected through the AUDIO GAIN control to the audio module and through the VIDEO GAIN control to a two stage video amplifier consisting of transistors A5Q2 and A5Q3. The output from A5Q3 is applied to the VIDEO OUTPUT jack. The emitter follower stage, A5Q1, is also used to operate the TUNING meter.

2.2.8 The AM-class signals (AM, CW, and Pulse) from the emitter followers in the respective IF strips are applied through one of the IF BANDWIDTH switch sections to the AGC amplifier and also to the VIDEO GAIN and AUDIO GAIN controls through one of the function switch sections.

2.2.9 The audio amplifier receives its input from the AM output of the IF strip in operation or from the emitter follower stage (A5Q1) in the video module depending on the setting of the function switch. The audio amplifier contains a voltage amplifier stage A6Q1, a driver stage, A6Q2, and a power amplifier stage, A6Q3. The audio output from the module is available at the PHONES jack on the front panel and at the rear apron terminal strip.

2.2.10 The AGC amplifier module contains an emitter follower, A7Q1, which is followed by a combination modulation filter and pulse rectifier. A cascaded emitter follower, A7Q2 and A7Q3, follows this combination network. The remaining stages, A7Q4 and A7Q5, are a voltage sensing stage and regulator respectively. The network following the input emitter follower acts as a modulation filter during AM and FM reception and the output of the AGC amplifier is a voltage which is based on the average RF carrier level. During pulse reception, the arrangement of the network is changed so that the voltage at the output of the amplifier is referenced to the amplitude of the pulses being received. The function switch disables the AGC amplifier when placed in the CW operating mode. The SIGNAL STRENGTH meter operates from the output of A7Q5. In the type 975 Receiver, the COR input is obtained from the driver amplifier A7Q6. The COR operating point can be adjusted over a wide range of RF signal levels by means of the COR SENSITIVITY control located on the front panel. When an incoming signal of sufficient strength activates the COR, a red lamp on the front panel is illuminated, a circuit is closed between terminals 5 and 7 of TB1 and opened between terminals 6 and 7. In the unactuated state, terminals 6 and 7 of the rear-mounted terminal strip are short-circuited and terminals 5 and 7 are open-circuited. The return of the COR function from an actuated to unactuated condition can be set for a FAST (less than 0.5 second) return or a SLOW (6 second) return by the front panel COR DELAY switch.

2.2.11 Either manual gain control or automatic gain control may be employed in the receiver, depending on the mode of operation. During FM reception, only AGC is available. In the AM and pulse modes, either AGC or manual gain control may be selected. In the CW mode, only manual gain control is available. Regardless of the operating mode, the gain control voltage applied to the RF amplifiers in the high and low band tuners is delayed by a network located in the wideband IF strip.

2.2.12 The self-contained power supply provides all of the necessary operating voltages for the receiver. The nominal primary power input to the receiver is 115 volts, 50-400 cps; power consumption is approximately 45 watts.

2.3 LOW BAND TUNER, 30-90 MC

The low band tuner consists of a cascode amplifier stage, V1 and V2, a mixer stage V3, and a local oscillator, V4. A schematic diagram of the tuner is shown in Figure 6-1, the reference designation prefix is A1.

2.3.1 RF Amplifier.- The RF amplifiers, V1 and V2, are type 6CW4 Nuvistor triodes. The input signal is connected to the tuner through jack J1 and an impedance matching input circuit. Inductor L3 and capacitors C7 and C8 form an IF rejection trap between the two triodes. Input tuning is accomplished by inductor L2A, one section of a four-section inductuner. Output tuning is accomplished by inductor L2B in the plate circuit of V2. The reference input signal (at a level of 1 mv or higher) is applied to the cascode amplifier through capacitor C40. Neutralization of the RF stage is achieved by feeding an out-of-phase signal from the plate to the grid of V1 through the broadband transformer T1. The gain of the RF amplifier is controlled by a delayed gain control voltage fed through capacitor C31.

2.3.2 Local Oscillator.- The local oscillator V4, is a type 6CW4 Nuvistor triode operating in a Colpitts configuration. The oscillator tank circuit is tuned by L2D, a section of the inductuner. The output, at a frequency 21.4 mc higher than the carrier signal, is coupled through capacitor C18 to the grid of the mixer stage; a second output is taken through capacitor C23 and jack J3 to a coupling network located on the main chassis. This second output from the local oscillator goes through a power splitter in the coupling network and appears at the common LO OUTPUT jack, J4, at a level of approximately 75 mv.

2.3.3 BFO Tuning Control.- The frequency of the local oscillator is varied to change the pitch of the received audio signal when the receiver is in the CW mode of operation. This action is accomplished by voltage-variable capacitor C38, which varies the shunt capacitance of the tank circuit. A voltage-variable capacitor is a semiconductor whose effective capacitance varies with the voltage across its terminals. The BFO control, R11, on the main chassis provides a variable dc voltage across resistor R18 which is applied through resistor R17 to the varicap, C38.

2.3.4 Mixer.- The low band mixer, V3, is a type 7587 Nuvistor tetrode with its input circuit tuned by inductuner section L2C. This stage heterodynes the incoming RF signal and the local oscillator signal to produce a 21.4-mc IF in the plate circuit.

2.3.5 IF Output Network.- The mixer output is through a plate circuit pi-network, which is also the output network for the high band mixer. This network is formed by variable inductor L11 as the series element with a capacitance to ground from each end of the inductor as the shunt elements. One of these capacitances is the plate-to-ground capacitance of the two mixers plus cable capacitance; the other is capacitor C44. The network is tuned to the IF frequency and is designed to transform the plate impedance of V3 in the low band tuner down to approximately 50 ohms at the output jack, J6. The IF output from the high band tuner is applied to the network through blocking capacitor, C41.

2.4 HIGH BAND TUNER, 60-300 MC

Refer to Figure 6-2 for a schematic of the high band tuner. Cascode RF stages V1 and V2, mixer stage V3, and local oscillator stage V4 are included in the tuner; A2 is used as the reference designation prefix.

2.4.1 RF Amplifier.- The high band tuner RF amplifier consist of two type 8058 ceramic triodes, V1 and V2, connected in a cascode configuration. The input signal is coupled to the grid of V1 through the input jack, J1. The nominal input impedance at J1 is 50 ohms. Tuning for the input to V1 is performed by L1A, part of a four-section inductuner. The output of V2 is coupled to the input of the mixer, V3, through the coupling network of which C14 and C16 form a part. The output from the plate circuit of V2 is tuned by L1B. Delayed AGC is applied to the grid of V1 through C35, R3, and L1A; delaying the AGC increases the dynamic range of the receiver.

2.4.2 Local Oscillator.- The local oscillator, V4 is a type 6CW4 Nuvistor triode connected in a balanced Colpitts circuit. The grid tank circuit is tuned by L2D, a section of the inductuner. The output from the oscillator is a frequency 21.4-mc higher than the RF carrier being received. One output is taken through capacitor C20 to the grid of the mixer; a second output is coupled through C22 and J4 to the common coupling network on the main chassis in the same manner as in the low band tuner (see par. 2.3.2).

2.4.3 BFO Tuning Control.- The frequency of the local oscillator is varied to change the pitch of the CW audio signal in the CW mode of operation by means of voltage-variable capacitor C44 in a similar fashion as in the low band tuner (see par. 2.3.3).

2.4.4 Mixer.- The high band mixer, V3 is a type 7587 Nuvistor tetrode. The incoming RF signal and the local oscillator signal, which are present in the grid circuit, are combined in the mixer to produce a 21.4 mc IF signal in the plate circuit. The output circuit of the RF amplifier and the mixer grid circuit form a two-section bandpass filter in which a shunt tuned circuit serves as the coupling device.

2.5 BANDSWITCHING

The tuners are placed into operation by applying the source voltages through the bandwidth S3. This is a three section, two position switch. Section S3B connects the 175 volt input to the respective tuner, placing this tuner in an operating condition. Section S3C simultaneously connects the regulated 120 volts to the same tuner. The dial light behind the respective tuning dial is illuminated by the 6.3 volts ac applied through switch section S2D.

2.6 60-KC IF STRIP

The operation of the 60-kc bandwidth IF is explained using the schematic diagram, Figure 6-4. Note that the reference designation prefix is A4.

2.6.1 21.4-mc IF Amplifier.- The input to the strip is through jack J1 which is in parallel with the input to the 300-kc/3-mc bandwidth IF strip. From jack J1 the signal is applied to the grid of the IF amplifier through broadband transformer T1. The 21.4-mc IF amplifier, V1, is a type 7587 Nuvistor tetrode connected with a double-tuned plate circuit which has a bandwidth of approximately 300 kc . The gain of the stage is varied by a gain control voltage applied through capacitor C41, resistor R1, and the secondary of transformer T1 to the control grid of the tube. The output of the first IF amplifier is coupled by capacitor C47 to the grid circuit of the mixer.

2.6.2 18.9-mc Oscillator.- The 18.9-mc oscillator, V3 uses a type 6CW4 Nuvistor triode in a crystal-controlled Colpitts configuration. The output is applied to the mixer through capacitor C6.

2.6.3 Mixer.- The mixer stage, V2, heterodynes the incoming 21.4-mc IF and the 18.9-mc oscillator signal to produce a 2.5-mc second IF. A type 7587 Nuvistor tetrode is employed in the circuit. The double-tuned mixer plate circuit establishes the bandwidth of the IF strip at 60 kc.

2.6.4 2.5-mc IF Amplifier.- The output from the mixer at 2.5-mc is amplified in V4, a type 7587 Nuvistor tetrode. The input signal is coupled through capacitor C14; the output signal is developed in a single-tuned plate circuit and coupled to the grid of the succeeding stage by capacitor C19. The gain of stage V4 is controlled by a gain control voltage applied through capacitor C41, resistor R34, and variable inductor L3.

2.6.5 Limiter Stages.- The 2.5-mc IF output from V4 is applied to V5, a type 7587 Nuvistor tetrode operating as the first limiter. A single-tuned plate circuit is used to develop the output signal which is coupled through capacitor C25 to the second limiter V6. Test point TP1, through isolation resistor R21, can be used to observe the response of the strip to this point.

2.6.6 FM Demodulator.- Demodulation of the FM carrier occurs in a Foster-Seeley type discriminator which operates from the second limiter output. Capacitance center tapping of the discriminator is used to obtain a high degree of balance unaffected by coil characteristics or tuning slug positions. The FM video output is applied to transistor Q2, which operates as an emitter follower, and then through feedthru E2 to the function switch on the main chassis.

2.6.7 AM Detector.- Diode CR6 is the AM detector. The 2.5-mc IF signal is coupled from the plate of V4 through capacitor C52 to the detector diode. Diode CR1 operates in conjunction with CR6 to form a voltage doubler. The AM video output is applied to emitter follower, Q1, and then through feedthru E1 to the function switch on the main chassis.

2.6.8 Beat Frequency Oscillator.- In the CW mode of operation, a 2.5-mc signal is injected into the AM detector through capacitor C34. This 2.5-mc signal beats with the IF frequency to produce an audible note. The pitch of the audio signal is varied by rotation of the BFO control which shifts the frequency of the local oscillator in the tuner. The BFO is placed in operation by application of plus 24 volts from switch section S4D on the main chassis. This plus 24 volts places diode CR5 in the forward direction which, in turn, applies the dc voltage to the collector of transistor Q3. The BFO is a self-regulating Colpitts oscillator; regulation is provided by connecting the collector of Q3 to the base through resistor R31. The output signal is derived from the feedback divider consisting of capacitors C36 and C37. In this mode of operation, diode CR4 is back-biased and has little effect in the circuit; but when the function switch is moved to any position other than the CW position, minus 24 volts is applied and CR4 is in the forward direction and CR5 is back-biased. When CR4 is in the forward direction, a short circuit is effectively placed across crystal Y2. If this action was not taken, crystal Y2 would be coupled to the IF strip through capacitors C36 and C34 and could cause undesirable effects in the IF response curve. Back-biasing CR5 protects transistor Q3.

2.7 300-KC IF STRIP

The 300-kc/3-mc bandwidth IF amplifiers are both constructed on the same subassembly; the schematic is shown in Figure 6-3. The 300-kc IF strip contains three 21.4-mc IF amplifiers, two FM limiter stages, an AM detector, an FM demodulator, and emitter followers for the AM and FM video outputs.

2.7.1 21.4-mc IF Amplifiers.- The input signal to the IF strip is connected to jack J1. A connection at this point through jack J2 places the input to the 60-kc IF strip in parallel with the input to the 300-kc IF strip. The SM OUTPUT is also taken off at this point through a T-pad at jack J4. Transformer T1 provides impedance transformation between the input and the grid circuits of V1 and V6. The first and second IF amplifiers, V1 and V2, employ type 7587 Nuvistor tetrodes. These stages are neutralized and are the bandwidth determining elements in the IF strip. The gain of both stages is controlled by gain control voltages fed through capacitor C43. The third 21.4-mc IF amplifier, V3, uses a type 7587 Nuvistor tetrode in a conventional voltage amplifier configuration with a double-tuned plate circuit.

2.7.2 Limiter Stages.- The amplified 21.4-mc IF signal from V3 is coupled to the grid circuit of V4, through capacitor C24. The first limiter, V4, has a single-tuned plate circuit formed by inductor L7 and capacitor C26; the output from the first limiter is applied to the control grid of the second limiter through capacitor C30. Test point TP1, through isolation resistor R19, provides a point at which the response of the stage can be observed on an oscilloscope.

2.7.3 FM Demodulator.- Diodes CR2 and CR3 are used for phase detection within the Foster-Seeley type discriminator which is driven from the plate circuit of V5. Transistor Q2, arranged in an emitter follower circuit, provides a high impedance load to the discriminator and a low impedance output through feedthru E2 to additional circuitry on the main chassis.

2.7.4 AM Detector.- The output of the third IF amplifier is applied to both the first limiter and the AM detector diode CR1. The output of the detector is a positive-going voltage which is impressed on emitter follower Q1. The AM video output is also the source of AGC voltage in the FM, PULSE/AGC and AM/AGC modes of operation.

2.8 3-MC IF STRIP

The 3-mc bandwidth IF strip consists of three 21.4-mc IF stages, two limiter stages, an AM detector, an FM demodulator, and emitter follower stages for the AM and FM video outputs. All of the tubes in the strip are type 7587 Nuvistor tetrodes; the transistors are both type 2N335. The 300-kc IF strip and the 3-mc IF strip are both constructed on the same subchassis, and the schematic diagram, Figure 6-3, includes the circuitry of both strips.

2.8.1 21.4-mc IF Amplifiers.- Stages V6, V7, and V8 are the 21.4-mc amplifiers, and the components in these stages determine the over-all bandwidth of the IF strip. The input to the first stage is in parallel with the input to the 300-kc strip from the secondary of transformer T1. The three amplifiers are all neutralized and over-coupled. The over-coupling causes a dip in the response which is filled in by a peak in the response of the front-end mixer output stage. The gain of the first two stages is controlled by gain control voltage fed through capacitor C43. The 21.4-mc IF output (available at J3) is derived from a capacitive divider, capacitors C71 and C72, in the plate circuit of V8.

2.8.2 Demodulator Circuits.- An AM detector, diode CR5, and two limiter stages, V9 and V10 follow the three IF amplifiers. The output of the limiters drives a Foster-Seeley type discriminator formed by diodes CR6 and CR7 and associated components. Emitter follower Q2 provides impedance transformation between the output of the discriminator and the FM video output. The output of the AM detector diode is a positive-going AM video signal which is also used as the AGC source. The AM video signal is taken from the emitter of Q1 through feedthru E3 to the main chassis.

2.9 VIDEO AMPLIFIER

The FM video output from the IF strip in operation is applied through IF BANDWIDTH switch section S2A to pin 1 of the video amplifier (see Figure 6-5). The video signal at pin 1 is applied to the base of transistor Q1, an emitter follower. The signal from the emitter of Q1 (in the FM mode) is developed across VIDEO GAIN potentiometer R10 through switch section S4B. From the arm of the control, the signal is coupled through capacitor C1 to the base of transistor Q2. In the AM, CW, or PULSE modes, the AM video signal from the IF strip in operation is applied through IF BANDWIDTH switch section S2B and function switch section S4B to the VIDEO GAIN control R10. The AM video signal is coupled from the arm of potentiometer R10 to the base of Q2 in the same manner as the FM video signal. Transistor Q2 is a common emitter amplifier; the output signal from Q2 is coupled to a second video amplifier stage, Q3. The signal is coupled from the collector of Q3 through resistor R9, capacitors C2 and C3, and module pin 9 to the VIDEO OUTPUT jack J6 on the rear apron of the receiver. The dc voltage at the emitter of Q1 is also used to operate the TUNING meter through module pin 3.

2.10 AUDIO AMPLIFIER

The type 7400 audio amplifier (see Figure 6-6) is contained on a separate module and uses three dc-coupled transistors Q1, Q2, and Q3. The first stage is a conventional voltage amplifier in a common emitter configuration. The input signal from the AUDIO GAIN potentiometer, R14, is applied to this stage through capacitor C1 and resistor R1. The second stage is an emitter follower used to match the high output impedance of the first stage to the low input impedance of the third stage, the power amplifier. An improvement in stability is obtained by a coupling network between the second and third stages. This coupling is made up of capacitor C2 and resistor R8 in parallel. Resistor R7 provides direct signal feedback from the first stage. Resistor R10 in the emitter lead of the output stage provides additional dc stability. The output is through transformer T1 which forms the third stage collector load.

2.11 TYPE 7800 AGC AMPLIFIER

The type 7800 AGC Amplifier is applicable to type 970A receivers with serial numbers 101-110 and type 975 receivers with serial numbers 101-103. The AGC amplifier is designed to provide a voltage during AM/AGC and FM reception which is referenced to the average carrier level. During PULSE/AGC reception, the AGC amplifier references both the amplitude of the pulses and the average carrier level. The amplifier is not used during CW reception. The reference designation prefix is A7; the schematic diagram is shown in Figure 6-7.

2.11.1 The AGC amplifier module consists of an emitter follower (Q1), followed by a combination modulation filter and pulse rectifier, a cascaded emitter follower (Q2 and Q3), a voltage sensing stage (Q4) and a regulator (Q5).

2.11.2 The input signal to the AGC amplifier is obtained from the AM output of the IF strip in operation through IF BANDWIDTH switch section S2B. As shown on the schematic diagrams of the IF strips, this signal from the AM detector in operation is positive-going and direct-coupled through an emitter follower stage. This direct coupling is preserved in the AGC amplifier. The input signal enters the module on pin 1 and is applied to the base of transistor Q1, which is used as an emitter follower. If the function switch is in the AM or FM position, resistors R4 and R5, in conjunction with capacitors C1 and C2, form a modulation filter which removes the modulation and allows subsequent circuitry to operate from the average carrier level. In the PULSE mode, function switch section S4A connects diode CR1 across resistor R4. Under these conditions, R4 rectifies the incoming pulses and capacitors C1 and C2 become the rectifier load. In the CW position, the function switch connects the output of Q1 to ground through resistor R9 located on the main chassis.

2.11.3 The modulation filter is followed by a cascaded emitter follower, Q2 and Q3, which provides a very high-impedance load for the filter. The emitter of Q3 is dc coupled to the base of the succeeding stage through resistor R8. Under conditions of no signal input to the receiver, the voltage input to the AGC amplifier is near zero and, due to direct-coupling through stages Q1-Q3, transistor Q4 is biased to cut-off by a voltage divider network in the emitter circuit. The stage will not begin to conduct until the incoming RF signal causes a positive-going voltage at the AM detector output (subsequently reflected through Q1, Q2, and Q3) which is sufficinetly large to overcome the bias on Q4. When Q4 is turned off, the collector voltage approaches the source voltage.

2.11.4 Current flows at all times through zener diodes CR2 and CR3 through one of two paths. When Q4 is turned off, the flow is between the plus 24 and minus 24 volt sources. When Q4 is conducting, the flow is through Q4. As a result of the voltage developed across the zener diodes, stage Q5 is biased off when stage Q4 is off and is turned on when the collector voltage of Q4 falls as the stage goes into conduction.

2.11.5 When stage Q5 is biased off, as is the case when no signal is applied to the receiver, the AGC voltage output at pin 17 of the module is almost zero. When a very strong signal is applied to the receiver, stage Q5 will conduct and the voltage developed across emitter resistor R19 (and applied to pin 17) exceeds the voltage that would be required to cutoff gain-controlled stages in the tuners and IF strips. Resistors R22, R23, R24, and R25 in conjunction with capacitors C8 and C9 form a second modulation filter in the output of Q5. During pulse operation, switch S4C grounds pin 16 which removes resistor R25 from the filter and increases the filtering on pulse signals. The signal strength meter operates from the output of Q5 through resistor R21, and module pin 18. In the early type 975 Receivers, the same current which operated the signal strength meter also operated the COR circuitry.

2.12 TYPE 7811 AGC AMPLIFIER

The type 7811 AGC amplifier module is used in type 970A receivers with serial numbers above 110 and in type 975 receivers with serial numbers above 103. The AGC amplifier is designed to provide a voltage during AM and FM reception which is referenced to the average carrier level. During pulse reception, the AGC amplifier references both the amplitude of the pulses and the average carrier level. The amplifier is not used during CW reception. The reference designation prefix is A7; the schematic diagram is shown in Figure 6-8.

2.12.1 The AGC amplifier module consists of an emitter follower (Q1), followed by a combination modulation filter and pulse rectifier, a cascaded emitter follower (Q2 and Q3), a voltage sensing stage (Q4), a regulator (Q5), and a driver-amplifier (Q6).

2.12.2 The input signal to the AGC amplifier is obtained from the AM output of the IF strip in operation through IF BANDWIDTH switch section S2B. As shown on the schematic diagrams of the IF strips, this signal from the AM detector in operation is positive-going and direct-coupled through an emitter follower stage. This direct coupling is preserved in the AGC amplifier. The input signal enters the module on pin 1 and is applied to the base of transistor Q1, which is used as an emitter follower. If the function switch is in the AM or FM position, resistors R4 and R5, in conjunction with capacitors C1 and C2 form a modulation filter which removes the modulation and allows subsequent circuitry to operate from the average carrier level. In the PULSE mode, function switch section S4A connects diode CR1 across resistor R4. Under these conditions, R4 rectifies the incoming pulses and capacitors C1 and C2 become the rectifier load. In the CW position, the function switch connects the output of Q1 to ground through resistor R9 located on the main chassis.

2.12.3 The modulation filter is followed by a cascaded emitter follower, Q2 and Q3, which provides a very high-impedance load for the filter. The emitter Q3 is dc coupled to the base of the succeeding stage through resistor

R8. Under conditions of no signal input to the receiver, the voltage input to the AGC amplifier is near zero and, due to the direct coupling through stages Q1-Q3, transistor Q4 is biased to cutoff by a voltage divider network in the emitter circuit. The stage will not begin to conduct until the incoming RF signal causes a positive-going voltage at the AM detector output (reflected through the direct-coupled emitter follower) which is sufficiently large to overcome the bias on Q4. When Q4 is turned off, the collector voltage approaches the source voltage.

2.12.4 Current flows at all times through zener diodes CR2 and CR3 through one of two paths. When Q4 is turned off, the flow is between the plus 24 and minus 24 volt sources. When Q4 is conducting, the flow is through Q4. As a result of the voltage developed across the zener diodes, stage Q5 is biased off when stage Q4 is off and is turned on when the collector voltage of Q4 falls as the stage goes into conduction.

2.12.5 Stage Q5 is biased off by Q4 when no signal appears at the input of the receiver or when the input is too small to produce a voltage that will overcome the bias developed across the emitter resistors of Q4. When Q5 is turned off due to a small signal input, the input of the SIGNAL STRENGTH meter is obtained from the output of Q6 across resistor R28. The input to the COR (type 975 Receiver) is likewise obtained from the output of Q6 through resistor R29, for small signal inputs. When a stronger signal is applied to the receiver, stage Q5 will conduct and the voltage developed across emitter resistor R19 (and applied to pin 17) exceeds the voltage that would be required to cutoff gain controlled stages in the tuners and IF strips. Resistors R22, R23, R24, and R25 in conjunction with capacitors C8 and C9 form a second modulation filter in the output of Q5. During pulse operation, switch S4C grounds pin 16 which removes resistor R25 from the filter and increases the filtering on pulse signals. For signal inputs above the AGC threshold, the SIGNAL STRENGTH meter receives its input from Q5 through resistor R21. The COR (type 975 Receiver) receives its input from Q5 through resistor R30 and module pin 6.

2.13 OVER-ALL GAIN CONTROL SYSTEM

The over-all system of gain control for the receiver is shown in the functional block diagram, Figure 2-1, and can also be determined from the main chassis schematic diagrams, Figures 6-11 and 6-12. The gain control voltage to the low and high band tuners is delayed by a network, which includes zener diode A3CR4, located on the 300-kc/3-mc IF chassis.

2.13.1 CW, PULSE/MAN or AM/MAN Reception.- With the function switch in the CW mode, or the AM or PULSE modes with the AGC switch in the MAN position, the gain control voltage used in the receiver is derived from the arm of RF GAIN potentiometer R8.

2.13.2 Pulse Reception with AGC.- During pulse reception with AGC, the AGC amplifier provides a peak-type AGC which is referenced to the amplitude of the received pulses through module pin 17.

2.13.3 FM or AM/AGC Reception.- During reception in the FM or AM/AGC modes, the AGC amplifier provides average-type AGC which is referenced to the RF carrier level through module pin 17.

2.14 LOCAL OSCILLATOR COUPLING NETWORK

A common local oscillator output from the tuner in operation is provided on the rear apron of the receiver (LO OUTPUT, A8J3). This output jack is connected through a resistive network to the local oscillator output signal from each tuner (see the schematic diagrams, Figures 6-11 and 6-12). The local oscillator output from the 60-300 mc tuner is connected from A2J4 to A8J2; the 30-90 mc tuner oscillator output is connected from A1J3 to A8J1. The mixing pad is formed by resistors R1 through R5 in the coupling network.

2.15 CARRIER-OPERATED RELAY

The COR circuitry (not used in the type 970A Receiver) consists of a plug-in COR amplifier and a relay mounted on the main deck. Refer to the schematic diagrams, Figure 6-10 and 6-12. The COR amplifier is a CEI type 7500; the reference designation prefix is A9.

2.15.1 The first two stages in the amplifier, Q1 and Q2, form a dc amplifier. The third stage, Q3, is a combination switch, relay driver, and time delay network. In the absence of a carrier, Q1 and Q2 conduct to saturation and hold Q3 biased to non-conduction. In the presence of a carrier, a negative-going voltage is developed at the output of the AGC amplifier. The current produced by this voltage returns to ground through the input of the module. This current turns off Q1 and Q2 which turns on Q3 and actuates the relay.

2.15.2 The COR SENSITIVITY control, R15, sets the level of input current which flows in the absence of a carrier. Thus, adjusting R15 fixes the level of negative control current (and hence the carrier level) required to turn off Q1.

2.15.3 It is possible to delay the return of the relay to the unactuated state following the disappearance of a carrier. When the COR DELAY switch, S6 is in the SLOW mode, capacitor C3 is connected between the collector of Q3 and the junction of the diodes CR4 and CR5. When Q3 conducts, C3 is discharged through CR5. When the carrier disappears, Q1 and Q2 conduct and the voltage at the collector or Q2 falls rapidly which would tend to simultaneously turn Q3 off. But capacitor C3 is now connected through diode CR4 between the collector and the base of Q3 forming a capacitance-multiplier circuit. The return of Q3 to the non-conducting state is therefore delayed about six seconds in accordance with the time constant formed by resistor R6 in series with relay K1 winding and the capacitance of C3 multiplied by the Beta of Q3. In the FAST mode, C3 is removed from the circuit by switch S6.

2.16 POWER SUPPLY

The power supply is shown on the main chassis schematic, Figures 6-11 and 6-12. All of the necessary voltage sources to operate the receiver are furnished by the power supply. Switch S1 applies input power to the primary winding of transformer T1 through fuse F1. There are four secondary windings on T1 which function as follows: the 9-10 winding operates the filaments and is the source for the dial lights; the 6-7-8 winding drives two full-wave rectifiers which ultimately furnish plus 24 volts regulated and minus 24 volts regulated; the 3-4-5 secondary operates into a full-wave rectifier from which the 205-volt, 175-volt, and 120-volt supplies are derived; and the 11-12-13 winding powers a full-wave rectifier from which the -6.3 volt regulated source is derived. Rectifiers CR5 and CR6 provide full-wave rectification of the ac voltage present at the 6-7-8 secondary winding. The output of this rectifier is filtered and then regulated at plus 24 volts by the combined action of transistor Q3 and zener diode CR13. A second rectifier operating from this winding provides a minus 24 volt regulated source in conjunction with transistor Q2 and zener CR11 in a similar fashion. The output of the full-wave rectifier (CR3 and CR4) operating from the 3-4-5 winding is applied to a capacitance input filter; the output of the filter is 205 volts. Zener diode CR10 in series with resistor R4, provides a regulated 120-volt source from the 205 volt supply. The minus 6.3 volt source is regulated by transistor Q1 and zener CR9, which are connected at the output of the full-wave rectifier formed by CR1 and CR2.

