903A

INSTRUCTION MANUAL FOR TYPE 903A RECEIVER

COMMUNICATION ELECTRONICS INCORPORATED
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INSTRUCTION MANUAL

FOR

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3RD REV.

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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Type of Reception	AM, FM, and CW
Frequency Range	30-300 mc in two bands Low Band: 30-60 mc High Band: 60-300 mc
Inputs	Two BNC type connectors, one with coaxial switch, permitting operation across full frequency range with single antenna or operation with separate antennas for each band
Input Impedance	Suitable for 50-ohm source
Noise Figure	Low Band: 4 db, max. High Band: 6.5 db, max.
Image Rejection	Low Band: 60 db, min. High Band: 50 db, min.
IF Frequency	21.4 mc
IF Bandwidths	300 kc or 50 kc, selectable from front panel
IF Rejection	Low Band: Above 40 mc, 75 db min. Below 40 mc, 54 db min. High Band: Greater than 100 db
Oscillator to Antenna Conduction	Low Band: 15 μv max. High Band: Below 260 mc, 15 μv max. Above 260 mc, 25 μv max.
Sensitivity at 150 mc	
300 KC Bandwidth	AM: 4 μv input, modulated 50%, produces 11-db $\frac{S+N}{N}$, min. FM: 4 μv input, modulated at 1 kc with 100-kc deviation, produces 21-db $\frac{S+N}{N}$, min.
50 KC Bandwidth	AM: 2 μv input, modulated 50%, produces 13-db $\frac{S+N}{N}$, min. FM: 2 μv input, modulated at 1 kc with 18-kc deviation, produces 20-db $\frac{S+N}{N}$, min.
Maximum Audio Output	100 mw, into 600-ohm, unbalanced load
Audio Response	100 cps to 40 kc ± 3 db

Table 1-1. Type 903A Receiver, Specifications (continued)

Maximum Video Output	1 volt rms across a 100-ohm unbalanced load
Video Response	250 cps to 150 kc ± 3 db
Video Sensitivity	1 volt rms min. across a 100-ohm unbalanced load with 100-kc deviation for FM 300-kc bandwidth, 18-kc deviation for FM 50-kc bandwidth, and 50% modulation 1000 μv input for AM either bandwidth
Signal Monitor Output	21.4-mc center frequency IF signal output for use with CEI signal monitors
IF Output	21.4-mc center frequency IF signal output from IF amplifiers
Output Stability with AGC	AM: Output varies less than 15 db for input range of 2-10,000 μv FM: Output varies less than 2 db for inputs above 1.5 μv
BFO	21.4-mc center frequency, variable ±20 kc for use with both bandwidths
Noise Limiter	Optional for AM mode only, switched on at front panel
Carrier Operated Relay	Controls a panel light, a 6.3 vac input, and two normally open switches connected across two pairs of terminal board contacts. Light comes on, 6.3 vac appears and terminal board contacts are shorted when carrier appears. Delay of return to carrier-off condition selectable at 0, 3, or 10 seconds approximately
Power Input	115 vac, 50-400 cps
Power Consumption	40 watts, approximately
Weight	20 pounds
Size	19 x 3-1/2 x 14-3/4 inches from front handle to rearmost extension

Figure 1-1. Type 903A Receiver, Front View

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

The CEI Type 903A Receiver is an AM-FM-CW superheterodyne covering the frequency range of 30 to 300 mc in two bands: 30-60 mc, and 60-300 mc. The input impedance is suitable for a 50-ohm source. The receiver uses single conversion to a 21.4-mc IF. The IF bandwidth can be set to either 50 or 300 kc. AM operation with or without a noise limiter is available. A tunable BFO is available during CW operation. The video output impedance is suitable for a 100-ohm unbalanced load. The audio output impedance is suitable for a 600-ohm unbalanced load. The receiver also includes a SIGNAL STRENGTH meter, a TUNING meter, and a carrier operated relay (COR). Specifications for the unit are included in Table 1-1; the semiconductor and tube complement is presented in Table 1-2.

1.2 MECHANICAL CHARACTERISTICS

The front panel (see Fig. 1-1) mounts the following: The BANDWIDTH switch with positions marked 300 KC and 50 KC; the TUNING meter; the mode selector, a switch with four positions, marked FM, AM, AM/ANL, and CW; the low band tuning dial; the band selector; the high band tuning dial; the SIGNAL STRENGTH meter; a red COR light; the BFO TUNING control; the VIDEO GAIN control; the AUDIO GAIN control; the RF-IF GAIN control, with an AGC position; the PHONES jack; and the POWER switch.

The chassis rear apron (see Fig. 1-2) mounts the following: A fuse marked F101 3/8 AMP SLOW-BLOW; a type BNC connector marked J102 INPUT; a type BNC connector marked J105 AUX INPUT; a type BNC connector marked J107 SM OUTPUT; a type BNC connector marked J108 VIDEO OUTPUT; a type BNC connector marked J111 IF output; a type BNC connector marked J110 AUDIO OUTPUT; and an eight-terminal barrier strip marked TB101 with the terminals numbered 1 through 8. The power cord is permanently connected through the rear of the receiver.

The front panel, main chassis, and top and bottom dust covers are constructed of aluminum. The panel is overlaid with a black-anodized etched plate. Within the main chassis are eight subassemblies. Three of these; the 30-60 mc RF tuner, the 60-300 mc RF tuner, and the IF strip, are constructed on silver-plated brass chassis which have been gold-flashed to prevent tarnishing and are wired into the main chassis. The other five consist of etched circuit board modules. One of these, the pulse counter module, is wired on the underside of the IF subassembly. The other four, the noise limiter module, the relay driver module, the audio module, and the video module, are mounted plug-in fashion on the main chassis top.

The receiver is designed for mounting in a standard 19-inch rack. It measures 19" wide, 3-1/2" high, and 14-3/4" deep from the front handles to the rearmost extension. There are handles on the front panel and the chassis rear apron. Provision for Grant slides has been made by the inclusion of three captive floating bolts spaced along the side aprons plus a hole in both the left and right extension of the front panel through which the Grant slide release bars can project. The weight is 20 pounds.

Figure 1-2. Type 903A Receiver, Rear View

Table 1-2. Type 903A Receiver, Semiconductor and Tube Complement

Symbol	Type	Function
	Main Chassis	
CR101	1N2615	Rectifier
CR102	1N2615	Rectifier
CR103	1N2615	Rectifier
CR104	1N2615	Rectifier
CR105	1N2610	Rectifier
CR106	1N2610	Rectifier
CR107	1N2610	Rectifier
CR108	1N2610	Rectifier
CR109	1N2610	Rectifier
CR110	1N2610	Rectifier
CR111	10M120Z5	Voltage Regulator
	Video Module	
CR201	1N759A	Voltage Regulator
Q201	2N335	DC Amplifier
Q202	2N335	DC Amplifier
Q203	2N335	Video Amplifier
Q204	2N335	Video Amplifier
Q205	2N697	Output Amplifier
	Audio Module	
CR301	1N759A	Voltage Regulator
Q301	2N335	Audio Amplifier
Q302	2N335	Audio Amplifier
Q303	2N1700	Output Amplifier
	Low Band Tuner	
V401	6CW4	RF Amplifier
V402	6CW4	RF Amplifier
V403	7587	Mixer
V404	6CW4	Local Oscillator
	High Band Tuner	
V501	7077	RF Amplifier
V502	7077	RF Amplifier
V503	7587	Mixer
V504	6CW4	Local Oscillator
	50/300 kc IF Strip	
CR601	1N756A	AGC Delay Diode
CR602	1N198A	Phase Detector
CR603	1N198A	Phase Detector
V601	7587	1st IF Amplifier
V602	7587	2nd IF Amplifier
V603	7587	3rd IF Amplifier (AM); 1st Limiter (FM)
V604	7587	COR Driver
V605	6CW4	BFO Buffer Amplifier
V606	6CW4	BFO
V607	7587	Detector (AM); 2nd Limiter (FM)
	Pulse Counter Module	
CR701	1N914	Pulse Counter
CR702	1N914	Pulse Counter
CR703	1N461	Pulse Rectifier
Q701	2N489	Pulse Trigger
Q702	2N335	Amplifier
	Noise Limiter Module	
CR801	1N54A	Noise Limiter
CR802	1N756A	Meter Scale Adjusting Diode
Q801	2N335	Emitter Follower
	Relay Driver Module	
CR901	1N462	Timing Switch
CR902	1N34A	Relay Flyback Suppressor
Q901	2N335	DC Amplifier
Q902	2N335	DC Amplifier
Q903	2N335	DC Amplifier
Q904	2N335	DC Amplifier

Figure 2-1

Figure 2-1. Type 903A Receiver, Functional Block Diagram

SECTION II

CIRCUIT DESCRIPTION

2.1 FUNCTIONAL ANALYSIS

The Type 903A Receiver (depicted by functional block diagram in Fig. 2-1) tunes the frequency range of 30-300 mc in two bands: 30-60 mc, and 60-300 mc. Either a 300-kc or a 50-kc IF bandwidth is available, and six outputs are present: a signal monitor output providing a 21.4-mc IF signal from the RF tuners; an IF output providing a 21.4-mc IF signal from the IF amplifiers; a video output; and audio outputs from a headphone jack, a pair of terminals for a speaker, and a BNC jack.

2.1.1 When only one antenna is used, it is connected to the INPUT connector, and the coaxial switch automatically switches the antenna to the RF tuner of the frequency band in use. To use separate antennas for each frequency, the AUX INPUT can be used to connect one antenna directly to the low band RF tuner, while the second antenna reaches the other tuner through the coaxial switch. (See Section III, Installation and Operation for use of the antenna inputs.)

2.1.2 The receiver contains two RF tuners, one for the 30-60 mc band and one for the 60-300 mc band. Each tuner contains an RF amplifier, a local oscillator, and a mixer. Each local oscillator is operated at a frequency 21.4 mc above the carrier being received. Thus the output from either mixer is a 21.4-mc IF signal. The 21.4-mc IF signal is applied to the IF strip and through an isolation network to the signal monitor output.

2.1.3 After one stage of IF amplification, the signal is coupled to the second IF amplifier through one of two different paths: a 50-kc bandwidth crystal filter or a 300-kc bandwidth LC filter. The path desired is selected by relays located in the IF chassis and operated by the front panel bandwidth switch.

2.1.4 From the second IF amplifier the signal is further conducted through a series of two stages. The functions of these two stages change according to the mode of receiver operation. In the AM, AM/ANL, and CW modes the two stages following the second IF amplifier are operated as a third IF amplifier and detector, respectively, and the signal from the detector is simultaneously applied to an emitter follower and a noise limiter. In the FM mode the same two stages are operated as a first and second limiter, respectively, and the signal from the second limiter is applied successively to an FM demodulator and a dc amplifier.

2.1.5 In the AM and CW modes the demodulated signal, coming through the emitter follower, is taken from the stage functioning as detector and simultaneously applied, through the VIDEO GAIN control, to the video amplifier and, through the AUDIO GAIN control, to the audio amplifier. In the AM/ANL mode the arrangement is the same except that the signal is clipped by the noise limiter on its way from the detector to the emitter follower. In the FM mode the demodulated signal is taken from the dc amplifier and simultaneously applied through the AUDIO GAIN control to the audio amplifier and through the VIDEO GAIN control to the video amplifier. The video amplifier terminates in the VIDEO OUTPUT; the audio amplifier terminates in the PHONES jack, the speaker terminals, and the AUDIO OUTPUT jack.

2.1.6 Operation in the CW mode is obtained by applying the output of the BFO buffer-doubler stage to the stage functioning as detector. The BFO TUNING control varies the BFO frequency approximately ± 20 kc.

2.1.7 The gain control circuit makes use of either an AGC voltage or a manual gain control voltage which applies simultaneously to the RF amplifiers and to the first and second IF amplifiers. To the first IF amplifier the gain control voltage is applied directly. But to the RF amplifiers and the second IF amplifier it is applied only after being subjected to a voltage delay. In the FM mode, only AGC is possible, and the AGC voltage is obtained from the stage functioning as the first limiter. In the AM or AM/ANL modes with AGC, an AGC voltage is derived from the stage functioning as a detector. Although available, AGC should not be used in the CW mode (see Section III, Installation and Operation). When manual gain control is used (AM, AM/ANL, and CW modes only) the gain control voltage is derived from a fixed bias supply and applied through the RF-IF GAIN control.

2.1.8 In all modes of operation, the signal applied to the AM detector/FM second limiter is also applied through a voltage divider network to the IF OUTPUT and the COR driver. The signal from the COR driver is passed to the pulse counter which applies a signal to the relay driver circuit. When a carrier of adequate level is present, the

COR is actuated turning on the COR light, applying 6.3 vac to an output terminal, and shorting across each of the two pairs of normally open COR terminals.

2.1.9 The SIGNAL STRENGTH meter receives operating voltages from the detector/second-limiter stage and the third-IF-amplifier/first-limiter stage. The TUNING meter is operated by the dc amplifier, whose output is proportional to the deviation of the IF from its center frequency of 21.4 mc.

2.1.10 The power supply operates on 115 vac, 50-400 cps, and provides the eight voltages required for the receiver. These are: 175 vdc; 150 vdc; 120 vdc, regulated; 24 vdc; -24 vdc; 24 vdc; -3 vdc; and 6.3 vac.

2.2 INPUT

The receiver INPUT, J102, is connected to the coaxial switch, K101, which has two outputs. Normally, each RF tuner input is coupled to one of the coaxial switch outputs, allowing the use of a single antenna which is automatically switched to the RF tuner of the band in operation. The coaxial switch has a built-in 24-vdc relay and is actuated by a 24-vdc source when the bandswitch is in the 60-300 mc position. In the unactuated position it connects the INPUT to the 30-60 mc tuner. If separate antennas are desired for each frequency band, the connection from the input to one of the tuners can be transferred from the coaxial relay to the AUX INPUT (see Section III, Installation and Operation). Then the AUX INPUT is used for one antenna and the INPUT is used for the other.

2.3 LOW BAND TUNER, 30-60 MC

The operation of the low band tuner is explained in the following paragraphs. Refer to the schematic diagram, Figure 6-1.

2.3.1 RF Amplifier.- The low band tuner RF amplifier consists of two type 6CW4 Nuvistor triodes, V401 and V402, in cascode amplifier configuration. In the low band tuner, the input circuit provides an impedance as seen by the first tube of a value which is near the optimum required for low noise figure operation. Input tuning is accomplished by inductor L402A, one section of a four-section inductuner, in the grid circuit of V401. Output tuning is accomplished by inductor L402B, another inductuner section, in the plate circuit of V402. Neutralization is achieved by feeding a small out-of-phase signal from the plate to the grid of V401 through broadband transformer T401. To extend the dynamic range of the receiver, the RF amplifier signal handling capability is improved by applying a delayed gain control voltage derived in the IF strip. Delaying the gain control voltage to the RF amplifier permits the IF signal to reach a suitable level before RF amplification is reduced. This gain control voltage is tapped from a voltage divider composed of R404 and R417. The low band tuner RF amplifier is placed in operation by means of bandswitch section S102A. It applies B-plus voltage to the V402 plate when the bandswitch is rotated to the 30-60 MC section.

2.3.2 Local Oscillator.- The low band tuner local oscillator is a type 6CW4 Nuvistor triode, V404, operated in a Colpitts configuration with the plate at RF ground. The tank circuit is tuned by inductor L402D, a section of the inductuner. The frequency of operation is maintained 21.4 mc above the carrier. To minimize drift due to variations in filament or plate voltage, the oscillator tube itself is appropriately decoupled from the main tank circuit by capacitor C421. The low band local oscillator is placed in operation by bandswitch section S102A. It applies B-plus voltage to the stage when the bandswitch is rotated to the 30-60 mc position.

2.3.3 Mixer.- The low band tuner mixer, V403, is a type 7587 Nuvistor tetrode with its input circuit tuned by inductuner section L402C. Both the signal from the RF amplifier and the output of the local oscillator are applied to its grid, and the two signals are mixed to produce a 21.4-mc IF. Test point TP401, decoupled from the grid, can be used to check oscillator injection and also to check RF tuning by means of an oscilloscope. To obtain uniform bandwidth through the tuning range, two means of coupling are used from the RF amplifier to the mixer. One means is capacitive coupling through C410. The other is by the mutual coupling of L402B and L402C. The mixer output is a plate circuit pi-network consisting of inductor L405 and capacitors C416 and C417. This network is tuned to the IF frequency, 21.4 mc, and is so designed that, at the tuner output, J403, the plate impedance of V403 is transformed down to approximately 50 ohms. When J403 is connected to a 50-ohm load, the IF has a single-tuned response with a bandwidth of one megacycle at the 3-db points. The operating voltage to the low band mixer screen grid, like that to the RF amplifier, is switched off when the band is not in use.

2.4 HIGH BAND TUNER, 60-300 MC

The high band tuner contains RF amplifiers, a local oscillator, and a mixer. Refer to Figure 6-2 as necessary during the following paragraphs.

2.4.1 RF Amplifier.- The high band tuner RF amplifier consists of two type 7077 ceramic triodes, V501 and V502, connected in a cascode configuration. The impedance as seen by the first tube is a value near the optimum required for low noise figure operation. Input tuning is by means of inductor L502A, part of a four-section inductuner in the grid circuit of V501. RF amplifier output tuning is by means of inductuner section L502B in the V502 plate circuit. Neutralization is used to achieve a low noise figure and high stability. This is in the form of a capacitive bridge, with capacitor C507 as one arm and the combination of C504 and C505 as another arm; these two arms balance the grid-to-plate capacitance and the input capacitance of V501. Delayed gain control voltage is applied to the RF amplifier through resistor R503 in a similar manner as in the low band tuner. The cathodes of V501 and V502 return to -3 vdc through resistors R504 and R505. This design provides degeneration which normalizes the effect of tube variations. Such degeneration also causes the tubes to function with a more remote cutoff, and such cutoff makes it possible to apply full gain control voltage to the high band RF amplifier, rather than through a voltage divider.

2.4.2 Local Oscillator.- The high band tuner local oscillator, V504, is a type 6CW4 Nuvistor triode operated in a balanced Colpitts configuration. It is tuned by L502D, a section of the inductuner and is maintained at a frequency 21.4 mc above that of the RF carrier. Capacitors C524 and C525 of the tank circuit have a negative temperature coefficient to compensate for frequency drift due to ambient temperature change. Oscillator energy is taken from the grid side of the tank circuit through capacitor C520. To reduce radiation at the antenna from this oscillator, a small portion of the oscillator signal is fed back, in phase opposition, through capacitors C510 and C511, to the plate of V502. This feedback tends to cancel the oscillator energy which is coupled to the antenna through the tuned circuits. The high band local oscillator is placed in operation by bandswitch section S102A. It applies B-plus voltage to the stage when the bandswitch is rotated to the 60-300 mc position.

2.4.3 Mixer.- The high band tuner mixer, V503, is a type 7587 Nuvistor tetrode. Both the signal from the RF amplifier and the output of the local oscillator are applied to its grid, and the two signals are mixed to produce a 21.4-mc IF. Test point TP501, decoupled from the grid, can be used to check oscillator injection and also to check RF tuning by means of an oscilloscope. The output circuit of the RF amplifier second stage and the mixer grid circuit form a tuned, two-section, bandpass filter in which a T-network serves as the coupling device. The T-network series arms are capacitors C513 and C514. The shunt arm consists of inductor L508 in parallel with the series combination of inductor L507 and variable capacitor C515. The shunt arm is resonated below 60 mc and becomes capacitive at higher frequencies. This capacitive shunting helps maintain a nearly constant bandwidth throughout the entire tuning range. Output from the high band mixer is through the same plate load IF network used for the low band mixer. This use of a common plate load for the two mixers is arranged by having their plates tied together through a coaxial cable. The high band mixer is placed in operation by means of bandswitch section S102A, which applies screen voltage to V503 when the bandswitch is in the 60-300 MC position.

2.5 IF STRIP

A schematic diagram of the 50/300 kc IF strip is included as Figure 6-3. The input to the strip is through connector J601, which is connected to the low band tuner output by coaxial cable. From J601, the IF signal is coupled through a 50-ohm T-pad composed of resistors R601, R602, and R603, to the SM OUTPUT, J107. In parallel with the T-pad input is the primary of transformer T601, a broadband transformer whose secondary applies the IF signal to the first IF amplifier.

2.5.1 First and Second IF Amplifiers.- The first and second IF amplifiers, V601 and V602, are type 7587 Nuvistor tetrodes. Coupling between them differs according to the IF bandwidth selected and is determined by relays K601 and K602. When the BANDWIDTH switch, S103, is in the 300 KC position, K601 is actuated, K602 is unactuated, and coupling is through a broadband coupling network consisting of inductor L603, capacitors C613 through C617, and inductor L604. When the bandswitch is in the 50 KC position, K601 is unactuated, K602 is actuated, and coupling is through crystal filter FL601. The crystal filter's low impedance level requires impedance transformation, which is achieved by capacitive tapping of the V601 plate circuit, through C611 and C612, and of the V602 grid circuit, through C618 and C620. Additional relay contacts ground both input and output of whichever filter is not in use. To avoid regeneration, the plate-to-grid capacitance in the first and second IF amplifier stages is neutralized. This is done by connecting a three-capacitor pi-network between the plate and screen grid circuits. These capacitors are C605, C606, and C607 in the V601 circuit, and C624, C625, and C626 in the V602 circuit.

2.5.2 Third IF Amplifier/First Limiter.- A type 7587 Nuvistor tetrode, V603, is used as a third IF amplifier in the AM mode and as a first limiter in the FM mode. This change of functions according to the mode of operation is brought about by using mode selector switch section S104C to vary the screen grid potential, a higher potential being used to operate the tube as an IF amplifier and a lower potential being used to operate it as a limiter. In the FM mode it grounds resistor R618, and that resistor acts as a screen grid bleeder, reducing the V603 screen voltage. In the AM and AM/ANL positions S104C removes the ground from R618, raising the V603 screen voltage. In the CW position S104C also grounds R618. A double-tuned circuit is used to couple to this stage from the second IF amplifier. The output from this stage is through the mutual inductance of inductors L607 and L608. In the FM mode, the AGC voltage is developed by grid rectification across resistor R615.

2.5.3 Detector/Second Limiter.- A type 7587 Nuvistor tetrode, V607, is used as a grid detector in the AM, AM/ANL, and CW modes, and as a second limiter in the FM mode. In the AM, AM/ANL, and FM modes the stage performs its required function without circuit change. However, in the CW mode, plate voltage is removed from the stage. This is to block the BFO signal from feeding on through the FM demodulator and dc amplifier to the TUNING meter, since the meter would respond to the BFO and not to the IF signal in the CW mode. The signal from the grid circuit of this stage is applied to a voltage divider made up of capacitors C632, C637, and C639. From the voltage divider two voltages are tapped off. One voltage is applied to the IF OUTPUT, J111. The other is applied to the grid of the COR driver, V604.

2.5.4 Detector Output.- The detector load consists of a resistive voltage divider, R804 and R805 in the noise limiter module. Connection to R804 is through inductor L609, a self-resonant choke which filters the IF from the detector output. From the junction of R804 and R805 an emitter follower couples the demodulated output through blocking capacitor C801 to mode selector switch section S104D, which applies the signal to both the AUDIO GAIN and the VIDEO GAIN potentiometers. The emitter follower reduces the shunting effect of the gain potentiometer on R805. In the AM and AM/ANL modes with AGC, stage V607 also provides an AGC voltage. This AGC voltage is taken from the junction of resistors R801 and R802 in the noise limiter module. From the junction of these resistors, the AM AGC voltage is conducted through S104B to the AGC position of S105, from which it may be applied to the gain control line through S104A.

