INSTRUCTION MANUAL

FOR

TYPE 215 RECEIVER

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20760

WARNING

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

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Table 1-1. Type 215 Receiver, Specifications

Tuning Modes	Panoramic, Manual or Remote
Types of Reception	AM, FM, Pulse
Frequency Range	2-1000 MHz using plug-in tuning heads
IF Bandwidths	10 kHz, 50 kHz, 300 kHz, and 1 MHz
IF Center Frequency	21.4 MHz
Types of AGC	Pulse and Average AGC in manual tuning; Logarithmic in panoramic tuning
Manual Gain Control	All IF's
Video Output Level	1 V rms into 100 Ω
Video Output Response	Within 3 dB from 50 Hz to 2 MHz
Audio Output	100 mW into 600 Ω, balanced or unbalanced
Predetection IF Output	50 mV minimum into 50 Ω, input signals above AGC threshold
AFC Input	± 4 V for frequency change of 0.3% of the installed tuner. Positive AGC voltage decreases frequency
LO Output	50 mV minimum, into 50 Ω load
SM Output	1.7 mV minimum, input signals above AGC threshold
Tuning Voltage Input	+10.3 V high band edge to -10.3 V low band edge.
Ramp Output	± 0.5 V ramp into 10 kΩ load
Marker Output	0 V, +0.5 V, and +1.2 V corresponding to blanking, normal intensity, and high intensity.
FM Output	4 V p-p into 100 Ω with deviation equal to IF bandwidth
AM Output	1.2 V p-p into 100 Ω with 50% AM modulation
COR Sensitivity Range	Range of control allows operation from noise to complete cutoff.
AGC Monitor Output	Negative going logarithmic voltage indicating relative signal strength for signals above AGC threshold
External Blanking Input	+18 V will blank marker output
Over-Sweep Indicator	+15 V during oversweep; normally zero volts
Tuning Voltage Monitor	-10 V low band edge to +10 V high band edge
Sweep Rage	Variable from 0.04 to 25 sweeps per second.

Table 1-1. Type 215 Receiver, Specifications (Continued)

Sector Width	Variable from zero to full frequency range of installed tuner	
Fine Tuning Range	Greater than 0.1% of the tuned frequency	
Remote Control Functions	TTL-compatible, two lines	
IF Bandwidth	10 kHz	00
	50 kHz	01
	300 kHz	10
	1 MHz	11
AGC Modes	Average	11
	Pulse	10
	Log	01
	AM/MAN	00
Tuning Speed (one line)	Slow	1
	Fast	0
Detection Mode	AM	0
	FM	1
Remote Gain Control	6 Bit binary to analog through D/A converter. Logic 1 increases gain	
Meters	Tuning and Signal Strength	
Input Power	115/220 V ac, 50-400 Hz	
Power Consumption	25 watts, approximately	
Dimensions*	19 inches wide, 3.5 inches high, and 16 inches deep	

* Measured from back of front panel to rear panel.

SECTION I
GENERAL DESCRIPTION

1.1 ELECTRCAL CHARACTERISTICS

1.1.1 The 215 Receiver is voltage tuned and designed for sweep or manual tuning. All functions of the receiver can be controlled from the receiver front panel or from a remote station via digital input jacks located on the rear panel of the receiver. Plug-in tuning heads provide frequency coverage from 2 to 1000 MHz. There are eleven basic VHF and UHF tuning heads available, but only one may be installed in the receiver at a time.

1.1.2 A signal display unit is usually operated in conjunction with the 215 Receiver. In addition, a frequency counter, such as the DRO-308-(X), and a frequency extender unis, such as the DRX-308, may be employed for accurate manual tuning and to indicate the SECTOR center frequency when sweeping.

1.1.3 The 215 Receiver features five modes of tuning: (1) PAN/SEC, (2) MAN, (2) SECTOR, (4) PAN, and (5) REMOTE TUNE. In the MAN tuning mode, the receiver provides AM, FM, and pulse reception and functions as a manually tuned receiver. Front panel, switch selectable IF bandwidths of 10 kHz, 50 kHz, 300 kHz, and 1 MHz are provided. In the REMOTE TUNE mode, all receiver functions are identical to the MAN mode except that the receiver tuning voltage and function selection information must be supplied from an external source. An internal COR (carrier operated relay) circuit provides audio squelch and rear panel contacts for operation of signal activated recording or other accessory equipment. A front panel COR lamp indicates COR activity and a COR SENSITIVITY control allows adjustment of the circuit threshold. Front panel controls are also provided to set video gain, audio gain, and fine tuning. In the MAN and MAN portion of the REMOTE TUNE modes, the receiver local oscillator can be locked to an external frequency counter having DAFC (digital automatic frequency control) capability. When locked to the external counter, the receiver stability approaches the stability of the internal reference source of the frequency counter.

1.1.4 Three sweep tuning modes may be selected for operation: PAN/SEC, PAN or SECTOR. In the PAN mode, the entire range of the tuning head installed in the receiver is swept. The sweep rate may be varied by a front-panel control from approximately one sweep every 25 seconds to 25 sweeps per second. At the end of each sweep, the manual tuning voltage output from the tuning head is inverted by the receiver and applied to the tuning head for 5 msec so that the DRO-308-(X) frequency counter can count and display the manually tuned frequency.

In addition to the control voltages mentioned in paragraph 1.1.3, a trigger pulse is applied to the counter which initiates its operating cycle in synchronization with the receiver operation.

1.1.5 When the SECTOR mode is chosen, any segment of the installed tuning head, from zero to the full frequency range, may be swept. A front-panel SECTOR WIDTH control is provided for this purpose. The sector being scanned is also influenced by the manual tuning control. The manual tuning voltage and the sweeping voltage are summed. The sector being scanned can be increased or decreased in frequency, within the limits of the installed tuner, by the manual tuning control. This means that the center of the sector being scanned will be the manually tuned frequency if the receiver is switched from the SECTOR to the MAN mode. The operation of the associated frequency counter is the same in the SECTOR mode as in the PAN mode.

1.1.6 The 215 also features a PAN/SEC tuning mode in which the receiver operation alternates between the pan and sector sweeps. In this mode, the external frequency counter is triggered only at the end of the sector sweep portion of the operating cycle.

1.1.7 In the PAN/SEC, PAN, and SECTOR tuning modes, the receiver automatically selects the optimum IF bandwidth. In the PAN mode, this is usually one of the wider IF bandwidths depending on the frequency range of the installed tuner. The same IF bandwidth will be selected for SECTOR operation when the sector width is 25% of the installed tuner bandwidth or greater. When the sector width has been reduced to less than 25% a narrower IF bandwidth will be selected by the receiver to increase the visual resolution of the associated display unit.

1.1.8 The receiver provides horizontal, vertical, and intensity modulation outputs to an associated video display unit. In the PAN mode, a portion of the CRT trace will be intensified corresponding to the section of the band which will be scanned if the receiver is switched to the SECTOR mode. In the PAN/SEC mode, intensification occurs on the portion of the PAN trace which corresponds to the portion swept in the SECTOR portion of the operating cycle.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 The Type 215 Receiver is designed for mounting in a standard 19-inch rack. As shown in Figures 1-1 and 5-1, all of the operating controls are located on the front panel. Although shown in both illustrations, the tuning head is not a part of the receiver. The one shown in the Type VH-14 which tunes from 180 to 300 MHz. The other tuning heads are very similar in appearance and cover the remaining frequency spectrum from 2 to 1000 MHz.

1.2.2 Input and output connections are made at the rear apron. As shown in Figure 5-2, a variety of connector types are employed. The rear apron also contains the primary power selector switch and the line fuses.

1.2.3 The front, rear, and side panels of the receiver are made of aluminum, as well as the top and bottom dust covers, main deck, and tuner housing. The main chassis contains sixteen subassemblies. Fourteen of these are constructed on plug-in printed wiring boards. The two remaining subassemblies are in brass chassis which have been plated with precious metals for improved conductivity and to prevent tarnishing. One of the two brass chassis contains the IF amplifier which is constructed on eight plug-in printed wiring boards located inside the brass chassis. The other is the RF monitor.

1.3 EQUIPMENT SUPPLIED

This equipment consists of the Type 215 Receiver, an extender card, alignment tools, and three Allen wrenches. The dimensions and weight of the unit are given in Table 1-1.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

1.4.1 In the MAN tuning mode, the receiver is capable of independent operation with a tuning head installed. For audio monitoring, 600-ohm headphones such as the Telex HM-5 are required, or any other 600-ohm audio device which contains a loudspeaker and can be connected to the rear-apron jack.

1.4.2 The 215 Receiver is designed to operate with the Type SM-7301(A) Signal Display and the Type DRO-308-(X) Frequency Counter. In any mode of operation, at least one plug-in tuning head is required to operate the receiver. If operation with any of the UH-Series tuning heads is intended, using the DRO-308-(X) Frequency Counter, the DRX-308 Frequency Extender is required.

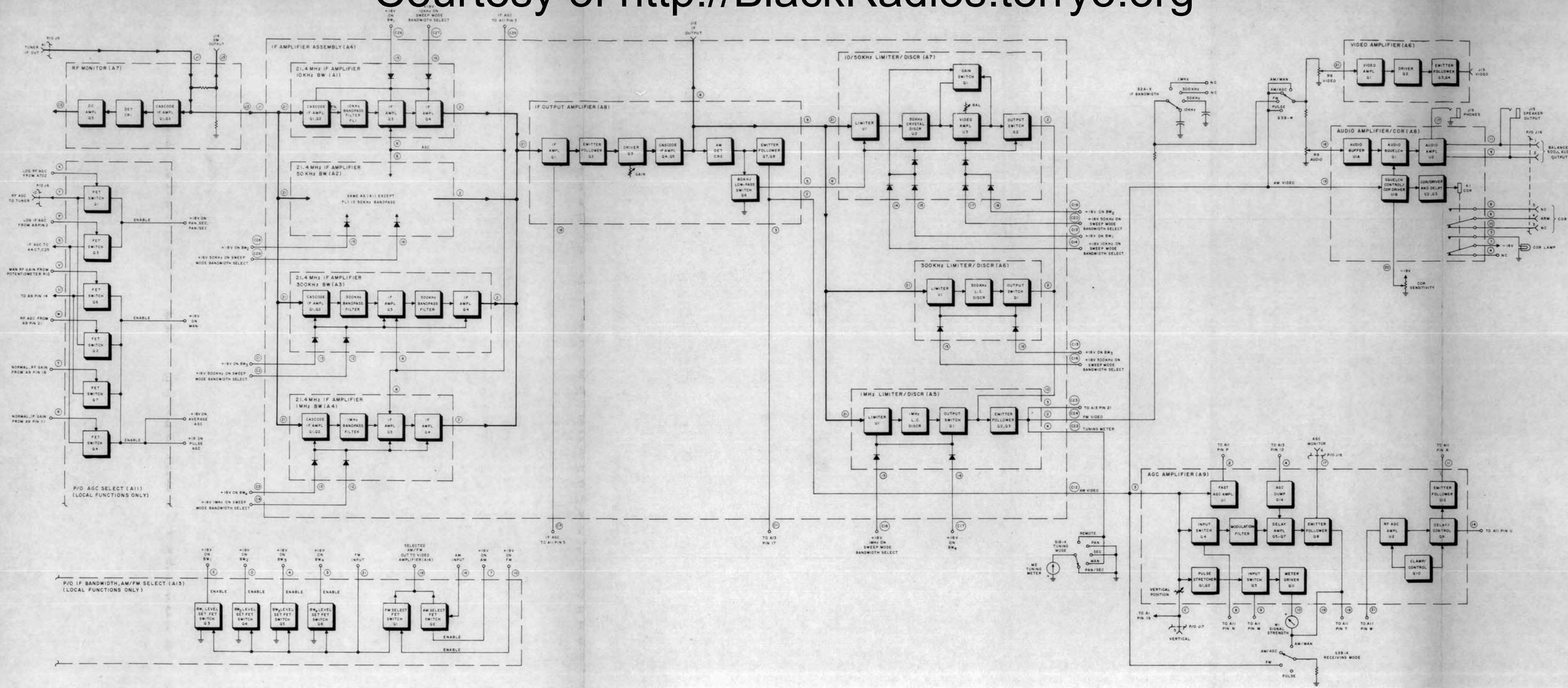


Figure 2-1. Type 215 Receiver, Receiving Circuits, Functional Block Diagram

SECTION II
CIRCUIT DESCRIPTION

2.1 GENERAL

Operation of the various circuits in the 215 Receiver is described in the following paragraphs using the functional block diagrams, Figures 2-1, 2-2, and 2-3, and the schematic diagrams in Section VI. The unit numbering method is used for electrical components. This means that parts on subassemblies and modules carry a prefix before the usual class letter and number of the item. Examples are: A7Q2 which identifies a transistor in module A7, and A10CR1 which identifies a diode on subassembly A10. These prefixes are omitted on illustrations and in the text except in those cases where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

The operation of the 215 Receiver is quite complex and is therefore divided into three parts, receiving circuits, internal control circuits, and remote control circuits.

2.2.1 Receiving Circuits. - Figure 2-1 illustrates the functional interconnections between the various receiving circuits in the 215 Receiver.

2.2.1.1 RF Monitor (A7). - Module A7 contains a cascode IF amplifier, Q1-Q2, a detector, CR1, and a dc amplifier, Q3. This module provides fast AGC voltage output to the receiver tuning head when the receiver is operating in any of the three sweeping modes. The AGC select module, A11, selects tuner AGC from this module in the PAN, SECTOR, and PAN/SEC modes of tuning. This AGC voltage, which is applied to the tuning head in conjunction with the sweep mode AGC voltage applied to the receiver IF circuits, results in a logarithmic video output for display on the associated signal monitor. A resistive divider network located in module A7 provides an output to rear panel jack J14 (SM output). This IF output signal is processed by the signal monitor to provide a panoramic display of signals within the IF passband of the tuning head when the 215 Receiver is operated in the MAN or REMOTE TUNE modes. An additional IF output from the RF monitor (A7) is applied to the paralleled inputs of the IF amplifiers in the IF amplifier assembly (A4).

2.2.1.2 IF Amplifier Assembly (A4). - This assembly contains four IF bandwidth determining amplifiers (A4A1 through A4A4), a common IF output amplifier (A4A8) which is also the AM demodulator, and three FM limiter/discriminators (A4A5 through A4A7). All of the circuits within this assembly are constructed on plug-in printed circuit boards.

Figure 2-2. Type 215 Receiver, Control Circuits, Functional Block Diagram

Three of the bandwidth determining amplifier circuits are functionally identical. These set the 10 kHz bandwidth (A4A1), the 50 kHz bandwidth (A4A2), and the 1 MHz bandwidth (A4A4). Each contains a cascode amplifier stage, Q1-Q2, followed by the bandwidth determining element, a gain controlled (AGC) amplifier stage, Q3, and an output stage, Q4. Boards A4A1 and A4A2 utilize crystal filters to determine the bandwidth while A4A4 uses a LC bandpass filter. Amplifier board A4A3 is functionally similar to the other boards except that two bandwidth determining elements are used: one preceding the automatic gain-controlled stage and one following it. Outputs from the four IF amplifier boards are paralleled and applied to IF output amplifier, A4A8. However, only one amplifier board is enabled at a time. The enabled IF board is determined by an automatic bandwidth select circuit when the receiver is operating in one of the sweeping modes, and by the front-panel IF BANDWIDTH switch or the remote digital select circuits when the receiver is operating in the MAN or REMOTE TUNE modes. In the MAN or REMOTE MANUAL TUNE modes, +18 V is applied to the selected IF amplifier board through switch S2A-W (IF BANDWIDTH) or the Remote Select Circuits. Diodes in series with the enable voltages on each amplifier board provide switching isolation. The function of the sweep mode automatic bandwidth select circuit is explained in a later paragraph. Its purpose is to select the correct IF bandwidth to provide optimum signal display resolution when the receiver is operating in one of the sweeping modes.

2.2.1.3 IF output amplifier A4A8 is a multi-function board. It provides the IF output to the paralleled inputs of the FM demodulators and demodulates AM signals. In the MAN and REMOTE MANUAL TUNE modes, the AM output is also used to develop AGC voltage for the receiver IF stages. When the receiver is operated in one of the sweeping modes, the AM output from this board is used to develop IF AGC and provide video output to the associated signal display. Additional outputs from the board are IF output at rear-panel jack, J12, and a rear-panel AM output at J21 and J22. The IF output amplifier consists of an automatic gain-controlled stage, Q1, emitter follower Q2, driver Q3, and cascode IF amplifier Q4-Q5 preceding the AM detector. The output from Q4-Q5 provides the IF signal to rear-panel jack J12, the FM limiter/discriminator boards, and the AM detector, CR2. The output from the AM detector is coupled through a switched 80-kHz lowpass filter to emitter followers Q7-Q8. The lowpass filter is switched on whenever the 10/50 kHz limiter/discriminator, A4A7, is enabled. This is done to reduce the noise bandwidth of the AM video signal outputs because the IF output amplifier bandwidth is greater than 1 MHz.

2.2.1.4 Three limiter/discriminator boards (A4A5 through A4A7) are used to demodulate FM signals. The appropriate board is enabled by the application of +18 V from the IF BANDWIDTH switch, S2A-W, or from the sweep mode automatic bandwidth select circuit. Enable lines

to the boards are isolated by diodes located on each board. The appropriate FM demodulator is enabled during sweep operation to provide an accurate center frequency indication of signals encountered during the sweep. Board A4A7 provides FM demodulation when either the 10 or 50 kHz bandwidth is enabled. The circuit consists of an integrated circuit limiter, U1, followed by a 50 kHz crystal discriminator, U2, an integrated circuit video amplifier, U3, output swithh Q2, and gain switch Q1. The gain switch is included to equalize the video output between the 10 kHz and 50 kHz bandwidths. Video output from the board is applied to emitter followers on the 1 MHz limiter/discriminator board, A4A5. The 300 kHz and 1 MHz limiter/discriminators are similar in design. Both utilize an integrated circuit limiter amplifier followed by an L-C discriminator and output switch. The video outputs of all three discriminator boards are switch enabled and coupled out through emitter followers Q2-Q3 on board A4A5. The FM video out is passed through FM FET switch Q1 on A13, and applied to video amplifiers on board A16, which supplies the FM output to jack J22. The FM video is also applied to receiving mode switch S3A-W, and the front-panel tuning meter through tuning mode switch S1B-X. IF bandwidth switch S2A-X connects capacitors across the FM video line in the 10 and 50 kHz bandwidth positions to reduce the FM video bandwidth.

2.2.1.5 Video Amplifier (A6) - This plug-in circuit receives input signals from the front-panel VIDEO gain control, R7. Receiving mode switch S3A-W supplies the appropriate mode signal to the VIDEO gain and AUDIO gain controls. A video amplifier, Q1, provides the voltage gain to drive Q2 which in turn drives output emitter followers Q3 and Q4. Video output signals are available at rear panel jack J13.

2.2.1.6 Audio Amplifier/COR (A8). - This multi-function circuit is constructed on a plug-in printed circuit board. It provides amplified audio signals to the front-panel PHONES jack, J19, the rear panel SPEAKER output jack, J15, and the balanced 600 ohm output at rear-panel connector J16. In addition, the circuit provides audio squelch and COR (carrier operated relay) functions. Input signals from the front panel AUDIO gain control are applied through unity-gain buffer U1A to audio squelch transistor Q1. When Q1 in conducting, the audio signal is passed to an audio amplifier circuit consisting of operational amplifier U2 and transistors Q4 and Q5. The conduction of Q1 is controlled by operational amplifier U1B. AM video and COR sensitivity voltage inputs to U1B determine its operation. AM input signals above threshold set by the COR sensitivity control cause U1B to switch, and turn on Q1, which passes the audio signal, and activates COR drivers Q2 and Q3. COR K1 closes at this time activating the front panel COR lamp. When the activating signal level falls below the set threshold, the squelch opens very rapidly. There is, however, a special delay feature associated with Q2 and Q3 which holds in the COR for a preset interval before deactivation.

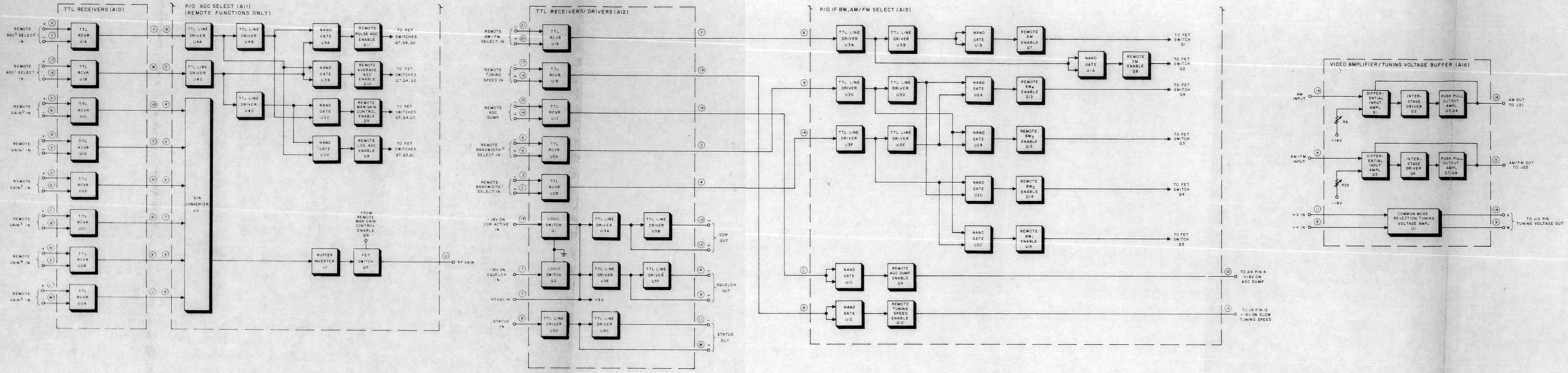


Figure 2-3. Type 215 Receiver, Remote Control Circuits, Functional Block Diagram

2.2.1.7 AGC Amplifier (A9). - This plug-in module provides gain control voltage for the receiver IF amplifier circuits. In addition, an AGC voltage for the installed tuner is provided when the receiver is operated in the MAN or REMOTE tuning modes and either the AM/AGC, FM or PULSE reception mode is selected. The gain-controlling output voltage from the module is derived from the AM video voltage in the AM/AGC, FM and PULSE reception modes and from the front panel RF GAIN control in the AM/MAN mode. In the three sweep tuning modes the IF AGC voltage is developed from the AM video by amplifier U1. This AGC voltage is selected by switch S1C-W which applies +18 V to AGC Select module, A11 pin K. This enables FET switch A11Q3 which applies the LOG IF AGC from the AGC amplifier, A9U1, to the IF amplifiers. When the receiver is operated in the MAN or REMOTE tuning modes, S1C-W applies +18 V to A11-L in MAN or A11-12 in REMOTE, which enables FET switch A11Q6 in MAN, or biases Q9 to conduct when it receives the proper logic level from the TTL Receivers, through A11U3C. When Q6 is turned on the voltage from the RF GAIN potentiometer is conducted from A11 pin V through the FET switch and out on A11 pin U. The voltage from A11 pin U is applied to module pin 14 of the AGC amplifier board, A9. The voltage is divided between Q12 and U2. The output from A9Q12, on module pin 11 is coupled through A11 pin R and FED switch Q4 to the IF Amplifier Assembly, A4, for IF AGC. The output voltage from A9U2, on pin 21, is applied through A11 pin W and FET switch Q2 to the RF tuner through RF AGC, jack J6, pin 10. Transistor A9Q9 delays the start of RF AGC until the IF AGC has reached a predetermined level. Transistor A9Q10 clamps the RF AGC voltage when it reaches a preset level. In the AM/AGC, FM, and PULSE modes, the input voltage is developed by AGC preamplifier circuits. The AGC preamplifier consists of switching circuits to select either normal AGC response or PULSE mode response. Input switch Q4 is activated in the AM/MAN, AM/AGC, and FM modes and applies the AM video signal to delay amplifiers, Q5, Q6, and Q7 and meter driver Q11 through a modulation filter. In the PULSE mode, Q4 is open and input switch Q3 is closed supplying pulse stretched video from Q1 and Q2 to the modulation filter. The filtered video signal is applied to delay amplifiers Q5 through Q7 which set the AGC threshold. The preamplifier voltage is buffered by Q8 and applied to AGC select module, A11 pin T, SIGNAL STRENGTH meter and the AGC monitor terminal, J16 pin 6. Meter driver transistor Q11 receives a portion of the output voltage from the modulation filter and drives the positive terminal of the SIGNAL STRENGTH meter. The negative terminal of the meter is driven by the AGC amplifier output voltage. Thus, the meter indicates the AM video level until AGC action begins. In the AM/MAN mode, S3B-X returns the negative meter terminal to ground through a termination so that the meter reads only the average AM signal level. The AM video input to the AGC module is also dc coupled out of the module to rear panel jack J17. This provides a vertical signal output for an

associated signal display. Switch section S2B-X is also used to terminate the AM video line when the receiver is switched to the FM reception mode. The AM video line load provided by the AUDIO and VIDEO GAIN control is removed in the FM mode position. The termination prevents an undesirable jump in AGC voltage when mode switching occurs.

2.2.1.8 In AM/AGC, FM and PULSE positions FET switches A11Q2, A11Q4, and A11Q7 are activated and direct the AGC signal to the IF Amplifier Assembly, A4, and the RF tuner as in the MAN position although the AGC voltage is derived from a different source.

2.2.2 Internal Control Circuits. - Figure 2-2 functionally illustrates the internal control circuits. These circuits are contained on modules A1, A2, A3, A5, and the receiver main chassis. The overall function of the circuitry is to determine the receiver tuning mode, select the IF bandwidth in the sweep tuning modes, and supply certain control and information outputs to auxiliary equipment used with the 215 Receiver. In the MAN tuning mode, a manual tuning voltage, developed by a precision potentiometer geared to the tuning drive and tape dial in the plug-in tuner, is inverted in the receiver and returned to the tuning head. The REMOTE TUNE mode function is identical except that the tuning voltage must be supplied to rear panel jack J23 and is coupled through common mode rejection amplifier A16U1. In the PAN mode, the entire range of the plug-in tuning head is swept at a rate set by the SWEEP RATE control. At the end of each sweep, the manual tuning voltage is switched to the tuning head for 5 ms so that the manually tuned frequency can be displayed on the associated frequency counter. The Ramp Generator and IF Selector Switch module, A2, develops the ramp tuning voltage and the 5 ms gate pulse output used to switch the tuning voltage. In the SECTOR tuning mode, any portion of the tuner range may be swept from zero to full range depending upon the settings of the manual tuning knob and the receiver SECTOR WIDTH control. The plug-in tuning head tuning knob essentially sets the center of the sector to be swept, and the receiver SECTOR WIDTH control determines the frequency dispersion from the center frequency. Also, at the end of each SECTOR sweep, the manually tuned frequency is switched to the tuning head for 5 ms as in the PAN mode. In the PAN/SEC mode, the receiver operation alternates between the PAN and SECTOR modes. Switching between these modes is accomplished by the split display switch (A1) and the tuning mode switch S1.

2.2.2.1 Ramp Generator and IF Selector Switch (A2). - This module performs two basic functions. One function is the automatic selection of the IF bandwidth in the PAN, SECTOR, and PAN/SEC tuning modes. Transistors Q1, Q3, and Q5 through Q7 perform this function. When the PAN sweeping mode is in use, the entire range of the tuner is swept. The wider IF bandwidth is automatically selected under those conditions.

This is also true in the SECTOR sweeping mode except when the sector width becomes less than 25% of the overall bandwidth of the installed tuner. Then, a narrowband IF is automatically selected to give increased resolution on the associated signal display. When transistor Q1 conducts, +18 volts is supplied to the wideband IF output pin of J6, and Q7, when conducting, supplies current to the narrowband IF output of J6. Determining which of the four available IF bandwidths will be narrowband or wideband is accomplished by jumper wires in the plug-in tuning head as shown by dotted lines in the block diagram. A Schmidt trigger circuit formed by Q3, Q6, and Q5 determines the conduction of Q1 and Q7. In the PAN tuning mode, the trigger state allows Q1 to conduct selecting the wideband IF. In the SECTOR mode and the SECTOR portion of the PAN/SEC mode, the Schmidt trigger will change state as a function of the settng of the SECTOR WIDTH control. When the trigger changes state, Q1 is turned off and Q7 on. This action connects the +18 volt source to the narrowband IF select circuit and de-energizes the wideband IF amplifier.

2.2.2.1.1 The second function of the module is the generation of the ramp, count blank and gate pulses, and the count period. Transistor Q9 operates from constant current source Q8 to produce a linear ramp waveform followed by a fixed 5 ms steady-state period. The ramp interval is variable from about one sweep every 25 seconds to 25 sweeps per second by the SWEEP RATE control. Transistor Q4 generates a count blank pulse which corresponds to the 5 msec count period. The count blank pulse drives Q2 which synchronizes the operation of split display switch (A1) under certain conditions. In the PAN, SECTOR, and PAN/SEC modes, blanking of the associated signal display CRT trance and generation of a gate pulse is also accomplished by Q4. Amplifier U1 is driven from ramp generator Q9 and provides four outputs: a ramp output to J7, a horizontal output to J17, a ramp output to module A5, and ramp voltage to output switch Q11. In the PAN, SECTOR, and PAN/SEC modes, Q10 opens Q11 to form the 5 ms count period. Subsequent circuits will insert the manual tuning voltage during this interval. In the MAN and REMOTE modes, output switch Q11 is always open because Q10 is held on by the +18 volt input at module pin 14.

2.2.2.2 Split Display Switch (A1). - The split display switch performs three major functions. The first is electronic switching between the PAN and SECTOR tuning modes. The second function is to reduce by a factor of one-half, the video output to the associated signal display and shifting the video dc level when operating on the PAN/SEC tuning mode. The third function is to provide a delayed trigger to the associated frequency counter to initiate the counter operating cycle when the receiver is operating in any of its sweeping modes.

2.2.2.2.1 A bi-stable flip-flop, Q2-Q3, provides mode switching in con-

junction with Q6 through Q8, Q10, and Q11 and main chassis tuning mode switch S1. The flip-flop is controlled by inputs from tuning mode switch S1 and a trigger input from module A2. Synchronization of the mode switching with the end of the count blank period is accomlished by the trigger input. When operating in the PAN/SEC mode, the flip-flop changes state with each trigger pulse input. In the SECTOR mode, Q3, Q6, and Q7 are on. With Q7 on, Q8 is helf off and the ramp voltage entering the module at pin 9 has no output path. However, with Q7 on, Q11 is off allowing Q10 to conduct. With Q10 conducting, the sector width voltage (a portion of the ramp) is conducted to module pin 12. When the flip-flop changes state, Q2 conducts and Q3, Q6, Q7, Q8, Q11, and Q10 change state. The full ramp voltage is then conducted through Q8 to the module output and the sector width voltage is disconnected by Q10. Operation in either the PAN or SECTOR mode individually is provided by forcing the flip-flop to the appropriate state by switched +18 volts from S1A-W through module pins 5 (SECTOR) and 6 (PAN).

2.2.2.2.2 Video gain switch Q5 and SEC level shifter Q4 are operational only in the PAN/SEC mode. Transistor Q5 is switched on by the +18 volt PAN/SEC voltage and provides a voltage divider on the video output line of module A9 at pin E. This reduces the video voltage supplied to the associated signal display by a factor of one half. This allows the SECTOR sweep to be displayed on the upper half of the signal display CRT and the PAN sweep on the lower half. Transistor Q4 conducts only on the SEC portion of the PAN/SEC mode operation. When Q4 is on it provides a dc offset on the video output voltage which shifts the associated signal display baseline to the CRT center for the SEC trace. Counter flip-flop transistors Q9 and Q12 provide a trigger pulse output to an associated frequency counter and initiate its operating cycle when the receiver is operating in one if its sweeping modes. This flip-flop provides a time delay before triggering the counter after the manual tuning voltage is switched to the receiver plug-in tuning head. This allows the tuning head local oscillator to stabilize before the counter operates. Transistor Q1 conducts to inhibit the flip-flop operation on the PAN portion of the PAN/SEC mode. Thus the counter is triggered only at the end of each SEC sweep in this mode. A dc voltage output is provided from module pin 7 which connects to marker jack J24. This voltage provides a slight shift in the marker voltage during the SEC portion of the PAN/SEC operating cycle for better trace definition.

2.2.2.3 Sweep Control (A3). - The sweep control module combines the various inputs to provide the tuning voltage configurations appropriate to each operating mode. Inputs include: manual tuning voltage, gate pulse, PAN or SECTOR ramp, fine tune voltage, and AFC voltage. Switching transistors Q1 through Q5 control the ramp and manual tuning voltage inputs to tuning voltage amplifier U1. In the PAN tuning mode, the output voltage from U1 is the PAN ramp followed by a 5 ms inter-

val of manual tuning voltage. This is accomplished by having Q2 initially off, Q3, on, Q5 on, Q1 off, and Q4 off. Under these conditions, the manual tuning voltage is prevented from reaching U1 by the opening of Q1 and the low impedance path to ground presented by Q5. The PAN ramp voltage from module A1 reaches U1, however, as Q4 is open. At the end of the PAN sweep, the gate pulse input switches Q3 and Q4 off. With Q3 off, Q1 conducts and Q5 opens allowing the manual tuning voltage to reach U1. In the SECTOR mode, or the SEC portion of the PAN/SEC mode, the output from U1 is the SECTOR ramp summed with the manual tuning voltage. This is followed by the manual tuning voltage only during the count interval (gate pulse). The configuration is accomplished by switching Q2 on by the +18 volt input to module pin 17. With Q2 off, Q3 conducts turning Q5 off and Q1 on. The control supplies by Q2 overrides the gate pulse input to Q3 allowing it to remain on. Now the gate pulse switches Q4 off during the SECTOR sweep interval and on during the count interval. This provides a sum of the SECTOR ramp and the manual tuning voltage during the SECTOR sweep, and only the manual tuning voltage during the count interval. Operation of the module on the MAN and REMOTE modes is identical to the SECTOR mode except that the gate pulse voltage is always held high by the +18 volt input to A2Q10 (ramp generator control). This holds Q4 constantly on. Thus, the only inputs to U1 are the manual tuning voltage, fine tune voltage, and AFC voltage. Tuning voltage amplifier U1 is an inverting amplifier for all of its inputs except the AFC voltage. Buffer amplifier U2 supplies the tuning voltage outputs to J5.

2.2.2.5 Marker Generator (A5). - This module performs two basic functions: intensity modulation (Z axis control) of the CRT beam in an associated signal display unit and generation of an oversweep indication whenever a tuning voltage is present that would cause the tuner to produce a frequency above or below its tuning range. The marker signal at J24 from output control Q2 may be one of three basic levels: zero, +0.5 V , or +1.2 V. The zero, +0.5 V, and +1.2 V outputs correspond to no trace, a trace of normal intensity, and a brighter than normal trace. five different inputs are used to determine the three output levels from Q2: a MAN, REMOTE, or SECTOR mode selection voltage, switch Q1, the count blank pulse, the oversweep circuit, and an external blanking input. Either the count blank pulse or an external blanking pulse will override any other condition and cause the marker output to go to zero volts. An output from either comparator U5 or U6, when the tuning voltage exceeds +10.3 V or -10.3 V, will similarly force the output of Q2 to zero and also provide a +15 V output on J16 pin 8 to indicate the oversweep condition. In the SECTOR, MAN or REMOTE tuning modes, a control voltage causes Q2 to produce a +1.2 V output except during blanking or oversweep. In the PAN mode or PAN portion of the PAN/SEC mode, Q2 produces +0.5 V in the absence of any inputs. With an input from switch Q1, Q2 will produce the +1.2 V output.

2.2.2.4.1 Marker generator module stages U1 through U4 use three input signals to control switch Q1: the ramp waveform, the sector width voltage, and the manual tuning voltage. A resistive divider network is used to place various combinations in equal proportions of the three signals on the inverting and non-inverting inputs of U3 and U4. If the sector width voltage is not present, both U3 and U4 will switch when the ramp amplitude exceeds the manual tuning voltage. By summing the sector width voltage with the manual tuning voltage in one comparator and with the ramp in the other, the following is achieved. Comparator U3 output will go from -18 V to +18 V when the sum of the sector width voltage and the ramp exceeds the manual tuning voltage. The output of U4 at that time is -18 V and Q1 will turn on, causing Q2 to produce a +1.2 V output. To cause U4 to switch, the ramp amplitude must now exceed the sum of the manual tuning voltage and the sector width voltage. When this happens, the output of U4 switches from -18 V to +18 V. The same voltage from both U3 and U4 causes Q1 to turn off. The result is that the CRT trace is intensified (+1.2 V output from Q2) only when Q1 is on. This intensification occurs over a portion of the ramp waveform corresponding to the setting of the SECTOR WIDTH control and occurs on the ramp at a point corresponding to the setting of the manual tuning control.

2.2.3 Remote Control Circuits. - Figure 2-3 illustrates the functional interconnections between the various remote controlling circuits in the 215 Receiver. These circuits are located on plug-in printed circuit boards A10 through A13 and A16. Portions of boards A11, A13, and A16 operate during the local operation of the receiver and are controlled by the front panel controls. In the REMOTE reception mode, the same circuits are used, but are controlled by remote command signals from the remaining boards.

2.2.3.1 TTL Receivers (A10). - The heart of the TTL receivers board is two quad operational amplifier integrated circuits. The input circuits consist of resistive voltage dividers with diode clamps for protection. A single +5 V supply is used to operate the TTL receivers and the diodes in the input circuit prevent the IC inputs from ever going negative. A -0.3 V input voltage would destroy the operation amplifier.

2.2.3.1.1 Input signals to select the AGC operating mode and to provide the six bit remote gain control voltage are applied to the inputs of the TTL receivers which compare the voltage on the non-inverting input to that on the inverting input and if no difference in potential is seen, produces an approximately zero volt output. As soon as there is a difference in potential between the two inputs the TTL receiver switches states and produces an approximate +3.5 V output. This change in output state is then coupled from the TTL receivers module to the AGC select module (A11) to either select the appropriate AGC operating module or, in the

case of REMOTE gain control, to program the digital to analog converter, A11U2, to produce the desired gain control voltage.

2.2.3.2 AGC Select (A11). - This module consists of bi-polar transistor switch drivers Q8-Q11, FET switches Q1-Q7, six integrated circuit TTL line drivers U4a-U4f, Quad dual input NAND gate selector package U3a-U3d, digital to analog converter U2 and analog output buffer U1.

2.2.3.2.1 AGC mode select switch driver transistors Q8-Q11 are enabled by +18 V applied to their emitters when the receiver is in the REMOTE mode of operation. The appropriate switch driver is then turned on by the change in logic state by the corresponding NAND gate in IC package U3. When the switch driver is turned on it energizes three of the depletion mode FET switches allowing the desired AGC voltage from AGC amplifier (A9), the front panel RF gain control or the REMOTE six bit digital gain control to be processed by the AGC amplifier and and distributed to the IF amplifier assembly (A4) and the plug-in RF tuner assembly.

2.2.3.3 TTL Receivers/Drivers (A12). - This multifunction module controls remote selection of IF bandwidth, AM or FM signal processing, AGC dump and tuning speed. Also provided are squelch and COR activity indication signals and a status output indication to inform a remote operator of the control mode, local or remote, of the receiver. The control function commands are processed by two quad TTL receiver IC packages to convert the input information to TTL format for processing by IF Bandwidth, AM/FM Select board A13. Information from squelch, COR and status indicating sources is processed by TTL line drives package U3 and is available at rear panel jack J18. Operation of the TTL receivers in this module is identical to that in the TTL receivers module A10.

2.2.3.3.1 Receiver status information from front panel switch S1C-X consists of an open circuit in all positions except REMOTE, in which case the status line is grounded. An open circuit at the status input, U3 pin 9 is interpreted as a high state. A high state at the input will produce a low state at U3 pin 8 and a high state at U3 pin 6. A ground at the status input is sensed as a low state and the outputs reverse logic states.

2.2.3.4 IF Bandwidth, AM/FM Select (A13). - This module receives AM and FM signals from the IF amplifier assembly, A4, and switches one or the other to the video amplifier in module A16. Next is four FET switches to switch in an appropriate load on the FM input line to maintain an equal signal level over all IF bandwidths. These FET switches are activated by the bi-polar transistor switch drivers which are controlled by NAND gate package U2. Last is the AGC dump and the tuning speed switches controlled by NAND gate packard U1. All switch drivers, Q7, Q8 and Q12-Q15, and bi-polar switches Q9-Q11 are

information from the TTL Receivers/Drivers module, A12. The switch driver transistors are enabled by +18 V applied to their emitters when the receiver is set to the REMOTE reception mode.

2.2.3.5 Video Amplifier/Tuning Voltage Buffer (A16). - This module contains two identical video amplifiers and a common mode rejection amplifier, U1, to process the remote tuning voltage.

2.2.3.5.1 The video amplifier composed of Q1-Q4 only amplifies AM signals and is not dependent on the AM/FM select switches on the IF BW, AM/FM Select module and provides an AM output at J21 any time an AM signal is being received. The second video amplifier, A5-A8, amplifies the selected signal, either AM or FM, as determined by the IF BW, AM/FM Select module. Input signals are coupled to the base of one half of the input differential amplifier, amplified and coupled to the interstage amplifier. From the interstage amplifier the video signal is applied to the bases of the class B push-pull output stage and then to the output jack on the rear of the receiver. A portion of the output signal from the push-pull output stage is coupled back to the second half of the differential amplifier as negative feedback to improve stability and cross-over distortion.

2.2.3.5.2 Remote tuning voltage is applied to the inverting and non-inverting inputs of common mode rejection amplifier U1. The output from U1 is a -10 V to +10 V ramp tuning voltage which is applied to the plug-in tuning head.

2.3 TYPE 79848 SPLIT DISPLAY SWITCH

Figure 6-1 is the schematic diagram for this module; its reference designation prefix is A1.

2.3.1 PAN/SEC Switching. - In the PAN/SEC mode, the flip-flop (Q2-Q3) alternates the receiver operation between these modes. Operation of the flip-flop is controlled by a trigger pulse from ramp generator board A2 and +18 V inputs from tuning mode switch S1A on the receiver main chassis. The flip-flop drives electronic switches which provide: (1) switching of the ramp waveform; (2) a +18 V output on SEC, or SEC portion of the PAN/SEC mode; (3) a dc shift for the vertical output voltage for the associated spectrum display unit during the SECTOR portion of the PAN/SEC cycle; (4) inhibit triggering of the accessory DRO-308 frequency counter for the PAN portion of the PAN/SEC cycle; (5) a dc shift to the marker output voltage during the SECTOR portion of the PAN/SEC cycle; and (6) a reduction in the vertical output level (video) by a factor of two in the PAN/SEC mode.

2.3.4 Counter Trigger Inhibit. - Transistor Q1 is used to inhibit the counter trigger pulse output from Q9-Q12 during the PAN portion of the PAN/SEC cycle. When Q1 conducts, it holds the junction of R19 and CR9 high preventing the one-shot circuit from being triggered by the negative-going pulse at module pin 2. Transistor Q1 conducts when several conditions are met: (1) +18 V is applied to module pin 3; (2) transistor Q2 of the PAN/SEC flip-flop is conducting (PAN mode); (3) the PAN only mode has not been selected by main chassis switch, S1. As examination of these conditions shows that the counter trigger will be inhibited only during the PAN portion of the PAN/SEC mode. With +18 V

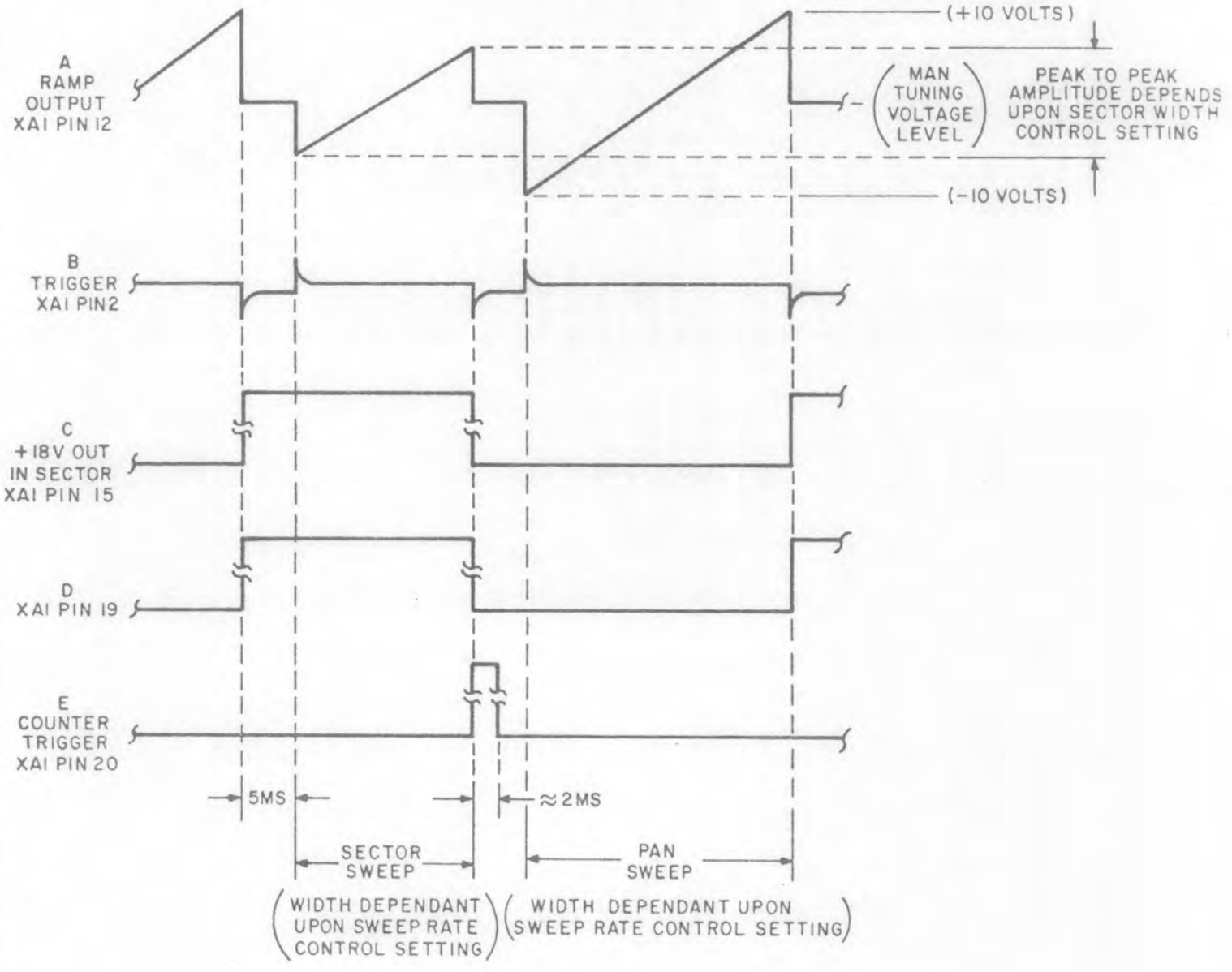


Figure 2-4. PAN/SEC Mode Tuning Diagram

2.3.2 PAN/SEC Timing. - A bi-stable flip-flop controls the PAN, SECTOR and PAN/SEC tuning mode switching for the Receiver. The flip-flop is triggered by negative-going pulses from the ramp generator board (A2). The trigger pulses occur at the end of each ramp waveform. In addition, the flip-flop is also controlled by the +18 V PAN, SECTOR, and PAN/SEC voltage inputs. Figure 2-4 illustrates the timing of the split display switch board for a complete PAN/SEC operating cycle. Waveform A is the switched ramp output from A1, pin 12. Waveform B is the trigger input applied to A1, pins 2 and 16. Waveform C is the +18 V output in SECTOR from A1, pin 15. Waveform D is the dc shift voltage for the SM-7301(A) vertical voltage during the SECTOR portion of the PAN/SEC mode. Waveform E is the delayed counter trigger pulse output from A1 pin 20. As shown in the diagram, the ramp output is alternated between the PAN and SECTOR sweeps in the PAN/SEC mode. When the 215 is operated in the PAN or SECTOR modes, the proper ramp is selected and counter triggering occurs every sweep, but the dc shifting of the SM-7301(A) vertical trace does not occur.