SECTION III

INSTALLATION AND OPERATION

3.1 INSTALLATION

The types 970A and 975 Receivers are designed for installation in a standard 19-inch rack. They require 3.5-inches of vertical space and will project 15.5-inches back into the rack. Adequate ventilation should be provided for proper operation and unnecessary aging of components.

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 three-to-two pin adapter provided.

3.1.2 Antenna Connections.- Connect the low band antenna (30-90 mc) to the 30-90 MC INPUT jack J3. Connect the high band antenna (60-300 mc) to the 60-300 MC INPUT jack J1.

3.1.3 Signal Monitor Connection.- Connect the signal monitor input to the SM OUTPUT jack J4, using a 50-ohm coaxial cable.

3.1.4 Video Output.- The video output signal is available at the VIDEO OUTPUT jack J6 on the rear apron.

3.1.5 Local Oscillator Output.- The local oscillator signal from the tuner in operation appears at the LO OUTPUT jack A8J3 at a level of approximately 75 mv.

3.1.6 Reference Signal Input.- A reference signal, at a level of 1 mv or higher, can be injected into the RF amplifier in operation through the REF INPUT jack J2.

3.1.7 IF Output Signal.- A 21.4-mc IF output signal is available at the IF OUTPUT jack J5, when the receiver is operating with the 3-mc bandwidth IF strip.

3.1.8 Audio/COR Output.- A 3.2-ohm audio output is provided at terminals 2 and 3 of TB1, and a 600 ohm audio output between terminals 1 and 3. The COR output from type 975 receivers is obtained on terminals 5, 6, and 7 of TB1.

3.2 OPERATION

The operating controls on the front panel of the receiver are described in the following paragraphs. These controls are shown in Figure 1-1.

3.2.1 Tuning Control.- Set the bandswitch to the 30-90 MC or the 60-300 MC position depending on the frequency to be received. A lamp will light behind the tuning dial corresponding to the band selected. The tuning controls may each be preset, allowing rapid switching between two RF carriers in different bands.

3.2.2 Bandwidth Selector.- The IF BANDWIDTH switch removes B-plus voltages from the IF strips not in use and applies B-plus sources to strip which has been selected. Set this switch to select the desired IF bandwidth. When searching for a signal, it is advisable to use the 3-mc bandwidth until the signal is located. Also since only the 60-kc strip contains a BFO, this strip must be used for CW reception.

3.2.3 Gain Control Mode Switch.- The MAN/AGC toggle switch is used to select the system of gain control when the receiver function switch is in the AM or PULSE positions. Under these conditions, if the toggle switch is moved to MAN, the gain of various stages in the receiver is under control of the RF GAIN potentiometer. When in the AGC position, the gain of these stages is automatically controlled by circuits within the receiver. The switch may be in either position when the function switch is in the FM or CW positions since internal circuitry provides that automatic gain control functions during FM reception and manual gain control is always in use during CW reception.

3.2.4 Function Switch.- Set the function switch to either FM, AM, CW, or PULSE as desired before the receiver is tuned. If the CW position is selected, the 60-kc bandwidth IF strip must also be selected and the gain must be manually controlled by the RF GAIN control. If the AM or PULSE positions are selected, and the MAN/AGC switch is in the MAN position, the gain of the receiver must be manually controlled with the RF GAIN control.

3.2.5 RF Gain Control.- When the receiver is adjusted for the reception of CW signals, or AM or pulse signals with manual gain control, the gain of the receiver must be adjusted with the RF GAIN control. Clockwise rotation of the control will increase the gain of the receiver.

3.2.6 Video Gain Control.- Adjust the VIDEO GAIN control for the desired amplitude of the video output signal present at jack J6.

3.2.7 BFO Tuning Control.- The BFO TUNING control varies the frequency of the local oscillator in the tuners to change the pitch of the CW-audio signal when in the CW mode of operation. The control should be normally set at mid-range and then adjusted during reception to increase or decrease the pitch of the beat note as desired.

3.2.8 Power Switch and Fuse.- The toggle switch marked ON/POWER controls the ac input to the receiver. The fuseholder on the rear apron contains a 1/2-ampere slow-blow fuse which fuses the primary winding of the power transformer.

3.2.9 Tuning Meter.- The TUNING meter indicates the relative position between the incoming signal and the center of the receiver. The meter operates from the discriminator output of the IF strip in use.

3.2.10 Signal Strength Meter.- The SIGNAL STRENGTH meter indicates the relative magnitude of the carrier received in AM, FM, and pulse operations. The meter is not calibrated in any specific units.

3.2.11 COR Sensitivity Control.- (Type 975 Receiver only) The front panel COR SENSITIVITY control (R10) is used to obtain COR operation at the desired carrier level. One of the two indicators built into the COR DELAY push-button switch will be illuminated when the COR is activated. Clockwise rotation of the control increases the sensitivity.

3.2.12 COR Delay Switch.- The COR DELAY push-button switch serves to control the length of time the COR function remains operated after the activating signal disappears and also to indicate when the COR is operated. The switch is a locking type which reverses modes each time it is depressed, alternately changing from FAST release to SLOW release. When the COR activates, one of the two lamps in the push-button switch will light. This action tells the operator that the COR is activated and also which release time is in effect.

SECTION IV
MAINTENANCE

4.1 GENERAL

Type 970A Receiver has been carefully designed so that it will operate for long periods of time with little more than routine maintenance. Should trouble occur, it is important that maintenance personnel be familiar with Section II, in which the circuits are described. In addition, they should refer to Figure 5-1 through 5-20 where the component locations are shown; to the schematic diagrams, Figures 6-1 through 6-12; and to Tables 4-1 and 4-2, the tube, transistor, and module pin socket voltages.

CAUTION

All maintenance work within this receiver should be kept to a minimum and performed only by trained and experienced personnel. The placement of components and the dress of leads in the equipment (especially within the RF tuners) have been carefully engineered to give optimum performance. In replacing any components, great care should be exercised to duplicate the exact physical layout of the original assembly.

4.2 MAINTENANCE OF GEAR TRAINS AND TUNING DIALS

The gear train mechanisms use friction drive and rely on the stops of the inductuners to halt the turning. The tuning dials are rigidly attached to their shafts and are geared to the tuners in a manner such as to make it quite unlikely they will ever get out of position. However, if it becomes necessary to mechanically realign either dial follow these steps:

(1) Release the Allen head setscrews on each side of the coupling between the gear train shaft and the inductuner shaft.
(2) Rotate the inductuner shaft to maximum clockwise position.
(3) Turn the dial until the hairline is at the first mark above 91, in the case of the low band dial, or at the first mark above 300, in the case of the high band dial.
(4) Tighten the coupling between the gear train and the inductuner shaft.
(5) Check the operation by turning the tuning crank counter-clockwise until the inductuner no longer turns. The dial should read at the mark just beyond 30 in the case of the low band tuner, and just beyond 60 in the case of the high band tuner.

4.3 PLUG-IN MODULES

The modules used for the video amplifier, AGC amplifier, and the audio amplifier can be easily removed by pulling them 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 diagrams, Figures 6-11 and 6-12 at the points where the connecting leads pass through the lines outlining each module on the schematic. For example, the output from the audio amplifier to the PHONES jack is through pins 11 and 13 of the receptacle into which the audio amplifier module is plugged.

4.4 TROUBLESHOOTING

Most troubles will be caused by failures of the fuse, tubes, or diodes. The proper functioning of all these parts should be assured either by test or by replacement with parts known to be good before any further troubleshooting is carried out. After the above measure has been carried out, initial troubleshooting should be directed toward localizing the problem to a specific portion of the receiver. In the case of the plug-in modules, a quick check can be made by simply plugging in a new module known to be good. Another procedure which should be considered for localizing troubles is to feed in a signal at the antenna jack and then check the signals present at each test point. To this end, it is desirable that all maintenance personnel familiarize themselves with the alignment procedures, even if an alignment is not required, because those procedures include methods of checking performance which may help in analyzing the cause of the trouble. In addition, be certain that the power supply is functioning normally before any other circuit is suspected.

4.5 ALIGNMENT INSTRUCTIONS

The alignment procedures in this book are suitable for performance in the field when making periodic performance checks, or when making adjustments after replacing tubes or components. Only those controls specifically referred to within a series of steps given for aligning a particular circuit affect the work in 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 their use. If the limits and tolerances specified in the following steps cannot be obtained during a field alignment, a factory alignment is necessary. Allow several minutes for warm-up before beginning the work.

4.5.1 Use of Marker During Alignment.- A post-detection type of marker adder is recommended, and the alignment procedures in this book assume that one is to be used. However, if such a marker adder is not available, the marker generator output should be loosely coupled to the sweep generator output. This can be done by connecting the marker signal source to a turn or two of insulated wire wrapped around the sweep generator lead near the point of connection to the circuit under test, or by coupling to the sweep generator lead through a small capacitor. To insure that the addition of the marker is not affecting the response curve, disconnect the marker generator and observe that no change in the curve's shape or symmetry occurs.

4.5.2 Use of Oscilloscope During Alignment.- The vertical and horizontal amplifier inputs on the oscilloscope should be set in the dc coupled mode. The dc component of the signal on the vertical input should be cancelled out by applying an equal voltage to the unused vertical differential scope input, since the dc component sometimes makes it impossible to center the signal vertically. Otherwise it will sometimes be necessary to use the ac coupled mode. A low-capacity shielded cable should be used to connect to the oscilloscope, and the shield should be grounded as closely as possible to the point to which the center conductor is connected.

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

(1) Oscilloscope, Tektronix Type 503
(2) VTVM, RCA Type WV-98B
(3) Signal Generator, Hewlett-Packard 606A
(4) Sweep Generator, Telonic Model HD-1A
(5) Signal Generator, Hewlett-Packard 608D
(6) Assorted cables, connectors, attenuation pads and alignment tools

4.6 60 KC IF ALIGNMENT

The 60-kc IF strip alignment is given in the following paragraphs.

4.6.1 Initial Settings.- The following steps should be performed before beginning the alignment.

(1) Set the receiver function switches to AM/MAN mode: BANDWIDTH switch to 60 KC.
(2) Disconnect IF strip from RF tuners by removing P12 from A3J1.
(3) Set oscilloscope horizontal sensitivity to 0.5 volt per centimeter.
(4) Connect VTVM to AGC line at A4C1 and adjust RF GAIN control for an indication of -1.5 volts on the VTVM.

4.6.2 Discriminator Alignment.- Proceed as follows:

(1) Remove tube V5.
(2) Remove bottom cover from the IF strip.
(3) Set up the equipment as shown in Figure 4-1.
(4) Adjust sweep generator output to display an S-curve response on the scope.
(5) Set signal generator to give an accurate 2.5-mc marker.
(6) Adjust L6 for amplitude symmetry of the S-Curve and L7 for zero crossing of the S-curve at 2.5-mc. If necessary, adjust the physical position of L7 in the mounting slot to give the correct peak-to-peak separation of the S-curve. A typical response is shown in Figure 4-2.
(7) Replace tube V5.

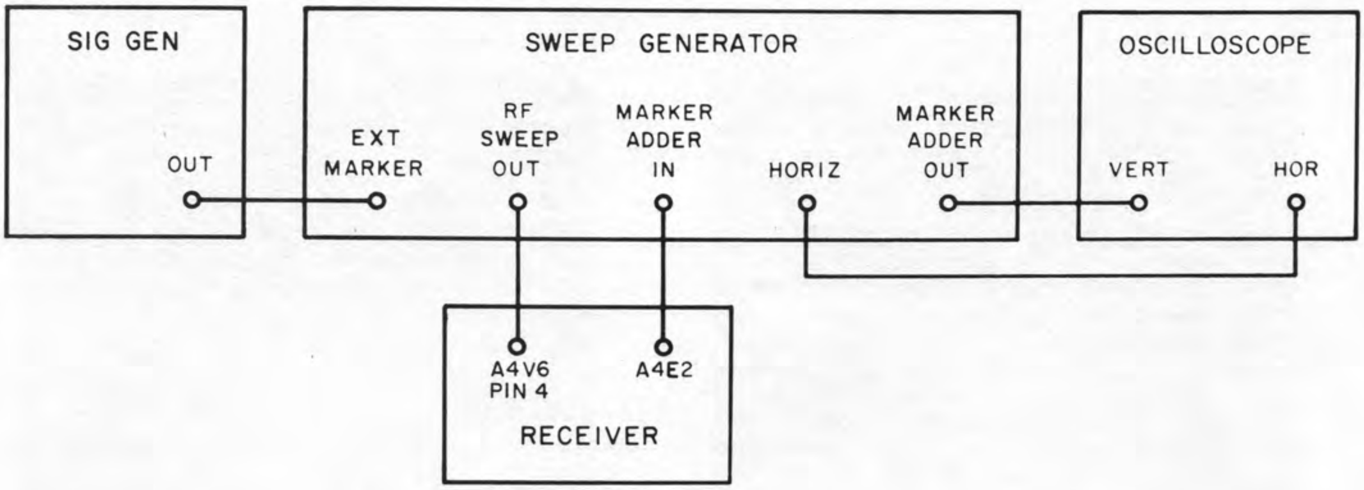


Figure 4-1. Equipment Setup, Receiver Alignment

4.6.3 V5 to V6 Interstage Alignment. - Proceed as follows:

(1) Remove tube V3.
(2) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to V5 pin 4 and the marker adder input to TP1.
(3) Adjust the sweep generator until a response curve is displayed on the oscilloscope screen.
(4) Adjust L5 for a single-peak response centered at 2.5 mc.

4.6.4 V2 to V5 Interstage Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to V4, pin 4 and the marker adder input to E1.
(2) Adjust L4 for a single-peak response centered at 2.5-mc.
(3) Move the sweep generator output to V2, pin 4.
(4) Adjust L2 and L3 for a single-peak response centered at 2.5-mc.

4.6.5 Over-all 60-kc Alignment. - Proceed as follows:

(1) Replace tube V3.
(2) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to the SM OUTPUT jack J4 on the rear apron of the receiver, and the marker adder input to E1.
(3) Adjust L1 and L9 for a single-peak response centered at 21.4-mc.
(4) Replace bottom cover.
(5) Readjust L1 and L9 for a symmetrical, single peak response centered at 21.4-mc, with a 3-db band-width of 60 kc. Readjust L2, L3 and L4 if necessary. A typical response curve is shown in Figure 4-3.

4.7 300 KC IF ALIGNMENT

The 300-kc IF strip alignment is given in the following paragraphs.

4.7.1 Initial Settings. - The following steps should be performed before beginning the alignment.

(1) Set the receiver function switches to AM/MAN mode, BANDWIDTH switch to 300 KC.
(2) Disconnect IF strip from RF tuners by removing P12 from A3J1.
(3) Set oscilloscope horizontal sensitivity to 0.5 volt per centimeter.
(4) Connect VTVM to AGC line at A3C43 and adjust RF GAIN control for an indication of -1.5 volts on the VTVM.

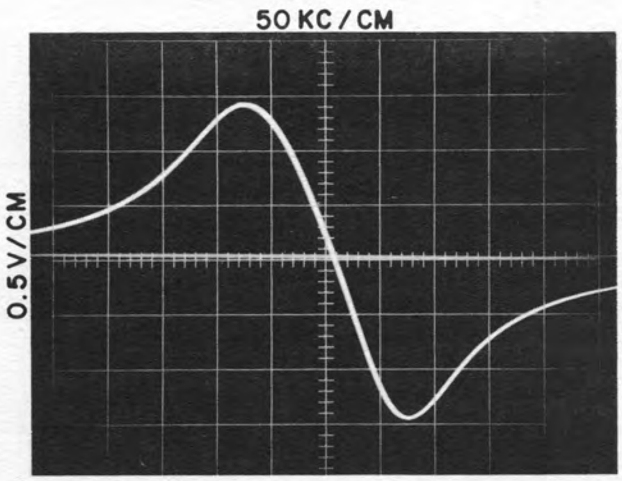


Figure 4-2. Typical Response Curve, Discriminator Alignment (60-kc)

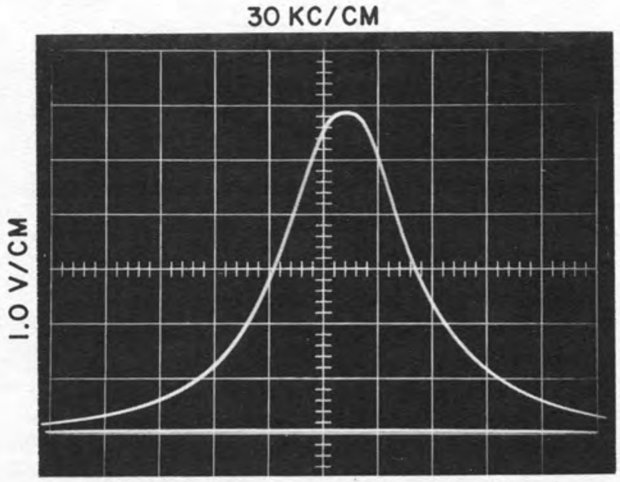


Figure 4-3. Typical Response Curve, IF Alignment (60-kc)

4.7.2 Discriminator Alignment. - Proceed as follows:

(1) Remove tube V4.
(2) Remove bottom cover from the IF strip.
(3) Set up the equipment as shown in Figure 4-1 except the sweep output is connected to A3V5 pin 4 and the marker adder input to A3E2.
(4) Adjust sweep generator output to display an S-curve response on the scope.
(5) Set signal generator to give an accurate 21.4 mc marker.
(6) Adjust L8 for amplitude symmetry of the S-curve and L9 for zero crossing of the S-curve at 21.4 mc. If necessary, adjust the physical position of L9 in the mounting slot to give the correct peak-to-peak separation of the S-curve. A typical response is shown in Figure 4-4.
(7) Replace tube V4.

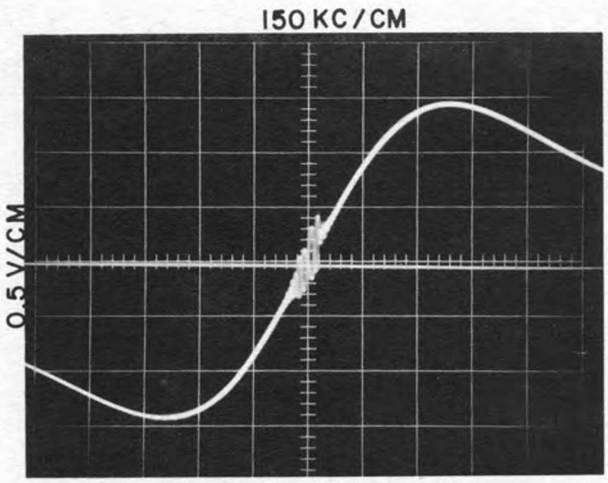


Figure 4-4. Typical Response Curve, Discriminator Alignment (300-kc)

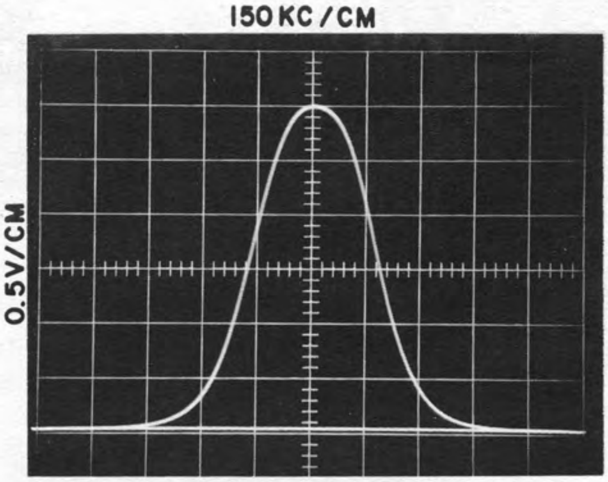


Figure 4-5. Typical Response Curve, IF Alignment (300-kc)

4.7.3 V4 to V5 Interstage Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to V4 pin 4 and the marker adder input to TP1.
(2) Adjust the sweep generator until a response curve is displayed on the oscilloscope screen.
(3) Adjust L7 for a single-peak response centered at 21.4-mc.

4.7.4 V2 to V6 Interstage Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to V3 pin 4 and the marker adder input to E1.
(2) Adjust L5 and L6 for a response centered at 21.4-mc.
(3) Move the sweep generator output to V2 pin 4.
(4) Adjust L3 and L4 for a response centered at 21.4-mc.

4.7.5 Over-all 300-kc Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to the SM OUTPUT jack J4 on the rear apron of the receiver and the marker adder input to E1.
(2) Adjust L1 and L2 for a single-peak response centered at 21.4-mc.
(3) Replace bottom cover.
(4) Readjust L1 and L2 for a symmetrical, single-peak response centered at 21.4-mc, with a 3-db bandwidth of 300 kc. Readjust L3 and L4 if necessary. A typical response curve is shown in Figure 4-5.

4.8 3 MC IF ALIGNMENT

The 3-MC IF strip alignment is given in the following paragraphs.

4.8.1 Initial Settings. - The following steps should be performed before beginning the alignment.

(1) Set the receiver function switches to AM/MAN mode; BANDWIDTH switch to 3 MC.
(2) Disconnect IF strip from RF tuners by removing P12 from A3J1.
(3) Set oscilloscope horizontal sensitivity to 0.5 volt per centimeter.
(4) Connect VTVM to AGC line at A3C43 and adjust RF GAIN control for an indication of -6.0 volts on the VTVM.
(5) Set the receiver bandswitch to 30-90 MC and tune to 90 MC.

4.8.2 Discriminator Alignment. - Proceed as follows:

(1) Remove tube V9.
(2) Remove bottom cover from the IF strip.
(3) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to V10 pin 4 and the marker adder input to E4.
(4) Adjust sweep generator output to display an S-curve response on the scope.
(5) Set signal generator to give an accurate 21.4-mc marker.
(6) Adjust L19 for amplitude symmetry of the S-curve and L20 for zero crossing of the S-curve at 21.4-mc. If necessary, adjust the coupling loop, L21, to give the correct peak-to-peak separation of the S-curve. A typical response is shown in Figure 4-6.
(7) Replace tube V9.

4.8.3 V6 to V7 Interstage Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to V9 pin 4 and the marker adder input to TP2.
(2) Adjust the sweep generator until a response curve is displayed on the oscilloscope screen.
(3) Adjust L18 for a single-peak response centered at 21.4 mc.

4.8.4 V2 to V6 Interstage Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to V8 pin 4 and the marker adder input to E3.
(2) Adjust L16 and L17 for an over-coupled response centered at 21.4 mc. The frequency difference between the peaks and center frequency should be equal.
(3) Move the sweep generator output to V7, pin 4.

(4) Adjust L14 and L15 for an over-coupled response centered at 21.4-mc. The frequency difference between the peaks and center frequency should be equal.

4.8.5 Over-all 3 mc Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to the SM OUTPUT jack J4, on the rear apron of the receiver, and the marker adder input to E3.
(2) Adjust L12 and L13 for an extremely over-coupled response centered at 21.4-mc. A typical response is shown in Figure 4-7.
(3) Replace bottom cover.

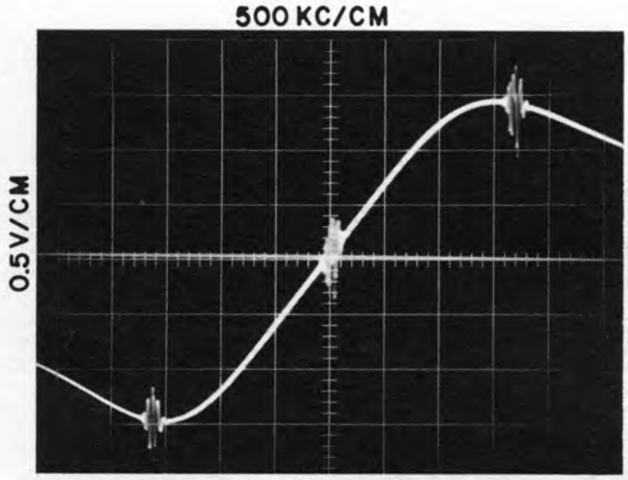


Figure 4-6. Typical Response Curve, Discriminator Alignment (3-mc)

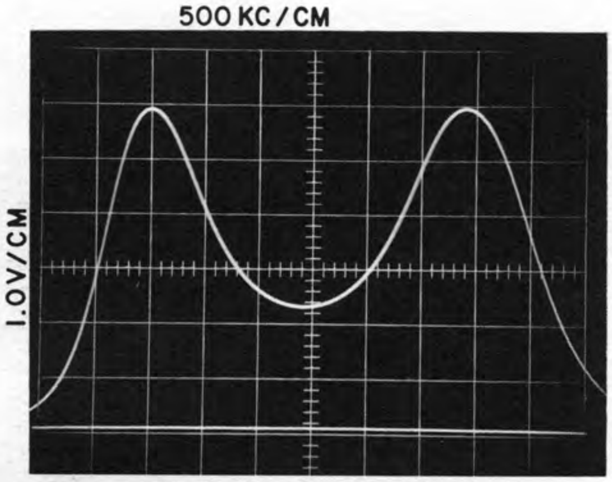


Figure 4-7. Typical Response Curve, IF Alignment (3-mc)

4.8.6 21.4 mc Mixer Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to A1V3 pin 4 and the marker adder input to A3E3.
(2) Make sure all interconnecting cables in the receiver are properly connected.
(3) Adjust A2L11 so that that middle peak of a three-peaked response is centered at 21.4 mc. If necessary readjust A3L12, A3L13, A3L14 and A3L15 for symmetry of response. A typical response curve is shown in Figure 4-8.

4.9 60-300 MC TUNER ALIGNMENT

The high band tuner is aligned in part using an accurately aligned IF strip. Before an alignment of the tuner is attempted, check the IF alignment as described in paragraphs 4.6, 4.7 and 4.8.

4.9.1 Initial Settings. - Make the following initial settings:

(1) Set the function switches in the AM/MAN mode.
(2) Adjust the RF GAIN control fully clockwise.
(3) Set the bandswitch in the 60-300 MC position.
(4) Set the BANDWIDTH switch to the 300 KC position.
(5) Set the fine tuning to mid-range.

4.9.2 RF Circuit Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1, except the sweep output is connected to J1, 60-300 mc input and the marker adder input to A2TP1.
(2) Set the receiver tuning dial to 100 mc and the sweep generator to 100 mc.
(3) Set the sweep generator sweep rate to line frequency.

(4) Remove the local oscillator tube A2V4.
(5) Disconnect tuner from IF strips by removing P6 from A1J6.
(6) Set the oscilloscope vertical sensitivity to 50 millivolts per centimeter.
(7) Adjust sweep generator sweep width and oscilloscope horizontal sensitivity until a response curve is displayed on the oscilloscope screen.
(8) Using a calibrated 100-mc marker from the signal generator, adjust C11 and C18 for a symmetrical double-tuned response with the 100-mc marker appearing between the center of the response and the low frequency peak. Adjust C15 for a peak-to-peak bandwidth of 3.5 mc (see Figure 4-9).
(9) Adjust C5 for maximum amplitude of the response at 100 mc.
(10) Check the response at 60 mc and 300 mc. The response shape will vary but the markers should still be on or between the peaks of the response curve.
(11) Re-install the local oscillator tube, A2V4.
(12) Reconnect P6 to A1J6.

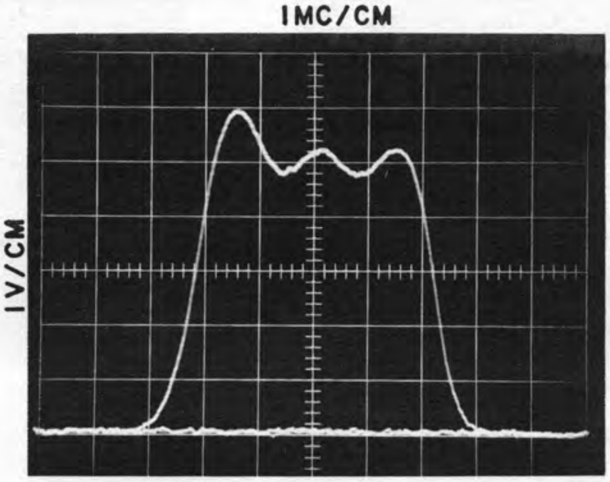


Figure 4-8. Typical Response Curve, 21.4-mc Mixer Alignment

4.9.3 Local Oscillator Alignment.- Proceed as follows:

(1) Connect the output of the Hewlett-Packard 608D signal generator to the INPUT jack J1.
(2) Calibrate the signal generator to produce a 60-mc signal.
(3) Adjust the signal generator output level for a 1/2 scale deflection on the signal strength meter.
(4) Tune the receiver to the signal generator using the tuning meter to indicate proper tuning.
(5) The receiver tuning dial should indicate 60.0 mc ±0.75%.
(6) Repeat steps (2) through (5) for 100 mc.
(7) Repeat steps (2) through (5) for 290 mc.
(8) If any of the tuning dial indications exceed the ±0.75% tolerance, adjust C29. After any adjustment of C29, repeat steps (2) through (7).

4.10 30-90 MC TUNER ALIGNMENT

The low band tuner is aligned in part using an accurately aligned IF strip. Before an alignment of the tuner is attempted, check the IF alignment as described in paragraph 4.6, 4.7 and 4.8.