2.5.5 FM Demodulator.- A Foster-Seeley type FM demodulator with a capacitance tapping of the secondary circuit is used. This method of tapping provides a high degree of balance unaffected by coil characteristics or tuning slug positions. Germanium diodes, CR602 and CR603, are used for phase detection. C646 and C675 of the primary and secondary circuits have negative temperature coefficients and are used to compensate for the center frequency drift caused by ambient temperature variation. A self-resonant choke, L612, is placed in series with the demodulator output to attenuate the IF signal. Output from this stage is applied to the first stage of the dc amplifier, Q201 in the video module. During FM operation mode selector switch section S104D conducts the demodulated FM signal from the second dc amplifier stage to the AUDIO GAIN and VIDEO GAIN potentiometers.

2.5.6 Beat Frequency Oscillator.- The BFO uses a type 6CW4 triode, V606, connected in a Clapp oscillator circuit. It oscillates at 10.7 mc, one half of the IF frequency. BFO pitch control is accomplished by adjusting capacitor C661, which changes the cathode-to-ground capacitance of the oscillator. The values chosen provide a reasonable degree of control linearity over the range of ±20 kc. Effects of oscillator frequency drift caused by temperature changes are reduced by the temperature compensating capacitor C665 in the tank circuit, which has a negative temperature coefficient. The plate circuit is tuned to 21.4 mc. Output of the BFO is taken from the plate circuit and fed to the BFO buffer-doubler stage through C658.

2.5.7 BFO Buffer-Doubler.- To achieve isolation between the BFO and the signal circuit, and therefore to reduce oscillator pulling, a 6CW4 buffer-doubler stage, V605, is used. Stray coupling is eliminated by complete shielding of the oscillator circuit. The BFO signal is connected to the grid of V604, through C647. CW operation is obtained when mode selector switch S104E applies B-plus voltage to V605 and V606.

2.5.8 COR Driver.- The COR driver, V607, is a type 7587 Nuvistor tetrode operated as a limiter. Output is taken from its tuned plate circuit and applied to the input of the pulse counter circuit through capacitor C701. The B-plus voltage used for the plate of this stage is taken from the same +24 vdc source used to supply the pulse counter, an arrangement which prevents B-plus supply voltage variations from disturbing the desired interaction between the COR driver and the pulse counter.

2.6 PULSE COUNTER

The pulse counter is used in conjunction with the COR driver to provide a dc control voltage to the relay driver in the presence of a received carrier without regard to the noise level which may be present. The essential components of the counting circuit are capacitors C701 and C702, diodes CR701 and CR702, and unijunction transistor, Q701 (see Fig. 6-3).

2.6.1 Pulse Trigger Stage Q701.- The operation during the presence of a normal IF signal is as follows: Note that the two diodes conduct during alternate half cycles and that C702 is 100 times the value of C701. During the first positive half cycle CR702 conducts, charging both capacitors. But the capacitors are in series, so the charging voltage will be divided between the two in inverse ratio to their capacities. Thus the initial charge across C702 is approximately 1% of the total charge. During negative half cycles C701 is discharged through CR701 and C702 holds its charge. When the second positive half cycle occurs, the charge stored in C702 opposes the incoming pulse and the total effective voltage applied across the two capacitors is reduced by the amount of charge already present in C702. Capacitor C702 then receives approximately 1% of this second applied voltage and thus a second step, slightly smaller than the first step, is added to the total voltage accumulating across C702. Until the unijunction transistor fires, there is no path except diode and transistor leakage through which C702 can discharge and the voltage across it continues to increase in successively smaller steps with each successive positive half cycle until the unijunction transistor fires. This conduction discharges C702 and the entire cycle is repeated again.

2.6.2 Pulse Amplifier Stage Q702.- The firing of the unijunction transistor sends a pulse through transformer T101 to the pulse amplifier, Q702 (normally biased at cutoff). The amplified output at the secondary of transformer T702 is rectified by a diode, CR703, charging capacitor C703. Resistor R701 provides a fixed discharge time constant for C703. This network makes the pulse counter sensitive to the pulse rate from Q702 because the time constant of C703 and R701 is such that, unless the pulses present at the output are kept up to certain rate, the voltage level across C703 will fall below that required to trigger the relay driver module and actuate the COR. Thus the actuation of the COR is dependent on the rate of firing of the unijunction transistor and with a normal carrier present the pulse rate is sufficiently high to keep the relay driver activated.

2.6.3 Operation Without Continuous Carrier.- When there is no continuous carrier present and only noise exists at the COR driver input, the circuit performs in a manner similar to that described above but the randum nature of noise makes it improbable that noise alone will build up the voltage across C702 rapidly enough to keep the firing rate of Q701 at a rate sufficient to bring ultimate actuation of the COR. With noise at the input, successive cycles are not of the same amplitude. Weak cycles, below the limiting threshold of the COR driver, will not produce a signal from the COR driver of amplitude equal to that produced by a carrier. Weaker pulses are counted with reduced stair-step amplitude while very small noise bursts are often ignored completely. Operating the receiver in the CW mode will cause activation of the COR circuitry because of the presence of the BFO signal at the COR driver input.

2.7 RELAY DRIVER

The relay driver performs two functions: It actuates the carrier operated relay, K102, in the presence of a carrier-induced dc control voltage from the pulse counter, and it provides a means for adjusting the length of time between the disappearance of the control voltage and the return of K102 to the carrier-off state. The time may be adjusted to a period of approximatley zero, three, or ten seconds. The relay driver is contained on a separate module which includes transistors Q901 through Q904 and their associated components. Q901 and Q902 form a two-stage dc amplifier with positive feedback due to the connection of their emitters together at resistor R904. Q903 and Q904 form a two-stage dc amplifier without feedback. The winding of K102 forms the Q904 collector load.

2.7.1 The circuit as shown in the schematic diagram, Figure 6-4, is set up for zero time delay. Note that switch S901 has disconnected capacitor C901 and resistor R907 from the circuit. In the carrier-off state no dc control voltage comes from the pulse counter and conditions are as follows: Q901 conducts because its base is forward biased by the current through R902. Q902 is shut off because the voltage developed across the Q901 collector load resistor, R903 is too low to cause base current in Q902. Q903 conducts due to the current through R906 applied to its base through diode CR901 from +24 vdc. Q904 is shut off because the voltage developed across the Q903 collector load resistor, R908, is too low to cause base current in Q904. Thus, no current passes through the K102 winding.

2.7.2 When a carrier appears and the pulse counter applies a negative voltage through resistor R901 to the input of Q901, that transistor shuts off and Q902 conducts, the change of states being accelerated by the positive feedback from Q902 to Q901. The conduction by Q902 lowers the voltage at the junction of the Q902 collector and diode CR901 to a level considerable more negative than in the carrier-off state with the result that Q903 is shut off. Shutting off Q903 allows the voltage at the input of Q904 to rise causing Q904 to conduct and energize the relay. When the carrier disappears there is an immediate return to the carrier-off state and K102 returns to the unactuated condition.

2.7.3 When switch S901 is moved to the three-second delay position the circuit is modified by the fact that capacitor C901 is connected between -24 vdc and the junction of the Q902 collector and CR901. The introduction of C901 into the circuit delays the changeover from the carrier-on state back to the carrier-off state, circuit operation being as follows: In the carrier-on state C901 is discharged, being shorted out by the relatively low resistance of Q902 in a state of conduction in series with R904. As the carrier disappears Q901 immediately conducts and Q902 immediately shuts off, but the return of Q903 and Q904 to the carrier-off state is delayed by the fact that the voltage at the collector of Q902 must rise from negative to slightly positive before Q903 begins to conduct, and this rise in voltage cannot occur until C901 is charged to a sufficient level. Thus the presence of C901 in the circuit occasions a delay of the change from carrier-on to carrier-off condition. To fix this delay period at three seconds, C901 is caused to recharge through resistor R906, the two having a time constant of approximately three seconds. To obtain a ten-second delay, S901 is moved to the ten-second delay position, adding resistor R907 in series with resistor R906, thereby increasing the time constant to approximately ten seconds.

2.7.4 The use of positive feedback from Q902 to Q901 is important with respect to the time delay function for the following reasons: The full amount of time delay will not be obtained unless C901 is discharged to the same level each time Q902 conducts. If there were no feedback, a momentary application of the carrier might allow Q902 to conduct only long enough to partially discharge C901. However, the feedback circuit is such that C901 is discharged through R904 and therefore, once C901 begins to discharge, a voltage developed by the discharge current through R904 holds Q901 in a non-conducting state until sufficient discharge of C901 occurs. Thus, even though the carrier is present only briefly, the entire circuit will be held to the carrier-on state for the desired period. CR902 prevents the possible damage of Q904 due to flyback voltage caused by the sudden interruption of current through K102.

2.8 NOISE LIMITER

The shunt-type noise limiter functions in the AM/ANL mode to prevent instantaneous noise bursts from exceeding the level of the loudest portions of the modulation envelope. A schematic diagram of the noise limiter is presented in Figure 6-5.

2.8.1 The noise limiter is placed in operation by mode selector switch section S104C which grounds one side of capacitor C802 when AM/ANL operation is selected. The output from the AM detector is applied to the emitter follower, Q801, and one end of CR801 from the junction of a voltage divider made up of resistors R804 and R805. The AM detector output is applied to the other end of CR801 through a low pass filter consisting of resistor R806 and capacitor C802. When a sudden noise pulse appears in the detector output the voltage at the junction of R804 and R805 increases rapidly but the voltage at the junction of R806 and C802 cannot change quickly due to the long time constant of R806 and C802. If the noise voltage is great enough, a difference of potential will appear across CR801 sufficient to cause the diode to conduct, shorting the input to the emitter follower to ground through CR801 and C802.

2.8.2 The time constant of R806 and C802 is chosen so that the voltage at the junction of CR801, R806, and C802 will change with average carrier level changes but will not change fast enough to follow the modulation. During use of the noise limiter, the voltage level at that point remains at approximately twice the average carrier level present at the junction of R804 and R805. Noise pulses which would otherwise rise above that level are clipped. Clipping begins at a level equivalent to approximately 90% to 95% modulation, a level high enough to avoid causing appreciable distortion. With the noise limiter in operation, noise will be heard but it is clipped to the loudest level of the intelligence contained in the modulation.

2.9 DC AMPLIFIER

The dc amplifier is located on the video module and consists of two type 2N335 transistors, Q201 and Q202, in a cascaded emitter follower configuration (see Fig. 6-6). The input is permanently connected to the output of the FM demodulator, to which the dc amplifier presents a high impedance. The output presents a low impedance across which the AUDIO GAIN and VIDEO GAIN potentiometers are shunted during FM operation. This connection is made through switch section S104D.

2.9.1 Zener diode CR201, in series with resistor R206, provides a regulated 12 volt supply for the module. Resistors R203 and R204 divide the +12 vdc producing approximately +1.2 vdc at their junction, a voltage which is offset by the base-to-emitter drop of Q201 and Q202. Thus in the absence of a carrier, the TUNING meter, which is connected between ground and the junction of R203 and R204, receives zero voltage with reference to ground and does not need a zero-adjust control.

2.9.2 When receiver tuning is inexact, a dc component appears in the FM demodulator output, and this dc component is amplified and applied to the meter. In all modes of operation the TUNING meter functions by indicating the value of the dc component of the FM demodulator output, a component which is zero when tuning is exactly at the carrier center frequency, and when tuning is inexact, is of a polarity and level such as to indicate the direction and extent to which the tuning is off.

2.10 VIDEO AMPLIFIER

The video amplifier (shown schematically in Fig. 6-6) is located on the video module and consists of a transistor common emitter amplifier, Q203, followed by transistors Q204 and Q205, the latter two in a cascaded emitter follower configuration. The amplifier input at resistor R205 is connected to the VIDEO GAIN potentiometer. The amplifier output is connected to J108, the VIDEO OUTPUT jack. To obtain high open-loop gain without sacrificing stability, "bootstrapping" is used in the amplifier. This is obtained by the connection of capacitor C203 between the third stage output and the first stage output. In the FM mode, or at 300-kc bandwidth, the amount of inverse feedback from Q205 to Q203 is varied by switch sections S104F or S103B. Under these conditions, one or both switch sections place resistor R211 across resistor R210, thus reducing the gain. This permits changing bandwidth or mode with a minimum readjustment of video gain.

2.11 AUDIO AMPLIFIER

Refer to Figure 6-7. The first stage in the audio amplifier is a conventional voltage amplifier in a common emitter configuration. The input signal from the AUDIO GAIN potentiometer R116, is applied to this stage through capacitor C301 and resistor R301. The second stage is an emitter follower used to match the high impedance of the first stage output to the low input impedance of the third stage, the power amplifier. High frequency response improvement is obtained by a coupling between the second and third stages. This coupling is made up of capacitor C302 and resistor R308 in parallel. Resistor R307 provides direct feedback from the third to the first stage. Resistor R310, in the emitter lead of the output stage, provides signal frequency current feedback. The output is coupled through transformer T301, which forms the third stage collector load. T301 provides an unbalanced output of approximately 600 ohms impedance. In parallel across the secondary of T301 are connected the PHONES jack, J109, the AUDIO OUTPUT jack, J110, and terminal 7 on TB101.

2.12 AGC SYSTEM

Gain control of the first and second stages in the IF strip is accomplished by application of a gain control voltage which is applied directly to the first stage, but is applied to the second stage after being delayed by Zener diode CR601. This permits the signal to build-up to a sufficient level in the first IF stage before the gain of the second stage is reduced. To keep the limiters driven to saturation, only automatic gain control voltage is used during FM operation. The FM AGC voltage is developed in the stage functioning as a first limiter, V603, and reaches the first IF stage through mode selector switch section S104A. During AM and AM/ANL operation with AGC, an AGC voltage from the stage functioning as a detector, V604, is applied to the first IF stage through a series consisting of switch section S104A, the AGC contact of switch S105, and a contact of switch section S104B. During operation with manual gain control (possible in the AM, AM/ANL, and CW modes) the gain control voltage is derived from the RF-IF GAIN potentiometer R108. This potentiometer, in series with resistor R111 is connected between -24 vdc and ground. The voltage tapped from R111 for manual gain control reaches the first IF amplifier through the manual gain position contact of S105 and the AM, AM/ANL or CW contacts of S104A. From there it is conducted to other stages as has been described above for AGC voltage. During either manual or automatic gain control, the delayed gain control voltage from Zener diode CR601 is also applied to the RF amplifiers in the tuners.

2.13 POWER SUPPLY

The power supply (shown in main chassis schematic, Fig. 6-8) is operated from a 115-vac, 50-400 cps source. A 3/8-ampere fuse is used in the primary winding of transformer T101. Four secondary windings are used to supply all necessary voltages to the receiver. One 6.3-vac winding supplies all the filaments. One supplies a full-wave rectifier whose output is LC filtered and taken off at 175 vdc. From the same rectifier a Zener diode, CR111 and a resistor, R101, are used to obtain a 120-vdc regulated supply. A third winding supplies another full-wave rectifier, whose output is 150 vdc, used only to power the 60-300 mc RF tuner. The negative side of this rectifier is held at -3 vdc and used as cathode return for V501 and V502. The fourth secondary winding supplies power for three full-wave rectifying circuits, two of which employ RC filtering and provide +24 vdc and -24 vdc for the video and audio stages. The third full-wave rectifying circuit uses a capacitive input filter and supplies +24 vdc for relay operation.

SECTION III

INSTALLATION AND OPERATION

3.1 INSTALLATION

The receiver is designed for installation in a standard 19-inch rack. It requires 3-1/2 inches of vertical space and will project 13-3/4 inches back into the rack. Adequate ventilation should be allowed. If three or more are stacked, 1-1/2 inch spacing should be allowed.

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

3.1.2 Single Antenna Operation.- For operation with a single antenna, connect it to the INPUT, J102, using a 50-ohm coaxial cable.

3.1.3 Two-Antenna Operation.- For operation with two antennas proceed as follows:

(1) At J103 on the coaxial switch, disconnect the cable leading from J401 on the low band tuner chassis.
(2) Connect the free end of the disconnected cable to J106, the connector leading to the AUX INPUT, J105.
(3) Connect the low band (30-60 mc) antenna to the AUX INPUT, J105, using a 50-ohm coaxial cable.
(4) Connect the high band (60-300 mc) antenna to the INPUT, J102.

3.1.4 Signal Monitor Connection.- To use a signal monitor with the receiver, connect its input to the SM OUTPUT, J107, using a 50-ohm coaxial cable.

3.1.5 Video Output Connection.- Connect the video amplifier load to the VIDEO OUTPUT, J108.

3.1.6 Audio Output Connection.- To use headphones, plug them into the PHONES jack. If a speaker is to be used, it should be of a 600-ohm impedance and should be connected across terminals 7 and 8 of terminal strip TB101, ground side to terminal 8. To connect a coaxial cable to the audio output, use the BNC AUDIO OUTPUT connector, J110.

3.1.7 Ground Connection.- System ground should be connected to terminal 8 of TB101.

3.1.8 COR Connections.- The COR contacts are available at terminal block TB101 on the rear apron. Terminals 1-3 are normally closed; terminals 2-3 and 4-5 are normally open. A COR-controlled 6.3-vac source is available at terminal 6.

3.1.9 COR Time Delay Adjustment.- With the relay driver module plugged into its receptacle, the COR time delay adjust switch, S901, should be pushed to the position closest to the rear of the receiver to obtain zero time delay, to the center position for a three-second delay, and to the forward position to obtain a ten-second delay. The switch is stenciled to indicate this on its top.

3.2 OPERATION

The following list is for the guidance of those operating the receiver:

(1) The POWER switch applies ac power to the receiver when the switch is in the up position. One of the tuning dials will light up when power is turned on. The receiver should be allowed a few minutes warm-up prior to use.
(2) For tuning, the bandswitch should be rotated to select operation in the 30-60 mc band or in the 60-300 mc band. As a certain band is selected the dial light for the selected band will come on. The tuning controls may each be preset, allowing rapid switching between two RF carriers in different bands. Each division of the 30-60 mc dial corresponds to 500 kc. Each division of the 60-300 mc dial corresponds to one megacycle.

(3) The mode selector should be set to FM, AM, AM/ANL, or CW prior to tuning. When using the CW position, the RF-IF GAIN control should not be in the AGC position.

(4) The BANDWIDTH switch should be set to 300 KC for wideband operation and to 50 KC for narrow band operation. When searching for signals, it is advisable to use wideband operation. For CW operation, only the narrow band is recommended.

(5) The SIGNAL STRENGTH meter indicates the relative magnitude of the carrier being received and is not calibrated in any specific units.

(6) The TUNING meter indicates zero when tuning is exactly to the center of the carrier, to the left of center when tuning is below the carrier frequency and to the right of center when tuning is above the carrier frequency. The amount of meter deviation indicates the relative degree of detuning, but the meter is not calibrated to interpret detuning in frequency units. This meter is useful in tuning in both AM and FM signals but will not indicate during CW operation.

(7) The RF-IF GAIN control may be used in the AM or AM/ANL modes to obtain manual control of the IF gain, or set at AGC to obtain automatic control. In the CW mode, only manual gain control should be used. In the FM mode, the RF-IF GAIN control may be left in any position, since only automatic gain control is possible during FM operation.

(8) The BFO TUNING control may be adjusted during CW operation to obtain the desired pitch of the beat note.

(9) The AUDIO GAIN control should be adjusted for the desired audio output level.

(10) The VIDEO GAIN control should be adjusted for the desired video output level.

(11) At all times during CW operation, and whenever a carrier appears during operation in the other modes, the COR light will come on.

SECTION IV

MAINTENANCE

4.1 GENERAL

The Type 903A Receiver will give comparatively trouble-free performance. However, should trouble occur, it is important that maintenance personnel be familiar with Section II, in which the circuits are described. In addition, use should be made of Figures 5-1 through 5-15, in which the location of components is shown; Figures 6-1 through 6-8, the schematic diagrams; and Tables 4-1 and 4-2, in which the tube socket and module pin voltages are given. The receiver presents no special maintenance problems and normally requires no care beyond being kept clean. Field maintenance should be confined to cleaning and the replacement of the fuse, tubes, or plug-in modules. All other maintenance and repair work should be carried on in a well-equipped shop and performed only by trained and experienced personnel.

CAUTION

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 of the inductuners. The only maintenance normally needed for the mechanisms is the occasional application of a few drops of light oil on the shaft bearings. Be careful not to get oil on the friction drive plates. 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 (such as after an inductuner replacement), follow these steps:

(1) By releasing the Allen setscrews on each side of it, loosen 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 second mark above 62, 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 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 MODULES

The plug-in modules 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 diagram, Figure 6-8, at the points where the connecting leads pass through the dashed lines outlining each module on the schematic. For example, the output from the audio amplifier to the PHONES jack is through pin 11 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, diodes, or relays. 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

Table 4-1. Type 903A Receiver, Tube Socket Voltage Chart

Symbol	Type	Tube Socket Pin Numbers					Plate	Grid*	Cathode	Heater	Heater
		2	4*	8	10	12					
V401	6CW4	75	-0.06	0.23	6.3 vac	0					
V402	6CW4	138	72	75	6.3 vac	0					
V403	7587	24.5	-1.5°	0	0	6.3 vac	165				
V404	6CW4	74.5	-1.22°	0	6.3 vac	0					
V501	7077						145	-0.47	0.86	6.3 vac	0
V502	7077						143	0	1.8	6.3 vac	0
V503	7587	22	-1.5°	0	6.3 vac	0	165				
V504	6CW4	74	-4.2°	0	0	6.3 vac					
V601	7587	24	-4.4	0	0	6.3 vac	150				
V602	7587	45	-0.035	1.4	0	6.3 vac	170				
V603	7587	24	-0.05	0.20	0	6.3 vac	170				
V604	7587	16.5	-1.2	0	0	6.3 vac	13				
V605	6CW4	106	-3.0	0	0	6.3 vac					
V606	6CW4	105	-7.4	0	0	6.3 vac					
V607	7587	15	-2.5	0	0	6.3 vac	23.5				

Note: All readings taken with reference to ground, using RCA VoltOhmyst WV-98B. All readings are positive dc unless otherwise noted. All readings taken with receiver powered by 115 vac, 60 cps; no signal input; controls set as follows unless otherwise noted: BANDWIDTH switch at 300 KC; mode selector at FM except at CW for V605 and V606; IF GAIN control at AGC; AUDIO GAIN maximum clockwise; VIDEO GAIN maximum clockwise; input terminated with 50-ohm resistive load; bandswitch and IF BANDWIDTH switches set for the particular subassembly to be measured.

* Voltages in this column taken with 1 megohm resistor in series with probe.

° Readings will vary with frequency.

Table 4-2. Type 903A Receiver, Module Pin Voltages

Video Module

Pin Number	1	2	3	4	5	6	9	10	11	12
Voltages	0	-24	-1.8	0	4.1	4.1	24	-0.7	-1.8	0

Audio Module

Pin Number	2	3	4	11	13
Voltages	0	-1.8	24	0	0

Relay Driver Module

Pin Number	1	2	5	9	10
Voltages	-26.0	-24	0	24	24

Noise Limiter Module*

Pin Number	1	2	3	4	5	6	7	8	9
Voltages	0	0	-24	0	-1.9	-1.9	-0.14	-2.6	0

Note: All readings taken with reference to ground, using RCA VoltOhmyst WV-98B. All readings are positive dc unless otherwise noted. All readings taken with receiver powered by 115 vac, 60 cps; no signal input; controls set as follows unless otherwise noted: BANDWIDTH switch at 300 KC; mode selector at FM; IF GAIN control at AGC; AUDIO GAIN maximum clockwise; VIDEO GAIN maximum clockwise; input terminated with 50-ohm resistive load.