2.3.3 Bi-Stable Flip-Flop. - Refer to Figure 6-1. Transistors Q2 and Q3 form the bi-stable flip-flop. the trigger pulse input from module pin 16 is applied through R35 to capacitors C1 and C2. These capacitors couple the pulses to the bases of Q2 and Q3 through steering diodes CR4 and CR5. In all three sweeping modes (PAN, SECTOR, and PAN/SEC) +18 V is applied to module pin 3 from main chassis tuning mode switch, S1A. This voltage activates the switching circuitry. Assuming that the PAN/SEC mode is selected, there are no inputs to module pins 5 and 6 (+18 V in PAN, +18 V in SEC). Flip-flop Q2-Q3 will change state with each negative-going trigger input. With Q2 initially on, and Q3 off, the negative-going trigger is coupled through C1 and CR4 to the base of Q2 turning the transistor off. The rising collector voltage of Q2 is applied through R33 to the base of Q3 and holds it on. This flip-flop state (Q2 off, Q3 on) is the SECTOR enabled portion of the PAN/SEC modes. With Q3 on, the low collector voltage pulls the base of Q6 low through R14. Since the emitter of Q6 is at +18 V, the transistor conducts and supplies +18 V to module pin 15. When Q6 conducts and its collector voltage goes high, the change is reflected through VR1, R16, and R17 to the base of Q7 which also conducts providing -18 volts at its collector. The -18 volts turns Q8 off through CR7 and turns Q11 off through R23. With Q8 off, the PAN ramp path to the module ramp output (module pin 12) is broken. With Q11 off, the source-to-gate voltage of Q10 allows it to conduct completing the path for the SECTOR width ramp from module pin 13 to module pin 12. During the SECTOR sweep, the associated signal monitor trace intensity is reduced slightly. This is accomplished by diode CR8 and R26 from the collector of Q7. The negative voltage coupled through the diode and R26 to module pin 7 slightly reduces the high intensity voltage output (approximately +1.2 V) from the marker generator, A5.

applied to module pin 3, diode CR1 supplies the voltage to the emitter of Q1. Transistor Q1 will conduct when its base is pulled low by Q2 conducting and only if +18 V is not supplied to module pin 6 (PAN mode) and coupled through CR6 to the base of Q1.

2.3.5 SECTOR Portion dc Shift, Video Reduction. - Transistor Q4 supplies a dc shift to the vertical output voltage to the Signal Display Unit during the SECTOR portion of the PAN/SEC cycle. In the PAN/SEC mode, +18 V is applied to module pin 18 which is applied through R7 to the base of Q5 and through CR2 to the emitter of Q4. Transistor Q5 conducts adding R13 in parallel with the vertical output line through module pin 19. This forms a voltage divider with components on the AGC board (A9) which reduces the vertical (video) output by a factor of two. Transistor Q4 conducts on the SECTOR portion of the PAN/SEC cycle to supply a positive voltage through R11 and R12 to the vertical output line which shifts the trace position on the SM-7301(A). During the PAN/SEC mode of operation, the SECTOR portion baseline is at the middle of the CRT screen and the PAN trace baseline is at the bottom of the CRT. Potentiometer R11 allows exact positioning of the SECTOR trace. Transistor Q4 and Q5 are active only during the PAN/SEC mode because the +18 V input at module pin 18 is not present in any other mode.

2.3.6 PAN, SECTOR, Mode Switching. - Mode switching in the PAN and SECTOR tuning modes is also accomplished by flip-flop Q2-Q3. However, in these modes, the flip-flop is forced to the appropriate state by either the +18 V applied to module pinn 5 or 6. Note that in the SECTOR mode, +18 V is supplied through CR11 and R31 to module pin 7. This voltage counteracts the voltage from CR8 and R26 allowing full SECTOR trace identification.

2.4 TYPE 79611 RAMP GENERATOR AND IF SELECTOR SWITCH

The Type 79611 Ramp Generator and IF Selector Switch develops the basic ramp signal, blanking and trigger pulses, and the automatic IF bandwidth selection. A schematic diagram of the module is shown in Figure 6-2; its reference designation prefix is A2.

2.4.1 IF Select Circuits. - When the receiver is in the PAN, SECTOR, or PAN/SEC tuning modes, the IF bandwidth is automatically selected and activated. In the PAN mode, the IF bandwidth is a function of the tuning range of the installed tuner. In the SECTOR mode, the selected IF bandwidth is a function of the tuning range of the installed tuner and the width of the sector being swept. At maximum sector width, a wide IF bandwidth will be activated. As the sector width decreases to about 25% of maximum, a more narrow IF bandwidth will be selected. In the PAN, SECTOR and PAN/SEC tuning modes, +18 V is applied to module

2.4.3 Count Blank and Trigger. - As explained in the previous paragraph, diode CR1 is turned on and off as the ramp and count period are generated. The voltage at the collector of Q4 is therefore low when CR1 is on (while the ramp is generated) and high when CR1 is off during the count period. This pulsed waveform is the count blank pulse which is coupled out through module pin 19. In addition, the count blank pulse is connected through R7 and "speed up" capacitor C2 to amplifier Q2. The output at the collector of Q2 is differentiated at module pin 20 by capacitor C5 operating into the input resistance of the split display switch module. This differential waveform is eventually used to trigger an associated counter. The count blank pulse will be used to blank the trace on an associated CRT display during the count period.

2.4.4 Ramp Outputs. - The basic ramp and count period waveform at the emitter of Q9 is connected to the non-inverting input (pin 3) of operational amplifier U1. Potentiometer R24 sets the gain of the stage. Potentiometer R22 is used to center the output waveform so that the positive and negative excursions of the ramp are equal. The ramp, ramp to marker, and horizontal amplifier outputs are supplied through module pins 7, 10, and 9.

2.4.5 Switched Ramp Output. - The count blank pulse at the collector of Q4 is applied to the base of Q10 through 18 V zener diode VR1. This turns Q10 on and its collector goes from +18 V to -18 V. The gate pulse output at module pin 12 is therefore +18 V during the sweep period and -18 V during the count period. The -18 V level during the count period forward biases diode CR4 which turns Q11 off. The output at module pin 11 is the ramp output from U1 interrupted during the count period. When the receiver is in the MAN or REMOTE TUNE modes, a steady +18 V level through module pin 14 keeps Q11 off.

2.5 TYPE 791036 SWEEP CONTROL

The Type 791036 Sweep Control provides the proper tuning voltage to the installed tuner based on whether the MAN, REMOTE TUNE, SECTOR, PAN or PAN/SEC tuning mode has been selected. A schematic diagram for this module is shown in Figure 6-3; its reference designation prefix is A3.

2.5.1 Pan Tuning Mode. - When the PAN tuning mode or PAN portion of the PAN/SEC mode is selected, the switched ramp is connected to module pin 14 and the gate pulse is connected to module pin 20. The manual tuning voltage, which can be any level from -10 V to +10 V, is present at module pin 21. Note that transistor Q1 is a junction field effect transistor which operates in the depletion mode while Q4 and Q5 are insulated-gate field-effect transistors which operate in the enhancement mode. This means that a set of conditions which will turn Q1 on,

pin 6. Transistor Q1 is then turned on by a voltage divider from the +18 V to -18 V supplies through R8, R9, R12, and R17, assuming the SECTOR mode has not been selected and +18 V does not appear at module pin 3. Transistor Q5 is a constant current source to operate transistors Q3 and Q6.

2.4.1.1 When the receiver is in the PAN tuning mode, Q1 is on, Q6 and Q7 are off, and Q3 may either be on or off as determined by the setting of the SECTOR WIDTH control. The arm of this main chassis control is connected through module pin 2 and controls the on-off status of Q3. As long as Q6 and Q7 are not enabled, the on-off action of Q3 has no effect. Transistor Q1 is always on and +18 V is supplied through module pin 5 and subsequent circuits to energize a wideband IF strip.

2.4.1.2 Once the SECTOR tuning mode has been chose, +18 V is applied to module pin 3. Under this condition, Q3 and Q6 form a Schmidt trigger, under the control of the SECTOR WIDTH potentiometer. With the SECTOR WIDTH control at the maximum CW position, Q3 is on, Q1 is on, and +18 V is supplied through module pin 5 as previously described. As the setting of the control is reduced, the voltage at the base of Q3 falls to a point where Q3 turns off. at that time, the collector of Q3 goes positive and this change is coupled through R12 to the base of Q6 which turns on. Transistor Q6, when conducting, turns Q7 on and Q1 off. A +18 V source to energize a narrow band IF amplifier is now connected through module pin 4.

2.4.2 Ramp Generator. - The basic ramp or sawtooth waveform is generated by charging capacitor C3 from a constant current source. This source is transistor Q8 with diode CR2, resistors R20 and R18, and front-panel SWEEP RATE potentiometer R2 in the base-emitter circuit. The ends of the SWEEP RATE potentiometer are connected across module pins 16 and 17 while the arm is connected to +18 V. This arrangement provides for smooth action of the control. The charging path for C3 is through R15, CR1, and Q8. When the collector of Q8 reaches approximately 11 volts, unijunction transistor Q9 turns on. The end of C3 which is connected to the emitter of Q9 is now pulled down to ground. The other end of C3 is therefore below ground and CR1 stops conducting. Capacitor C3 then charges from ground through the base one emitter junction of Q9 and R14 to the +18 V supply. After approximately 5 ms, the charge on C3 will reach a value large enough to turn CR1 back on again, completing the cycle. The output at the emitter of Q9 is a ramp followed by a 5 ms steady-state period. The repetition rate of the ramp is variable from about one every 25 seconds to 25 per second by the SWEEP RATE control. The 5 ms interval is the count period and remains a constant length regardless of the duration of the ramp.

will turn Q4 or Q5 off and vice versa. During the sweeping period, the gate pulse level is +18 V. This turns Q4 off and Q3 on. The -18 V at the Q3 collector then forward biases CR4 and turns Q5 on. When diode CR4 turns on, Q1 turns off. Under these conditions, the manual tuning voltage is disconnected, the switched ramp is connected to the inverting input of operational amplifier U1, and the parallel input to U1 is grounded by Q5. During the count period, all conditions are reversed. The -18 V level of the gate pulse turns Q4 on, Q3 off, CR4 off, and Q1 on. Now, the manual tuning voltage is connected to the inverting input of U1 and the switched ramp is grounded through Q4.

2.5.2 Sector Tuning Mode. - The conditions in the SECTOR tuning mode, or SECTOR portion of the PAN/SEC mode, are similar to the PAN tuning mode. The gate pulse and manual tuning voltage are present at module pins 20 and 21, respectively. The switched ramp is also present at pin 14 but it is now connected from the arm of the main chassis SECTOR WIDTH control. The most significant difference is that the +18 V source is now applied to module pin 17. This voltage turns Q2 on which turns Q3 off. This means that Q1 is on and Q5 is off during both the sweeping period and the counter period. The output of U1 during the sweeping period is therefore the sum of the manual tuning voltage and the ramp waveform.

2.5.3 Man Tuning Mode. - During the MAN tuning mode, +18 V is connected to module pin 18. This voltage turns Q2 on, Q3 off, Q5 off, and Q1 on as in the SECTOR sweeping mode. However, the input at pin 20 is now steady -18 V signal which turns Q4 on and the switched ramp signal is not present at module pin 14. The output of U1 is the inverted manual tuning voltage from module pin 21.

2.5.4 Remote Tuning Mode. - In the REMOTE tuning mode, only the tuning monitor portion of the module is used. The REMOTE tuning voltage from Video Amplifiers/Tuning Voltage Buffer A16 is coupled directly to the tuning head.

2.5.5 Sweep Control Output. - Operational amplifier U1 is used as a dc amplifier. Potentiometer R13 adjusts the input level to amplifier U1. Resistor R19 and capacitor C1 provide input frequency compensation. The voltage at the arm of potentiometer R23 is coupled through resistor R21 to U1 and sets the dc offset voltage from the operational amplifier. The output, inverted from the input, at pin 6 of U1 is as follows for the tuning mode combinations:

(1) In PAN or PAN portion of PAN/SEC the output of U1 durint the sweeping period is the inverted ramp. During the count period the output of U1 is the inverted manual tuning voltage.

(2) In SECTOR or SECTOR portion of PAN/SEC the output of U1 during the sweeping period is the sum of the inverted ramp and the inverted manual tuning voltage. The output during the count period is the inverted manual tuning voltage.

(3) In MAN or REMOTE TUNE, the output of U1 is always the inverted manual tuning voltage.

2.5.6 Fine Tuning and AFC. - The arm of the FINE TUNING control is connected to a voltage divider formed by R25 and R26. This voltage at module pin 13 can be at any level between +10 V and -10 V. From the voltage divider, the fine tuning input is applied to the inverting input of U1 (pin 2) through isolation resistor R24. The AFC (or DAFC as the case may be) corrective voltage, if used, is connected to a voltage divider formed by R18 and R16 at module pin 12. From the divider, this signal is connected to the non-inverting input of U1 (pin 3) through isolation resistor R17. The tuning voltage output from U1 can therefore be affected by either the fine tuning or AFC inputs.

2.5.7 Tuning Monitor. - The output of U1 is applied to the inverting input of operational amplifier U2 through switch S1D to module pin 7. The ratio of R29 to R27 sets the gain of U2 at unity. The output of U2 is therefore at the same level as the input except it is inverted.

2.6 TYPE 72418 IF AMPLIFIER ASSEMBLY

The IF amplifier assembly contains IF amplifier and demodulator circuits with bandwidths of 10 kHz, 50 kHz, 300 kHz, and 1 MHz. Almost all of the circuitry is contained on eight printed circuit boards located within the assembly. An overall schematic diagram of the IF amplifier assembly is shown in Figure 6-4. Schematic diagrams for the eight subassemblies are shown in Figures 6-5 through 6-11. The reference designation prefix for the IF amplifier assembly is A4; the subassemblies therefore have reference designation prefixes of A4A1 through A4A8.

2.6.1 Input. - The 21.4-MHz input signal in cabled from main chassis jack J5 pin A1 to the IF amplifier input connector J1 through a strap in the RF monitor, A7. From J1 the incoming signal is simultaneously applied to the inputs of all four IF amplifier boards through pin 21 on each board (refer to Figure 6-4). Note that gain control voltages through C25 are applied to all IF amplifiers through pin 8 on each module.

2.6.2 Output. - The 21.4-MHz outputs of all four IF amplifiers (A4A1 through A4A4) at pin 2 are connected in parallel and then applied to the input of IF output amplifier A4A8 through pin 21 of that module. From pin 9 of A4A8, a 21.4-MHz output is connected to the limiter/discriminator subassemblies (A4A5 through A4A7) at pins 21. The FM video

outputs from A4A6 and A4A7 (through module pins 2) utilize a common video amplifier located on A4A5, the 1-MHz Limiter/Discriminator. This connection is made through A4A5 pin 10. The AM video output is taken from A4A8 pin 2 and connected to feedthru capacitor C12. In a similar fashion, the FM video output is obtained at A4A5 pin 2 and connected to C24.

2.6.3 Control. - Seven of the eight subassemblies are enabled and disabled as a function of receiver tuning mode (PAN/SEC, MAN, SECTOR, PAN or REMOTE TUNE), and within these modes by the frequency range of the tuner installed, the setting of the SECTOR WIDTH control, and the setting of the IF BANDWIDTH control This action is accomplished by switching the +18 V source through sixteen different feedthru capacitors as shown in Figure 6-4.

2.6.3.1 In the MANUAL TUNE mode, +18 V from the wiper of main chassis switch S2A-W is connected to C13 and C26, C19 and C28, C1 and C15, and C3 and C17 for operation of the 10 kHz, 50 kHz, 300 kHz, and 1 MHz IF bandwidths, respectively.

2.6.3.2 In the PAN and PAN portion of the PAN/SEC modes, an IF bandwidth is chosen based on the frequency range of the tuning head. In the 500 to 5000 MHz band, the 1-MHz IF bandwidth is enabled. In the VHF bands, the 300-kHz IF bandwidth will normally be in operation. For lower frequency ranges, the 50-kHz bandwidth will usually be selected. At pin 5 of the ramp generator module, +18 V is supplied when the receiver is in the PAN mode. This voltage is connected to jack J6, pin 14. The installed tuner will connect this +18 V source back through J4 on pin 6, 7, or 8 as applicable. The various bandwidths are then enabled through C14 and C27, C20 and C29, C2 and C16, and C4 and C18, corresponding to 10 kHz, 50 kHz, and 1 MHz.

2.6.3.3 In the SECTOR mode and SECTOR portion of the PAN/SEC mode, one of two IF bandwidths can be enabled for each tuning head as a function of the setting of the SECTOR WIDTH control. From 25% rotation to maximum clockwise rotation of this control, the IF bandwidth selection is the same as for the PAN mode as described in paragraph 2.6.3.2. As the sector width is decreased from maximum CW to a point representing 25% of the range of the control, the +18 V present at pin 5 of the ramp generator module is removed and +18 V is applied to pin 4 of the ramp generator module. From pin 4, this voltage is connected to jack J4, pin 13. A strap in the tuning head connects pin 13 to J6 pin 5, 6, or 7 as applicable to provide the next lower IF bandwidth than would be operative in the PAN mode. This operating feature has been provided to allow a higher resolution display with the narrower sector widths.

2.6.4 Type 72292 10-kHz Bandwidth and Type 72293 50-kHz Bandwidth IF Amplifiers. - The 10-kHz Bandwidth IF Amlifier carries reference designation prefix A4A1. The 50-kHz Bandwidth IF Amplifier has reference designation prefix A4A2. The schematic diagram for both units is shown in Figure 6-5. As stated in Note 3 on the schematic diagram, the design of both IF amplifiers is identical except for a few frequency determining values.

2.6.4.1 The 21.4-MHz IF input signal is connected through pin 21 of the plug-in module and coupled through C2 to the base of Q2. Transistors Q1 and Q2 form a cascode amplifier. The collector circuit of Q1 is tuned by L1, C8, and C9. A capacitive voltage divider, C8 and C9, is used to match the input impedance of the crystal filter FL1. This filter sets the bandwidth if the IF amplifier at either 10 kHz or 50 kHz as applicable. A similar impedance match is made at the output of the filter into the tuned circuit formed by L2, C10, and C11.

2.6.4.2 Transistor Q3 is a dual-insulated gate MOS FET IF amplifier. The 21.4-MHz signal is applied to one gate (pin 3) of Q3 through blocking capacitor C12. A gain control voltage from module pin 8 is applied to the other gate (pin 2) of the FET, through R14. Diode CR3 provides a return path for the gate (pin 2) bias for Q3 with no AGC voltage applied. In addition, the diode provides protection for the FET should a transistor in the AGC circuit short. If a short should occur, CR3 provides a clamp on the AGC input protecting the FET. With no signal input, diode CR3 is forward biased by the +18 V source through R15 and R16. This action clamps the junction of R14 and R16 at +0.6 V. When the incoming gain control voltage swings sufficiently negative to turn CR3 off (approximately -0.6 V), the gate (pin 2) voltage on Q3 follows the AGC voltage.

2.6.4.3 The IF output at the drain of Q3 (pin 1) is connected to the base of Q4 through C17. The collector circuit of Q4 is tuned by L3, C19, and C20. Capacitor C21, places the lower end of the tuned circuit at RF ground. The output is coupled through diode CR4 which is used as a switch. When the IF amplifier is energized, CR4 is forward biased from the switched +18 V source through R18, R21, and R28. When this amplifier is not selected, CR4 disconnects the tuned circuit in the collector of Q4 from similar circuits in the other parallel amplifiers. Potentiometer R26 in the emitter circuit of Q4 controls the amount of degeneration and hence the gain of the stage. Similar controls are used in all four IF amplifiers to normalize the gain-bandwidth product.

2.6.4.4 The IF amplifier is turned on by a control voltage which may be applied to either module pin 15 or 16. In the MANUAL and REMOTE TUNE modes, switching occurs through pin 15 and diode CR1 becomes forward biased. In the PAN, PAN/SEC and SECTOR modes, the IF strip is turned on by connecting +18 V to pin 16 which forward biases

diode CR2. The two diodes are used to isolate the two +18 V lines from each other. Diode VR1 zeners at 18 volts which turns Q2 on and provides an operating point of approximately zero volts to complete the base biasing network for the input cascode amplifier.

2.6.5 Type 72291 300-kHz Bandwidth IF Amplifier. - The 300-kHz IF Amplifier (reference designation prefix A4A3) is similar in design to the IF amplifiers described in preceding paragraphs. The major difference is that discrete components form the bandpass filter in the 300-kHz strip while crystal filters are used in the 10-kHz and 50-kHz strips. The schematic diagram for the 300-kHz IF Amplifier is shown in Figure 6-6.

2.6.5.1 The 300-kHz bandwidth IF amplifier is turned on by the application of +18 V to either module pin 12 or pin 13. In the MANUAL and REMOTE TUNE modes, +18 V is connected to pin 13. In the PAN, PAN/SEC or SECTOR modes, the enabling voltage is connected to pin 12. Diodes CR1 and CR2 are used to isolate the two voltage supplies from each other.

2.6.5.2 The 21.4-MHz IF input signal is connected to pin 21 of the module and coupled through blocking capacitor C2 to the base of Q2. This transistor and Q1 form a cascode amplifier. The bandwidth of the IF strip is determined by a three pole filter located between the cascode stage and Q3, and a two pole filter located between Q3 and Q4. Coupling between the first three poles is accomplished by C8 and C11. Capacitors C23 and C25 provide an impedance adjustment between the filter and the input of Q3. A similar function is performed by C24 and C26 at the output of the second filter.

2.6.5.3 Stage Q3 is a dual-insulated gate MOD FET gain-controlled 21.4-MHz amplifier. The incoming signal is connected to gate 1 (pin 3) while the gain control voltage is connected to gate two (pin 2). Diode CR3 provides a return path for the biasing voltage divider until the AGC voltage swings sufficiently negative to reverse-bias it. In addition, it provides protection for the FET should a transistor in the AGC circuit short. In which case CR3 conducts and provides a voltage clamp.

2.6.5.4 The bandwidth limited 21.4-MHz signal at the output of the two-pole filter is applied to the base of amplifier stage Q4. The output is taken from the collector of Q4 through module pin 2. Potentiometer R27, in the emitter circuit of Q4, is used to set the gain of the stage to achieve gain-bandwidth normalization.

2.6.6 Type 72290 1-MHz Bandwidth IF Amplifier. - A schematic diagram of the 1-MHz bandwidth IF amplifier is shown in Figure 6-7; its reference designation prefix is A4A4. The design of this IF strip is very similar to the design of the 300-kHz bandwidth IF strip previously de-

scribed. The only essential difference exists in the filter design. In the 300-kHz bandwidth IF strip, the bandwidth was determined by a three pole filter which was followed by a two-pole filter. In the 1-MHz bandwidth IF strip, a five-pole filter is used to set the bandwidth. The five poles are coupled together by C8, C11, C14 and the parallel combination of C17 and C18. The explanation of the 300-kHz bandwidth IF amplifier in paragraph 2.6.5 is applicable to this circuit.

2.6.7 Type 72285 IF Output Amplifier. - The 21.4-MHz IF signal from the selected IF strip is connected to the IF output amplifier module. A schematic diagram for the module is shown in Figure 6-11; the complete reference designation prefix is A4A8.

2.6.7.1 The input signal through module pin 21 is applied to gate 1 of MOS FET IF amplifier Q1. A delayed gain control voltage, connected to gate 2 (pin 2), is used on this stage. The manual or automatic gain control voltage at module pin 18 is zero volts for maximum gain and -6.6 volts for minimum gain. With zero volts at pin 18, diode CR1 is forward biased from the +18 V source through resistors R18, R5, R4, and R2. Gate 2 of Q1 is therefore clamped until the voltage at pin 18 is sufficiently negative to turn CR1 off.

2.6.7.2 The drain circuit of Q1 is broadly tuned to 21.4 MHz be inductor L2 which resonates with various small capacitances in the circuit. Emitter follower Q2 provides a constant load for the tuned circuit. Stage Q3 is an IF amplifier with a gain control potentiometer in its emitter circuit. The input impedance of Q3 is therefore partially a function of the setting of potentiometer R20, and would present a varying load to Q1 if emitter follower Q2 was not present.

2.6.7.3 Transistors Q4 and Q5 form a cascode IF amplifier. The incoming signal is applied to the base of Q5 through blocking capacitor C7. The collector circuit of Q4 is tuned by L3 and C13. Negative feedback, from the collector of Q4 through R19 and C9 to the base of Q5, is employed to stabilize the gain and increase the bandwidth of the stage. The output is applied to the limiter/discriminator modules and the rear-apron IF OUTPUT jack from a capacitive voltage divider formed by C15 and C16. The 21.4-MHz IF signal is filtered by C17, L5, and C21.

2.6.7.4 The output of Q4 is also coupled to the AM detector, CR2. The AM video signal is applied to emitter followers Q7 and Q8 which provide a low impedance source to drive the two AM video outputs through module pins 2 and 3.

2.6.7.5 In the narrower IF bandwidths of 10 kHz and 50 kHz, it is desirable to reduce the bandwidth in the AM video path. Such a reduction will often improve the signal-to-noise ratio of the receiver. Stage Q6,

a JFET, has been included as a switch. In the 300-kHz and 1-kHz IF bandwidths, Q6 is held off by the -18 V source connected to its gate. In the 10-kHz and 50-kHz IF bandwidths, +18 V is applied through module pin 5. A voltage divider is then formed by R33 and R34. The voltage at the junction of R33 and R34 turns Q6 on connecting filter capacitor C20 to ground. The bandwidth of the AM video path is then reduced to approximately 80 kHz.

2.6.8 Type 79616 10-kHz Bandwidth and 50-kHz Bandwidth FM Limiter/Discriminator. - A schematic diagram of the 10-kHz and 50-kHz limiter/discriminator is shown in Figure 6-10. The reference designation prefix is A4A7.

2.6.8.1 The 21.4-MHz IF input signal is connected to module pin 21. The module is active when +18 V is applied to module pin 14, 15, 17, or 18. When the module is active, +18 V is coupled out on pin 6 to turn on the video bandwidth select circuit on the IF output amplifier module. The FM video output is taken at module pin 2.

2.6.8.2 Operation amplifier U1 operates as an amplifier for small signals and as an overdriven amplifier/limiter for larger signals. Resistor R1 completes the bias network between the high and low level inputs of U1. Zener diode VR1 reduces the supply voltage by 4.3 V to provide the correct operating potential for U1. The output circuit of U1 is tuned by L1 and C4 with C6 and C7 in parallel. The tuned circuit is tapped at the junction of C6 and C7 to provide an impedance match for the input of the crystal discriminator U2.

2.6.8.3 The output of the 50-kHz bandwidth crystal discriminator is connected to the non-inverting input (pin 3) of operational amplifier U3. Potentiometer R4, through resistor R7, is used to obtain a zero crossover point (balance) at the output. During 50-kHz bandwidth operation, the gain of U3 is approximately five as determined by feedback resistors R9 and R13. In the 10-kHz bandwidth, the output of the crystal discriminator is much lower (for a given percentage of modulation) than in 50-kHz operation because the slope of the discriminator is constant. To compensate for this condition, the gain of U3 is increased to about 25 in the 10-kHz bandwidth. Transistor Q1 is turned on by the +18 V supply through pin 14 or pin 15. Resistor R8 is then connected in parallel with R13 and the feedback network is now R9 and the parallel combination of R8 and R13. Resistor R14, inside the feedback loop, is used to make the impedance from U3 pin 2 to ground approximately the output impedance of the crystal discriminator which is connected through U3 pin 3 to ground.

2.6.8.4 When neither the 10-kHz nor 50-kHz bandwidth is in operation, it is desirable to disconnect the output of the module from other circuits

in parallel with the output. Transistor Q2 is used as a switch for this purpose. When the module is on, a voltage divider is forned by 12-volt Zener diode VR2 and R11 from the switched +18 V source to the -18 V source. Under these conditions, diode CR7 is reverse biased, and zero volts exists from source to gate of Q2 (a depletion mode device) turning it on. The output of amplifier U3 is then connected to the output of the module at module pin 2. With the +18 V supply removed, diode CR7 is forward biased and Q2 is turned off disconnecting the circuit.

2.6.9 Type 79620 300-kHz Bandwidth FM Limiter/Discriminator. - Figure 6-9 is the schematic diagram for this module; its reference designation prefix is A4A6.

2.6.9.1 The design of the 300-kHz bandwidth FM limiter/discriminator is similar to the design of the 10-kHz and 50-kHz bandwidth limiter/discriminator described in paragraph 2.6.8. The basic difference is that the discriminator is a modified Foster-Seeley circuit in the wider bandwidth device instead of a crystal discriminator. Integrated circuit U1 is a high-gain amplifier/limiter for the 21.4-MHz center-frequency IF input. For most input signal levels U1 provides limiting as it becomes overdriven.

2.6.9.2 The output of U1 operates into a tuned circuit formed by C5, C6, C7, L2 and the primary of transformer T1. Capacitor C12 couples the IF reference voltage to the transformer secondary. Diodes CR3 and CR4 demodulate the FM signal and apply it to a low pass filter formed by C15, C16, L3 and L4. Junction FET Q1 operates as a switch to connect the output when the 300-kHz bandwidth is in operation. Since Q1 is a depletion mode device, it is on when zero volts exists from source to gate. It is off when the gate is negative with respeft to the source. When this module is operating, +18 V is present at either pin 15 or 16. the drop across zener diode VR2 is +12 V and diode CR5 is back biased and the gate and source are held with zero volts between them by R7. With the module inoperative, the -18 V supply from pin 11 through R8 forward biases CR5 and Q1 is turned off.

2.6.10 Type 79626 1-MHz Bandwidth FM Limiter/Discriminator. - The design of the 1-MHz bandwidth limiter/discriminator is nearly identical to the 300-kHz limiter/discriminator described in paragraph 2.6.9. A schematic diagram of the 1-MHz limiter/discriminator is shown in Figure 6-8. The reference designation prefix is A4A5.

2.6.10.1 Refer to paragraph 2.6.9 for an explanation of the circuit through the output switch, Q1.

2.6.10.2 The FM video outputs of all three limiter/discriminator modules are connected in parallel through module pin 10. As previously

discussed, only the output of the active module is present at any one time. The output in use is directly coupled to cascoded emitter followers Q2 and Q3. Three outputs are taken from the emitter of Q3; the FM video output to the video amplifier; an external FM output to module A13 pin 21; and an output through module pin 4 to drive the tuning meter.

2.7 TYPE 79612-1 MARKER GENERATOR

Figure 6-12 is the schematic diagram for this module; its reference designation prefix is A5. The Type 79612-1 Marker Generator provides the Z axis or marker output and an over-sweep indication. The marker output controls the intensity of the beam on the associated CRT display. The over-sweep output is essentially an alarm to warn that the tuning voltage present at that time would cause the tuner to exceed the low band edge or the high band edge as applicable.

2.7.1 Inputs. - The marker output is generated as a function of the ramp waveform, sector width voltage, and manual tuning voltage when the receiver is in the PAN tuning mode. These three signals are connected to module pins 12, 18, and 19. The ramp waveform at pin 12 is supplied from the output of operational amplifier A2U1 on the ramp generator module through a ten-ohm resistor. The sector width and manual tuning voltage inputs are connected to operational amplifiers U1 and U2 which are arranged for unity gain and are driven on the non-inverting inputs. At this point, all three signals are being supplied from very low impedance sources; namely, the outputs of operational amplifiers U1, U2, and A2U1.

2.7.2 Voltage Dividers. - Resistors R6 through R13 are used to form precision voltage dividers to develop six signals (two from each input) at one-half of the input levels. As an example, the ramp is connected to the non-inverting inputs of both U3 and U4 through dividers formed by R11 and R13 to ground and R12 and R10 to ground through the output impedance of U1.

2.7.3 Comparators. - Operational amplifiers U3 and U4 are connected as comparators. The six outputs of the voltage dividers are connected to the comparator inputs as follows:

(1) U3 inverting input (pin 2): manual tuning voltage.

(2) U2 non-inverting input (pin 3): ramp waveform and sector width voltage.

(3) U4 inverting input (pin 2): manual tuning voltage and sector width voltage.

(4) U4 non-inverting input (pin 3): ramp waveform.

2.7.3.1 For purposes of explanation, assume that the sector width and manual tuning voltages are each at a level of approximately +2 V at the inputs to U3 and U4. The ramp waveform at the inputs of U3 and U4 is approximately -5 V. When the ramp starts at -5 V, the input to U3 is +2 V on pin 2 and -3 V (-5 V ramp summed with +2 V sector width) on pin 3. This means the output of U3 will be -18 V and remain so until the ramp crosses zero volts at which time the U3 output will switch to +18 V. At U4, the voltage at the inverting input will be +4 V (the manual tuning and sector voltages summed) while the -5 V ramp will be on the non-inverting input. The output of U4 is then -18 V until the ramp crosses +4 V at which time the output switches to +18 V. Hence, U3 switches at a point representing the lower sector edge while U4 switches at a point corresponding to the upper sector edge.

2.7.3.2 In the PAN tuning mode, or PAN portion of the PAN/SEC mode, transistor Q1 is turned on and off by U3 and U4. When the output of U3 is +18 V and the output of U4 is -18 V, Q1 is conducting. Zener diode VR1 protects the transistor under these conditons. In the MAN, REMOTE TUNER, SECTOR, and SECTOR portion of the PAN/SEC mode, stage Q1 is held off by +18 V connected to module pins 10 or 11.

2.7.4 Marker Waveform. - The marker (or Z axis) waveform consists of three levels: zero to turn off the display tube beam; +0.5 V for low intensity; and +1.2 V for high intensity. These levels exist only in the PAN tuning mode or PAN portion of the PAN/SEC mode. The count blank pulse, from pin 19 of the ramp generatormodule, is applied to the base of Q2 through R30 and module pin 8. During the count period, this pulse goes from zero to +18 V and turns Q2 on. With Q2 on, the marker output line at module pin 9 is pulled down to ground. When Q2 is off, the voltage divider formed by R16 and R23 from the +18 V supply to ground provides +0.5 V output at pin 9. When U3 and U4 turn on, a second voltage divider is formed by R23, CR3, Q1, and R17 to the +18 V output from U3. The voltage at pin 9 is then +1.2 V because of the clamp provided by CR7 and the base-emitter junction of Q2. In the MAN, REMOTE TUNE, SECTOR, or SECTOR portion of the PAN/SEC tuning modes, +18 V from module pins 10 or 11 through R22 increases the voltage drop across R23 to a value which will maintain the +1.2 V output at pin 9. The output will still go to zero during the count period because of the count blank pulse on pin 8.

2.7.5 Oversweep. - The discussion in paragraph 2.7.4 ignored the over-sweep condition. This occurs whenever the tuning voltage applied to the tuner would cause the tuner to exceed either the upper or lower band edge. Usually this situation occurs only in the SECTOR sweeping mode or SECTOR portion of the PAN/SEC mode. When the oversweep condition is present, it is desirable to blank the trace on the associated display (Z axis output to zero volts) and to provide an output to indicate the over-

sweep on-off situation. Operational amplifiers U5 and U6 are used as comparators to defect the oversweep condition. The tuning voltage input at module pin 2 is in parallel with the signal to the tuner from the ramp generator module. In the PAN, SECTOR, and PAN/SEC modes, this signal is a ramp waveform. The upper and lower limits of the ramp waveform are compared to the regulated +10.3 V and -10.3 V supply voltages connected through module pins 3 and 5 to U5 and U6. With no oversweep present, the outputs of U5 and U6 are both -18 V. If the ramp goes above +10.5 V, the output of U5 switches to +18 V. This action turns CR6 on. The +18 V output blanks the Z axis by turning Q2 on. The +18 V at module pin 6 through R26 is the oversweep indicator. A similar action takes place in U6 when the ramp becomes more negative than -10.5 V. Diodes CR6 and CR7 isolate the outputs of the two operational amplifiers.

2.9 TYPE 7366 VIDEO AMPLIFIER

A schematic diagram of the Type 7366 Video Amplifier is shown in Figure 6-13; its reference designation prefix is A6. The input to the amplifier, from the arm of the main chassis VIDEO GAIN potentiometer, is either the AM video or the FM video signal as determined by the setting of the main chassis function switch. The input signal, from module pin 21, is applied through R1 and C1 to the base of amplifier Q1. This stage is followed by Q2, another amplifier. These two stages provide the necessary voltage gain to drive complementary symmetry emitter followers Q3 and Q4. Negative dc feedback to set the overall gain of the amplifier is taken at the junction of emitter resistors R11 and R12 and applied to the emitter of Q1 through a voltage divider formed by R5 and R6. Silicon diodes CR3 and CR4 determine the idling currents of Q3 and Q4, correct for crossover distortion, and prevent thermal runaway. They also compensate for the base-emitter voltage drops of Q3 and Q4. Since the transistors and diodes are both silicon devices, they exhibit similar changes in temperature. A rise in temperature, for example, lowers the base-emitter voltage drop of the transistors tending to make them conduct harder. However, the diode voltage drop decreases by the same amount so that the voltage applied to the bases also decreases, holding the collector current nearly constant. Resistors R11 and R12 are included to provide additional feedback with low-level input signals. Resistor R13 sets the output impedance of the amplifier. Resistor R14 provides a discharge path for C6 if the amplifier is operated without a dc load. Capacitor C3 provides additional drive for Q4 during the negative-going portion of the input signal. The bases of Q3 and Q4 are coupled through C4 to equalize the input signal level to the two stages.

2.10 TYPE 71291 RF MONITOR

A schematic diagram of the Type 71291 RF Monitor is shown in Figure 6-14. The assembly carries reference designation prefix A7. As

shown on the receiver main chassis schematic diagram (Figure 6-24), the RF Monitor is connected at the input of the receiver in parallel with the IF amplifier. Its function is to provide a fast AGC for the tuner when the receiver is in the PAN, PAN/SEC, or SECTOR sweeping modes maintaining fidelity of the data on the associated signal display.

2.9.1 IF Amplifiers. - The incoming 21.4-MHz IF signal from the tuner is connected to jack J1. A parallel connection at this point is made to the IF amplifier assembly (A4) through jack J2. An output to the signal monitor is made through jack J3 from a divider formed by R1 and R2. Transistors Q1 and Q2 form a cascode IF amplifier for the 21.4-MHz signal. The input is to the base of Q1 from the divider formed by R3 and R4 through blocking capacitor C5. Capacitor C8, between Q1 and Q2, reduces the high frequency gain thereby increasing the stability of the stage. The collector circuit of Q2 is tuned by L1; parallel resistor R12 broadens the frequency response of the circuit.

2.9.2 RF Detector. - The output of the tuned circuit in the collector of Q2 is coupled to the detector diode CR1. The detected signal, after filtering by L2 and C10, is amplified by stage Q3. The fast RF AGC at the collector of Q3 is filtered by R16 and C12 and connected to the output through feedthru capacitor C2.

2.9.3 Operation. - In a sweeping mode, the 21.4-MHz input to the RF Monitor at any given instant contains all of the signals within the bandpass of the tuner. Since the bandwidth of the cascode amplifier in the RF Monitor is wider than the bandwidth of the tuner, all signals present in the tuner bnadpass which are above the detector threshold will contribute to the value of the detected output. Assume then that the tuner is being swept and a large signal enters the passband of the tuner. At that time, the circuit reduces the gain of the tuner. Once the tuner has been swept away from the large signal, the AGC action will decrease restoring the gain of the tuner to its no signal value.

2.10 TYPE 7443 AUDIO AMPLIFIER/CARRIER OPERATED RELAY

This board contains the audio amplifier and the squelch and COR circuits. Figure 6-15 is the schematic diagram for this module and the reference designation prefix is A8.

2.10.1 Audio Path. - Audio input signals from the arm of the audio level potentiometer R9 are applied to the non-inverting input of unity gain buffer U1A. Operational amplifier U1A matches the high impedance audio input to the low impedance of the depletion mode squelch control, FET switch Q1. When the squelch switch is deactivated, the audio signals are coupled through FET Q1 to audio amplifier U2 where they are amplified and applied to complementary symmetry emitter followers Q4 and Q5.

Negative feedback to set the overall gain of the amplifier is taken from the junction of emitter resistors R21 and R22 and coupled to the inverting input of audio amplifier U2 through voltage divider R14 and R15. The quiescent current is maintained over the operating temperature range by diodes CR5 and CR6 and resistors R21 and R22. Diodes CR5 and CR6 also correct for crossover distortion, thus providing a low distortion audio output.

2.10.2 COR/Squelch Circuits. - Transistors Q2, Q3, and operatinal amplifier switch U1B provide the switching voltage of squelch gate, Q1, and activate the COR relay K1 and squelch indicator. The input to switching amplifier U1B is dc coupled from the AM detector. Zener diode VR1 clamps the detected AM signal at +3.3 V. Modulation filter R2 and C1 removes amplitude modulation from the detected signal applied to the non-inverting input of amplifier U1B. Feedback capacitor C4 also helps eliminate any AM variation at the output of U1B. The COR SENSITIVITY control, R11, sets the operating level for the COR relay K1 and the squelch gate Q1. The normal output of U1B is approximately -18 volts. In this state, squelch switch Q5 is biased off by the negative voltage applied to the gate through CR1. With Q5 turned off, the audio path is held open and transistors Q2 and Q3 are turned off holding the COR relay at rest. When the average AM detector voltage is sufficiently positive to overcome the negative voltage supplied by the COR SENSITIVITY control, switch U1B transfers supplying approximately +18 V to squelch gate by reverse biasing diode CR1 allowing the gate voltage to approach the source voltage. Also, COR relay K1 is activated.

2.10.3 COR Operation. - Carrier operated relay K1 is energized by transistors Q2 and Q3 being turned on by the switched +18 V from U1B. Transistors Q2 and Q3 are connected in a Darlington configuration to aid in the delayed relay drop-out feature. A much smaller base current is required to start the Darlington pair conducting than if a single bi-polar switch was used. This allows the use of a much smaller hold-in capacitor, C8. Relay K1 is connected between the +18 V supply and the collectors of Q2 and Q3. When the transistors conduct, relay K1 is activated. When the AM signal is below threshold, the -18 V through R12, CR2, and CR3 holds Q2 and Q3 off. With the Darlington pair off, the voltage at the collectors and the positive end of C8 is +18 volts through the winding of K1. The other end of C8 is returned to ground through forward biased diode CR3. When the detected AM input signal exceeds the threshold, U1B switches turning on the Darlington pair. This energizes K1 and places the positive end of C8 at ground, causing the other end to appear more negative. This negative voltage reverse biases CR2 and the capacitor rapidly discharges through CR3. When the detected input to U1B falls below the threshold point U1B switches, opening the squelch gate instantly. However, as Q2 and Q3 try to turn off and the collector voltage rises, capacitor C8 begins to charge. The charging current

through C8 flows through CR2 to the base of Q3 and through R12 to the low impedance output of U1B. This charging current supplies forward bias voltage to Q2 and Q3 holding them in conduction. As the charging current decreases, Q2 and Q3 decrease conduction to the point where K1 de-energizes. External timing controls can be added to the circuit through module pins 2 and 5. A capacitor connected across the terminals will increase the nominal six second delay time, or a resistor will decrease the delay time. If a resistor is used to decrease the time delay, its value should be a minimum of 100 Ω. Diode CR4 is included in the circuit to prevent transient voltages developed across the windings of K1 from damaging Q2 or Q3 when the delay time is reduced.

2.11 TYPE 78100 AGC AMPLIFIER

The Type 78100 AGC Amplifier provides a fast responding IF AGC voltage when the receiver is operating in the sweep tuning modes. In these tuning modes, RF AGC voltage is developed by RF monitor subassembly, A7. A pulse or average responding AGC, or manual gain control voltage for the receiver RF and IF circuits is provided in the MAN tuning mode. The AGC amplifier schematic diagram is Figure 6-16; its reference designation prefix is A9.

2.11.1 PAN, SECTOR, PAN/SEC Tuning Modes. - Operational amplifier U1 is driven by the AM detector voltage and provides a fast response IF AGC in the PAN, SECTOR, and PAN/SEC tuning modes. The AM detector voltage is also used to drive the vertical amplifier of the associated signal display in these tuning modes.

2.11.1.1 Operational amplifier U1 functions as a fast responding IF AGC amplifier. The AM detector input voltage is applied to the inverting input (pin 2) through R7. A feedback network consisting of R12, R43, and C3 shapes the amplifier response. Capacitor C10 and R44 are included for frequency compensation. The output voltage from pin 6 is coupled through R45 to module pin 2.

2.11.1.2 The voltage divider consisting of R2 and R3 provides the AM detector voltage output at module pin E where it is used to drive the vertical amplifier of the associated signal display. Potentiometer R9 is connected between +18 and -18 volts. The arm of the control is connected to the voltage divider through R8. This provides an adjustable dc offset voltage for the vertical output which is used to adjust the vertical trace position of the signal display. Capacitor C1 provides filtering for the vertical output voltage.

2.11.2 MAN and REMOTE TUNE Modes. - The remainder of the circuitry of this module is active only when the receiver is operated in the MAN, or REMOTE TUNE modes. Gain control voltage for the receiver

RF and IF circuits is developed from the front panel RF GAIN control, or from the AM detector voltage depending upon the reception mode of the receiver. The circuit provides pulse responding AGC voltage when pulse reception is selected and average responding AGC voltages when AM/AGC or FM reception is selected. In addition, the circuit uses a delay and clamping technique which delays the start of IF AGC voltage until the AM detector voltage input reaches a specified level. The start of RF AGC voltage is further delayed until the IF AGC voltage reaches a specified level at which time the IF AGC voltage is clamped. With further increases in AM detector voltage input, the RF AGC voltage increases until the RF AGC voltage reaches a predetermined level. When this level is reached, the IF AGC clamp is released and both the IF AGC and RF AGC voltages increase with an increase in AM detector level.

2.11.2.1 The position of the front panel reception mode switch determines which portions of the circuit are activated in the MAN or REMOTE TUNE modes. In the AM/AGC and FM reception modes, +18 volts is applied to module pin 8. This voltage places the cathode of diode CR2 at zero volts allowing input switch Q4 (a depletion mode FET) to conduct. With Q4 on, the AM detector voltage is coupled through R6 and Q4 to a modulation filter consisting of R16 and C5 in the base circuit of Q5. Transistor Q5 is a delay amplifier which delays the start of IF AGC voltage until the AM detector voltage reachs approximatey +1.5 volts. Emitter bias for Q5 is set by a voltage divider from the +18 volt supply consisting of R17 and R19. The output voltage from Q5 is direct coupled to the base of DC amplifier Q6 which is followed by another direct coupled DC amplifier, Q7. The output voltage from Q7 is direct coupled to emitter follower Q8. Transistors Q6, Q7, and Q8 perform the necessary phase inversion and level translation so that the AGC voltage from the preamplifier starts at zero and swings negative as the conduction of Q5 increases. The output voltage from the emitter of Q8 is coupled to module pin 17 where it connects to a rear panel AGC monitor terminal. A portion of the voltage from Q8 is applied through R25 to module pin 18 and to AGC select module, A11, pin T. From the AGC select module, the preamplifier output voltage is connected to module pin 14 when the receiver is operating in AM/AGC, FM and PULSE modes of reception. A portion of the preamplifier output voltage is also connected to module pin 19 from a voltage divider consisting of R26 (the emitter resistor of Q8), R28, CR3, CR5, and R42. Module pin 19 connects to the front panel SIGNAL STRENGTH meter negative terminal. The positive terminal of the meter is driven from the modulation filter output through Q11 and module pin 10. The voltage divider in the negative side of the SIGNAL STRENGTH meter compensates for the base-emitter voltage drop across Q5 through Q8 and Q11. This sets the SIGNAL STRENGTH meter reading at zero with no signal input.

2.11.2.2 The same preamplifier circuitry is used when PULSE type signals are selected for reception. However, the input to the modulation fil-

ter is through FET switch Q3, which is activated by the application of +18 volts to module pin 9. The input to the modulation filter is taken from a pulse stretcher circuit consisting of complementary emitter follower Q1 and Q2 and associated circuitry. Input voltage from the AM detector is direct coupled to the base of Q1 which is direct coupled to Q2. Positive-going pulses from the AM detector charge capacitorC2 in the low impedance emitter circuit of Q2. When the pulse amplitude falls, the capacitor discharge path is through R5 back to the base of Q1. The input pulse is therefore stretched by the circuit. The voltage across C2 is coupled through R10 and Q3 to the modulation filter.