4.10.1 Initial Settings.- Make the following initial settings:

(1) Set the bandswitch in the 30-90 MC position.
(2) Set the function switches in the AM/MAN position.
(3) Connect the VTVM to C31 and adjust the RF GAIN control for an indication of -1.5 volts on the VTVM.
(4) Set the fine tuning to mid-range.

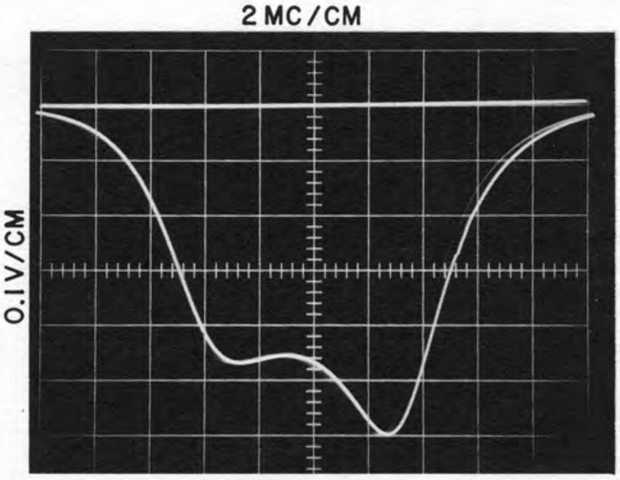


Figure 4-9. Typical Response Curve, 60-300 mc Tuner Alignment

4.10.2 RF Circuit Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1 except that the sweep output is connected to J3 and the marker adder input to A1TP1.
(2) Set the receiver tuning dial to 30 mc and the sweep generator to 30 mc.
(3) Set the sweep generator sweep rate to line frequency.
(4) Remove the local oscillator tube, A1V4.
(5) Disconnect the tuner from the IF strips by removing P6 from A1J6.
(6) Set the oscilloscope vertical sensitivity to 50 millivolts per centimeter.
(7) Adjust sweep generator sweep width and oscilloscope horizontal sensitivity until a response curve is displayed on the oscilloscope screen.
(8) Using a calibrated 30-mc marker from the signal generator, adjust C3 for maximum amplitude of the response at 30 mc.
(9) Adjust C12 and C15 for a symmetrical response centered at 30 mc.
(10) Set the receiver tuning dial to 36 mc and the sweep generator to 36 mc.
(11) Adjust L5 for a 2 mc peak-to-peak response curve.
(12) Check the response at 50 mc, 70 mc, and 90 mc. The response shape will vary but the markers should still be on or between the peaks of the response curve.
(13) Re-install the local oscillator tube, A1V4.
(14) Reconnect P6 to A1J6.

4.10.3 Local Oscillator Alignment. - Proceed as follows:

(1) Connect the output of the Hewlett-Packard 608D signal generator to the input jack J3.
(2) Calibrate the signal generator to produce a 30-mc signal.
(3) Adjust the signal generator output level for a 1/2 scale deflection on the signal strength meter.
(4) Tune the receiver to the signal generator using the tuning meter to indicate proper tuning.
(5) The receiver tuning dial should indicate 30.0 mc ±0.5%.
(6) Repeat steps (2) through (5) for 50 mc, 70 mc, and 90 mc.
(7) If any of the tuning dial indications exceed the ±0.5% tolerance, adjust C22. After any adjustment of C22, repeat steps (2) through (6).

Table 4-1. Types 970A and 975 Receivers, Tube and Transistor Pin Voltages

Ref. Desig.	Type	Pin Number or Element								
		2	4 Grid	8 Cathode	10 Heater	12 Heater	Plate	Emitter	Base	Collector
A1V1	6CW4	78	-.4	0	0	6.3vac				
A1V2	6CW4	142	74	78	0	6.3vac				
A1V3	7587	22	-1.0	0	0	6.3vac	66			
A1V4	6CW4	66	-2.3	0	0	-6.2				
A2V1	8058	0*	0*	0*	0	6.3vac	113			
A2V2	8058	.4	.4	.4	0	6.3vac	108			
A2V3	7587	19	-.9	0	0	6.3vac	98			
A2V4	6CW4	70	9.0	10.3	0	-6.2				
A3V1	7587	25	-0.7*	.08	0	6.3vac	118			
A3V2	7587	20	-0.7*	.04	0	6.3vac	118			
A3V3	7587	16	0	.3	0	6.3vac	118			
A3V4	7587	20	-0.6*	0	0	6.3vac	113			
A3V5	7587	18	-4.0*	.09	0	6.3vac	20			
A3Q3	2N335							-.55	0	22
A3Q4	2N335							-0.6	0	22
A3V6	7587	40	-0.5*	0.4	0	6.3vac	116			
A3V7	7587	40	-0.5*	0.6	0	6.3vac	116			
A3V8	7587	37	0	0.6	0	6.3vac	116			
A3V9	7587	15	-0.4*	0	0	6.3vac	111			
A3V10	7587	15	-6.0*	0.15	0	6.3vac	50			
A3Q1	2N335							0.3	0.9	22
A3Q2	2N335							-0.7	0	22
A4V1	7587	26	-0.5		0	6.3vac	107			
A4V2	7587	8	-0.5		0	6.3vac	110			
A4V3	6CW4	85	21*	26*	0	6.3vac				
A4V4	7587	30	-0.5		0	6.3vac	117			
A4V5	7587		-0.2		0	6.3vac	75			
A4V6	7587	4	-2		0	6.3vac	15			
A4Q1	2N335							-0.5	.05	22
A4Q2	2N335							-0.6	0	22
A4Q3	2N706							**	**	**

Test Conditions: All voltages are positive dc with respect to ground unless otherwise indicated. Readings taken with RCA WV-98B VTVM with 115 vac applied. Control settings as follows unless otherwise indicated: RF GAIN, VIDEO GAIN, AUDIO GAIN, FINE TUNING, and BFO TUNING controls at mid-range; AGC/MAN switch in AGC; bandswitch for tuner being measured ; IF BANDWIDTH for IF being measured.

NOTES:

* Measured with 1 megohm series resistor

** Element not accessible

Table 4-2. Types 970A and 975 Receivers, Module Pin Voltages

Video Amplifier Module

Pin Number	1	2	3	4	5	7	8	9
Voltages	0	-1.5	0	-24	22	-.25	0	0

Audio Amplifier Module

Pin Number	2	3	4	11	12	13
Voltages	0	-0.2	22	0	0	0

AGC Amplifier Module (Type 7800)

Pin Number	1	2	3	5	11	16	17	18	19
Voltages	-0.5	0	-0.8	0	-24	0	-0.5	0	22

AGC Amplifier Module (Type 7811)

Pin Number	1	2	3	5	11	16	17	18	19
Voltages	0.9	0	0.5	2.3	-24	0	-0.7	-0.1	23

COR Amplifier Module

Pin Number	1	2	3	4	5	11	12	13	14
Voltages	24	0	-0.4	0	-24	0	0.1	13	0.1

Test Conditions: All voltages are positive dc with respect to ground unless otherwise indicated. Readings taken with RCA WV-98B VTVM with 115 vac applied. Control settings as follows unless otherwise indicated: RF GAIN, VIDEO GAIN, AUDIO GAIN, FINE TUNING and BFO TUNING controls at mid-range; AGC/MAN switch in AGC; bandswitch in 30-90 mc; IF BANDWIDTH in 3 MC; function switch in AM.

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:

A1R1

Subassembly Designation	Class and No. of item
Read from right to left as:	First (1) resistor (R) of first (1) subassembly (A)

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	Abbreviation	Name and Address
AB	Allen-Bradley Co. 136 W. Greenfield Avenue Milwaukee, Wisconsin	C-J	Cinch Jones Manufacturing Co. 1026 S. Homan Avenue Chicago, Illinois
FXR	Amphenol-Borg Electronics 33 E. Franklin Street Danbury, Connecticut	Cornish	Cornish Wire Co. 50 Church Street New York, New York
Arco	Arco Electronics, Inc. Community Drive Great Neck, New York	CTC	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, Massachusetts
Buss	Bussman Manufacturing Co. University at Jefferson Street St. Louis, Missouri	Erie	Erie Technological Products, Inc. 644 W. 12th Street Erie, Pennsylvania
CEI	Communication Electronics, Inc. 4908 Hampden Lane Bethesda 14, Maryland	Ferroxcube	Ferroxcube Corp. of America Saugerties New York
CD	Continental Devices Corp. 12515 Chadion Avenue Hawthorne, California	GE	General Electric Co. 777 14th Street, N.W. Washington, D.C.
C-H	Cutler-Hammer, Inc. 321 N. 12th Street Milwaukee, Wisconsin	IEI	International Electronic Industries Box 9036 Nashville, Tennessee

Abbreviation	Name and Address	Abbreviation	Name and Address
M-H	Minneapolis-Honeywell Wayne and Windrim Avenues Philadelphia, Pa.	Sprague	Sprague Electric Co. 91 Marshall Street N. Adams, Massachusetts
Motorola	Motorola Semiconductor Products 5005 E. McDowell Road Phoenix, Arizona	Switchcraft	Switchcraft, Inc. 5555 N. Elston Avenue Chicago, Illinois
Oak	Oak Manufacturing Co. Crystal Lake Illinois	Sylvania	Sylvania Electric Products, Inc. 1740 Broadway New York, New York
Piezo	Piezo Crystal Co. 265 E. Pomfret Street Carlisle, Pennsylvania	Taurus	Taurus Corporation 8 Coryell Street Lambertville, New Jersey
PSI	Pacific Semiconductors, Inc. 10451 W. Jefferson Boulevard Culver City, California	Tepro	Tepro of Florida, Inc. Dunedin Florida
QC	Quality Components, Inc. St. Mary's Pennsylvania	TI	Texas Instruments, Inc. 6000 Lemmon Avenue Dallas, Texas
RCA	Radio Corp. of America 415 S. Fifth Street Harrison, New Jersey	Wilco	Wilco Corp. 546 Drover Street Indianapolis, Indiana
RMC	Radio Materials Corp. 4242 W. Bryn Mawr Avenue Chicago 46, Illinois	Sigma	Sigma Instruments, Inc. 70 Pearl Street S. Braintree, Massachusetts
Roanwell	Roanwell Corp. 180 Varick Street New York 14, New York		

5.4 PARTS LIST

When ordering replacement parts from CEI, specify the type and serial number of the equipment, and the reference designations 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 Type 970A Receiver, Main Chassis

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A1	30-90 MC TUNER	7103	CEI
A2	60-300 MC TUNER	7108	CEI
A3	3 MC/300 KC IF STRIP	7215	CEI
A4	60 KC IF STRIP	7212	CEI
A5	VIDEO AMPLIFIER	7301	CEI
A6	AUDIO AMPLIFIER	7400	CEI
A7	AGC AMPLIFIER	7800 or 7811	CEI
A8	COUPLING NETWORK	7909	CEI
C1	CAPACITOR, METAL CLAD, THRUPASS: .01 μf, 600V	102P515	Sprague
C2	Same as C1		
C3	CAPACITOR, ELECTROLYTIC: 1000 μf, 25V	43F2468BA1	GE
C4	CAPACITOR, ELECTROLYTIC: 25 μf, 12V	30D256G012BB4	Sprague
C5A, B	CAPACITOR, ELECTROLYTIC: 15-15 μf, 350-350V	43F2299BB1	GE
C6A, B	CAPACITOR, ELECTROLYTIC: 100-100 μf, 50-50V	43F2300BB1	GE
C7	CAPACITOR, ELECTROLYTIC: 50 μf, 50V	30D506G050DH4	Sprague
C8	CAPACITOR, ELECTROLYTIC: 1.0 μf, 20%, 35V	150D105X0035A2	Sprague
C9	NOT USED		
C10	CAPACITOR, ELECTROLYTIC: 4.7 μf, 20%, 35V	150D475X0035B2	Sprague
CR1	DIODE	1N3253	RCA
CR2	Same as CR1		
CR3	DIODE	1N3255	RCA
CR4	Same as CR3		
CR5	Same as CR1		
CR6	Same as CR1		
CR7	Same as CR1		
CR8	Same as CR1		
CR9	DIODE, ZENER	1N753A	Motorola
CR10	DIODE, ZENER	1N3008B	Motorola
CR11	DIODE, ZENER	1N970A	CD
CR12	DIODE, ZENER	1N979A	CD
CR13	Same as CR11		
DS1	LAMP: 6-8V, 150 ma	#47	GE
DS2	Same as DS1		
F1	FUSE: 1/2 amp, Slow-Blow, 3 AG	MDL-1/2	Buss
J1	RECEPTACLE, JACK: Type N, p/o W3	UG-1052/U	FXR

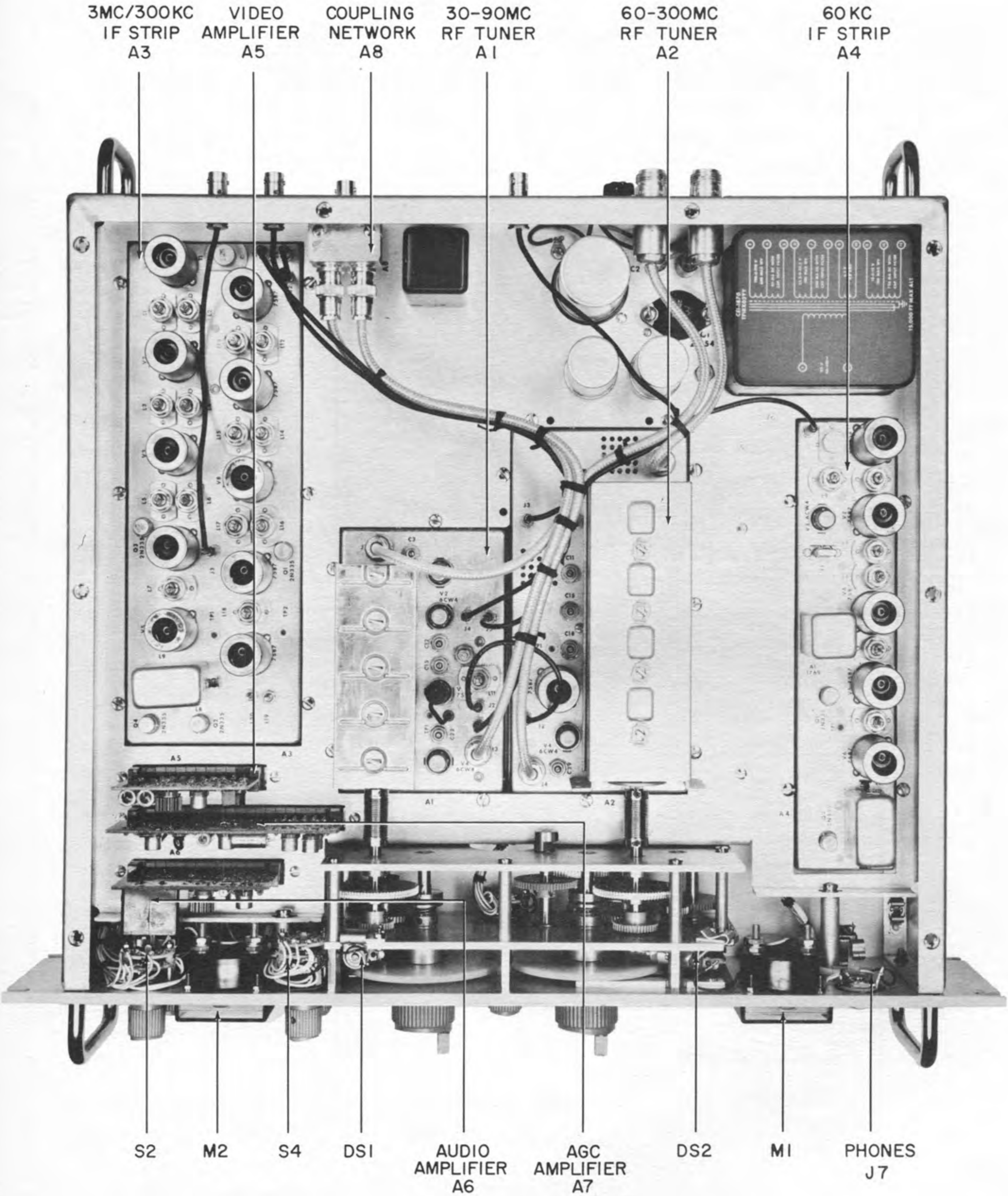


Figure 5-1. Type 970A Receiver, Top View, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
J2	RECEPTACLE, JACK: Type BNC, p/o W2	17825	FXR
J3	Same as J1, p/o W1		
J4	Same as J2, p/o W9		
J5	Same as J2, p/o W10		
J6	RECEPTACLE, JACK: Type BNC	UG-1094/U	FXR
J7	JACK, PHONE	C11	Switchcraft
L1	CHOKE, FILTER	1070	CEI
M1	METER, SIGNAL STRENGTH	1632	CEI
M2	METER, TUNING	1633	CEI
P1	CONNECTOR: TYPE BNC, p/o W3	UG-88/U	FXR
P2	CONNECTOR: Type BNC, p/o W2	27-7	FXR
P3	Same as P1, p/o W1		
P4	Same as P2, p/o W4		
P5	Same as P1, p/o W5		
P6	Same as P2, p/o W6		
P7	Same as P2, p/o W4		
P8	Same as P1, p/o W8		
P9	Same as P2, p/o W7		
P10	Same as P1, p/o W8		
P11	Same as P1, p/o W5		
P12	Same as P2, p/o W6		
P13	Same as P2, p/o W11		
P14	Same as P2, p/o W11		
P15	Same as P2, p/o W9		
P16	POWER PLUG AND CABLE	01753-001	Cornish
P17	Same as P2, p/o W7		
P18	Same as P2, p/o W10		
Q1	TRANSISTOR	2N1544	Motorola
Q2	TRANSISTOR	2N1038	TI
Q3	TRANSISTOR	2N1700	RCA
R1	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	CB1515	AB
R2	Same as R1		
R3	RESISTOR, FIXED, COMPOSITION: 1.5K, 5%, 2W	HB1525	AB
R4	RESISTOR, FIXED, WIREWOUND: 2.5K, 3%, 10W	TM-10W	Tepro
R5	NOT USED		
R6	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1W	GB4735	AB
R7	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	CB4725	AB

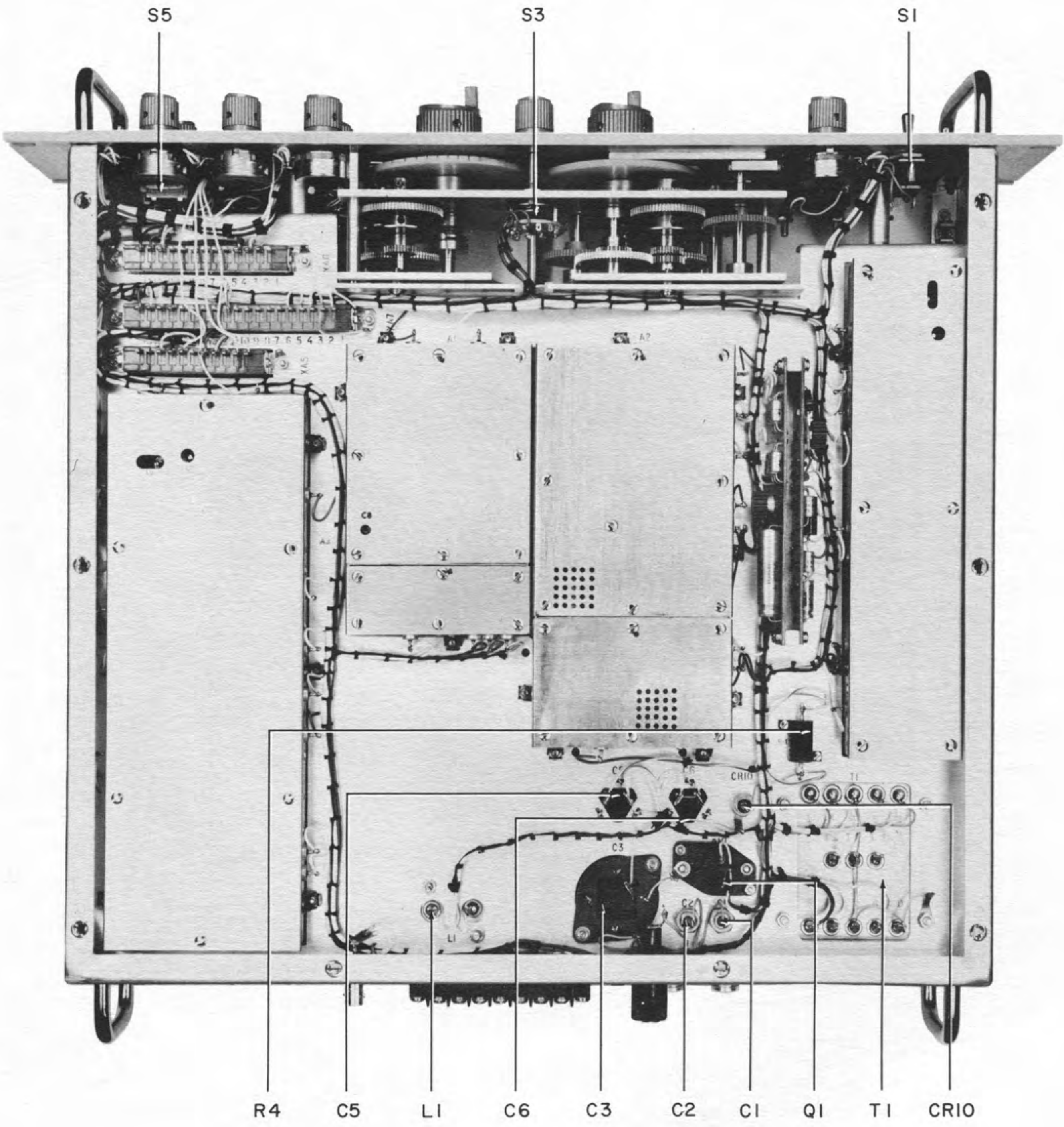


Figure 5-2. Type 970A Receiver, Bottom View, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
R8	RESISTOR, VARIABLE, COMPOSITION: 10K, 10%, 2W	RV4NAYSD103A	AB
R9	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	CB3915	AB
R10	RESISTOR, VARIABLE, COMPOSITION: 5K, 10%, 2W	RV4NAYSD502A	AB
R11	RESISTOR, VARIABLE, COMPOSITION: 100K, 10%, 2W	RV4NAYSD104A	AB
R12	RESISTOR, FIXED, COMPOSITION: 51K, 5%, 1/4W	CB5135	AB
R13	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/2W	EB1045	AB
R14	Same as R11		
S1	SWITCH, TOGGLE: SPST	8280-K16	C-H
S2A, B, C	SWITCH, ROTARY: 4 pole, 3 position	399225A	Oak
S3A, B, C	SWITCH, ROTARY: 3 pole, 2 position	399235A	Oak
S4A, B, C D, E	SWITCH, ROTARY: 5 pole, 4 position	399227A	Oak
S5	SWITCH, TOGGLE: SPDT	8282-K14	C-H
T1	TRANSFORMER, POWER	1870	CEI
TB1	TERMINAL BOARD	7-140-Y	C-J
W1	CABLE AND CONNECTOR ASSEMBLY	2126-144	CEI
W2	CABLE AND CONNECTOR ASSEMBLY	2126-169	CEI
W3	CABLE AND CONNECTOR ASSEMBLY	2126-144	CEI
W4	CABLE AND CONNECTOR ASSEMBLY	2126-127	CEI
W5	CABLE AND CONNECTOR ASSEMBLY	2126-100	CEI
W6	CABLE AND CONNECTOR ASSEMBLY	2126-147	CEI
W7	CABLE AND CONNECTOR ASSEMBLY	2126-32	CEI
W8	CABLE AND CONNECTOR ASSEMBLY	2126-26	CEI
W9	CABLE AND CONNECTOR ASSEMBLY	2126-75	CEI
W10	CABLE AND CONNECTOR ASSEMBLY	2126-74	CEI
W11	CABLE AND CONNECTOR ASSEMBLY	2126-170	CEI

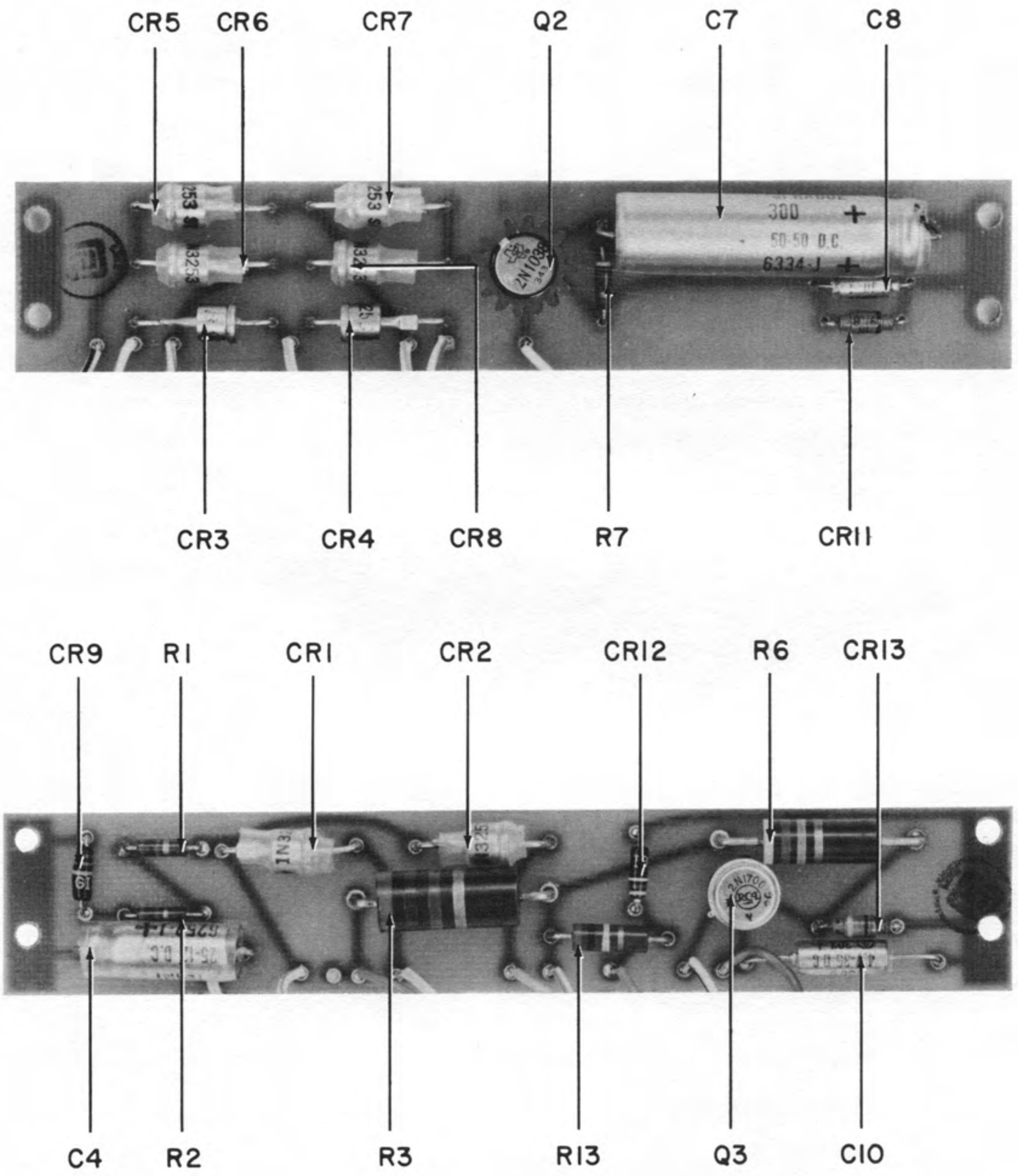


Figure 5-3. Power Supply Component Boards, Component Locations

5.4.2 Type 975 Receiver, Main Chassis

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A1	30-90 MC TUNER	7103	CEI
A2	60-300 MC TUNER	7108	CEI
A3	3 MC/300 KC IF STRIP	7215	CEI
A4	60 KC IF STRIP	7212	CEI
A5	VIDEO AMPLIFIER	7301	CEI
A6	AUDIO AMPLIFIER	7400	CEI
A7	AGC AMPLIFIER	7800 or 7811	CEI
A8	COUPLING NETWORK	7909	CEI
A9	CARRIER OPERATED RELAY	7500	CEI
C1	CAPACITOR, METAL CLAD, THRUPASS: .01 μf, 600V	102P515	Sprague
C2	Same as C1		
C3	CAPACITOR, ELECTROLYTIC: 1000 μf, 25V	43F2468BA1	GE
C4	CAPACITOR, ELECTROLYTIC: 25 μf, 12V	30D256G012BB4	Sprague
C5A,B	CAPACITOR, ELECTROLYTIC: 15-15 μf, 350-350V	43F2299BB1	GE
C6A,B	CAPACITOR, ELECTROLYTIC: 100-100 μf, 50-50V	43F2300BB1	GE
C7	CAPACITOR, ELECTROLYTIC: 50 μf, 50V	30D506G050DH4	Sprague
C8	CAPACITOR, ELECTROLYTIC: 1.0 μf, 20%, 35V	150D105X0035A2	Sprague
C9	NOT USED		
C10	CAPACITOR, ELECTROLYTIC: 4.7 μf, 20%, 35V	150D475X0035B2	Sprague
CR1	DIODE	1N3253	RCA
CR2	Same as CR1		
CR3	DIODE	1N3255	RCA
CR4	Same as CR3		
CR5	Same as CR1		
CR6	Same as CR1		
CR7	Same as CR1		
CR8	Same as CR1		
CR9	DIODE, ZENER	1N753A	Motorola
CR10	DIODE, ZENER	1N3008B	Motorola
CR11	DIODE, ZENER	1N970A	CD
CR12	DIODE, ZENER	1N979A	CD
CR13	Same as CR11		
DS1	LAMP: 6-8V, 150 ma	#47	GE
DS2	Same as DS1		
DS3	LAMP: p/o S6		