* Readings taken with mode selector at AM/ANL position.

troubleshooting is 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 other work. In addition, the power supply should be known to be functioning properly before any other circuit is suspected.

4.5 ALIGNMENT INSTRUCTIONS

The alignment procedures in this book are suitable for 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 therein. 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 and thoroughly familiar with the receiver. Allow a 30-minute warm-up period 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. 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.

4.5.2 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, Boonton Type 202E
(4) Univerter, Boonton Type 207E
(5) Signal Generator, Hewlett-Packard 606A
(6) Audio Signal Generator, Hewlett-Packard 200CD
(7) Sweep Generator, Jerrold 900-A or 900-B with external marker generator, or Telonic Model HD-1A with built-in 10-mc harmonic generator
(8) Signal Generator, Hewlett-Packard 608D
(9) Assorted cables, connectors, attenuation pads and alignment tools

4.6 IF STRIP ALIGNMENT

Make the following initial settings:

(1) Set receiver function switch to AM position.
(2) At C602, ground gain control voltage line to IF strip chassis.
(3) By removing P601 from J601, disconnect IF strip from RF tuners.
(4) Set oscilloscope horizontal sensitivity to 0.2 volt per centimeter.

4.6.1 V601 to V602, Interstage Alignment, 50-kc Bandwidth.- Proceed as follows:

(1) Set up test equipment as shown in Figure 4-1.
(2) Set audio generator output to 5 cps.
(3) Set oscilloscope vertical sensitivity to 50 millivolts per centimeter.
(4) Set Boonton 202E output to 171.4 mc.
(5) Set Boonton Univerter dial at 0 KC.

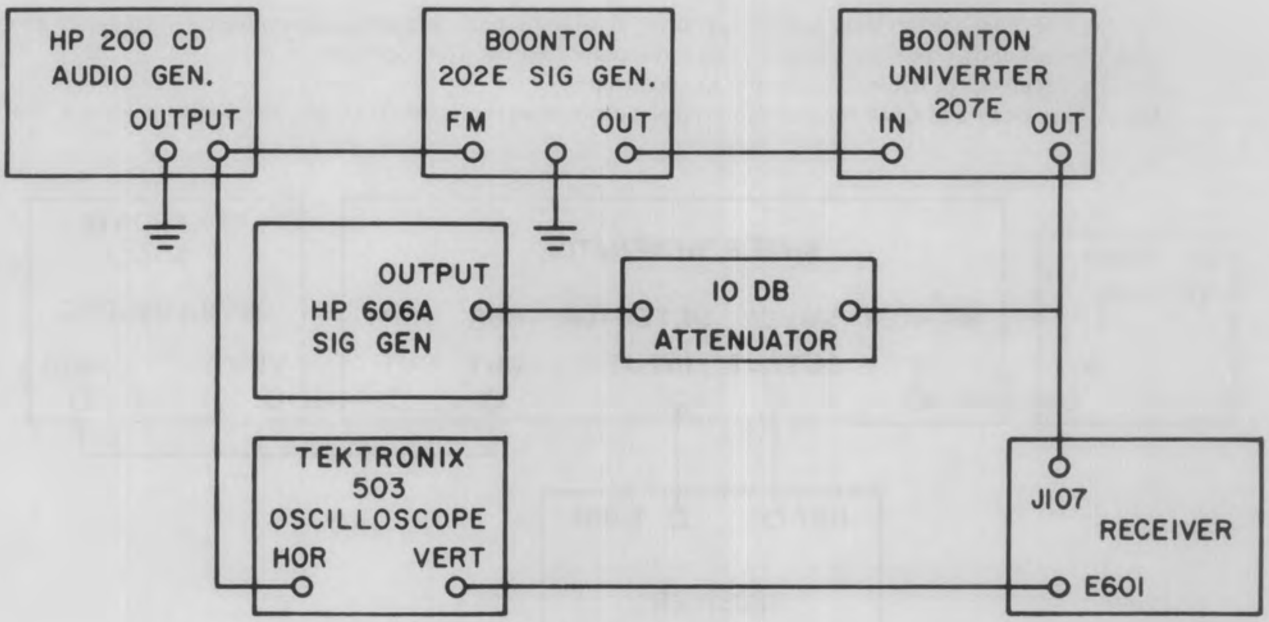


Figure 4-1. Equipment Setup, V601 to V602 Alignment, 50-kc Bandwidth

(6) Adjust sweep width by setting FM deviation to approximately 60 kc.
(7) Set receiver BANDWIDTH switch to 50 KC position.
(8) Adjust L603 and L604 of receiver for a response curve on oscilloscope screen as shown in Figure 4-2.
(9) Adjust Hewlett-Packard 606A output for use as a 21.4-mc marker with marker output level such that marker barely appears on response curve.
(10) Check bandwidth by tuning Boonton Univerter dial so that response curve moves across oscilloscope screen. Bandwidth will be the frequency difference read from dial when 3-db curve points intersect 21.4-mc marker line, as shown in Figure 4-2.

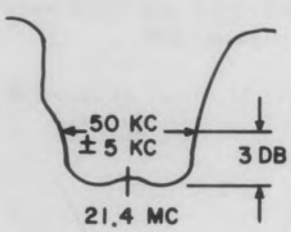


Figure 4-2. Typical Response Curve, V601 to V602 Alignment, 50-kc Bandwidth

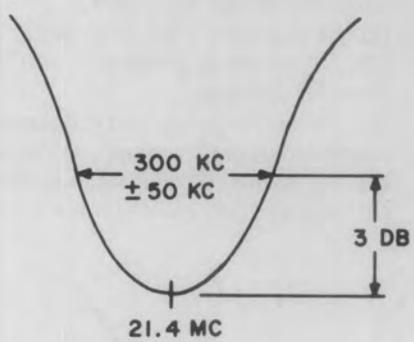


Figure 4-3. Typical Response Curve, V601 to V602 Alignment, 300-kc Bandwidth

4.6.2 V601 to V602, Interstage Alignment, 300-kc Bandwidth.- Proceed as follows:

(1) Set up test equipment as shown in Figure 4-4.
(2) Adjust sweep generator near 21.4 mc for narrow sweep width with its detector switch at external detector position.

(3) Set oscilloscope vertical sensitivity at 50 millivolts per centimeter and adjust sweep generator sweep width until a response curve is well-displayed on oscilloscope screen.
(4) Set receiver BANDSWITCH to 300 KC position.
(5) Adjust C614 and C616 for a symmetrical response centered at 21.4 mc, as shown in Figure 4-3.

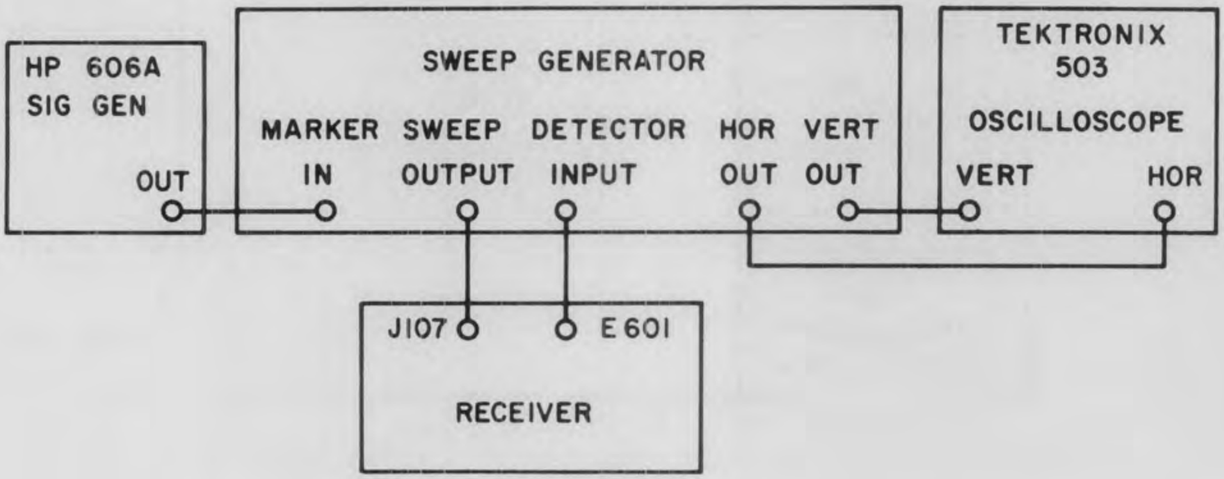


Figure 4-4. Equipment Setup, V601 to V602 Alignment, 300-kc Bandwidth

(6) Using calibrated 21.4-mc signal from Hewlett-Packard 606A signal generator as a marker, check bandwidth by moving the marker along response curve. Bandwidth will be the frequency difference read from signal generator dial at points where marker intersects 3-db points of response curve, as shown in Figure 4-3.

4.6.3 V602 to V603, Interstage Alignment.- Proceed as follows:

(1) Set up test equipment as shown in Figure 4-4 except that sweep output of sweep generator should be connected to pin 4 of V602.
(2) By removing P601 from J601, disconnect IF strip from RF tuners.
(3) Adjust sweep generator near 21.4 mc for narrow sweep width with its detector switch at external detector position.
(4) Set oscilloscope vertical sensitivity at 50 millivolts per centimeter and adjust sweep generator sweep width until a response curve is well-displayed on oscilloscope screen.
(5) Set receiver bandswitch to 300 KC position.
(6) Adjust L605 and L606 for a symmetrical response centered at 21.4 mc, as shown in Figure 4-5.

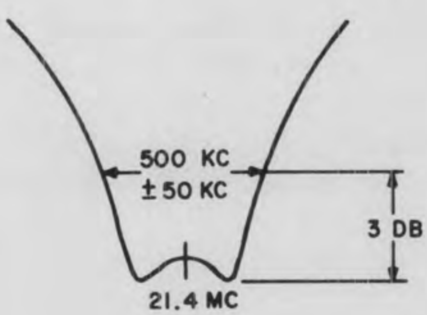


Figure 4-5. Typical Response Curve, V602 to V603 Alignment

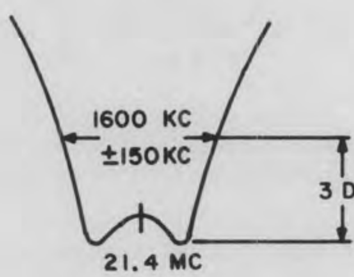


Figure 4-6. Typical Response Curve, V603 to V607 Alignment

4.6.4 V603 to V607, Interstage Alignment. - Proceed as follows:

(1) Set up test equipment as shown in Figure 4-4 except that sweep output of sweep generator should be connected to pin 4 of V603.
(2) Adjust sweep generator near 21.4 mc for narrow sweep width with its detector switch at external detector position.
(3) Set oscilloscope vertical sensitivity at 50 millivolts per centimeter and adjust sweep generator sweep width until a response curve is well-displayed on oscilloscope screen.
(4) Set receiver bandswitch to 300 KC position.
(5) Adjust L607 and L608 for a symmetrical response curve centered at 21.4 mc, as shown in Figure 4-6.
(6) Adjust C657 for dip in center of response curve, as shown in Figure 4-6.

4.6.5 COR Driver, V604, Alignment. - Proceed as follows:

(1) Set VTVM to scale suitable for measuring approximately 5 vdc.
(2) Adjust HP606A signal generator to produce a 21.4-mc CW signal.
(3) Connect equipment as shown in Figure 4-7.
(4) Adjust L619 for maximum indication on the VTVM.

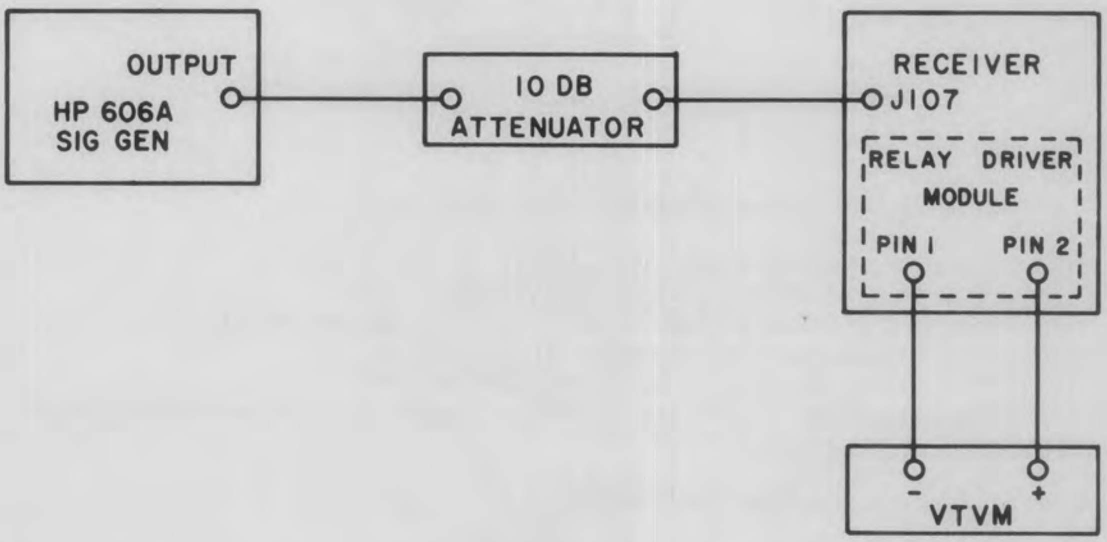


Figure 4-7. Equipment Setup, COR Driver Alignment

4.6.6 Discriminator Alignment. - Proceed as follows:

(1) Set up equipment as shown in Figure 4-4 except that sweep output of sweep generator should be connected to pin 4 of V603 and the detector input should be connected to the FM output, E602.
(2) Adjust sweep generator near 21.4 mc for narrow sweep width with its detector switch at external detector position.
(3) Set oscilloscope vertical sensitivity at 50 millivolts per centimeter and adjust sweep generator sweep width until a response curve is well-displayed on oscilloscope screen.
(4) Set receiver bandswitch to 300 KC position.
(5) Adjust phasing of the sweep generator.
(6) Adjust L611 for zero crossing of S-curve at 21.4 mc and adjust L610 for symmetry of S-curve, as shown in Figure 4-8.
(7) Using calibrated 21.4-mc marker from Hewlett-Packard 606A signal generator, check that the

S-curve has the following characteristics:

(a) centered at 21.4 mc.
(b) equal amplitude and symmetry.
(c) peak-to-peak separation of 750 ± 30 kc, as shown in Figure 4-8.

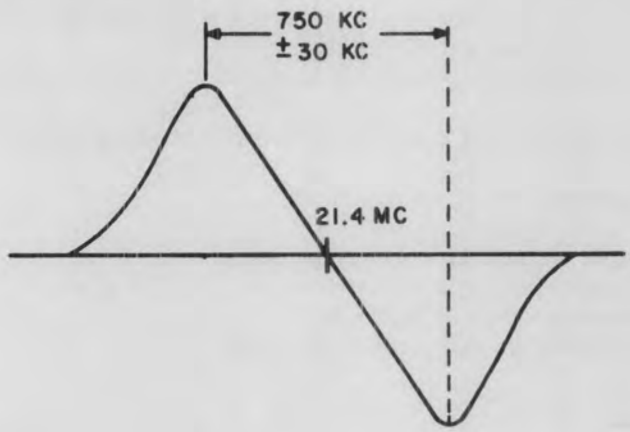


Figure 4-8. Typical Response Curve, Discriminator Alignment

4.6.7 BFO, V606, Alignment.- Proceed as follows:

(1) Set receiver function switch to CW position.
(2) Set receiver BANDWIDTH switch to 50 KC position.
(3) Connect the Hewlett-Packard 606A signal generator to the SM OUTPUT, J107
(4) Adjust the signal generator frequency to 21.4 mc exactly.
(5) Connect a set of headphones to the receiver PHONES jack.
(6) Set the receiver BFO TUNING control with the white dot at the upward midpoint position.
(7) Adjust L616 for zero beat.

4.7 LOW BAND RF TUNER ALIGNMENT PROCEDURES

For each circuit of the low band RF tuner a separate alignment procedure is given. Any one of the procedures may be carried out without disturbing other portions of the tuner. However, all low band RF tuner alignment procedures are critical and should not be attempted in the field unless considered absolutely necessary, such as after replacement of a component. Make the following initial settings:

(1) Set the receiver function switch to the AM position.
(2) Set the receiver bandswitch to the 30-60 MC position.
(3) Connect the VTVM positive lead to C432, negative lead to the tuner chassis, and adjust the IF GAIN control until the VTVM indicates -1.5 vdc.

4.7.1 Mixer Plate Coil Alignment.- Proceed as follows:

(1) Set BANDWIDTH switch to 50 KC position.
(2) From the Hewlett-Packard 606A signal generator, feed a calibrated 21.4-mc signal to the INPUT jack, J102.
(3) Adjust signal generator output level for a mid-scale reading on the receiver SIGNAL STRENGTH meter.
(4) Adjust L405 for maximum indication on the SIGNAL STRENGTH meter.

4.7.2 Local Oscillator, V404, Alignment.- Proceed as follows:

(1) Set the BANDWIDTH switch to the 300 KC position.
(2) Set the receiver dial exactly at 30 mc.
(3) Feed the output of the Hewlett-Packard 608D signal generator to the INPUT jack, J102.
(4) Calibrate the VHF signal generator to produce exactly 30 mc.
(5) Adjust the output level of the VHF signal generator until the SIGNAL STRENGTH meter indicates at 3/4 deflection.
(6) Recalibrate the VHF signal to exactly 30 mc.
(7) Adjust C420 until the TUNING meter indicates exactly at the center of its scale.
(8) Tune the receiver dial exactly to 60 mc.
(9) Calibrate the VHF signal exactly to 60 mc. If the TUNING meter again indicates exactly at the center of its scale, the alignment is completed. If not, adjust C420 for center indication of TUNING meter.
(10) Repeat steps (2) through (9) until the TUNING meter indicates at its center for both 30 mc and 60 mc.

4.7.3 V402 to V403 Interstage Alignment.- Proceed as follows:

(1) Remove bottom cover from the 30-60 mc tuner chassis.
(2) Unsolder C403 from C402, carefully noting the location of the two capacitors so that they may later be resoldered in exactly the same position.
(3) Set up equipment as shown in Figure 4-9.

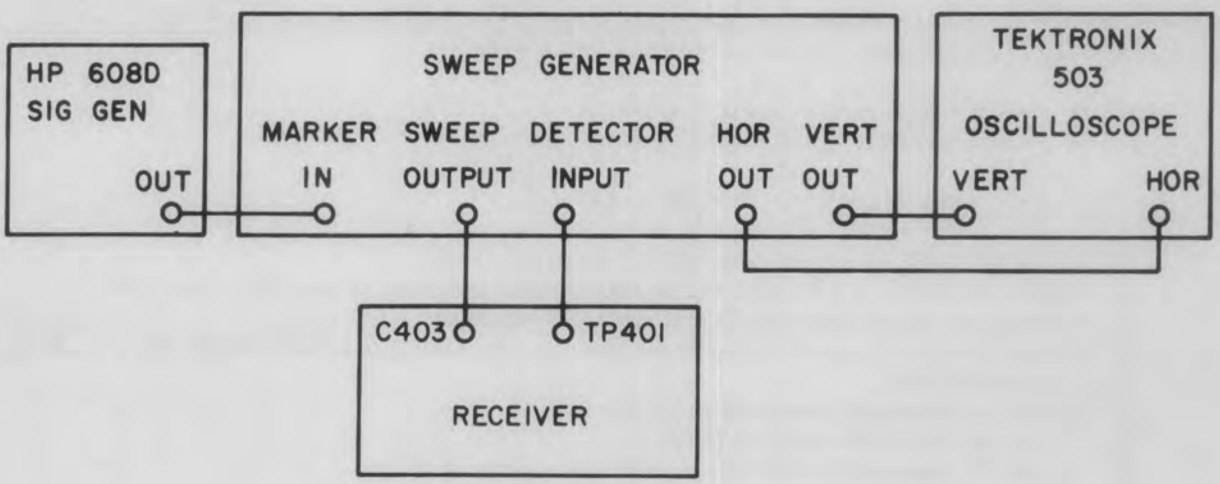


Figure 4-9. Equipment Setup, V402 to V403 Alignment

(4) Set the oscilloscope vertical sensitivity to 10 millivolts per centimeter and the vertical input to the ac-coupled position.
(5) Set the oscilloscope horizontal sensitivity such that the total trace of the horizontal sweep is 10 centimeters.
(6) Set the receiver dial to 30 mc and sweep generator at approximately 30 mc.
(7) Using a calibrated 30-mc signal from the Hewlett-Packard 608D signal generator as a marker, adjust C409 and C411 for a symmetrical double-tuned response centered at 30 mc.
(8) Change receiver dial to 60 mc and sweep generator to approximately 60 mc.
(9) Using a calibrated 60-mc signal from the Hewlett-Packard 608D signal generator as a marker, check the response for a symmetrical double-tuned response with a center dip of approximately 10%. If the response seems acceptable, the alignment is finished. Otherwise, adjust C409 and C411 to produce proper centering and symmetry.

(10) Repeat steps (6) through (9) until the response curve has an acceptable symmetry and centering at both ends of the band.
(11) Resolder C403 and C402 in their original positions.

4.7.4 Input Circuit Alignment.- Proceed as follows:

(1) Set up the equipments as shown in Figure 4-9 except that the output of the sweep generator is moved from C403 to the INPUT jack, J102.
(2) Set the oscilloscope vertical sensitivity to 10 millivolts per centimeter and the vertical input to the ac-coupled position.
(3) Set the oscilloscope horizontal sensitivity such that the total trace of the horizontal sweep is 10 centimeters.
(4) Set the receiver dial and sweep generator center frequency to 30 mc.
(5) Using a calibrated 30-mc signal from the Hewlett-Packard 608D signal generator as a marker, adjust C402 for a maximum symmetrical response centered at 30 mc.
(6) Change receiver dial to 60 mc and sweep generator frequency to approximately 60 mc.
(7) Using a calibrated 60-mc signal from the Hewlett-Packard 608D signal generator as a marker, adjust C402 for a maximum symmetrical response centered at 60 mc.
(8) Repeat steps (4) and (5).

4.8 HIGH BAND RF TUNER ALIGNMENT PROCEDURES

For each circuit of the high band RF tuner a separate alignment procedure is given. Any one of the procedures may be carried out without disturbing other portions of the tuner. However, all high band RF tuner alignment procedures are critical and should not be attempted in the field unless considered absolutely necessary, such as after replacement of a component. Make the following initial settings:

(1) Set the function switch to the FM position.
(2) Set the bandswitch to the 60-300 MC position.

4.8.1 Local Oscillator, V504, Alignment.- Proceed as follows:

(1) Set the BANDWIDTH switch to the 300 KC position.
(2) Connect the output of a Hewlett-Packard 608D signal generator to the INPUT jack, J102.
(3) Calibrate the signal generator to produce a 270-mc signal.
(4) Adjust the signal generator output level until the receiver SIGNAL STRENGTH meter reads approximately 3/4 deflection.
(5) Recalibrate the signal generator to 270 mc exactly.
(6) Set the receiver dial exactly at 270 mc.
(7) Adjust C533 until the TUNING meter indicates exactly at center
(8) Set the dial exactly at 100 mc.
(9) Tune and calibrate the signal generator to produce a 100-mc signal. If the TUNING meter again indicates exactly at the center of its scale, the alignment is completed. If not, adjust C533 for center indication of TUNING meter.
(10) Repeat steps (5) through (9) until TUNING meter indicates at its center for both 100 mc and 270 mc.