2.11.2.3 Transistors Q9, Q10, and Q12 in conjunction with operational amplifier U2 provide the MAN or REMOTE TUNE mode gain control voltage outputs. The IF gain control is provided through module pin 11 from the emitter of Q12. The RF gain control voltage is from operational amplifier U2 through module pin 21. Input to this circuit (through module pin 14) is either from the front panel RF GAIN control or the remote digital gain control source. Transistor Q12 is an emitter follower providing low output impedance to the IF AGC line. Transistor Q9 is used to clamp the IF AGC line at approximately -3 V when the IF AGC reaches this level. The IF AGC line clamp is maintained until the RF AGC level reaches approximately -6 volts at which time Q10 releases the clamp allowing the IF AGC to swing further negative with an increase in negative voltage at module pin 14. This action provides the desired AGC characteristics for both the receiver IF circuits and the installed tuner. Transistors Q9 and Q10 are initially biased off by voltage dividers in their base circuits from the -18 volt supply. This sets the bias at approximately -2.7 volts on Q9 and approximately -5 volts on Q10. With Q9 off, the input voltage to RF AGC amplifier U2 is zero and the RF AGC voltage is zero. The IF AGC emitter follower, Q12, follows the input voltage applied to module pin 14 until the voltage is sufficiently negative at the emitter of Q9 to cause it to conduct. With Q9 conducting, it maintains a constant base-emitter junction drop of approximately 0.6 volt which clamps the IF AGC voltage until the base voltage on Q9 changes. As Q9 conducts, it develops a negative voltage across its collector load resistors, R31 and R29, which is dc coupled to the non-inverting (pin 3) input of U2. Operational amplifier U2 has a gain of approximately three and provides the RF AGC voltage output through module pin 21. The amplifier feedback network consists of R37 and C7 in conjunction with R34. A portion of the output voltage from U2 is coupled through R38 to the emitter of Q10. When the voltage at the emitter of Q10 becomes approximately 0.6 volt more negative than the fixed -5 volt base bias, Q10 begins to conduct. With Q10 conducting, a more negative voltage is developed across its collector load resistor R33 which is part of the base bias voltage divider of Q9. As the base voltage on Q9 swings negative, its emitter voltage follows and the clamp on the IF AGC voltage is removed. Diode CR4 in the collector circuit of Q9 is used to change the slope of the RF AGC voltage at high signal levels. When the voltage across the diode is suf-

ficiently negative to forward bias it, R29 is effectively removed from the circuit and the gain of the Q9 is reduced.

2.11.2.4 Transistors Q13, Q14, and Q15 in conjunction with the TTL receivers/drivers module and IF Bandwidth, AM/FM Select module provide a means by which capacitors C2 and C5, which are charged in the PULSE AGC mode, can be quickly discharged, by remote command, when switching to another AGC mode.

2.12 TYPE 791235 TTL RECEIVERS

The reference designation prefix for this module is A10, and the schematic diagram is Figure 6-17.

2.12.1 AGC Commands. - Differential TTL input commands to select one of the three AGC modes, are applied through module pins X and Y, and 17 and 18 to matched voltage dividers, R3 and R4, R5 and R6, R7 and R8, and R10 and R11. These resistor pairs form an approximate 67:1 voltage divider. Clamping diodes CR1 through CR4 prevent the junction of each voltage divider and the associated diode cathode from ever going more negative than -0.3 V. An input voltage level greater than -0.3 V would destroy the integrated circuit, U1. Integrated circuit U1 is a quad operational amplifier array. Operating voltage is taken from the +5 V supply at module pin U. In the rest state (both inputs equal) the output is a logic zero. As soon as there is a difference voltage at the input, the line designated + is high, the output of the particular op amp in U1 switches to a logic 1. A logic zero is approximately +0.3 V and a logic 1 is approximately +3.5 V.

2.12.2 Six-Bit Gain Control. The six-bit remote gain circuits operate exactly the same as the AGC TTL receivers. Six pairs of differential TTL lines are converted by a portion of U1 and U2 to six single ended TTL lines.

2.13 TYPE 791223 AGC SELECT

The reference designation prefix for this module is A11 and the schematic diagram if Figure 6-18. Selection of the various AGC modes is accomplished in the local reception mode by the front panel receiving mode switch which activates various combinations of FET switches to couple AGC voltages from the AGC amplifier or RF GAIN control to the RF tuner and IF amplifier assembly. When the receiver is operating in the REMOTE mode, the AGC selection is made via data lines from the TTL receivers module which energizes bi-polar transistor switch drivers to activate the FET switches.

2.13.1 Local AGC Selection. - Local control modes are MAN, PAN, SEC and PAN/SEC. These modes, along with REMOTE, are selected by front panel control S1. For this discussion, assume that the MAN tuning mode is selected, and the FM or AM/AGC receiving mode is selected for average AGC. In this AGC mode, +18 V from reception mode switch S3B-W is applied to pin H of the AGC select module. From pin H, the +18 V is coupled through diodes CR5 and CR9 to the cathodes of CR12, CR14, and CR17. The +18 V reverse biases these diodes, which activates FET switches Q2, Q4, and Q7. These switches in addition to switches Q1, Q3, Q5, and Q6 are junction field-effect transistors operating in the depletion mode. When the diode connected to the gate is reverse biased, thus eliminating the negative voltage applied through the gate diodes from the -18 V supply, it allows the gate voltage to approach the source voltage and the FET switch conducts. With FET switches Q2, Q4, and Q7 activated, the AGC voltage from the preamplifier output of AGC amplifier A9 pin 18 is coupled through AGC select module pin T to the source of switch Q7. With Q7 activated, the AGC voltage is coupled through Q7 back to the AGC amplifier where it is processed by A9Q12 and A9U2 and then coupled back to the AGC select module on pins R and W respectively. From module pin R, the AGC voltage from A9Q12 is coupled through activated switch Q4 and out through A11 pin S to IF amplifier assembly A4 as IF AGC. The output voltage from A9U2 is applied through activated FET switch Q2 from module pin W to RF AGC output pin Y. From there it is coupled to the RF tuner for RF AGC.

2.13.2 Remote AGC Select. - The preceding example is also applicable to the remote AGC select. The only difference is the manner in which the +18 V to activate the FET switches is applied. When the tuning mode switch, S1, is set to REMOTE, +18 V is applied to A11 pin 12 which in turn applies +18 V to mdule pins C, E, and F to enable bi-polar switch driver transistors Q8 through Q11. With these switch drivers enabled, the TTL data from the TTL receivers module, A10, through line drives, U4, and NAND gates U3, will activate one of the switch driver transistors thus applying +18 V to activate the corresponding FET switches. In the example given previously, switch driver Q10 would be tuned on to activate FET switches Q2, Q4, and Q7.

2.13.3 MAN Gain Mode. - In local MAN gain control, gain control voltage is taken from the front panel RF GAIN control and coupled through FET swiches Q6, Q2, and Q4 to control tuner and IF gain as was the AGC voltage. However, in the REMOTE MAN mode, the gain control voltage is generated by the six bit TTL remote gain data from the TTL receivers module, A10. Digital-to-analog converter U2 converts the binary information to an analog voltage which is applied to the inverting input of operational amplifier U1. The inverted analog output voltage from U1 is then coupled through FET switch Q5 to the AGC amplifier for processing and then through activated FET switches Q2 and Q4 to the RF tuner and IF amplifier modules.

2.14 TYPE 791233 TTL RECEIVERS/DRIVERS

The reference designation prefix for this module is A12 and the schematic diagram is Figure 6-19. This module receives remote differential TTL data and converts this data to a single line of TTL logic for remote selection of IF bandwidths, AM or FM reception modes, tuning speed and AGC dump. Squelch, COR and status information is coupled into this module from the receiver, on single TTL lines and is converted to differential TTL logic for uses remote to the receiver. With the exception of the circuit consisting of transistors Q1 and Q2 and intverter U3, the operation of this module is identical to the TTL receivers described in paragraph 2.12.

2.14.1 Squelch Circuit. - When the squelch is deactivated by the presence of a signal, +18 V is applied from audio amplifier/COR, A8 Pin 14, to TTL receivers/drivers pin 7. The +18 V from module pin 7 is applied through diode CR8 and resistor R20 to the base of Q2. Transistor Q2 then conducts pulling the +5 V through R22 to ground. This is interpreted by the input of U3, pin 11 as a logic 0 state. Line driver U3E inverts the logic 0 to produce an output logic 1. This logic 1 is then applied to U3F and inverted again producing a logic 0. Both the logic 1 and logic 0 states are coupled to the squelch output, module pins 9 and H respectively. When the squelch is active the procedure is reversed.

2.14.2 COR Circuit. - Operation of the COR circuit is similar to the squelch except when the COR is activated by the RF input signal. -18 V is applied through R24 to the emitter of transistor Q1 causing it to conduct pulling the +5 V through R23 to ground. This, as in the squelch, produces a logic 1 output from U3A and a logic 0 output from U3B.

2.14.3 Status. - Status input to line driver U3D is either ground or open which produces a zero or one state output respectively. With the receiver operating in the REMOTE position, a ground is placed on the status input U3D, pin 9. Line driver U3D inverts the logic 0 to produce a logic 1 state at its output, module pin 11. The logic 1 at U3D is also coupled through U3C to produce the logic 0 output at module pin M.

2.15 TYPE 791227-1 IF BW, AM/FM SELECT

The schematic diagram for this module is Figure 6-20 and the reference designation prefix is A13. Inputs to this module, from TTL receivers/drivers, module A12, control selection of the IF bandwidth, AM or FM reception, tuning speed and AGC dump.

2.15.1 IF Bandwidth. - When the receiver is operating in a local control MAN tuning mode, the IF Bandwidth is selected by front panel switch S2A which applies +18 V to this module to select the appropriate gain bandwidth switch, Q3 through Q6. The switch also applies +18 V to the IF amplifier assembly, A4, to select the proper IF bandwidth filter. In the Remote operating mode, +18 V from front panel switch S1 is applied to the emitters of transistor Q12 through Q15 as an enable voltage. When the remote data command is received, one of the transistors conducts the +18 V to the gain bandwidth switches and the selected IF bandwidth filter board in assembly A4. The data commands to select the IF bandwidth are applied to line drivers U3C and U3F from the TTL receivers/drivers module A12. Inverted logic states from U3C and U3F are applied to NAND gates U2B, U2C, and U2C, U2D respectively. In addition, portions of their outputs are inverted by U3D and U3E and applied to U2A, U2D, and U2A, U2B respectively. Thus a high state at the input to U3C and a low state at the input to U3F will yield high states at both inputs to NAND gate U2D causing a low state at its output. This turns Q14 on which selects BW2 and closes FET switch Q4 for proper gain bandwidth compensation.

2.15.2 AM/FM Select. - In the Remote tuning mode. AM reception is selected by a high at the input to U3A which causes a low output from U1B. A low at the output of U1B activates switch Q7 which reverse biases CR2 by applying +18 V to the cathode. With CR2 turned off, the voltage at the gate of Q2, a junction FET operating in the depletion mode, is allowed to approach the source voltage and conduct the AM signals from the AM input, pin 17, to the AM/FM output on module pin 19. The FM output is selected by a low at the input to U3A activating U1A, Q8 and Q1.

2.15.3 Tuning Speed. - Remote tuning speed selection is controlled by NAND gate U1C activating or inhibiting bi-polar switching transistor Q10. During MAN tuning, switch S1C applies +18 V through A13 pin S, CR12, CR13 and module pin 15 to the RF tuner to select the slow time constant filter in the tuner shaping amplifier. When the receiver is operated in the PAN, SEC or PAN/SEC sweeping modes, module pin S is open and transistor Q11 maintains zero volts at module pin 15 thus selecting the fast time constant filter. In the REMOTE tuning mode, +18 V is applied to the emitter of Q10 through module pin 13. When transistor Q10 is activated by a logic one at the input to U1C, +18 V is conducted through Q10, CR11, and CR13 to the shaping amplifier in the RF tiner and selects the slow time constant filter. With Q10 turned off, Q11 operates as before to maintain 0 V at A13 pin 15 to select the fast time constant filter.

2.15.4 AGC Dump. - This function is used only when the receiver is under REMOTE digital control. When the AGC dump command is received, transistor Q9 is pulsed and conducts +18 V from its emitter

through CR9 and module pin 12 to the base of A9Q13, A9Q14 and A9Q15 turning them on. With A9Q13, A9Q14, and A9Q15 turned on, any charge on capacitor A9C2 or A9C5 is quickly conducted through A9Q13 or A9Q14 to ground. Transistor A9Q15 prevents the pulse stretching circuitry from supplying any charge current to C2 and C5 for the duration on the AGC dump. The duration of the AGC dump enable pulse is determined by the softwear program.

2,16 TYPE 76230 ±18 V/+5 V POWER SUPPLY REGULATOR

The reference designation prefix for this subassembly is A14. Figure 6-21 is the schematic diagram. This subassembly is composed of four full-wave bridge rectifiers, U1-U4 and three monolithic voltage regulators, U5-U7. The output voltage from the regulators is as follows: +18 V from U5, -18 V from U6, and +5 V from U7.

2.17 TYPE 76179 PRECISION REGULATORS

The precision voltage regulators on this module use -18 V, +18 V, and +40 V inputs to develop -10.3 V, +10.3 V, and +30 V precision power supply sources. A schematic diagram of the module is shown in Figure 6-22; its reference designation prefix is A15.

2.17.1 Minus 10.3 V Regulator. - Operational amplifier U1 and transistor Q1 provide the -10.3 V precision regulated supply from a regulated -18 V input to module pin 20. All other outputs from this module are dependent upon the generation of the -10.3 V output. The -18 V input through resistors R12 and R1 will develop a small voltage across zener diode VR1. This small negative voltage on the non-inverting input of U1 (pin 3) will cause a negative output from U1 which will turn Q1 on. The feedback path for U1 is now complete and the voltage at the emitter of Q1 through CR1 and R3 will cause VR1 to regulate at -6.2 V. Poteneiometer R5, in the feedback network of U1, is adjusted so that the amplifier will provide a regulated output of -10.3 V at the emitter of Q1.

2.17.2 Plus 10.3 V Regulator. - The -10.3 V source is used to develop the +10.3 V source. Operational amplifier U2 is connected as an inverting amplifier. Its feedback network is adjusted by potentiometer R8 for unity gain. The -10.3 V regulated source on the inverting input (pin 2) will then cause a +10.3 V output at the emitter of Q2. Amplifier U2 therefore controls series regulator Q2 to produce the +10.3 V precision regulated supply.

2.17.3 Plus 30 V Regulator. - The +10.3 V precision supply is connected to the non-inverting input (pin 3) of operational amplifier U3. The gain of U3 is set to provide a regulated +30 V output at the emitter of Q3. Resistor R20 and capacitor C9 provide additional filtering for

the unregulated +40 V input from module pin 2. Capacitor C10 across feedback resistor R16 is used to lower the power supply noise. Note that the regulated +30 V output is used as the operating voltage for U3 at pin 7.

2.18 TYPE 791243 VIDEO AMPLIFIERS/TUNING VOLTAGE BUFFERS

This module is made up of three independent circuits; two video amplifiers and a common mode rejection tuning voltage buffer. The reference designation prefix is A16 and the schematic diagram is Figure 6-23.

2.18.1 AM Video Amplifier. - AM input signals from the IF amplifier assembly are coupled through input matching network, R2 and R4, to the base of one half of differential amplifier Q1. Amplified AM signals from the collector of Q1 (pin 1) are applied to the base of Q2 where they are amplified further before application to complementary symmetry emitter followers Q3 and Q4. Diodes CR2 and CR3 set the idling current for Q3 and Q4 and prevent thermal runaway. Silicon diodes CR2-CR3 also compensate for the emitter-base voltage drop of silicon transistors Q3-Q4. As the temperature increases the emitter-base voltage drop decreases tending to make the transistors conduct harder. However, with the same temperature change, the diode voltage drop increases by a similar amount so the base drive is less tending to decrease the transistor conduction thus holding the collector current nearly constant. The gain of the amplifier is set by feedback network R12, R13, and C2 to the base of the second half of differential amplifier Q1. The amplifier gain at the junction of R17 and R18 is approximately two. Amplified signals are then coupled through output matching network R19 and L1 which attenuate the AM signal to unity and sets the output impedance to 100 Ω. Potentiometer R6 adjusts the dc offset.

2.18.2 AM/FM Video Amplifier. - This video amplifier consisting of Q5 through Q8 and associated components operates exactly the same as the one described in paragraph 2.18.1 except the overall gain at the AM/FM output is two, and the input signals are from the IF bandwidth, AM/FM select module, A13. The input is either the selected AM or FM video.

2.18.3 Tuning Voltage Buffer. - Remote tuning voltage for the plug-in tuning head is applied to pins 8 and 11 and coupled through R40 and R43 to the inverting and non-inverting inputs of operational amplifier U1. Tuning voltage buffer U1 has a common mode rejection ratio of 60 dB minimum and a differential voltage gain of -1. Capacitor C7 across the input terminals of U1 is a high frequency bypass. Potentiometer R42 balances the two inputs so a differential input of 0.0 V yields an output of 0.0 volts.

SECTION III
INSTALLATION AND OPERATION

3.1 UNPACKING AND INSPECTION

3.1.1 Examine the shipping carton for damage before the equipment is unpacked. If the carton has been damaged, try to have the carrier's agent present when the equipment is unpacked. If not, retain the shipping cartons and padding material for the carrier's inspection if damage to the equipment is evident after it has been unpacked.

3.1.2 See that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, Gaithersburg, or your Watkins-Johnson representative with details of any shortage.

3.1.3 The unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. It is, therefore, ready for use upon receipt. After uncrating and checking contents against the packing slip, visually inspect all exterior surfaces for dents and scratches. If external damage is visible, remove the dust covers and inspect the internal components for apparent damage. Then check the internal cables for loose connections, and plug-in items such as printed wiring boards, which may have been loosened from their receptacles.

3.2 INSTALLATION

3.2.1 Rack/Mounting Support. - Rack mount equipment, manufactured by WJ Gaithersburg, is designed for assembly in standard 19-inch racks in accordance with MIL-STD-189, or E.I.A. standard No. RS-310. The unit may be supported solely by the front panel for static installations, but it is recommended that chassis slides be added for ease of assembly, access to the unit, and to provide additional support for general installations. Mobile installations of the equipment should be evaluated on an individual basis. Additional information, such as recommended mounting methods, may be found in WJ-Gaithersburg Application Note 1302.50.

3.2.2 Thermal Considerations. - WJ-Gaithersburg equipment is designed for operational temperatures between 0°C and 50°C (32°F to 122°F). The operational temperature range is further qualified for free, unrestricted ambient air at sea level pressure. Equipment installation should provide for free flow of air around and through ventilated units. Multiple stacking, in particular close adjacent stacking of electronic equipment in a standard console, can produce an appreciable increase in the ambient air temperature for the units as compared to the ambient air in the vicinity of the console. Forced-air ventilation may be neces-

sary to maintain the proper ambient air temperature in a console which accommodates equipment that contributes to a high thermal density.

3.2.3 Power Connections. -Turn the POWER switch OFF. Plug the power cord into a 115 or 220 V ac, 40-420 Hz, source. The third pin of the power plug grounds the unit. If a three-pin receptacle is not available, use the three-to-two pin adapter provided. Be sure to attach the wire from the adapter to a suitable ground. Before energizing the receiver, check the rear-apron input power selector switch, S7, to make sure it is in the proper position for the line voltage being used.

3.2.4 Antenna Connection. - Connect the antenna to RF INPUT jack J1. This jack is a type N connector.

3.2.5 AFC Connection. - An external voltage for automatic frequency control may be connected to the AFC jack, J11, a type BNC connector. Although this input is designed to receive a DAFC (Digital Automatic Frequency Control) input from a Type DRO-308 Counter, other forms of AFC can be employed. A voltage of ± 4 V at J11 will produce a frequency change of 0.3% of the installed tuner operating band. A positive-going corrective voltage produces a decrease in the tuned frequency.

3.2.6 Local Oscillator Output. - The LO OUTPUT jack, J2, is a type BNC connector. This output will deliver 50 mV, minimum, into a 50-ohm load.

3.2.7 Signal Monitor Output. - A 21.4-MHz signal to drive a signal monitor is available at the SM OUTPUT jack, J14, a type BNC connector.

3.2.8 Ramp Connection. - The ramp waveform is available at RAMP jack, J7, a BNC connector. This output will deliver a ± 0.5 V ramp with a 1 k ohm source impedance.

3.2.9 Marker Output. - The MARKER (or Z axis) output is available at jack J24, a type BNC connector. A steady +1.2 V output is present during MAN, REMOTE TUNE, and SECTOR modes, except for zero volts during the 5 ms count period in the SECTOR sweeping mode. In the PAN mode, the output is a pulse on a pedestal and a zero volt count period of 5 ms. The pedestal is at a level of +0.5 V and the pulse is at an amplitude of +1.2 V. The width of the pulse is a function of the setting of the SECTOR WIDTH control. The horizontal position of the pulse along the pedestal is a function of the setting of the manual tuning control.

3.2.10 Tuning Voltage Connection. - The tuned frequency can be controlled externally by a voltage of -10 V for low band edge to +10 V for high band edge, applied to jack J23. The mating plug for this connector is a Trompeter PL-76.

3.2.11 Video Output. - The video output from the receiver is available at the BNC connector marked VIDEO J13. This output will deliver 1 Vrms, into a 100-ohm load.

3.2.12 IF Output Connection. - A 21.4-MHz IF output, after bandwidth limiting, is available at IF OUTPUT jack J12, a type BNC connector. A level of at least 50 mV will be delivered into a 50-ohm load for all input signals above AGC threshold.

3.2.13 Speaker Output. - The 600-ohm audio output is available at miniature phone jack J15. This output is in parallel with the audio output available at J16, pins 1 and 2.

3.2.14 Counter Connection. - The Type DRO-308 Counter is usually connected to the COUNTER jack J8. This 19-pin connector will mate with a Deutsch DS07-19P-059 plug. In addition to this connection, the counter also connects to the receiver LO OUTPUT and AFC input jacks.

3.2.15 Signal Display Connection. - The Type SM-7301 (A) Signal Display is usually connected to the 12-pin SM jack J17. Supply and control voltages are supplied through this connector as well as the vertical and horizontal outputs to the display. Note that the vertical output on pin 5 of J17 is not available in that form at any other connector on the receiver. A Deutsch DS07-12P-059 plug will mate with J17.

3.2.16 Balanced Audio Output. - A 100-mW, 600-ohm balanced audio output is available at connector J16, pins 1 and 2. Note that the SPKR OUTPUT jack J15 is in parallel with this output.

3.2.17 COR Connection. - The COR relay contacts are wired to J16 pins 3, 4, and 5. Connector pins 3 and 4 connect to the normally closed contacts while 4 and 5 go to normally open contacts.

3.2.18 AGC Monitor Output. - The AGC monitor output at J16 pin 6 is a negative-going voltage which indicates relative signal level for signals above AGC threshold. Response is logarithmic with respect to signal strength.

3.2.19 Oversweep Indicator. - The oversweep indicator signal is present at J16 pin 8 marked OVERSWEEP. This output indicates when the sweep width setting at the particular tuned frequency would cause the tuner to be swept beyond its tuning range, either at the high end or the low end of the band. This output, normally at zero volts, rises to about +15 V during any segment of the sweep cycle when an oversweep condition exists.

3.2.20 Tuning Voltage Monitor. - The tuning voltage can be monitored at J16 pin 9. In the MAN or REMOTE TUNE modes, this voltage is steady and may be at any value between -10 V and +10 V as a function of the setting of themanual tuning control or the remote voltage input. In the PAN sweeping mode, a ramp of ± 10 V is present followed by a 5 ms step which may be at any level from -10 V to +10 V. The duration of the step is the count period. The amplitude of the step is a function of the setting of the manual tuning control. The duration of the ramp is a function of of the setting of the SWEEP RATE control. The presentation in the SECTOR sweeping mode is similar to the PAN mode except that the ramp amplitude may be varied from zero volts to ± 10 V as a function of the SECTOR WIDTH control. The output alternates between the PAN and SECTOR conditions in the PAN/SEC mode.

3.2.21 Tuning Mode Indicator. - When the receiver is in the MAN or REMOTE TUNE modes, +18 V is present at J16 pin 10. Absence of this voltage therefore indicates receiver operation in a panoramic mode, either PAN, SECTOR, or PAN/SEC.

3.2.22 External Blank Input. - The Z axis (MARKER) output at J24 can be blanked by the application of +18 V to J16 pin 7.

3.2.23 Tuning Head Installation. - The tuning heads for the Type 215 Receiver are installed through the opening in the front panel. All connections are automatically made when the tuner is installed. A mechanical locking device is provided in the lower left-hand corner of the tuner to secure the unit in place.

3.3 OPERATION

The operation of the controls and switches on the Type 215 Receiver are explained in the following paragraphs. Front and rear views of the receiver are shown in Figures 5-1 and 5-2.

3.3.1 Power Switch. - The POWER PUSH ON/OFF switch controls the ac input to the receiver. Make certain that the setting of the rear-apron 115 V/220 V voltage selector switch is set to match the power source before the receiver is energized.

3.3.2 Tuning Mode Switch. - The tuning mode switch is used to select MAN (manual), REMOTE TUNE, SECTOR, PAN (panoramic), or PAN/SEC tuning. In the MAN or REMOTE TUNE mode, the receiver functions as a conventional manual receiver. In the PAN mode, the entire tuning range of the installed tuner is swept. In the SECTOR mode, any segment, from zero to the full range of the installed tuner, may be swept. The sector being swept will be centered around the frequency on the tuning dial

except at either band end. In the PAN/SEC mode, operation alternates between the PAN and SECTOR modes.

3.3.3 Sector Width Control. - The SECTOR WIDTH control sets the lower and upper frequency limits of the swept sector when the receiver is in the SECTOR mode or SECTOR portion of the PAN/SEC mode. At the maximum CW position, the entire range of the tuner will be swept if the manual tuning control is set at midband. The segment being swept approaches zero as the control is turned to the maximum CCW position.

3.3.4 Sweep Rate Control. - The SWEEP RATE control is used to adjust the sweep from a minimum of approximately 1 sweep every 25 seconds to a maximum of 25 sweeps per second.

3.3.5 RF Gain Control. - The RF GAIN control sets the gain of the receiver in the MAN or REMOTE TUNE modes with the reception mode switch set for AM/MAN reception. Turning the control in a clockwise direction increases the gain.

3.3.6 Fine Tuning Control. - The FINE TUNING control is an electronic vernier on the main tuning control. With this control set initially at midrange, it is possible to increase or decrease the tuned frequency when the receiver is in the manual tuning mode.

3.3.7 Audio Level Control. - The AUDIO LEVEL control sets the level of all audio outputs from the receiver. The audio outputs are disabled in the PAN and SECTOR modes.

3.3.8 Video Gain Control. - The video level at the rear-apron VIDEO OUTPUT jack, J13, is set by the VIDEO GAIN control.

3.3.9 Reception Mode Switch. - The four-position reception mode switch is used to select the type of recption desired when the receiver is in the the MAN tuning mode. Either PULSE, FM, AM/AGC, or AM/MAN reception may be selected.

3.3.10 IF Bandwidth Switch. - The IF BANDWIDTH switch is operative when the receiver is in the MAN tuning mode. A bandwidth of 10-kHz, 50-kHz, 300-kHz, or 1-MHz can be selected.

3.3.11 COR Sensitivity Control and Lamp. - The COR SENSITIVITY control is used to obtain COR (carrier operated relay) action at the desired incoming signal level. The white lamp above the control indicates COR action. A delay of about six seconds will occur after the incoming signal has been removed before the COR is released. This control also acts as an audio squelch. Turning the control clockwise increases COR sensitivity.

3.3.12 Tuning Meter. - The TUNING meter operates in the MAN or REMOTE TUNE mode to indicate the relative position of a signal in the passband of the selected IF amplifier.

3.3.13 Signal Strength Meter. - The SIGNAL STRENGTH meter operates when the receiver is in the MAN or REMOTE TUNE modes. It indicates the relative signal strength of received signals.

3.3.14. Phones Jack. - The PHONES jack provides an audio monitoring point on the front panel. The impedance of the headphones should be 600 ohms.

3.3.15 Main Tuning. - All of the tuning heads for the Type 215 Receiver operate in a similar manner. A main tuning knob with crank has been provided to manually tune a single frequency (as indicated on a counter, if used, or the tape dial) in the MAN tuning mode, or to adjust the sector being swept if the receiver is in the SECTOR mode.

3.4 PREPARATION FOR RESHIPMENT AND STORAGE

3.4.1 If the unit must be prepared for reshipment, the packaging methods should follow the pattern established in the original shipment. If retained, the original materials can be reused to a large extent or will at a minimum provide guidance for the repackaging effort.

3.4.2 Conditions during storage and shipment should normally be limited as follows:

(1) Maximum humidity: 95% (no condensation)

(2) Temperature range: -30 °C to 85 °C.

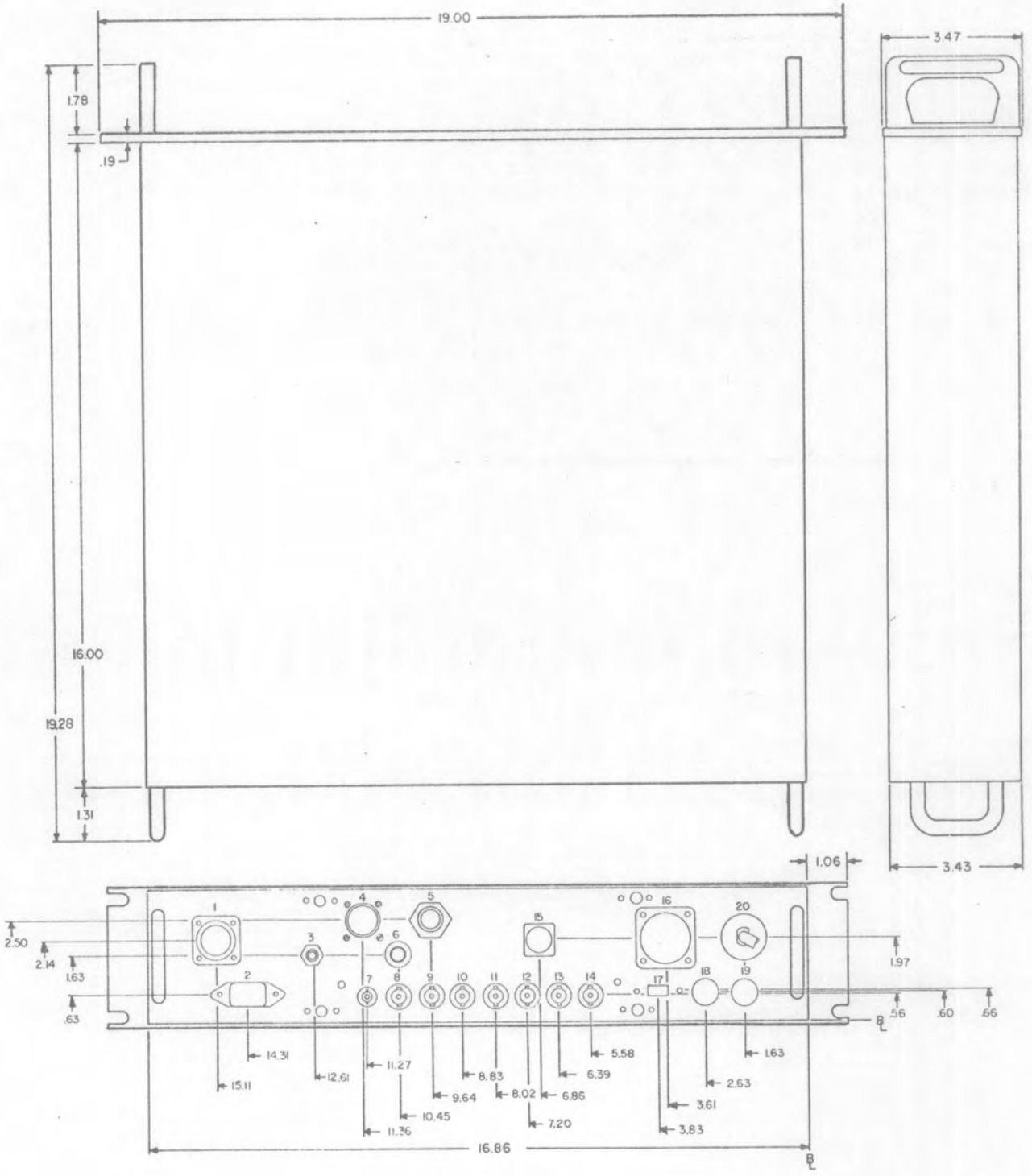


Figure 3-1. Type 215 Receiver, Critical Dimensions

SECTION IV
MAINTENANCE

4.1 GENERAL

The Type 215 Receiver has been conservatively designed to operate for extended periods of time with little or no routine maintenance. An occasional cleaning and inspection are the only preventive maintenance recommended. The intervals for these operations should be determined by the operating environment. Should trouble occur, repair time can be minimized if the maintenance technician is familiar with the circuit descriptions located in section II. Reference should also be made to the block diagrams, Figures 2-1, 2-2, and 2-3, and to the schematic diagrams located in Section VI. A complete parts list and component location illustrations can be found in Section V.

4.2 CLEANING AND LUBRICATION

The unit should be kept clean, free of dust, grease, moisture, and foreign matter to ensure trouble-free operation. If available, low velocity compressed air may be used to blow accumulated dust from the exterior of the unit. A clean dry cloth, a soft bristled brush, or a cloth saturated with cleaning compound may also be used. The 215 Receiver does not require lubrication.

4.3 INSPECTION FOR DAMAGE AND WEAR

Many potential or existing problems can be located by a thorough visual inspection of the unit. For this reason, a detailed inspection should be made an integral part of any periodic maintenance. Special attention focused towards signs of mechanical wear and darkening of resistors, transistor cases, or printed circuit board material can save much time in troubleshooting. It is essential that the cause of overheating be located and corrected before replacing damaged parts. Mechanical parts, front panel controls and switches should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4.4 TEST EQUIPMENT REQUIRED

The following test instruments, or their equivalents are required to troubleshoot and align the 215 Receiver.

Table 4-1. Test Equipment Required

(1) Signal Generator, Hewlett Packard, Type 606B
(2) Signal Generator, Hewlett Packard, Type 608E
(3) Signal Generator, Hewlett Packard, Type 612A
(4) Marker Generator, Telonic, Type TMS-1
(5) Sweeping Signal Generator, Wavetek, Type 2001
(6) AM/FM signal Generator, Boonton, Type 102A
(7) Pulse Generator, Data Pulse, Type 106A
(8) RF VTVM, Boonton, Type 92A with Type 91-14A 50Ω adapter
(9) VTVM ac, dc, RCA, Type WV-98C
(10) RMS Voltmeter, Hewlett Packard, Type 3400A
(11) AC VTVM, Hewlett Packard, Type 400FL
(12) Oscilloscope, Tektronix, Type 503
(13) Frequency Counter, Computer Measurement Company, Type CMC-738A
(14) Digital Voltmeter, Dana, Type 5500/112
(15) Metered Variac, General Radio, Type W5MT3A
(16) 3 dB Attenuator Pad, Applied Research Inc., Type HFA-50
(17) Step Attenuator, Kay, Type 30-0 432D
(18) Balanced Mixer, Relcom, Type M1-A
(19) One 100 Ω 1/2W 5% Resistor
(20) Test Fixture, Figure 4-30

All of the above signal generators may or may not be needed, depending on the operating frequency of the installed tuning head. The oscilloscope can be used to check waveforms and can also be substituted for the display unit in the PAN and SECTOR modes.

4.5 TROUBLESHOOTING

Should trouble occur, the first step should be directed towards localizing the problem to a particular module or circuit group. To aid in this effort, there is a troubleshooting table (Table 4-2), waveform photographs taken at key points, and a table of semiconductor element voltages (Table 4-3).

4.5.1 Localizing Troubles. - The troubleshooting table is designed to show methods by which logical troubleshooting can be applied to the Type 215 Receiver. If the unit is totally inoperative, the problem is most likely associated with the input power rectifiers, or power regulators. If the receiver will operate in the PAN and SECTOR modes but fails to operate in the MAN mode, the problem probably is located in circuits following the AM detector. If the receiver operates in MAN but will not operate in PAN and SECTOR modes, the ramp generator or sweep control is probably faulty.

4.5.2 Failure Analysis - Once the trouble has been located, the unit can be returned to operation by substituting a spare module or subassembly known to be in good condition. Prior to performing corrective maintenance on a faulty module, the procedures followed up to this point should be reviewed to determine exactly why the failure affected the equipment in the manner it did. The review is necessary to make sure that the problem discovered is actually the cause and not just the result of the malfunction.

Table 4-2. Troubleshooting Information

Trouble Indication	Probable Fault	Diagnostic Procedure
Unit totally inoperative; power light out.	Fuse F1 or F2 blown, power switch S6 defective, line cord or line filter defective, primary of transformer T1 open.	Use an ac voltmeter to check primary voltages.
Unit totall inoperative; power light illuminated.	Secondary of power transformer T1 defective, or power supply regulators defective.	Check secondary of power transformer using ac voltmeter. Use dc voltmeter to check -18 V at XA11 pin 11, +18V at XA11 pin 10, +5 V at XA11 pin 3, -10.3 V at XA15 pin 19, +10.3 V at XA15 pin 16, and +30 V at XA15 pin 3.
Unit totally inoperative in local and remote PAN, SEC, and PAN/SEC.	Faulty ramp generator/IF Selector Switch or IF Amplifier Assembly.	Check for ramp waveform at J7 using the oscilloscope. Connect the appropriate signal generator to the RF input jack, J1. With the receiver in the MAN TUNE mode, tune the receiver and signal generator to a convenient in-band frequency and check the 21.4 MHz output on rear

Table 4-2. Troubleshooting Information (Continued)

Trouble Indication	Probable Fault	Diagnostic Procedure
		panel jack J12 using the frequency counter.
Unit will not operate in one IF bandwidth position.	Defective IF filter board or IF bandwidth, AM/FM select board defective.	Check for +18 V on the missing IF amplifier filter board select line A4C13, A4C19, A4C15, or A4C17. Check for 21.4 MHz IF output at J12.
No readout on the associated frequency counter.	Failure of local oscillator in tuning head, accessory counter failure or count trigger pulse absent.	Check for correct LO output level. Switch to PAN mode and check for count trigger pulse output at J8 pin 6. Also check for +18 V on J8 pin 7 in PAN, SECTOR, and PAN/SEC modes. Connect the signal generator tuned to mid-band frequency of the installed tuning head, to the counter input at a level of 100 mV. The reading on the frequency counter will be the signal generator input frequency less the IF offset. The IF offset is 21.4 MHz for VHF tuners and 160 MHz for UHF tuners.
Receiver will not change IF bandwidths on remote command.	Failure in the IF BW select module or the IF amplifier assembly.	Switch the control mode to local. Manually select the IF bandwidths checking for the +18V on the appropriate IF select line A4C13, A4C19, A4C15, or A4C17.

Table 4-2. Troubleshooting Information (Continued)

Trouble Indication	Probable Fault	Diagnostic Procedure
All IF's select properly from local control.	Failure in the IF Bandwidth AM/FM select module.	Refer to paragraph 4.5.7.2 and perform the performance check.

4.6 PERFORMANCE CHECKS

The performance checks presented here can be used to verify proper operation for the 215 Receiver after repair, realignment, or as part of a periodic maintenance check.

4.6.1 Power Supply Regulator Checks. - The following tests will insure proper voltage regulation over the range of 105 V ac to 125 V ac.

4.6.1.1 The following test equipment is required:

(1) Metered Variac, General Radio, Type W5MT3A
(2) Digital Voltmeter, dana, Type 5500/112
(3) An operational tuning head for the 215 Receiver
(4) Oscilloscope, Tektronix, Type 503

4.6.1.2 Plus the receiver into the Variac and turn both on. Use the digital voltmeter to measure the voltage as outlined:

(1) Set the ac input voltage to 115 V ac and measure the regulator output voltages.

POWER SUPPLY	MEASURE AT	MINIMUM READING	MAXIMUM READING
+5 V	A14 pin 3	+4.80 V	+5.20 V
+18 V	A14 pin P	+17.3 V	+18.7 V
-18 V	A14 pin 9	-17.3 V	-18.7 V
+10.3 V	A15 pin 16	+10.299 V	+10.301 V
-10.3 V	A15 pin 19	-10.299 V	-10.301 V
+30 V	A15 pin 3	+29.99 V	+30.01 V

(2) Set the ac input voltage to 127 V ac and measure the regulator output voltages.
(3) Set the ac input voltage to 103 V ac and measure the regulator output voltages.
(4) Set the ac input voltage to 115 V ac.
(5) Using the 503 oscilloscope, measure the ac ripple voltage at XA14 pin P and pin 9.

(6) The ripple voltage must not be greater than 3 mV.

4.6.2 AM Output Stability Check. - This check is used to evaluate the operation of the average AGC circuit over a wide range of input signal levels.

4.6.2.1 The following equipment is needed:

(1) AC VTVM, Hewlett Packard, Type 400 FL
(2) Signal Generator, Hewlett Packard, Type 606B
(3) Frequency Counter, Computer Measurements Corp., Type CMC-738A

4.6.2.2 Perform checks as follows:

(1) Set the 215 Receiver controls as follows:

(a) Tuning Mode - MAN
(b) Reception mode - AM/AGC
(c) IF BANDWIDTH - 1 MHz

(2) Connect the equipment as shown in Figure 4-1.

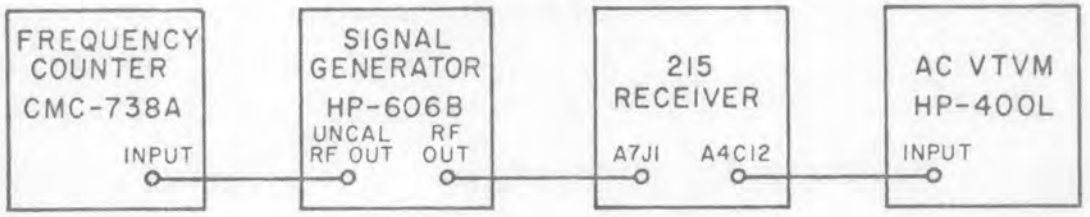


Figure 4-1. Test Setup, AM Output Stability Check

(3) Use the frequency counter to set the signal generator to 21.4 MHz. Use 1 kHz modulation frequency at 50% AM.
(4) Adjust the signal generator output level to -62 dBm. Set the AC VTVM range switch to produce a convenient reading.
(5) Record this reading.
(6) Increase the signal generator output level to -21 dBm.
(7) Record this reading.
(8) Subtract the reading obtained in step (5) from that in step (7). The difference should be 4 dB MAXIMUM.
(9) Place the IF BANDWIDTH switch in the 300 kHz position.
(10) Adjust the signal generator output level to -67 dBm and repeat steps (5) through (8).
(11) Place the IF BANDWIDTH switch in the 50 kHz position.

(12) Adjust the signal generator output level to -74 dBm and repeat steps (5) through (8).
(13) Place the IF BANDWIDTH switch in the 10 kHz position,
(14) Adjust the signal generator output level to -82 dBm and repeat steps (5) through (8).

4.6.3 IF Gain and Bandwidth. - The folowing tests ensure that the four IF preselectors, operating through the IF output amplifier, have the proper gain and bandwidth.

4.6.3.1 The following equipment is required:

(1) Frequency Counter, Computer Measurement Corp., Type CMC-738A
(2) Signal Generator, Hewlett Packard, Type 606B
(3) 3-dB Attenuator Pad, Applied Research Inc., Type HFS-50
(4) VTVM, RCA, Type WV-98C

4.6.3.2 The tests are made as follows:

(1) Place the tuning mode switch in MAN.
(2) Place the reception mode switch in AM/MAN.
(3) Set the RF GAIN control to the maximum CW position.

CAUTION

When connecting the test equipment, do not short A2C12 to ground. Failure to observe this caution may destroy several transistors.

(4) Place the IF BANDWIDTH switch in the 1 MHz position.
(5) Connect the equipment as shown in Figure 4-2.

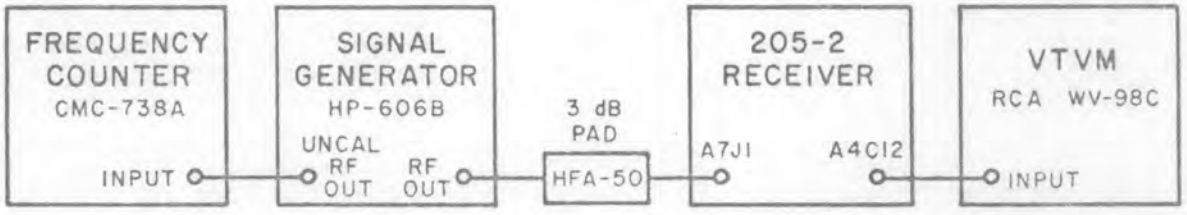


Figure 4-2. Test Setup, IF Gain and Bandwidth Check

(6) Using the counter, adjust the signal generator to produce a 21.4 MHz CW signal.

(7) Adjust the signal generator output until the VTVM reads exactly 1.5 V dc.
(8) With the 3 dB pad installed as shown, the signal generator output must be between -68 dBm and -66 dBm
(9) Remove the 3 dB pad.
(10) Increase the generator frequency until the VTVM again indicates exactly 1.5 V dc.
(11) Record the counter indication.
(12) Repeat steps (10) and (11) tuning the signal generator below 21.4 MHz.
(13) Subtract the frequency obtained in step (12) from the frequency obtained in step (11). The difference in frequency must be between 900 kHz and 1.1 MHz.
(14) Replace the 3 dB pad, place the IF BANDWIDTH switch in 300 kHz, and repeat steps (5) through (13). The signal generator output at step (8) must be between -73 dBm and -71 dBm. The 3 dB bandwidth must be between 270 kHz and 330 kHz.
(15) Replace the 3 dB pad, place the IF BANDWIDTH switch in the 50 kHz position, and repeat steps (5) through (13). The signal generator output at step (8) must be between -81 dBm and -79 dBm. The 3 dB bandwidth must be between 45 kHz and 55 kHz.
(16) Replace the 3 dB pad, place the IF BANDWIDTH switch in the 10 kHz position, and repeat steps (5) through (13). The signal generator ourpur at step (8) must be between -88 dBm and -86 dBm. The 3 dB bandwidth must be between 9 kHz and 11 kHz.

4.6.4 Video and Audio Output Tests. - The following tests ensure that the video and audio amplifiers will deliver their rated outputs.

4.6.4.1 The following equipment is required:

(1) AC VTVM, Hewlett Packard, Type 400L
(2) Signal Generator, Hewlett Packard, Type 606B
(3) Frequency Counter, Computer Measurements Corp., Type CMC-738A
(4) Resistor, 100 Ω, 5%

4.6.4.2 The tests are performed as follows:

(1) Place the receiver controls as follows:

a. IF BANDWIDTH - 300 kHz
b. Tuning mode - MAN
c. Reception mode - AM/AGC

d. VIDEO GAIN - max CW
e. AUDIO LEVEL - max CW
f. COR SENSITIVITY - max CW

(2) Connect the equipment as shown in Figure 4-1 except the AC VTVM connects to J16.
(3) Adjust the signal generator to produce an output level of -47 dBm, 1 kHz modulation rate, 50% modulation amplitude. Set the output frequency to 21.4 MHz using the counter.
(4) Terminate the video output jack, J13, in a 100-ohm load.
(5) The AC VTVM must read 1.0 V rms, minimum.
(6) Terminate the audio output, J16 pins 1 and 2, in a 600-ohm load.
(7) Connect the AC VTVM across the audio output. It must read 7.7 V rms, minimum.

4.6.5 Sweeping Mode AGC Tests. - The following tests will evaluate the AGC system in the PAN and SECTOR modes. In these modes, AGC voltages are produced by the RF Monitor (A7) and the AGC Amplifier (A9).

4.6.5.1 The following equipment is required:

(1) Signal Generator, Hewlett Packard, Type 608E and Type 606B
(2) Oscilloscope, Tektronix, Type 503
(3) VTVM, RCA, Type WV-98C

4.6.5.2 The tests are performed as follows:

(1) Connect the equipment as shown in Figure 4-3.