Ref. Desig.	Description	Vendor Part No.	Vendor Name
DS4	LAMP: p/o S6		
F1	FUSE: 1/2 amp, Slow-Blow, 3 AG	MDL-1/2	Buss
J1	RECEPTACLE, JACK: Type N, p/o W3	UG-1052/U	FXR
J2	RECEPTACLE, JACK: Type BNC, p/o W2	17825	FXR
J3	Same as J1, p/o W1		
J4	Same as J2, p/o W9		
J5	Same as J2, p/o W10		
J6	RECEPTACLE, JACK: Type BNC	UG-1094/U	FXR
J7	JACK, PHONE	C11	Switchcraft
K1	RELAY, MINIATURE: Hermetically sealed, DPDT	22RJCC1000G/ Sil	Sigma
L1	CHOKE, FILTER	1070	CEI
M1	METER, SIGNAL STRENGTH	1632	CEI
M2	METER, TUNING	1633	CEI
P1	CONNECTOR: Type BNC, p/o W3	UG-88/U	FXR
P2	CONNECTOR: Type BNC, p/o W2	27-7	FXR
P3	Same as P1, p/o W1		
P4	Same as P2, p/o W4		
P5	Same as P1, p/o W5		
P6	Same as P2, p/o W6		
P7	Same as P2, p/o W4		
P8	Same as P1, p/o W8		
P9	Same as P2, p/o W7		
P10	Same as P1, p/o W8		
P11	Same as P1, p/o W5		
P12	Same as P2, p/o W6		
P13	Same as P2, p/o W11		
P14	Same as P2, p/o W11		
P15	Same as P2, p/o W9		
P16	POWER PLUG AND CABLE	01753-001	Cornish
P17	Same as P2, p/o W7		
P18	Same as P2, p/o W10		
Q1	TRANSISTOR	2N1544	Motorola
Q2	TRANSISTOR	2N1038	TI
Q3	TRANSISTOR	2N1700	RCA
R1	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	CB1515	AB
R2	Same as R1		

Ref. Desig.	Description	Vendor Part No.	Vendor Name
R3	RESISTOR, FIXED, COMPOSITION: 1.5K, 5%, 2W	HB1525	AB
R4	RESISTOR, FIXED, WIREWOUND: 2.5K, 3%, 10W	TM-10W	Tepro
R5	NOT USED		
R6	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1W	GB4735	AB
R7	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	CB4725	AB
R8	RESISTOR, VARIABLE, COMPOSITION: 10K, 10%, 2W	RV4NAYSD103A	AB
R9	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	CB3915	AB
R10	RESISTOR, VARIABLE, COMPOSITION: 5K, 10%, 2W	RV4NAYSD502A	AB
R11	RESISTOR, VARIABLE, COMPOSITION: 100K, 10%, 2W	RV4NAYSD104A	AB
R12	RESISTOR, FIXED, COMPOSITION: 51K, 5%, 1/4W	CB5135	AB
R13	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/2W	EB1045	AB
R14	RESISTOR, VARIABLE, COMPOSITION: 100K, 10%, 2W w/switch	JS1N056P104UA	AB
R15	RESISTOR, VARIABLE, COMPOSITION: 500K, 10%, 2W	RV4NAYSD504A	AB
S1	SWITCH: p/o R14		
S2A, B, C	SWITCH, ROTARY: 4 pole, 3 position	399225A	Oak
S3A, B, C	SWITCH, ROTARY: 3 pole, 2 position	399235A	Oak
S4A, B, C D, E	SWITCH, ROTARY: 5 pole, 4 position	399227A	Oak
S5	SWITCH, TOGGLE: SPDT	8816-K5	C-H
S6	SWITCH, INDICATOR	302-PB6-T-GR	M-H
T1	TRANSFORMER, POWER	1870	CEI
TB1	TERMINAL BOARD	7-140-Y	C-J
W1	CABLE AND CONNECTOR ASSEMBLY	2126-144	CEI
W2	CABLE AND CONNECTOR ASSEMBLY	2126-169	CEI
W3	CABLE AND CONNECTOR ASSEMBLY	2126-144	CEI
W4	CABLE AND CONNECTOR ASSEMBLY	2126-127	CEI
W5	CABLE AND CONNECTOR ASSEMBLY	2126-100	CEI
W6	CABLE AND CONNECTOR ASSEMBLY	2126-147	CEI
W7	CABLE AND CONNECTOR ASSEMBLY	2126-32	CEI
W8	CABLE AND CONNECTOR ASSEMBLY	2126-26	CEI
W9	CABLE AND CONNECTOR ASSEMBLY	2126-75	CEI
W10	CABLE AND CONNECTOR ASSEMBLY	2126-74	CEI
W11	CABLE AND CONNECTOR ASSEMBLY	2126-170	CEI

REF DESIG PREFIX A1

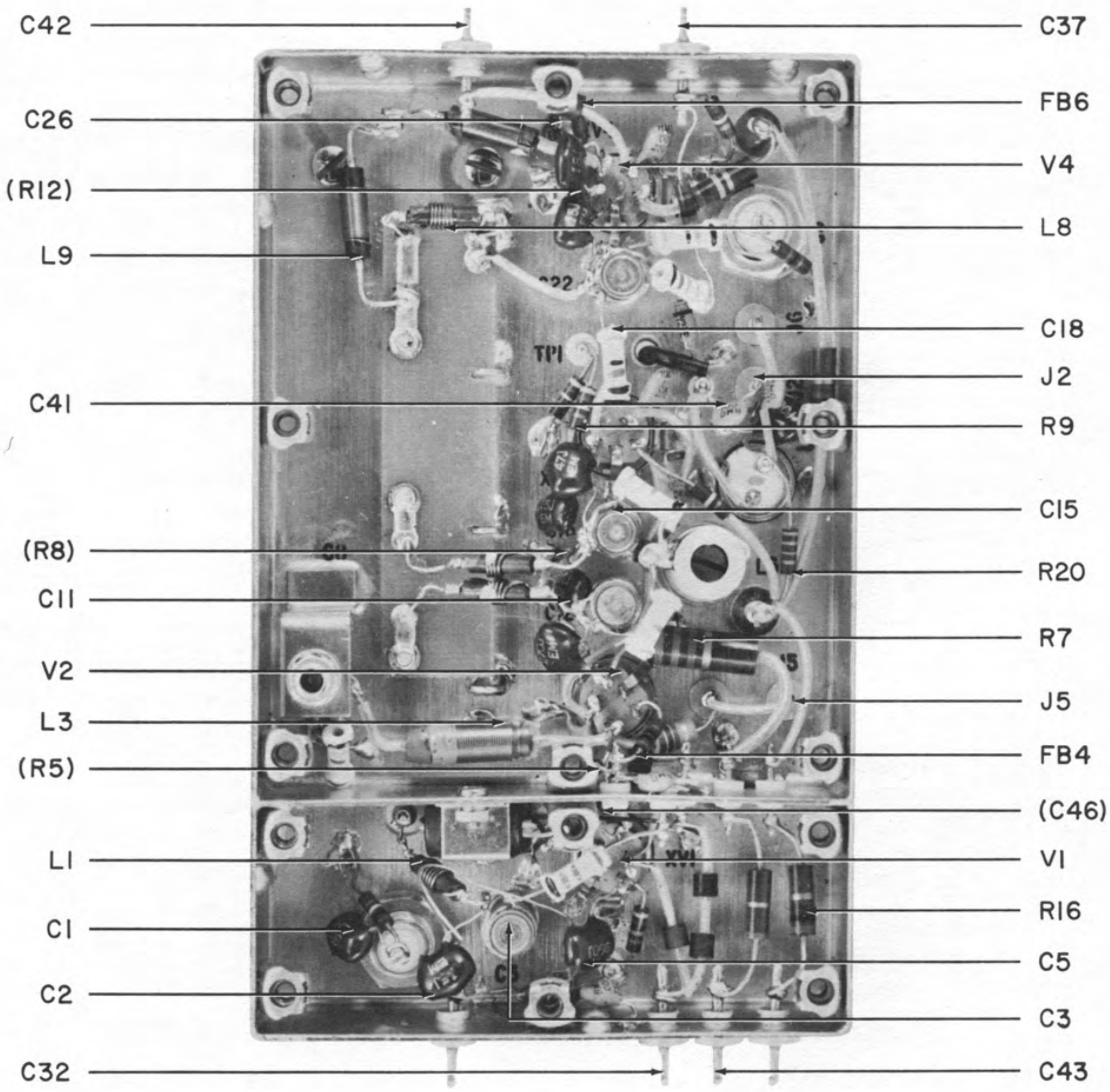


Figure 5-4. Type 7103 30-90 mc Tuner, Component Locations

5.4.3 Type 7103 30-90 mc Tuner

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A1C1	CAPACITOR, DIPPED MICA: 33 pf, 5%	DM10-330J	Arco
A1C2	CAPACITOR, DIPPED MICA: 15 pf, 5%	DM10-150J	Arco
A1C3	CAPACITOR, VARIABLE TRIMMER: 0.7-9.0 pf	MG11016	Roanwell
A1C4	CAPACITOR, CERAMIC TUBULAR: 1.5 pf, ±0.25 pf	301-000-COKO-159C	Erie
A1C5	CAPACITOR, DIPPED MICA: 300 pf, 5%	DM10-301J	Arco
A1C6	CAPACITOR, CERAMIC DISC: 1000 pf, 20%	Type SM	RMC
A1C7	CAPACITOR, CERAMIC TUBULAR: 4.7 pf, ±0.25 pf	301-000-COHO-479C	Erie
A1C8	CAPACITOR, VARIABLE TRIMMER: 0.8-4.5 pf	MG-1305	Roanwell
A1C9	Same as A1C6		
A1C10	CAPACITOR, DIPPED MICA: 270 pf, 5%	DM10-271J	Arco
A1C11	CAPACITOR, DIPPED MICA: 22 pf, 5%	DM10-220J	Arco
A1C12	Same as A1C3		
A1C13	Same as A1C7		
A1C14	Same as A1C7		
A1C15	Same as A1C3		
A1C16	Same as A1C2		
A1C17	CAPACITOR, DIPPED MICA: 47 pf, 5%	DM10-470J	Arco
A1C18	CAPACITOR, CERAMIC TUBULAR: 1.0 pf, ±0.25 pf	301-000-COKO-109C	Erie
A1C19	Same as A1C6		
A1C20	CAPACITOR, CERAMIC STANDOFF: 1000 pf, GMV	SS5A102W	AB
A1C21	Same as A1C20		
A1C22	Same as A1C3		
A1C23	CAPACITOR, CERAMIC TUBULAR: 2.0 pf, ±0.25 pf	301-000-COKO-209C	Erie
A1C24	Same as A1C2		
A1C25	CAPACITOR, DIPPED MICA: 18 pf, 5%	DM10-180J	Arco
A1C26	Same as A1C2		
A1C27	Same as A1C6		
A1C28	Same as A1C6		
A1C29	Same as A1C6		
A1C30	Same as A1C6		
A1C31	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV	FA5C-102W	AB
A1C32	Same as A1C31		
A1C33	Same as A1C31		

REF DESIG PREFIX A1

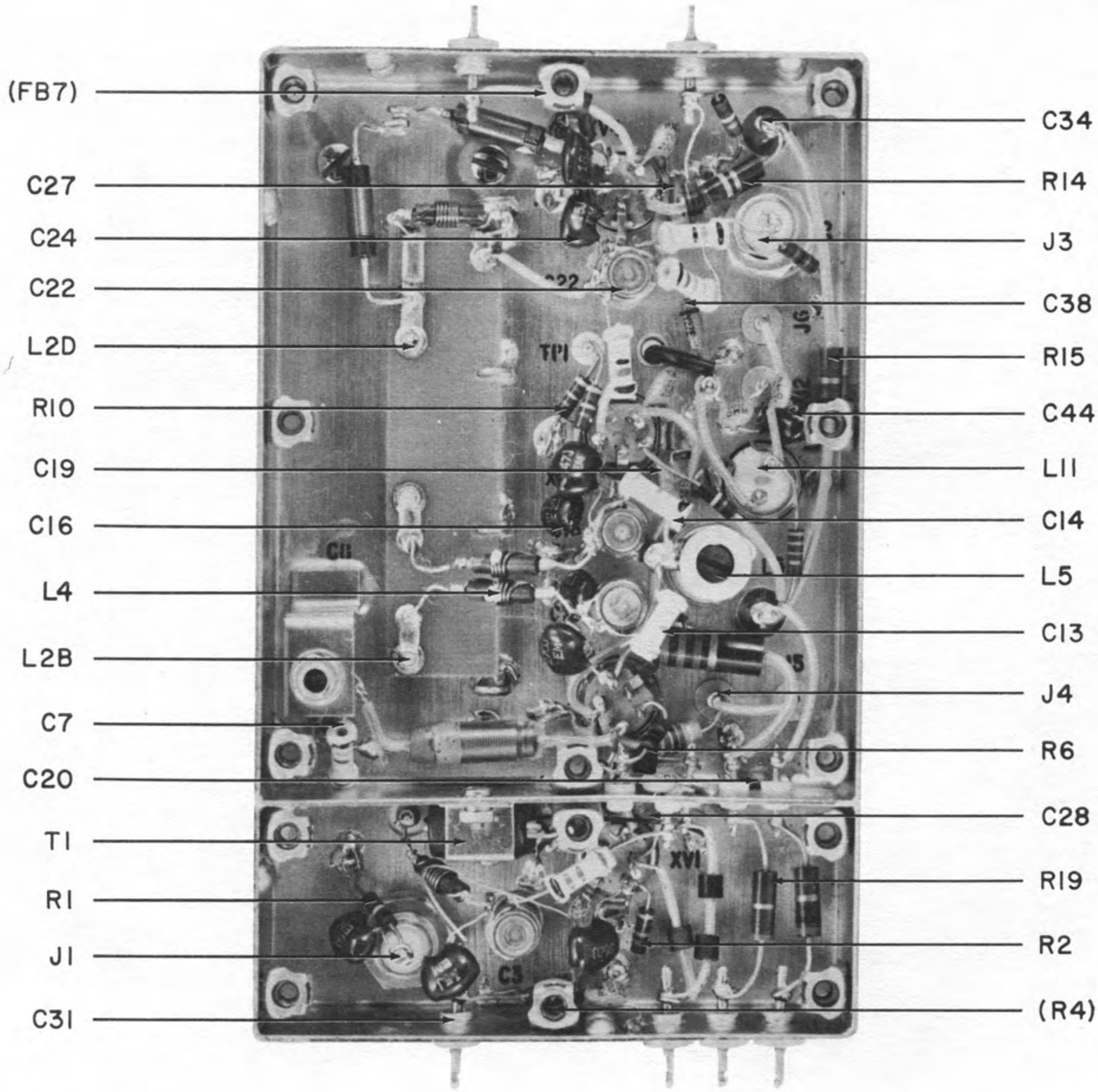


Figure 5-5. Type 7103 30-90 mc Tuner, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A1C34	Same as A1C20		
A1C35	Same as A1C6		
A1C36	Same as A1C6		
A1C37	Same as A1C31		
A1C38	DIODE, VARICAP	V-27E	PSI
A1C39	CAPACITOR, CERAMIC TUBULAR: 0.68 pf, ±0.25 pf	NPOA	Erie
A1C40	CAPACITOR, CERAMIC TUBULAR: 0.51 μf, 10%	Type MC	QC
A1C41	Same as A1C6		
A1C42	Same as A1C31		
A1C43	Same as A1C31		
A1C44	CAPACITOR, DIPPED MICA: 330 pf, 5%	DM10-331J	Arco
A1C45	Same as A1C6		
A1C46	Same as A1C6		
A1FB1	FERRITE BEAD	56-590-65/4A	Ferroxcube
A1FB2	Same as A1FB1		
A1FB3	Same as A1FB1		
A1FB4	Same as A1FB1		
A1FB5	Same as A1FB1		
A1FB6	Same as A1FB1		
A1FB7	Same as A1FB1		
A1J1	CONNECTOR, RECEPTACLE: Type BNC	UG-1094/U	FXR
A1J2	CONNECTOR, RECEPTACLE	27-9	FXR
A1J3	Same as A1J1		
A1J4	Same as A1J2		
A1J5	Same as A1J2		
A1J6	Same as A1J2		
A1L1	COIL	1131-22	CEI
A1L2A,B C,D	INDUCTUNER: Four section	2026	CEI
A1L3	COIL	1131-23	CEI
A1L4	COIL	1131-24	CEI
A1L5	COIL, VARIABLE	1443	CEI
A1L6	Same as A1L4		
A1L7	COIL: 4.7 μh	W47G	Wilco
A1L8	Same as A1L1		
A1L9	COIL	1131-25	CEI
A1L10	NOT USED		
A1L11	COIL, VARIABLE	1472-3	CEI

REF DESIG PREFIX A1

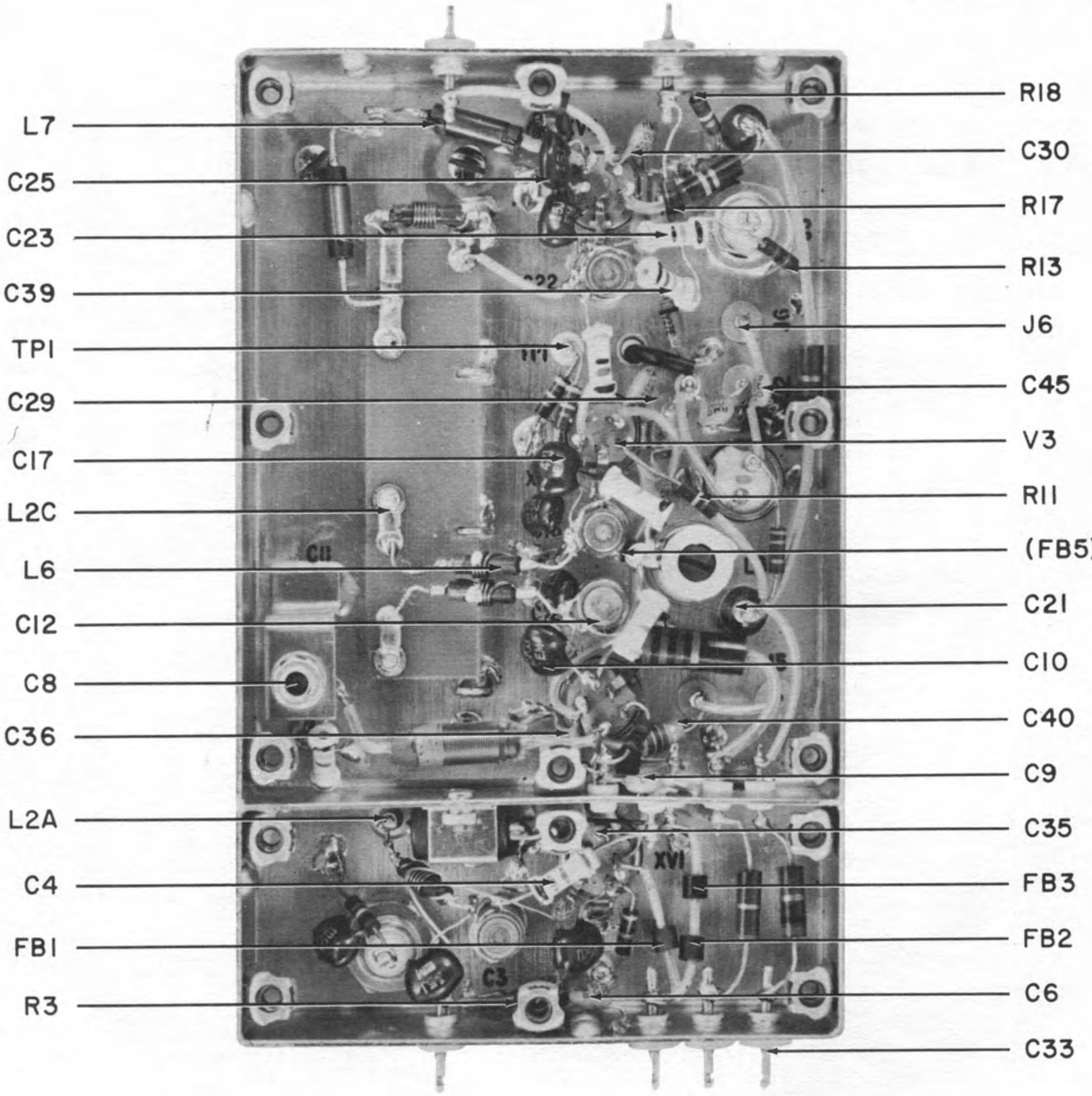


Figure 5-6. Type 7103 30-90 mc Tuner, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A1R1	RESISTOR, FIXED, COMPOSITION: 100K, 10%, 1/4W	CB1041	AB
A1R2	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1/4W	CB4735	AB
A1R3	RESISTOR, FIXED, COMPOSITION: 270K, 10%, 1/4W	CB2741	AB
A1R4	Same as A1R3		
A1R5	Same as A1R2		
A1R6	RESISTOR, FIXED, COMPOSITION: 10 Ω, 10%, 1/4W	CB1001	AB
A1R7	RESISTOR, FIXED, COMPOSITION: 6.8K, 5%, 1W	GB6825	AB
A1R8	RESISTOR, FIXED, COMPOSITION: 5.1K, 5%, 1/4W	CB5125	AB
A1R9	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	CB4745	AB
A1R10	Same as A1R9		
A1R11	RESISTOR, FIXED, COMPOSITION: 220K, 5%, 1/4W	CB2245	AB
A1R12	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	CB2235	AB
A1R13	RESISTOR, FIXED, COMPOSITION: 51 Ω, 5%, 1/4W	CB5105	AB
A1R14	RESISTOR, FIXED, COMPOSITION: 15K, 5%, 1/2W	EB1535	AB
A1R15	RESISTOR, FIXED, COMPOSITION; 1K, 5%, 1/2W	EB1025	AB
A1R16	Same as A1R15		
A1R17	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	CB1025	AB
A1R18	RESISTOR, FIXED, COMPOSITION: 150K, 5%, 1/4W	CB1545	AB
A1R19	RESISTOR, FIXED, COMPOSITION: 1.5K, 5%, 1/2W	EB1525	AB
A1R20	RESISTOR, FIXED, COMPOSITION: 33K, 5%, 1/4W	CB3335	AB
A1T1	TRANSFORMER	1469	CEI
A1TP1	TEST POINT	TJ-6	Taurus
A1V1	TUBE, ELECTRON: Nuvistor triode	6CW4	RCA
A1V2	Same as A1V1		
A1V3	TUBE, ELECTRON: Nuvistor tetrode	7587	RCA
A1V4	Same as A1V1		

REF DESIG PREFIX A2

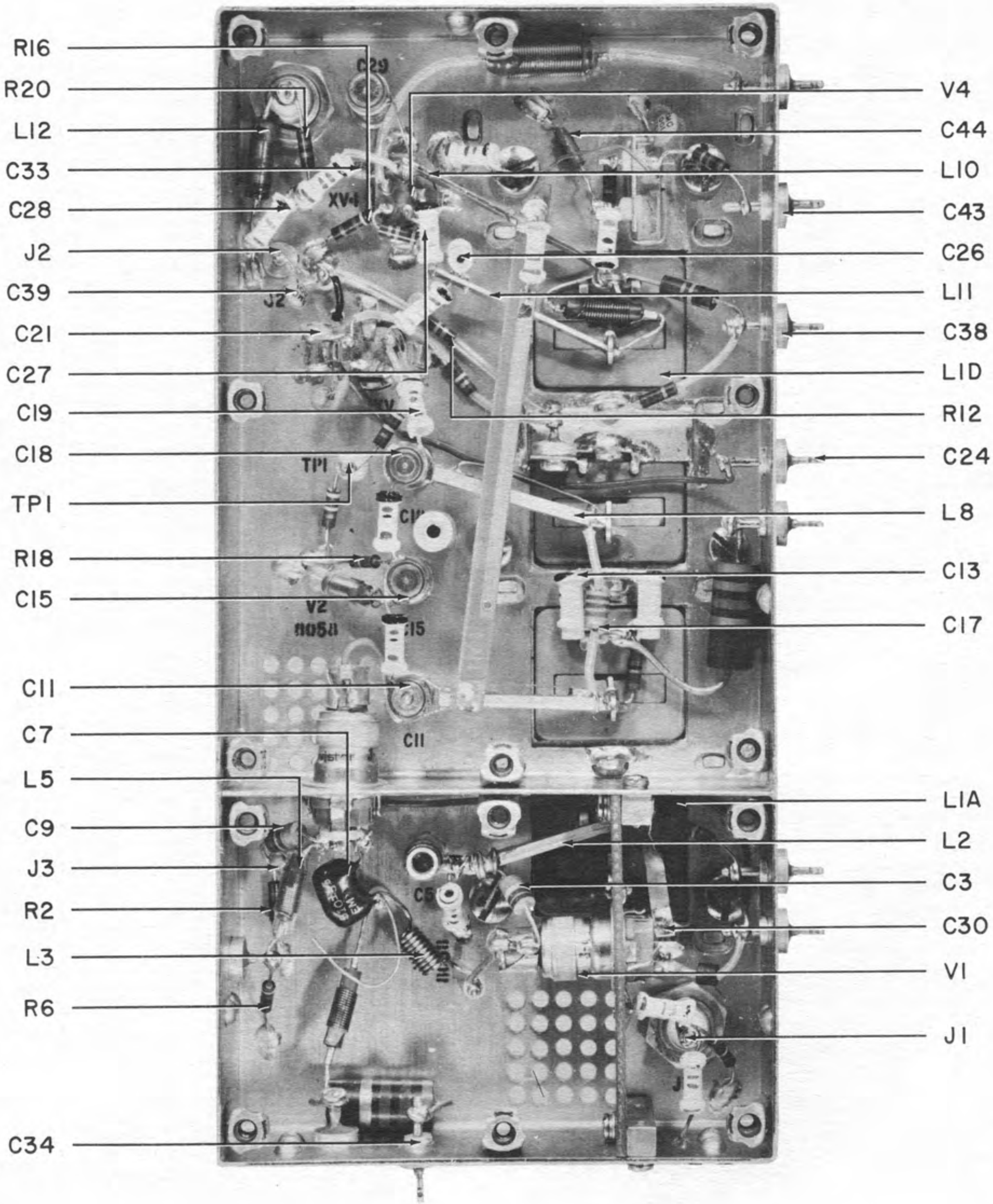


Figure 5-7. Type 7108 60-300 mc Tuner, Component Locations

5.4.4 Type 7108 60-300 mc Tuner

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A2C1	CAPACITOR, CERAMIC TUBULAR: 5.6 pf, ±0.5 pf	301-000-COHO-569D	Erie
A2C2	CAPACITOR, CERAMIC TUBULAR: 8.2 pf, ±0.5 pf	301-000-COHO-829D	Erie
A2C3	CAPACITOR, CERAMIC TUBULAR: 1.5 pf, 10%	Type QC	QC
A2C4	CAPACITOR, CERAMIC TUBULAR: 6.2 pf, ±0.5 pf	301-000-COHO-629D	Erie
A2C5	CAPACITOR, VARIABLE: 0.5-4.5 pf	CST-6	CTC
A2C6	CAPACITOR, CERAMIC STANDOFF: 1000 pf, GMV	SS5A-102W	AB
A2C7	CAPACITOR, DIPPED MICA: 510 pf, 5%	DM15-511J	Arco
A2C8	Same as A2C6		
A2C9	CAPACITOR, FIXED, COMPOSITION: .51 pf, 10%	Type QC	QC
A2C10	CAPACITOR, CERAMIC TUBULAR: 1.5 pf, ±.1 pf	NPOA	Erie
A2C11	CAPACITOR, VARIABLE, COMPOSITION: 0.7-9.0 pf	MG11016	Roanwell
A2C12	CAPACITOR, CERAMIC TUBULAR: 47 pf, 5%	308-000-COGO-470J	Erie
A2C13	Same as A2C12		
A2C14	CAPACITOR, CERAMIC TUBULAR: 1.0 ±0.1 pf	NPOA	Erie
A2C15	Same as A2C11		
A2C16	Same as A2C14		
A2C17	CAPACITOR, CERAMIC TUBULAR: 0.22 pf, 10%	Type QC	QC
A2C18	Same as A2C11		
A2C19	CAPACITOR, CERAMIC TUBULAR: 5.1 pf, ±0.5 pf	301-000-COHO-159D	Erie
A2C20	CAPACITOR, CERAMIC TUBULAR: .68 pf, ±.1 pf	NPOA	Erie
A2C21	CAPACITOR, CERAMIC DISC: 1000 pf, 20%	Type SM	RMC
A2C22	CAPACITOR, CERAMIC TUBULAR: 1.2 pf, ±.1 pf	NPOA	Erie
A2C23	CAPACITOR, CERAMIC TUBULAR: 2.7 pf nominal	NPOA	Erie
A2C24	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV	FA5C-102W	AB
A2C25	CAPACITOR, CERAMIC TUBULAR: 1.2 pf, ±.1 pf	NPOA	Erie
A2C26	CAPACITOR, CERAMIC TUBULAR: 3.3 pf, ±0.5 pf	N750A	Erie
A2C27	CAPACITOR, CERAMIC TUBULAR: 3.3 pf, ±0.25 pf	301-000-U2JO-339C	Erie
A2C28	CAPACITOR, CERAMIC TUBULAR: 4.7 pf, ±0.25 pf	301-000-COHO-479C	Erie
A2C29	Same as A2C11		
A2C30	Same as A2C21		
A2C31	Same as A2C21		