4.8.2 V502 to V503 Interstage Alignment.- Proceed as follows:

(1) Remove bottom cover from the 60-300 mc tuner chassis.
(2) Unsolder C508 from the junction of L503 and L504, carefully noting the capacitor's position so that it may later be resoldered to exactly the same point.
(3) Set up the equipment as shown in Figure 4-10.
(4) Set the oscilloscope vertical sensitivity to 10 millivolts per centimeter and the vertical input to the ac-coupled position.
(5) Set the oscilloscope horizontal sensitivity so that the total trace of the horizontal sweep is 10 centimeters.
(6) Set the receiver dial to 290 mc and sweep generator to approximately 290 mc.

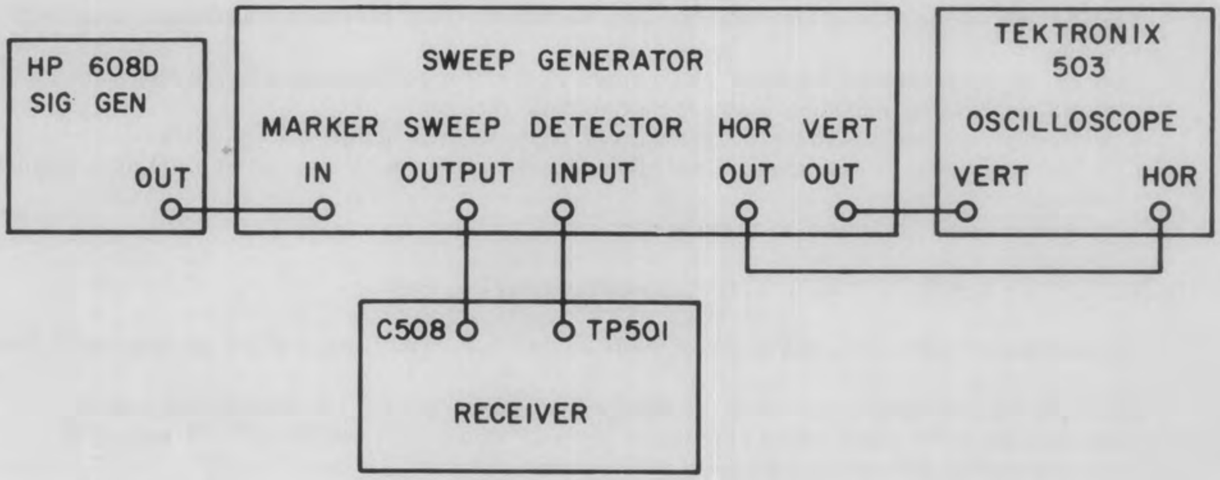


Figure 4-10. Equipment Setup, V502 to V503 Alignment

(7) Using a calibrated 290-mc marker from the Hewlett-Packard 608D signal generator, adjust C512, C516, and C515 for a symmetrical flat-topped response with the 290-mc marker appearing 6% down on the higher frequency slope as shown in Figure 4-11.

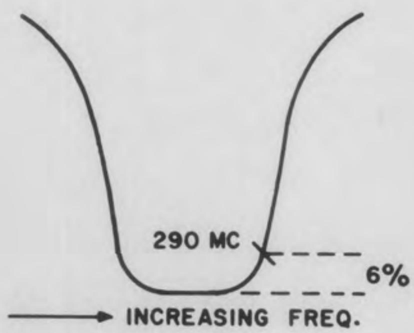


Figure 4-11. Typical Response Curve, V502 to V503 Alignment

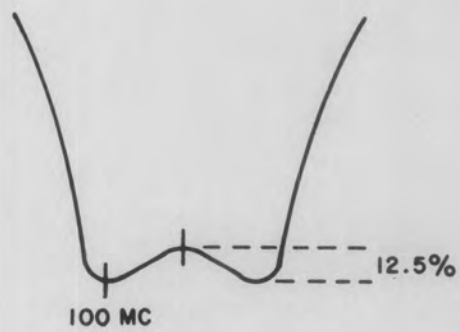


Figure 4-12. Typical Response Curve at 100 mc, V502 to V503 Alignment

(8) Set the receiver dial to 100 mc and sweep generator to approximately 100 mc.
(9) Using a calibrated 100-mc marker from the Hewlett-Packard 608D signal generator, adjust C512 and C516 for a symmetrical double-tuned response with the 100-mc marker appearing at the low frequency peak as shown in Figure 4-12.
(10) Adjust C515 for 12.5% center dip as shown in Figure 4-12.
(11) Repeat steps (9) and (10) until the final response curve assumes the proper shape with the bottom cover on.
(12) Resolder C508 in its original position.

4.8.3 Input Circuit Alignment. - Proceed as follows:

(1) Set up equipment as shown in Figure 4-10 except that the output of the sweep generator is now connected to the INPUT, J102.
(2) Set the oscilloscope vertical sensitivity to 10 millivolts per centimeter and the vertical input to the ac-coupled position.

(3) Set the oscilloscope horizontal sensitivity so that the total trace of the horizontal sweep is 10 centimeters.
(4) Set the receiver dial to 290 mc and the sweep generator to approximately 290 mc.
(5) Adjust C504 for maximum gain and symmetrical response.
(6) Set the receiver dial to 100 mc and the sweep generator to approximately 100 mc.
(7) If the response is symmetrical, the alignment is completed. If not, adjust C504 for a symmetrical response.
(8) Repeat steps (5) through (7) as necessary.

4.9 ADJUSTMENT OF PULSE COUNTER OUTPUT POTENTIOMETER, R641

Potentiometer R641 is located on top of the IF subchassis. To properly adjust it, proceed as follows:

(1) Connect a VTVM to read the dc voltage between pins 1 and 2 of the relay driver module.
(2) Connect an RF voltmeter to read the 21.4-mc IF signal from the SM OUTPUT jack, J107.
(3) Connect the receiver to a primary power source of exactly 115 vac.
(4) Connect a signal generator, adjusted to produce a CW signal of any frequency within the receiver's range, to the input of the receiver and tune the receiver to the signal.
(5) Adjust the signal generator output level so that the RF voltmeter indicates a level of one millivolt.
(6) Set the receiver's BANDWIDTH switch to the 300 KC position and its function switch to the FM position.
(7) Adjust R641 until the VTVM indicates 2.75 vdc present between pins 1 and 2 of the relay driver module.

SECTION V

PARTS LIST, TYPE 903A RECEIVER

MAIN CHASSIS

Symbol Number	Description	Vendor Part No.	Vendor Name
A101	ASSEMBLY, VIDEO MODULE	1213	CEI
A102	ASSEMBLY, AUDIO MODULE	1044A	CEI
A103	ASSEMBLY, NOISE LIMITER MODULE	1312	CEI
A104	ASSEMBLY, RELAY DRIVER MODULE	1249	CEI
C101A, B	CAPACITOR, ELECTROLYTIC, TWIST-LOCK: 15-15 µf, 350-350 wvdc	43F2299B	GE
C102A, B	Same as C101A, B		
C103A, B	CAPACITOR, ELECTROLYTIC, TWIST-LOCK: 100-100 µf, 50-50 wvdc	43F2300B	GE
C104	CAPACITOR, ELECTROLYTIC: 50 µf, 50 wvdc	TE-1307	Sprague
C105	Same as C104		
C106A, B	Same as C103A, B		
C107	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 µf, 20%, 20 vdc	150D106X-0020B0	Sprague
CR101	DIODE, SILICON RECTIFIER	1N2615	Motorola
CR102	Same as CR101		
CR103	Same as CR101		
CR104	Same as CR101		
CR105	DIODE, SILICON RECTIFIER	1N2610	Motorola
CR106	Same as CR105		
CR107	Same as CR105		
CR108	Same as CR105		
CR109	Same as CR105		
CR110	Same as CR105		
CR111	DIODE, SILICON ZENER	10M120Z5	Motorola
DS101	LAMP: 6-8 volts, 0.15 amp	47	GE
DS102	Same as DS101		
DS103	LAMP: 6 volts, 0.20 amp	328	GE
F101	FUSE: 3/8 amp, Slo-Blo		Littelfuse
J101	NOT USED		
J102	RECEPTACLE, JACK: Type BNC, Part of K101		
J103	RECEPTACLE, JACK: Type BNC, Part of K101		
J104	RECEPTACLE, JACK: Type BNC, Part of K101		

Figure 5-1

903A RECEIVER

Figure 5-3
Figure 5-4
Figure 5-5

903A RECEIVER

Figure 5-7

903A RECEIVER

R418 R414 R416

Figure 5-8

903A RECEIVER

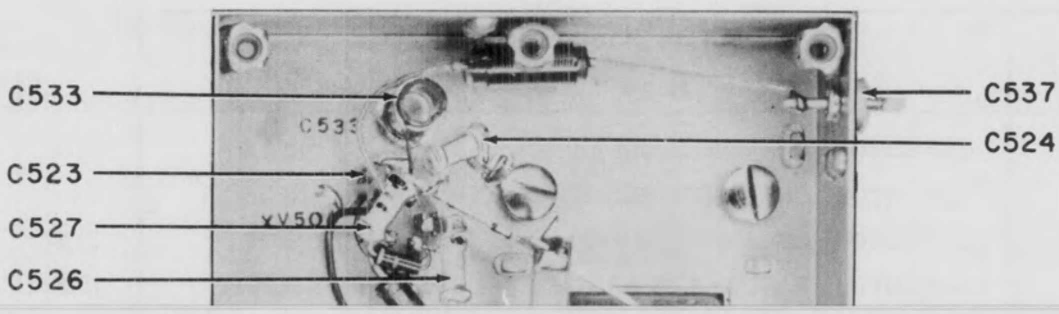


Figure 5-10

903A RECEIVER

SECTION V

PARTS LIST, TYPE 903A RECEIVER

MAIN CHASSIS

Symbol Number	Description	Vendor Part No.	Vendor Name
A101	ASSEMBLY, VIDEO MODULE	1213	CEI
A102	ASSEMBLY, AUDIO MODULE	1044A	CEI
A103	ASSEMBLY, NOISE LIMITER MODULE	1312	CEI
A104	ASSEMBLY, RELAY DRIVER MODULE	1249	CEI
C101A, B	CAPACITOR, ELECTROLYTIC, TWIST-LOCK: 15-15 μf, 350-350 wvdc	43F2299B	GE
C102A, B	Same as C101A, B		
C103A, B	CAPACITOR, ELECTROLYTIC, TWIST-LOCK: 100-100 μf, 50-50 wvdc	43F2300B	GE
C104	CAPACITOR, ELECTROLYTIC: 50 μf, 50 wvdc	TE-1307	Sprague
C105	Same as C104		
C106A, B	Same as C103A, B		
C107	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μf, 20%, 20 vdc	150D106X-0020B0	Sprague
CR101	DIODE, SILICON RECTIFIER	1N2615	Motorola
CR102	Same as CR101		
CR103	Same as CR101		
CR104	Same as CR101		
CR105	DIODE, SILICON RECTIFIER	1N2610	Motorola
CR106	Same as CR105		
CR107	Same as CR105		
CR108	Same as CR105		
CR109	Same as CR105		
CR110	Same as CR105		
CR111	DIODE, SILICON ZENER	10M120Z5	Motorola
DS101	LAMP: 6-8 volts, 0.15 amp	47	GE
DS102	Same as DS101		
DS103	LAMP: 6 volts, 0.20 amp	328	GE
F101	FUSE: 3/8 amp, Slo-Blo		Littelfuse
J101	NOT USED		
J102	RECEPTACLE, JACK: Type BNC, Part of K101		
J103	RECEPTACLE, JACK: Type BNC, Part of K101		
J104	RECEPTACLE, JACK: Type BNC, Part of K101		

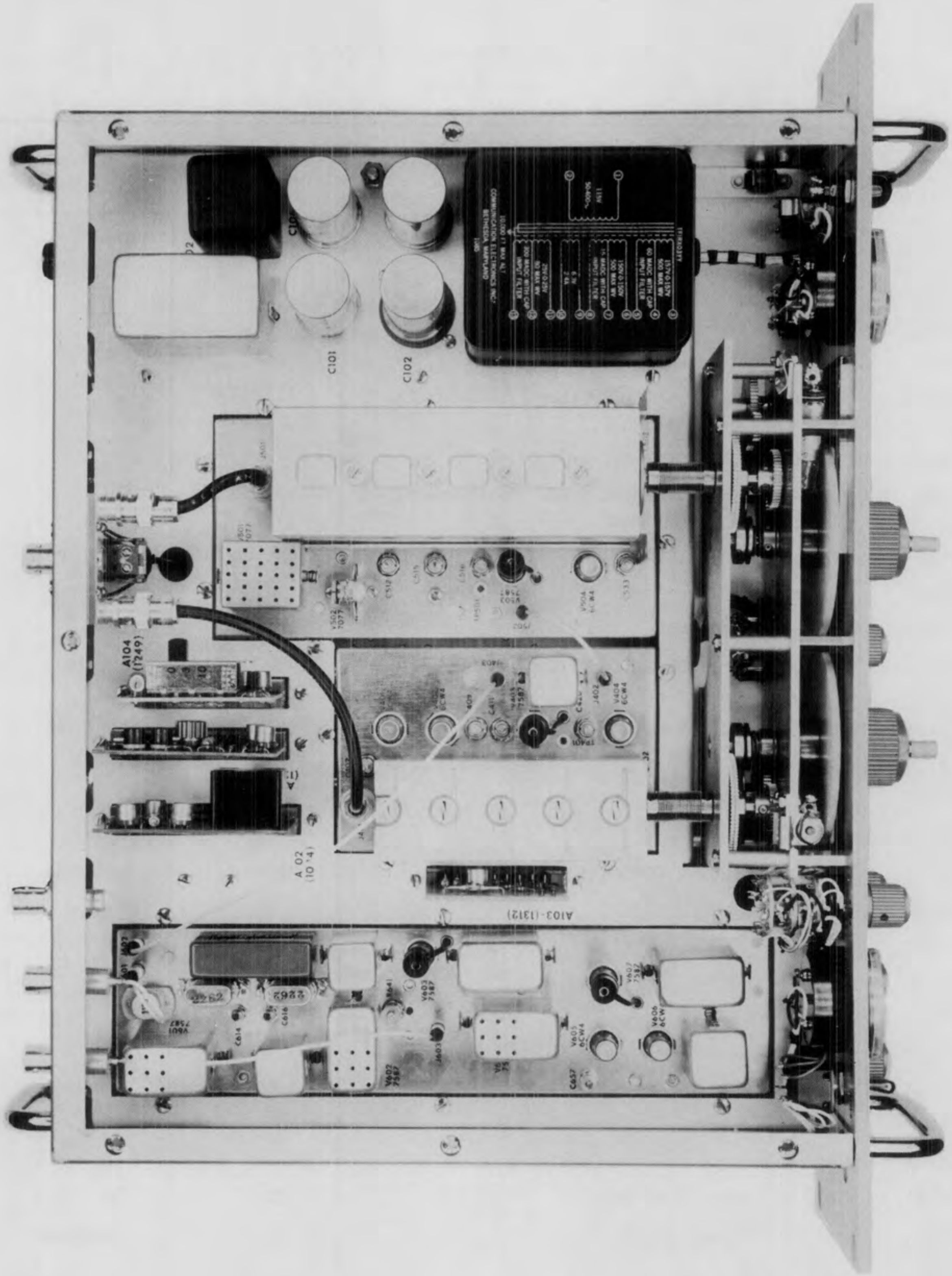


Figure 5-1. Type 903A Receiver, Top View

Symbol Number	Description	Vendor Part No.	Vendor Name
J105 J106	ADAPTER: Straight single-hole bulkhead feedthru (Jack-Jack), Type BNC	UG-492A/U	FXR
J107	RECEPTACLE, JACK: Type BNC, with 53-82 Microdot adapter	UG-1094/U	FXR
J108	Same as J107		
J109	JACK, PHONE: Open-circuited	C-11	Switchcraft
J110	Same as J107		
J111	Same as J107		
K101	SWITCH, COAXIAL: 26 vdc, relay operated	317-010202-3	RF Products
K102	RELAY, 3PDT	ML4030	Potter & Brumfield
L101	CHOKE, FILTER:	1070	CEI
M101	METER: 0-50 μa, dc, light gray SL-7858	MM-1	Marion
M102	METER: 100-0-100 μa, dc, light gray SL-7858	MM-1	Marion
P101	POWER CORD AND PLUG ASSEMBLY	01753-001	Cornish
P102	NOT USED		
P103	CONNECTOR, PLUG	UG-88/U	FXR
P104	Same as P103		
R101	RESISTOR, FIXED COMPOSITION: 4.3K, 5%, 2W	HB4325	AB
R102	RESISTOR, FIXED COMPOSITION: 2K, 5%, 1W	GB2025	AB
R103	RESISTOR, DEPOSITED CARBON: 130K, 1%, 1/2W	DCM1/2	Electra
R104	RESISTOR, DEPOSITED CARBON: 2.7K, 1%, 1/2W	DCM1/2	Electra
R105	RESISTOR, FIXED COMPOSITION: 82 Ω, 5%, 1/2W	EB8205	AB
R106	RESISTOR, FIXED COMPOSITION: 820 Ω, 5%, 1/2W	EB8215	AB
R107	RESISTOR, WIRE WOUND: 250 Ω, 3%, 3W	CS	Sage
R108	RESISTOR, VARIABLE, COMPOSITION: 10K, 20%, 1W with SPDT switch	KB22141	CTS
R109	RESISTOR, VARIABLE, COMPOSITION: 10K, 20%, 1/2W	RV6NAYS-D103B	AB
R110	RESISTOR, VARIABLE, COMPOSITION: 100K, 20%, 1/2W	RV6NAYS-D104B	AB
R111	RESISTOR, FIXED COMPOSITION: 390 Ω, 5%, 1/2W	EB3915	AB
S101	SWITCH, TOGGLE: SPST	8280-K16	Cutler-Hammer
S102	SWITCH, ROTARY: Non-shorting	399213-A	Oak
S103	SWITCH, TOGGLE: DPDT	8363-K7	Cutler-Hammer
S104	SWITCH, ROTARY: Non-shorting	399211-A	Oak
S105	SWITCH: Part of R108, not separately replaceable		
T101	TRANSFORMER, POWER	1085	CEI
TB101	TERMINAL STRIP	8-140-Y	Cinch-Jones

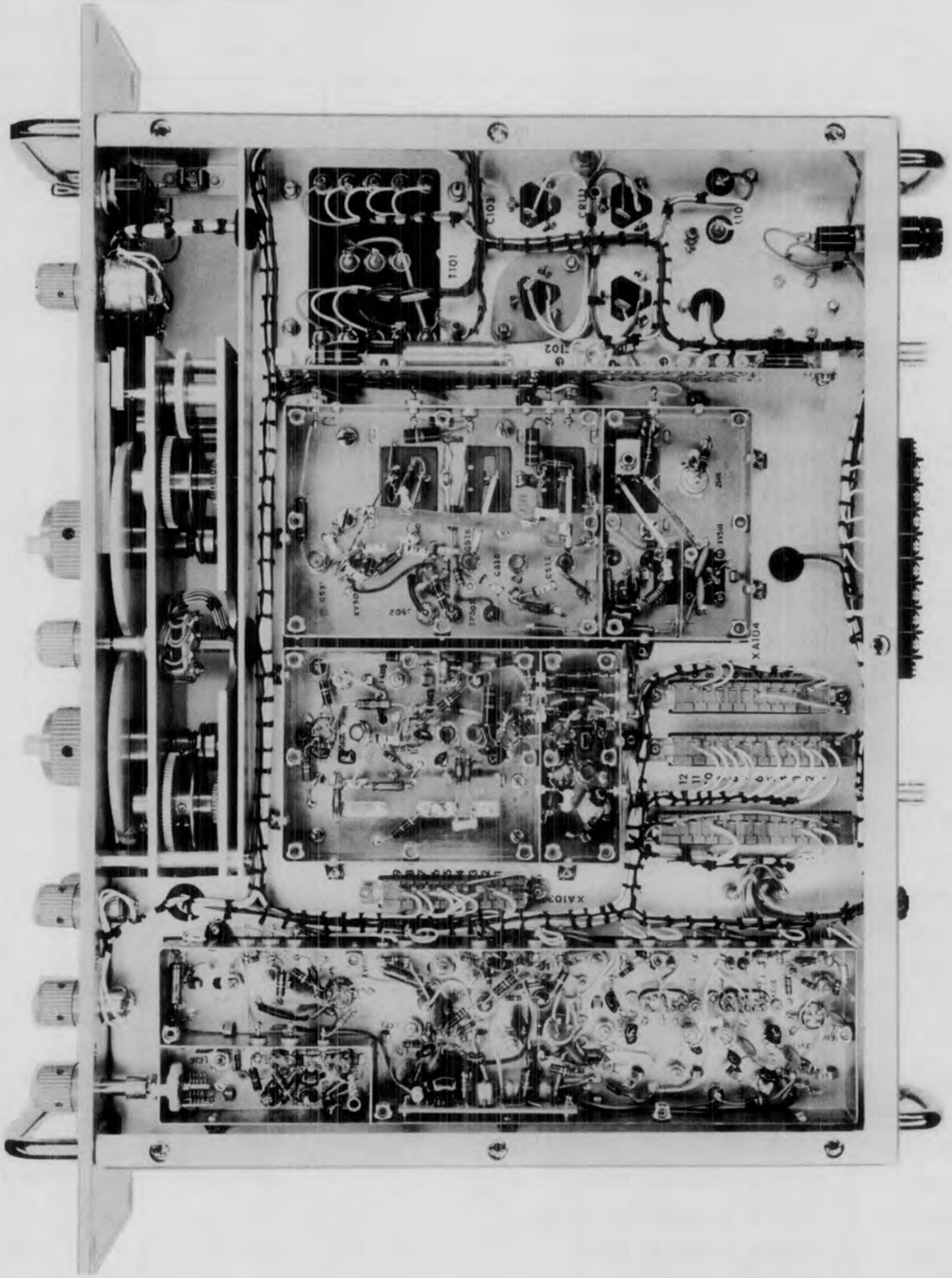


Figure 5-2. Type 903A Receiver, Bottom View

PARTS LIST, TYPE 903A RECEIVER

VIDEO MODULE

Symbol Number	Description	Vendor Part No.	Vendor Name
C201	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.47 μf, 20%, 35 wvdc	150D474X-0035A2	Sprague
C202	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μf, 20%, 20 wvdc	150D106X-0020B0	Sprague
C203	Same as C202		
C204	Same as C202		
C205	CAPACITOR, CERAMIC TUBULAR: 6.2 pf±0.3 pf	NPOA	Erie
C206	CAPACITOR, DIPPED MICA: 470 pf	DM15-471K	Arco
CR201	DIODE, ZENER	1N759A	PSI
Q201	TRANSISTOR, SILICON	2N335	Texas Instruments
Q202	Same as Q201		
Q203	Same as Q201		
Q204	Same as Q201		
Q205	TRANSISTOR, SILICON	2N697	Texas Instruments
R201	RESISTOR, FIXED COMPOSITION: 3.9 meg, 5%, 1/4W	CB3955	AB
R202	RESISTOR, FIXED COMPOSITION: 8.2K, 5%, 1/4W	CB8225	AB
R203	RESISTOR, FIXED COMPOSITION: 100K, 5%, 1/4W	CB1045	AB
R204	RESISTOR, FIXED COMPOSITION: 1 meg, 5%, 1/4W	CB1055	AB
R205	RESISTOR, FIXED COMPOSITION: 10K, 5%, 1/4W	CB1035	AB
R206	RESISTOR, FIXED COMPOSITION: 1.2K, 5%, 1/4W	CB1225	AB
R207	RESISTOR, FIXED COMPOSITION: 1K, 5%, 1/4W	CB1025	AB
R208	Same as R207		
R209	RESISTOR, FIXED COMPOSITION: 3.6K, 5%, 1/4W	CB3625	AB
R210	RESISTOR, FIXED COMPOSITION: 30K, 5%, 1/4W	CB3035	AB
R211	RESISTOR, FIXED COMPOSITION: 6.2K, 5%, 1/4W	CB6225	AB
R212	RESISTOR, FIXED COMPOSITION: 150 Ω, 5%, 1/4W	CB1515	AB
R213	Same as R212		
R214	Same as R212		
R215	Same as R203		