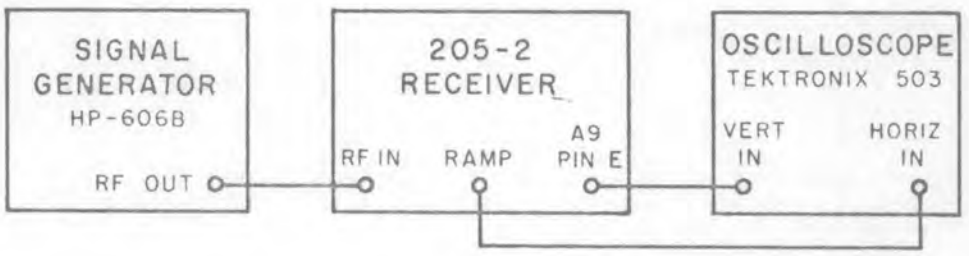


Figure 4-3. Test Setup, Sweep Mode AGC Check

(2) Adjust the signal generator to produce a CW signal near mid-band of the installed tuner at a level of 1 mV.
(3) Refer to Table 4-3. Place the receiver in PAN and SECTOR modes with maximum and minimum sweep width as required to obtain two readings on the oscilloscope at A9 pin E. The limits are:

10 kHz	0.8 V dc +0.1 V dc
50 kHz	0.7 V dc +0.1 V dc
300 kHz	0.6 V dc +0.1 V dc
1 MHz	0.5 V dc +0.1 V dc

(4) Connect the signal generator output to A7J1.
(5) Adjust the signal generator to produce a CW signal at 21.4 MHz at a level of -30 dBm.
(6) Connect the VTVM to A7C2. Adjust the VTVM for a convenient mid-scale reading.
(7) Gradually increase the signal generator output level. The VTVM reading should start moving in a negative direction at -26 dBm ± 2 dBm.

Table 4-3. Operating IF Bandwidths in Pan and Sector Tuning Modes

		IF Bandwidth		
			Sector Tuning Mode	
Tuner Type	Frequency Range	Pan Tuning Mode	Sweep Width max CW	Sweep Width max CCW
HH-11	2-30 MHz	50 kHz	50 kHz	10 kHz
VH-11	30-60 MHz	50 kHz	50 kHz	10 kHz
VH-12	60-120 MHz	300 kHz	300 kHz	50 kHz
VH-13	100-180 MHz	300kHz	300 kHz	50 kHz
VH-14	180-300 MHz	300 kHz	300 kHz	50 kHz
VH-15	20-40 MHz	50 kHz	50 kHz	10 kHz
VH-16	40-80 MHz	50 kHz	50 kHz	10 kHz
VH-17	50-100 MHz	300 kHz	300 kHz	50 kHz
UH-11	250-500 MHz	300 kHz	300 kHz	50 kHz
UH-12	500-1000 MHz	300 kHz	300 kHz	50 kHz
UH-13	220-440 MHz	300 kHz	300 kHz	50 kHz

4.6.6 Incidental FM Check. - The following equipment is needed:

(1) Marker Generator, Telonic TMS-1
(2) RMS Voltmeter, HP 3400A
(3) Step Attenuator, Kay 30-0 432D
(4) 100 Ω resistor

4.6.6.1 Perform checks as follows:

(1) Connect the equipment as shown in Figure 4-4.

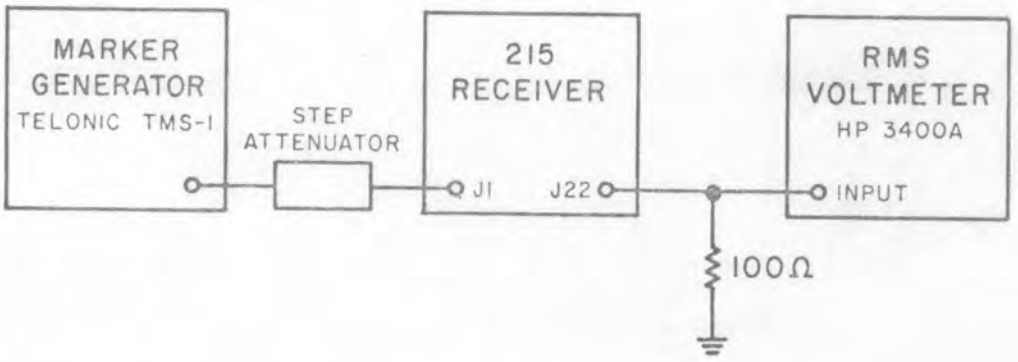


Figure 4-4. Test Setup, Incidental FM Check

(2) Install a known good VH tuning head in the receiver.
(3) Adjust the receiver controls as follows:

a. Reception Mode - FM
b. Operating Mode - MAN
c. IF Bandwidth - 10 kHz

(4) Tune the receiver to the marker generator.
(5) Using the following equations calculate the maximum allowable incidental FM output level in mV rms.

a. 0.75 X Receiver tuned frequency = Deviation
b. Deviation X 0.4 = Volts Peak
c. Volts Peak X 0.707 = RMS value for incidental FM

example:
you have installed a VH-13 Tuning Head and are tuned to 140 MHz

a. 0.75 X 140 = 105
b. 105 X 0.4 = 42.0
c. 42 X 0.707 = 29.694 V rms 29.7 mV rms

(6) Using the step attenuator adjust the output of the marker generator to -50 dBm as read on the RF millivoltmeter.
(7) Read the incidental FM voltage on the RMS voltmeter. It must not exceed the value calculated above.

4.6.7 Remote Function Checks. - Make the following initial settings on the remote control test fixture (Figure 4-30). All switches will remain in these positions unless otherwise specified for the remote tests.

(1) AM/FM select - AM
(2) Bandwidths select - BW3
(3) RG0 through RG5 select - Position 0
(4) Remote tuning speed - slow
(5) Remote AGC dump - no dump
(6) Remote AGC select - average

4.6.7.1 Test Equipment Required:

(1) Test Fixture (Figure 4-30)
(2) VTVM, RCA, WV-98C
(3) AC VTVM, HP-400FL
(4) AM/FM Signal Generator, Boonton 102A
(5) Pulse Generator, Data Pulse 106A
(6) Balanced Mixer, Relcom M1-A
(7) Oscilloscope, Tektronix 515A
(8) Attenuator, Kay 30-0
(9) Adapters and cables

NOTE
With the receiver mode switch in the REMOTE position the receiver can not be tuned from the front panel. Because of this, all remote checks will be performed at mid-band of the installed tuner. Short J23 pins C and R together.

4.6.7.2 Remote IF Bandwidth Selection. -

(1) Interconnect the equipment as shown in Figure 4-5.
(2) Set the receiver operating mode to Remote.
(3) Set the test fixture Bandwidth select switch to BW1.
(4) Measure the voltage at the following points on the IF Amplifier Assembly A4, switching IF bandwidths as required.

Bandwidth	C13/C26	C19/C28	C1/C15	C3/C17
BW1	+18 V dc	-18 V dc	-18 V dc	-18 V dc
BW2	-18 V dc	+18 V dc	-18 V dc	-18 V dc
BW3	-18 V dc	-18 V dc	+18 V dc	-18 V dc
BW4	-18 V dc	-18 V dc	-18 V dc	+18 V dc

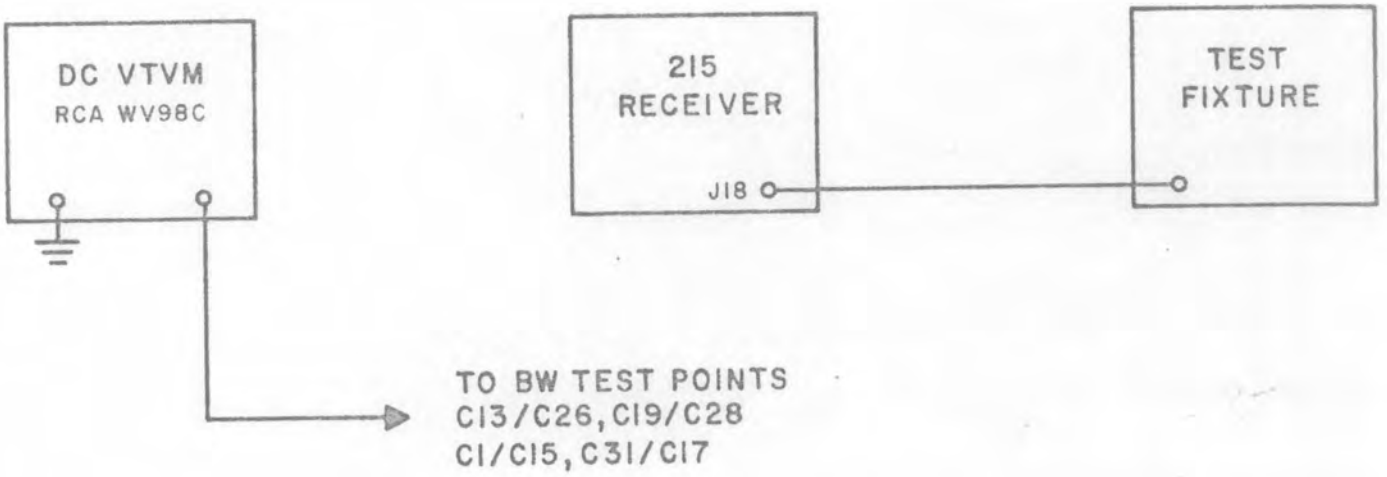


Figure 4-5. Test Setup, Remote IF Bandwidth Select Check

4.6.7.3 Remote AM/FM Select. -

(1) Connect the test equipment as shown in Figure 4-6.

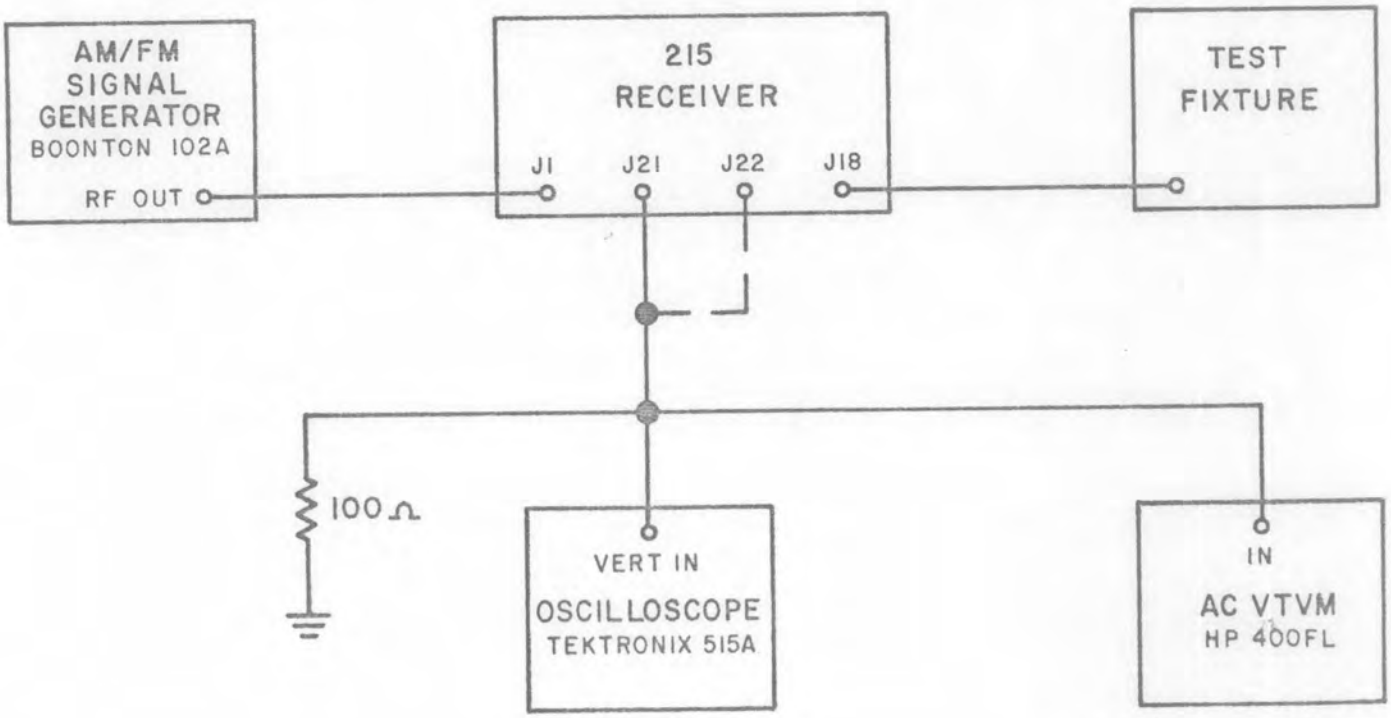


Figure 4-6. Test Setup, Remote AM/FM Select Check

(2) Adjust the signal generator to the mid-band frequency of the installed tuner.
(3) Set the generator output level to 1 mV and 50% AM modulation at 1 kHz.
(4) Set the Bandwidth switch on the test fixture to BW3 and the reception mode switch to AM/AGC.
(5) Verify the AM output is 0.42 V rms minimum.
(6) Transfer the test fixture AM/FM switch to the FM position. Verify the loss of signal at J22.
(7) With the signal generator RF output at 1 mV, adjust the generator to produce an FM output with a peak deviation of 150 kHz.
(8) Verify the FM output is 1.4 V rms.
(9) Transfer for test fixture AM/FM switch to the AM position and verify the loss of signal at J22.

4.6.7.4 Remote Average AGC

(1) Interconnect the equipment as shown in Figure 4-7.

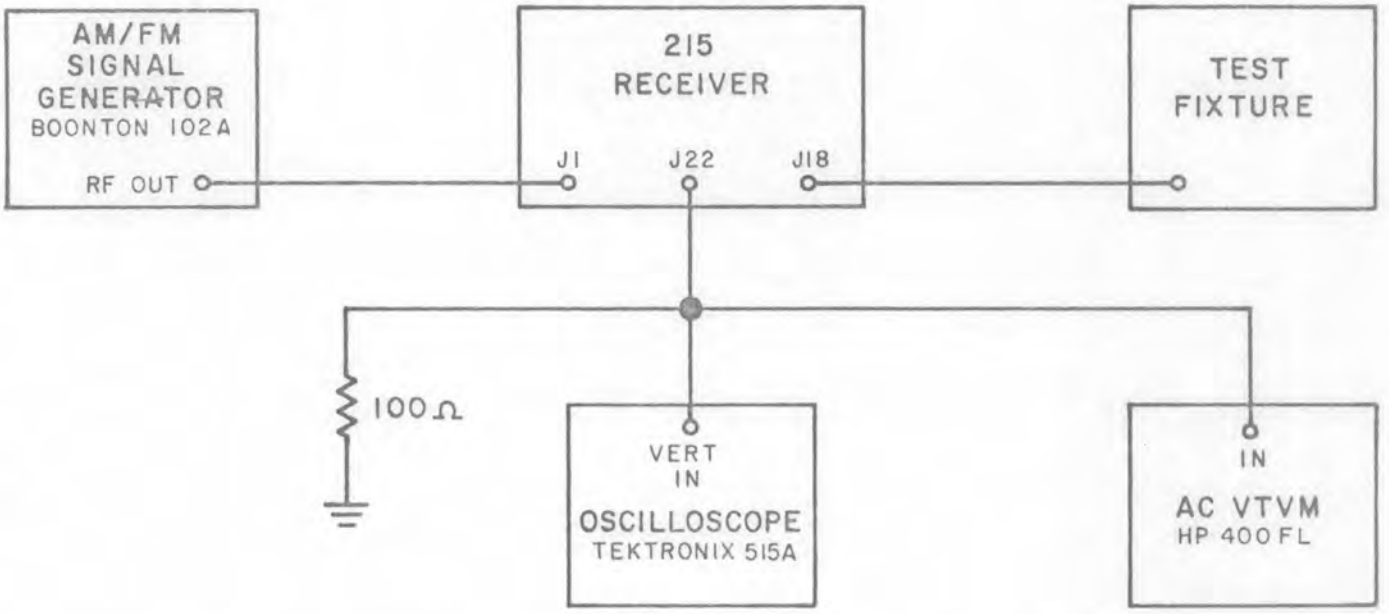


Figure 4-7. Test Setup, Remote Average AGC Check

(2) Set the test fixture IF bandwidth switch to BW3.
(3) Tune the signal generator to the mid-band frequency of the installed tuner.
(4) Adjust the signal generator output level as specified below for the installed tuner.

TUNER	Generator Output
VH-11	-93 dBm
VH-12	-92 dBm
VH-13	-92 dBm
VH-14	-91 dBm
VH-15	-93 dBm
VH-16	-93 dBm

(5) Adjust the video gain control for a convenient reference level (such as 0 dB) on the 1 volt range of the AC VTVM. Make note of this reference setting.
(6) Increase the signal generator output level from that specified above to -13 dBm.
(7) The Video output as read on the AC VTVM should not change more than 4.0 dB.

4.6.7.5 Remote Pulse AGC. -

(1) Connect the equipment as shown in Figure 4-8.

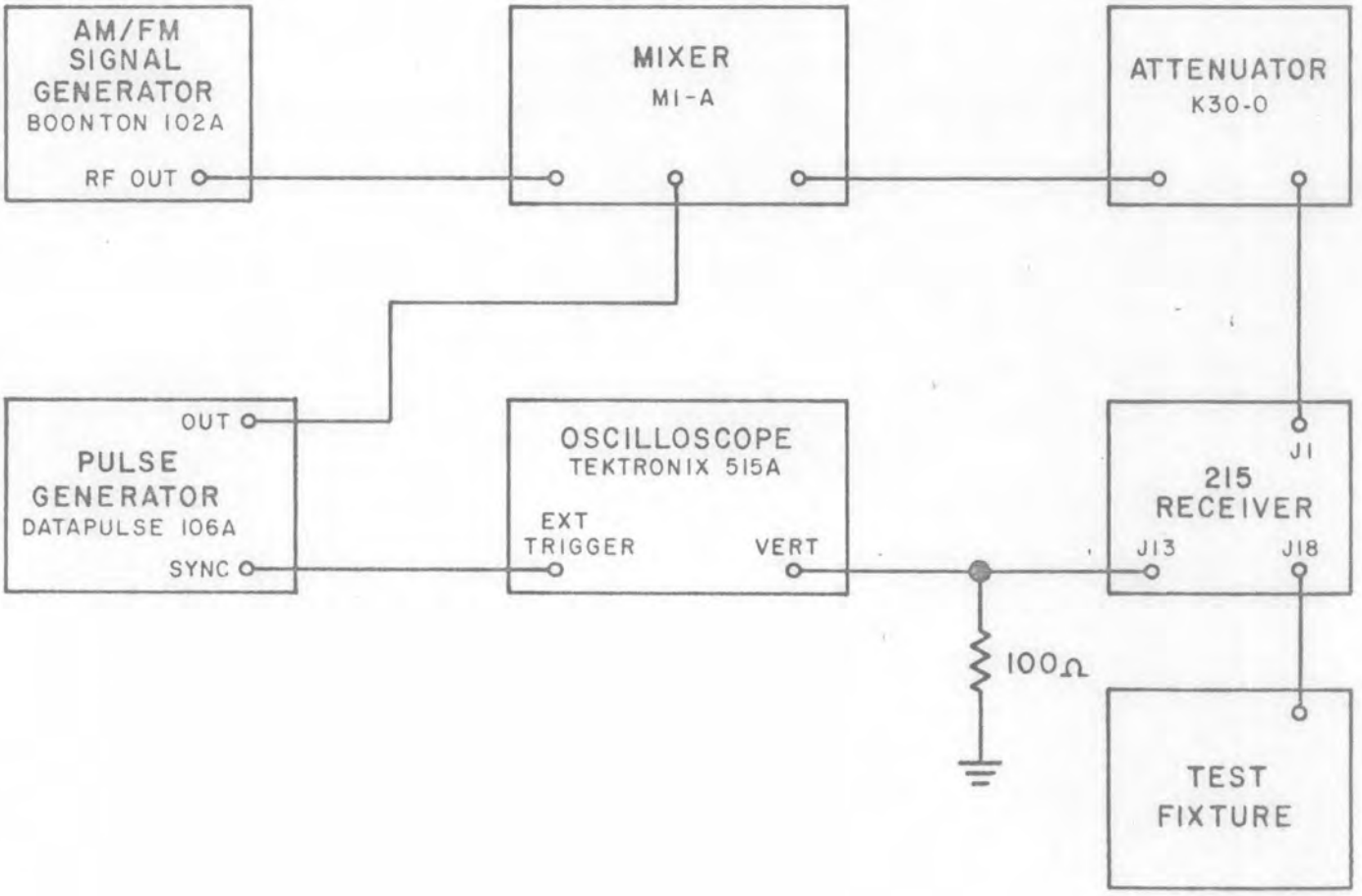


Figure 4-8. Test Setup, Remote Pulse AGC Check

(2) Set the remote AGC select switch to the pulse position.
(3) Tune the signal generator to the mid-band frequency of the installed tuner.
(4) Adjust the signal generator output to +6 dBm with 50% AM modulation at 1 kHz.
(5) Set the step attenuator to provide the proper input level as specified in paragraph 4.6.7.4, step (4).
(6) Adjust the pulse generator as follows:

a. Pulse repetition rate - 1 kHz
b. Pulse width - 24 m Sec

(7) Adjust the video gain control for 1 volt peak to peak.
(8) Remote the 70 dB from the attenuator and note the output on the oscilloscope. It should not change by more than 2 volts. (A 2 V change indicates a 6 dB change in output level.)

4.6.7.6 Remote Log. - This check can only be performed if a known operational SM-7301 display unit is available.

(1) Place the remote tuning speed switch in the FAST position and the remote AGC select switch in the LOG position.
(2) Connect the equipment as shown in Figure 4-9.

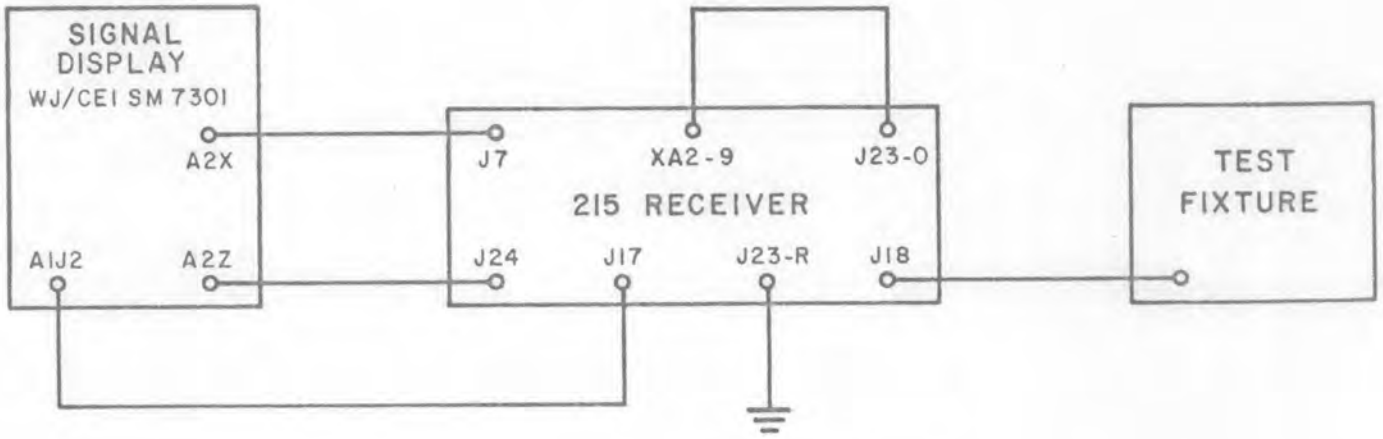


Figure 4-9. Test Setup, Remote LOG AGC Select Check

(3) Tune the signal generator to the mid-band frequency of the tuner. Use no modulation and adjust the generator output for 10 μV rms.

(4) Increase the signal generator output to -13 dBm.
(5) Verify that the trace on the display unit does not exceed 6 cm.

4.6.7.7 Remote Manual Gain. -

(1) Connect the equipment as shown in Figure 4-10.

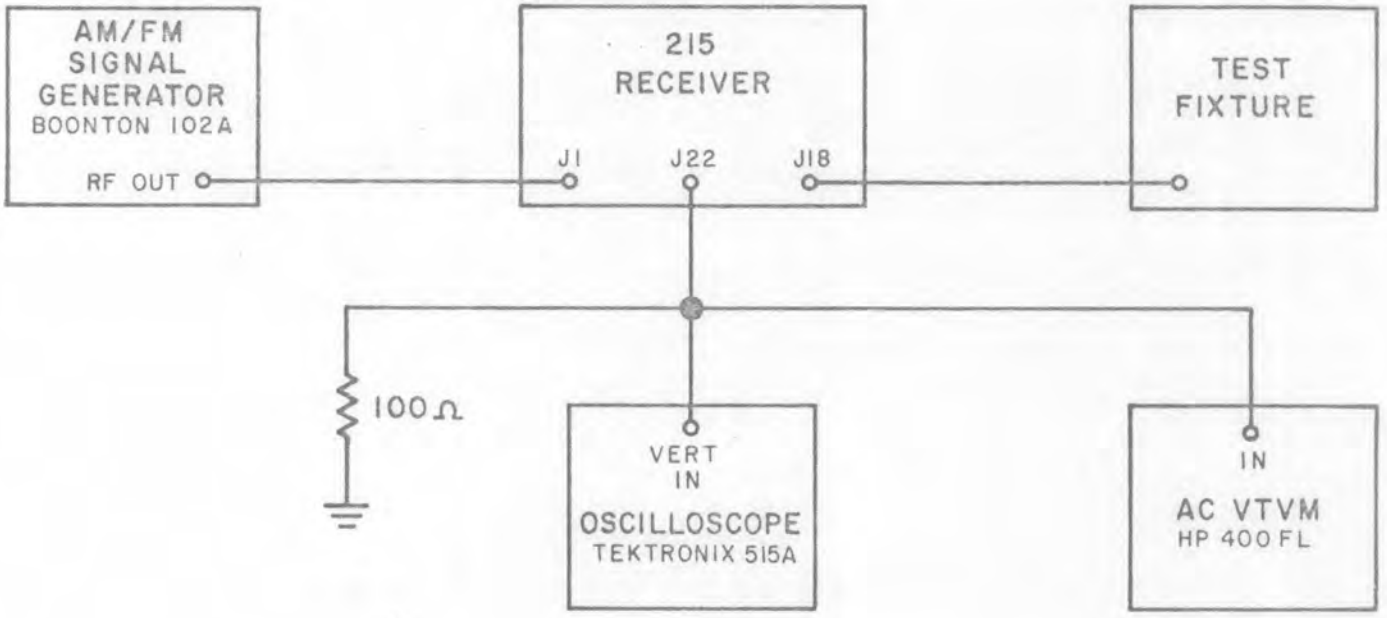


Figure 4-10. Test Setup, Remote Manual Gain Check

(2) Set the remote tuning speed switch to slow and the remote AGC select switch to MAN.
(3) Tune the signal generator to the mid-band frequency of the tuner and modulate it at 50% AM at 1 kHz.
(4) Adjust the RF level of the generator to produce an undistorted output at J22.
(5) Note the level on the AC VTVM and the RF input level.
(6) One at a time transfer the remote gain switches, (RG0-RG5) to position 1. Verify that the AC VTVM level decreases as each switch is transferred.
(7) After all switches have been transferred to position 1, increase the generator output level to regain the reference level on the AC VTVM.
(8) The amount the signal generator was increased represents the remote manual gain control range and should be a minimum of 30 dB.
(9) Return all switches to the 0 position (RG0-RG5).

4.6.7.8 Remote AGC Dump and Tuning Speed. -

(1) Set the remote AGC mode switch to AVERAGE.
(2) Connect the test equipment as shown in Figure 4-11.

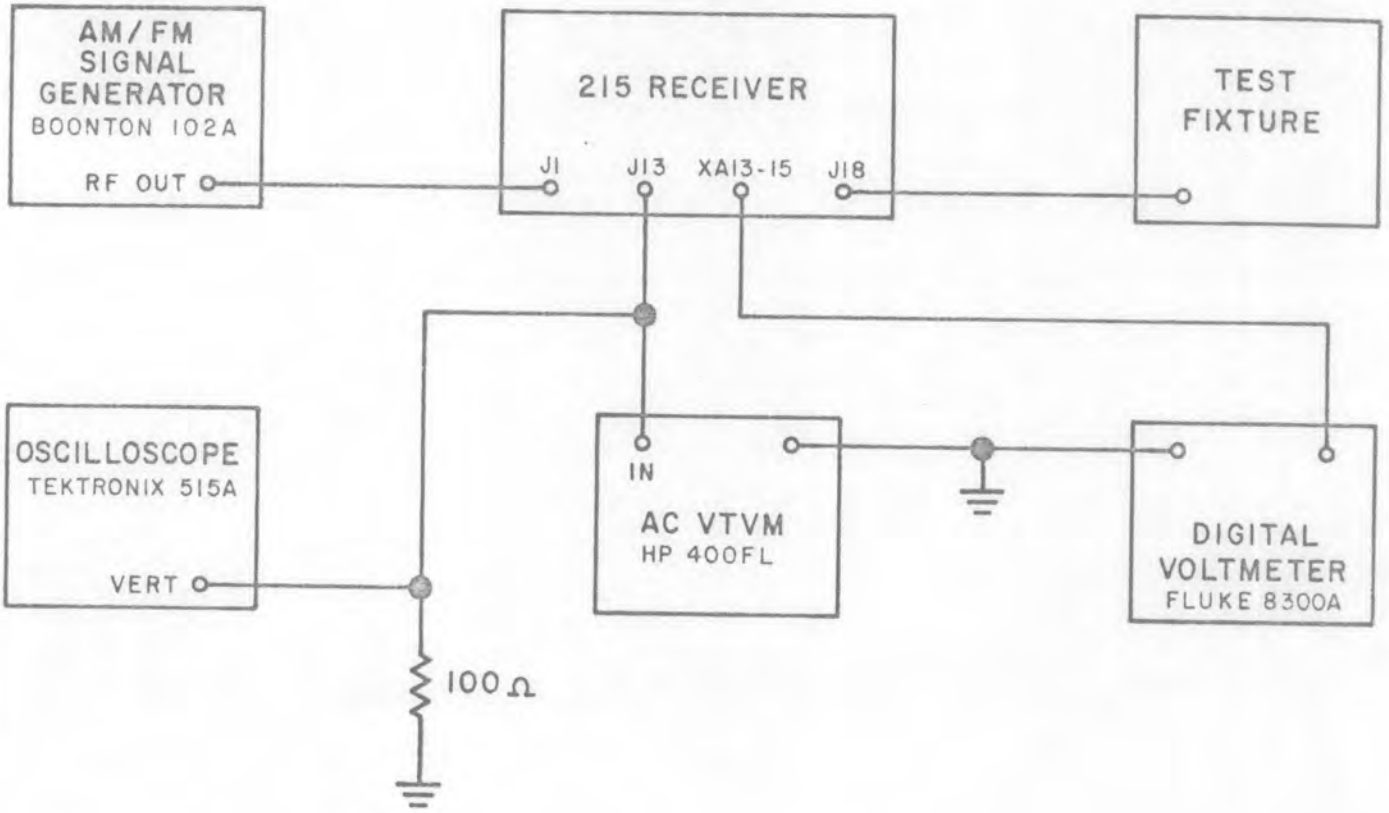


Figure 4-11. Test Setup, Remote AGC Dump and Tuning Speed Check

(3) Tune the signal generator to the mid-band frequency of the installed tuner. Set the generator to produce 50% AM at 1 kHz.
(4) Set the generator output level to 50 μV. Note the level on the AC VTVM.
(5) Set the remote AGC Dump switch to DUMP. Note the output level on the AC VTVM.
(6) Vary the RF input level and note that the output level on the AC VTVM varies also. Set the remote AGC switch to AVERAGE.
(7) Remove the RF input from J1.
(8) Verify that the voltage at XA3-15 is approximately +18 V with the remote tuning speed switch in the slow position and approximately 0 V with the switch in the fast position.
(9) Return the tuning speed switch to the SLOW position and the AGC Dump switch to NO DUMP.

4.6.7.9 Remote Indicators (COR, SQUELCH and STATUS). -

(1) Connect the equipment as shown in Figure 4-12.

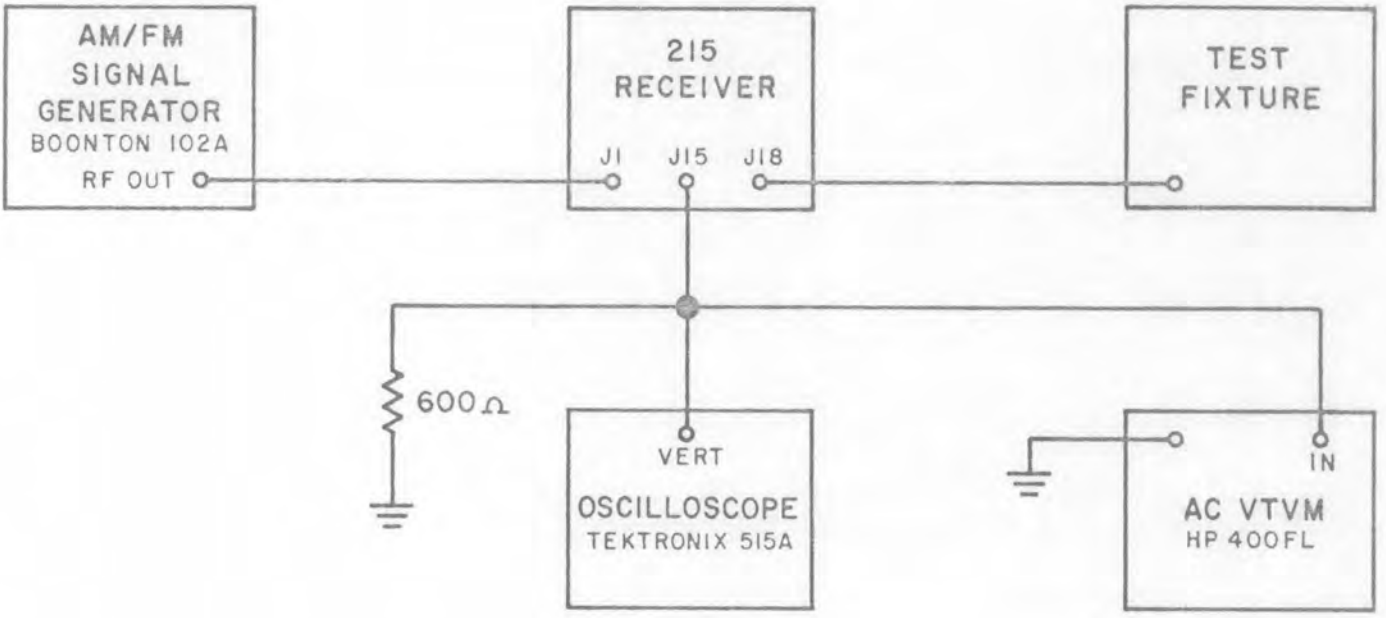


Figure 4-12. Test Setup, Remote Indicator Checks

(2) Tune the signal generator to the mid-band frequency of the installed tuner.
(3) Adjust the generator for 50% AM at a 1 kHz rate.
(4) Set the RF output to 1 mV rms.
(5) Set the receiver mode switch to MAN and note the status indicator on the test fixture indicates local.
(6) Set the receiver mode switch to remote and note the status indicator on the test fixture indicates remote.
(7) Turn the signal generator RF output level to minimum and adjust the COR sensitivity control until the squelch indicator just goes off. The COR light will go off 6-10 seconds later.
(8) Increase the signal generator RF output level to 1 mV. The Squelch and COR lights should both come on.
(9) Disconnect the signal generator from J1. The squelch light should go out immediately and 6-10 seconds later the COR light should go off.

4.7 ALIGNMENT AND ADJUSTMENT PROCEDURES

4.7.1 General. - The alignment procedures given here are suitable for

making adjustments after replacing components or modules. Front panel controls not specifically called out in an alignment procedure may be left in any position with no adverse affects. If limits and tolerances specified can not be obtained using the following procedures, a factory alignment is necessary.

4.7.2 Test Equipment Required. - The following test instruments, or their equivalents, are required to align the 215 Receiver.

(1) Signal Generator, Hewlett Packard, Type 606B
(2) Oscilloscope, Tektronix, Type 503
(3) Sweep Signal Generator, Wavetek, Type 2001
(4) Digital Voltmeteer, Dana, Type 550/112
(5) Frequency Counter, Computer Measurement Company, Type CMC-738A
(6) High Impedance Detector, shown in Figure 4-13
(7) Any tuning head used with the 215 Receiver
(8) Assorted cables, connectors, and alignment tools

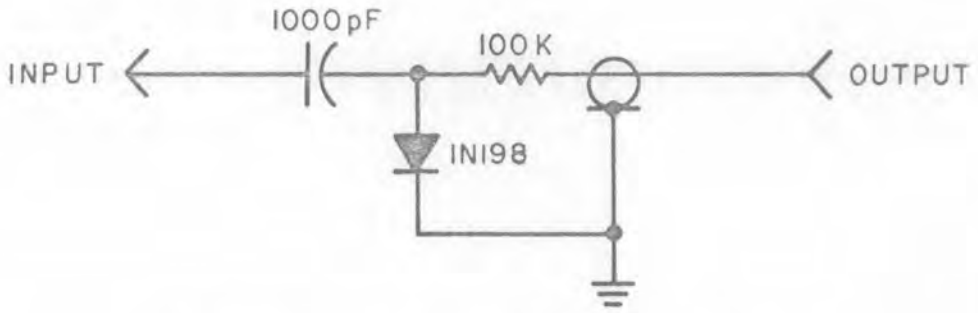


Figure 4-13. High Impedance Detector

4.7.3 Control Settings. - Set the front panel controls to the positions indicated below. Controls not specifically called out may be left in any position.

(1) Tuning Mode - MAN
(2) Reception Mode - AM/MAN
(3) RF Gain - Maximum CW
(4) IF Bandwidth - Consistent with the bandwidth being aligned
(5) Any known good tuning head

4.7.4 Power Supplies. - Adjust the power supplies in the sequence listed:

(1) Turn the receiver on.

(2) Connect the digital voltmeter to XA15 pin 19 and adjust A15R5 for a -10.300 V reading.
(3) Connect the digital voltmeter to XA15 pin 16 and adjust A15R8 for a +10.300 V reading.
(4) Connect the digital voltmeter to XA15 pin 3 and adjust A15R18 for a +30.00 V reading.
(5) Disconnect the digital voltmeter.

4.7.5 Sweep Control Alignment (A3). - Make the sweep control adjustments only after verifying porper power supply voltages, (paragraph 4.7.4). Proceed as follows:

(1) Disconnect any AFC inputs from jack J11.
(2) Set the FINE TUNING control to mid-range. Use the DVM to adjust A3 pin 13 to zero volts with the fine tuning control. Jumper A3 pin 13 to A3 pin 11.
(3) Switch to the REMOTE TUNE mode, and short the R and C terminals on the rear panel connector J23 together.
(4) Connect the digital voltmeter to A3 pin 9.
(5) Adjust A3R23 for a 0V ± 0.001 V reading.
(6) Remove the short from J23 and switch the receiver to the MAN mode.
(7) Connect the digital voltmeter to A3 pin 21.
(8) Adjust the main tuning knob on the tuning head until a +10.000 ± 0.001 V reading is obtained. Do not disturb this setting for the remainder of the test.
(9) Connect the digital voltmeter to A3 pin 9.
(10) Adjust A3R13 for a -10.000 ± 0.001 V reading.
(11) Disconnect the test equipment.

4.7.6 Ramp Generator Alignment (A2). - Make the following adjustments only after verifying proper sweep control alignment. Proceed as follows:

(1) Connect the external horizontal input of the 503 oscilloscope to the ramp output jack J7.
(2) Connect the positive vertical input of the 503 oscilloscope to the over sweep output J16 pin 8.
(3) Make the following initial control settings:

a. Oscilloscope-Horizontal Amplifier, Sweep Disabled
b. Oscilloscope-Horizontal Sensitivity, 0.1 V/cm calibrated
c. Receiver-PAN mode, SWEEP rate maximum CW, (tuning head installed)

(4) Adjust A2R22 and A2R24 maximum CW.

(5) Adjust the oscilloscope to display the +15 V over sweep pulses.
(6) Adjust the horizontal position control to observe the second pulse.
(7) Adjust A2R22 to obtain a pulse width of 0.03 V for the second pulse.
(8) Adjust the horizontal position control to display the first pulse and adjust A2R24 for a pulse width of 0.06 V.
(9) Disconnect the test equipment.

4.7.7 RF Monitor Alignment (A7). - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-14.

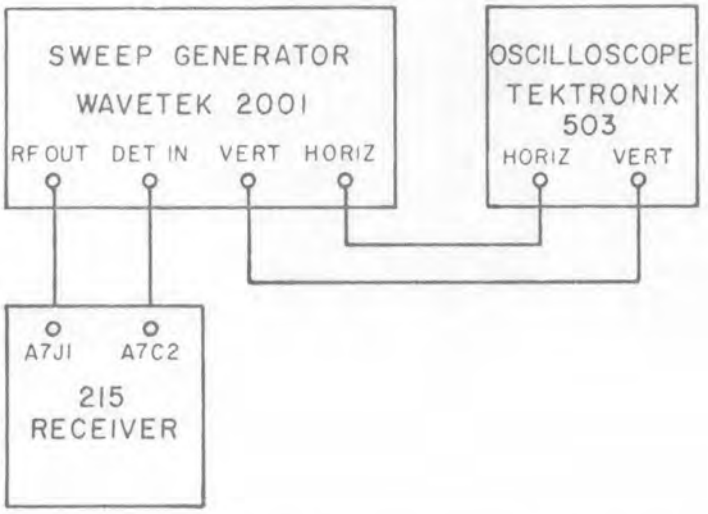


Figure 4-14. Equipment Connections, RF Monitor Alignment

(2) Adjust the sweep generator to produce a minimum 7 MHz wide sweep centered at 21.4 MHz. Use a slow sweep rate and the internal 21.4 MHz marker.
(3) Adjust the oscilloscope and sweep generator for a usable response.
(4) Adjust A7L1 for best symmetry and a bandwidth of 7-10 MHz centered about the 21.4 MHz marker.
(5) Disconnect the test equipment.

4.7.8. IF Output Amplifier Alignment (A4A8). - Proceed as follows:

CAUTION

Exercise care not to short A4C12 when connecting the test equipment. Failure to do so will destroy one or more of the semiconductors.

(1) Connect the equipment as shown in Figure 4-14 except connect the sweep generator RF output to A4A8 pin 21 and the detector input to A4C12.
(2) Set the IF BANDWIDTH switch to the 1 MHz position, set the reception mode switch to AM/MAN and the MAN GAIN control maximum CW.
(3) Adjust the sweep generator and oscilloscope to display an approximate 10 MHz wide response centered about 21.4 MHz
(4) Adjust A4A8C13 for a symmetrival response centered about the 21.4 MHz marker. The 3 dB bandwidth should be approximately 7 MHz.
(5) Adjust the sweep generator to produce a CW signal at 21.4 MHz and a level of -50 dBm.
(6) Adjust A4A8R20 for a level of 1.5 V dc at A4C12.
(7) Disconnect the test equipment.

4.7.9 1-MHz IF Preselector (A4A4). - Proceed as follows:

(1) Carefully remove the 1-MHz bandwidth preselector and install it on the extender card.
(2) Place the IF BANDWIDTH switch in the 1 MHz position.
(3) Connect the test equipment as shown in Figure 4-15.

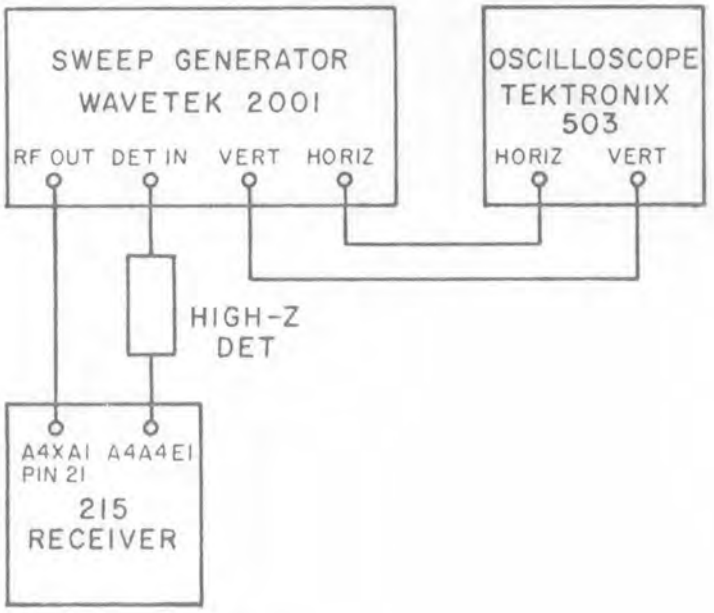


Figure 4-15. Equipment Connections, IF Preselector Alignment

(4) Use a small screwdriver and short out A4A4L2 from the back of the printed circuit board.
(5) Adjust A4A4C7 for a peak at 21.4 MHz.
(6) Remove the short from A4A4L2.
(7) Short out A4A4L3 and adjust A4A4C10 for a null at 21.4 MHz and then remove the short.
(8) Short out A4A4L4 and peak A4A4C13 at 21.4 MHz. Remove the short.
(9) Short out A4A4L5 and null A4A4C16 at 21.4 MHz. Remove the short.
(10) Adjust A4A4C20 for a peak at 21.4 MHz.
(11) Remove the high-Z detector from A4E1.
(12) Replace the module in the receptacle.
(13) Connect the high-Z detector to pin 2.
(14) Carefully adjust A4A4C7 for an overall 1 MHz bandwidth at the 3 dB points, centered about the 21.4 MHz marker.
(15) Figure 4-16 illustrates a typical 1 MHz IF response.

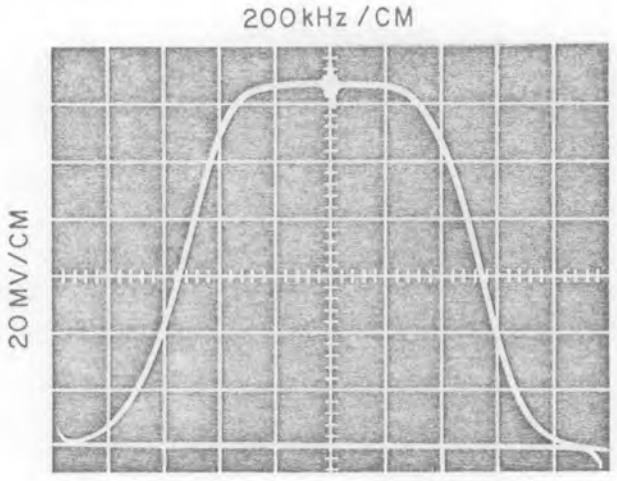


Figure 4-16. Typical 1 MHz IF Response Curve

(16) Make slight adjustments of A4A4C7, C10, C13, C6, and C20 for optimum response.

4.7.10. 300-kHz IF Preselector Alignment (A4A3). - Proceed as follows:

(1) Carefully remove the 300 kHz IF board from its recepticle and install it on the extender card.

(2) Connect the equipment as shown in Figure 4-15 except the detector connects to A4A3E1.
(3) Place the IF Bandwidth switch in the 300 kHz position.
(4) Adjust the sweep generator and oscilloscope to display the 300 kHz bandwidth response and 21.4 MHz marker.
(5) Use a small screwdriver to short out A4A3L2 from the back of the printed circuit board.
(6) Adjust A4A3C7 for a peak at 21.4 MHz. Remove the short from L2.
(7) Short out A4A3C20 and adjust C10 for a null at 21.4 MHz. Remove the short.
(8) Adjust A4A3C20 for a peak at 21.4 MHz.
(9) Move the sweep injection point to gate #1 (pin 3) of A4A3Q3 and couple the sweep through a 1000 pF capacitor.
(10) Move the detector to module pin 2.
(11) Adjust C13 and C16 for an overcoupled response centered at 21.4 MHz with a 1 dB dip.
(12) Remove the extender card and reinstall the PC board in the socket.
(13) Connect the sweep generator to pin 21.
(14) Carefully readjust C7 for an overall response centered at 21.4 MHz with a 3 dB bandwidth of 300 kHz. Figure 4-17 shows a typical 300 kHz response curve.