REF DESIG PREFIX A2

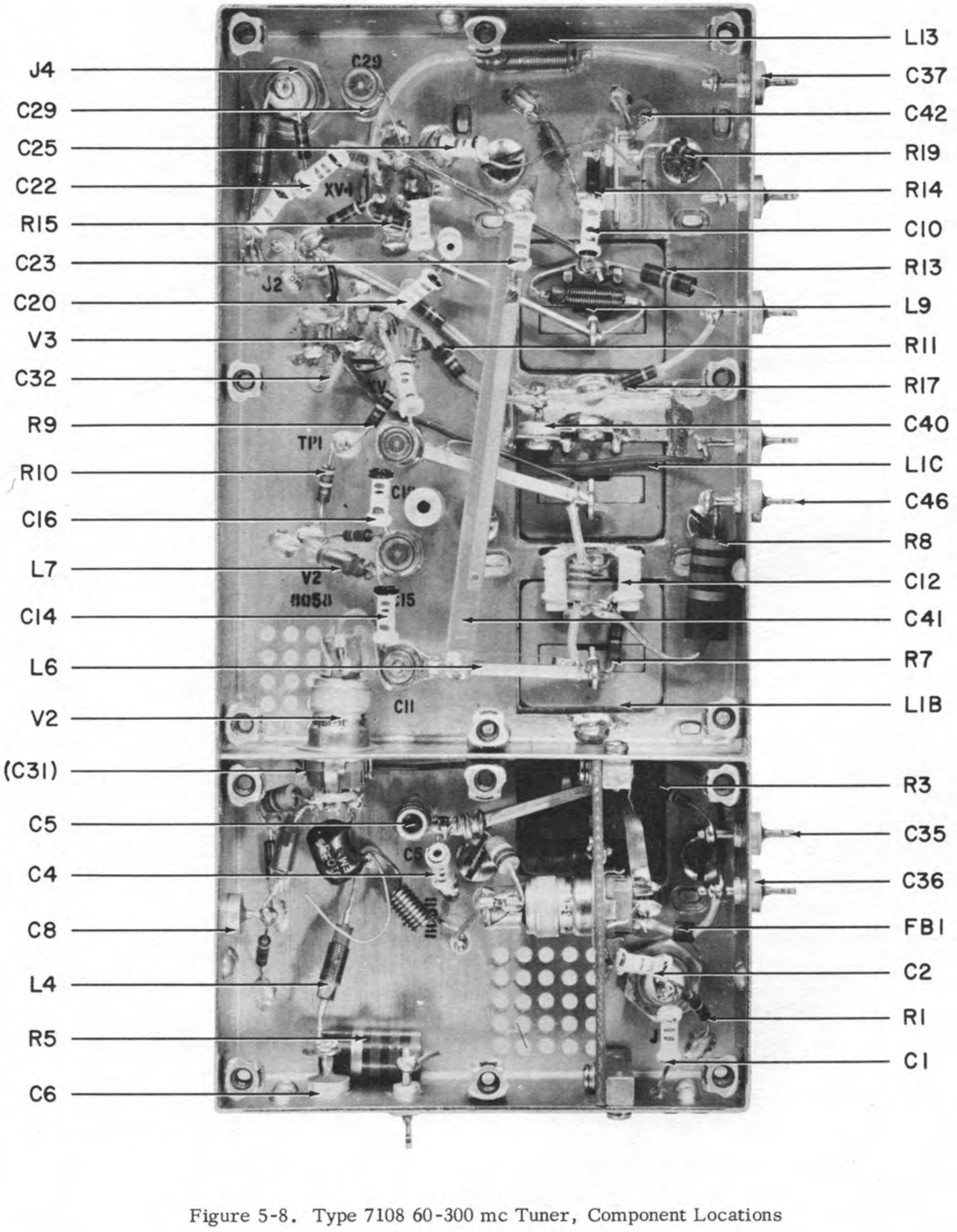


Figure 5-8. Type 7108 60-300 mc Tuner, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A2C32	Same as A2C21		
A2C33	Same as A2C21		
A2C34	Same as A2C24		
A2C35	Same as A2C24		
A2C36	Same as A2C24		
A2C37	Same as A2C24		
A2C38	Same as A2C24		
A2C39	Same as A2C21		
A2C40	Same as A2C6		
A2C41	CAPACITOR: p/o Circuit Board	1101	CEI
A2C42	Same as A2C21		
A2C43	Same as A2C24		
A2C44	DIODE, VARICAP	V-27E	PSI
A2C45	NOT USED		
A2C46	Same as A2C24		
A2FB1	FERRITE BEAD	56-590-65/4A	Ferroxcube
A2J1	RECEPTACLE, JACK: Type BNC	UG-1094/U	FXR
A2J2	RECEPTACLE, JACK	27-9	FXR
A2J3	Same as A2J2		
A2J4	Same as A2J1		
A2L1A, B C, D	INDUCTUNER: Four-section	2027	CEI
A2L2	INDUCTOR, PADDING	10167	CEI
A2L3	CHOKE	1129-01	CEI
A2L4	CHOKE	1131-36	CEI
A2L5	CHOKE	1131-01	CEI
A2L6	INDUCTOR, PADDING	10166	CEI
A2L7	CHOKE	1131-02	CEI
A2L8	INDUCTOR	1200-02	CEI
A2L9	CHOKE	1131-03	CEI
A2L10	INDUCTOR, PADDING	1107-2	CEI
A2L11	INDUCTOR, PADDING	10169	CEI
A2L12	COIL: 27 μh	W270	Wilco
A2L13	CHOKE	1131-05	CEI
A2R1	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	AB
A2R2	RESISTOR, FIXED, COMPOSITION: 51 Ω, 5%, 1/4W	CB5105	AB
A2R3	RESISTOR, FIXED, COMPOSITION: 680K, 5%, 1/4W	CB6845	AB

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A2R4	NOT USED		
A2R5	RESISTOR, FIXED, COMPOSITION: 6.2K, 5%, 2W	HB6225	AB
A2R6	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	CB4705	AB
A2R7	RESISTOR, FIXED, COMPOSITION: 15K, 5%, 1/4W	CB1535	AB
A2R8	RESISTOR, FIXED, COMPOSITION: 6.8K, 5%, 2W	HB6825	AB
A2R9	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	CB4745	AB
A2R10	Same as A2R9		
A2R11	RESISTOR, FIXED, COMPOSITION: 220K, 5%, 1/4W	CB2245	AB
A2R12	Same as A2R7		
A2R13	RESISTOR, FIXED, COMPOSITION: 20K, 5%, 1/2W	EB2035	AB
A2R14	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	CB1025	AB
A2R15	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1/4W	CB4735	AB
A2R16	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	CB4725	AB
A2R17	RESISTOR, FIXED, COMPOSITION: 2.2K, 5%, 1/4W	CB2225	AB
A2R18	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	CB2235	AB
A2R19	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	CB1015	AB
A2R20	Same as A2R2		
A2TP1	TEST POINT	TJ-6	Taurus
A2V1	TUBE, ELECTRON: Nuvistor triode	8058	RCA
A2V2	Same as A2V1		
A2V3	TUBE, ELECTRON: Nuvistor tetrode	7587	RCA
A2V4	TUBE, ELECTRON: Nuvsitor triode	6CW4	RCA

5.4.5 Type 7215 300 kc/ 3 mc Bandwidth IF Strip

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A3C1	CAPACITOR, CERAMIC DISC: .05 μf, 20%, 500V	33C17A	Sprague
A3C2	CAPACITOR, CERAMIC DISC: 1000 pf, GMV, 500V	Type SM	RMC
A3C3	Same as A3C2		
A3C4	CAPACITOR, DIPPED MICA: 18 pf, 5%, 500V	DM10-180J	Arco
A3C5	CAPACITOR, CERAMIC TUBULAR: 0.33 pf, 10%	Type MC	QC
A3C6	CAPACITOR, CERAMIC DISC: 470 pf, 1000V	Type B	RMC
A3C7	CAPACITOR, DIPPED MICA: 15 pf, 500V	DM10-150J	Arco
A3C8	Same as A3C6		
A3C9	Same as A3C2		
A3C10	Same as A3C4		
A3C11	CAPACITOR, CERAMIC TUBULAR: 0.51 pf, 10%	Type MC	QC
A3C12	Same as A3C2		
A3C13	CAPACITOR, CERAMIC STANDOFF: 1000 pf, GMV	SS5A-102W	AB
A3C14	Same as A3C6		
A3C15	Same as A3C7		
A3C16	Same as A3C2		
A3C17	Same as A3C4		
A3C18	Same as A3C2		
A3C19	Same as A3C13		
A3C20	CAPACITOR, CERAMIC TUBULAR: 0.82 pf, 10%	Type QC	QC
A3C21	Same as A3C6		
A3C22	Same as A3C4		
A3C23	Same as A3C7		
A3C24	Same as A3C7		
A3C25	Same as A3C2		
A3C26	Same as A3C7		
A3C27	Same as A3C2		
A3C28	Same as A3C13		
A3C29	Same as A3C2		
A3C30	Same as A3C7		
A3C31	Same as A3C2		
A3C32	CAPACITOR, DIPPED MICA: 22 pf, 5%, 500V	DM10-220J	Arco
A3C33	Same as A3C2		
A3C34	Same as A3C13		
A3C35	Same as A3C32		
A3C36	CAPACITOR, DIPPED MICA: 10 pf, 5%, 500V	DM10-100J	Arco

REF DESIG PREFIX A3

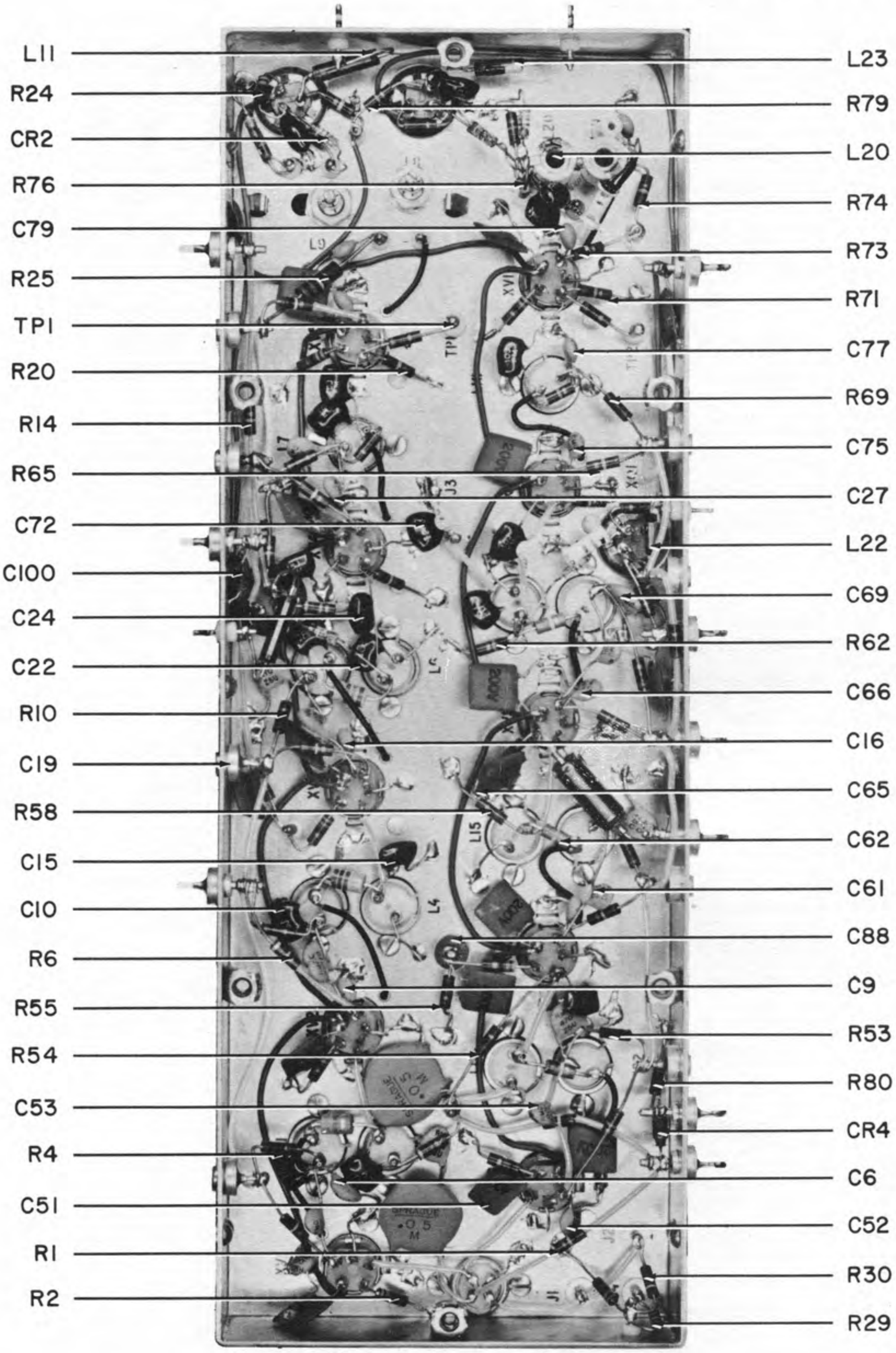


Figure 5-9. Type 7215 300-kc/3-mc IF Strip, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A3C37	CAPACITOR, DIPPED MICA: 100 pf, 5%, 500V	DM10-101J	Arco
A3C38	Same as A3C37		
A3C39	CAPACITOR, DIPPED MICA: 68 pf, 5%, 500V	DM10-680J	Arco
A3C40	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV	FA5C-102W	AB
A3C41	Same as A3C40		
A3C42	Same as A3C40		
A3C43	Same as A3C40		
A3C44	CAPACITOR, CERAMIC TUBULAR: 0.01 μf, 200V	4835-000-Z5UO-103M	Erie
A3C45	Same as A3C44		
A3C46	Same as A3C44		
A3C47	Same as A3C44		
A3C48	Same as A3C44		
A3C49	Same as A3C40		
A3C50	Same as A3C44		
A3C51	Same as A3C44		
A3C52	Same as A3C2		
A3C53	Same as A3C2		
A3C54	CAPACITOR, CERAMIC TUBULAR: 2.2 pf, 10%	Type MC	QC
A3C55	Same as A3C6		
A3C56	Same as A3C36		
A3C57	Same as A3C1		
A3C58	Same as A3C44		
A3C59	Same as A3C2		
A3C60	Same as A3C13		
A3C61	Same as A3C2		
A3C62	Same as A3C54		
A3C63	Same as A3C6		
A3C64	Same as A3C36		
A3C65	Same as A3C44		
A3C66	Same as A3C2		
A3C67	Same as A3C2		
A3C68	Same as A3C54		
A3C69	Same as A3C6		
A3C70	Same as A3C13		
A3C71	Same as A3C36		
A3C72	CAPACITOR, DIPPED MICA: 120 pf, 500V	DM10-121J	Arco

REF DESIG PREFIX A3

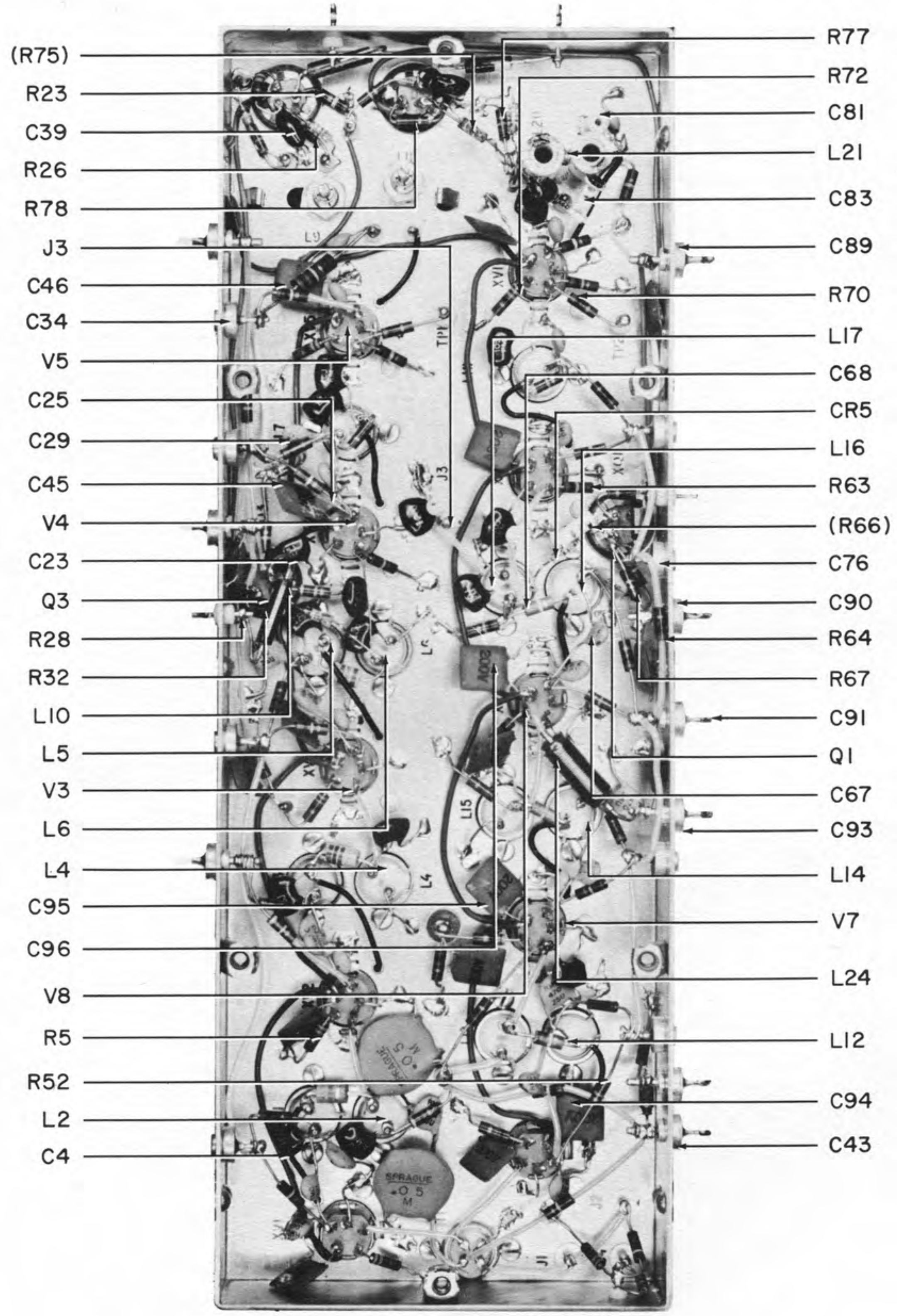


Figure 5-10. Type 7215 300-kc/3-mc IF Strip, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A3C73	Same as A3C36		
A3C74	CAPACITOR, CERAMIC TUBULAR: 8.2 pf, ±0.5 pf	301-000-COHO-829D	Erie
A3C75	Same as A3C2		
A3C76	Same as A3C13		
A3C77	Same as A3C2		
A3C78	Same as A3C36		
A3C79	Same as A3C2		
A3C80	Same as A3C13		
A3C81	CAPACITOR, CERAMIC TUBULAR: 2.7 pf, ±0.25 pf	301-000-COJO-279C	Erie
A3C82	Same as A3C2		
A3C83	Same as A3C81		
A3C84	Same as A3C4		
A3C85	Same as A3C4		
A3C86	Same as A3C36		
A3C87	Same as A3C44		
A3C88	Same as A3C13		
A3C89	Same as A3C40		
A3C90	Same as A3C40		
A3C91	Same as A3C40		
A3C92	Same as A3C44		
A3C93	Same as A3C40		
A3C94	Same as A3C44		
A3C95	Same as A3C44		
A3C96	Same as A3C44		
A3C97	Same as A3C44		
A3C98	Same as A3C44		
A3C99	Same as A3C44		
A3C100	Same as A3C44		
A3C101	Same as A3C44		
A3CR1	DIODE, ZENER	1N198	Sylvania
A3CR2S	Same as A3CR1		
A3CR3	Same as A3CR1		
A3CR4	DIODE, ZENER	1N752A	TI
A3CR5	Same as A3CR1		
A3CR6	Same as A3CR1		
A3CR7	Same as A3CR1		

REF DESIG PREFIX A3

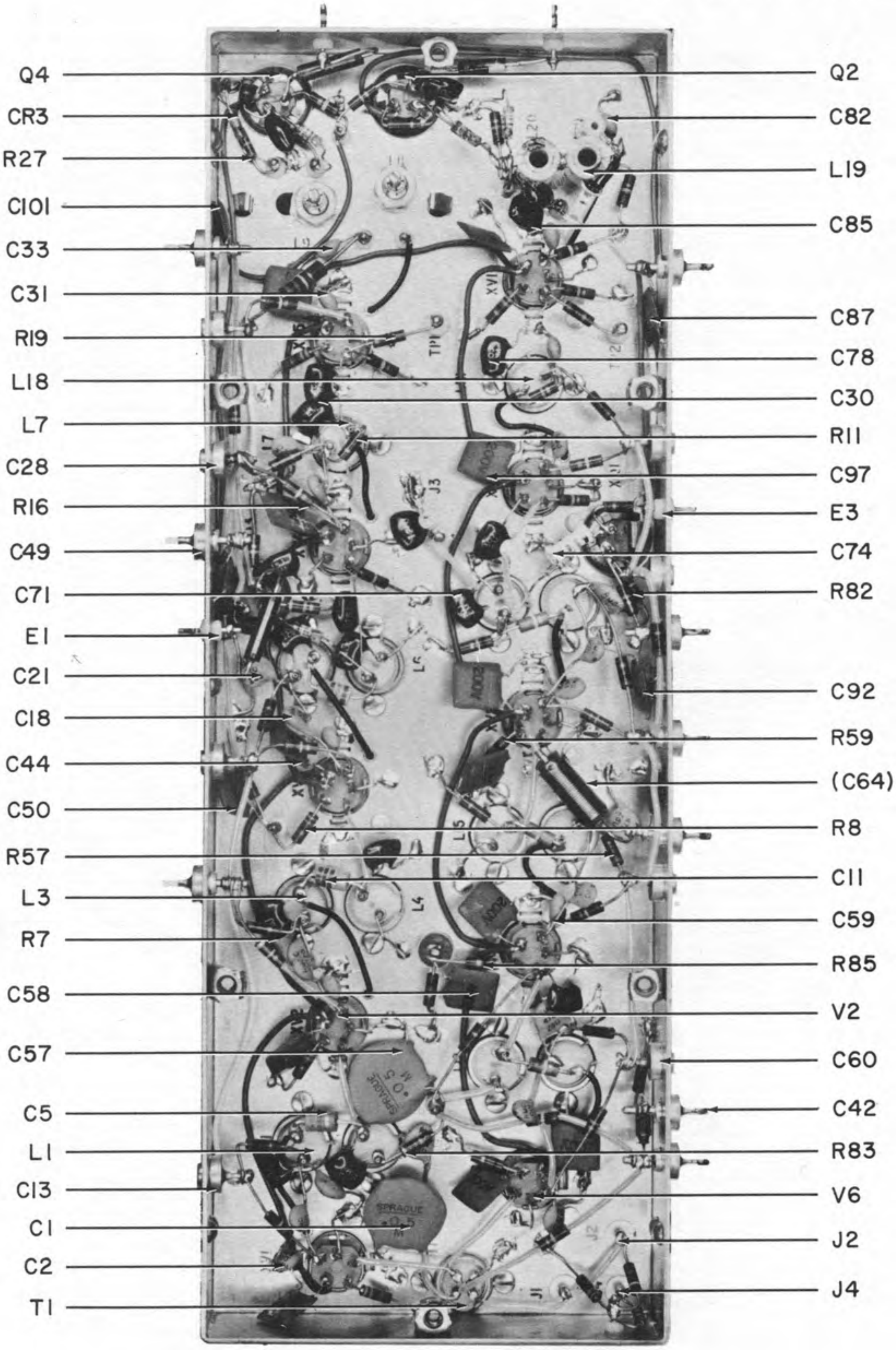


Figure 5-11. Type 7215 300-kc/3-mc IF Strip, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A3E1	FEEDTHRU	SFU-16	Taurus
A3E2	Same as A3E1		
A3E3	Same as A3E1		
A3E4	Same as A3E1		
A3J1	CONNECTOR, JACK	27-9	FXR
A3J2	Same as A3J1		
A3J3	Same as A3J1		
A3J4	Same as A3J1		
A3L1	COIL, VARIABLE	1472-3	CEI
A3L2	Same as A3L1		
A3L3	Same as A3L1		
A3L4	Same as A3L1		
A3L5	Same as A3L1		
A3L6	Same as A3L1		
A3L7	Same as A3L1		
A3L8	COIL, VARIABLE	2171-12	CEI
A3L9	COIL, VARIABLE	2171-20	CEI
A3L10	COIL, FIXED: 63 μh	1131-37	CEI
A3L11	Same as A3L10		
A3L12	COIL, VARIABLE	1472-4	CEI
A3L13	Same as A3L1		
A3L14	Same as A3L12		
A3L15	Same as A3L1		
A3L16	Same as A3L12		
A3L17	Same as A3L1		
A3L18	Same as A3L12		
A3L19	COIL, VARIABLE	1588-1	CEI
A3L20	COIL, VARIABLE	1588-2	CEI
A3L21	COIL, FIXED	1974	CEI
A3L22	CHOKE: Radio Frequency, 10 μh	1131-40	CEI
A3L23	Same as A3L22		
A3L24	COIL, FIXED	1131-5	CEI
A3Q1	TRANSISTOR	2N335	TI
A3Q2	Same as A3Q1		
A3Q3	Same as A3Q1		
A3Q4	Same as A3Q1		

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A3R1	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	AB
A3R2	RESISTOR, FIXED, COMPOSITION: 33 Ω, 5%, 1/4W	CB3305	AB
A3R3	RESISTOR, FIXED, COMPOSITION: 220K, 5%, 1/4W	CB2245	AB
A3R4	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	CB1025	AB
A3R5	Same as A3R2		
A3R6	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	CB4745	AB
A3R7	Same as A3R4		
A3R8	Same as A3R2		
A3R9	Same as A3R1		
A3R10	Same as A3R4		
A3R11	RESISTOR, FIXED, COMPOSITION: 8.2K, 5%, 1/4W	CB8225	AB
A3R12	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	CB2235	AB
A3R13	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1/4W	CB4735	AB
A3R14	Same as A3R12		
A3R15	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	CB1015	AB
A3R16	RESISTOR, FIXED, COMPOSITION: 150K, 5%, 1/4W	CB1545	AB
A3R17	Same as A3R4		
A3R18	Same as A3R12		
A3R19	RESISTOR, FIXED, COMPOSITION: 1 meg, 5%, 1/4W	CB1055	AB
A3R20	Same as A3R12		
A3R21	Same as A3R2		
A3R22	Same as A3R1		
A3R23	Same as A3R1		
A3R24	RESISTOR, FIXED, COMPOSITION: 3.3 meg, 5%, 1/4W	CB3355	AB
A3R25	RESISTOR, FIXED, COMPOSITION: 68K, 5%, 1/2W	EB6835	AB
A3R26	RESISTOR, FIXED, COMPOSITION: 75K, 5%, 1/4W	CB7535	AB
A3R27	Same as A3R26		
A3R28	Same as A3R4		
A3R29	RESISTOR, FIXED, COMPOSITION: 24 Ω, 5%, 1/4W	CB2405	AB
A3R30	Same as A3R29		
A3R31	Same as A3R2		
A3R32	RESISTOR, FIXED, COMPOSITION: 1.2 meg, 5%, 1/4W	CB1255	AB
A3R33	Same as A3R12		
A3R34 thru A3R50	NOT USED		
A3R51	Same as A3R15		