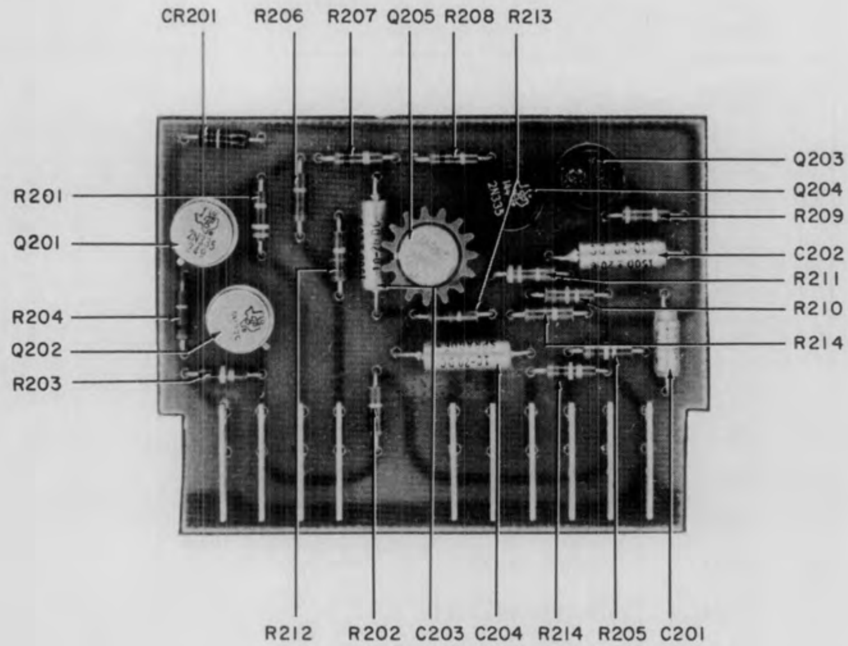


Figure 5-4. Type 903A Receiver, Video Module

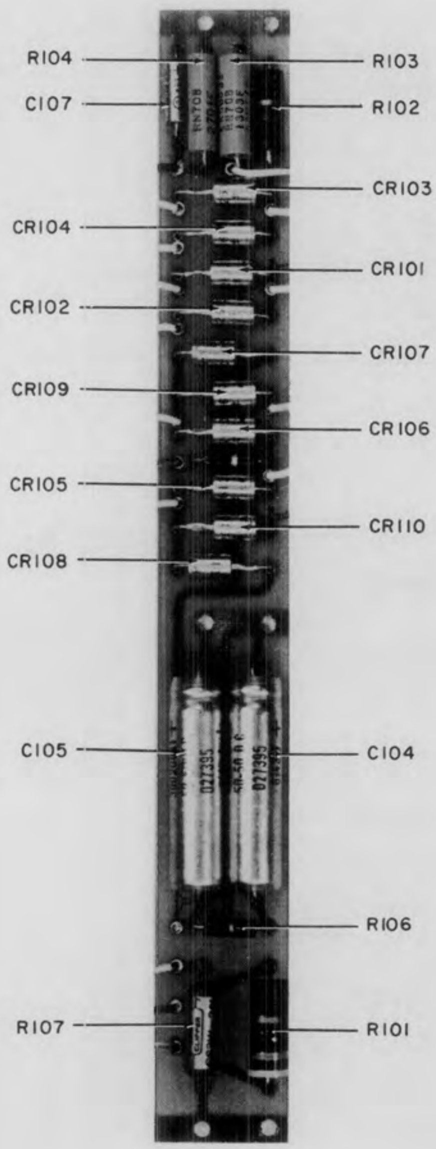


Figure 5-3. Type 903A Receiver, Component Board

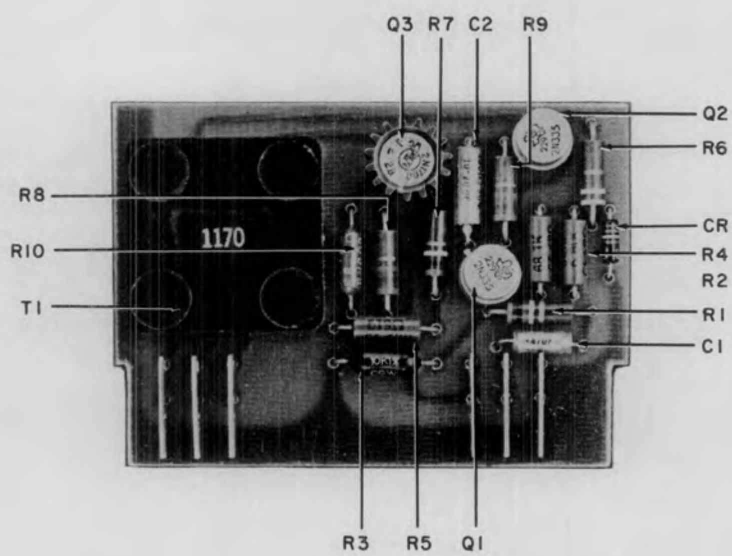


Figure 5-5. Type 903A Receiver, Audio Module

PARTS LIST, TYPE 903A RECEIVER

TYPE 1044A AUDIO MODULE

Symbol Number	Description	Vendor Part No.	Vendor Name
C301	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.47 μf, 20%, 35 wvdc	150D474X-0035A2	Sprague
C302	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μf, 20%, 20 wvdc	150D106X-0020B0	Sprague
CR301	DIODE, ZENER	1N759A	Continental Devices
Q301	TRANSISTOR, SILICON	2N335	Texas Instruments
Q302	Same as Q301		
Q303	TRANSISTOR, SILICON	2N1700	RCA
R301	RESISTOR, FIXED COMPOSITION: 10K, 5%, 1/2W	EB1035	AB
R302	RESISTOR, FIXED, CARBON FILM: 68.1K, 1%, 1/8W	CF 1/8	Electra
R303	RESISTOR, FIXED, CARBON FILM: 10K, 1%, 1/8W	CF 1/8	Electra
R304	RESISTOR, FIXED, CARBON FILM: 6.81K, 1%, 1/8W	CF 1/8	Electra
R305	RESISTOR, FIXED, CARBON FILM: 619 Ω, 1%, 1/8W	CF 1/8	Electra
R306	RESISTOR, FIXED COMPOSITION: 3.9K, 5%, 1/2W	EB3925	AB
R307	RESISTOR, FIXED COMPOSITION: 100K, 5%, 1/2W	EB1045	AB
R308	RESISTOR, FIXED COMPOSITION: 620 Ω, 5%, 1/2W	EB6215	AB
R309	Same as R308		
R310	RESISTOR, FIXED, CARBON FILM: 68.1 Ω, 1%, 1/8W	CF 1/8	Electra
T301	TRANSFORMER: Audio output	1170	CEI

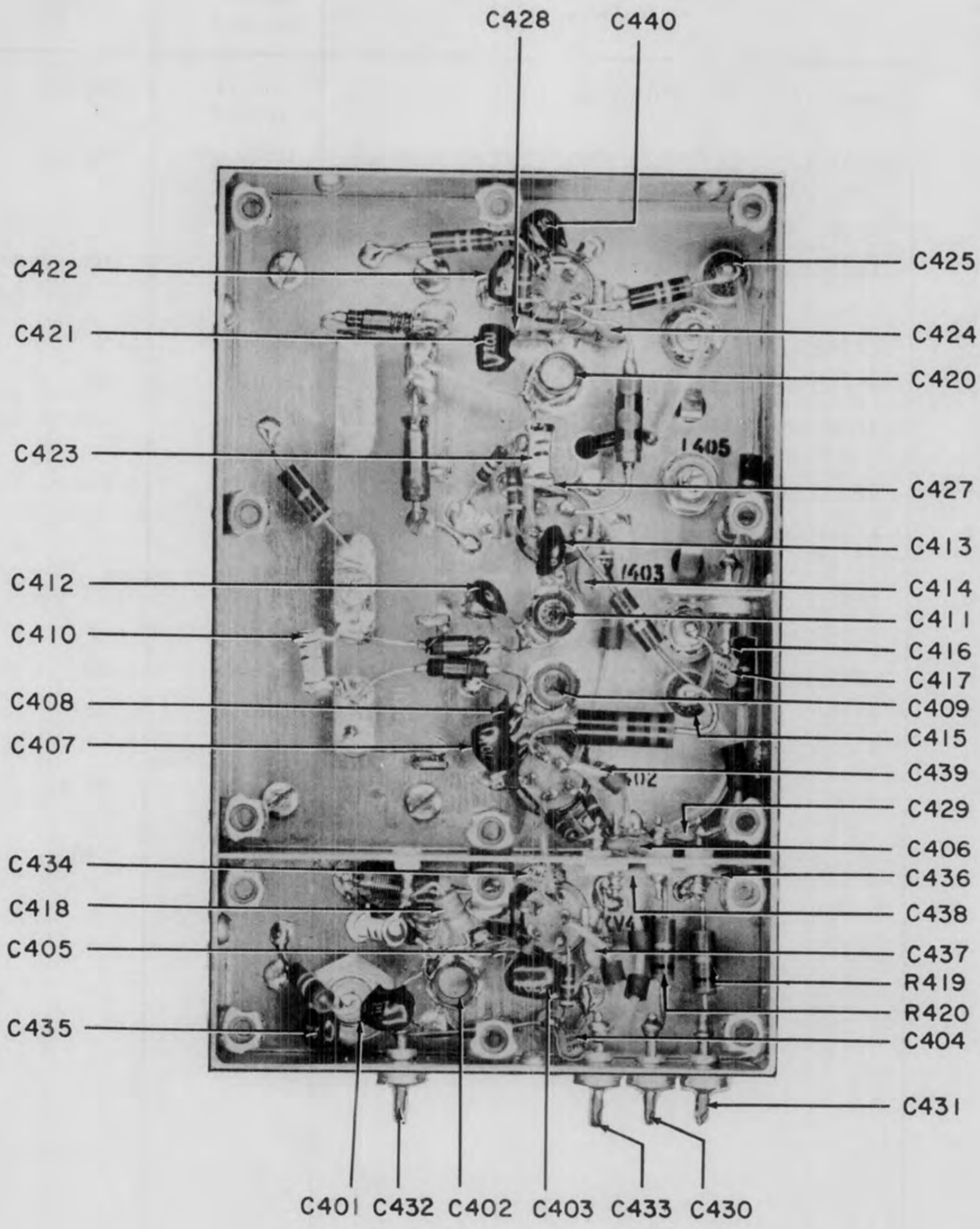


Figure 5-6. Type 903A Receiver, Low Band Tuner

PARTS LIST, TYPE 903A RECEIVER

LOW BAND TUNER, 30-60 MC

Symbol Number	Description	Vendor Part No.	Vendor Name
C401	CAPACITOR, DIPPED MICA: 15 pf, 5%	DM10-150J	Arco
C402	CAPACITOR, VARIABLE TRIMMER: 0.7-9.0 pf	VC1G	JFD
C403	CAPACITOR, DIPPED MICA: 270 pf, 5%	DM15-271J	Arco
C404	CAPACITOR, CERAMIC DISC: 1000 pf, 20%	Type SM	RMC
C405	Same as C404		
C406	Same as C404		
C407	Same as C403		
C408	CAPACITOR, DIPPED MICA: 18 pf, 5%	DM10-180J	Arco
C409	Same as C402		
C410	CAPACITOR, CERAMIC TUBULAR: 2.2 pf ± 0.25 pf	NPOA	Erie
C411	Same as C402		
C412	CAPACITOR, DIPPED MICA: 12 pf, 5%	DM10-120J	Arco
C413	CAPACITOR, DIPPED MICA: 47 pf, 5%	DM10-470J	Arco
C414	Same as C404		
C415	CAPACITOR, CERAMIC STANDOFF: 1000 pf, GMV	SS5A-102W	AB
C416	CAPACITOR, CERAMIC FEEDTHRU: 330 pf, GMV	SS5A-3311	AB
C417	Same as C404		
C418	CAPACITOR, CERAMIC TUBULAR: 0.33 pf, 10%	QC 0.33	QC
C419	CAPACITOR, CERAMIC TUBULAR: 1.5 pf ± 0.25 pf	NPOA	Erie
C420	Same as C402		
C421	CAPACITOR, DIPPED MICA: 10 pf, 5%	DM10-100J	Arco
C422	CAPACITOR, DIPPED MICA: 22 pf, 5%	DM10-220J	Arco
C423	CAPACITOR, CERAMIC TUBULAR: 1.0 pf ± 0.1 pf	NPOA	Erie
C424	Same as C404		
C425	Same as C415		
C426	NOT USED		
C427	Same as C404		
C428	Same as C404		
C429	Same as C404		
C430	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV	FA5C-102W	AB
C431	Same as C430		
C432	Same as C430		

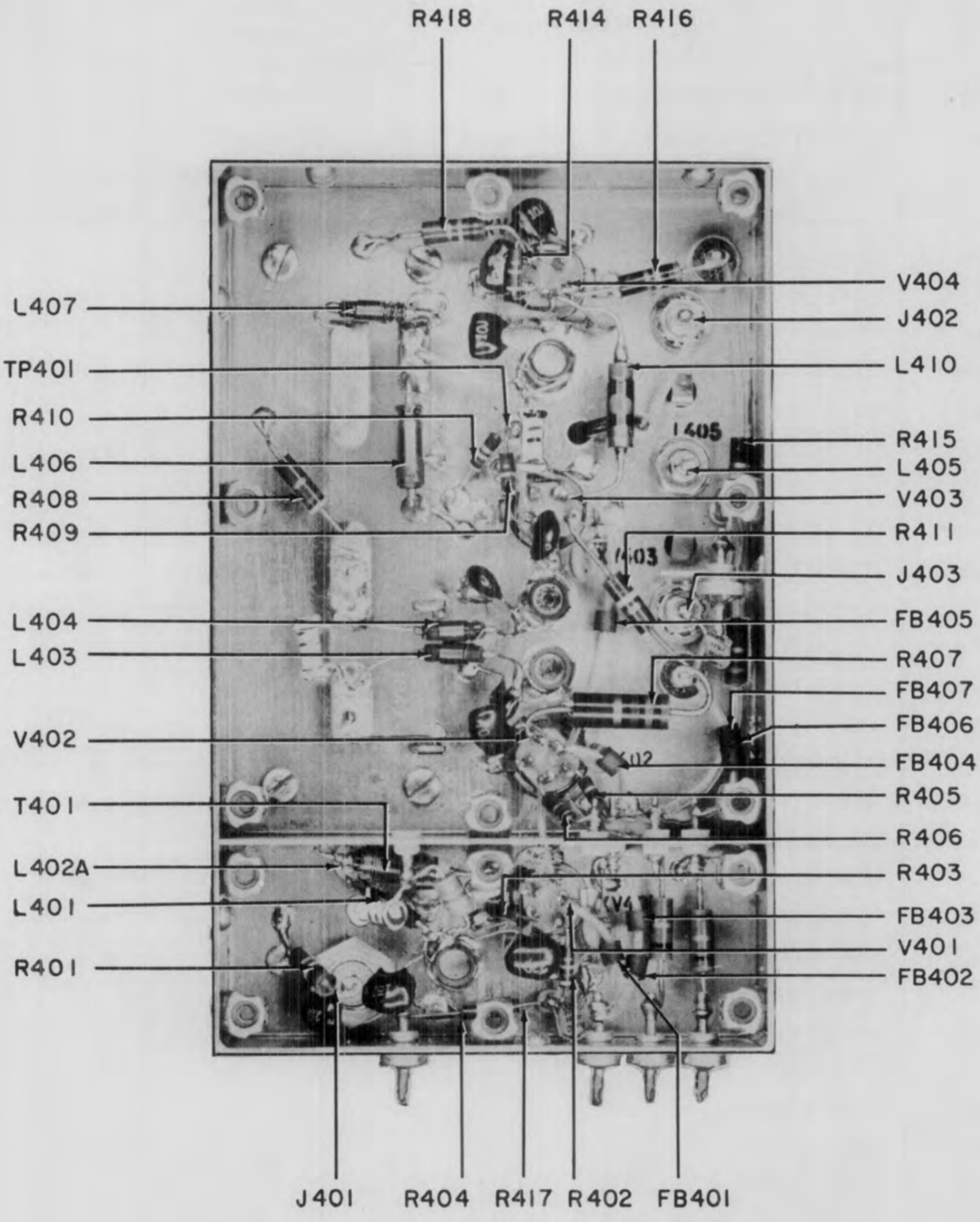


Figure 5-7. Type 903A Receiver, Low Band Tuner

Symbol Number	Description	Vendor Part No.	Vendor Name
C433	Same as C430		
C434	Same as C404		
C435	Same as C422		
C436	Same as C404		
C437	Same as C404		
C438	Same as C404		
C439	Same as C404		
C440	Same as C421		
FB401	SHIELDING BEAD, FERRITE	56-590-65/4A	Ferroxcube
FB402	Same as FB401		
FB403	Same as FB401		
FB404	Same as FB401		
FB405	Same as FB401		
FB406	Same as FB401		
FB407	Same as FB401		
J401	RECEPTACLE, JACK: Type BNC	UG-1094/U	FXR
J402	RECEPTACLE, JACK	31-50	Microdot
J403	Same as J402		
L401	COIL	1131-06	CEI
L402A, B, C, D	INDUCTUNER: Four-section	2026	CEI
L403	Same as L401		
L404	Same as L401		
L405	COIL, VARIABLE	1111-08	CEI
L406	COIL	1131-07	CEI
L407	COIL	1131-08	CEI
L408	NOT USED		
L409	NOT USED		
L410	COIL	211-11	Wilco
L411	NOT USED		
L412	COIL	1131-16	CEI
P401	CONNECTOR, PLUG	UG-88/U	FXR
P402	CONNECTOR, PLUG	32-21	Microdot
P403	Same as P402		
R401	RESISTOR, FIXED COMPOSITION: 100K, 10%, 1/2W	EB1041	AB

Symbol Number	Description	Vendor Part No.	Vendor Name
R402	RESISTOR, FIXED COMPOSITION: 47K, 5%, 1/4W	CB4735	AB
R403	RESISTOR, FIXED COMPOSITION: 56 Ω, 5%, 1/4W	CB5605	AB
R404	RESISTOR, FIXED COMPOSITION: 270K, 10%, 1/4W	CB2741	AB
R405	RESISTOR, FIXED COMPOSITION: 10Ω, 10%, 1/4W	CB1001	AB
R406	Same as R402		
R407	RESISTOR, FIXED COMPOSITION: 6.8K, 5%, 1W	GB6825	AB
R408	RESISTOR, FIXED COMPOSITION: 4.7K, 5%, 1/2W	EB4725	AB
R409	RESISTOR, FIXED COMPOSITION: 470K, 10%, 1/4W	CB4741	AB
R410	Same as R409		
R411	RESISTOR, FIXED COMPOSITION: 220K, 5%, 1/2W	EB2245	AB
R412	RESISTOR, FIXED COMPOSITION: 2.7K, 5%, 1/2W	EB2725	AB
R413	RESISTOR, FIXED COMPOSITION: 33K, 5%, 1/2W	EB3335	AB
R414	Same as R402		
R415	RESISTOR, FIXED COMPOSITION: 10K, 5%, 1/2W	EB1535	AB
R416	Same as R415		
R417	Same as R404		
R418	RESISTOR, FIXED COMPOSITION: 22K, 5%, 1/2W	EB2235	AB
R419	RESISTOR, FIXED COMPOSITION: 1K, 5%, 1/2W	EB1025	AB
R420	Same as R419		
T401	TRANSFORMER	1134	CEI
TP401	TEST POINT	TJ-6	Taurus
V401	TUBE, ELECTRON: Nuvistor triode	6CW4	RCA
V402	Same as V401		
V403	TUBE, ELECTRON: Nuvistor tetrode	7587	RCA
V404	Same as V401		

PARTS LIST, TYPE 903A RECEIVER
HIGH BAND TUNER, 60-300 MC

Symbol Number	Description	Vendor Part No.	Vendor Name
C501	CAPACITOR, CERAMIC TUBULAR: 5.6 pf±0.25 pf	NPOA	Erie
C502	CAPACITOR, CERAMIC TUBULAR: 6.0 pf±0.25 pf	NPOA	Erie
C503	CAPACITOR, CERAMIC TUBULAR: 47 pf, 5%	NPOT	Erie
C504	CAPACITOR, VARIABLE TRIMMER: 0.8-4.5 pf	VC-21G	JFD
C505	CAPACITOR, DIPPED MICA: 10 pf, 5%	DM10-100J	Arco
C506	CAPACITOR, CERAMIC DISC: 1000 pf, 20%	Type JL	RMC
C507	CAPACITOR, CERAMIC TUBULAR: 3.3 pf±0.25 pf	NPOA	Erie
C508	CAPACITOR, DIPPED MICA: 500 pf, 10%	DM15-501K	Arco
C509	CAPACITOR, CERAMIC STANDOFF: 1000 pf, GMV	SS5A-102W	AB
C510	CAPACITOR, CERAMIC TUBULAR: 0.5 pf±0.1 pf	NPOA	Erie
C511	CAPACITOR, CERAMIC TUBULAR: 1.0 pf±0.1 pf	NPOA	Erie
C512	CAPACITOR, VARIABLE TRIMMER: 0.7-9.0 pf	VC1G	JFD
C513	CAPACITOR, CERAMIC TUBULAR: 2.0 pf±0.1 pf	NPOA	Erie
C514	Same as C513		
C515	Same as C512		
C516	Same as C512		
C517	CAPACITOR, CERAMIC TUBULAR: 5.0 pf±0.25 pf	NPOA	Erie
C518	CAPACITOR, CERAMIC DISC: 1000 pf, 20%	Type SM	RMC
C519	Same as C518		
C520	Same as C510		
C521	Same as C518		
C522	Same as C509		
C523	Same as C518		
C524	CAPACITOR, CERAMIC TUBULAR: 3.3 pf±0.5 pf	N750A	Erie
C525	CAPACITOR, CERAMIC TUBULAR: 3.3 pf±0.5 pf	N470A	Erie
C526	Same as C507		
C527	Same as C511		
C528	NOT USED		
C529	Same as C509		
C530	Same as C518		
C531	NOT USED		
C532	Same as C509		
C533	Same as C512		