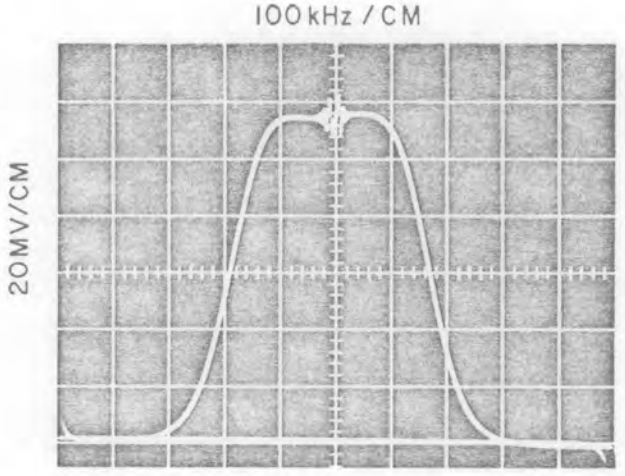


Figure 4-17. Typical 300 kHz IF Response Curve

4.7.11 10 and 50 kHz IF Preselector Alignment (A4A1-A4A2). - Use reference designation prefix A4A1 for 10 kHz IF and A4A2 for 50 kHz IF. Proceed as follows:

(1) Connect the equipment as shown in Figure 4-15, except connect the detector to pin 2 of the IF being aligned.
(2) Install the IF to be aligned on the extender card.
(3) Adjust the sweep generator and oscilloscope to display the IF response. Use no marker.
(4) Adjust L1 and L2 for minimum response ripple.
(5) Adjust L3 for a slight round-nosed response centered at 21.4 MHz
(6) Figures 4-18 and 4-19 illustrate typical 50 kHz and 10 kHz response curves.

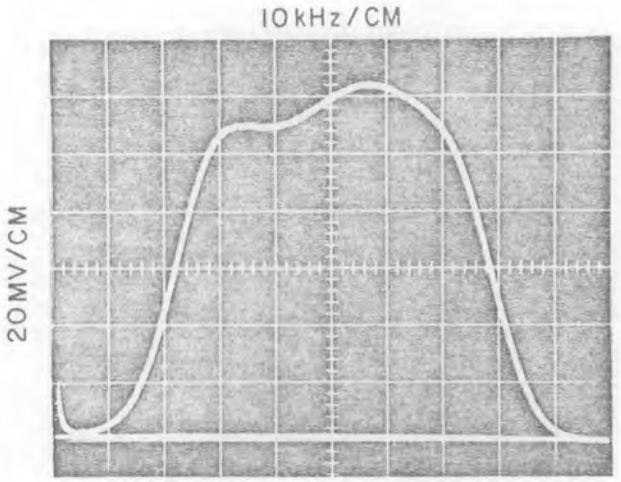


Figure 4-18. Typical 50 kHz IF Response Curve

4.7.12 IF Preselector Gain Adjustments. - After the IF output module and all four IF preselector modules have been aligned, the gain of each IF preselector should be adjusted. Proceed as follows:

(1) Connect the equipment as shown in Figure 4-20.

CAUTION

Do not short A4C12 to ground when interconnecting the equipment.

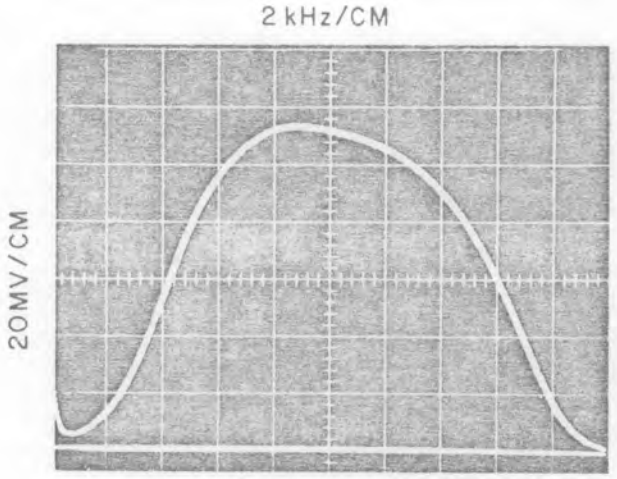


Figure 4-19. Typical 10 kHz IF Response Curve

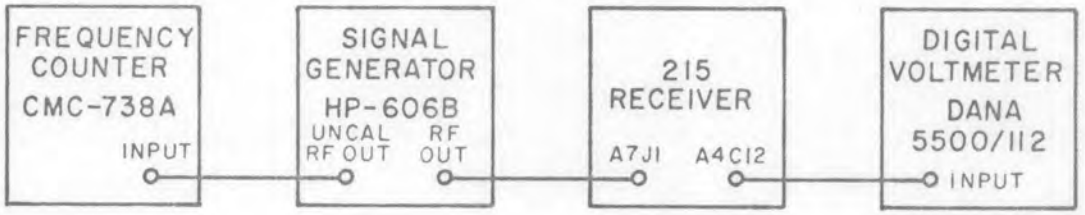


Figure 4-20. Equipment Connections, IF Preselector Gain Adjustment

(2) Gain adjust potentiometers on each IF preselector board should be set to produce 1.5 V dc output reading on the digital voltmeter with a 21.4 MHz CW input at the level specified below. Use the frequency counter to adjust the signal generator to exactly 21.4 MHz.

Signal Generator Output Level	IF Bandwidth	Gain Adjustment
-90 dBm	10 kHz	A4A1R26
-83 dBm	50 kHz	A4A2R26
-75 dBm	300 kHz	A4A3R27
-70 dBm	1 MHz	A4A4R27

4.7.13 1 MHz Discriminator Alignment (A4A5). - Proceed as follows:

(1) Place the IF BANDWIDTH switch in the 1 MHz position.
(2) Connect the equipment as shown in Figure 4-15, except connect the sweep generator output to A4A5 pin 21 and connect the DET IN to A4A5 pin 2.
(3) Adjust the sweep generator and oscilloscope until the discriminator S-curve is displayed.
(4) Adjust A4A5C7 to center the S-curve about the 21.4 MHz marker.
(5) Adjust A4A5C11 for best symmetry and linearity. A typical response is illustrated in Figure 4-21.

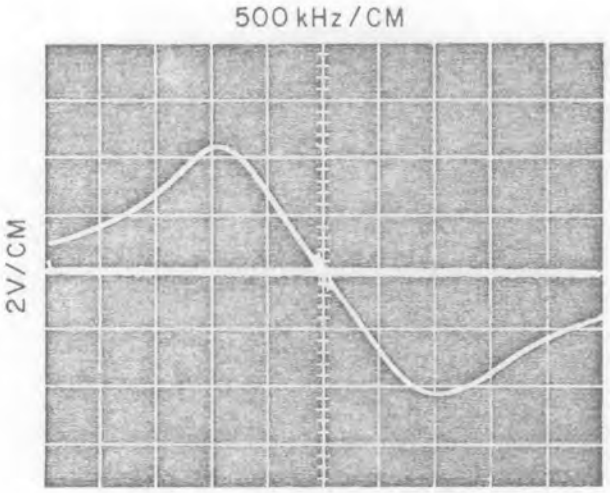


Figure 4-21. Typical 1 MHz Discriminator Response Curve

4.7.14 300 kHz Discriminator Alignment (A4A6). - Proceed as follows:

(1) Set the IF BANDWIDTH switch to the 300 kHz position.
(2) Connect the equipment as shown in Figure 4-15, except the sweep generator output connects to A4A6 pin 21 and the DET IN connects to A4A6 pin 2.
(3) Adjust the sweep generator and oscilloscope to display the discriminator S-curve.
(4) Adjust A4A6C7 to center the S-curve at 21.4 MHz.
(5) Adjust A4A6C11 for best symmetry and linearity.
(6) Figure 4-22 illustrates a typical 300kHz discriminator S-curve.

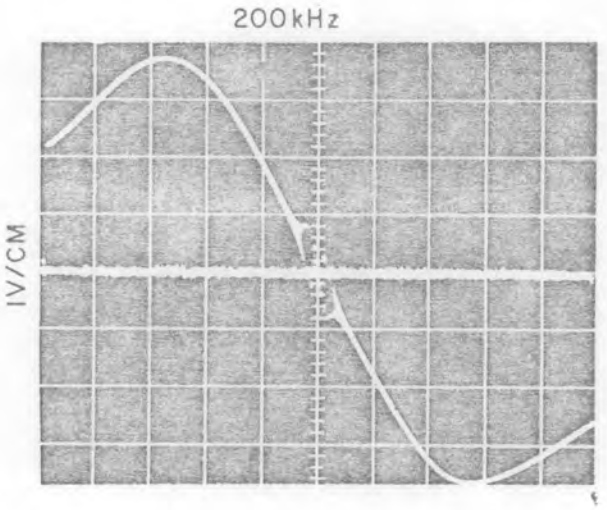


Figure 4-22. Typical 300 kHz Discriminator Response Curve

4.7.15 10 kHz and 50 kHz Discriminator Alignment (A4A7). - Proceed as follows:

(1) Place the IF BANDWIDTH switch inthe 10 kHz position.
(2) With a clip lead short pin 21 of A4A7 to ground.
(3) Adjust A4A7R4 for a zero volt output as measured at A4A7 pin 2. Remove the clip lead.
(4) Interconnect the equipment as in Figure 4-15, except the sweep generator output is connected to A4A7 pin 21 and the DET IN is connected to A4A7 pin 2.
(5) Adjust the sweep generator and oscilloscope to display the S-curve.
(6) Adjust A4A7C4 for a linear response about 21.4 MHz.
(7) A typical response curve is shown in Figure 4-11.

NOTE

Crystal discriminators exhibit the characteristics shown, including the spurious responses. However only a small portion of the curve around 21.4 MHz is used.

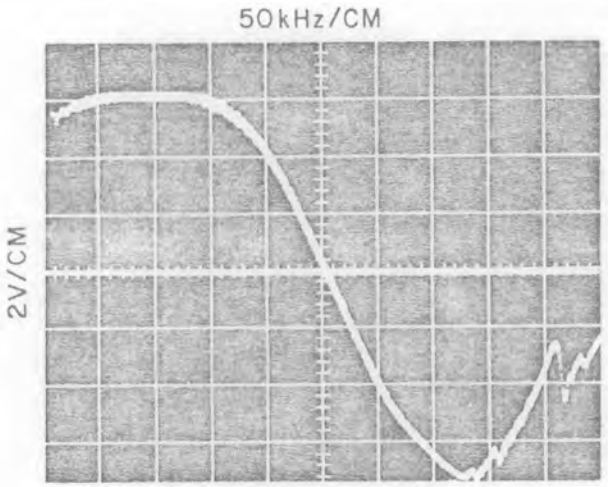


Figure 4-23. 10 kHz and 50 kHz Discriminator Response Curve

4.7.16 IF Amplifier Overall Alignment Check. - After completion of all sub module alignments, the overall IF Amplifier response should be checked. If a particular response fails to approximate the typical response shown that IF Preselector should be realigned. If all responses appear bad, the IF output amplifier should be realigned. Figures 4-24 through 4-27 illustrates typical overall 1 MHz, 300 kHz, 50 kHz and 10 kHz IF responses. Proceed as follows:

(1) Connect the equipment as shown in Figure 4-15, except the DET IN connects to A4C12.

CAUTION

Do not short A4C12 to ground when interconnecting the equipment. Failure to observe this caution will destroy one or more of the semiconductor devices.

(2) Place the IF BANDWIDTH switch in the 1 MHz position. Place the tuning mode switch in MAN and turn the RF GAIN control maximum CW.
(3) Readjust the sweep generator and oscilloscope to display the response curve and 21.4 MHz marker.
(4) Compare the displayed response to the corresponding response curve, Figures 4-24 through 4-27.

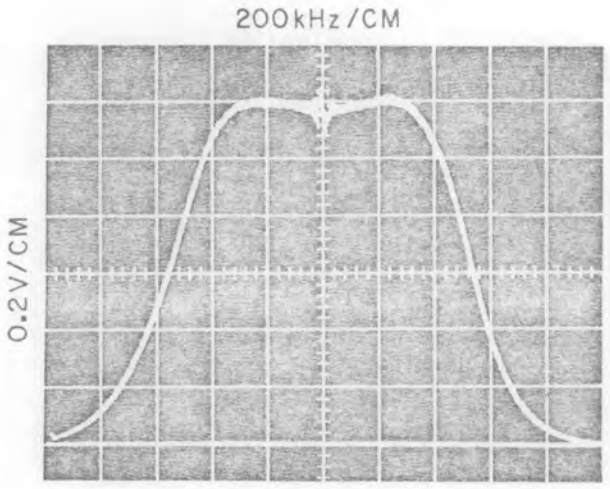


Figure 4-24. Typical 1 MHz IF BW Overall Response Curve

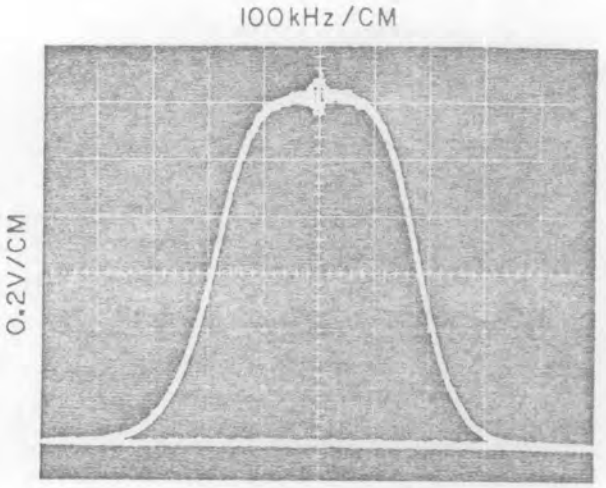


Figure 4-25. Typical 300 kHz IF Bw Overall Response Curve

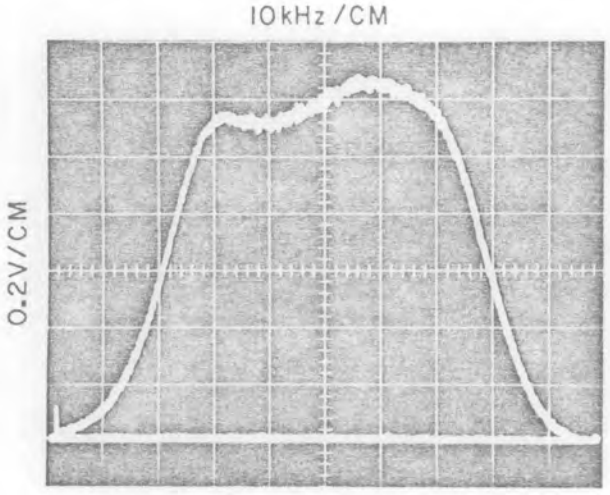


Figure 4-26. Typical 50 kHz IF BW Overall Response Curve

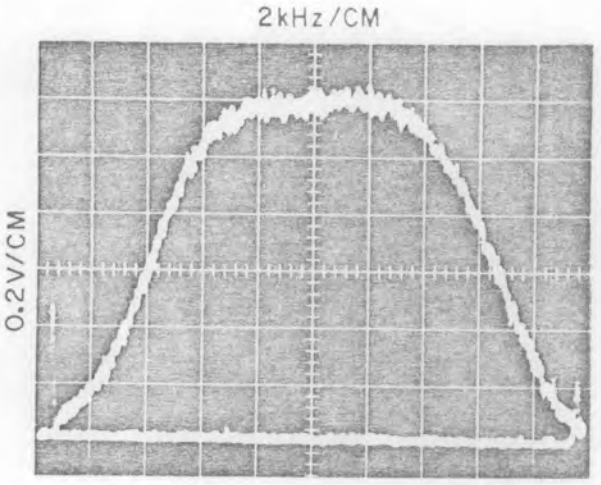


Figure 4-27. Typical 10 kHz IF BW Overall Response Curve

(5) Repeat steps (3) and (4) for the other IF bandwidths.

4.7.17 CRT Vertical Position Adjustment. - If a signal display unit is used with the 215 Receiver, it may be necessary to adjust the vertical positioning of the trace for the PAN and SECTOR modes. Proceed as follows:

(1) Interconnect the display unit and receiver using normal operating connections.
(2) Put the 215 Receiver in the MAN tuning mode.
(3) Using the controls on the display unit, position the trace on the bottom gradual line.
(4) Switch the receiver to PAN mode.
(5) Adjust A9R9 until the same position is obtained as in step (3).
(6) Switch the receiver to the PAN/SEC mode and adjust A1R11 to position the SECTOR trace in the center of the CRT.

4.7.18 IF BW, AM/FM Select Alignment (A13). - Proceed as follows:

(1) Interconnect the equipment as shown in Figure 4-28.

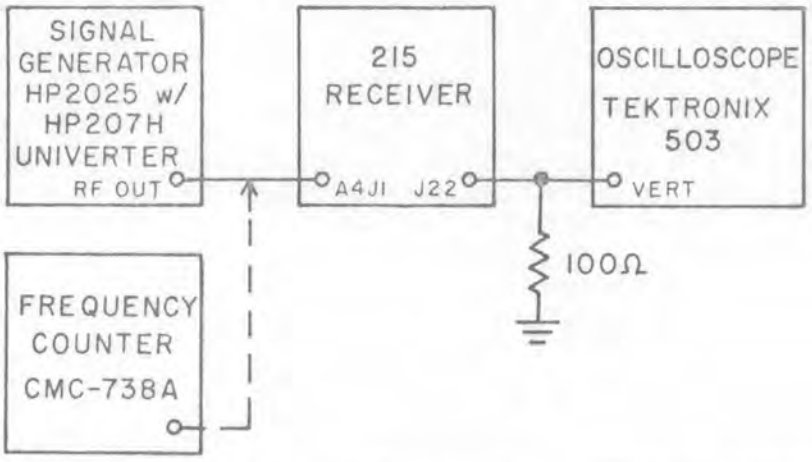


Figure 4-28. Equipment Connections, IF BW, AM/FM Select Alignment

(2) Use the frequency counter to adjust the FM signal generator to produce 21.400 MHz out of the univerter.
(3) Turn the FM generator internal 1 kHz modulation on and adjust for a peak deviation of 1/4 the IF bandwidth being adjusted.
(4) Adjust gain bandwidth potentiometers as follows for a two volt output as displayed on the oscilloscope:

10 kHz	A13R6
50 kHz	A13R7
300 kHz	A13R8
1 MHz	A13R9

4.7.19 Video Amplifiers Alignment (A16). - Proceed as follows:

(1) With the receiver turned on and no RF input signal applied, connect the oscilloscope with a 100 Ω load across XA16 pin 18 and ground.
(2) Adjust A16R6 for a minimum dc output reading on the oscilloscope.
(3) Remove the oscilloscope and 100 Ω load from XA16 pin 18 and connect it across XA16 pin 5 and ground.
(4) Adjust A16R25 for a minimum dc output on the oscilloscope.
(5) Disconnect all test equipment.

4.7.20 Remote Tuning Common Mode Rejection. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-29.

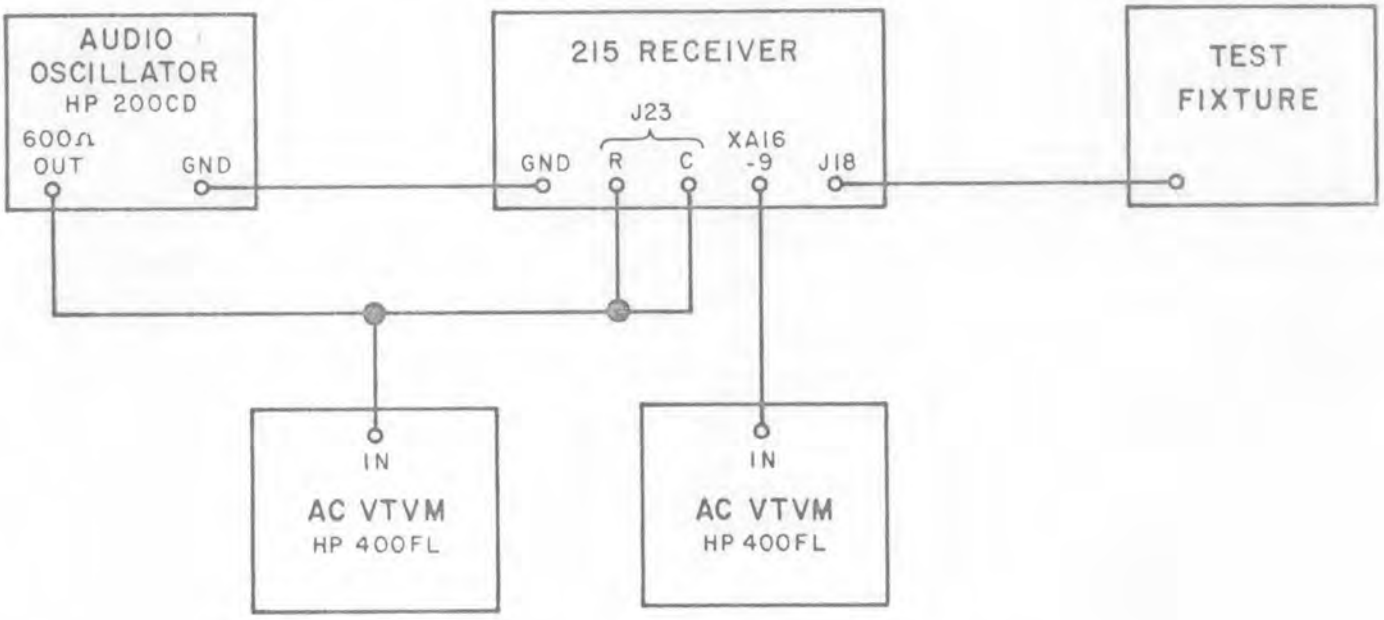


Figure 4-29. Equipment Connections, Common Mode Rejection Adjustment

(2) Adjust the audio oscillator to produce a 100 Hz output frequency at a level of 0 dB as read on the AC VTVM #1.
(3) Adjust A16R42 for an output null on AC VTVM #2.
(4) The output levels on the #2 meter must be down 60 dB from the reading on the #1 meter.
(5) Disconnect all test equipment.

Table 4-4. Typical Transistor and Integrated Circuit Pin Voltages

		Integrated Circuit Pin Numbers									
		1	2	3	4	5	6	7	8	9	10
		Field Effect Transistor Pins							Transistor Elements		
Ref. Desig.	Type	Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
A1Q1	2N3906(7)								17.7	18.60	28.65
A1Q2	2N3904(7)								0.0	0.027	17.14
A1Q3	2N3904(7)								0.0	0.75	0.02
A1Q4	2N3251(15)								17.5	17.1	8.1-9.1
A1Q5	2N3904(15)								0.0	0.6	0.036
A1Q6	2N4918(8)								17.7	18.0	0.18
A1Q7	2N3904(8)								18.0	17.9	15.3
A1Q8	U1899E(16)								---	---	---
A1Q9	2N3904(7)								0.0	0.08	14.4
A1Q10	U1899E(16)								---	---	---
A1Q11	2N3904(8)								-18.0	17.4	17.9
A1Q12	2N3904(7)								0.0	0.63	0.99
A2Q1	2N4918(7)								18.0	17.30	17.96
A2Q2	2N2222(8)								0.0	0.120	4.422
A2Q3	2N4074(7)								9.623	10.26	12.48
A2Q4	2N2222(8)								0.0	0.788	1.760
A2Q5	2N4074(7)								-13.36	-12.74	9.623
A2Q6	2N4074(7)								9.623	2.124	17.98
A2Q7	2N4918(7)								18.0	18.0	-0.236
A2Q8	2N3251(8)								14.66	13.97	5.5
A2Q9	2N4853(8)								5.5	0.0 (12)	11.68 (13)
A2Q10	2N4074(8)								-17.44	-17.29	10.0
A2Q11	U1899E(9)	NOT APPLICABLE									
A2U1	μA741C(8)	-17.42	---	---	-17.43	-17.42	---	16.90	---		
A3Q1	U1899E(9)	-2.003	---	1.686	-2.004						
A3Q2	2N929(9)								-18.0	-17.42	-17.96
A3Q3	2N929(9)								-18.0	-17.96	13.61

Table 4-4. Typical Transistor and Integrated Circuit Pin Voltages (Continued)

		Integrated Circuit Pin Numbers									
		1	2	3	4	5	6	7	8	9	10
		Field Effect Transistor Pins							Transistor Elements		
ef. Desig.	Type	Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
3Q4	MEM511C (9)	-2.00	10.93 (14)	11.60	0.0						
3Q5	MEM511C (9)	0.0	0.0	-17.80	0.0						
3U1	LM201A(9)	-16.72	-0.002	-0.002	-18.0	-16.78	2.030	18.0	1.419		
3U2	μA741C(9)	-18.0	0.002	-0.002	-18.0	-18.0	1.942	18.0	0.0		
4A1Q1	2N5109 (1)(2)								-10.56	-9.913	-1.505
4A1Q2	2N5109 (1)(2)								-0.706	0.0	15.75
4A1Q3	3N140 (1)(2)	10.94	3.495	0.853	1.803						
4A1Q4	2N3933 (1)(2)								1.562	2.281	16.12
4A2Q1	2N5109 (1)(3)								-10.56	-9.813	-1.505
4A2Q2	2N5109 (1)(3)								-0.706	0.0	15.75
4A2Q3	3N140 (1)(3)	10.94	3.495	0.853	1.803						
4A2Q4	2N3933 (1)(3)								1.562	2.281	16.12
4A3Q1	2N5109 (1)(4)								-10.67	-9.925	-1.523
4A3Q2	2N5109 (1)(4)								-0.714	0.0	15.80
4A3Q3	3N140 (1)(4)	12.88	3.300	0.801	1.804						
4A3Q4	2N3933 (1)(4)								1.607	2.334	17.63

Table 4-4. Typical Transistor and Integrated Circuit Pin Voltages (Continued)

		Integrated Circuit Pin Numbers									
		1	2	3	4	5	6	7	8	9	10
		Field Effect Transistor Pins							Transistor Elements		
Ref. Desig.	Type	Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
A4A4Q1	2N5109 (1)(5)								-10.74	-10.01	-1.504
A4A4Q2	2N5109 (1)(5)								-0.712	0.0	15.81
A4A4Q3	3N140 (1)(5)	14.45	3.407	0.864	1.163						
A4A4Q4	2N3933 (1)(5)								1.603	2.334	17.63
A4A5Q1	U1899E (1)(5)	-1.462	---	-1.833	-1.462						
A4A5Q2	2N3251 (1)(5)								-0.780	-1.45	-18.0
A4A5Q3	2N2270 (1)(5)									-0.796	17.74
A4A5U1	μA719C (1)(5)	1.980	1.984	---	0.702	0.0	14.86	0.818	0.156	5.910	11.13
A4A6Q1	U1899E (1)(4)	-0.082	---	-0.024	-0.081						
A4A6U1	μA719C (1)(4)	1.969	1.972	1.655	0.686	0.0	15.14	0.788	0.147	6.242	11.37
A4A7Q1	U1899E (1)(3)	0.059	---	-17.74	0.0						
A4A7Q2	U1899E (1)(3)	0.317	---	-0.419	0.318						
A4A7U1	μA719C (1)(3)	2.070	2.070	---	0.680	0.0	16.00	0.816	0.177	6.191	12.25
A4A7U2	μA719C (1)(3)	-18.0	0.052	0.042	-18.0	-18.0	0,303	16.38	---	---	---
A4A8Q1	3N140(1)	16.26	3.547	0.849	1.816						

TABLE 4-4. Typical Transistor and Integrated Circuit Pin Voltages (Continued)

		Integrated Circuit Pin Numbers									
		1	2	3	4	5	6	7	8	9	10
		Field Effect Transistor Pins							Transistor Elements		
Ref. Desig.	Type	Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
A4A8Q2	2N3933(1)								3.839	4.556	17.12
A4A8Q3	2N3933(1)								3.107	3.839	16.64
A4A8Q4	2N5109(1)								-15.30	-14.57	-1.150
A4A8Q5	2N4109(1)								-0.708	0.0	17.10
A4A8Q6	U1899E (1)(2)	0.002	---	0.507	0.0						
A4A8Q7	2N3251 (1)(2)								0.418	0.213	-18.0
A4A8Q8	2N2222 (1)(2)								-0.036	0.637	18.0
A5Q1	2N2907(9)								16.88	17.28	0.037
A5Q2	2N4072(9)								0.0	0.587	0.849
A5U1	μA741C(9)	-17.36	10.29	10.29	-17.37	-17.36	10.29	17.45	---		
A5U2	μA741C(9)	-17.36	-2.00	-2.00	-17.37	-17.36	-2.00	17.45	---		
A5U3	μA741C(9)	-17.36	-0.994	4.35	-17.37	-17.36	16.89	17.45	---		
A5U4	μA741C(9)	-17.36	4.14	-1.0	-17.37	-17.36	-12.20	17.45	---		
A5U5	μA741C(9)	-17.34	1.950	-10.3	-17.37	-17.36	-15.52	17.45	---		
A5U6	μA741C(9)	-17.34	10.28	1.950	-17.37	-17.36	-15.45	17.45	---		
A6Q1	2N3904								1.467	2.102	17.11
A6Q2	2N3906								17.79	17.11	9.209
A6Q3	2N3904								8.560	9.209	18.0
A6Q4	2N3906								8.014	7.40	0.0
A9Q1	2N3251(10)								0.645	-0.032	0.007
A9Q2	2N2270(10)								0.218	0.645	17.99
A9Q3	U1899E(10)	0.197	---	0.064	0.197						
A9Q4	U1899E(10)	-0.027	---	-0.010	-0.027						
A9Q5	2N929(11)								0.551	-0.027	17.87
A9Q6	2N3251(11)								17.98	17.27	-17.98
A9Q7	2N929(11)								-18.00	-17.98	0.040

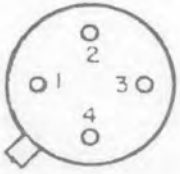
Table 4-4. Typical Transistor and Integrated Circuit Voltages (Continued)

		Integrated Circuit Pin Numbers									
		1	2	3	4	5	6	7	8	9	10
		Field Effect Transistor Pins							Transistor Elements		
Ref. Desig.	Type	Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
A9Q8	2N3251(11)								0.672	0.020	-18.00
A9Q9	2N929(11)								0.671	-2.787	0.0
A9Q10	2N929(11)								-0.004	-5.1	-2.774
A9Q11	2N929(11)								-0.417	-0.022	18.00
A9Q12	2N3251(11)								0.496	0.671	-18.00
A9U1	MC1439C	14.45	0.004	0.0	-18.00	1.517	0.037	18.00	14.55		
A9U2	μA741C	-17.99	-0.002	0.0	-18.00	17.00	-0.004	18.00	---		
A15Q1	2N2907								-10.30	-10.94	-16.20
A15Q2	2N4074								17.08	10.94	10.30
A15Q3	2N4074								30.00	26.30	43.10
A15U1	μA741C	-16.33	-6.322	-6.334	-16.34	-16.32	-10.94	0.0	---		
A15U2	μA741C	-16.34	0.001	0.0	-16.35	-16.34	-10.94	16.80	---		
A15U3	μA741C	0.008	10.30	10.30	0.0	0.009	17.12	30.00	---		

TEST CONDITIONS: All readings are positive dc with respect to the chassis unless otherwise noted. Readings taken with DANA Type 5500/112 Digital Voltmeter. Line voltage applied to receiver set at 115 V ac, 60 Hz; no signal input.

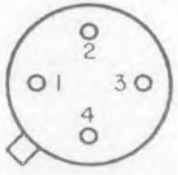
(1) MAN mode, AM/MAN, RF GAIN control max. CW.
(2) 10 kHz BW on.
(3) 50 kHz BW on.
(4) 300 kHz BW on.
(5) 1 MHz BW on.
(6) SECTOR mode, SECTOR WIDTH max. CW.
(7) PAN mode, SECTOR WIDTH max. CW, SWEEP RATE max. CW.
(8) MAN mode, set MAN tune voltage on Pin21 of A7 to -2.0 V by operating manual tuning control.
(9) MAN mode, PULSE.
(10) MAN mode, AM/AGC.
(11) Base should be interpreted Base 1.
(12) Collector should be interpreted Base 2.
(13) Gate 2 should be interpreted Case.
(14) PAN/SEC mode, SWEEP WIDTH and SECTOR WIDTH max. CW.
(15) Voltage measurements not relevant. Sawtooth waveform present.

3N140



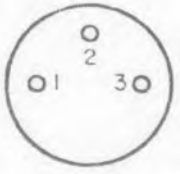
1. DRAIN
2. GATE 2
3. GATE 1
4. SOURCE

MEM511C



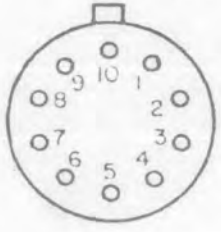
1. DRAIN
2. GATE
3. CASE
4. SOURCE

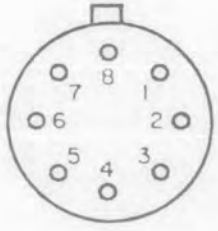
U1899E



1. SOURCE
2. DRAIN
3. GATE

µA719C



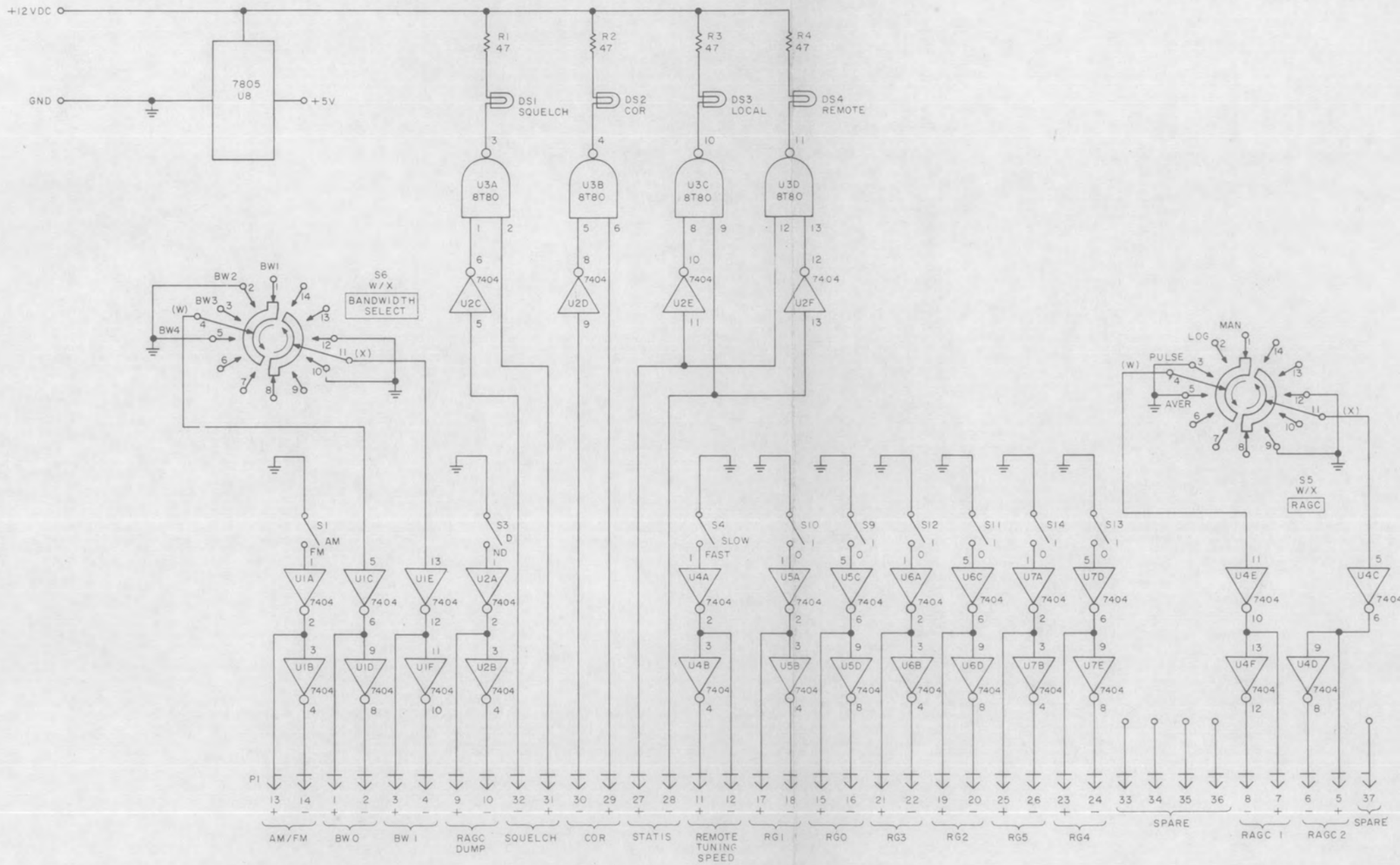


µA741C
LM709C
LM201A

2N3904

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
S1					
hru	LAMP, INCANDESCENT: .06 A, 5 V	4	FB12	08717	
S4					
	CONNECTOR, RECEPTACLE, MULTIPIN	1	DS07-37P059	11139	
1					
hru	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	4	RCR07G470JS	81349	01121
4					
	SWITCH, TOGGLE: SPDT	9	MST115D	95146	
	NOT USED				
	Same as S1				
	Same as S1				
	SWITCH, ROTARY	2	1128-39	14632	
	Same as S5				
	NOT USED				
	NOT USED				
ru	Same as S1				
4					
	INTEGRATED CIRCUIT	6	867404	14632	
	Same as U1				
	INTEGRATED CIRCUIT	1	868T80	14632	
	Same as U1				
	Same as U1				

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
6	Same as U1				
7	Same as U1				
8	INTEGRATED CIRCUIT	1	MC7805CP	04713	

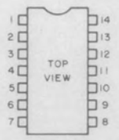


42444

NOTES:

1. RESISTANCE IS IN OHMS, ±5%, 1/4W.
2. LEAD ARRANGEMENTS FOR U1 THRU U7 ARE SHOWN IN DETAIL A.
3. U1 THRU U7 VCC & GND ARE SHOWN IN DETAIL B.
4. SWITCHES S5, S6 ARE SHOWN IN EXTREME CCW POSITION AND ARE VIEWED FROM END OPPOSITE OF CONTROL KNOB. LETTERS W, X DENOTES SEGMENTS OF WAFER. ARROW INDICATES CW ROTATION OF CONTROL KNOB.
5. P1 TYPE DS07-37P-059.

DETAIL A



DETAIL B

IC	U1—U7
VCC	14
GND	7

Figure 4-30. 215 Receiver Remote Test Fixture

SECTION V

REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

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

A1 R1

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

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

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Reference Designations Prefixes are provided on drawings and illustrations in parenthesis within the figure titles.

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53212
02114	Ferroxcube Corporation Post Office Box 359 Mt. Marion Road Saugerties, New York 12477
02660	Bunker-Ramo Corporation Amphenol Connector Division 2801 South 25th Avenue Broadview, Illinois 60153
02735	RCA Corporation Solid State Division Route 202 Somerville, New Jersey 08876

Mfr. Code	Name and Address
03040	Bulova Watch Company, Inc. American Time Products Dept. Electronics Division 61 - 20 Woodside Avenue Woodside, New York 11377
04013	Taurus Corporation 1 Academy Hill Lambertville, New Jersey 08530
04713	Motorola Semiconductors Products, Inc. 5005 East Mc Dowell Road Phoenix, Arizona 85008
06001	General Electric Company Capacitor Department Post Office Box 158 Irmo, South Carolina 29063
07263	Fairchild Camera and Instrument Corp. Semiconductor Division 464 Ellis Street Mountain View, California 94040
11139	Deutsch Company Electronic Component Division Municipal Airport Banning, California 92220
11711	General Instrument Corporation Rectifier Division 65 Gouverneur Street Newark, New Jersey 07014
14193	CAL-R Incorporated 1601 Olympic Boulevard Santa Monica, California 90404
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, Maryland 20760
14949	Trompeter Electronics, Inc. 8936 Comanche Avenue Chatsworth, California 91311
15818	Teledyne Semiconductor 1300 Terra Bella Avenue Mountain View, California 94040
17549	ITT Gremar Connectors, Canada, Ltd. 23 Racine Road Rexdale, Ontario, Canada
21604	The Buckeye Stamping Company 555 Marion Road Columbus, Ohio 43207
25088	Siemens America, Incorporated 350 5th Avenue New York, New York 10001
27014	National Semi-Conductor Corp. 2950 San Ysidro Way Santa Clara, California 95051
28480	Hewlett Packard Company 1501 Page Mill Road Palo Alto, California 94304
56289	Sprague Electronic Company Marshall Street North Adams, Massachusetts 01247
71279	Cambridge Thermionic Corporation 445 Concord Avenue Cambridge, Massachusetts 02138

Mfr. Code	Name and Address
71400	Bussman Manufacturing Division of Mc Graw-Edison Company 2536 West University Street St. Louis, Missouri 63107
71468	ITT Cannon Electric 666 East Dryer Road Santa Ana, California 92702
71590	Centralab Electronics Division of Globe-Union Inc. 5757 North Green Bay Avenue Milwaukee, Wisconsin 53201
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640
71785	Cinch Manufacturing Company Howard B. Jones Division 1026 South Homan Avenue Chicago, Illinois 60624
72136	Electro Motive Manufacturing Co., Inc. South Part and John Streets Willimantic, Connecticut 06226
72619	Dialight Corporation Division of Digitronics Corporation 60 Stewart Avenue Brooklyn, New York 11237
72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512
73138	Beckman Instruments, Incorporated Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
74306	Piezo Crystal Company 100 K Street Carlisle, Pennsylvania 17013
74868	Bunker Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, Connecticut 06810
75042	IRC Division of TRW Incorporated 401 North Broad Street Philadelphia, Pennsylvania 19108
75915	Littelfuse, Incorporated 800 East Northwest Highway Des Plaines, Illinois 60016
77342	American Machine and Foundry Co. Potter and Brumfield Division Post Office Box 522 Princeton, Indiana 47570
80058	Joint Electronic Type Designation System
80131	Electronic Industries Association 2001 Eye Street, N. W. Washington, D. C. 20006
81073	Grayhill Incorporated 561 Hillgrove Avenue La Grange, Illinois 60525
81312	Winchester Electronics Division of Litton Industries, Inc. Main Street and Hillside Avenue Oakville, Connecticut 06779

Mfr. Code	Name and Address
81349	Military Specifications
82389	Switchcraft, Incorporated 5555 North Elson Avenue Chicago, Illinois 60630
87034	Marco-Oak Industries Division of Oak Electro/Netics Corp. 207 South Helena Street Anaheim, California 92803
91293	Johanson Manufacturing Company Post Office Box 329 Boonton, New Jersey 07005
91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
93332	Sylvania Electric Products, Inc. Semiconductor Products Division 100 Sylvan Road Woburn, Massachusetts 01801
98291	Sealectro Corporation 225 Hoyt Mamaroneck, New York 10544
99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, New York 14052
99848	Wilco Corporation 4030 West 10th Street Post Office Box 22248 Indianapolis, Indiana 46222

5.4 PARTS LIST

The parts list which follows contains all electrical parts used in the equipment and certain mechanical parts which are subject to unusual wear or damage. When ordering replacement parts from the Watkins-Johnson Company, specify the type and serial number of the equipment and the reference designation and description of each part ordered. The list of manufacturers provided in paragraph 5.3 and the manufacturer's part number for components are included as a guide to the user of the equipment in the field. These parts may not necessarily agree with the parts installed in the equipment, however, the parts specified in this list will provide satisfactory operation of the equipment. Replacement parts may be obtained from any manufacturer as long as the physical and electrical parameters of the part selected agree with the original indicated part. In the case of components defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

NOTE

As improved semiconductors become available it is the policy of Watkins-Johnson to incorporate them in proprietary products. For this reason some transistors, diodes and integrated circuits installed in the equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

4.1 Type 215 Receiver, Main Chassis

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	SPLIT DISPLAY SWITCH	1	79848	14632	
2	RAMP GENERATOR AND IF SELECTOR SWITCH	1	79611	14632	
3	SWEEP CONTROL	1	791036	14632	
4	IF AMPLIFIER ASSEMBLY	1	72418-1	14632	
5	MARKER GENERATOR	1	79612-1	14632	
6	VIDEO AMPLIFIER	1	7366	14632	
7	RF MONITOR	1	71291	14632	
8	AUDIO AMPLIFIER AND COR	1	7443	14632	
9	AGC AMPLIFIER	1	78100	14632	
10	TTL RECEIVERS	1	791235	14632	
11	AGC SELECT	1	791223	14632	
12	TTL RECEIVERS/DRIVERS	1	791233	14632	
13	IF BW AM/FM SELECT	1	791227-1	14632	
14	POWER SUPPLY REGULATOR	1	76230	14632	
15	PRECISION REGULATORS	1	76179	14632	
16	VIDEO AMPLIFIERS/TUNING VOLTAGE BUFFER	1	791243	14632	
R1	DIODE	2	1N462A	80131	93332
R2	Same as CR1				
R3	DIODE	1	1N4003	80131	04713
R4	DIODE	4	1N458A	80131	93332
R5	Same as CR4				

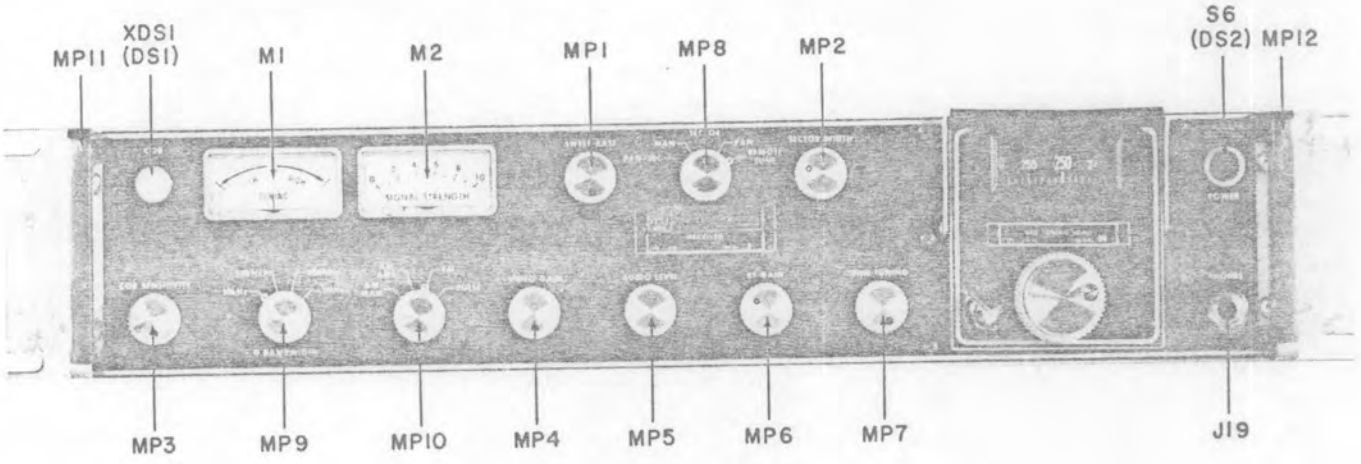


Figure 5-1. Type 215 Receiver Front View, Location of Components.