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A3R52	RESISTOR, FIXED, COMPOSITION: 82K, 5%, 1/4W	CB8235	AB
A3R53	Same as A3R4		
A3R54	RESISTOR, FIXED, COMPOSITION: 5.1K, 5%, 1/4W	CB5125	AB
A3R55	Same as A3R15		
A3R56	Same as A3R52		
A3R57	Same as A3R4		
A3R58	Same as A3R54		
A3R59	Same as A3R15		
A3R60	RESISTOR, FIXED, COMPOSITION: 68K, 5%, 1/4W	CB6835	AB
A3R61	Same as A3R4		
A3R62	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	CB1035	AB
A3R63	Same as A3R62		
A3R64	Same as A3R4		
A3R65	Same as A3R16		
A3R66	Same as A3R62		
A3R67	Same as A3R12		
A3R68	Same as A3R13		
A3R69	Same as A3R4		
A3R70	Same as A3R19		
A3R71	Same as A3R62		
A3R72	Same as A3R2		
A3R73	Same as A3R1		
A3R74	Same as A3R12		
A3R75	RESISTOR, FIXED, COMPOSITION: 27K, 5%, 1/4W	CB2735	AB
A3R76	Same as A3R11		
A3R77	Same as A3R75		
A3R78	Same as A3R32		
A3R79	Same as A3R12		
A3R80	Same as A3R19		
A3R81	Same as A3R1		
A3R82	Same as A3R12		
A3R83	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	CB4715	AB
A3R84	Same as A3R32		
A3R85	Same as A3R2		
A3T1	TRANSFORMER	1126	CEI
A3TP1	TEST POINT	TJ-6	Taurus
A3TP2	Same as A3TP1		

REF DESIG PREFIX A3

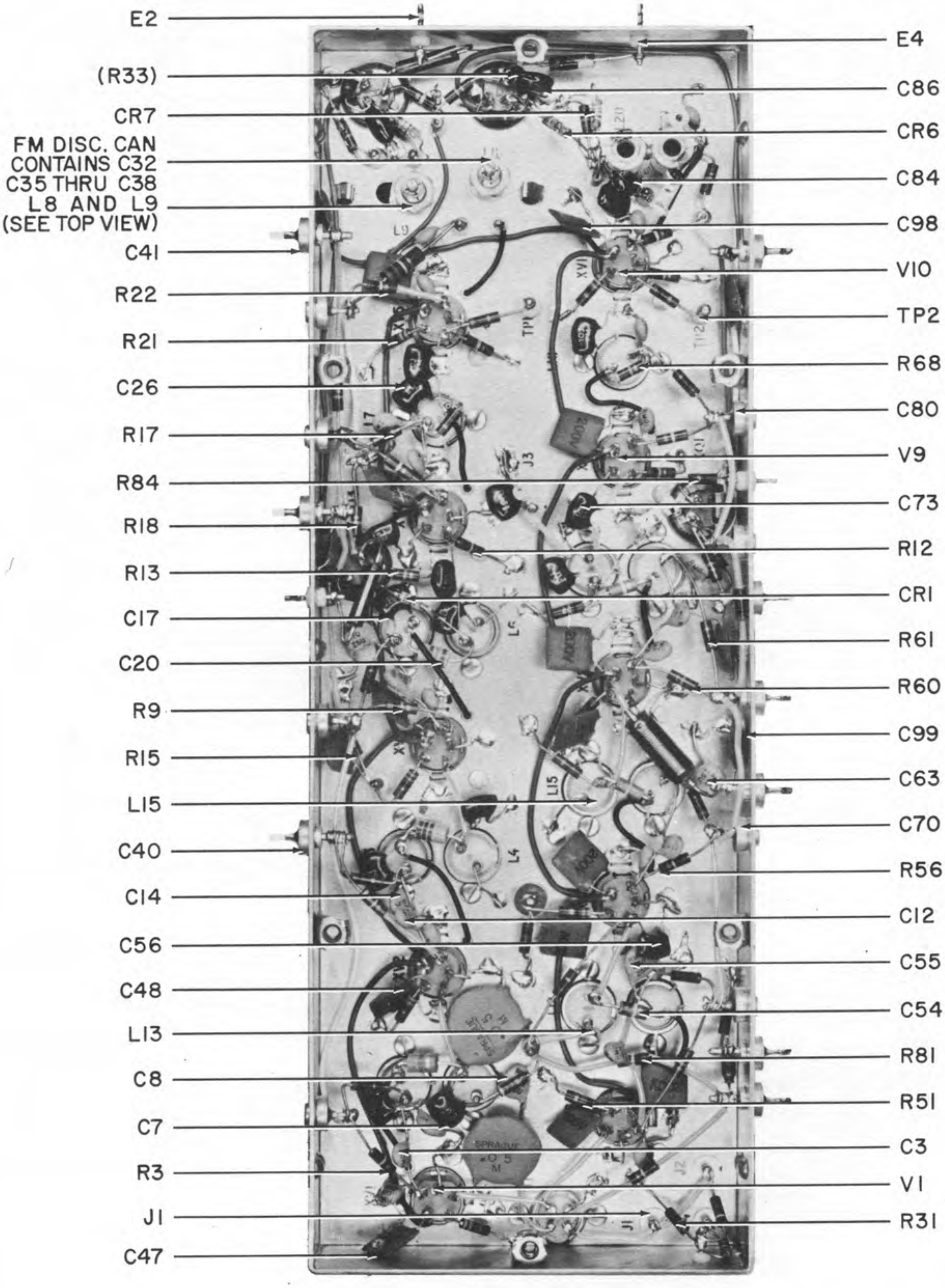


Figure 5-12. Type 7215 300-kc/3-mc IF Strip, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A3V1	TUBE, ELECTRON: Nuvistor tetrode	7587	RCA
A3V2	Same as A3V1		
A3V3	Same as A3V1		
A3V4	Same as A3V1		
A3V5	Same as A3V1		
A3V6	Same as A3V1		
A3V7	Same as A3V1		
A3V8	Same as A3V1		
A3V9	Same as A3V1		
A3V10	Same as A3V1		

REF DESIG PREFIX A4

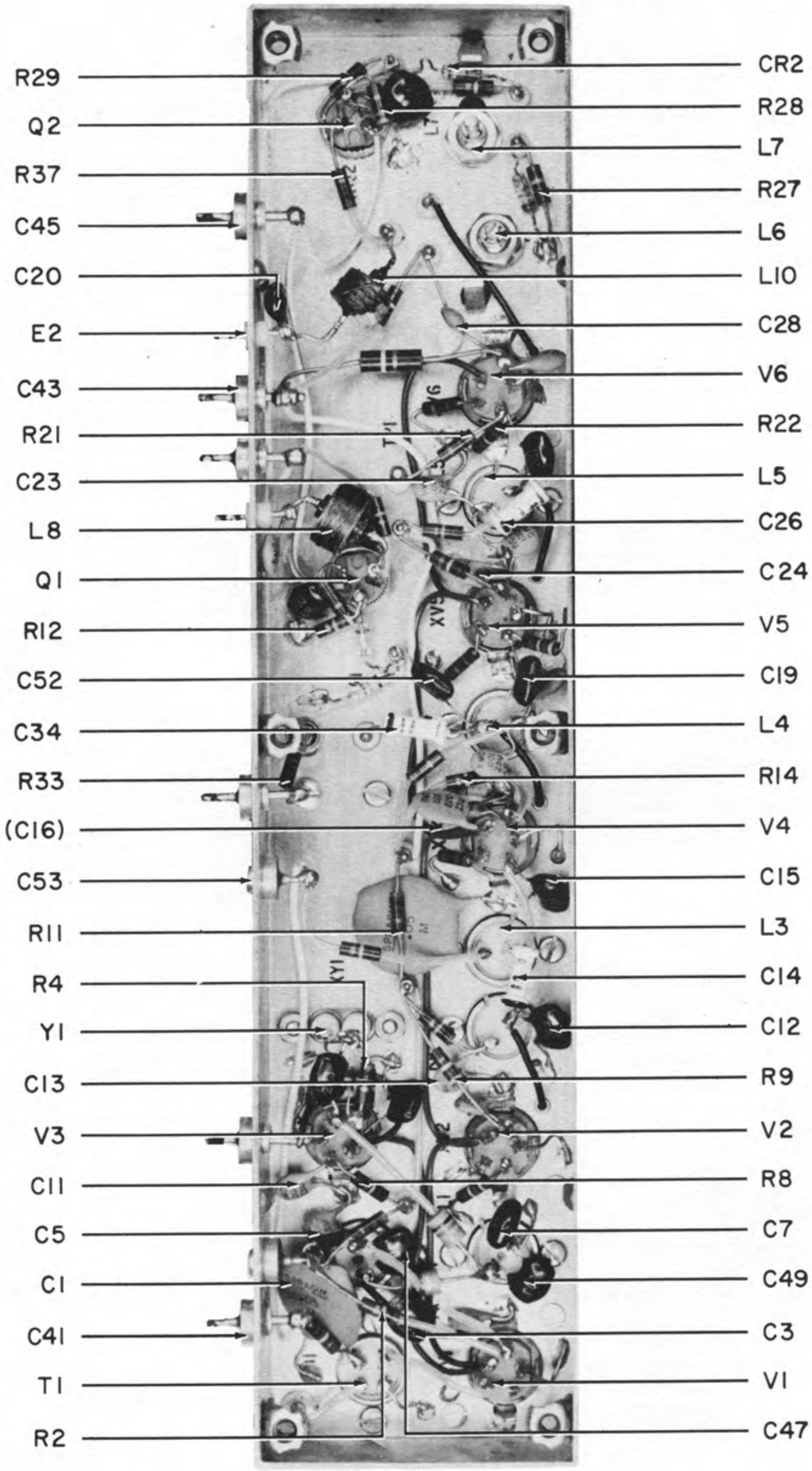


Figure 5-13. Type 7212 60-kc IF Strip, Component Locations

5.4.6 Type 7212 60 kc Bandwidth IF Strip

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A4C1	CAPACITOR, CERAMIC DISC: .05 μf, 20%, 500V	33C17A	Sprague
A4C2	CAPACITOR, CERAMIC DISC: 1000 pf, 20%, 500V	Type SM	RMC
A4C3	CAPACITOR, DIPPED MICA: 270 pf, 5%	DM10-271J	Arco
A4C4	CAPACITOR, CERAMIC STANDOFF: 1000 pf, GMV	SS5A-102W	AB
A4C5	Same as A4C2		
A4C6	CAPACITOR, CERAMIC TUBULAR: 0.51 μf, 10%	Type QC	QC
A4C7	CAPACITOR, DIPPED MICA: 47 pf, 5%	DM10-470J	Arco
A4C8	Same as A4C2		
A4C9	CAPACITOR, DIPPED MICA: 22 pf, 5%	DM10-220J	Arco
A4C10	Same as A4C9		
A4C11	Same as A4C2		
A4C12	CAPACITOR, DIPPED MICA: 47 pf, 5%	DM10-470J	Arco
A4C13	Same as A4C2		
A4C14	CAPACITOR, CERAMIC TUBULAR: 1.0 pf, ±0.25 pf	301-000-COKO-109C	Erie
A4C15	CAPACITOR, DIPPED MICA: 43 pf, 5%	DM10-430J	Arco
A4C16	Same as A4C2		
A4C17	Same as A4C2		
A4C18	Same as A4C2		
A4C19	CAPACITOR, DIPPED MICA: 10 pf, 5%	DM10-100J	Arco
A4C20	CAPACITOR, DIPPED MICA: 100 pf, 5%	DM10-101J	Arco
A4C21	CAPACITOR, DIPPED MICA: 33 pf, 5%	DM10-330J	Arco
A4C22	Same as A4C2		
A4C23	Same as A4C2		
A4C24	Same as A4C2		
A4C25	Same as A4C19		
A4C26	CAPACITOR, CERAMIC TUBULAR: 4.7 pf, ±.5 pf	301-000-COHO-479D	Erie
A4C27	Same as A4C2		
A4C28	Same as A4C2		
A4C29	CAPACITOR, DIPPED MICA: 82 pf, 5%	DM10-820J	Arco
A4C30	Same as A4C21		
A4C31	Same as A4C20		
A4C32	Same as A4C20		
A4C33	CAPACITOR, DIPPED MICA: 200 pf, 5%	DM10-201J	Arco
A4C34	CAPACITOR, CERAMIC TUBULAR: 2.2 pf, ±0.25 pf	301-000-COJO-229C	Erie

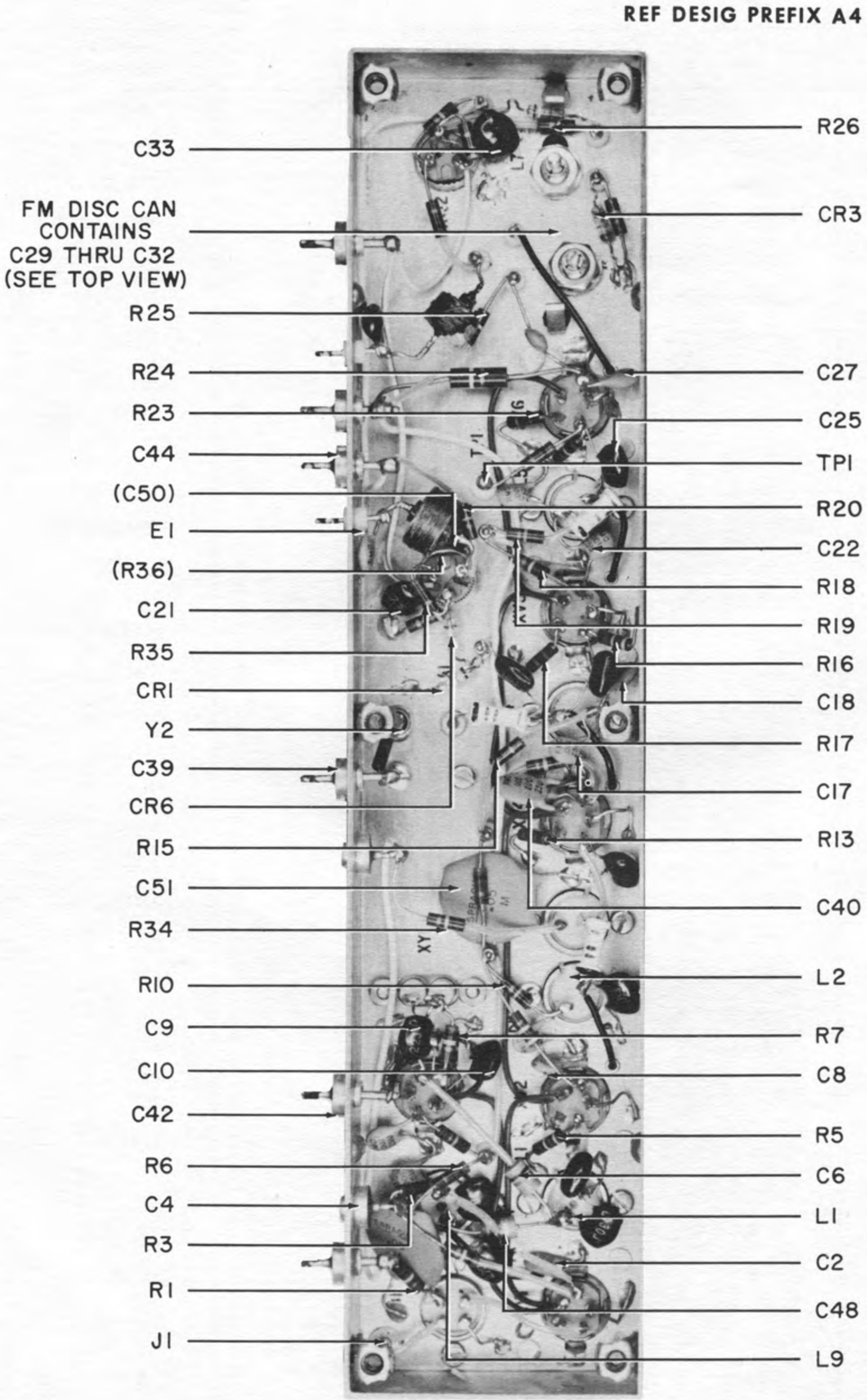


Figure 5-14. Type 7212 60-kc IF Strip, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A4C35	CAPACITOR, CERAMIC DISC: .005 μf, 20%, 500V	Type SM	RMC
A4C36	CAPACITOR, DIPPED MICA: 68 pf, 5%	DM10-680J	Arco
A4C37	CAPACITOR, DIPPED MICA: 43 pf, 5%	DM10-430J	Arco
A4C38	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV	FA5C-102W	AB
A4C39	Same as A4C38		
A4C40	Same as A4C35		
A4C41	Same as A4C38		
A4C42	Same as A4C38		
A4C43	Same as A4C38		
A4C44	Same as A4C38		
A4C45	Same as A4C38		
A4C46	NOT USED		
A4C47	CAPACITOR, DIPPED MICA: 30 pf, 5%	DM10-300J	Arco
A4C48	CAPACITOR, CERAMIC TUBULAR: .82 pf, 10%	Type QC	QC
A4C49	Same as A4C47		
A4C50	CAPACITOR, DIPPED MICA: 470 pf, 5%	DM15-471J	Arco
A4C51	Same as A4C1		
A4C52	CAPACITOR, DIPPED MICA: 10 pf, 5%	DM10-100J	Arco
A4C53	Same as A4C4		
A4CR1	DIODE	1N198	Sylvania
A4CR2	Same as A4CR1		
A4CR3	Same as A4CR1		
A4CR4	DIODE	1N462A	CD
A4CR5	Same as A4CR4		
A4CR6	Same as A4CR1		
A4E1	FEEDTHRU, INSULATED	SFU-16	Taurus
A4E2	Same as A4E1		
A4J1	CONNECTOR, JACK	27-9	FXR
A4L1	COIL, VARIABLE	1472-2	CEI
A4L2	COIL, VARIABLE	1472-8	CEI
A4L3	Same as A4L2		
A4L4	COIL, VARIABLE	1472-9	CEI
A4L5	Same as A4L4		
A4L6	COIL, VARIABLE	2060-6	CTC
A4L7	COIL, VARIABLE	1041-1	CEI
A4L8	COIL, FIXED: 1000 μh	11000-15	Wilco
A4L9	Same as A4L1		

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A4L10	COIL, FIXED: 430 μh	3430-15	Wilco
A4Q1	TRANSISTOR	2N335	TI
A4Q2	Same as A4Q1		
A4Q3	TRANSISTOR	2N706	TI
A4R1	RESISTOR, FIXED, COMPOSITION: 220K, 5%, 1/4W	CB2245	AB
A4R2	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	AB
A4R3	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	CB1025	AB
A4R4	Same as A4R2		
A4R5	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	CB4745	AB
A4R6	Same as A4R3		
A4R7	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	CB2235	AB
A4R8	Same as A4R7		
A4R9	Same as A4R5		
A4R10	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	CB1035	AB
A4R11	Same as A4R3		
A4R12	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1/4W	CB4735	AB
A4R13	RESISTOR, FIXED, COMPOSITION: 56 Ω, 5%, 1/4W	CB5605	AB
A4R14	Same as A4R2		
A4R15	Same as A4R3		
A4R16	Same as A4R12		
A4R17	Same as A4R13		
A4R18	Same as A4R1		
A4R19	Same as A4R7		
A4R20	Same as A4R7		
A4R21	RESISTOR, FIXED, COMPOSITION: 1 meg, 5%, 1/4W	CB1055	AB
A4R22	Same as A4R10		
A4R23	Same as A4R13		
A4R24	RESISTOR, FIXED, COMPOSITION: 220K, 5%, 1/2W	EB2245	AB
A4R25	RESISTOR, FIXED, COMPOSITION: 150K, 5%, 1/4W	CB1545	AB
A4R26	Same as A4R2		
A4R27	Same as A4R2		
A4R28	RESISTOR, FIXED, COMPOSITION: 3.3 meg, 5%, 1/4W	CB3355	AB
A4R29	Same as A4R2		
A4R30	Same as A4R12		
A4R31	RESISTOR, FIXED, COMPOSITION: 240K, 5%, 1/4W	CB2445	AB
A4R32	Same as A4R10		
A4R33	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	CB1015	AB

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A4R34	Same as A4R1		
A4R35	RESISTOR, FIXED, COMPOSITION: 1.2 meg, 5%, 1/4W	CB1255	AB
A4R36	Same as A4R7		
A4R37	Same as A4R3		
A4T1	TRANSFORMER	1126	CEI
A4TP1	TEST POINT	TJ-6	Taurus
A4V1	TUBE, ELECTRON: Nuvistor tetrode	7587	RCA
A4V2	Same as A4V1		
A4V3	TUBE, ELECTRON: Nuvistor triode	6CW4	RCA
A4V4	Same as A4V1		
A4V5	Same as A4V1		
A4V6	Same as A4V1		
A4Y1	CRYSTAL: 18.9 mc except must be 15 pf	CR-78/U	Piezo
A4Y2	CRYSTAL: 2.5 mc except must be wire leads	CR-18/U	Piezo

5.4.7 Type 7301 Video Amplifier

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A5C1	CAPACITOR, ELECTROLYTIC: 2.2 μf, 20%, 20V	150D225X-0020A2	Sprague
A5C2	CAPACITOR, ELECTROLYTIC: 47 μf, 20%, 35V	150D476X-0035S2	Sprague
A5C3	Same as A5C2		
A5C4	CAPACITOR, CERAMIC DISC: .01 μf, 20%, 200V	4835-000-Z5UO-103M	Erie
A5Q1	TRANSISTOR	2N335	TI
A5Q2	TRANSISTOR	2N697	TI
A5Q3	TRANSISTOR	2N1131	TI
A5R1	RESISTOR, FIXED, COMPOSITION: 2 meg, 5%, 1/4W	CB2055	AB
A5R2	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	AB
A5R3	RESISTOR, FIXED, COMPOSITION: 8.2K, 5%, 1/4W	CB8225	AB
A5R4	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	CB2235	AB
A5R5	RESISTOR, FIXED, COMPOSITION: 110K, 5%, 1/4W	CB1145	AB
A5R6	RESISTOR, FIXED, COMPOSITION: 2.2K, 5%, 1/4W	CB2225	AB
A5R7	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	CB1015	AB
A5R8	RESISTOR, FIXED, COMPOSITION: 620 Ω, 5%, 1/4W	CB6215	AB
A5R9	RESISTOR, FIXED, COMPOSITION: 24 Ω, 5%, 1/4W	CB2405	AB
A5R10	RESISTOR, FIXED, COMPOSITION: 160 Ω, 5%, 1/4W	CB1615	AB
A5R11	Same as A5R2		

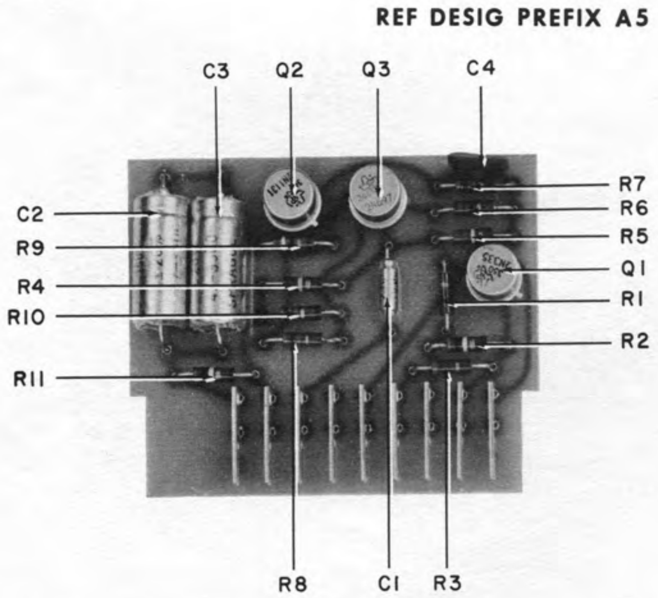


Figure 5-15. Type 7301 Video Amplifier, Component Locations

5.4.8 Type 7400 Audio Amplifier

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A6C1	CAPACITOR, ELECTROLYTIC TANTALUM: 0.47 μf	150D474X-0035A2	Sprague
A6C2	CAPACITOR, ELECTROLYTIC TANTALUM: 10 μf, 20%, 20V	150D106X-0020B2	Sprague
A6CR1	DIODE, ZENER	1N759A	CD
A6Q1	TRANSISTOR, SILICON	2N335	TI
A6Q2	Same as A6Q1		
A6Q3	TRANSISTOR, SILICON	2N2270	RCA
A6R1	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/2W	EB1035	AB
A6R2	RESISTOR, FIXED, COMPOSITION: 68.1K, 1%, 1/8W	RN60B6812F	TI
A6R3	RESISTOR, FIXED, CARBON FILM: 10K, 1%, 1/8W	RN60B1002F	TI
A6R4	RESISTOR, FIXED, CARBON FILM: 6.81K, 1%, 1/8W	RN60B6811F	TI
A6R5	RESISTOR, FIXED, CARBON FILM: 619 Ω, 1%, 1/8W	RN60B6190F	TI
A6R6	RESISTOR, FIXED, COMPOSITION: 3.9K, 5%, 1/2W	EB3925	AB
A6R7	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/2W	EB1045	AB
A6R8	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	CB8215	AB
A6R9	RESISTOR, FIXED, COMPOSITION: 620 Ω, 5%, 1/2W	EB6215	AB
A6R10	RESISTOR, FIXED, CARBON FILM: 68.1 Ω, 1%, 1/8W	RN60B68R1F	TI
A6T1	TRANSFORMER: Audio output	1170	CEI

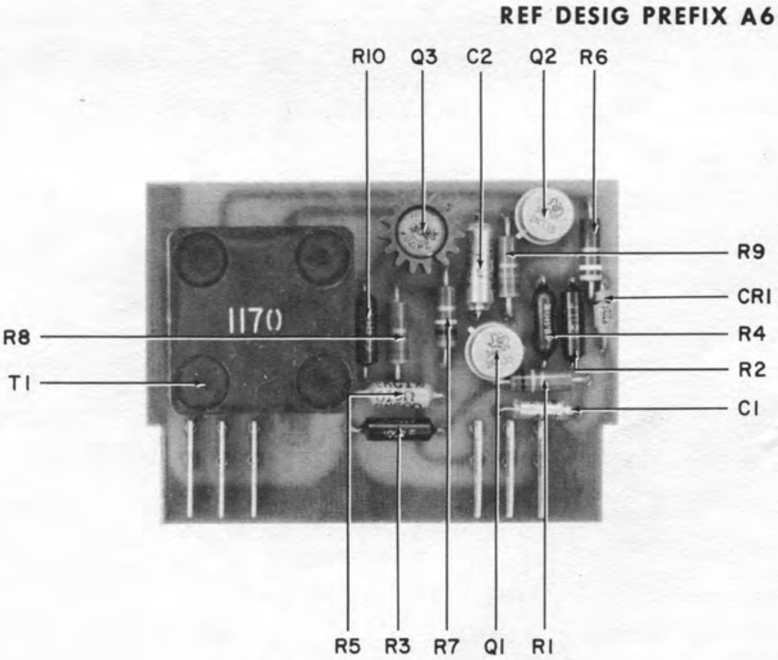


Figure 5-16. Type 7400 Audio Amplifier, Component Locations

5.4.9 Type 7800 AGC Amplifier.- Type 7800 AGC Amplifier was used on 970A Receiver serial numbers 101-110 and 975 Receivers serial numbers 101-103.