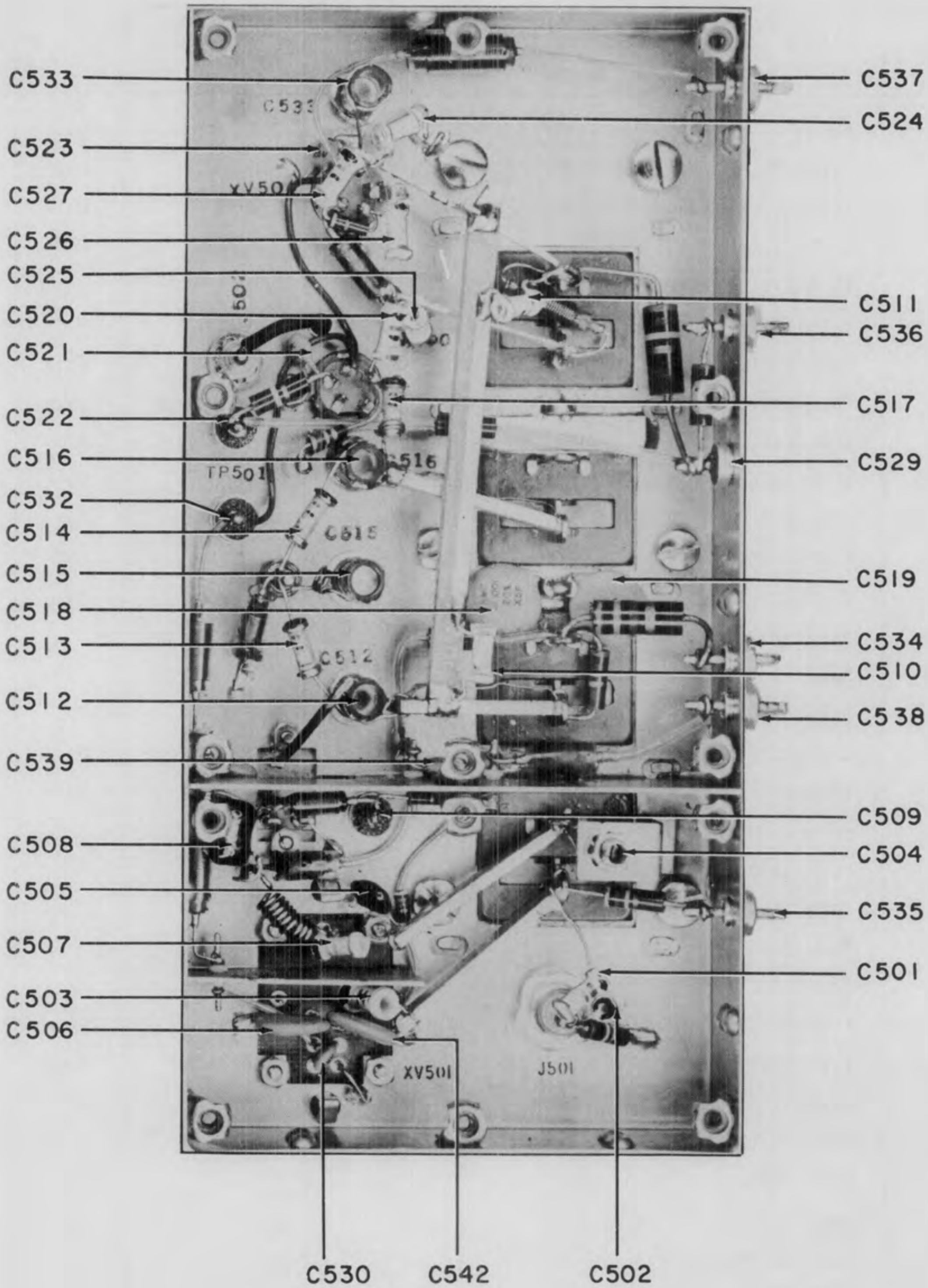


Figure 5-8. Type 903A Receiver, High Band Tuner

Symbol Number	Description	Vendor Part No.	Vendor Name
C534	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV	FA5C-102W	AB
C535	Same as C534		
C536	Same as C534		
C537	Same as C534		
C538	Same as C534		
C539	Same as C518		
C540	Same as C518		
C541	Same as C518		
C542	Same as C506		
J501	RECEPTACLE, JACK: Type BNC	UG-1094/U	FXR
J502	RECEPTACLE, JACK	31-50	Microdot
L501	INDUCTOR, PADDING	1108	CEI
L502A, B, C, D	INDUCTUNER: Four-section	2027	CEI
L503	CHOKE	1129-01	CEI
L504	CHOKE: 1.0 μh	W10G	Wilco
L505	CHOKE	1131-01	CEI
L506	INDUCTOR, PADDING	1234	CEI
L507	CHOKE	1129-02	CEI
L508	CHOKE	1131-02	CEI
L509	INDUCTOR, PADDING	1235	CEI
L510	CHOKE	1131-03	CEI
L511	INDUCTOR, PADDING	1107	CEI
L512	INDUCTOR, PADDING	1106-01	CEI
L513	CHOKE: 2.2 μh	W22G	Wilco
L514	CHOKE	1131-04	CEI
L515	Same as L514		
L516	CHOKE	1131-05	CEI
L517	CHOKE: 1.8 μh	208-11-18	Wilco
L518	INDUCTOR, PADDING	1200-1	CEI
P501	CONNECTOR, PLUG	UG-88/U	FXR
P502	CONNECTOR, PLUG	32-21	Microdot
R501	RESISTOR, FIXED COMPOSITION: 100K, 10%, 1/2W	EB1041	AB
R502	RESISTOR, FIXED COMPOSITION: 47K, 5%, 1/4W	CB4735	AB

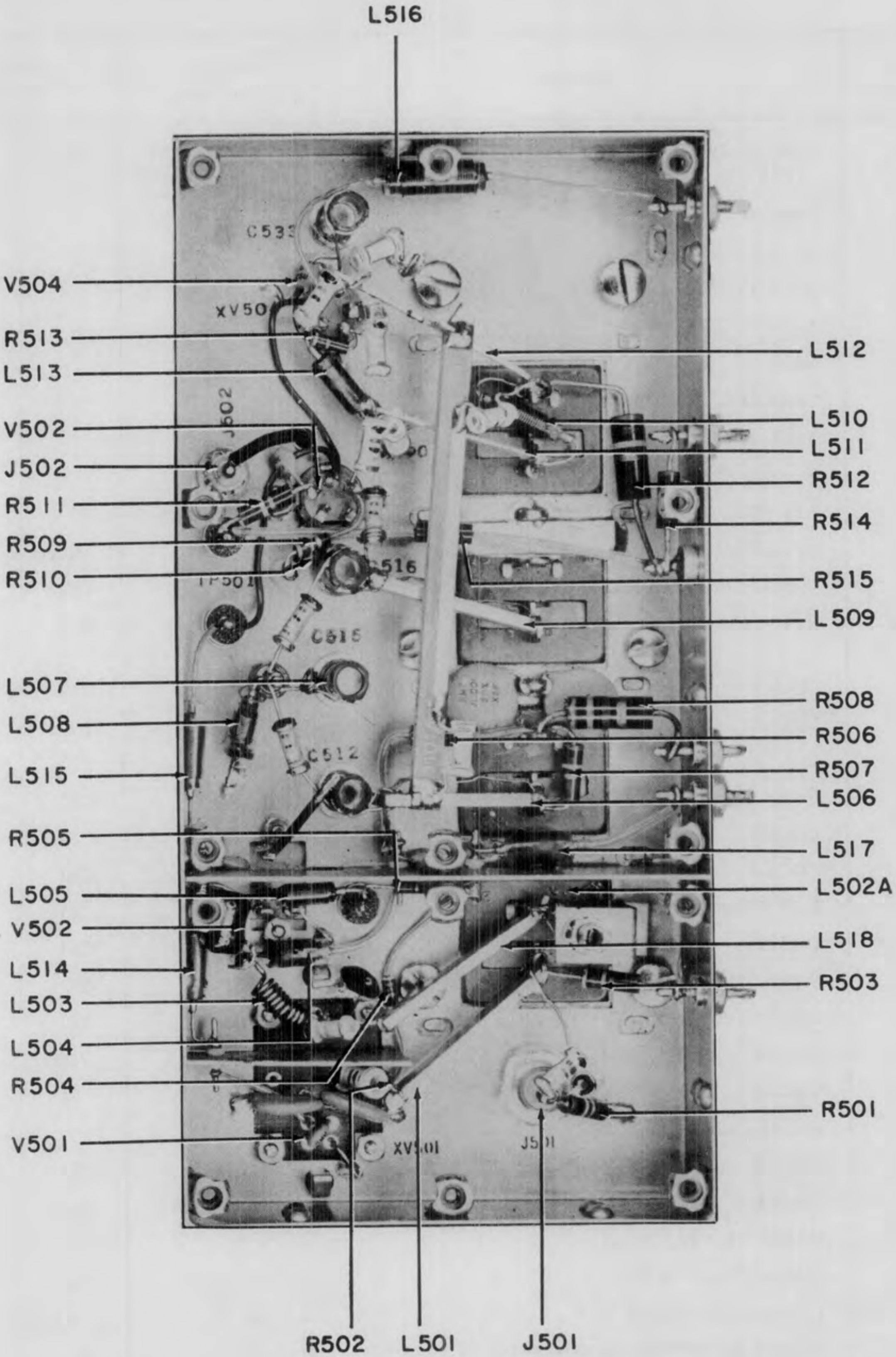


Figure 5-9. Type 903A Receiver, High Band Tuner

Symbol Number	Description	Vendor Part No.	Vendor Name
R503	RESISTOR, FIXED COMPOSITION: 47K, 5%, 1/2W	EB4735	AB
R504	RESISTOR, FIXED COMPOSITION: 470 Ω, 5%, 1/4W	CB4715	AB
R505	RESISTOR, FIXED COMPOSITION: 560 Ω, 5%, 1/4W	CB5615	AB
R506	RESISTOR, FIXED COMPOSITION: 100 Ω, 5%, 1/2W	EB1015	AB
R507	RESISTOR, FIXED COMPOSITION: 15K, 5%, 1/2W	EB1535	AB
R508	RESISTOR, FIXED COMPOSITION: 3.3K, 5%, 1W	GB3325	AB
R509	RESISTOR, FIXED COMPOSITION: 470K, 5%, 1/4W	EB4745	AB
R510	Same as R509		
R511	RESISTOR, FIXED COMPOSITION: 220K, 5%, 1/2W	EB2245	AB
R512	RESISTOR, FIXED COMPOSITION: 15K, 5%, 1W	GB1535	AB
R513	Same as R502		
R514	RESISTOR, FIXED COMPOSITION: 1K, 5%, 1/2W	EB1025	AB
R515	Same as R514		
TP501	TEST POINT	TJ-6	Taurus
V501	TUBE, ELECTRON: Ceramic triode	7077	GE
V502	Same as V501		
V503	TUBE, ELECTRON: Nuvistor tetrode	7587	RCA
V504	TUBE, ELECTRON: Nuvistor triode	6CW4	RCA

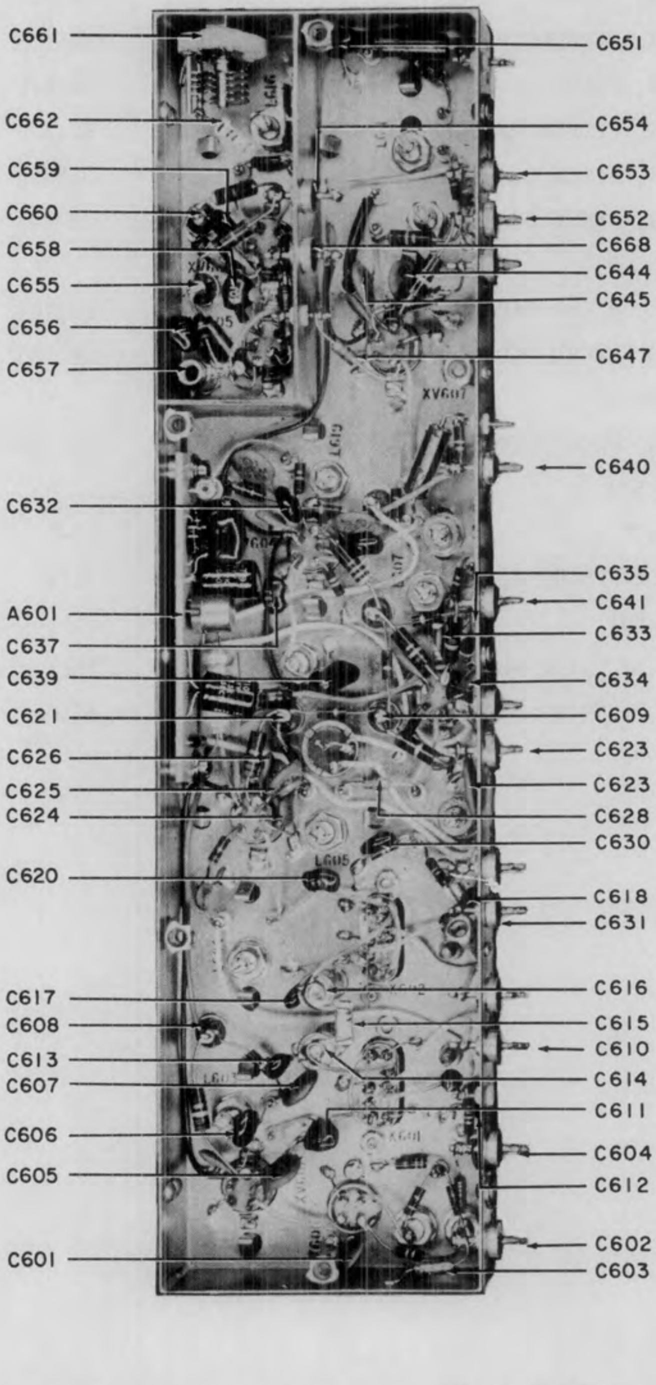


Figure 5-10. Type 903A Receiver, 50/300-kc IF Strip

PARTS LIST, TYPE 903A RECEIVER

50/300-KC IF STRIP

Symbol Number	Description	Vendor Part No.	Vendor Name
A601	ASSEMBLY, PULSE COUNTER MODULE	1259	CEI
C601	CAPACITOR, CERAMIC DISC: 1000 pf, 20%	Type SM	RMC
C602	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV	FA5C-102W	AB
C603	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.47 µf, 20%, 35 wvdc	150D474X-0035A2	Sprague
C604	Same as C602		
C605	Same as C601		
C606	CAPACITOR, DIPPED MICA: 120 pf, 5%, 500 wvdc	DM10-121J	Arco
C607	Same as C601		
C608	CAPACITOR, CERAMIC STANDOFF: 1000 pf, GMV	SS5A-102W	AB
C609	Same as C608		
C610	Same as C602		
C611	CAPACITOR, DIPPED MICA: 68 pf, 5%, 500 wvdc	DM10-680J	Arco
C612	Same as C606		
C613	CAPACITOR, DIPPED MICA: 100 pf, 5%, 500 wvdc	DM10-101J	Arco
C614	CAPACITOR, VARIABLE: 1-28 pf	MC-603	JFD
C615	CAPACITOR, CERAMIC TUBULAR: 4.7 pf±0.25 pf	NPOA	Erie
C616	Same as C614		
C617	CAPACITOR, DIPPED MICA: 75 pf, 5%, 500 wvdc	DM10-750J	Arco
C618	Same as C613		
C619	Same as C602		
C620	Same as C611		
C621	Same as C608		
C622	CAPACITOR, CERAMIC DISC: 0.0047 µf, 20%, 1000 wvdc	Type B	RMC
C623	Same as C602		
C624	CAPACITOR, CERAMIC DISC: 470 pf, 20%, 1000 wvdc	Type B	RMC
C625	Same as C601		
C626	Same as C624		
C627	CAPACITOR, DIPPED MICA: 15 pf, 5%, 500 wvdc	DM10-150J	Arco
C628	CAPACITOR, CERAMIC TUBULAR: 0.75 pf, 10%	MC 0.75	QC
C629	CAPACITOR, DIPPED MICA: 33 pf, 5%, 500 wvdc	DM10-330J	Arco
C630	Same as C613		

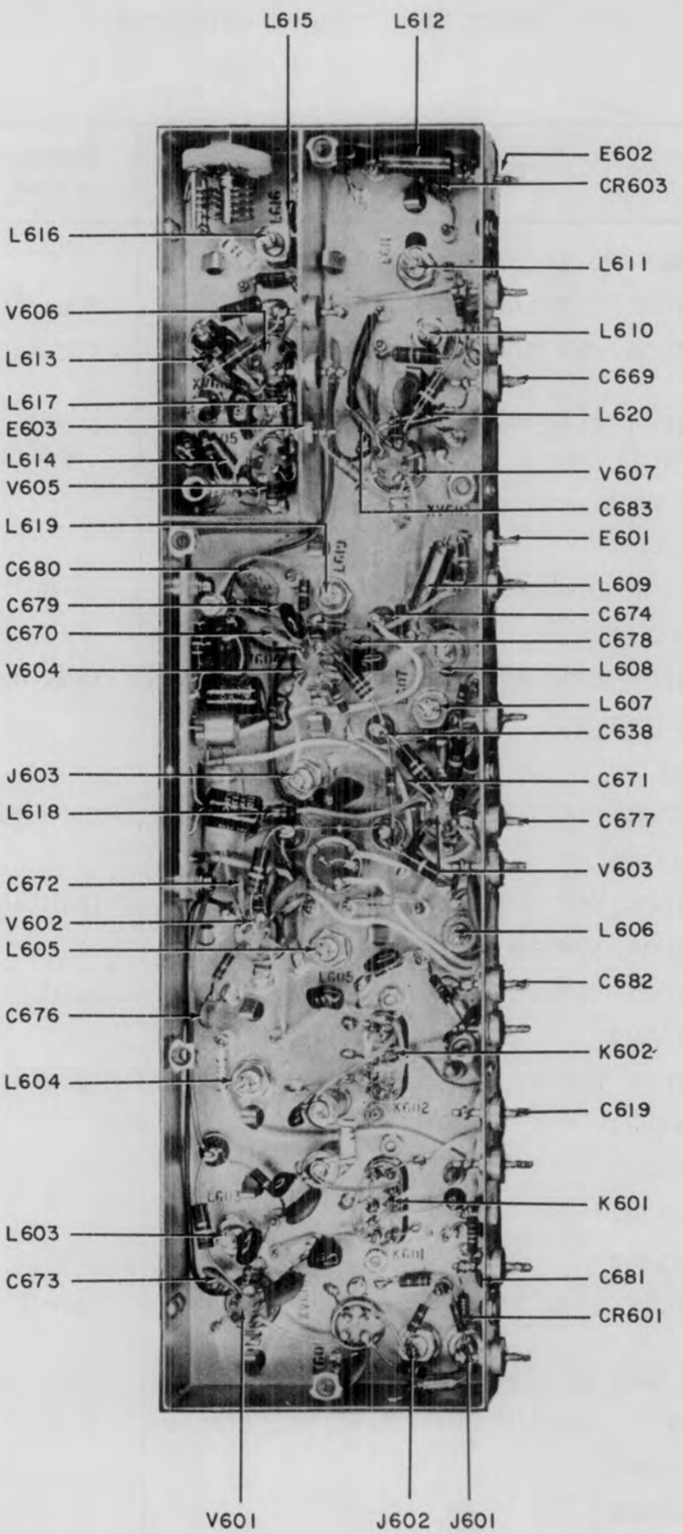


Figure 5-11. Type 903A Receiver, 50/300-kc IF Strip

Symbol Number	Description	Vendor Part No.	Vendor Name
C631	Same as C602		
C632	Same as C611		
C633	Same as C624		
C634	Same as C624		
C635	Same as C624		
C636	Same as C615		
C637	Same as C611		
C638	Same as C608		
C639	CAPACITOR, DIPPED MICA: 500 pf, 10%	DM15-501K	Arco
C640	Same as C602		
C641	Same as C602		
C642	CAPACITOR, DIPPED MICA: 39 pf, 5%, 500 wvdc	DM10-390J	Arco
C643	Same as C615		
C644	Same as C601		
C645	Same as C601		
C646	CAPACITOR, CERAMIC TUBULAR: 22 pf, 5%	N150A	Erie
C647	CAPACITOR, CERAMIC TUBULAR: 0.82 pf, 10%	MC 0.82	QC
C648	CAPACITOR, DIPPED MICA: 22 pf, 5%	DM10-220J	Arco
C649	Same as C613		
C650	Same as C613		
C651	Same as C629		
C652	Same as C602		
C653	Same as C602		
C654	Same as C602		
C655	Same as C608		
C656	Same as C627		
C657	CAPACITOR, VARIABLE TRIMMER: 2-12 pf	CST-50	CTC
C658	CAPACITOR, DIPPED MICA: 10 pf, 5%	DM10-100J	Arco
C659	CAPACITOR, DIPPED MICA: 220 pf, 5%, 500 wvdc	DM10-221J	Arco
C660	Same as C608		
C661	CAPACITOR, VARIABLE TRIMMER: 1.8-8.7 pf, 9M11	160-104	E.F. Johnson
C662	CAPACITOR, CERAMIC TUBULAR: 5.6 pf±0.25 pf	NPOA	Erie
C663	CAPACITOR, DIPPED MICA: 270 pf, 5%	DM10-271J	Arco
C664	Same as C606		
C665	CAPACITOR, DIPPED MICA: 47 pf, 5%	DM10-470J	Arco