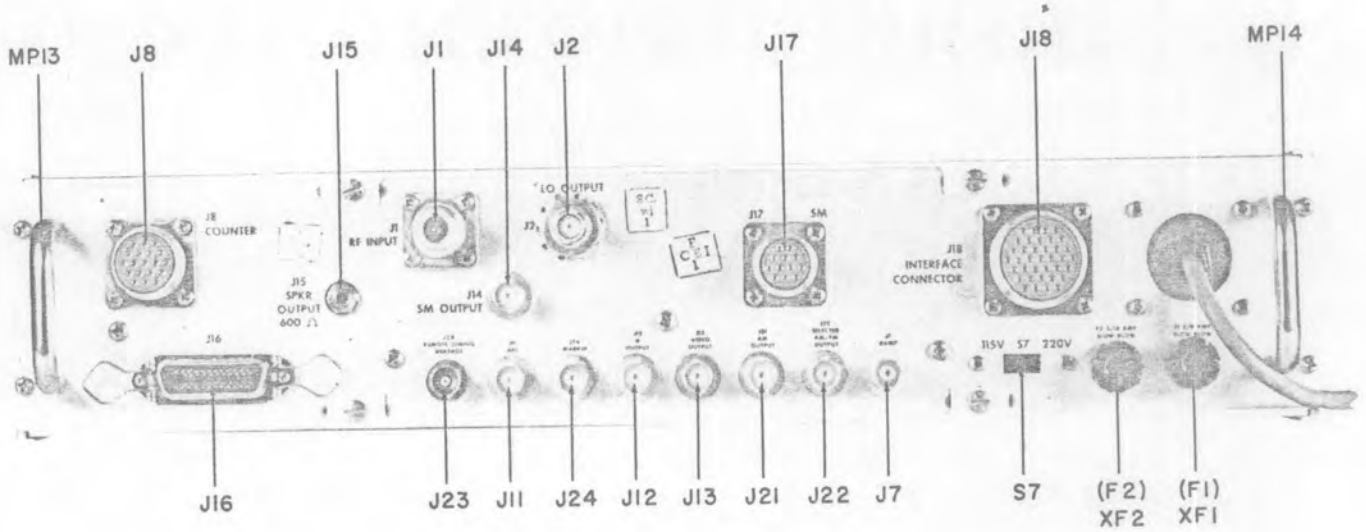


Figure 5-2. Type 215 Receiver Rear View, Location of Components.

REF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R6	Same as CR4				
R7	Same as CR4				
1	CAPACITOR, CERAMIC, DISC: 0.1 μF, 20%, 100 V	2	8131M100-651-104M	72982	
2	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	1	C023B101E502M	56289	
3	CAPACITOR, PLASTIC, TUBULAR: 0.47 μF, 20%, 250 V	1	B32231A3474M	25088	
4	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 100 V	2	C023B101F103M	56289	
5	Same as C1				
6	Same as C4				
7	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 500 V	1	SM5000PFM	91418	
8	CAPACITOR, ELECTROLYTIC, ALUMINUM: 1400 μF, -10+100%, 50 V	3	86F164M	06001	
9	CAPACITOR, ELECTROLYTIC, ALUMINUM: 470 μF, -10+100%, 100 V	1	86F182L	06001	
10	Same as C8				
11	Same as C8				
S1	LAMP, INCANDESCENT	1	327	71744	
S2	LAMP, NEON Part of S6		A1H	87034	
1 thru 6	TERMINAL, FEEDTHRU, INSULATED	6	SFU16	04013	
L1	FILTER, LOWPASS	1	JN33-694B	56289	
1	FUSE, CARTRIDGE: 1/2 AMP, 3AG	1	MDL1/2	71400	
2	FUSE, CARTRIDGE: 1/4 AMP, 3AG	1	MDL1/4	71400	
	CONNECTOR, RECEPTACLE Part of W1	1	UG-1052/U	80058	74868

EF SIG	DESCRIPTION		QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	CONNECTOR, RECEPTACLE	Part of W2	1	UG-909B/U	80058	74868
	CONNECTOR, RECEPTACLE	Part of W1	2	8212B	17549	
	Same as J3	Part of W2				
	CONNECTOR, RECEPTACLE		1	DAM11W1S	71468	
A1	CONNECTOR, INSERT	Part of W3	1	DM53742-5001	71468	
	CONNECTOR, RECEPTACLE		1	DAM15S	71468	
	CONNECTOR, RECEPTACLE		9	17825-1002	74868	
	CONNECTOR, RECEPTACLE		1	DS00-19S	11139	
	CONNECTOR, RECEPTACLE		2	MRE26SG7	81312	
0	Same as J9					
1	Same as J7					
2	Same as J7					
3	Same as J7					
4	Same as J7	Part of W5				
5	JACK, TELEPHONE		1	41	82389	
6	CONNECTOR, RECEPTACLE		1	57-40240	02660	
7	CONNECTOR, RECEPTACLE		1	DS00-12S	11139	
8	CONNECTOR, RECEPTACLE		1	DS00-37S	11139	
	JACK, TELEPHONE		1	L11	82389	
9	CONNECTOR, RECEPTACLE		1	MRE7-2SG7	81312	
	Same as J7					

REF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
2	Same as J7				
3	CONNECTOR, RECEPTACLE	1	BJ77	14949	
4	Same as J7				
1	METER, TUNING	1	14549-1	14632	
2	METER, SIGNAL STRENGTH	1	14524-1	14632	
P1 thru P7	KNOB	7	PS70D2 (GREY)	21604	
P8	KNOB	3	PS70PL2 (GREY)	21604	
P9	Same as MP8				
P10	Same as MP8				
P11	HANDLE	2	32306-2	14632	
P12	Same as MP11				
P13	HANDLE	2	415-1250-01-02	71279	
P14	Same as MP13				
P15	EXTENDER CARD	1	79878	14632	
P16	COVER	2	32574-3	14632	
P17	Same as MP16				
	CONNECTOR, PLUG Part of W4	4	44950	74868	
	Same as P1 Part of W4				
	Same as P1 Part of W3				
	Same as P1 Part of W5				

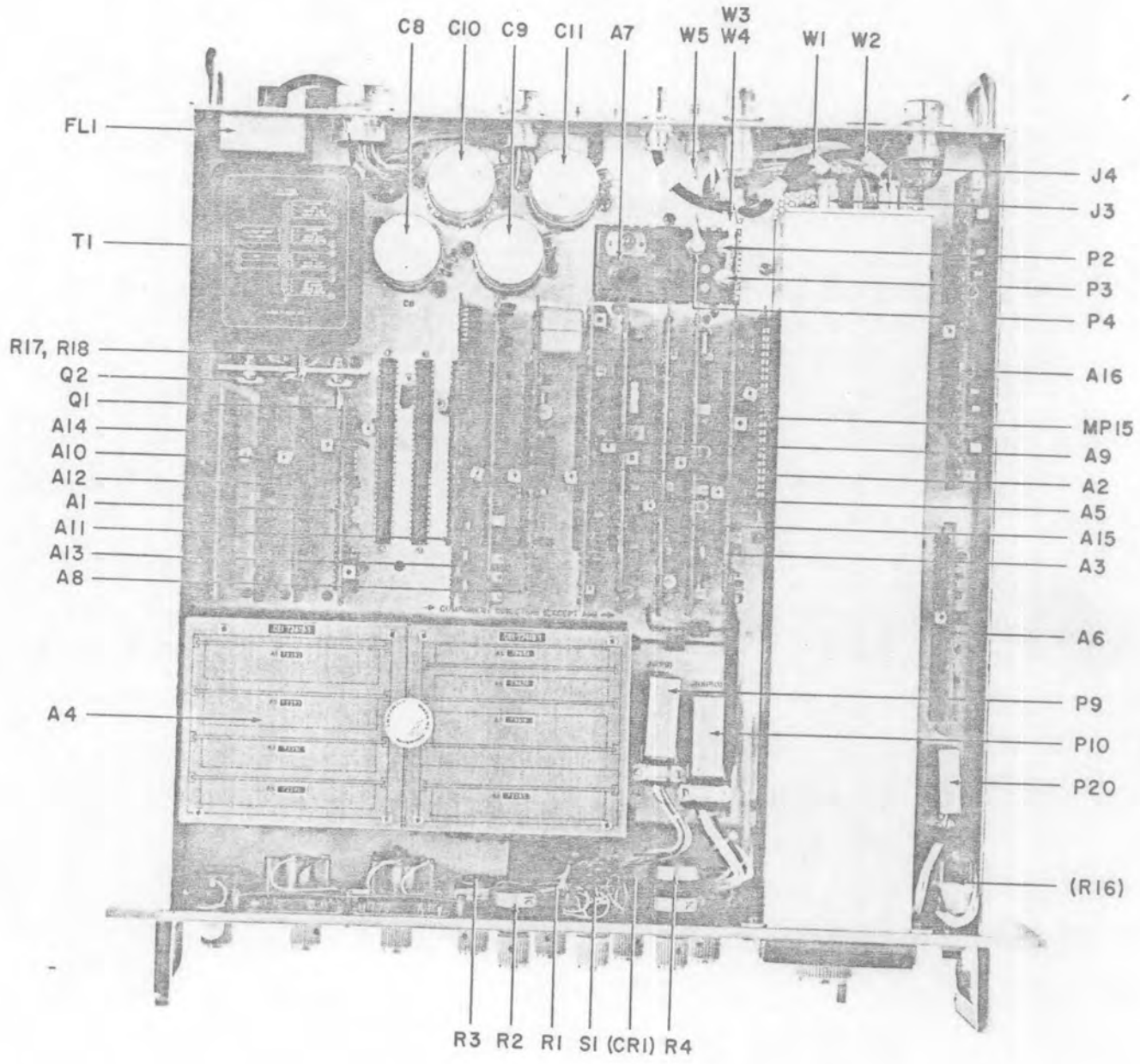


Figure 5-3. Type 215 Receiver Top View, Location of Components.

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	NOT USED				
	NOT USED				
	NOT USED				
	NOT USED				
	CONNECTOR, PLUG	1	23488-1	14632	
0	CONNECTOR, PLUG	1	23488-2	14632	
1 ıru 9	NOT USED				
0	CONNECTOR, PLUG	1	MRE7-2PG7	81312	
	TRANSISTOR	2	2N4398	80131	04713
	Same as Q1				
	RESISTOR, FIXED, COMPOSITION: 56 kΩ, 5%, 1/4W	1	RCR07G563JS	81349	01121
	RESISTOR, VARIABLE, COMPOSITION: 25 kΩ, 10%, 2W	3	RV4NAYSD253A	81349	01121
	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	1	RCR07G682JS	81349	01121
	RESISTOR, VARIABLE, COMPOSITION: 10 kΩ - 10 kΩ, 10%, 2W	1	1587-7	14632	
	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349	01121
	RESISTOR, VARIABLE COMPOSITION: 10 kΩ, 10%, 2W	2	RV4NAYSD103A	81349	01121
	RESISTOR, VARIABLE, COMPOSITION: 250 Ω, 10%, 2W	1	RV4NAYSD251A	81349	01121
	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	2	RCR07G102JS	81349	01121
	Same as R2				
0	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	RCR07G220JS	81349	01121

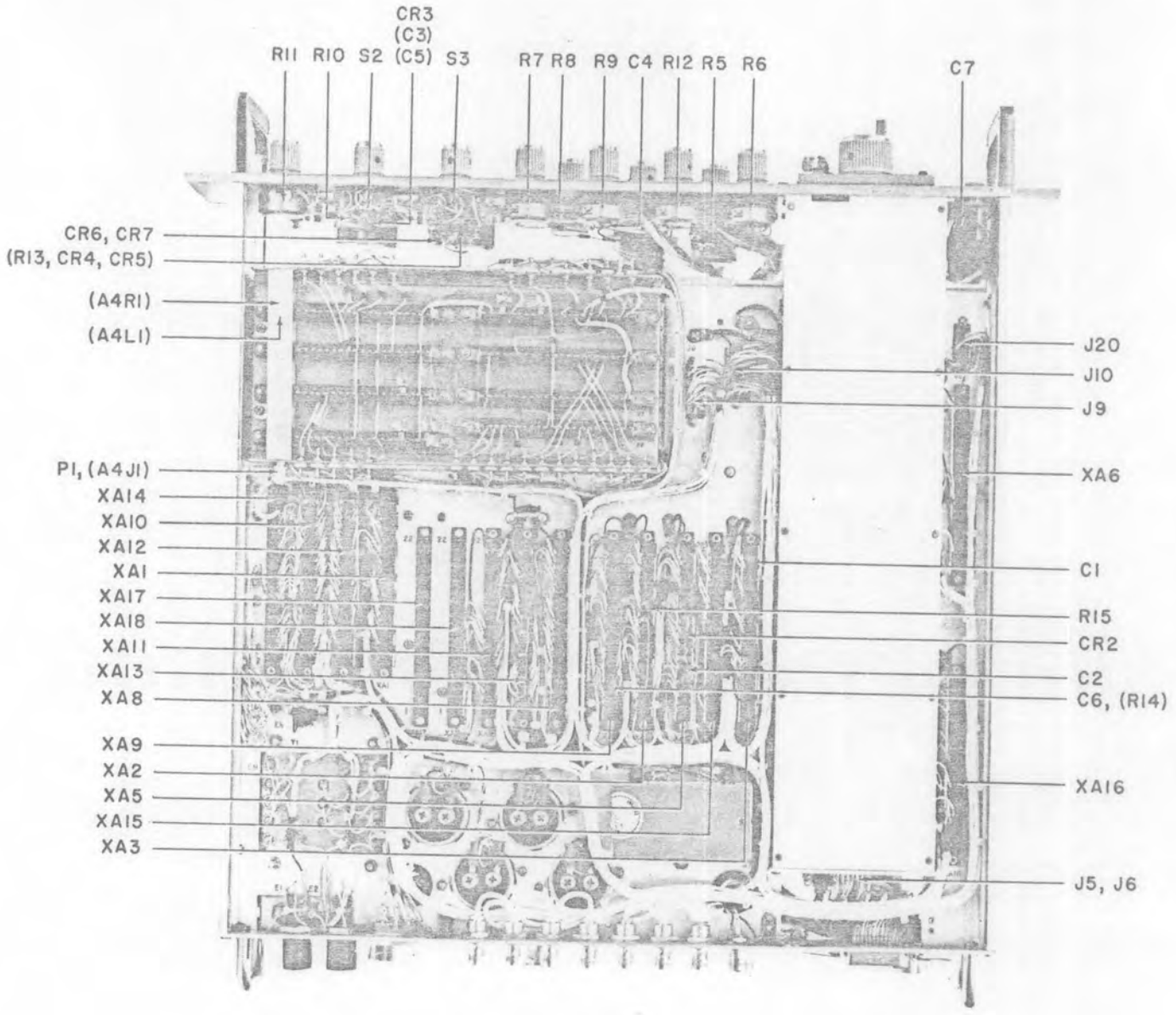


Figure 5-4. Type 215 Receiver Bottom View, Location of Components.

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	Same as R2				
2	Same as R6				
3	RESISTOR, FIXED, COMPOSITION: 240 Ω, 5%, 1/4W	1	RCR07G241JS	81349	01121
4	Same as R8				
5	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 27 kΩ, 5%, 1/2W	1	RCR20G273JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 33 Ω, 5%, 1/4W	2	RCR07G330JS	81349	01121
8	Same as R17				
	SWITCH, ROTARY	1	1128-55	14632	
	SWITCH, ROTARY	1	1128-43	14632	
	SWITCH, ROTARY	1	1128-02	14632	
	NOT USED				
	NOT USED				
	SWITCH, PUSH	1	671-6A1H	87034	
	SWITCH, SLIDE	1	11A1211	82389	
1	TRANSFORMER, POWER	1	17302	14632	
1	CABLE ASSEMBLY	1	17300-6-1	14632	
2	CABLE ASSEMBLY	1	17300-6-2	14632	
3	CABLE ASSEMBLY	1	17300-6-3	14632	
4	CABLE ASSEMBLY	1	17300-6-4	14632	
5	CABLE ASSEMBLY	1	17300-6-5	14632	

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	CONNECTOR, PRINTED CIRCUIT CARD	14	251-22-30-160	71785	
A2 thru A16	Same as XA1				
DS1	LAMP ASSEMBLY, INCANDESCENT	1	107-1930-0975-201	72619	
F1	FUSEHOLDER	2	342004	75915	
F2	Same as XF1				
	The following accessory items are furnished with the equipment:				
	CONNECTOR, PLUG	1	57-30240	02660	
	CONNECTOR, PLUG	1	DS07-37P059	11139	
	CONNECTOR, PLUG	1	DS07-12P059	11139	
	CONNECTOR, PLUG	1	DS07-27P059	11139	

4.2 Type 79848 Split Display Switch

REF DESIG PREFIX A1

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	7	1N462A	80131	93332
R2	Same as CR1				
R3	DIODE	4	1N458A	80131	93332
R4 thru R6	Same as CR1				
R7	Same as CR3				
R8	Same as CR3				
R9	Same as CR1				
R10	Same as CR1				
R11	Same as CR3				
1	CAPACITOR, CERAMIC, DISC: 5000 pF, 10%, 500 V	2	SM5000PFM	91418	
2	Same as C1				
3	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μF, 10%, 20 V	1	CS13BE106K	81349	56289
4	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.22 μF, 10%, 35 V	1	150D224X9035A2	56289	
5	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 200 V	1	8131A200Z5U103M	72982	
6	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM1000PFP	91418	
1	TRANSISTOR	1	2N3906	80131	04713
2	TRANSISTOR	7	2N3904	80131	04713
3	Same as Q2				
4	TRANSISTOR	1	2N3251	80131	04713
5	Same as Q2				

REF DESIG PREFIX A1

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
6	TRANSISTOR	1	2N4918	80131	04713
7	Same as Q2				
8	TRANSISTOR	2	U1899E	15818	
9	Same as Q2				
10	Same as Q8				
11	Same as Q2				
12	Same as Q2				
1	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	2	RCR07G222JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	2	RCR07G332JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	2	RCR07G474JS	81349	01121
4	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	7	RCR07G103JS	81349	01121
5	Same as R4				
6	Same as R4				
7	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	6	RCR07G104JS	81349	01121
8	Same as R4				
9	Same as R3				
10	Same as R7				
11	RESISTOR, VARIABLE, FILM: 10 kΩ, 10%, 1/2W	1	62PAR10K	73138	
12	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	2	RCR07G333JS	81349	01121
13	Same as R1				
14	Same as R2				

REF DESIG PREFIX A1

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
15	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	1	RCR07G102JS	81349	01121
16	Same as R7				
17	Same as R4				
18	RESISTOR, FIXED, COMPOSITION: 22 MΩ, 5%, 1/4W	2	RCR07G226JS	81349	01121
19	Same as R4				
20	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	2	RCR07G183JS	81349	01121
21	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349	01121
22	Same as R12				
23	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	1	RCR07G224JS	81349	01121
24	Same as R18				
25	Same as R4				
26	RESISTOR, FIXED, COMPOSITION: 20 kΩ, 5%, 1/4W	2	RCR07G203JS	81349	01121
27	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	2	RCR07G822JS	81349	01121
28	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349	01121
29*	Same as R7				
30	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	1	RCR07G223JS	81349	01121
31	Same as R26				
32	Same as R27				
33	Same as R7				
34	Same as R7				
35	Same as R20				

* Nominal value. Final value factory selected.

REF DESIG PREFIX A1

REF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE, ZENER	1	1N967B	80131	04713

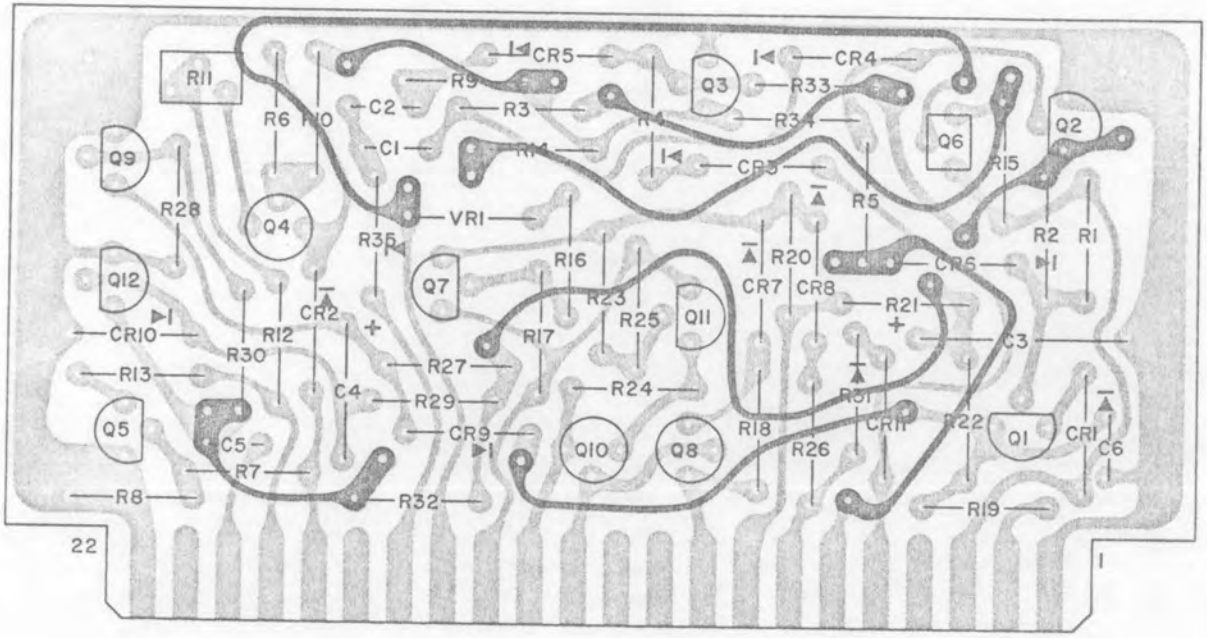


Figure 5-5. Type 79848 Split Display Switch (A1), Location of Components.

4.3 Type 79611 Ramp Generator And IF Selector Switch — REF DESIG PREFIX A2

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	2	1N462A	80131	93332
R2	DIODE	1	1N4446	80131	93332
R3	Same as CR1				
R4	DIODE	1	1N458A	80131	04713
	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 μF, 20%, 25 V	2	109D107X0025F2	56289	
	CAPACITOR, MICA, DIPPED: 43 pF, 2%, 500 V	1	CM05ED430G03	81349	72136
	CAPACITOR, ELECTROLYTIC, TANTALUM: 3.6 μF, 10%, 60 V	1	109D365X9060C2	56289	
	Same as C1				
	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM1000PFP	91418	
	TRANSISTOR	2	2N4918	80131	04713
	TRANSISTOR	6	2N2222A	80131	04713
	Same as Q2				
	Same as Q2				
	Same as Q2				
	Same as Q2				
	Same as Q1				
	TRANSISTOR	1	2N3251	80131	04713
	TRANSISTOR	1	2N4853	80131	04713
0	Same as Q2				
1	TRANSISTOR	1	U1899E	15818	
	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349	01121

REF DESIG PREFIX A2

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
2	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	2	RCR07G103JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	3	RCR07G102JS	81349	01121
	Same as R2				
5	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	2	RCR07G183JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	1	RCR07G223JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	RCR07G473JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	2	RCR07G331JS	81349	01121
	Same as R3				
10	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	2	RCR07G682JS	81349	01121
11	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349	01121
12	RESISTOR, FIXED, COMPOSITION: 13 kΩ, 5%, 1/4W	1	RCR07G133JS	81349	01121
13	Same as R3				
14*	RESISTOR, FIXED, COMPOSITION: 3.0 kΩ, 5%, 1/4W	1	RCR07G302JS	81349	01121
15	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349	01121
16	Same as R8				
17	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	2	RCR07G472JS	81349	01121
18	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	2	RCR07G100JS	81349	01121
19	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	2	RCR07G104JS	81349	01121
20	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	2	RCR07G182JS	81349	01121
21	Same as R20				
22	RESISTOR, VARIABLE, FILM: 2 kΩ, 10%, 1/2W	1	62PAR2K	73138	

REF DESIG PREFIX A2

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
23	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349	01121
24	RESISTOR, VARIABLE, FILM: 10 kΩ, 10%, 1/2W	1	62PAR10K	73138	
25	Same as R5				
26	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	RCR07G562JS	81349	01121
27	RESISTOR, FIXED, COMPOSITION: 68 kΩ, 5%, 1/4W	2	RCR07G683JS	81349	01121
28	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	RCR07G333JS	81349	01121
29	Same as R27				
30	Same as R1				
31	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349	01121
32	RESISTOR, FIXED, FILM: 21.5 kΩ, 1%, 1/4W	1	RN60D2152F	81349	75042
33	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349	01121
34	Same as R31				
35	Same as R18				
36	Same as R19				
37	Same as R10				
38	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	1	RCR07G474JS	81349	01121
39	Same as R17				
40	RESISTOR, FIXED, FILM: 1.13 kΩ, 1%, 1/4W	1	RN60D1131F	81349	75042
	INTEGRATED CIRCUIT	1	U5B7741393	07263	
R1	DIODE, ZENER	1	1N967B	80131	04713

* Nominal value. Final value factory selected.

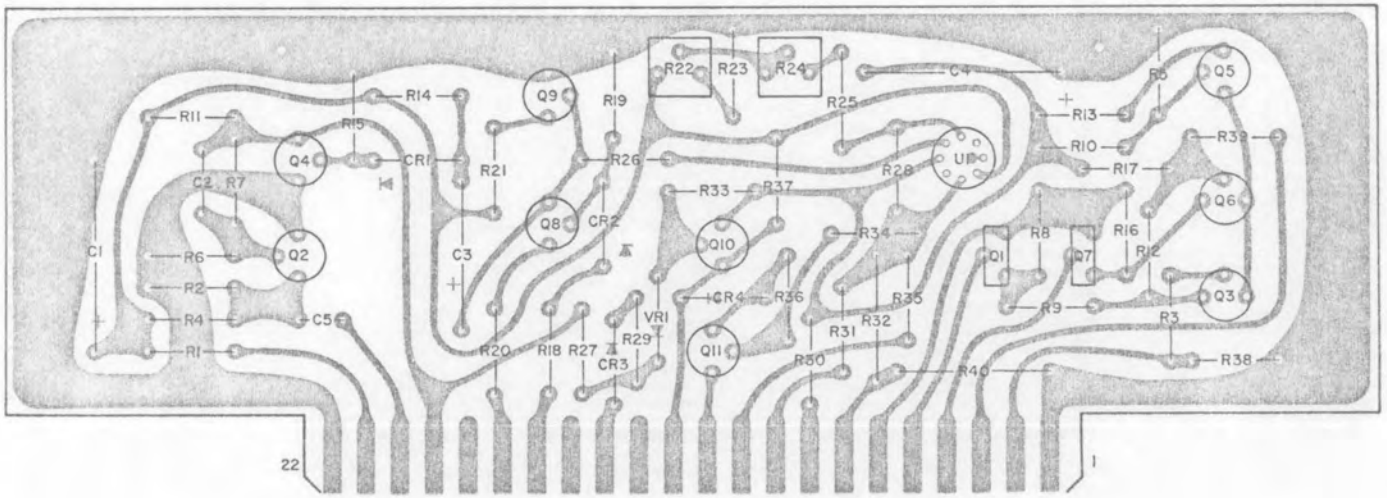


Figure 5-6. Type 79611 Ramp Generator and IF Selector Switch (A2), Location of Components.

4.4 Type 791036 Sweep Control

REF DESIG PREFIX A3

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	2	1N462A	80131	93332
R2	Same as CR1				
R3	NOT USED				
R4	DIODE	1	1N458A	80131	93332
1	CAPACITOR, MICA, DIPPED: 62 pF, 2%, 500 V	1	CM05ED620G03	81349	72136
2	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 20%, 25 V	2	109D226X0025C2	56289	
3	Same as C2				
1	TRANSISTOR	1	U1899E	15818	
2	TRANSISTOR	2	2N929	80131	04713
3	Same as Q2				
4	TRANSISTOR	2	MEM511C	11711	
5	Same as Q4				
1	RESISTOR, FIXED, COMPOSITION: 2.2 MΩ, 5%, 1/4W	1	RCR07G225JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	2	RCR07G224JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	3	RCR07G473JS	81349	01121
4	Same as R2				
5	Same as R3				
6	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	RCR07G104JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	2	RCR07G124JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 2.7 Ω, 5%, 1/4W	1	RCR07G2R7JS	81349	01121
9	Same as R3				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R10	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	1	RCR07G223JS	81349	01121
R11	Same as R7				
R12	RESISTOR, FIXED, WIREWOUND: 100 kΩ, 1%, 1/4W	2	A2537-100KF	14193	
R13	RESISTOR, VARIABLE, FILM: 5 kΩ, 10%, 3/4W	1	89PR5K	73138	
R14	RESISTOR, FIXED, WIREWOUND: 97.6 kΩ, 1%, 1/4W	1	A2537-97.6KF	14193	
R15	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	2	RCR07G333JS	81349	01121
R16	Same as R15				
R17	RESISTOR, FIXED, COMPOSITION: 1.0 MΩ, 5%, 1/4W	2	RCR07G105JS	81349	01121
R18	Same as R6				
R19	RESISTOR, FIXED, COMPOSITION: 10 MΩ, 5%, 1/4W	1	RCR07G106JS	81349	01121
R20	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349	01121
R21	RESISTOR, FIXED, COMPOSITION: 5.1 MΩ, 5%, 1/4W	1	RCR07G515JS	81349	01121
R22	Same as R12				
R23	RESISTOR, VARIABLE, FILM: 100 kΩ, 10%, 1/2W	1	62PAR100K	73138	
R24	Same as R17				
R25	Same as R6				
R26	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	RCR07G392JS	81349	01121
R27	RESISTOR, FIXED, WIREWOUND: 20 kΩ, .1%, 1/10W	2	M40-20K	14193	
R28	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
R29	Same as R27				
R30	Same as R20				

REF DESIG PREFIX A3

REF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
U1	INTEGRATED CIRCUIT	1	LM201A	27014	
U2	INTEGRATED CIRCUIT	1	U5B7741393	07263	
VR1	DIODE, ZENER	1	1N967B	80131	04713

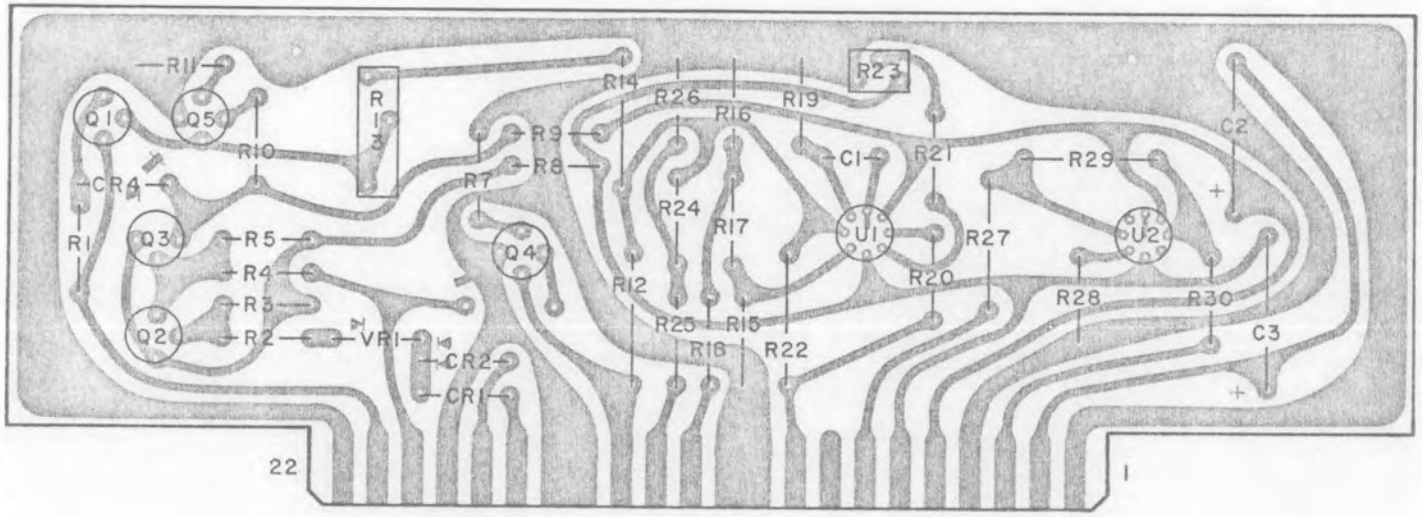


Figure 5-7. Type 791036 Sweep Control (A3), Location of Components.

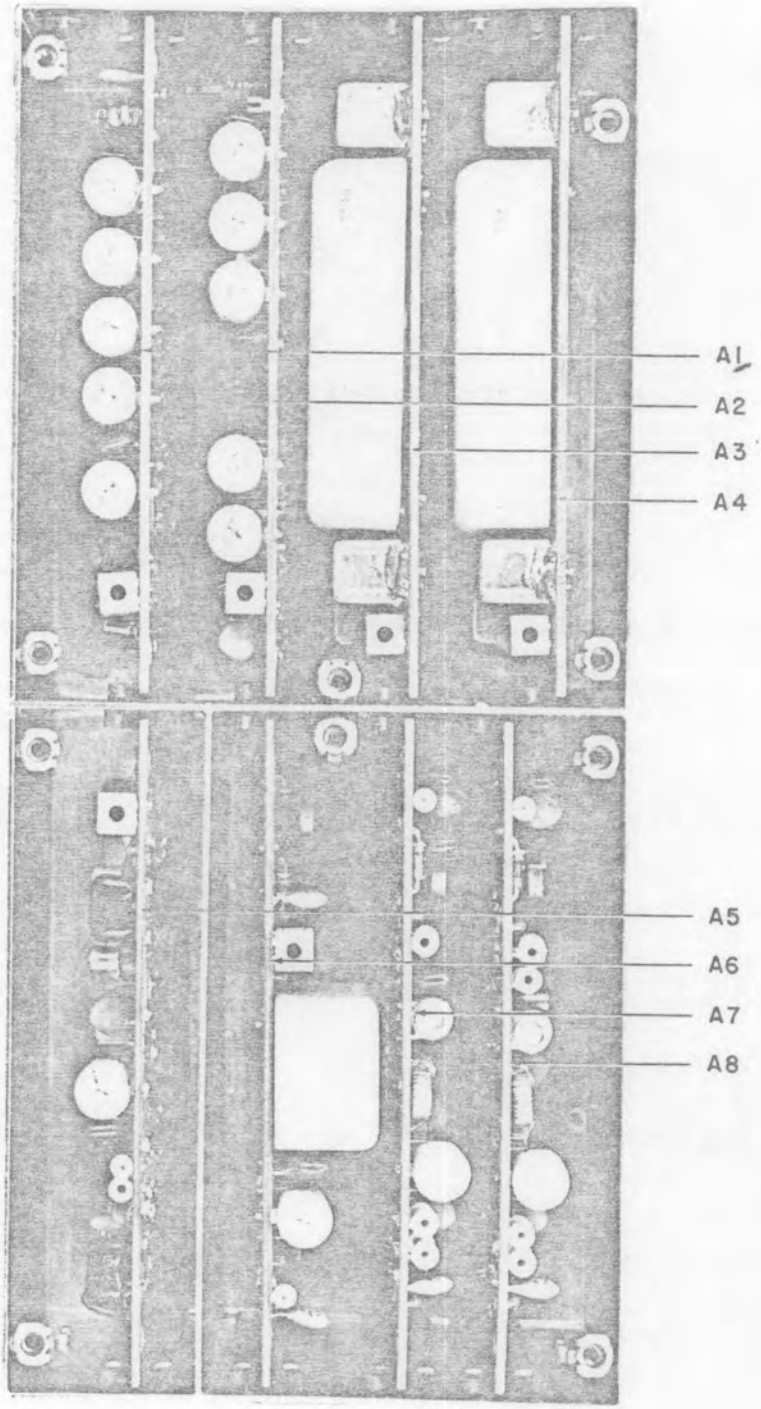


Figure 5-8. Type 72418 IF Amplifier Assembly (A4), Location of Components.

4.5 Type 72418-1 IF Amplifier Assembly

REF DESIG PREFIX A4

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	21.4 MHz IF AMPLIFIER (10 kHz BW)	1	72292	14632	
2	21.4 MHz IF AMPLIFIER (50 kHz BW)	1	72293-1	14632	
3	21.4 MHz IF AMPLIFIER (300 kHz BW)	1	72291	14632	
4	21.4 MHz IF AMPLIFIER (1 MHz BW)	1	72290	14632	
5	FM LIMITER/DISCRIMINATOR (1 MHz BW)	1	79626	14632	
6	FM LIMITER/DISCRIMINATOR (300 kHz BW)	1	79620	14632	
7	FM LIMITER/DISCRIMINATOR (10 and 50 kHz BW)	1	79616-1	14632	
8	IF OUTPUT AMPLIFIER	1	72285	14632	
1 thru 10	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500 V	25	FA5C102W	01121	
11	CAPACITOR, CERAMIC, FEEDTHRU: 330 pF, 10%, 500 V	4	FA5C3311	01121	
12	Same as C11				
13 thru 22	Same as C1				
23	Same as C11				
24	Same as C11				
25 thru 29	Same as C1				
30 thru 3	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	24	C023B101E502M	56289	

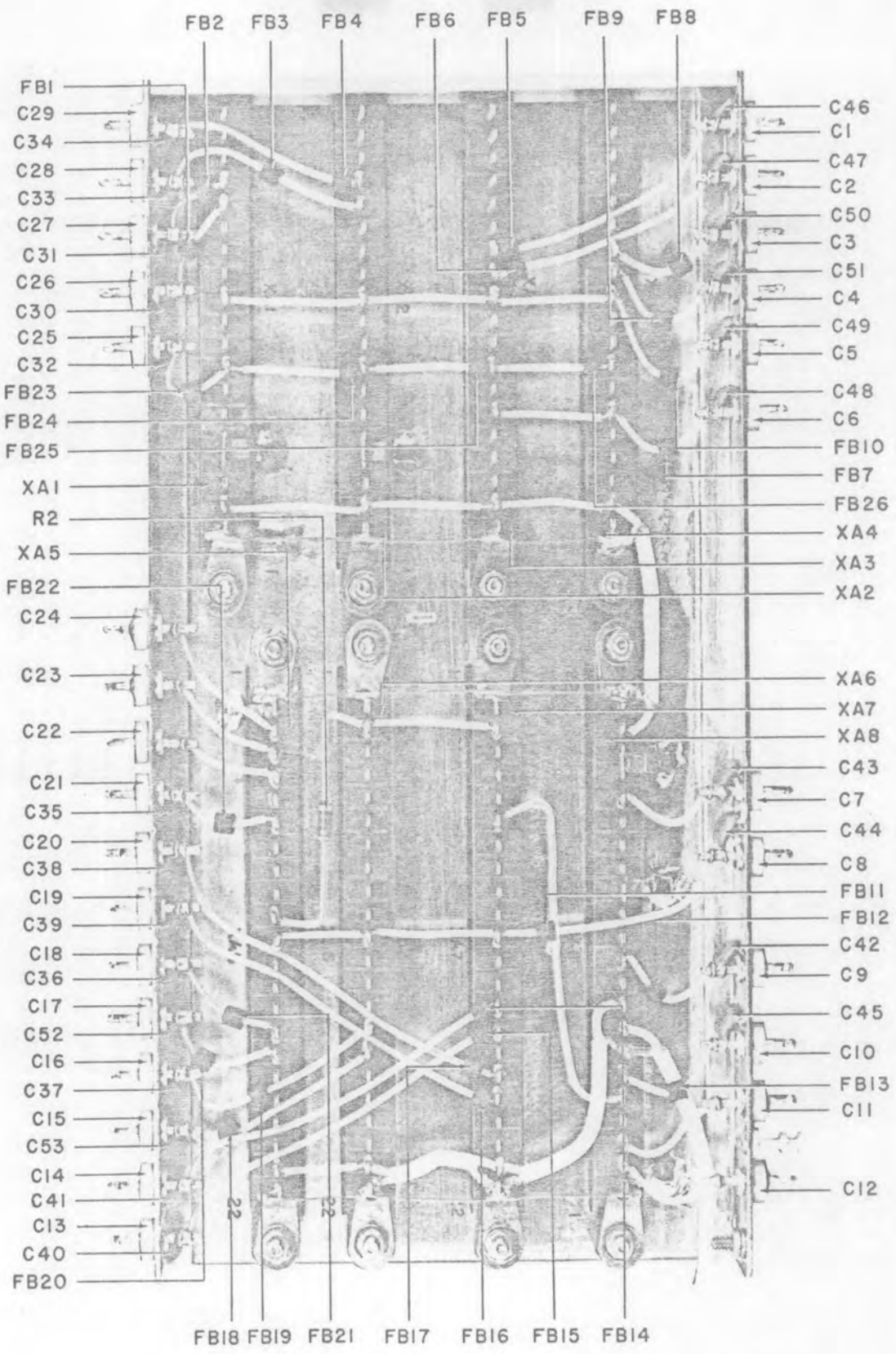


Figure 5-9. Type 72418 IF Amplifier Assembly (A4), Location of Components.

REF DESIG PREFIX A4

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
31 ıru 326	FERRITE BEAD	26	56-590-65-4A	02114	
	CONNECTOR, RECEPTACLE	1	46025	74868	
	COIL, FIXED: 0.56 μH, 15%	1	202-11	99848	
P1	COVER	1	33507-1	14632	
P2	COVER	1	33508-1	14632	
	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	RCR07G101JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349	01121
A1 ıru A8	CONNECTOR, PRINTED CIRCUIT BOARD	8	250-22-30-170	71785	

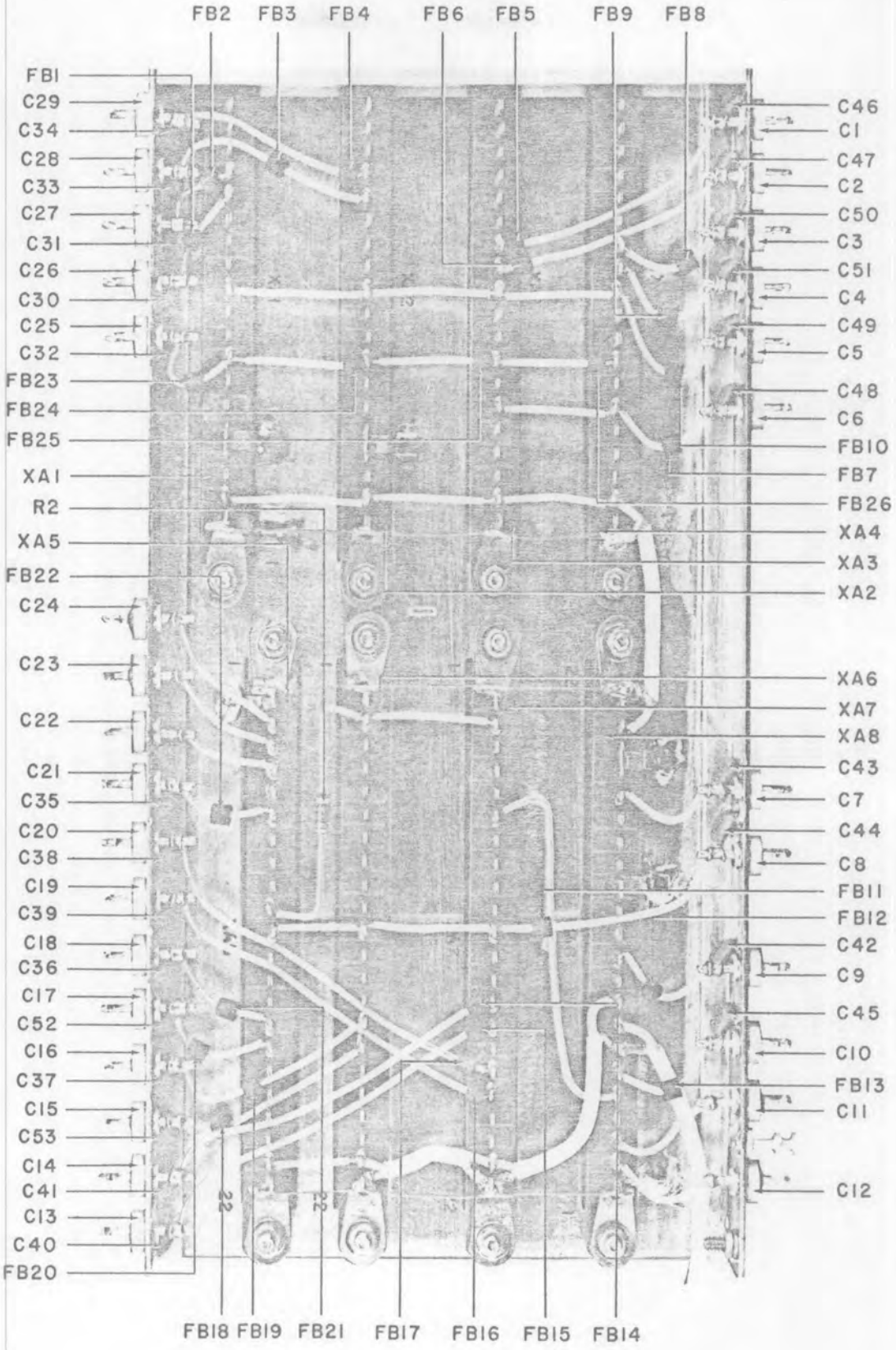


Figure 5-10. Type 72418 IF Amplifier Assembly (A4), Location of Components.

4.5.1 Type 72292, 21.4 MHz IF Amplifier (10 kHz BW)

REF DESIG PREFIX A4A1

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	3	1N462A	80131	93332
R2	Same as CR1				
R3	Same as CR1				
R4	DIODE	1	1N4446	80131	93332
	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	10	C023B101E502M	56289	
	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	3	SM1000PFP	91418	
ru	Same as C1				
	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35 V	1	196D225X0035JE3	56289	
	CAPACITOR, MICA, DIPPED: 130 pF, 2%, 500 V	1	CM05FD131G03	81349	72136
	CAPACITOR, MICA, DIPPED: 240 pF, 2%, 500 V	1	CM05FD241G03	81349	72136
0	CAPACITOR, MICA, DIPPED: 160 pF, 2%, 500 V	2	CM05FD161G03	81349	72136
1	Same as C10				
2	Same as C2				
3	CAPACITOR, MICA, DIPPED: 100 pF, 2%, 500 V	1	CM05FD101G03	81349	72136
4	Same as C1				
5	Same as C1				
6	Same as C1				
7	Same as C2				
8	Same as C1				
9	CAPACITOR, MICA, DIPPED: 430 pF, 5%, 500 V	1	DM15-431J	72136	

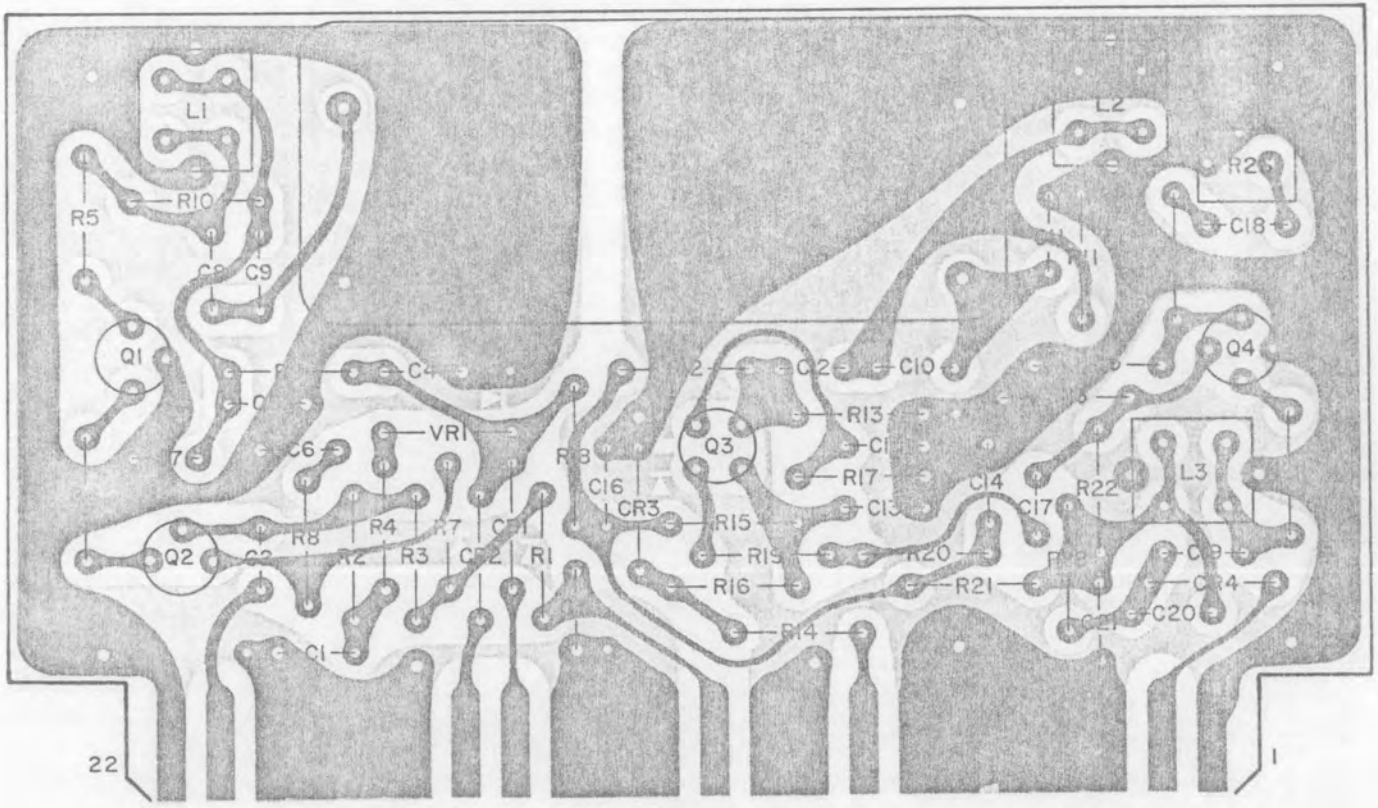


Figure 5-11. Type 72292 21.4 MHz IF Amplifier (10 kHz BW) (A4A1), Location of Components.