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A7C1	CAPACITOR, ELECTROLYTIC, TANTALUM: .047 µf, 20%, 35V	150D473X-0035A2	Sprague
A7C2	CAPACITOR, ELECTROLYTIC, TANTALUM: .47 µf, 20%, 35V	150D474X-0035A2	Sprague
A7C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 µf, 20%, 35V	150D106X-0035R2	Sprague
A7C4	Same as A7C3		
A7C5	CAPACITOR, DIPPED MICA: 470 pf, 5%	DM15-471J	Arco
A7C6	Same as A7C3		
A7C7	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 µf, 20%, 35V	150D105X-0035A2	Sprague
A7C8	CAPACITOR, CERAMIC DISC: .01 µf, 200V	4835-000-Z5UO-103M	Erie
A7C9	Same as A7C7		
A7CR1	DIODE, SWITCHING	1N914	TI
A7CR2	DIODE, ZENER: 6.2V	1N753A	Motorola
A7CR3	DIODE, ZENER: 8.2V	1N756A	TI
A7Q1	TRANSISTOR	2N697	TI
A7Q2	Same as A7Q1		
A7Q3	Same as A7Q1		
A7Q4	Same as A7Q1		
A7Q5	TRANSISTOR	2N1305	RCA
A7R1	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	CB2215	AB
A7R2	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	CB2235	AB
A7R3	Same as A7R2		
A7R4	RESISTOR, FIXED, COMPOSITION: 680K, 5%, 1/4W	CB6845	AB
A7R5	RESISTOR, FIXED, COMPOSITION: 620 Ω, 5%, 1/4W	CB6215	AB
A7R6	Same as A7R2		
A7R7	Same as A7R2		
A7R8	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	CB4725	AB
A7R9	RESISTOR, FIXED, COMPOSITION: 22 meg, 5%, 1/4W	CB2265	AB
A7R10	RESISTOR, FIXED, COMPOSITION: 2.7K, 5%, 1/4W	CB2725	AB
A7R11	RESISTOR, FIXED, COMPOSITION: 3.3K, 5%, 1/4W	CB3325	AB
A7R12	Same as A7R2		
A7R13	Same as A7R2		
A7R14	RESISTOR, FIXED, COMPOSITION: 33K, 5%, 1/4W	CB3335	AB
A7R15	Same as A7R10		

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A7R16	RESISTOR, FIXED, COMPOSITION: 150K, 5%, 1/4W	CB1545	AB
A7R17	Same as A7R2		
A7R18	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	CB4745	AB
A7R19	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	CB1035	AB
A7R20	RESISTOR, FIXED, COMPOSITION: 10 meg, 5%, 1/4W	CB1065	AB
A7R21	RESISTOR, FIXED, COMPOSITION: 200K, 5%, 1/4W	CB2045	AB
A7R22	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	AB
A7R23	Same as A7R19		
A7R24	Same as A7R19		
A7R25	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1/4W	CB4735	AB

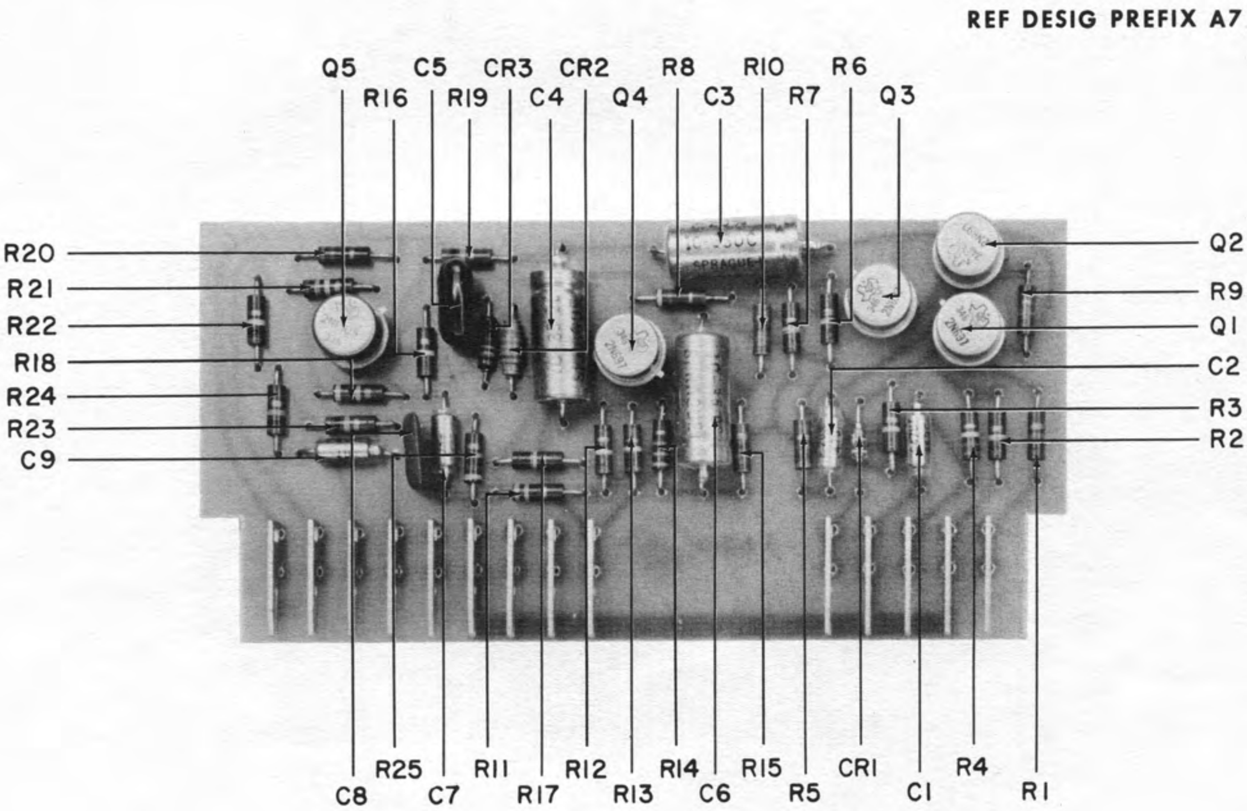


Figure 5-17. Type 7800 AGC Amplifier, Component Locations

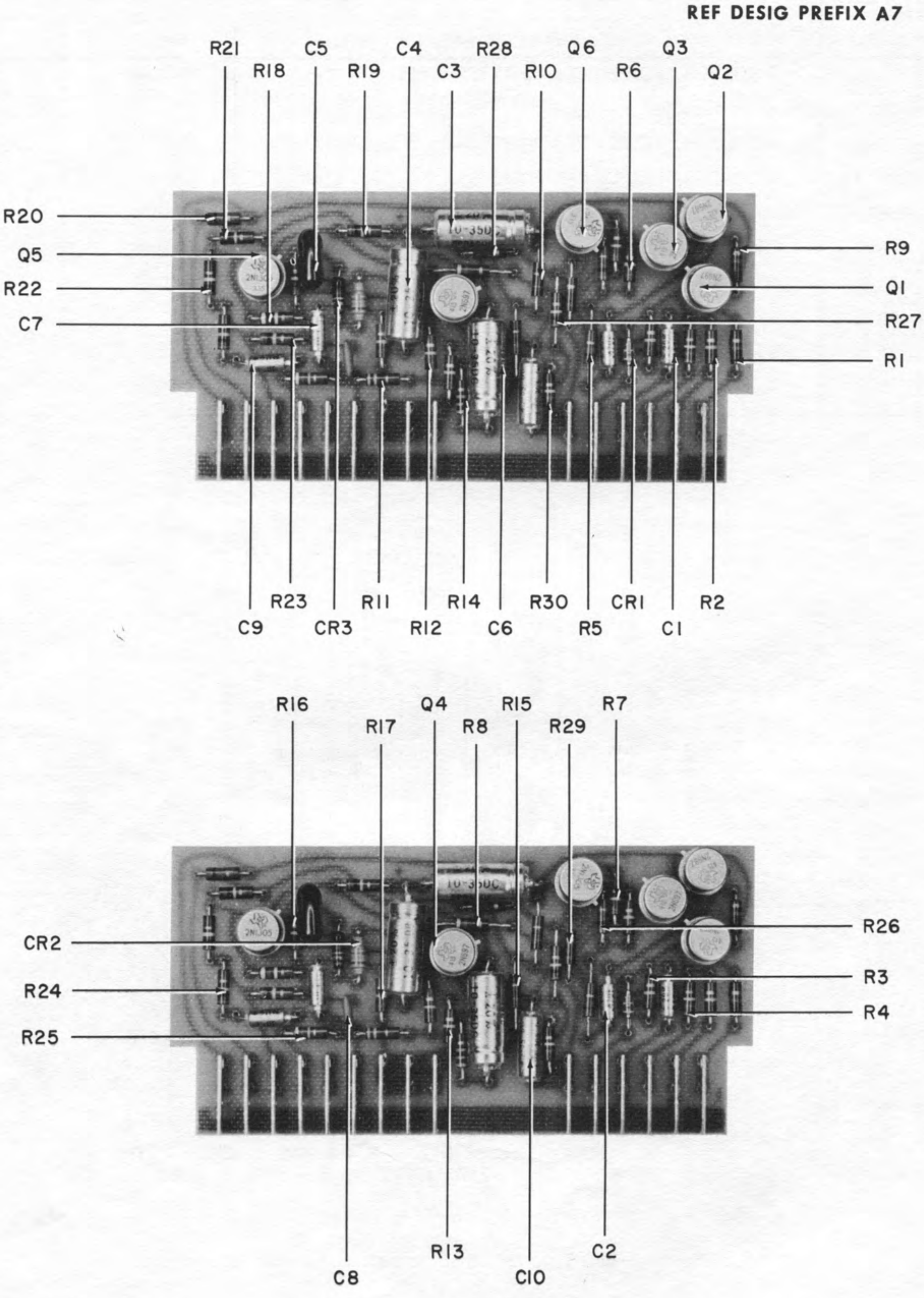


Figure 5-18. Type 7811 AGC Amplifier, Component Locations

5.4.10 Type 7811 AGC Amplifier.- Type 7811 AGC Amplifier is used on 970A Receivers serial number 111 and higher and on 975 Receivers serial number 104 and higher.

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A7C1	CAPACITOR, ELECTROLYTIC, TANTALUM: .047 μf, 20%, 35V	150D473X-0035A2	Sprague
A7C2	CAPACITOR, ELECTROLYTIC, TANTALUM: .47 μf, 20%, 35V	150D474X-0035A2	Sprague
A7C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μf, 20%, 35V	150D106X-0035R2	Sprague
A7C4	Same as A7C3		
A7C5	CAPACITOR, DIPPED MICA: 470 pf, 5%, 500V	DM15-471J	Arco
A7C6	Same as A7C3		
A7C7	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μf, 20%, 35V	150D105X-0035A2	Sprague
A7C8	CAPACITOR, CERAMIC DISC: .01 μf, 20%, 200V	4835-000-Z5UO-103M	Erie
A7C9	Same as A7C7		
A7C10	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μf, 20%, 35V	150D475X-0035B2	Sprague
A7CR1	DIODE	1N914	TI
A7CR2	DIODE, ZENER	1N753A	Motorola
A7CR3	DIODE, ZENER	1N756A	TI
A7Q1	TRANSISTOR	2N697	TI
A7Q2	Same as A7Q1		
A7Q3	Same as A7Q1		
A7Q4	Same as A7Q1		
A7Q5	TRANSISTOR	2N1305	TI
A7Q6	Same as A7Q5		
A7R1	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	CB2215	AB
A7R2	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	CB2235	AB
A7R3	Same as A7R2		
A7R4	RESISTOR, FIXED, COMPOSITION: 680K, 5%, 1/4W	CB6845	AB
A7R5	RESISTOR, FIXED, COMPOSITION: 620 Ω, 5%, 1/4W	CB6215	AB
A7R6	Same as A7R2		
A7R7	Same as A7R2		
A7R8	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	CB4725	AB
A7R9	RESISTOR, FIXED, COMPOSITION: 22 meg, 5%, 1/4W	CB2265	AB
A7R10	RESISTOR, FIXED, COMPOSITION: 2.7K, 5%, 1/4W	CB2725	AB
A7R11	RESISTOR, FIXED, COMPOSITION: 3.3K, 5%, 1/4W	CB3325	AB
A7R12	Same as A7R2		

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A7R13	Same as A7R2		
A7R14	RESISTOR, FIXED, COMPOSITION: 33K, 5%, 1/4W	CB3335	AB
A7R15	Same as A7R10		
A7R16	RESISTOR, FIXED, COMPOSITION: 150K, 5%, 1/4W	CB1545	AB
A7R17	Same as A7R2		
A7R18	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	CB4745	AB
A7R19	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	CB1035	AB
A7R20	RESISTOR, FIXED, COMPOSITION: 10 meg, 5%, 1/4W	CB1065	AB
A7R21	RESISTOR, FIXED, COMPOSITION: 200K, 5%, 1/4W	CB2045	AB
A7R22	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	AB
A7R23	Same as A7R19		
A7R24	Same as A7R19		
A7R25	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1/4W	CB4735	AB
A7R26	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	CB1025	AB
A7R27	Same as A7R19		
A7R28	RESISTOR, FIXED, COMPOSITION: 2.2 meg, 5%, 1/4W	CB2255	AB
A7R29	Same as A7R28		
A7R30	RESISTOR, FIXED, COMPOSITION: 270K, 5%, 1/4W	CB2745	AB

5.4.11 Type 7909 Coupling Network

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A8J1	CONNECTOR, JACK: Type BNC	UG-1094/U	FXR
A8J2	Same as A8J1		
A8J3	Same as A8J1		
A8R1	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	CB1015	AB
A8R2	RESISTOR, FIXED, COMPOSITION: 68 Ω, 5%, 1/4W	CB6805	AB
A8R3	NOT USED		
A8R4	Same as A8R2		
A8R5	Same as A8R1		

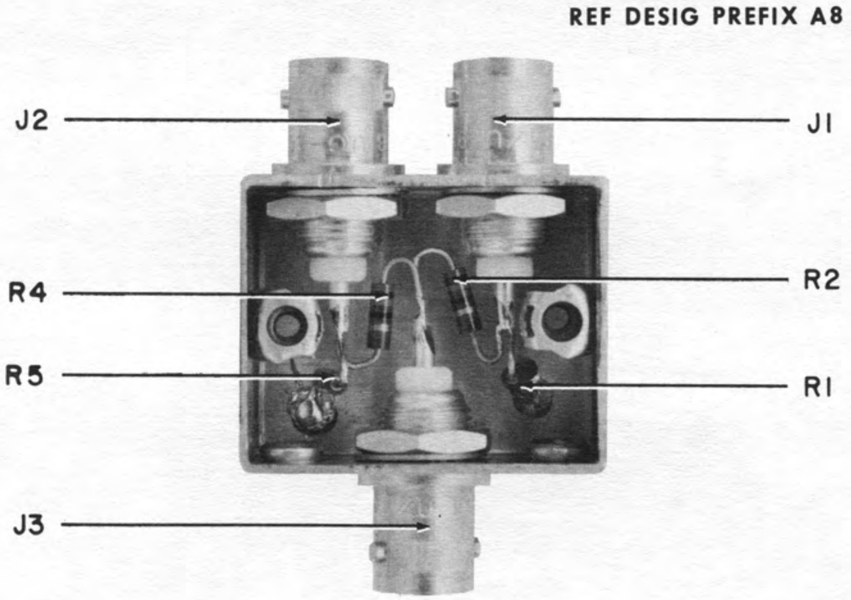


Figure 5-19. Type 7909 Coupling Network, Component Locations

5.4.12 Type 7500 Carrier Operated Relay

Ref. Desig.	Description	Vendor Part No.	Vendor Name
A9C1	CAPACITOR, ELECTROLYTIC TANTALUM: 0.1 µf, 20%, 200V	150D104X-9035A2	Sprague
A9C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 µf, 20%, 35V	150D105X-0035A2	Sprague
A9C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 µf, 50V	APD-127	IEI
A9CR1	DIODE, SILICON	1N462A	CD
A9CR2	Same as A9CR1		
A9CR3	Same as A9CR1		
A9CR4	Same as A9CR1		
A9CR5	Same as A9CR1		
A9Q1	TRANSISTOR, SILICON	2N335	TI
A9Q2	Same as A9Q1		
A9Q3	TRANSISTOR, SILICON	2N697	TI
A9R1	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	CB4745	AB
A9R2	RESISTOR, FIXED, COMPOSITION: 20K, 5%, 1/4W	CB2035	AB
A9R3	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/2W	EB4725	AB
A9R4	RESISTOR, FIXED, COMPOSITION: 6.8K, 5%, 1/2W	EB6825	AB
A9R5	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	CB1035	AB
A9R6	RESISTOR, FIXED, COMPOSITION: 1.2K, 5%, 1/2W	EB1225	AB

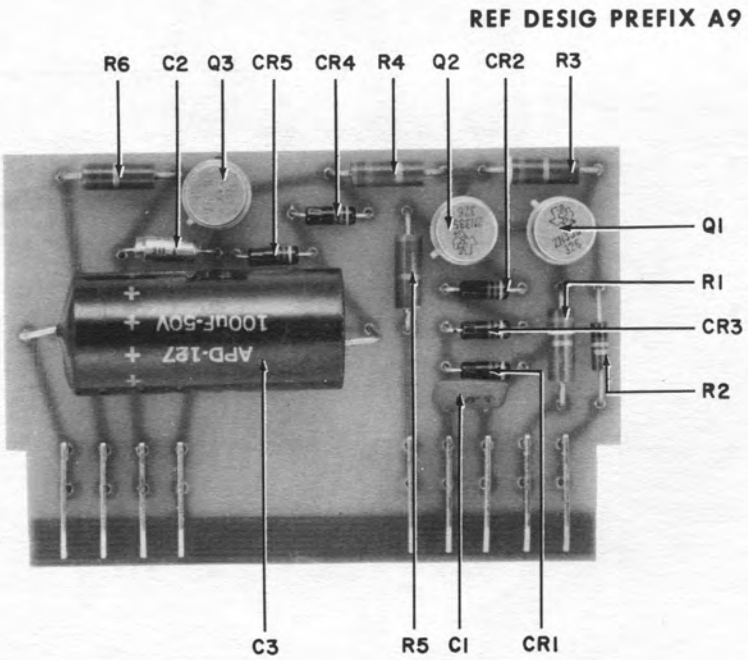
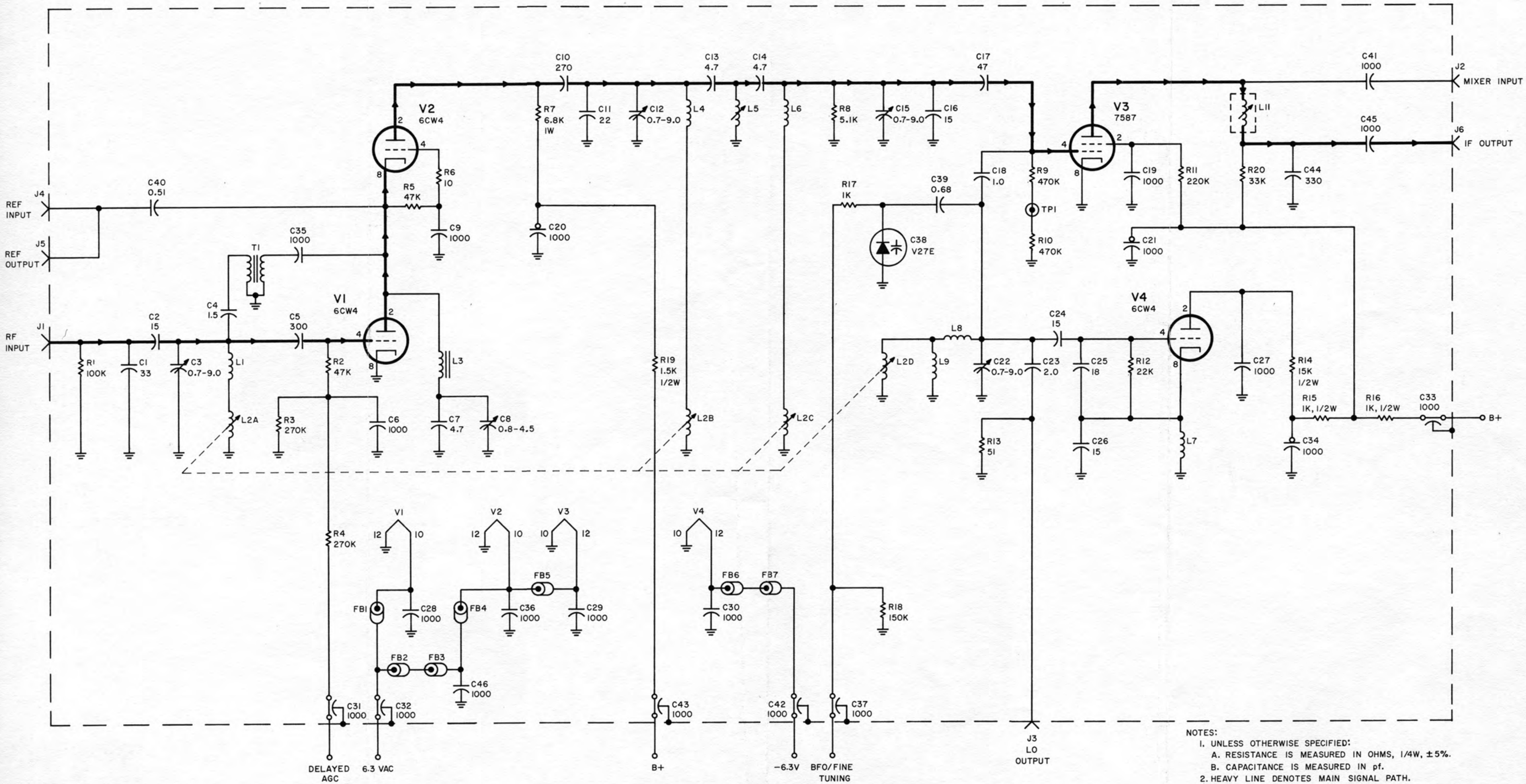


Figure 5-20. Type 7500 COR Amplifier, Component Locations

SECTION VI

SCHEMATIC DIAGRAMS

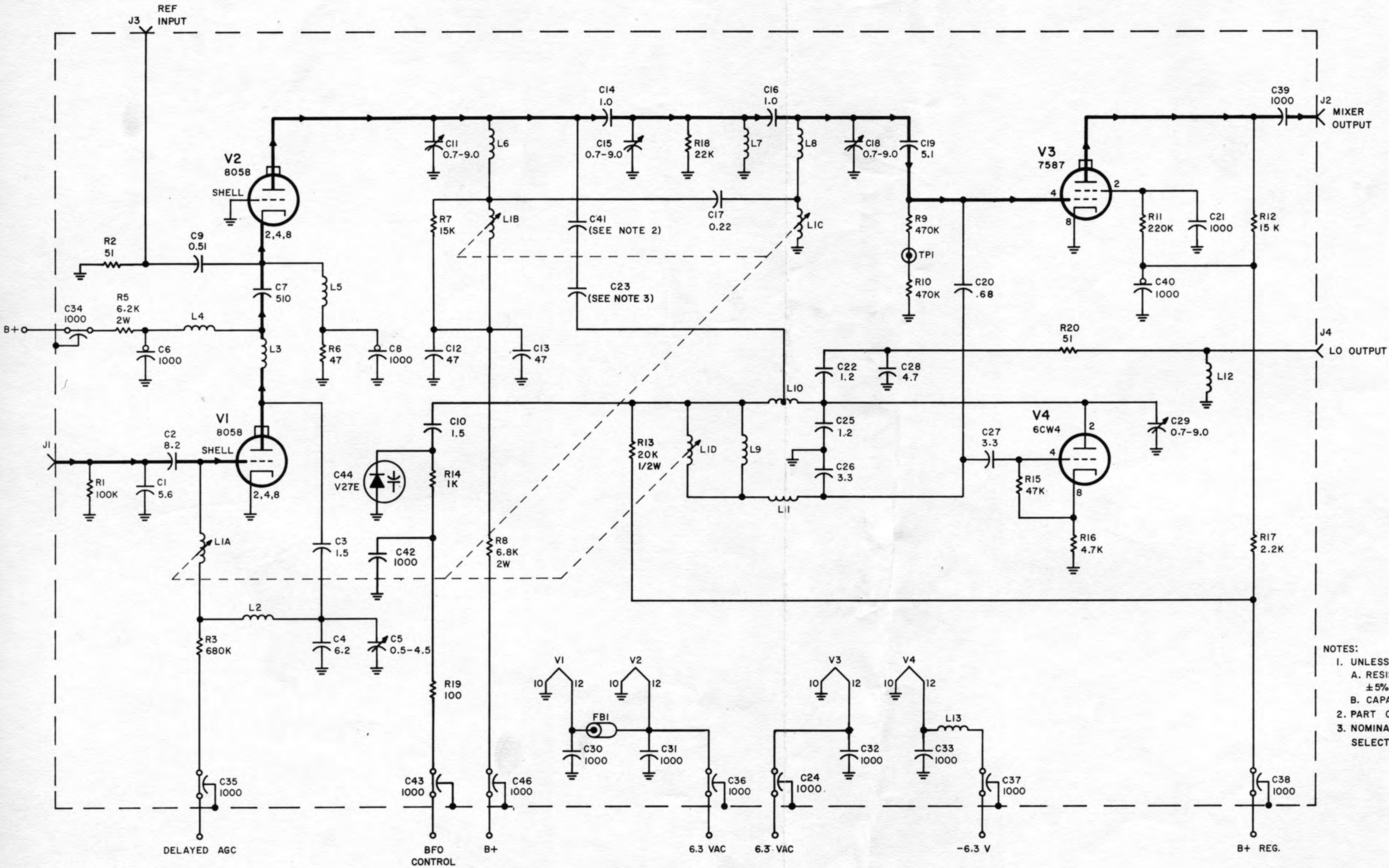
REF DESIG PREFIX A1



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
A. RESISTANCE IS MEASURED IN OHMS, 1/4W, ±5%.
B. CAPACITANCE IS MEASURED IN pf.
2. HEAVY LINE DENOTES MAIN SIGNAL PATH.

Figure 6-1. Type 7103 30-90 mc 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.
2. PART OF CIRCUIT BOARD, CEI #1101.
3. NOMINAL VALUE; FINAL VALUE FACTORY SELECTED.