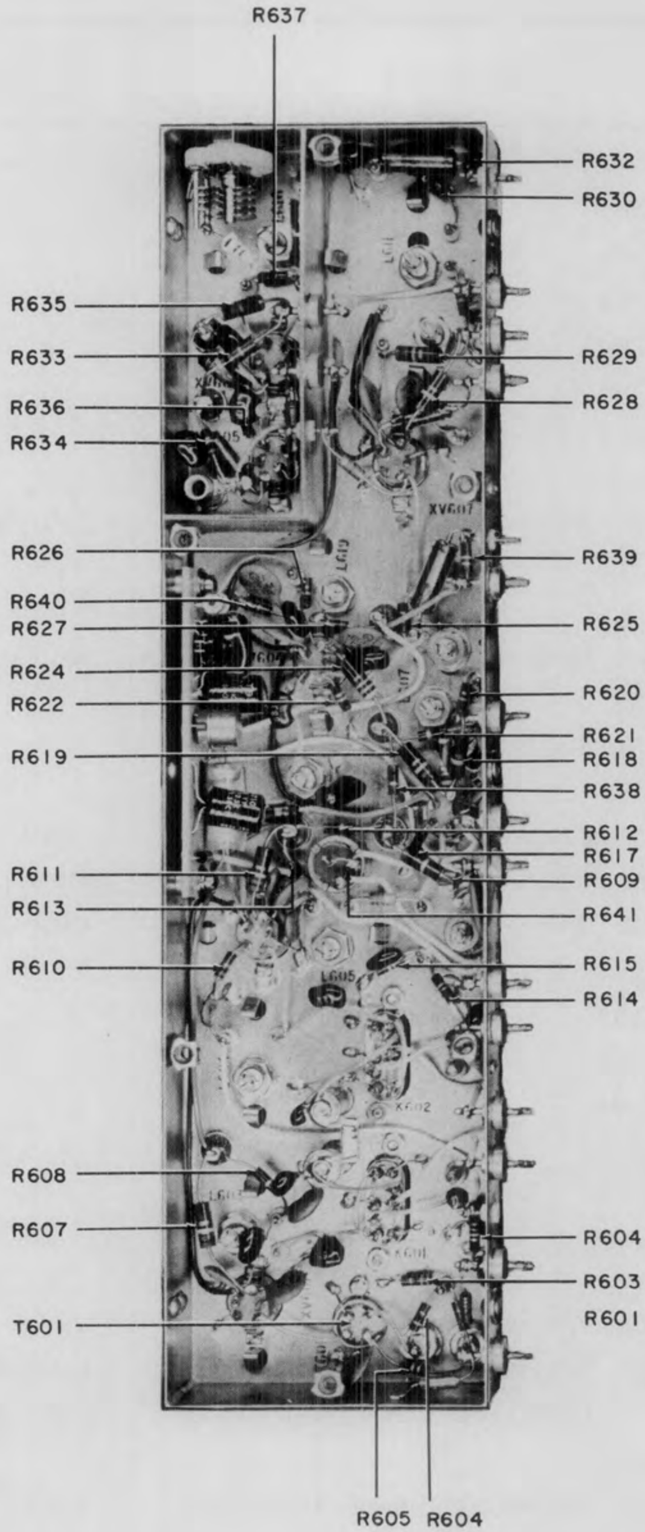


Figure 5-12. Type 903A Receiver, 50/300-kc IF Strip

Symbol Number	Description	Vendor Part No.	Vendor Name
C666	CAPACITOR, CERAMIC TUBULAR: 10 pf±0.5 pf	N750A	Erie
C667	CAPACITOR, CERAMIC DISC: 0.005 μf, 20%, 50 wvdc	TGD50	Sprague
C668	Same as C602		
C669	Same as C602		
C670	Same as C667		
C671	Same as C667		
C672	Same as C667		
C673	Same as C667		
C674	Same as C608		
C675	Same as C666		
C676	Same as C667		
C677	Same as C602		
C678	Same as C601		
C679	Same as C606		
C680	Same as C601		
C681	Same as C667		
C682	Same as C602		
C683	Same as C667		
CR601	DIODE, SILICON ZENER	1N756A	PSI
CR602	DIODE, GERMANIUM	1N198A	Sylvania
CR603	Same as CR602		
E601	FEEDTHRU, TEFLON	SFU-16	Taurus
E602	Same as E601		
E603	Same as E601		
FL601	FILTER, CRYSTAL: Dwg. ME-00070	40B2	McCoy
J601	RECEPTACLE, JACK	31-50	Microdot
J602	Same as J601		
J603	Same as J601		
K601	RELAY, DPDT	MS24250-6	Elgin
K602	Same as K601		
L601	NOT USED		
L602	NOT USED		
L603	COIL, VARIABLE	1111-04	CEI
L604	COIL, VARIABLE	1111-05	CEI
L605	COIL, VARIABLE	1111-06	CEI

Symbol Number	Description	Vendor Part No.	Vendor Name
L606	COIL, VARIABLE	1111-03	CEI
L607	COIL, VARIABLE	1111-01	CEI
L608	COIL, VARIABLE	1111-07	CEI
L609	COIL, FIXED	1115	CEI
L610	COIL, VARIABLE	1111-02	CEI
L611	COIL, VARIABLE	1109	CEI
L612	Same as L609		
L613	COIL, FIXED: 2.2 μh	209-11-2.2	Wilco
L614	COIL, FIXED	1071	CEI
L615	COIL, FIXED	1116	CEI
L616	COIL, VARIABLE	1113	CEI
L617	COIL	1131-16	CEI
L618	Same as L617		
L619	Same as L603		
L620	Same as L617		
P601	CONNECTOR, PLUG	32-21	Microdot
P602	Same as P601		
P603	Same as P601		
R601	RESISTOR, FIXED COMPOSITION: 24 Ω, 5%, 1/4W	CB2405	AB
R602	Same as R601		
R603	RESISTOR, FIXED COMPOSITION: 33 Ω, 5%, 1/4W	CB3305	AB
R604	RESISTOR, FIXED COMPOSITION: 330K, 10%, 1/4W	CB3341	AB
R605	RESISTOR, FIXED COMPOSITION: 220K, 5%, 1/4W	CB2245	AB
R606	NOT USED		
R607	RESISTOR, FIXED COMPOSITION: 110K, 5%, 1/2W	EB1145	AB
R608	RESISTOR, FIXED COMPOSITION: 1K, 5%, 1/4W	CB1025	AB
R609	RESISTOR, FIXED COMPOSITION: 1K, 10%, 1/2W	EB1021	AB
R610	RESISTOR, FIXED COMPOSITION: 36 Ω, 5%, 1/4W	CB3605	AB
R611	Same as R607		
R612	Same as R608		
R613	Same as R608		
R614	RESISTOR, FIXED COMPOSITION: 100K, 5%, 1/4W	CB1045	AB
R615	Same as R614		
R616	RESISTOR, FIXED COMPOSITION: 47K, 5%, 1/4W	CB4735	AB
R617	RESISTOR, FIXED COMPOSITION: 30 Ω, 5%, 1/4W	CB3005	AB

Symbol Number	Description	Vendor Part No.	Vendor Name
R618	RESISTOR, FIXED COMPOSITION: 16K, 5%, 1/2W	EB1635	AB
R619	RESISTOR, FIXED COMPOSITION: 51K, 5%, 1/2W	EB5135	AB
R620	RESISTOR, FIXED COMPOSITION: 27K, 5%, 1/4W	CB2735	AB
R621	Same as R608		
R622	Same as R614		
R623	NOT USED		
R624	RESISTOR, FIXED COMPOSITION: 43K, 5%, 1/2W	EB4335	AB
R625	RESISTOR, FIXED COMPOSITION: 20K, 5%, 1/4W	CB2035	AB
R626	RESISTOR, FIXED COMPOSITION: 75K, 5%, 1/4W	CB7535	AB
R627	Same as R608		
R628	RESISTOR, FIXED COMPOSITION: 100K, 5%, 1/2W	EB1045	AB
R629	RESISTOR, FIXED COMPOSITION: 68K, 5%, 1/2W	EB6835	AB
R630	Same as R626		
R631	Same as R626		
R632	Same as R608		
R633	RESISTOR, FIXED COMPOSITION: 3K, 5%, 1/2W	EB3025	AB
R634	RESISTOR, FIXED COMPOSITION: 10K, 5%, 1/4W	CB1035	AB
R635	Same as R633		
R636	Same as R614		
R637	Same as R625		
R638	Same as R608		
R639	Same as R605		
R640	RESISTOR, FIXED COMPOSITION: 1.8K, 5%, 1/4W	CB1825	AB
R641	RESISTOR, VARIABLE COMPOSITION: 5K, 10%, 1/2W	GA1M028S-502UC	AB
T601	TRANSFORMER	1126	CEI
V601	TUBE, ELECTRON: Nuvistor tetrode	7587	RCA
V602	Same as V601		
V603	Same as V601		
V604	Same as V601		
V605	TUBE, ELECTRON: Nuvistor triode	6CW4	RCA
V606	Same as V605		
V607	Same as V601		

PARTS LIST, TYPE 903A RECEIVER
PULSE COUNTER MODULE

Symbol Number	Description	Vendor Part No.	Vendor Name
C701	CAPACITOR, CERAMIC TUBULAR: 5.0 pf ± 0.25 pf	NPOA	Erie
C702	CAPACITOR, DIPPED MICA: 500 pf, 10%	DM15-501K	Arco
C703	CAPACITOR, ELECTROLYTIC, TANTALUM: 20 μf, +20%, -15%, 60 wvdc	109D206C-2060F2	Sprague
C704	Same as C702		
CR701	DIODE, SILICON	1N914	Texas Instruments
CR702	Same as CR701		
CR703	DIODE, SILICON	1N461	Continental Devices
Q701	TRANSISTOR, SILICON UNI-JUNCTION	2N489	GE
Q702	TRANSISTOR, SILICON	2N335	Texas Instruments
T701	TRANSFORMER	DO-T9	UTC
T702	TRANSFORMER	DO-T10	UTC

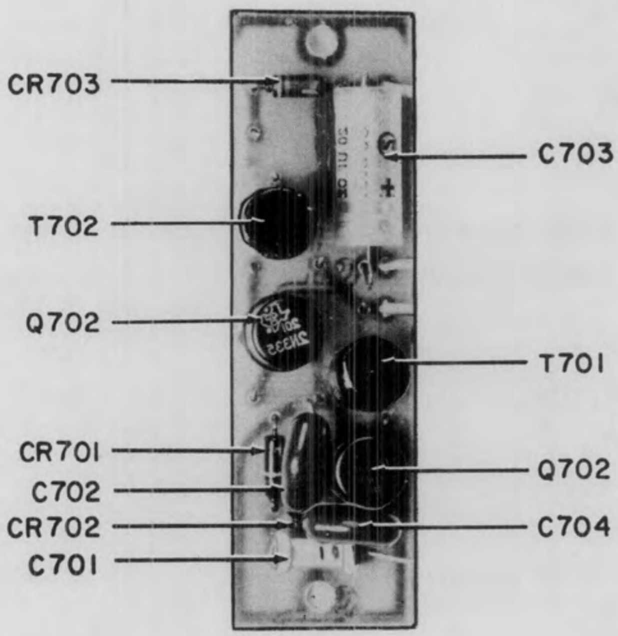


Figure 5-13. Type 903A Receiver, Pulse Counter Module

PARTS LIST, TYPE 903A RECEIVER

NOISE LIMITER MODULE

Symbol Number	Description	Vendor Part No.	Vendor Name
C801	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.47 μf, 20%, 35 wvdc	150D474X-0035A2	Sprague
C802	Same as C801		
CR801	DIODE, GERMANIUM	1N54A	Sylvania
CR802	DIODE, SILICON, ZENER	1N756A	PSI
Q801	TRANSISTOR, SILICON	2N335	Texas Instruments
R801	RESISTOR, FIXED COMPOSITION: 150K, 5%, 1/4W	CB1545	AB
R802	RESISTOR, FIXED COMPOSITION: 430K, 5%, 1/4W	CB4345	AB
R803	RESISTOR, FIXED COMPOSITION: 5.1K, 5%, 1/4W	CB5125	AB
R804	RESISTOR, FIXED COMPOSITION: 27K, 5%, 1/4W	CB2735	AB
R805	Same as R804		
R806	RESISTOR, FIXED COMPOSITION: 270K, 5%, 1/4W	CB2745	AB
R807	RESISTOR, FIXED COMPOSITION: 1.5 meg, 5%, 1/4W	CB1555	AB
R808	RESISTOR, FIXED COMPOSITION: 750K, 5%, 1/4W	CB7545	AB
R809	RESISTOR, FIXED COMPOSITION: 300K, 5%, 1/4W	CB3045	AB

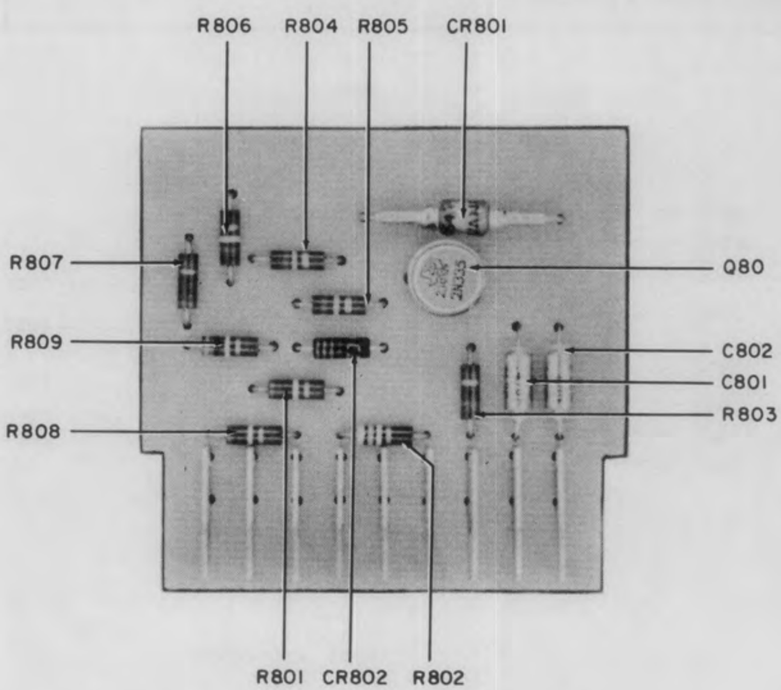


Figure 5-14. Type 903A Receiver, Noise Limiter Module

PARTS LIST, TYPE 903A RECEIVER

RELAY DRIVER MODULE

Symbol Number	Description	Vendor Part No.	Vendor Name
C901	CAPACITOR, ELECTROLYTIC, TANTALUM: 20 μf +20%, -15%, 60 wvdc	109D206C-2060F2	Sprague
CR901	DIODE, SILICON:	1N462	Continental Devices
CR902	DIODE, GERMANIUM	1N34A	Raytheon
Q901	TRANSISTOR, SILICON	2N335	Texas Instruments
Q902	Same as Q901		
Q903	Same as Q901		
Q904	Same as Q901		
R901	RESISTOR, FIXED COMPOSITION: 68K, 5%, 1/4W	CB6835	AB
R902	RESISTOR, FIXED COMPOSITION: 470K, 5%, 1/4W	CB4745	AB
R903	RESISTOR, FIXED COMPOSITION: 47K, 5%, 1/4W	CB4735	AB
R904	RESISTOR, FIXED COMPOSITION: 51 Ω, 5%, 1/4W	CB5105	AB
R905	RESISTOR, FIXED COMPOSITION: 1 meg, 5%, 1/4W	CB1055	AB
R906	RESISTOR, FIXED COMPOSITION: 150K, 5%, 1/4W	CB1545	AB
R907	RESISTOR, FIXED COMPOSITION: 360K, 5%, 1/4W	CB3645	AB
R908	Same as R903		
S901	SWITCH: Slide, 3 position	SS-16	Stackpole

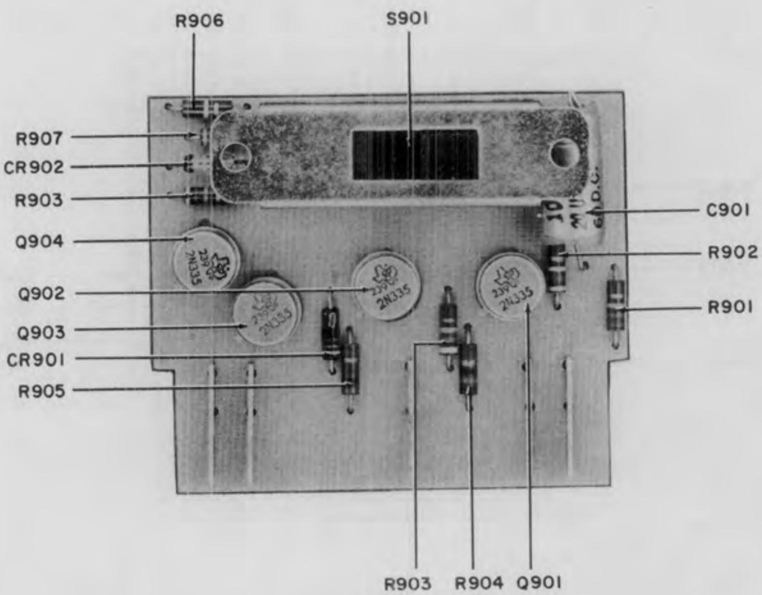


Figure 5-15. Type 903A Receiver, Relay Driver Module

LIST OF MANUFACTURERS

Abbreviation	Name and Address
AB	Allen Bradley Company 136 W. Greenfield Avenue Milwaukee, Wisconsin
FXR	Amphenol-Borg Electronics, Corp. 1830 S. 54th Avenue Chicago, Illinois
Arco	Arco Electronics, Inc. Community Drive Great Neck, New York
CTC	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, Massachusetts
CTS	Chicago Telephone Supply Corp. 1142 W. Beardsley Avenue Elkhart, Indiana
Cinch-Jones	Cinch-Jones Manufacturing Co. 1026 S. Homan Avenue Chicago, Illinois
CEI	Communication Electronics, Inc. 4908 Hampden Lane Bethesda 14, Maryland
Continental Devices	Continental Devices Corp. 12515 Chadion Avenue Hawthorne, California
Cornish	Cornish Wire Co. 50 Church Street New York, New York
Cutler-Hammer	Cutler-Hammer, Inc. 321 N. 12th Street Milwaukee, Wisconsin
Electra	Electra Manufacturing Co. 4051 Broadway Kansas City, Missouri
Elgin	Elgin Laboratories, Inc. A Subsidiary of Erie Resistor Corp. Waterford, Pennsylvania
Erie	Erie Resistor Corp. 644 W. 12th Street Erie, Pennsylvania

Abbreviation	Name and Addres
E. F. Johnson	E. F. Johnson Co. Waseca, Minnesota
Ferroxcube	Feroxcube Corp. of America Saugerties, New York
GE	General Electric Co. 777 14th Street, N. W. Washington, D.C.
JFD	J.F.D. Electronics Corp. 6101 16th Avenue Brooklyn, New York
Littelfuse	Littelfuse, Inc. 1865 Miner Street Des Plaines, Illinois
Marion	Marion Instrument Division Minneapolis-Honeywell Regulator Co. Manchester, New Hampshire
Microdot	Microdot Inc. 220 Pasadena Avenue South Pasadena, California
Motorola	Motorola Semiconductor Products, Inc. 5005 E. McDowell Road Phoenix, Arizona
McCoy	McCoy Electronics Co. Mt. Holly Spring, Pennsylvania
Oak	Oak Manufacturing Co. Crystal Lake, Illinois
PSI	Pacific Semiconductors, Inc. 10451 W. Jefferson Boulevard Culver City, California
Potter and Brumfield	Potter and Brumfield Princeton, Indiana
QC	Quality Components, Inc. St. Marys, Pennsylvania

LIST OF MANUFACTURERS (Cont)

Abbreviation	Name and Address
RCA	Radio Corp. of America 415 S. Fifth Street Harrison, New Jersey
RMC	Radio Materials, Corp. 4242 W. Bryn Mawr Avenue Chicago 46, Illinois
Raytheon	Raytheon Co. 55 Chappel Street Newton 58, Massachusetts
RF Products	RF Products 33 E. Franklin Street Danbury, Connecticut
Sage	Sage Electronics, Inc. Country Club Road E. Rochester, New York
Sprague	Sprague Electric Co. 91 Marshall Street N. Adams, Massachusetts
Stackpole	Stackpole Carbon Co. Electronic Components Division St. Marys, Pennsylvania
Switchcraft	Switchcraft, Inc. 5555 N. Elston Avenue Chicago, Illinois
Taurus	Taurus Corp. 8 Coryell Street Lambertville, New Jersey
Texas Instruments	Texas Instruments, Inc. 6000 Lemmon Avenue Dallas, Texas
UTC	United Transformer Co. 150 Varick Street New York City, New York
Wilco	Wilco Corp. 546 Drover Street Indianapolis, Indiana

SECTION VI

SCHEMATIC DIAGRAMS

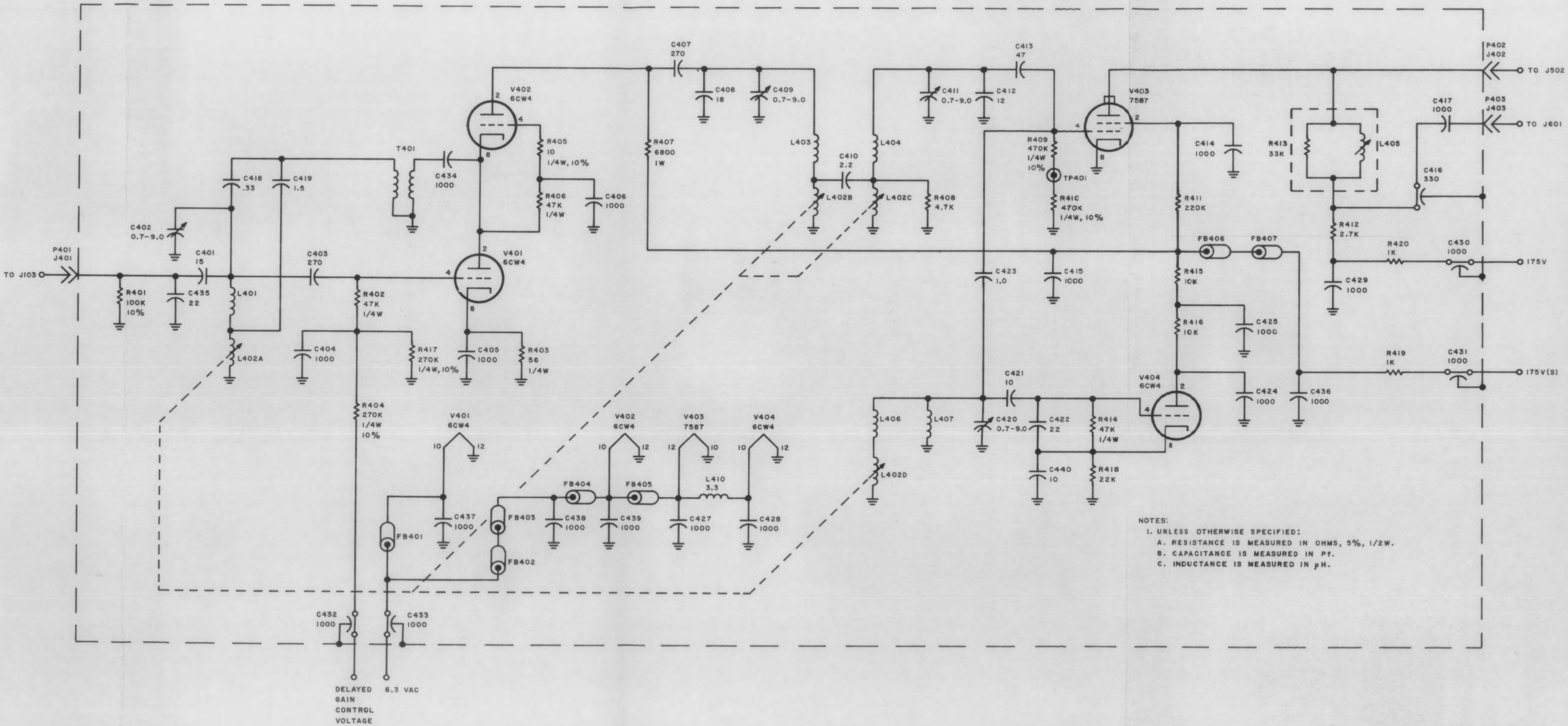
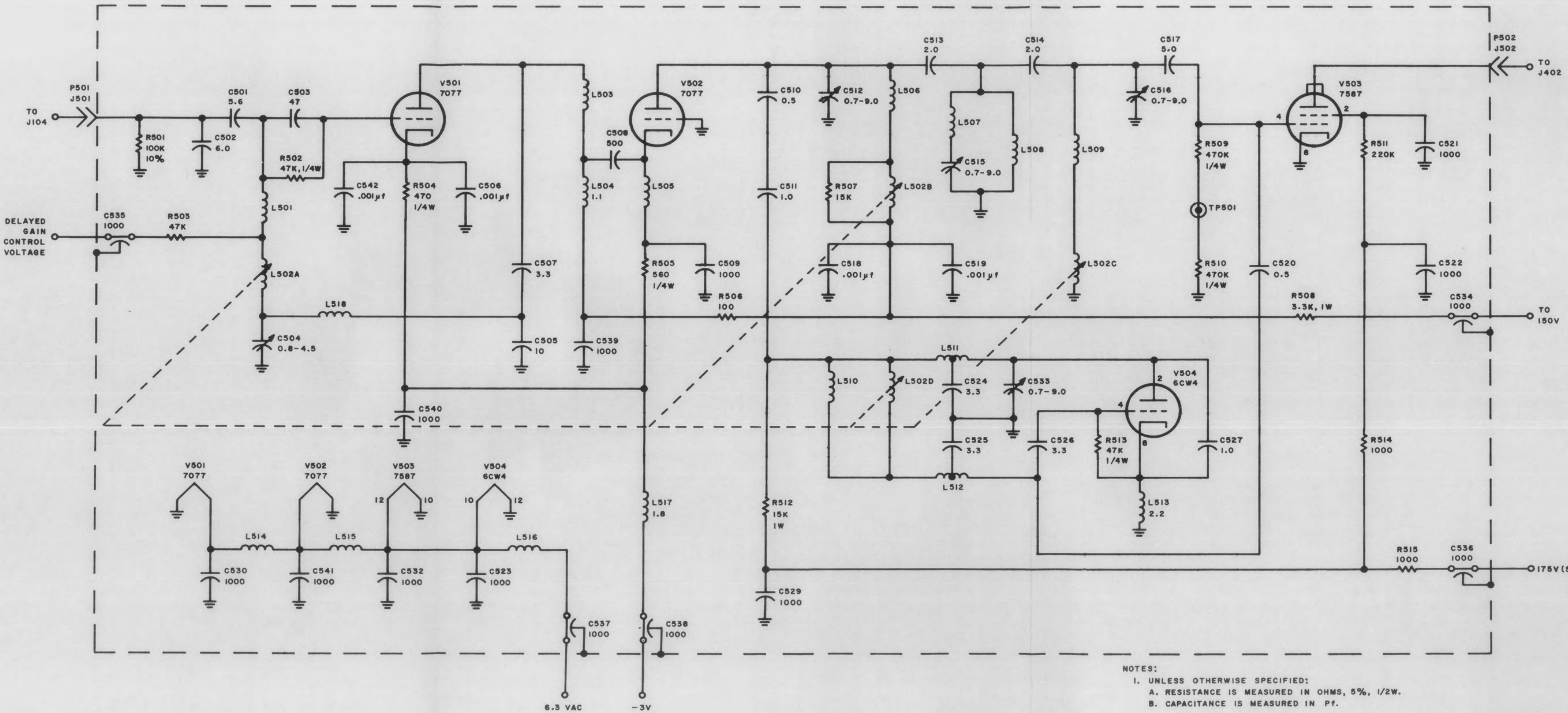


Figure 6-1. Type 903A Receiver, Low Band Tuner, Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, 5%, 1/2W.
   B. CAPACITANCE IS MEASURED IN Pf.