REF DESIG PREFIX A4A1

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
20	CAPACITOR, MICA, DIPPED: 560 pF, 5%, 300 V	1	DM15-561J	72136	
21	Same as C1				
L1	FILTER, BANDPASS	1	9680067	74306	
1	COIL, VARIABLE: 0.612-0.748 μH	2	7107-11	71279	
2	Same as L1				
3	COIL, VARIABLE: 0.198-0.242 μH	1	7107-05	71279	
1	TRANSISTOR	2	2N5109	80131	02735
2	Same as Q1				
3	TRANSISTOR	1	3N187	80131	02735
4	TRANSISTOR	1	2N3478	80131	02735
1	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	RCR07G220JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	2	RCR07G392JS	81349	01121
3	Same as R2				
4	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	3	RCR07G471JS	81349	01121
5	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	6	RCR07G470JS	81349	01121
6	Same as R5				
7	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	1	RCR07G391JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 33 Ω, 5%, 1/4W	2	RCR07G330JS	81349	01121
9	Same as R8				
10	RESISTOR, FIXED, COMPOSITION: 3.0 kΩ, 5%, 1/4W	1	RCR07G302JS	81349	01121
11	RESISTOR, FIXED, COMPOSITION: 680 Ω, 5%, 1/4W	1	RCR07G681JS	81349	01121

REF DESIG PREFIX A4A1

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
12	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	1	RCR07G184JS	81349	01121
13	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
14	Same as R4				
15	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349	01121
16	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349	01121
17	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349	01121
18	Same as R5				
19	Same as R5				
20	RESISTOR, FIXED, COMPOSITION: 1.2 kΩ, 5%, 1/4W	1	RCR07G122JS	81349	01121
21	Same as R5				
22	RESISTOR, FIXED, COMPOSITION: 27 kΩ, 5%, 1/4W	1	RCR07G273JS	81349	01121
23	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349	01121
24	Same as R5				
25	Same as R4				
26	RESISTOR, VARIABLE, FILM: 100 Ω, 10%, 1/2W	1	62PAR100	73138	
27	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349	01121
28	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	RCR07G562JS	81349	01121
R1	DIODE, ZENER	1	1N967B	80131	04713

4.5.2 Type 72293-1, 21.4 MHz IF Amplifier (50 kHz BW) REF DESIG PREFIX A4A2

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	3	1N462A	80131	93332
R2	Same as CR1				
R3	Same as CR1				
R4	DIODE	1	1N4446	80131	93332
1	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	10	C023B101E502M	56289	
2	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	3	SM1000PFP	91418	
3					
nru 6	Same as C1				
7	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35 V	1	196D225X0035JE3	56289	
8	CAPACITOR, MICA, DIPPED: 130 pF, 2%, 500 V	1	CM05FD131G03	81349	72136
9	CAPACITOR, MICA, DIPPED: 240 pF, 2%, 500 V	1	CM05FD241G03	81349	72136
10	CAPACITOR, MICA, DIPPED: 160 pF, 2%, 500 V	2	CM05FD161G03	81349	72136
11	Same as C10				
12	Same as C2				
13	CAPACITOR, MICA, DIPPED: 100 pF, 2%, 500 V	1	CM05FD101G03	81349	72136
14	Same as C1				
15	Same as C1				
16	Same as C1				
17	Same as C2				
18	Same as C1				
19	CAPACITOR, MICA, DIPPED: 430 pF, 5%, 500 V	1	DM15-431J	72136	

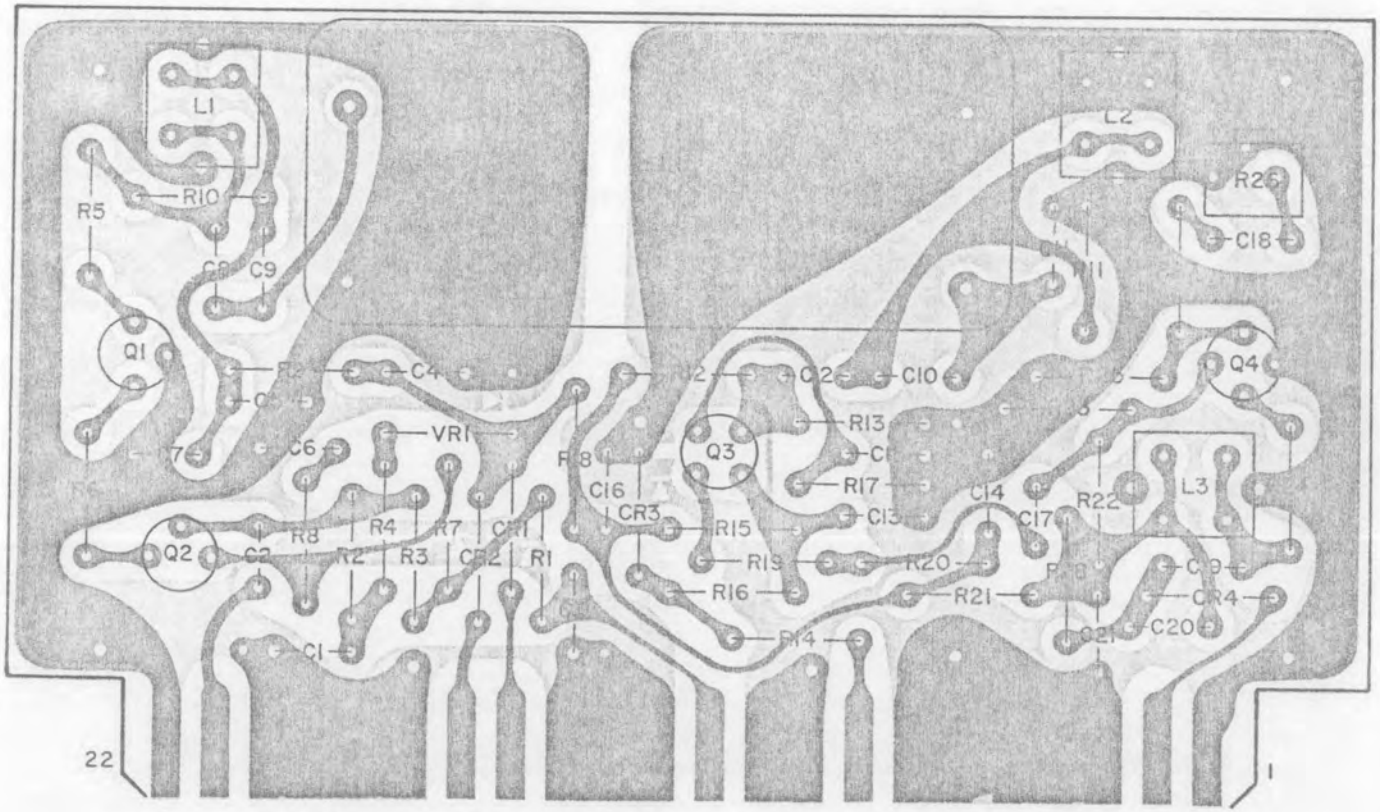


Figure 5-12. Type 72293 21.4 MHz IF Amplifier (50 kHz BW) (A4A2), Location of Components.

REF DESIG PREFIX A4A2

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
20	CAPACITOR, MICA, DIPPED: 560 pF, 5%, 300 V	1	DM15-561J	72136	
21	Same as C1				
L1	FILTER, BANDPASS	1	9680068	74306	
1	COIL, VARIABLE: 0.612-0.748 μH	2	7107-11	71279	
2	Same as L1				
3	COIL, VARIABLE: 0.198-0.242 μH	1	7107-05	71279	
1	TRANSISTOR	2	2N5109	80131	02735
2	Same as Q1				
3	TRANSISTOR	1	3N187	80131	02735
4	TRANSISTOR	1	2N3478	80131	02735
1	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	RCR07G220JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	2	RCR07G392JS	81349	01121
3	Same as R2				
4	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	4	RCR07G471JS	81349	01121
5	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	7	RCR07G470JS	81349	01121
6	Same as R5				
7	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	1	RCR07G391JS	81349	01121
8	Same as R5				
9	RESISTOR, FIXED, COMPOSITION: 33 Ω, 5%, 1/4W	1	RCR07G330JS	81349	01121
10	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	2	RCR07G472JS	81349	01121
11	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349	01121

REF DESIG PREFIX A4A2

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
12	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	1	RCR07G184JS	81349	01121
13	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
14	Same as R4				
15	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349	01121
16	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349	01121
17	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349	01121
18	Same as R5				
19	Same as R5				
20	Same as R4				
21	Same as R5				
22	RESISTOR, FIXED, COMPOSITION: 27 kΩ, 5%, 1/4W	1	RCR07G273JS	81349	01121
23	Same as R10				
24	Same as R5				
25	Same as R4				
26	RESISTOR, VARIABLE, FILM: 500 Ω, 10%, 1/2W	1	62PAR500	73138	
27	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349	01121
28	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	RCR07G562JS	81349	01121
R1	DIODE, ZENER	1	1N967B	80131	04713

4.5.3 Type 72291, 21.4 MHz IF Amplifier (300 kHz BW) REF DESIG PREFIX A4A3

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	3	1N462A	80131	93332
R2	Same as CR1				
R3	Same as CR1				
1	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	11	C023B101E502M	56289	
2	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	3	SM1000PFP	91418	
3 hru 6	Same as C1				
7	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350 V	5	538-006D9-35	72982	
8	CAPACITOR, CERAMIC, TUBULAR: 1.2 pF, ±0.1 pF, 500 V	1	301-000C0K0-129B	72982	
9	CAPACITOR, MICA, DIPPED: 82 pF, 2%, 500 V	2	CM05ED820G03	81349	72136
10	Same as C7				
11	CAPACITOR, CERAMIC, TUBULAR: 0.68 pF, ±0.1 pF, 500 V	1	301-000C0K0-688B	72982	
12	CAPACITOR, MICA, DIPPED: 110 pF, 2%, 500 V	2	CM05FD111G03	81349	72136
13	Same as C7				
14	CAPACITOR, MICA, DIPPED: 620 pF, 5%, 300 V	1	DM15-621J	72136	
15	Same as C2				
16	Same as C7				
17	CAPACITOR, MICA, DIPPED: 100 pF, 2%, 500 V	1	CM05FD101G03	81349	72136
18	Same as C1				
19	Same as C1				
20	Same as C7				

REF DESIG PREFIX A4A3

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
21	Same as C12				
22	CAPACITOR, CERAMIC, TUBULAR: 1.8 pF, ±0.1 pF, 500 V	1	301-000C0K0-189B	72982	
23	CAPACITOR, MICA, DIPPED: 150 pF, 2%, 500 V	1	CM05FD151G03	81349	72136
24	CAPACITOR, MICA, DIPPED: 120 pF, 2%, 500 V	1	CM05FD121G03	81349	72136
25	CAPACITOR, MICA, DIPPED: 300 pF, 2%, 500 V	1	CM05FD301G03	81349	72136
26	CAPACITOR, MICA, DIPPED: 390 pF, 2%, 500 V	1	CM05FD391G03	81349	72136
27	Same as C1				
28	Same as C1				
29	Same as C2				
30	Same as C1				
31	Same as C1				
32	Same as C9				
1	COIL, TOROIDAL	2	20681-28	14632	
2	Same as L1				
3	COIL, TOROIDAL	2	20681-64	14632	
4	Same as L3				
5	COIL, TOROIDAL	1	20681-8	14632	
6	COIL, FIXED: 10 μH, 10%	1	1537-36	99800	
1	TRANSISTOR	2	2N5109	80131	02735
2	Same as Q1				
3	TRANSISTOR	1	3N187	80131	02735

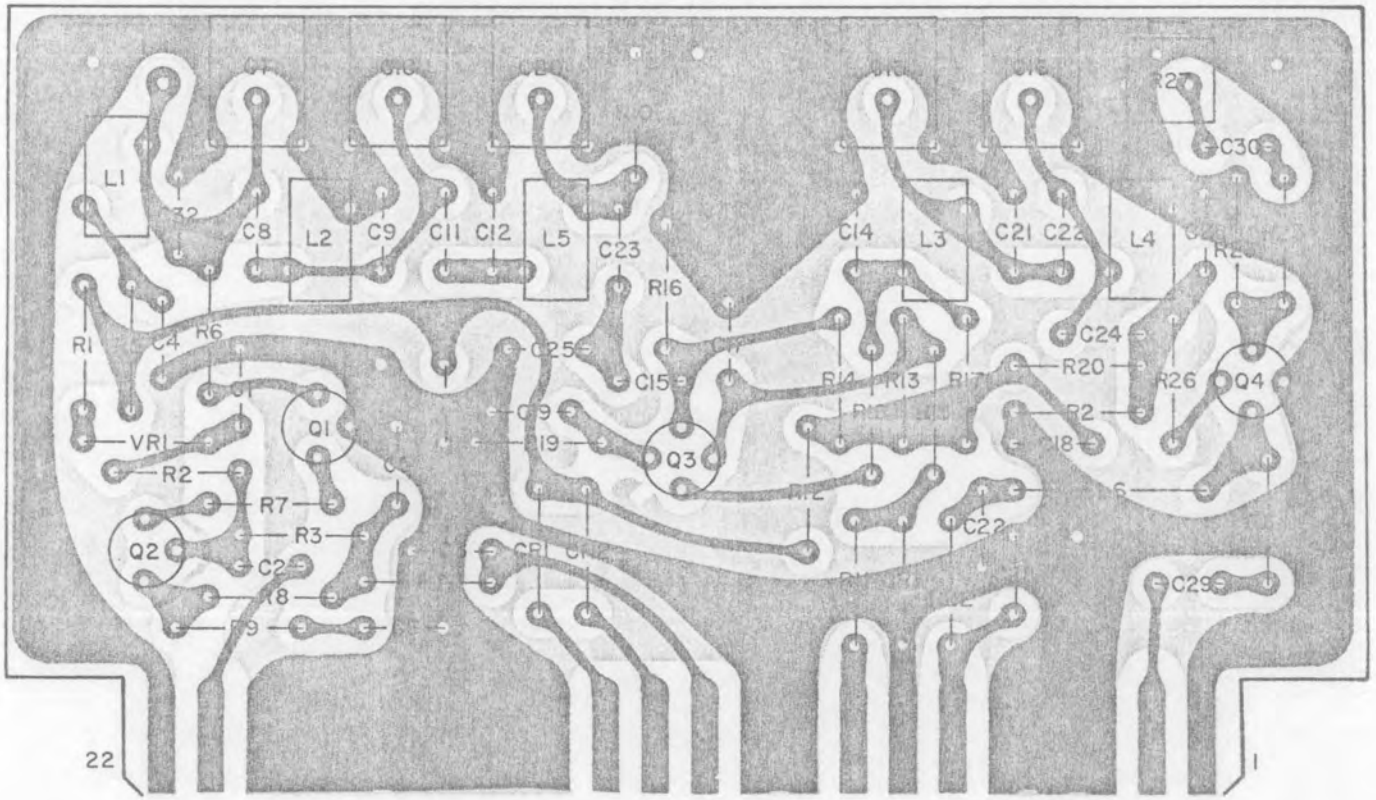


Figure 5-13. Type 72291 21.4 MHz IF Amplifier (300 kHz) (A4A3), Location of Components.

REF DESIG PREFIX A4A3

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
Q4	TRANSISTOR	1	2N3478	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	RCR07G471JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	2	RCR07G392JS	81349	01121
R3	Same as R2				
R4	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	RCR07G220JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 33 Ω, 5%, 1/4W	1	RCR07G330JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	6	RCR07G470JS	81349	01121
R7	Same as R6				
R8	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	1	RCR07G391JS	81349	01121
R9	Same as R6				
R10	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/4W	1	RCR07G512JS	81349	01121
R11	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	2	RCR07G472JS	81349	01121
R12	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	2	RCR07G221JS	81349	01121
R13	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	1	RCR07G154JS	81349	01121
R14	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	1	RCR07G184JS	81349	01121
R15	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	RCR07G333JS	81349	01121
R16	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
R17	Same as R1				
R18	Same as R6				
R19	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349	01121
R20	RESISTOR, FIXED, COMPOSITION: 27 kΩ, 5%, 1/4W	1	RCR07G273JS	81349	01121

REF DESIG PREFIX A4A3

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R21	Same as R11				
R22	Same as R12				
R23	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	1	RCR07G102JS	81349	01121
R24	Same as R6				
R25	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349	01121
R26	Same as R6				
R27	RESISTOR, VARIABLE, FILM: 100 Ω, 10%, 1/2W	1	62PAR100	73138	
VR1	DIODE, ZENER	1	1N967B	80131	04713

5.4.5.4 Type 72290, 21.4 MHz IF Amplifier (1 MHz BW) REF DESIG PREFIX A4A4

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	DIODE	3	1N462A	80131	93332
CR2	Same as CR1				
CR3	Same as CR1				
C1	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	11	C023B101E502M	56289	
C2	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	4	SM1000PFP	91418	
C3	Same as C1				
C4	Same as C1				
C5	Same as C1				
C6	Same as C1				
C7	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350 V	5	538-006D9-35	72982	
C8	CAPACITOR, CERAMIC, TUBULAR: 3.6 pF, ±0.25 pF, 500 V	1	301-000C0J0-369C	72982	
C9	CAPACITOR, MICA, DIPPED: 82 pF, 2%, 500 V	4	CM05ED820G03	81349	72136
C10	Same as C7				
C11	CAPACITOR, CERAMIC, TUBULAR: 3.0 pF, ±0.1 pF, 500 V	1	301-000C0J0-309B	72982	
C12	Same as C9				
C13	Same as C7				
C14	CAPACITOR, CERAMIC, TUBULAR: 4.0 pF, ±0.1 pF, 500 V	1	301-000C0H0-409B	72982	
C15	Same as C9				
C16	Same as C7				
C17	CAPACITOR, CERAMIC, TUBULAR: 4.7 pF, ±0.1 pF, 500 V	1	301-000C0H0-479B	72982	
C18	CAPACITOR, CERAMIC, TUBULAR: 6.0 pF, ±0.1 pF, 500 V	1	301-000C0H0-609B	72982	

REF DESIG PREFIX A4A4

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C19	CAPACITOR, MICA, DIPPED: 110 pF, 2%, 500 V	1	CM05FD111G03	81349	72136
C20	Same as C7				
C21	CAPACITOR, MICA, DIPPED: 120 pF, 2%, 500 V	1	CM05FD121G03	81349	72136
C22	CAPACITOR, MICA, DIPPED: 470 pF, 5%, 500 V	1	DM15-471J	72136	
C23	Same as C2				
C24	CAPACITOR, MICA, DIPPED: 100 pF, 2%, 500 V	1	CM05FD101G03	81349	72136
C25	Same as C1				
C26	Same as C2				
C27	Same as C1				
C28	Same as C1				
C29	Same as C2				
C30	Same as C1				
C31	Same as C1				
C32	Same as C9				
C33	Same as C1				
L1	COIL, TOROIDAL	4	20681-28	14632	
L2	Same as L1				
L3	Same as L1				
L4	Same as L1				
L5	COIL, TOROIDAL	1	20681-8	14632	
L6	COIL, FIXED: 10 μH, 10%	1	1537-36	99800	

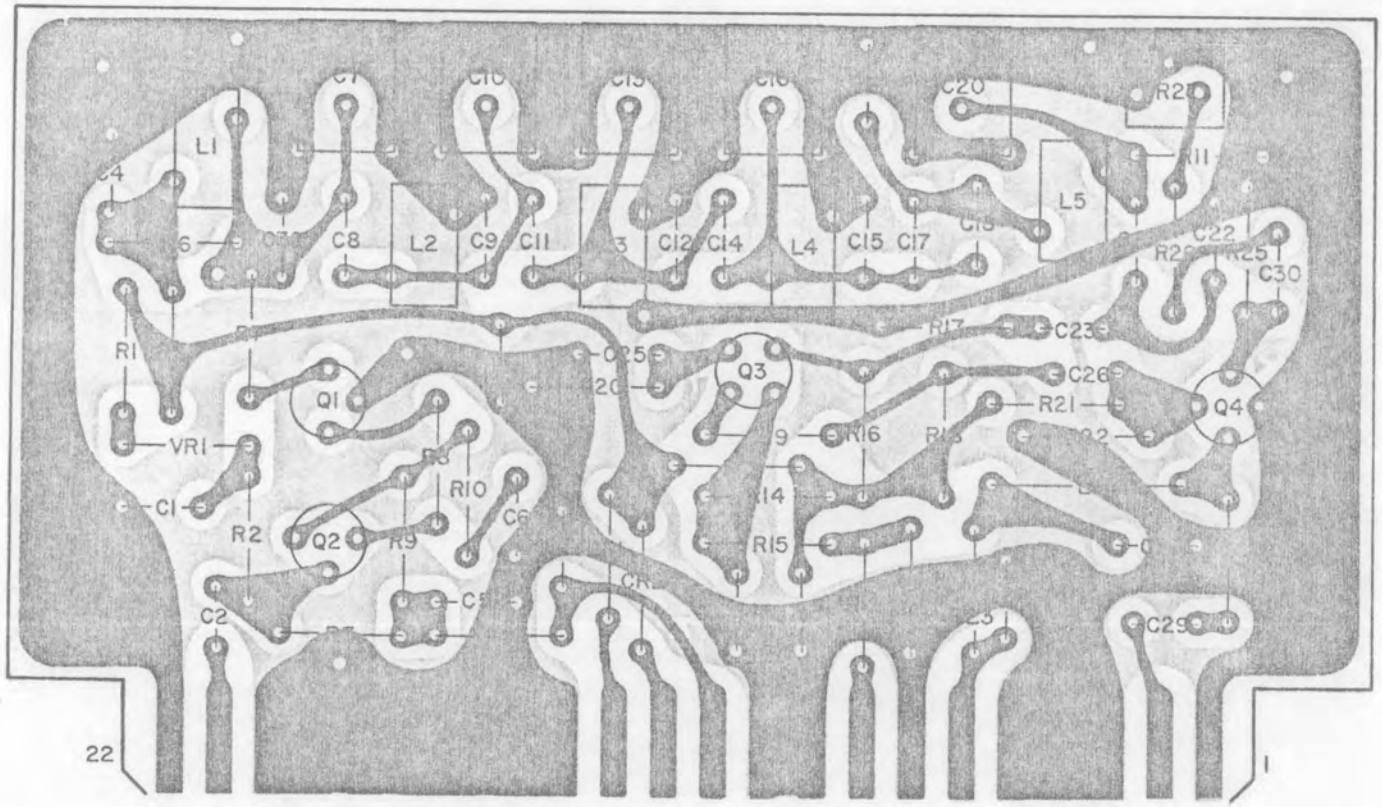


Figure 5-14. Type 72290 21.4 MHz IF Amplifier (1 MHz BW)(A4A4), Location of Components.

REF DESIG PREFIX A4A4

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
Q1	TRANSISTOR	2	2N5109	80131	02735
Q2	Same as Q1				
Q3	TRANSISTOR	1	3N187	80131	02735
Q4	TRANSISTOR	1	2N3478	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	RCR07G471JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	2	RCR07G392JS	81349	01121
R3	Same as R2				
R4	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	RCR07G220JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 33 Ω, 5%, 1/4W	1	RCR07G330JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	2	RCR07G103JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	5	RCR07G470JS	81349	01121
R8	Same as R7				
R9	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	1	RCR07G391JS	81349	01121
R10	Same as R7				
R11	Same as R9				
R12	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	2	RCR07G472JS	81349	01121
R13	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	2	RCR07G221JS	81349	01121
R14	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	1	RCR07G154JS	81349	01121
R15	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	RCR07G333JS	81349	01121
R16	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	1	RCR07G184JS	81349	01121
R17	Same as R6				

REF DESIG PREFIX A4A4

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R18	Same as R1				
R19	Same as R7				
R20	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349	01121
R21	RESISTOR, FIXED, COMPOSITION: 27 kΩ, 5%, 1/4W	1	RCR07G273JS	81349	01121
R22	Same as R12				
R23	Same as R13				
R24	Same as R7				
R25	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	1	RCR07G102JS	81349	01121
R26	RESISTOR, FIXED, COMPOSITION: 27 Ω, 5%, 1/4W	1	RCR07G270JS	81349	01121
R27	RESISTOR, VARIABLE, FILM: 1 kΩ, 10%, 1/2W	1	62PAR1K	73138	
VR1	DIODE, ZENER	1	1N967B	80131	04713

.4.5.5 Type 79626 FM Limiter/Discriminator (1 MHz BW) REF DESIG PREFIX A4A5

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	2	1N462A	80131	93332
R2	Same as CR1				
R3	DIODE	2	5082-2800	28480	
R4	Same as CR3				
R5	DIODE	1	1N458A	80131	93332
1	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM1000PFP	91418	
2	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	11	C023B101E502M	56289	
3	Same as C2				
4	Same as C2				
5	CAPACITOR, CERAMIC, TUBULAR: 1.5 pF, ±0.25 pF, 500 V	1	301-000C0K0-159C	72982	
6	CAPACITOR, CERAMIC, TUBULAR: 1.5 pF, ±0.25 pF, 500 V	1	301-000T2K0-159C	72982	
7	CAPACITOR, VARIABLE, CERAMIC: 2-8 pF, 350 V	1	538-006A2-8	72982	
8	Same as C2				
9	Same as C2				
10	Same as C2				
11	CAPACITOR, VARIABLE, AIR: 0.8-10.0 pF, 250 V	1	5201	91293	
12	CAPACITOR, CERAMIC, TUBULAR: 5.1 pF, ±0.5 pF, 500 V	1	301-000C0H0-519D	72982	
13	CAPACITOR, CERAMIC, TUBULAR: 1.5 pF, ±0.25 pF, 500 V	1	301-000P3K0-159C	72982	
14	CAPACITOR, CERAMIC, TUBULAR: 4.7 pF, ±0.25 pF, 500 V	1	301-000P3K0-479C	72982	
15	CAPACITOR, MICA, DIPPED: 12 pF, 5%, 500 V	1	CM05CD120J03	81349	72136
16	CAPACITOR, MICA, DIPPED: 10 pF, ±0.5 pF, 500 V	1	CM05CD100D03	81349	72136

REF DESIG PREFIX A4A5

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
17	Same as C2				
18	Same as C2				
19	Same as C2				
20	Same as C2				
21	Same as C2				
1	COIL, FIXED: 18 μH, 10%	2	1537-42	99800	
2	COIL, FIXED	1	20681-40	14632	
3	Same as L1				
4	COIL, FIXED: 4.7 mH, 10%	1	3635-45	71279	
5	COIL, FIXED: 5.6 μH, 10%	1	1537-30	99800	
6	COIL, FIXED: 15 μH, 10%	2	1537-40	99800	
7	Same as L6				
1	TRANSISTOR	1	U1899E	15818	
2	TRANSISTOR	1	2N3251	80131	04713
3	TRANSISTOR	1	2N2270	80131	02735
1	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	1	RCR07G221JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	4	RCR07G470JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349	01121
4	Same as R3				
5	RESISTOR, FIXED, COMPOSITION: 12 kΩ, 5%, 1/4W	1	RCR07G123JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	2	RCR07G223JS	81349	01121

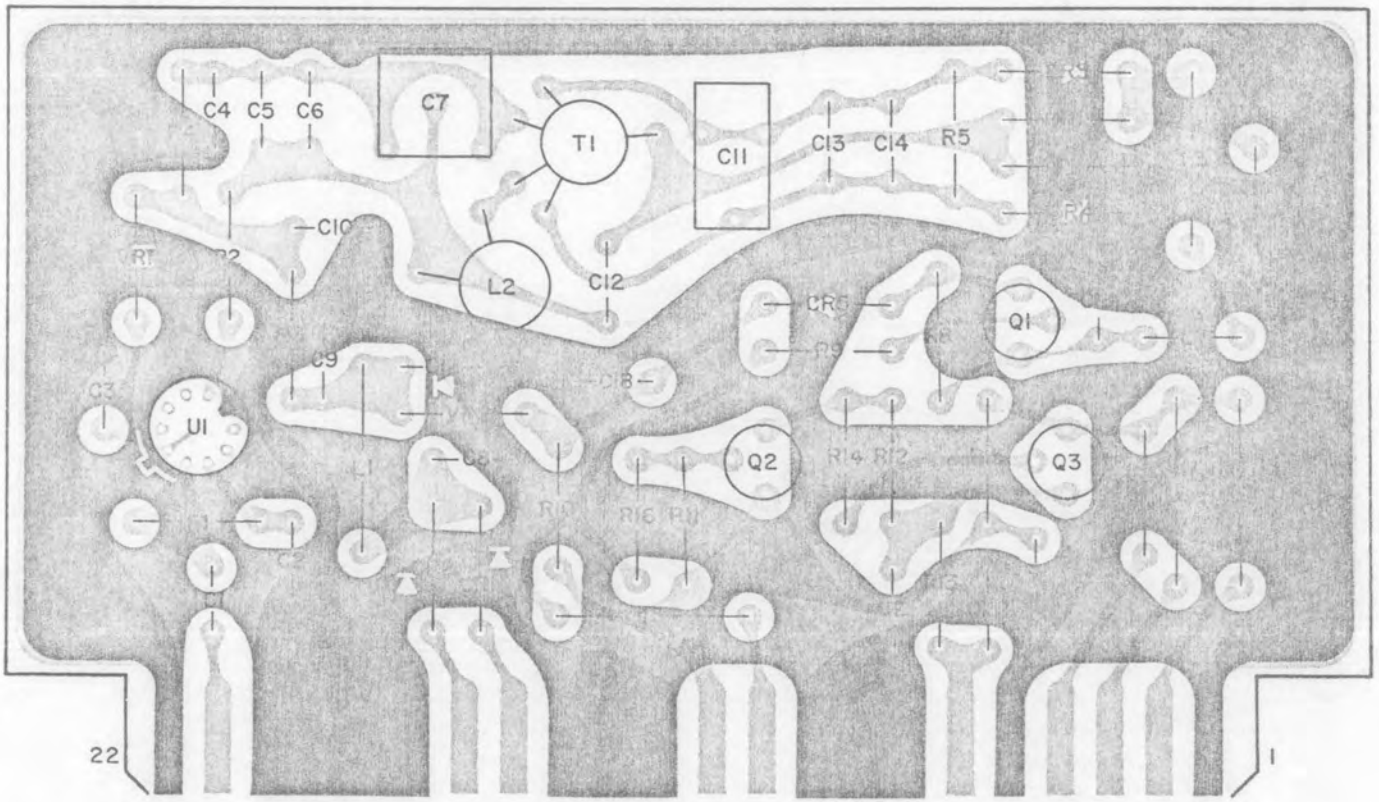


Figure 5-15. Type 79626 FM Limiter/Discriminator (1 MHz BW)(A4A5), Location of Components.

REF DESIG PREFIX A4A5

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
7	Same as R6				
8	RESISTOR, FIXED, COMPOSITION: 22 MΩ, 5%, 1/4W	1	RCR07G226JS	81349	01121
9	Same as R2				
10	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	1	RCR07G104JS	81349	01121
11	RESISTOR, FIXED, COMPOSITION: 5.6 MΩ, 5%, 1/4W	1	RCR07G565JS	81349	01121
12	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	RCR07G333JS	81349	01121
13	Same as R2				
14	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349	01121
15	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	1	RCR07G152JS	81349	01121
16	Same as R2				
17	RESISTOR, FIXED, COMPOSITION: 20 kΩ, 5%, 1/4W	1	RCR07G203JS	81349	01121
1	TRANSFORMER	1	21427-6	14632	
1	INTEGRATED CIRCUIT	1	U5F7719393	07263	
R1	DIODE, ZENER	1	1N749A	80131	04713
R2	DIODE, ZENER	1	1N759A	80131	04713

4.5.6 Type 79620 FM Limiter/Discriminator (300 kHz BW) REF DESIG PREFIX A4A6

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	2	1N462A	80131	93332
R2	Same as CR1				
R3	DIODE	2	1N914	80131	93332
R4	Same as CR3				
R5	DIODE	1	1N458A	80131	93332
	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM1000PFP	91418	
	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	9	C023B101E502M	56289	
	Same as C2				
	Same as C2				
	CAPACITOR, CERAMIC, TUBULAR: 2.2 pF, ±0.25 pF, 500 V	1	301-000C0J0-229C	72982	
	CAPACITOR, CERAMIC, TUBULAR: 4.7 pF, ±0.25 pF, 500 V	1	301-000U2J0-479C	72982	
	CAPACITOR, VARIABLE, CERAMIC: 2-8 pF, 350 V	1	538-006A2-8	72982	
	Same as C2				
	Same as C2				
0	Same as C2				
1	CAPACITOR, VARIABLE, AIR: 0.8-10.0 pF, 250 V	1	5201	91293	
2	CAPACITOR, CERAMIC, TUBULAR: 8.2 pF, ±0.5 pF, 500 V	1	301-000C0H0-829D	72982	
3	CAPACITOR, MICA, DIPPED: 36 pF, 2%, 500 V	1	CM05ED360G03	81349	72136
4	CAPACITOR, CERAMIC, TUBULAR: 15 pF, 5%, 500 V	1	301-000U2J0-150J	72982	
5	CAPACITOR, MICA, DIPPED: 27 pF, 2%, 500 V	1	CM05ED270G03	81349	72136
6	CAPACITOR, MICA, DIPPED: 47 pF, 2%, 500 V	1	CM05ED470G03	81349	72136

REF DESIG PREFIX A4A6

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
17	Same as C2				
18	Same as C2				
19	Same as C2				
1	COIL, FIXED: 18 μH, 10%	2	1537-42	99800	
2	COIL, FIXED	1	20681-26	14632	
3	Same as L1				
4	COIL, FIXED: 10 mH, 10%	1	3635-49	71279	
1	TRANSISTOR	1	U1899E	15818	
1	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	1	RCR07G221JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349	01121
3	Same as R2				
4	RESISTOR, FIXED, COMPOSITION: 20 kΩ, 5%, 1/4W	1	RCR07G203JS	81349	01121
5	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	RCR07G473JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	1	RCR07G223JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 22 MΩ, 5%, 1/4W	1	RCR07G226JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	1	RCR07G104JS	81349	01121
9	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349	01121
10	Same as R9				
1	TRANSFORMER	1	21427-7	14632	
1	INTEGRATED CIRCUIT	1	U5F7719393	07263	
R1	DIODE, ZENER	1	1N749A	80131	04713

REF DESIG PREFIX A4A6

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R2	DIODE, ZENER	1	1N759A	80131	04713

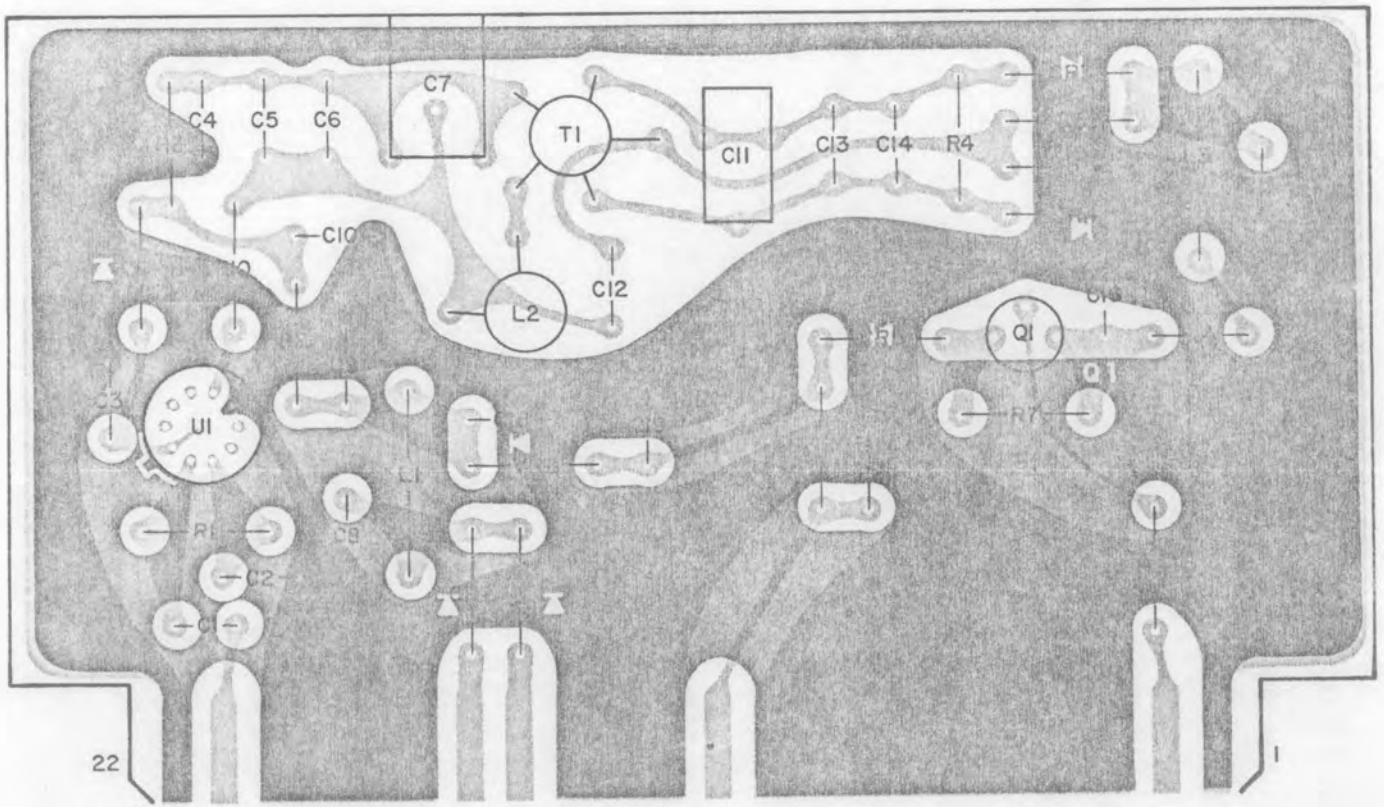


Figure 5-16. Type 79620 FM Limiter/Discriminator (300 kHz BW)(A4A6), Location of Components.

4.5.7 Type 79616-1 FM Limiter/Discriminator (10 and 50 kHz BW) REF DESIG PREFIX A4A7

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	6	1N462A	80131	93332
R2 hru R6	Same as CR1				
R7	DIODE	1	1N458A	80131	93332
1	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM1000PFP	91418	
2	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	7	C023B101E502M	56289	
3	Same as C2				
4	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350 V	1	538-006D9-35	72982	
5	Same as C2				
6	CAPACITOR, MICA, DIPPED: 43 pF, 2%, 500 V	2	CM05ED430G03	81349	72136
7	Same as C6				
8 hru 11	Same as C2				
1	COIL, FIXED: 1.0 μH, 10%	1	1537-12	99800	
2	COIL, FIXED: 18 μH, 10%	1	1537-42	99800	
1	TRANSISTOR	2	U1899E	15818	
2	Same as Q1				
1	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	1	RCR07G221JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349	01121

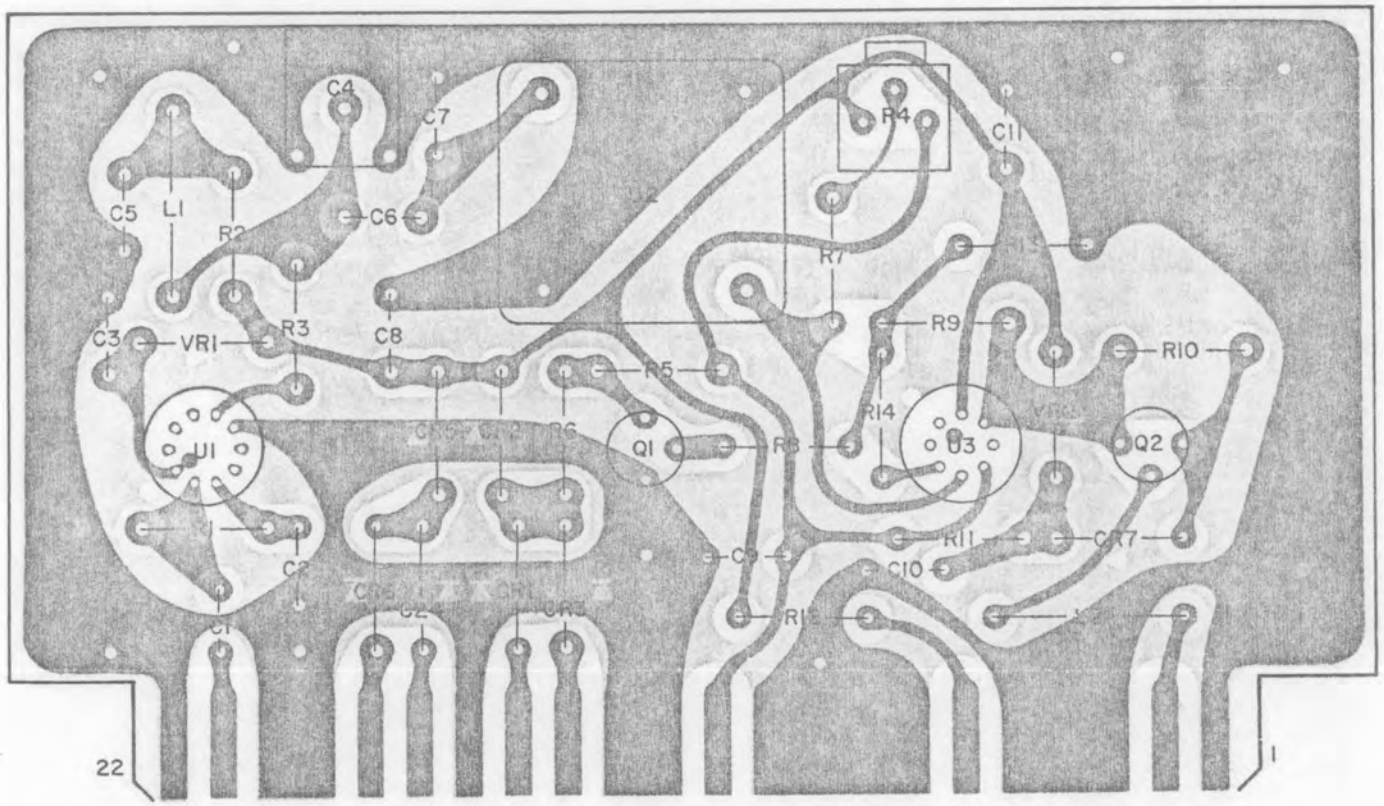


Figure 5-17. Type 79616 FM Limiter/Discriminator (10 + 50 kHz BW)(A4A7), Location of Components.

REF DESIG PREFIX A4A7

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
4	RESISTOR, VARIABLE, FILM: 100 kΩ, 10%, 1/2W	1	62PAR100K	73138	
5	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	1	RCR07G154JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	RCR07G104JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 6.8 MΩ, 5%, 1/4W	1	RCR07G685JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/4W	1	RCR07G512JS	81349	01121
9	Same as R6				
10	RESISTOR, FIXED, COMPOSITION: 22 MΩ, 5%, 1/4W	1	RCR07G226JS	81349	01121
11	Same as R6				
12	Same as R2				
13	RESISTOR, FIXED, COMPOSITION: 24 kΩ, 5%, 1/4W	1	RCR07G243JS	81349	01121
14	RESISTOR, FIXED, COMPOSITION: 39 kΩ, 5%, 1/4W	1	RCR07G393JS	81349	01121
1	INTEGRATED CIRCUIT	1	U5F7719393	07263	
2	DISCRIMINATOR CRYSTAL	1	8680040	03040	
3	INTEGRATED CIRCUIT	1	U5B7741393	07263	
R1	DIODE, ZENER	1	1N749A	80131	04713
R2	DIODE, ZENER	1	1N759A	80131	04713

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	1	1N462A	80131	93332
R2	DIODE	1	5082-2800	28480	
1	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	9	C023B101E502M	56289	
2	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	3	SM1000PFP	91418	
3	CAPACITOR, MICA, DIPPED: 100 pF, 2%, 500 V	2	CM05FD101G03	81349	72136
4	Same as C1				
5	Same as C1				
6	Same as C2				
7	Same as C2				
8	CAPACITOR, MICA, DIPPED: 470 pF, 5%, 500 V	1	DM15-471J	72136	
ru 2	Same as C1				
3	CAPACITOR, VARIABLE, CERAMIC: 5.5-18 pF, 350 V	1	538-006A5.5-18	72982	
4	CAPACITOR, MICA, DIPPED: 47 pF, 2%, 500 V	1	CM05ED470G03	81349	72136
5	CAPACITOR, CERAMIC, DISC: 6.8 pF, ±0.5 pF, 500 V	1	301-000C0H0-689D	72982	
6	CAPACITOR, MICA, DIPPED: 68 pF, 2%, 500 V	1	CM05ED680G03	81349	72136
7	CAPACITOR, MICA, DIPPED: 15 pF, 5%, 500 V	1	CM05CD150J03	81349	72136
8	Same as C1				
9	Same as C1				
0	CAPACITOR, MICA, DIPPED: 750 pF, 5%, 300 V	1	DM15-751J	72136	
1	CAPACITOR, MICA, DIPPED: 10 pF, ±0.5 pF, 500 V	1	CM05CD100D03	81349	72136

REF DESIG PREFIX A4A8

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
22	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μF, 10%, 35 V	1	CS13BF105K	81349	56289
23	Same as C3				
1	COIL, FIXED: 2.2 μH, 10%	1	1537-20	99800	
2	COIL, FIXED: 4.7 μH, 10%	2	1537-28	99800	
3	COIL, FIXED: 3.9 μH, 10%	1	1537-26	99800	
4	Same as L2				
5	COIL, FIXED: 130 μH, 5%	1	1537-82	99800	
6	COIL, FIXED: 27 μH, 5%	1	1537-48	99800	
7	COIL, FIXED: 18 μH, 10%	1	1537-42	99800	
1	TRANSISTOR	1	3N187	80131	02735
2	TRANSISTOR	2	2N3478	80131	07235
3	Same as Q2				
	TRANSISTOR	2	2N5109	80131	02735
	Same as Q4				
	TRANSISTOR	1	U1899E	15818	
	TRANSISTOR	1	2N3251	80131	04713
	TRANSISTOR	1	2N2222A	80131	04713
	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	2	RCR07G221JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349	01121

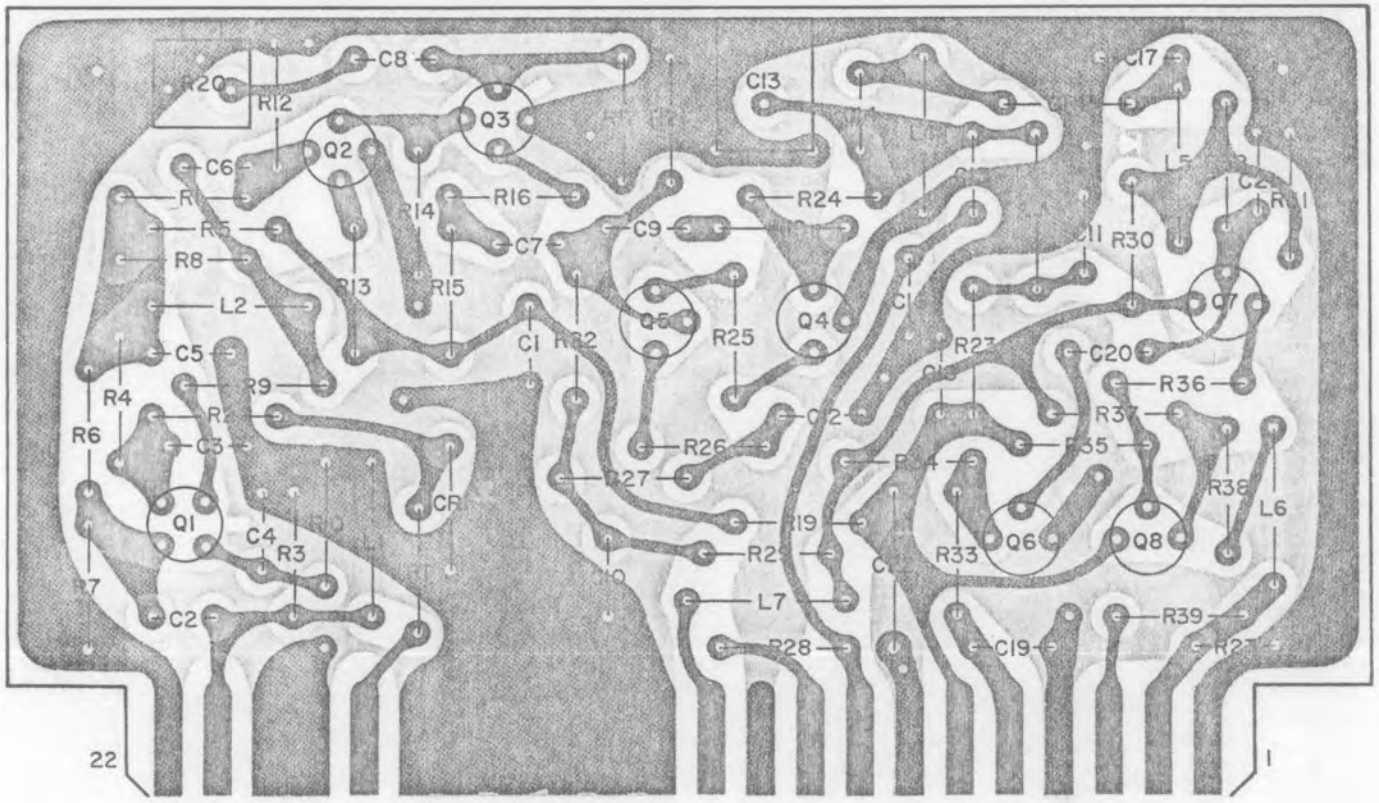


Figure 5-18. Type 72285 IF Output Amplifier (A4A8), Location of Components.