Figure 6-2. Type 7108 60-300 mc Tuner, Schematic Diagram

REF DESIG PREFIX A3

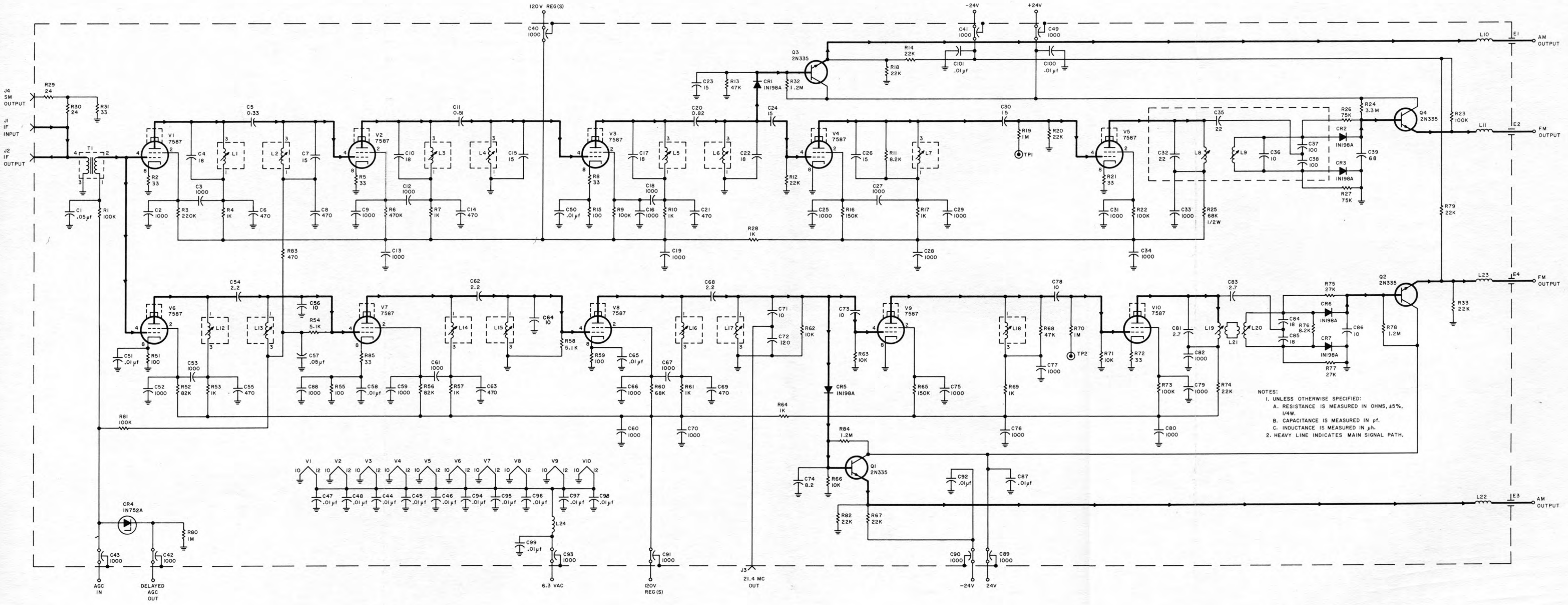


Figure 6-3. Type 7215 300-kc/3-mc IF Strip, Schematic Diagram

REF DESIG PREFIX A4

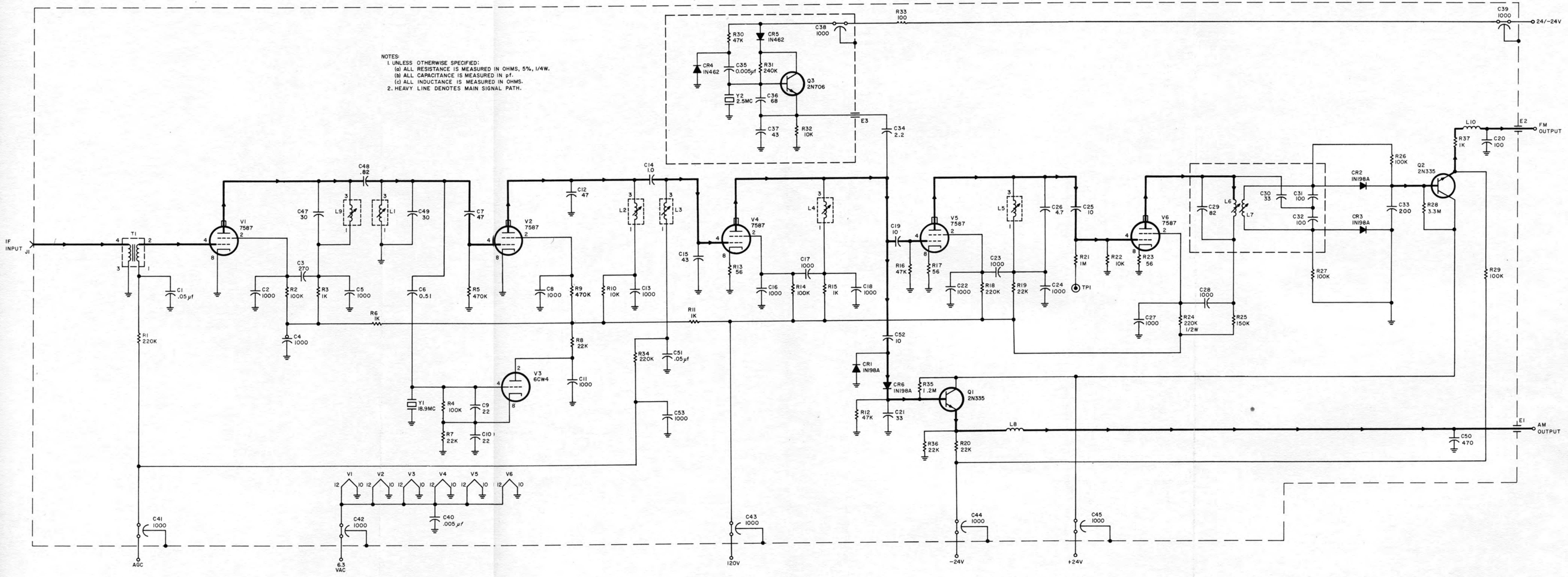
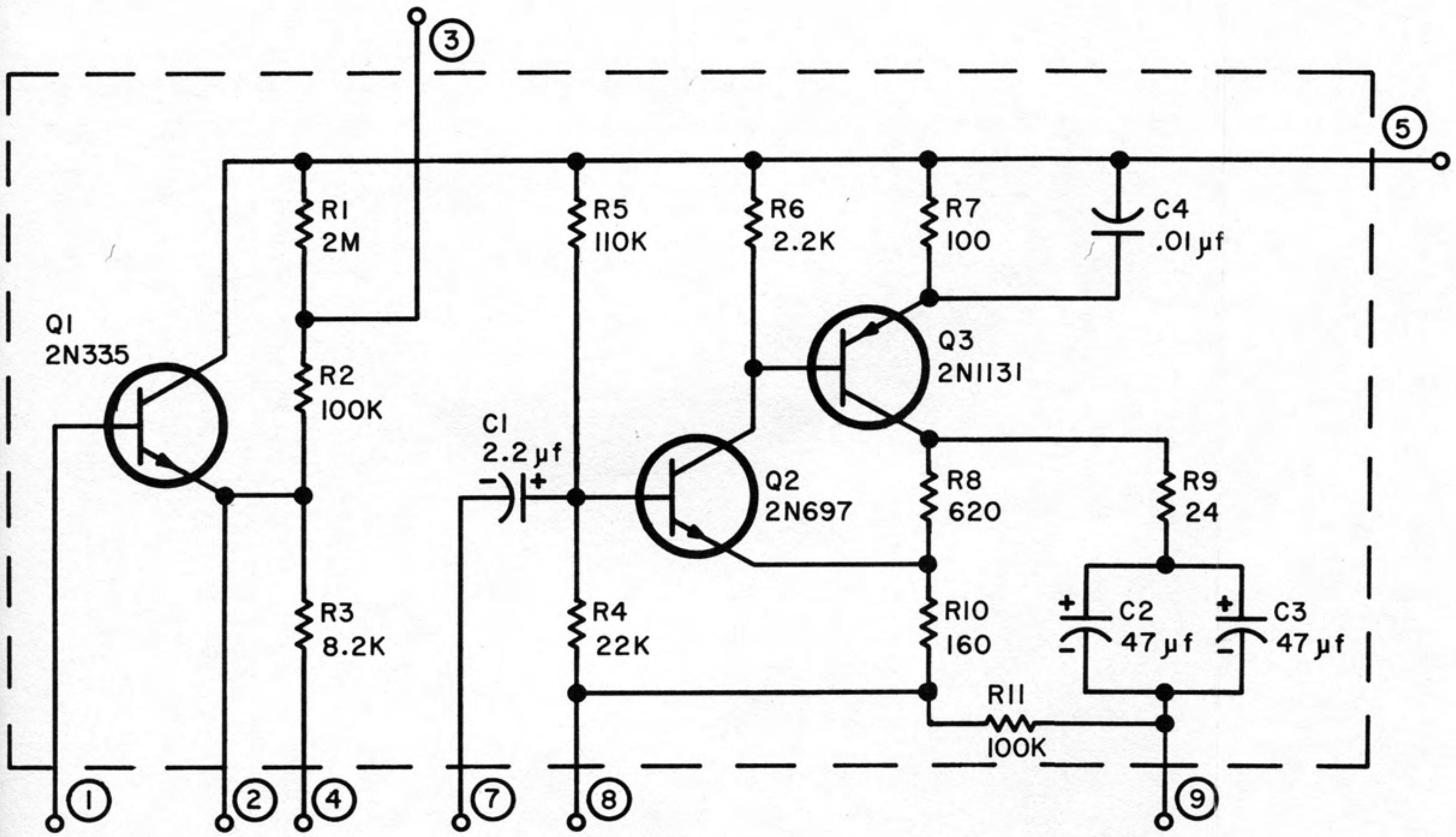


Figure 6-4. Type 7212 60-kc IF Strip, Schematic Diagram

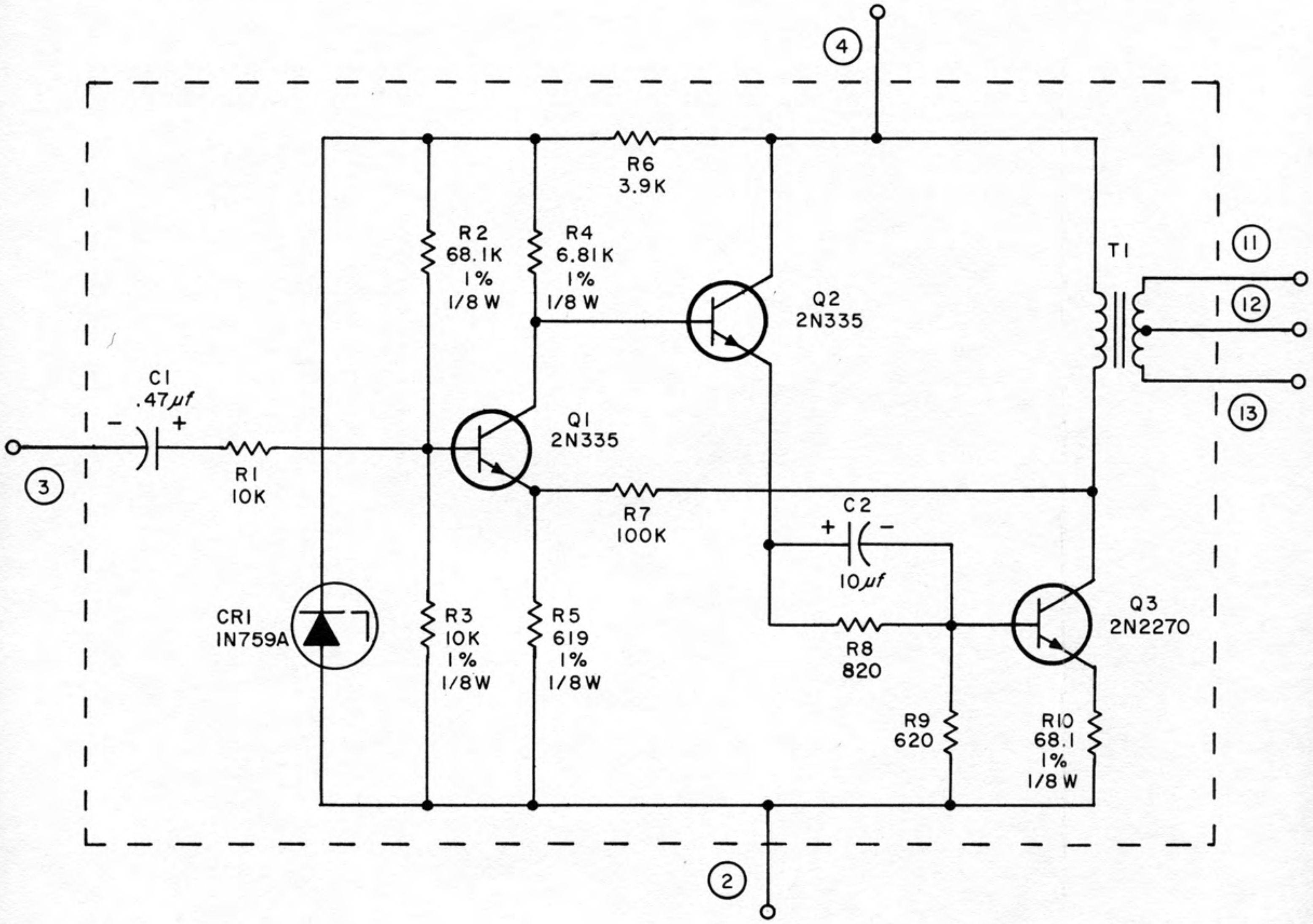
REF DESIG PREFIX A5



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

Figure 6-5. Type 7301 Video Amplifier, Schematic Diagram

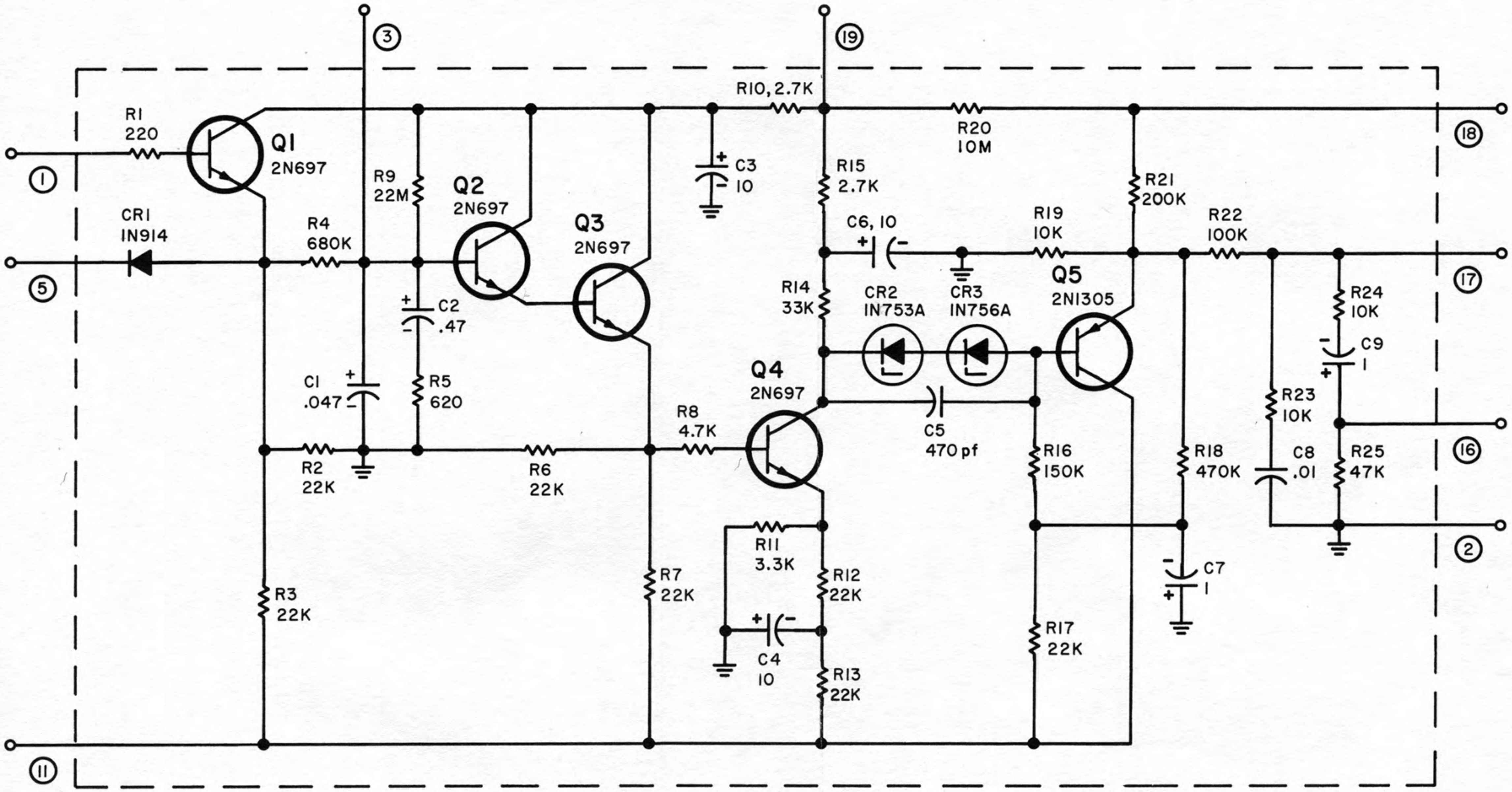
REF DESIG PREFIX A6



1. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
2. UNLESS OTHERWISE SPECIFIED:
   a. RESISTORS ARE MEASURED IN OHMS, 1/4W, ±5%.
   b. CAPACITORS ARE MEASURED IN pf.
3. Q3 UTILIZES A WAKEFIELD HEAT RADIATOR.

Figure 6-6. Type 7400 Audio Amplifier, Schematic Diagram

REF DESIG PREFIX A7

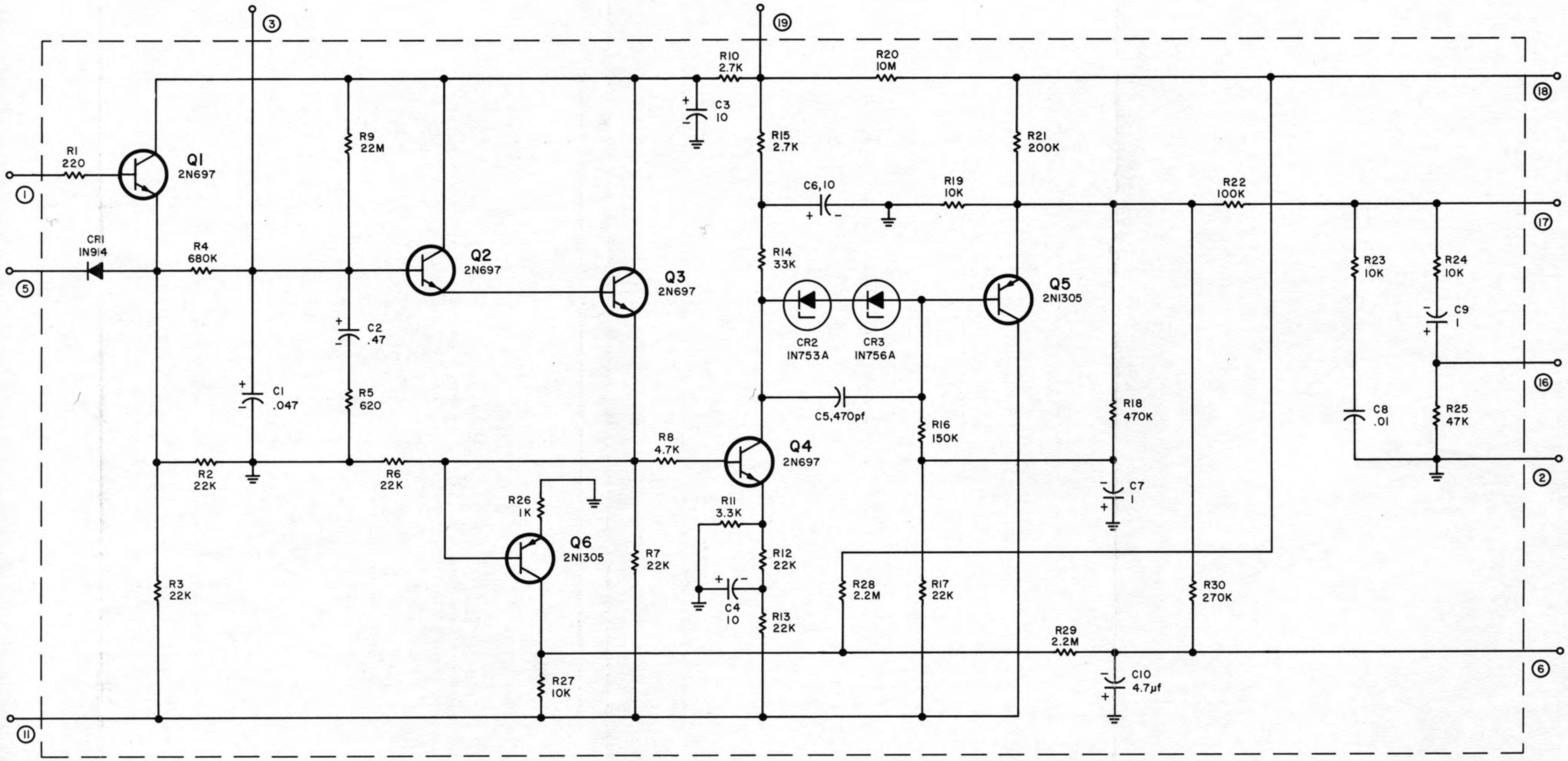


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   B. CAPACITANCE IS MEASURED IN μf.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. SUPERSEDED BY AGC AMP TYPE 7811, SCHEMATIC 4415
   TYPE 7800 WAS USED ON:
   770A : S/N 101-110
   975 : S/N 101-103 ← NOTE
   970A : S/N 101-110

Figure 6-7. Type 7800 AGC Amplifier, Schematic Diagram

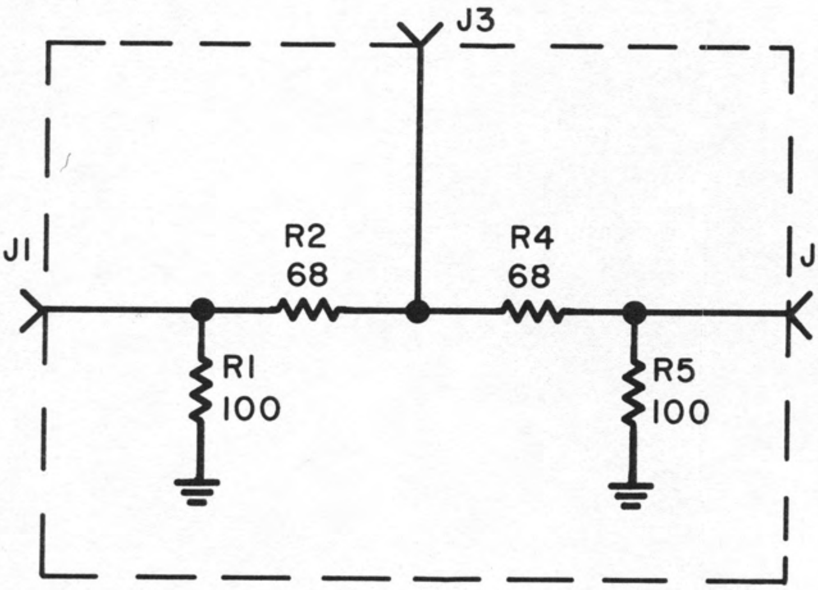
REF DESIG PREFIX A7



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, ± 5%, 1/4 W.
   B. CAPACITANCE IS MEASURED IN μf.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. SUPERSEDES TYPE 7800 (SEE SCHEMATIC 3466)

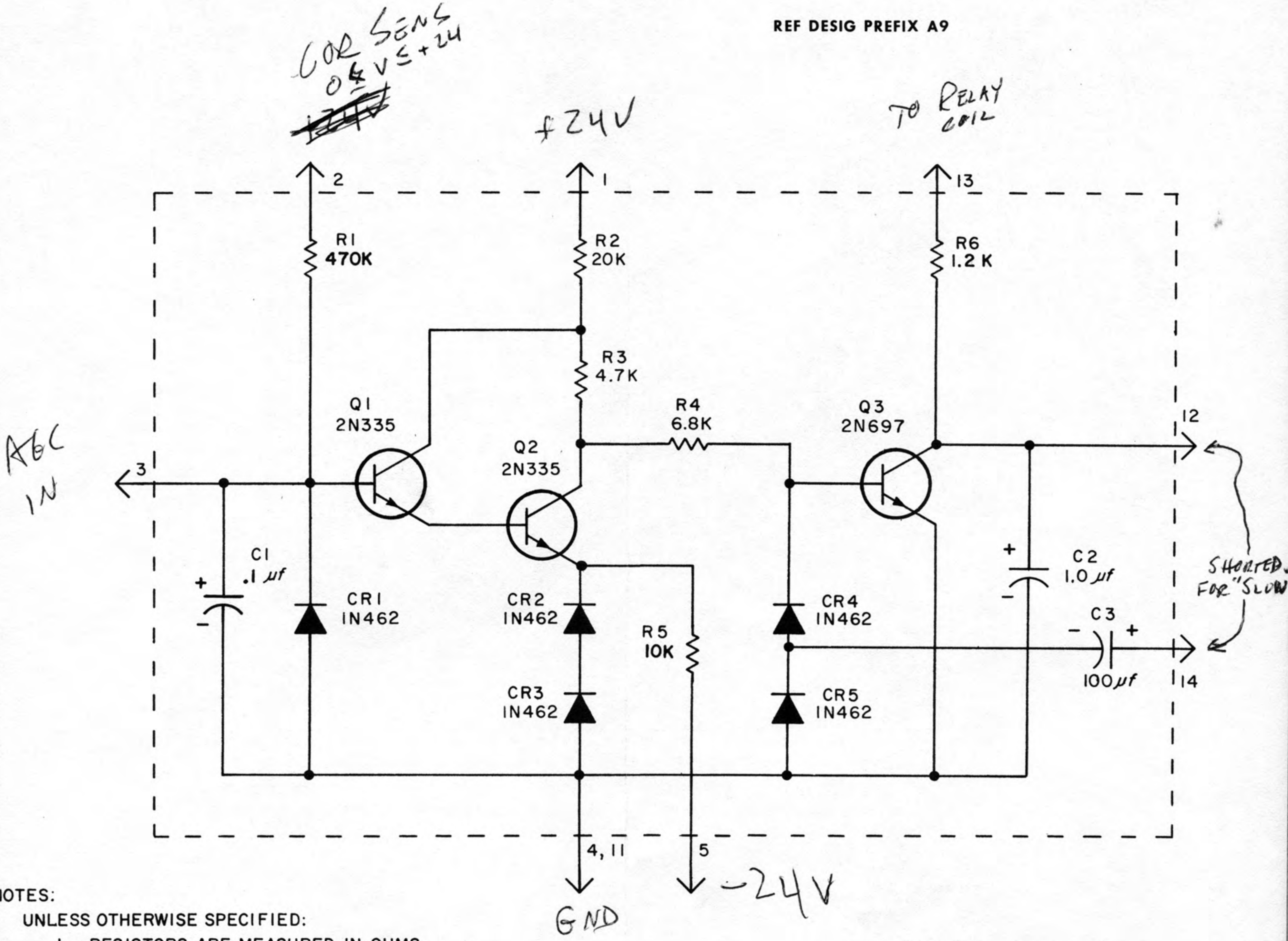
Figure 6-8. Type 7811 AGC Amplifier, Schematic Diagram

REF DESIG PREFIX A8



NOTE:
1. RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.

Figure 6-9. Type 7909 Coupling Network, Schematic Diagram



NOTES:

UNLESS OTHERWISE SPECIFIED:

1. RESISTORS ARE MEASURED IN OHMS, ±5%, 1/4 W
2. CAPACITORS ARE MEASURED IN µµf.

Figure 6-10. Type 7500 COR Amplifier, Schematic Diagram

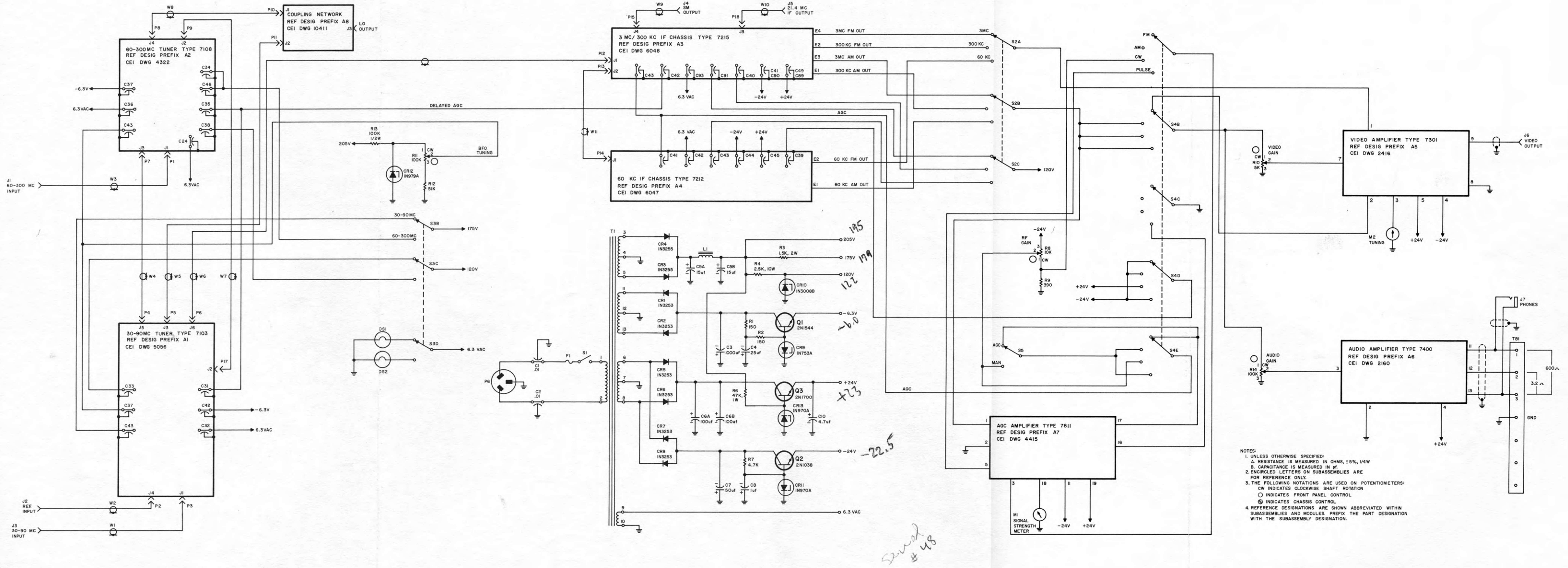


Figure 6-11. Type 970A Receiver, Main Chassis Schematic Diagram

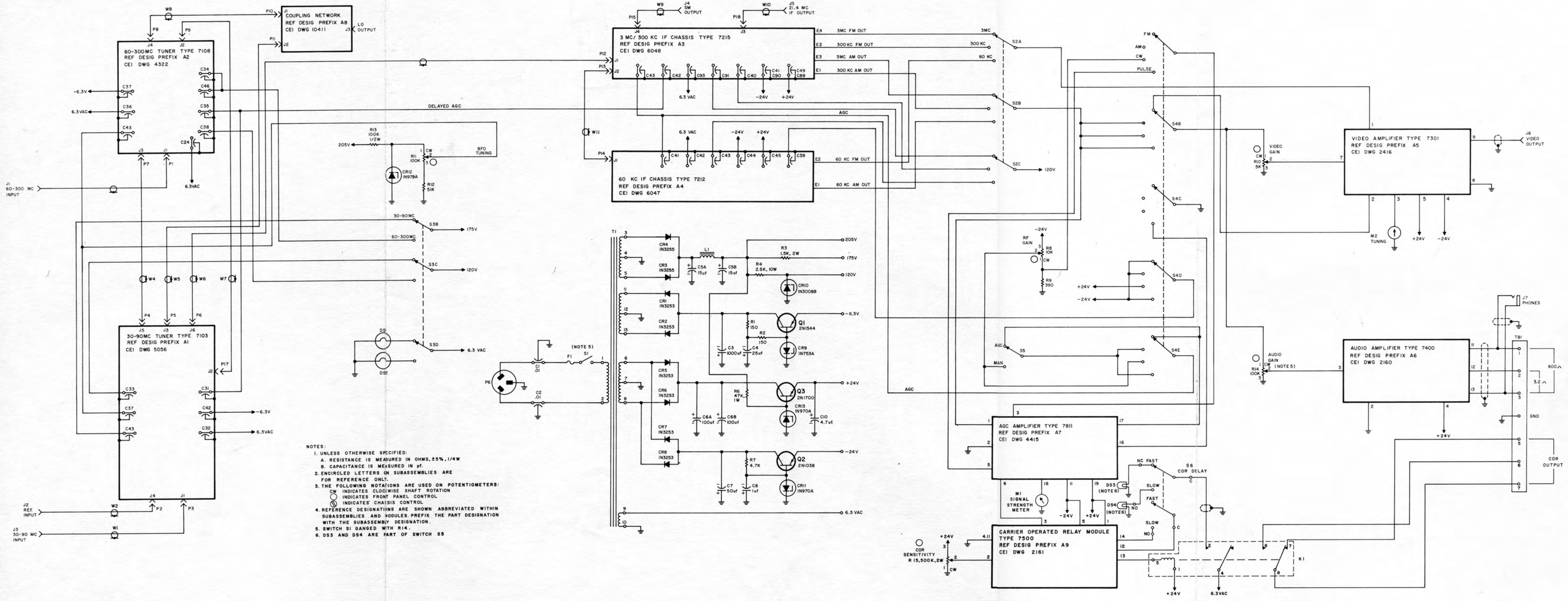


Figure 6-12. Type 975 Receiver, Main Chassis Schematic Diagram

CEI