Figure 6-2. Type 903A Receiver, High Band Tuner, Schematic Diagram

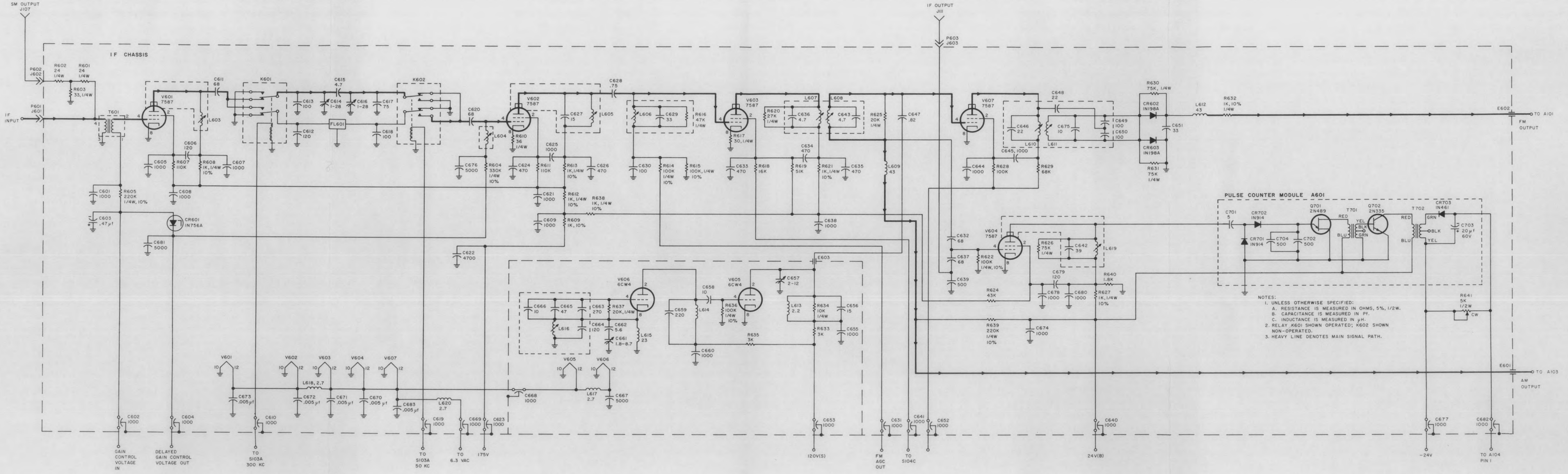
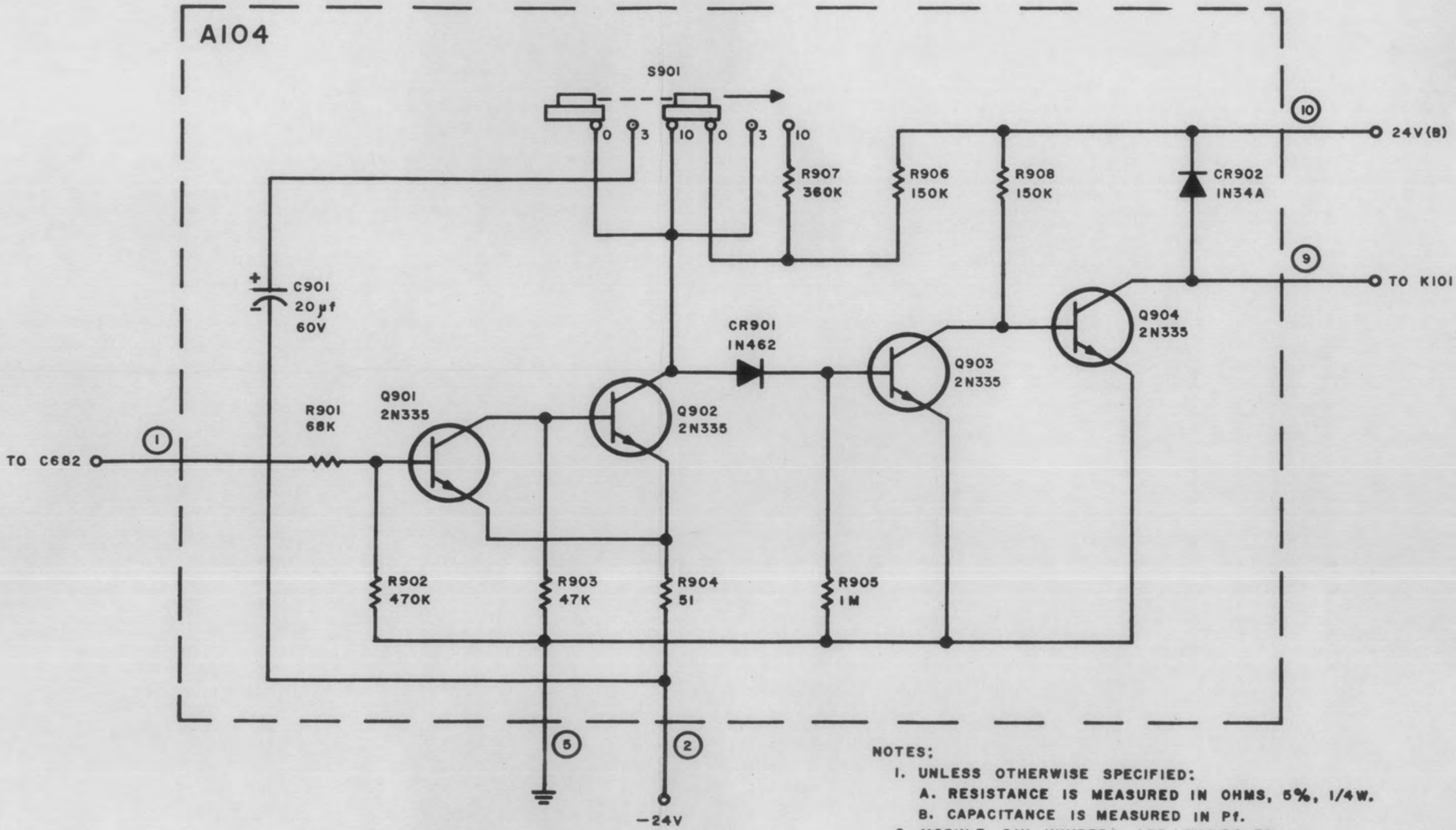
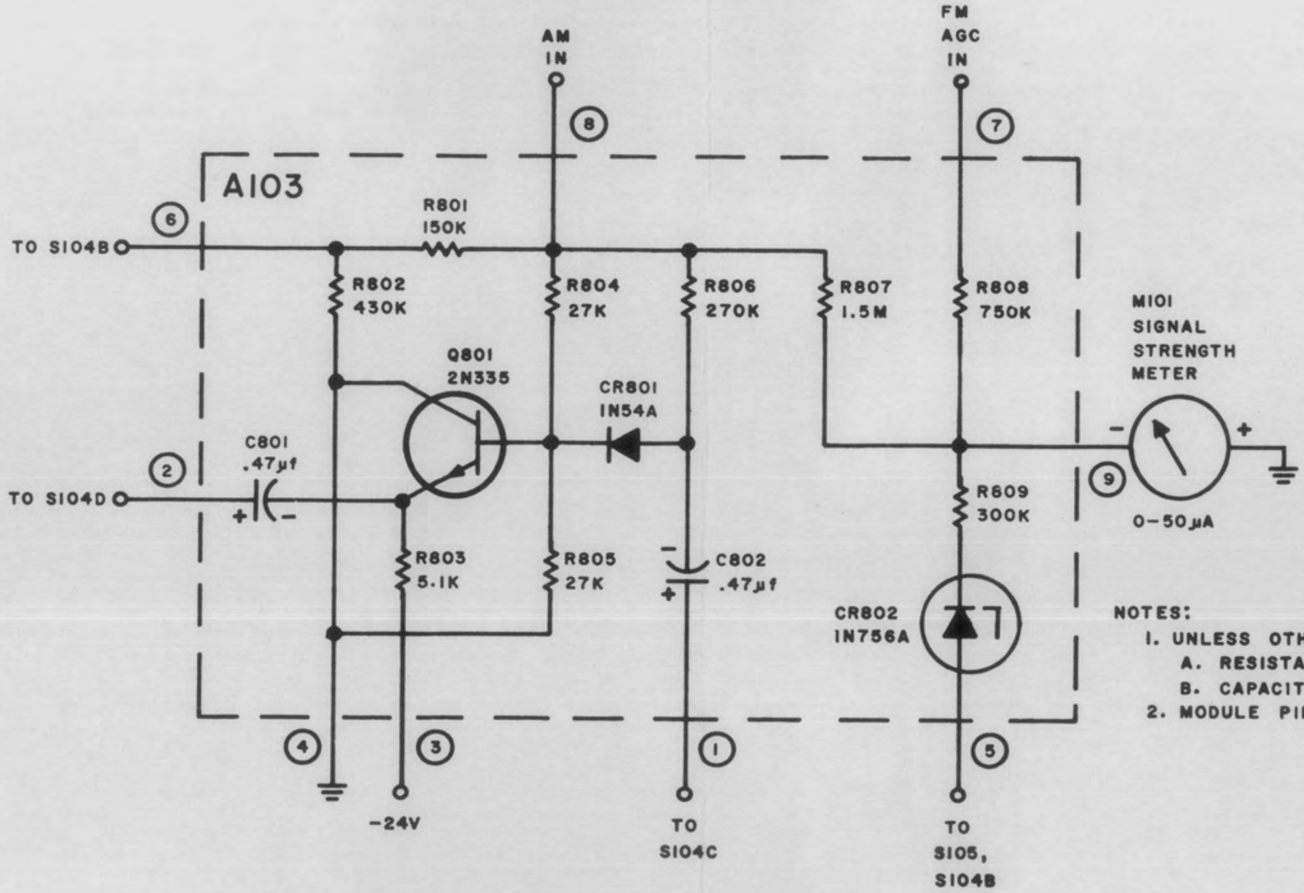


Figure 6-3. Type 903A Receiver, 50/300-kc IF Strip, Schematic Diagram



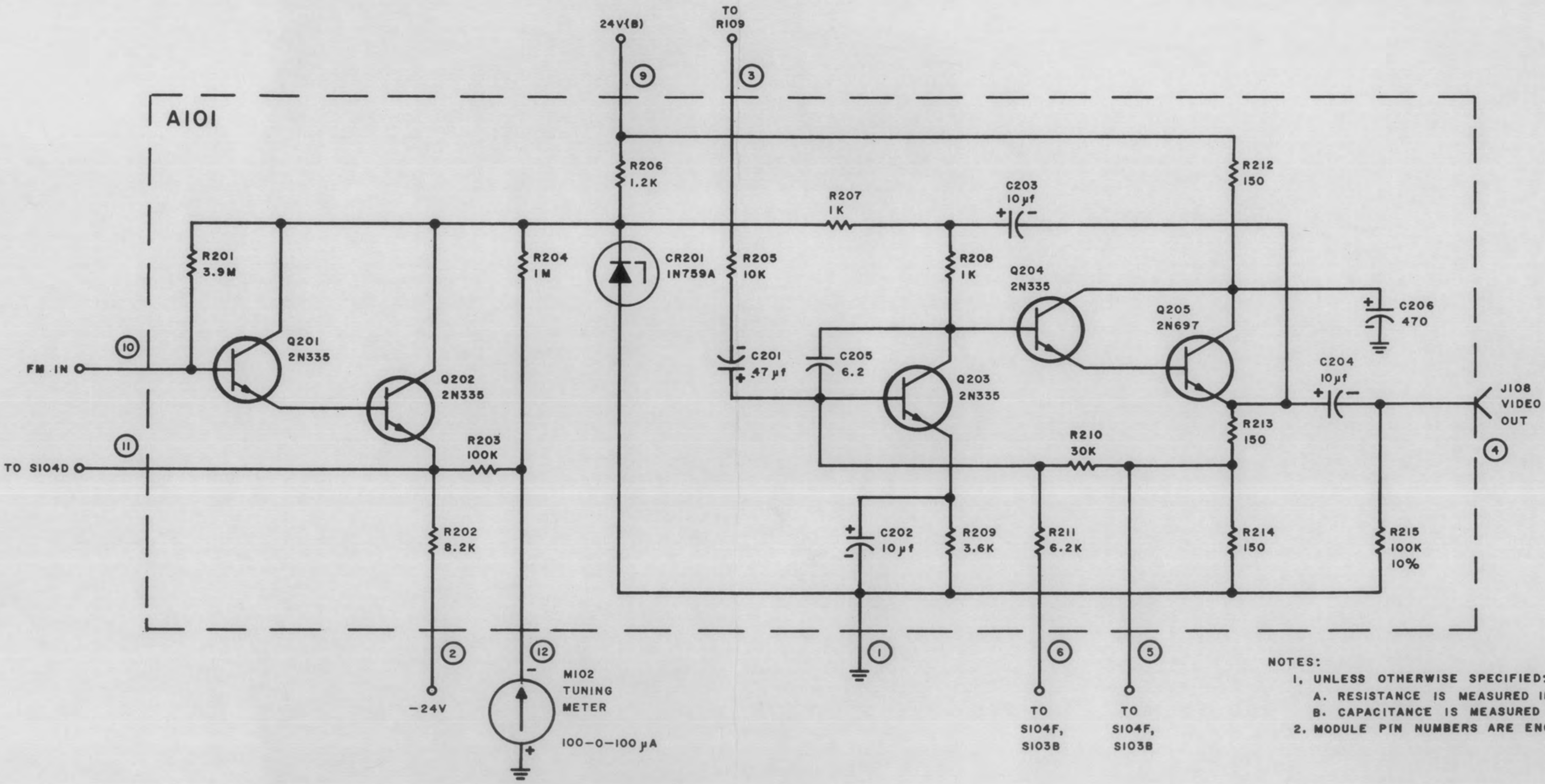
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
A. RESISTANCE IS MEASURED IN OHMS, 5%, 1/4W.
B. CAPACITANCE IS MEASURED IN Pf.
2. MODULE PIN NUMBERS ARE ENCIRCLED.

Figure 6-4. Type 903A Receiver, Relay Driver Module, Schematic Diagram



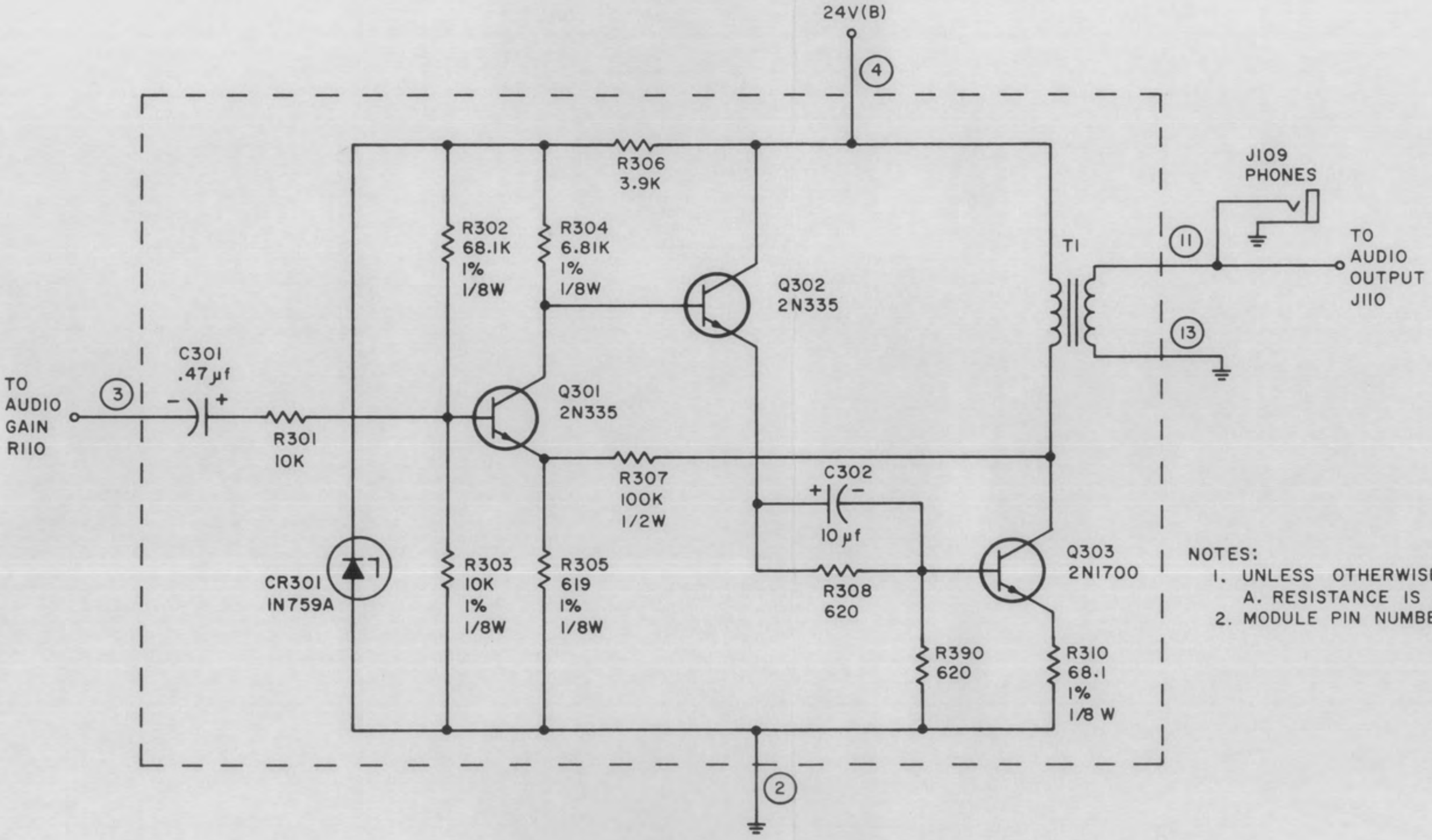
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTANCE IS MEASURED IN OHMS, 5%, 1/4W.
   B. CAPACITANCE IS MEASURED IN Pf.
2. MODULE PIN NUMBERS ARE ENCIRCLED.

Figure 6-5. Type 903A Receiver, Noise Limiter Module, Schematic Diagram



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

Figure 6-6. Type 903A Receiver, Video Amplifier Module, Schematic Diagram



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

Figure 6-7. Type 903A Receiver, Audio Amplifier Module, Schematic Diagram

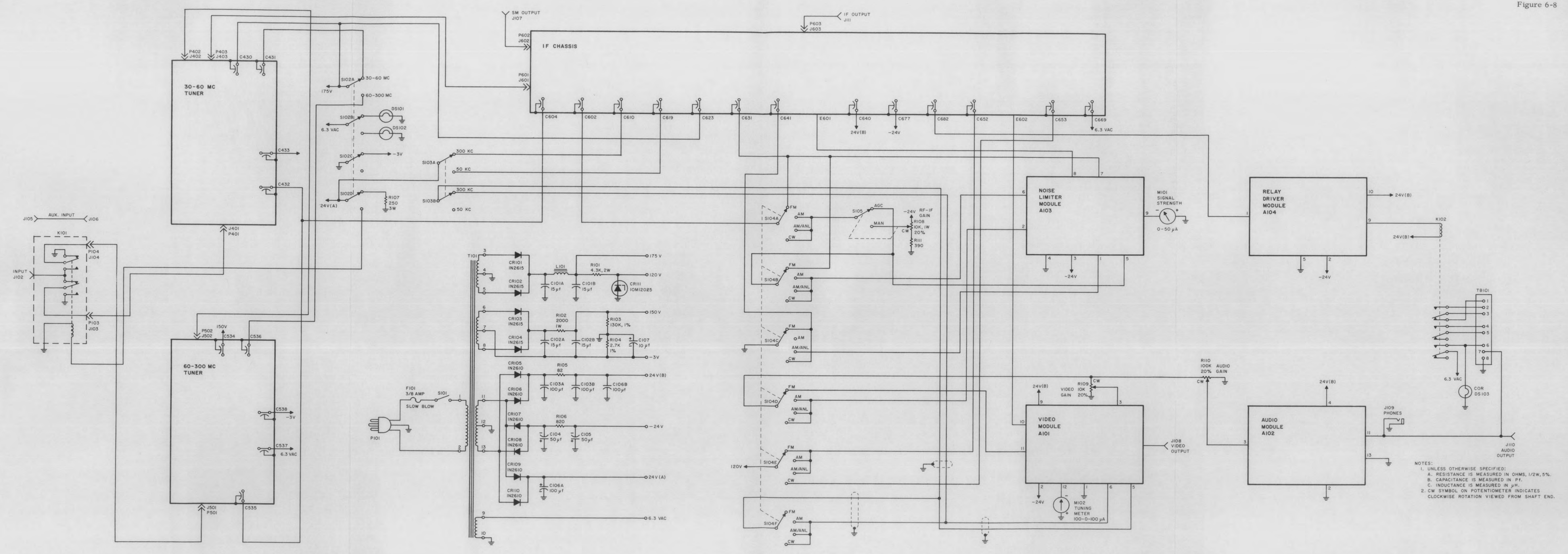


Figure 6-8. Type 903A Receiver, Main Chassis and Power Supply Schematic Diagram