REF DESIG PREFIX A4A8

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
5	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	RCR07G101JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	1	RCR07G184JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	3	RCR07G103JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	2	RCR07G102JS	81349	01121
9	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	7	RCR07G470JS	81349	01121
10	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349	01121
11	RESISTOR, FIXED, COMPOSITION: 12 kΩ, 5%, 1/4W	2	RCR07G123JS	81349	01121
12	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	2	RCR07G472JS	81349	01121
13	Same as R9				
14	Same as R8				
15	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	1	RCR07G151JS	81349	01121
16	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	3	RCR07G220JS	81349	01121
17	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	1	RCR07G821JS	81349	01121
18	Same as R9				
19	Same as R7				
20	RESISTOR, VARIABLE, FILM: 100 Ω, 10%, 1/2W	1	62PAR100	73138	
21	Same as R11				
22	RESISTOR, FIXED, COMPOSITION: 3.0 kΩ, 5%, 1/4W	1	RCR07G302JS	81349	01121
23	Same as R9				
24	Same as R9				
25	Same as R9				

REF DESIG PREFIX A4A8

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
6	RESISTOR, FIXED, COMPOSITION: 4.7 Ω, 5%, 1/4W	1	RCR07G4R7JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 240 Ω, 5%, 1/4W	1	RCR07G241JS	81349	01121
8	Same as R9				
9	Same as R16				
0	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	1	RCR07G154JS	81349	01121
1	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	2	RCR07G222JS	81349	01121
2	Same as R31				
3	RESISTOR, FIXED, COMPOSITION: 24 kΩ, 5%, 1/4W	1	RCR07G243JS	81349	01121
4	RESISTOR, FIXED, COMPOSITION: 39 kΩ, 5%, 1/4W	1	RCR07G393JS	81349	01121
5	Same as R7				
6	RESISTOR, FIXED, COMPOSITION: 91 Ω, 5%, 1/4W	1	RCR07G910JS	81349	01121
7	Same as R12				
8	Same as R16				
9	Same as R3				

4.6 Type 79612-1 Marker Generator

REF DESIG PREFIX A5

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1 ıru R8	DIODE	8	1N462A	80131	93332
	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 μF, 20%, 25 V	2	109D107X0025F2	56289	
2	Same as C1				
	TRANSISTOR	1	2N2907	80131	04713
2	TRANSISTOR	1	2N2222A	80131	04713
	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	2	RCR07G102JS	81349	01121
2	Same as R1				
3	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	2	RCR07G222JS	81349	01121
5	Same as R4				
ıru 13	RESISTOR, FIXED, WIREWOUND: 20 kΩ, 1/10%, 1/10W	8	M40-20K	14193	
4	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	5	RCR07G103JS	81349	01121
5	Same as R14				
6	RESISTOR, FIXED, COMPOSITION: 27 kΩ, 5%, 1/4W	1	RCR07G273JS	81349	01121
7*	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	1	RCR07G474JS	81349	01121
9	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	2	RCR07G100JS	81349	01121
0	Same as R19				

* Nominal value. Final value factory selected.

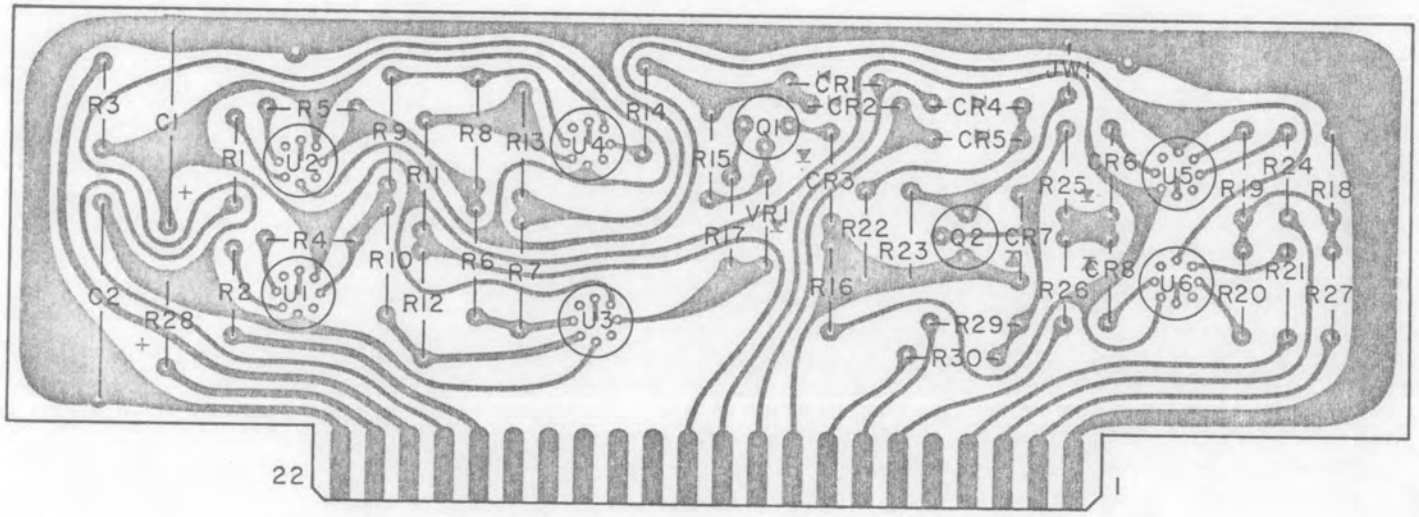


Figure 5-19. Type 79612-1 Marker Generator (A5), Location of Components.

REF DESIG PREFIX A5

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
21	Same as R14				
22	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349	01121
23	RESISTOR, FIXED, COMPOSITION: 750 Ω, 5%, 1/4W	1	RCR07G751JS	81349	01121
24	Same as R14				
25	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	3	RCR07G562JS	81349	01121
26	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	RCR07G473JS	81349	01121
27	Same as R14				
28	Same as R3				
29	Same as R25				
30	Same as R25				
ru	INTEGRATED CIRCUIT	6	U5B7741393	07263	
21	DIODE, ZENER	1	1N752A	80131	04713

4.7 Type 7366 Video Amplifier

REF DESIG PREFIX A6

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	2	1N462A	80131	93332
R2	Same as CR1				
R3	DIODE	2	1N4446	80131	93332
R4	Same as CR3				
	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 10%, 35 V	1	CS13BF225K	81349	56289
2	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μF, 10%, 35 V	4	CS13BF105K	81349	56289
3	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 10%, 35 V	1	CS13BF226K	81349	56289
	Same as C2				
5	Same as C2				
6	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 μF, 10%, 30 V	1	109D107X9030T2	56289	
	Same as C2				
	TRANSISTOR	2	2N3904	80131	04713
	TRANSISTOR	2	2N3906	80131	04713
	Same as Q1				
	Same as Q2				
	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349	01121
	RESISTOR, FIXED, FILM: 150 kΩ, 1%, 1/4W	1	RN60D1503F	81349	75042
	RESISTOR, FIXED, FILM: 24.3 kΩ, 1%, 1/4W	1	RN60D2432F	81349	75042
	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	3	RCR07G102JS	81349	01121
	RESISTOR, FIXED, FILM: 681 Ω, 1%, 1/4W	1	RN60D6810F	81349	75042
	RESISTOR, FIXED, FILM: 4.75 kΩ, 1%, 1/4W	1	RN60D4751F	81349	75042

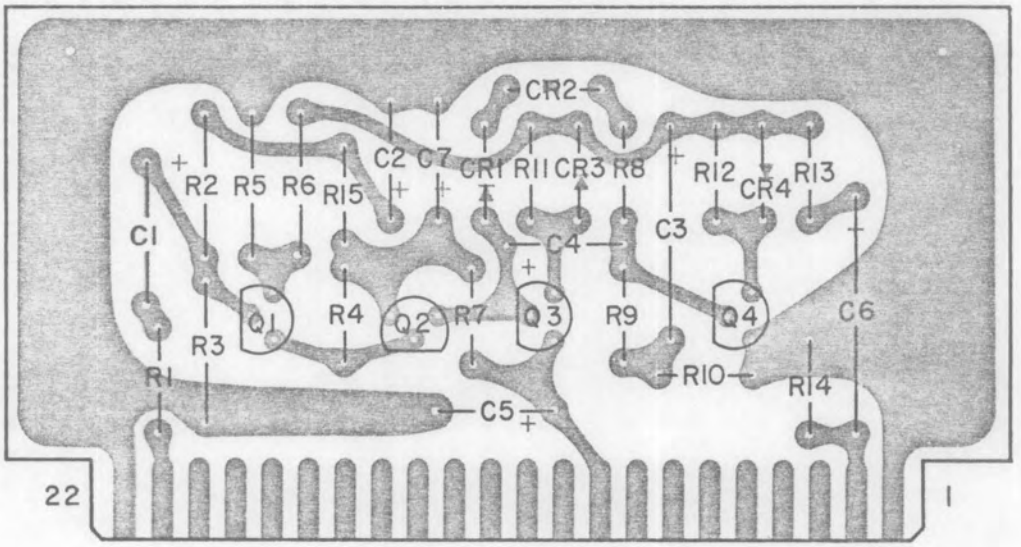


Figure 5-20. Type 7366 Video Amplifier (A6), Location of Components.

REF DESIG PREFIX A6

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
7	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	4	RCR07G470JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	RCR07G101JS	81349	01121
9	Same as R4				
10	Same as R4				
11	Same as R7				
12	Same as R7				
13	Same as R7				
14	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
15	RESISTOR, FIXED, COMPOSITION: 20 kΩ, 5%, 1/4W	1	RCR07G203JS	81349	01121

4.8 Type 71291 RF Monitor

REF DESIG PREFIX A7

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	1	5082-2800	28480	
1	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500 V	3	FA5C102W	01121	
2	Same as C1				
3	Same as C1				
4	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	5	C023B101E502M	56289	
5	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM1000PFP	91418	
6	Same as C4				
7	Same as C4				
8	CAPACITOR, MICA, DIPPED: 10 pF, ±0.5 pF, 500 V	1	CM04CD100D03	81349	72136
9	CAPACITOR, MICA, DIPPED: 100 pF, 2%, 500 V	1	CM05FD101G03	81349	72136
10	CAPACITOR, CERAMIC, DISC: 470 pF, 20%, 1000 V	1	B470PFM	91418	
11	Same as C4				
12	Same as C4				
	CONNECTOR, RECEPTACLE	3	46025	74868	
	Same as J1				
	Same as J1				
	COIL, VARIABLE: 3.2-8.3 μH	1	1472-4	14632	
2	COIL, FIXED: 18 μH, 10%	1	1537-42	99800	
3	COIL, FIXED: 12 μH, 10%	1	1537-38	99800	
P1	COVER	1	15646-1	14632	
	TRANSISTOR	2	2N3478	80131	02735

REF DESIG PREFIX A7

F IG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	Same as Q1				
	TRANSISTOR	1	2N929	80131	04713
	RESISTOR, FIXED, COMPOSITION: 75 Ω, 5%, 1/4W	1	RCR07G750JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	3	RCR07G101JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	1	RCR07G151JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	2	RCR07G682JS	81349	01121
	Same as R5				
	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	2	RCR07G183JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 680 Ω, 5%, 1/4W	1	RCR07G681JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349	01121
0	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349	01121
1	Same as R9				
2	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	1	RCR07G474JS	81349	01121
4	Same as R2				
5	Same as R7				
6	Same as R2				
1	DIODE, ZENER	1	1N758A	80131	04713
1	SOCKET, TRANSISTOR	2	22-16-4	81073	
2	Same as XQ1				

REF DESIG PREFIX A7

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
Q3	SOCKET, TRANSISTOR	1	22-16-2	81073	

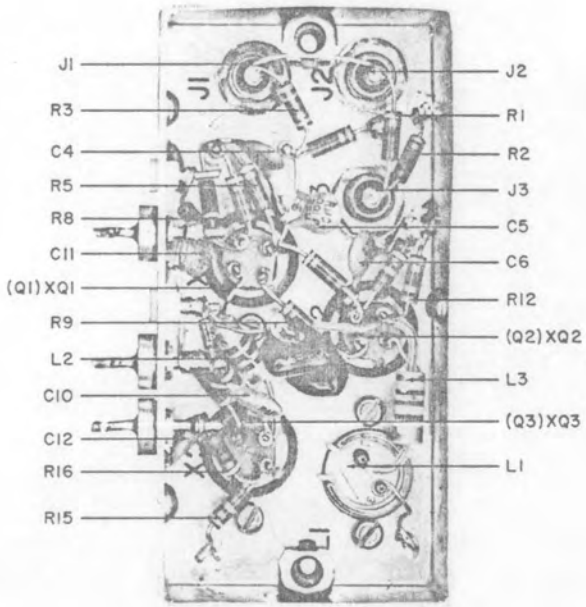


Figure 5-21. Type 71291 RF Monitor (A7), Location of Components.

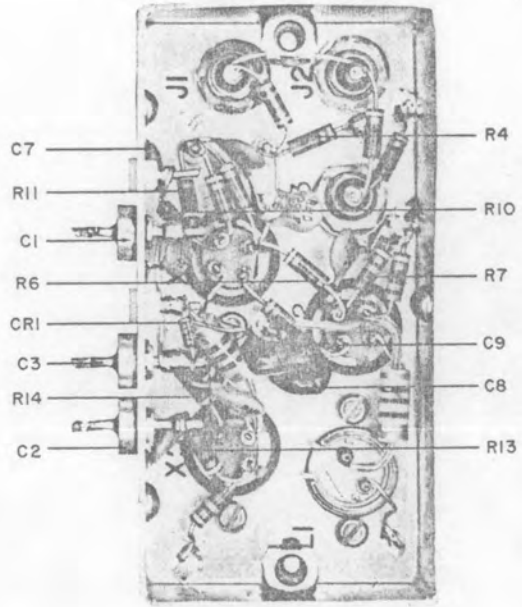


Figure 5-22. Type 71291 RF Monitor (A7), Location of Components.

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	1	1N458A	80131	93332
R2 thru R6	DIODE	5	1N462A	80131	93332
	CAPACITOR, CERAMIC, DISC: 0.47 μF, 20%, 100 V	2	8131M100-651-474M	72982	
	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 10%, 35 V	3	CS13BF226K	81349	56289
	Same as C1				
	CAPACITOR, MICA, DIPPED: 510 pF, 2%, 500 V	1	CM06FD511G03	81349	72136
	CAPACITOR, CERAMIC, DISC: 0.1 μF, 20%, 100 V	2	8131M100-651-104M	72982	
	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μF, 10%, 35 V	1	CS13BF476K	81349	56289
	Same as C2				
	Same as C2				
	CAPACITOR, CERAMIC, DISC: 2200 pF, 10%, 200 V	1	CK06BX222K	81349	56289
0	Same as C5				
	RELAY	1	HP11D24V	77342	
	TRANSISTOR	1	U1899E	15818	
	TRANSISTOR	2	2N2222A	80131	04713
	Same as Q2				
	TRANSISTOR	1	2N3904	80131	04713
	TRANSISTOR	1	2N3906	80131	07413
	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349	01121
	RESISTOR, FIXED, COMPOSITION: 56 kΩ, 5%, 1/4W	1	RCR07G563JS	81349	01121

REF DESIG PREFIX A8

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
3	RESISTOR, FIXED, COMPOSITION: 330 kΩ, 5%, 1/4W	1	RCR07G334JS	81349	01121
4	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	1	RCR07G223JS	81349	01121
5	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	2	RCR07G224JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	1	RCR07G104JS	81349	01121
7	Same as R5				
8	RESISTOR, FIXED, COMPOSITION: 10 MΩ, 5%, 1/4W	1	RCR07G106JS	81349	01121
9	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	2	RCR07G333JS	81349	01121
10	Same as R9				
11	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	3	RCR07G472JS	81349	01121
12	RESISTOR, FIXED, COMPOSITION: 390 kΩ, 5%, 1/4W	1	RCR07G394JS	81349	01121
13	RESISTOR, FIXED, COMPOSITION: 2.0 kΩ, 5%, 1/4W	2	RCR07G202JS	81349	01121
14	RESISTOR, FIXED, COMPOSITION: 51 kΩ, 5%, 1/4W	1	RCR07G513JS	81349	01121
15	Same as R13				
16	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349	01121
17	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	1	RCR07G102JS	81349	01121
18	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	RCR07G562JS	81349	01121
19	Same as R11				
20	Same as R11				
21	RESISTOR, FIXED, COMPOSITION: 8.2 Ω, 5%, 1/4W	2	RCR07G8R2JS	81349	01121
22	Same as R21				
23	RESISTOR, FIXED, COMPOSITION: 43 Ω, 5%, 1/4W	1	RCR07G430JS	81349	01121

REF DESIG PREFIX A8

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
24	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349	01121
25	RESISTOR, FIXED, COMPOSITION: 2.2 MΩ, 5%, 1/4W	1	RCR07G225JS	81349	01121
1	AUDIO TRANSFORMER	1	16934	14632	
1	INTEGRATED CIRCUIT	1	N5558V	27014	
2	INTEGRATED CIRCUIT	1	MC1439G	04713	
R1	DIODE, ZENER	1	1N746A	80131	04713

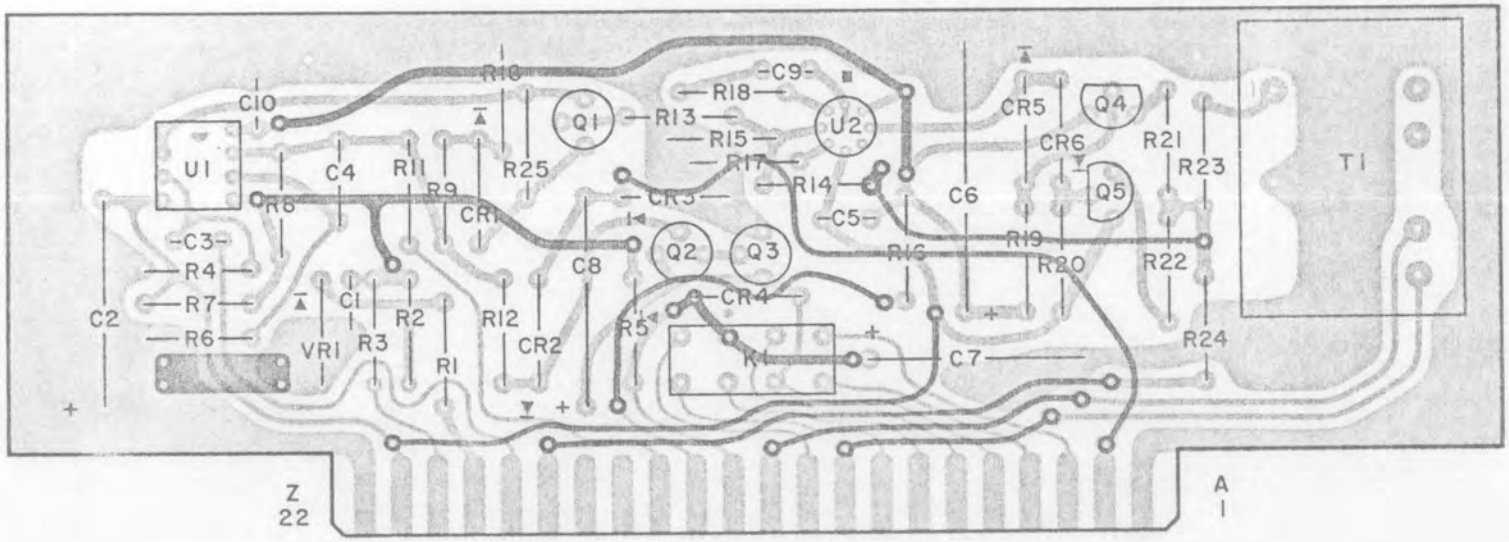


Figure 5-23. Type 7443 Audio/COR (A8), Location of Components.

4.10 Type 78100 AGC Amplifier

REF DESIG PREFIX A9

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	2	1N458A	80131	93332
R2	Same as CR1				
R3	DIODE	1	1N270	80131	93332
R4	DIODE	2	1N462A	80131	93332
R5	Same as CR4				
1	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 100 V	1	C023B101F103M	56289	
2	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.47 μF, 10%, 35 V	1	CS13BF474K	81349	56289
3	CAPACITOR, MICA, DIPPED: 470 pF, 5%, 500 V	1	DM15-471J	72136	
4	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 20%, 25 V	2	109D226X0025C2	56289	
5	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μF, 10%, 20 V	1	CS13BE106K	81349	56289
6	CAPACITOR, CERAMIC, DISC: 0.05 μF, -20+80%, 20 V	1	UK20-503	71590	
7	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM1000PFP	91418	
8	Same as C4				
9	CAPACITOR, CERAMIC, DISK: 5000 pF, 20%, 500 V	1	SM5000PFM	91418	
10	CAPACITOR, CERAMIC, DISC: 2200 pF, 20%, 1000 V	1	JF2200PFM	91418	
1	TRANSISTOR	4	2N3251	80131	04713
2	TRANSISTOR	1	2N2270	80131	02735
3	TRANSISTOR	2	U1899E	15818	
4	Same as Q3				
5	TRANSISTOR	5	2N929	80131	04713
6	Same as Q1				

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
7	Same as Q5				
8	Same as Q1				
9	Same as Q5				
10	Same as Q5				
11	Same as Q5				
12	Same as Q1				
13	TRANSISTOR	2	2N3904	80131	04713
14	Same as Q13				
15	Same as Q13				
1	RESISTOR, FIXED, COMPOSITION: 68 kΩ, 5%, 1/4W	3	RCR07G683JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	8	RCR07G103JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	RCR07G182JS	81349	01121
4	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	5	RCR07G682JS	81349	01121
5	RESISTOR, FIXED, COMPOSITION: 330 kΩ, 5%, 1/4W	3	RCR07G334JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	1	RCR07G183JS	81349	01121
8	Same as R5				
9	RESISTOR, VARIABLE, FILM: 100 kΩ, 10%, 1/4W	1	62PAR100K	73138	
10	Same as R2				
11	RESISTOR, FIXED, COMPOSITION: 22 MΩ, 5%, 1/4W	2	RCR07G226JS	81349	01121
12	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349	01121

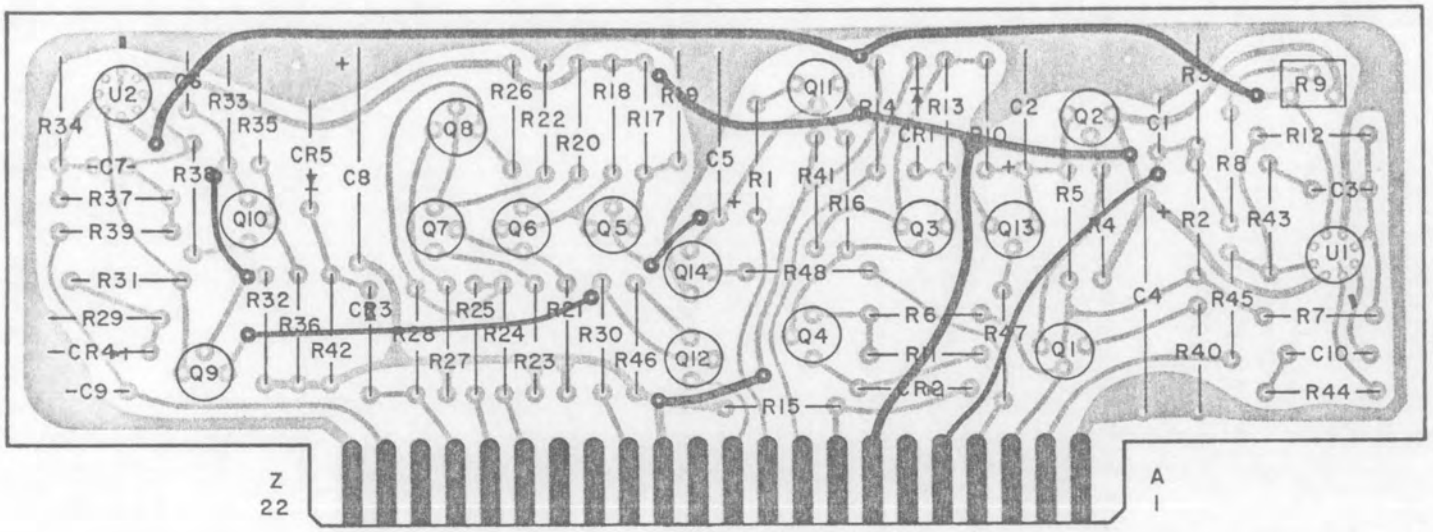


Figure 5-24. Type 78100 AGC Amplifier (A9), Location of Components.

REF DESIG PREFIX A9

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
3	Same as R11				
4	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	RCR07G104JS	81349	01121
5	Same as R14				
6	Same as R14				
7	RESISTOR, FIXED, COMPOSITION: 680 kΩ, 5%, 1/4W	1	RCR07G684JS	81349	01121
8	Same as R1				
9	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	2	RCR07G223JS	81349	01121
0	Same as R2				
1	Same as R2				
2	Same as R2				
3	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349	01121
4	Same as R2				
5	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	3	RCR07G102JS	81349	01121
6	Same as R2				
7	RESISTOR, FIXED, COMPOSITION: 2.7 Ω, 5%, 1/4W	2	RCR07G2R7JS	81349	01121
8	Same as R1				
9	RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W	1	RCR07G272JS	81349	01121
0	Same as R2				
1	Same as R4				
2	RESISTOR, FIXED, COMPOSITION: 24 kΩ, 5%, 1/4W	1	RCR07G243JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 4.3 kΩ, 5%, 1/4W	1	RCR07G432JS	81349	01121

REF DESIG PREFIX A9

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
4	Same as R19				
5	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 12 kΩ, 5%, 1/4W	1	RCR07G123JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	RCR07G473JS	81349	01121
8	Same as R6				
9	Same as R25				
0	Same as R27				
1	RESISTOR, FIXED, COMPOSITION: 7.5 MΩ, 5%, 1/4W	1	RCR07G755JS	81349	01121
2	Same as R5				
3	RESISTOR, FIXED, COMPOSITION: 1.1 kΩ, 5%, 1/4W	1	RCR07G112JS	81349	01121
4	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	1	RCR07G391JS	81349	01121
5	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349	01121
6	Same as R25				
7	Same as R4				
8	Same as R4				
9	Same as R4				
	INTEGRATED CIRCUIT	1	MC1439G	04713	
	INTEGRATED CIRCUIT	1	U5B7741393	07263	

4.11 Type 791235 TTL Receivers

REF DESIG PREFIX A10

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1 ru R16	DIODE	16	1N4446	80131	93332
	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 20%, 10 V	2	196D226X0010JE3	56289	
	Same as C1				
	CAPACITOR, CERAMIC, DISC: 0.1 μF, 20%, 100 V	2	8131M100-651-104M	72982	
	Same as C3				
	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	2	RCR07G100JS	81349	01121
	Same as R1				
	RESISTOR, FIXED, FILM: 100 kΩ, 1%, 1/10W	16	RN55C1003F	81349	75042
	RESISTOR, FIXED, FILM: 1.5 kΩ, 1%, 1/10W	16	RN55C1501F	81349	75042
	Same as R3				
	Same as R4				
	Same as R3				
	Same as R4				
	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	8	RCR07G332JS	81349	01121
0	Same as R3				
1	Same as R4				
2	Same as R9				
3	Same as R3				
4	Same as R4				
5	Same as R9				

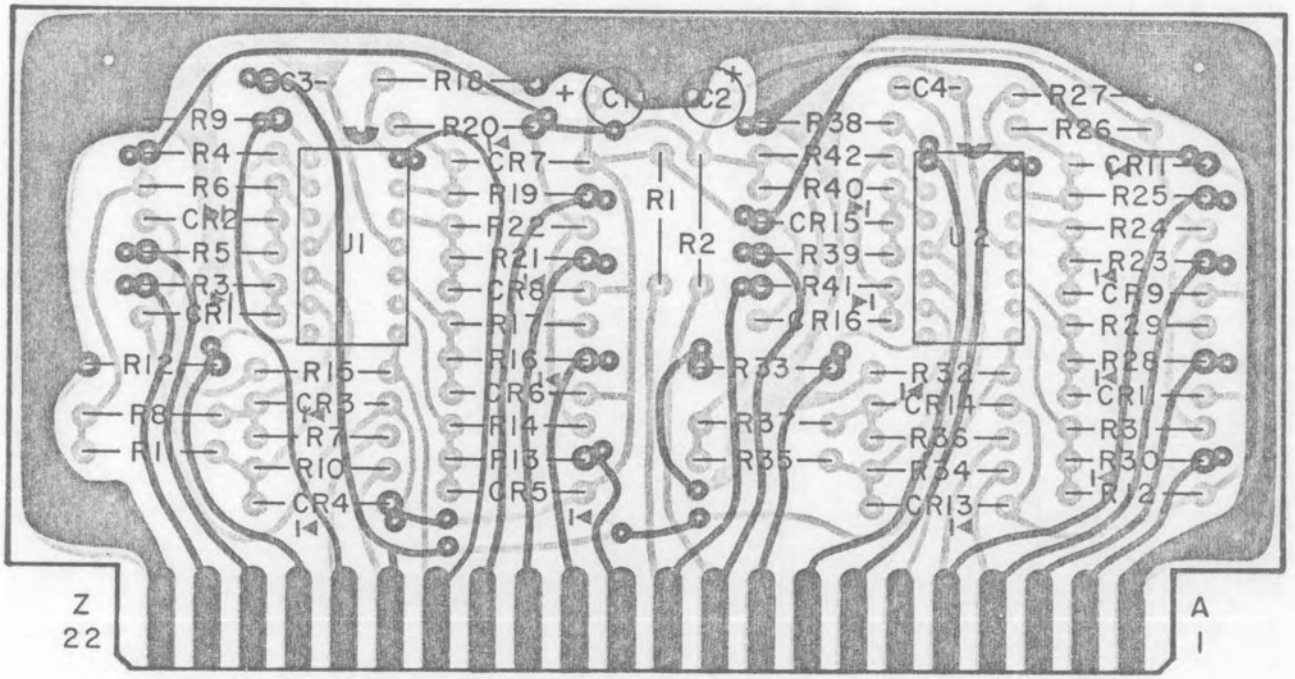


Figure 5-25. Type 791235 TTL Receivers (A10), Location of Components.

REF DESIG PREFIX A10

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
6	Same as R3				
7	Same as R4				
8	Same as R9				
9	Same as R3				
0	Same as R4				
1	Same as R3				
2	Same as R4				
3	Same as R3				
4	Same as R4				
5	Same as R3				
6	Same as R4				
7	Same as R9				
8	Same as R3				
9	Same as R4				
0	Same as R3				
1	Same as R4				
2	Same as R9				
3	Same as R9				
4	Same as R3				
5	Same as R4				
6	Same as R3				

REF DESIG PREFIX A10

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
37	Same as R4				
38	Same as R9				
39	Same as R3				
40	Same as R4				
41	Same as R3				
42	Same as R4				
	INTEGRATED CIRCUIT	2	LM324N	27014	
	Same as U1				

4.12 Type 791223 AGC Select

REF DESIG PREFIX A11

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1 ru R22	DIODE	22	1N458A	80131	93332
	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35 V	2	196D225X0035JE3	56289	
	Same as C1				
	CAPACITOR, CERAMIC, DISC: 0.1 μF, 20%, 100 V	1	8131M100-651-104M	72982	
ru	TRANSISTOR	7	U1899E	15818	
ru 1	TRANSISTOR	4	2N3906	80131	04713
	RESISTOR, FIXED, COMPOSITION: 22 MΩ, 5%, 1/4W	7	RCR07G226JS	81349	01121
	Same as R1				
	Same as R1				
	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	5	RCR07G104JS	81349	01121
	Same as R1				
	Same as R4				
	Same as R1				
	Same as R4				
	Same as R1				
0	Same as R4				
1	Same as R1				

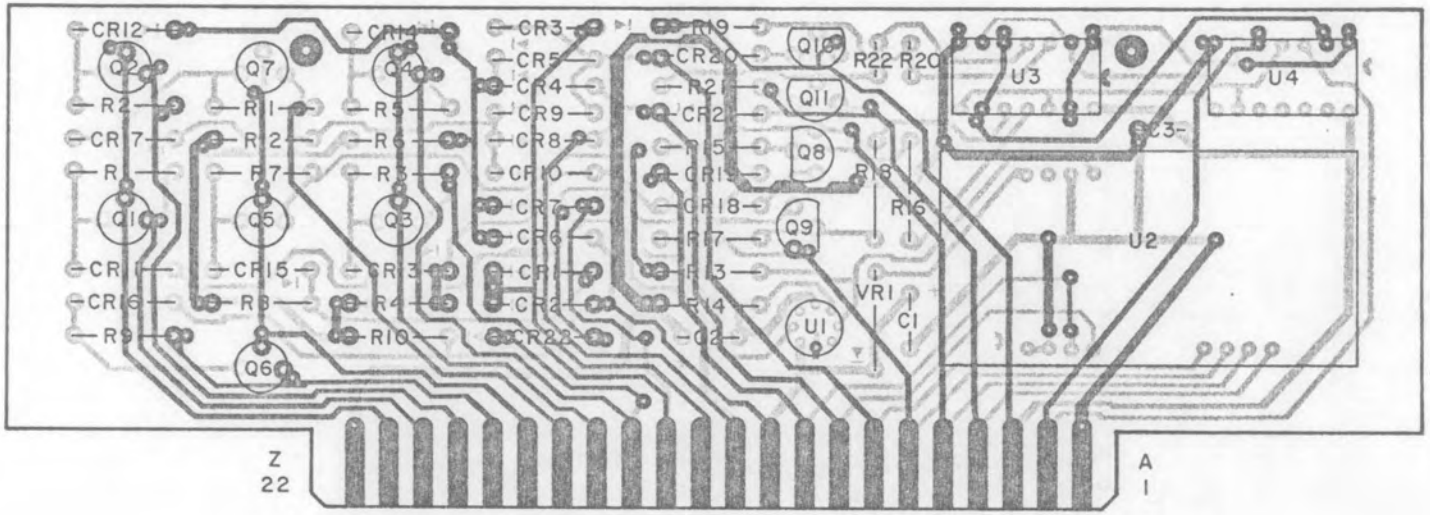


Figure 5-26. Type 791223 AGC Select (A11), Location of Components.

REF DESIG PREFIX A11

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
12	Same as R4				
13	RESISTOR, FIXED, COMPOSITION: 16 kΩ, 5%, 1/4W	1	RCR07G163JS	81349	01121
14	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	RCR07G392JS	81349	01121
15	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	4	RCR07G102JS	81349	01121
16	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	4	RCR07G562JS	81349	01121
17	Same as R15				
18	Same as R16				
19	Same as R15				
20	Same as R16				
21	Same as R15				
22	Same as R16				
1	INTEGRATED CIRCUIT	1	U5B7741393	07263	
2	INTEGRATED CIRCUIT	1	DAC9-8BI	50721	
3	INTEGRATED CIRCUIT	1	868T80	14632	
4	INTEGRATED CIRCUIT	1	867404	14632	
R1	DIODE, ZENER	1	1N746A	80131	04713

.4.13 Type 791233 TTL Receivers/Drivers

REF DESIG PREFIX A12

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1 thru R12	DIODE	12	1N4446	80131	93332
1	CAPACITOR, CERAMIC, DISC: 0.1 μF, 20%, 100 V	2	8131M100-651-104M	72982	
2	Same as C1				
1	TRANSISTOR	2	2N3904	80131	04713
2	Same as Q1				
1	RESISTOR, FIXED, FILM: 100 kΩ, 1%, 1/10W	10	RN55C1003F	81349	75042
2	RESISTOR, FIXED, FILM: 1.5 kΩ, 1%, 1/10W	10	RN55C1501F	81349	75042
3	Same as R2				
4	Same as R1				
5	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	7	RCR07G332JS	81349	01121
6	Same as R1				
7	Same as R2				
8	Same as R2				
9	Same as R1				
10	Same as R5				
11	Same as R1				
12	Same as R2				
13	Same as R2				
14	Same as R1				
15	Same as R5				

REF DESIG PREFIX A12

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
6	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	1	RCR07G682JS	81349	01121
7	RESISTOR, FIXED, FILM: 18.2 kΩ, 1%, 1/10W	1	RN55C1822F	81349	75042
8	RESISTOR, FIXED, FILM: 10 kΩ, 1%, 1/10W	1	RN55C1002F	81349	75042
9	Same as R5				
0	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	2	RCR07G562JS	81349	01121
1	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
2	Same as R5				
3	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349	01121
4	Same as R20				
5	Same as R2				
6	Same as R1				
7	Same as R1				
8	Same as R2				
9	Same as R5				
0	Same as R2				
1	Same as R1				
2	Same as R1				
3	Same as R2				
4	Same as R5				
	INTEGRATED CIRCUIT	2	LM324N	27014	
	Same as U1				

REF DESIG PREFIX A12

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
3	INTEGRATED CIRCUIT	1	867404	14632	

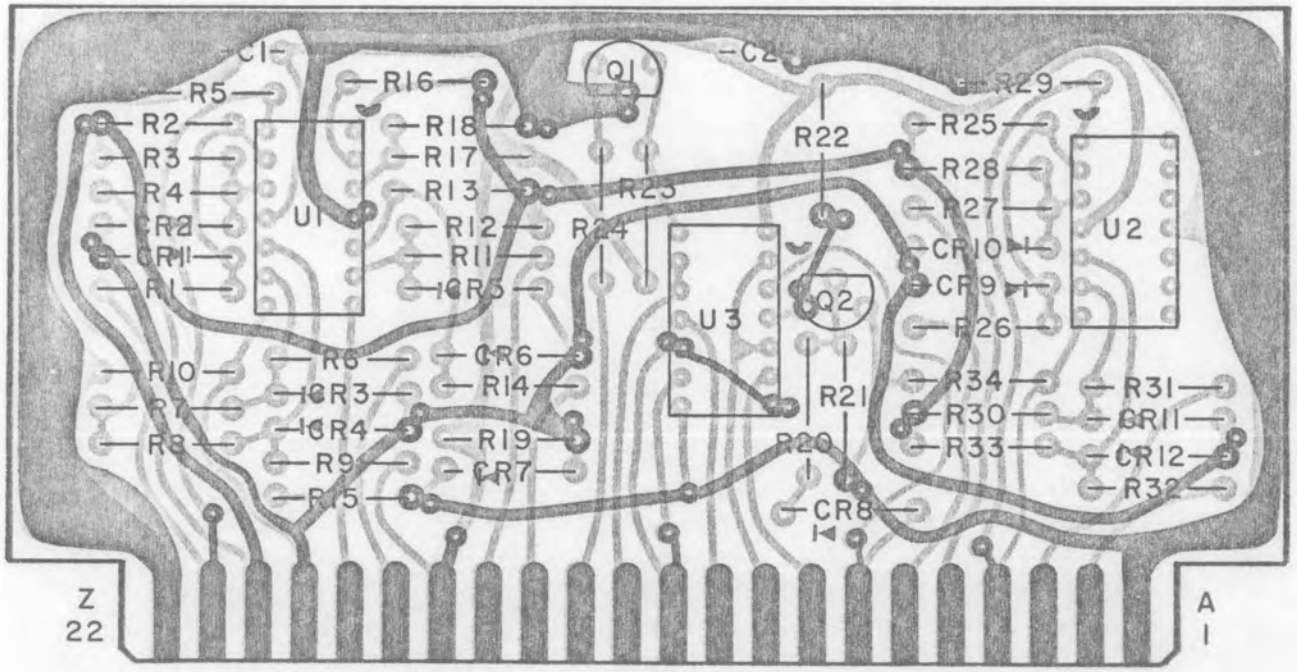


Figure 5-27. Type 791233 Receivers/Drivers (A12), Location of Components.

4.14 Type 791227-1 IF BW AM/FM Select

REF DESIG PREFIX A13

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1 ru R13	DIODE	13	1N458A	80131	04713
R14	DIODE	4	1N4003	80131	04713
R15 ru R17	Same as CR14				
	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35 V	1	196D225X0035JE3	56289	
	CAPACITOR, CERAMIC, DISC: 0.1 μF, 20%, 100 V	2	8131M100-651-104M	72982	
	Same as C2				
	CAPACITOR, CERAMIC, DISC: .015 μF, 10%, 100 V	1	CK06BX153K	81349	56289
	CAPACITOR, CERAMIC, DISC: 3900 pF, 10%, 100 V	1	CK06BX392K	81349	56289
	NOT USED				
	NOT USED				
	TRANSISTOR	6	U1899E	15818	
	Same as Q1				
	Same as Q1				
	Same as Q1				
	Same as Q1				
	Same as Q1				
	TRANSISTOR	5	2N3906	80131	04713
	Same as Q7				

REF DESIG PREFIX A13

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	Same as Q7				
0	Same as Q7				
1	Same as Q7				
2	TRANSISTOR	4	2N4403	80131	04713
3	Same as Q12				
4	Same as Q12				
5	Same as Q12				
	RESISTOR, FIXED, COMPOSITION: 22 MΩ, 5%, 1/4W	6	RCR07G226JS	81349	01121
	Same as R1				
	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	6	RCR07G104JS	81349	01121
	Same as R3				
	RESISTOR, FIXED, COMPOSITION: 750 Ω, 5%, 1/4W	1	RCR07G751JS	81349	01121
	RESISTOR, VARIABLE, FILM: 1 kΩ, 10%, 3/4W	4	89PR1K	73138	
	Same as R6				
	Same as R6				
	Same as R6				
0	RESISTOR, FIXED, COMPOSITION: 510 Ω, 5%, 1/4W	4	RCR07G511JS	81349	01121
1	Same as R10				
2	Same as R10				
3	Same as R10				
4	Same as R3				

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
5	Same as R1				
6	Same as R3				
7	Same as R1				
8	Same as R3				
9	Same as R1				
0	Same as R3				
1	Same as R1				
2	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	8	RCR07G102JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	5	RCR07G103JS	81349	01121
4	Same as R22				
5	Same as R23				
6	Same as R22				
7	Same as R23				
8	Same as R22				
9	Same as R23				
0	Same as R23				
1	Same as R22				
2	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	4	RCR07G562JS	81349	01121
3	Same as R22				
4	Same as R32				
5	Same as R22				

REF DESIG PREFIX A13

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
36	Same as R32				
37	Same as R22				
38	Same as R32				
39	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	1	RCR07G821JS	81349	01121
40	RESISTOR, FIXED, COMPOSITION: 1.1 kΩ, 5%, 1/4W	1	RCR07G112JS	81349	01121
1	INTEGRATED CIRCUIT	2	868T80	14632	
2	Same as U1				
3	INTEGRATED CIRCUIT	1	867404	14632	

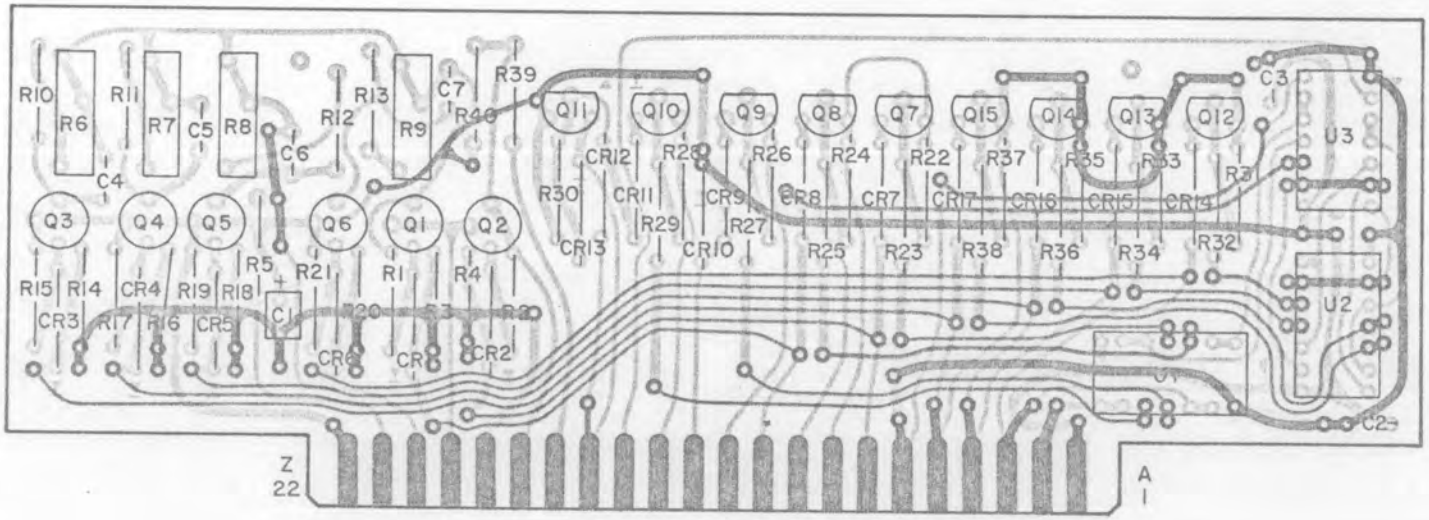


Figure 5-28. Type 791227-1 IF BW, AM/FM Select (A13), Location of Components.

4.15 Type 76230 Power Supply Regulator

REF DESIG PREFIX A14

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.33 μF, 10%, 35 V	3	CS13BF334K	81349	56289
2	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35 V	3	196D225X0035JE3	56289	
3	Same as C1				
4	Same as C2				
5	Same as C1				
6	Same as C2				
1	INTEGRATED CIRCUIT	4	MDA960-2	04713	
2	Same as U1				
3	Same as U1				
-	Same as U1				
5	INTEGRATED CIRCUIT	2	7818UC	07263	
6	Same as U5				
7	INTEGRATED CIRCUIT	1	MC7805CP	04713	

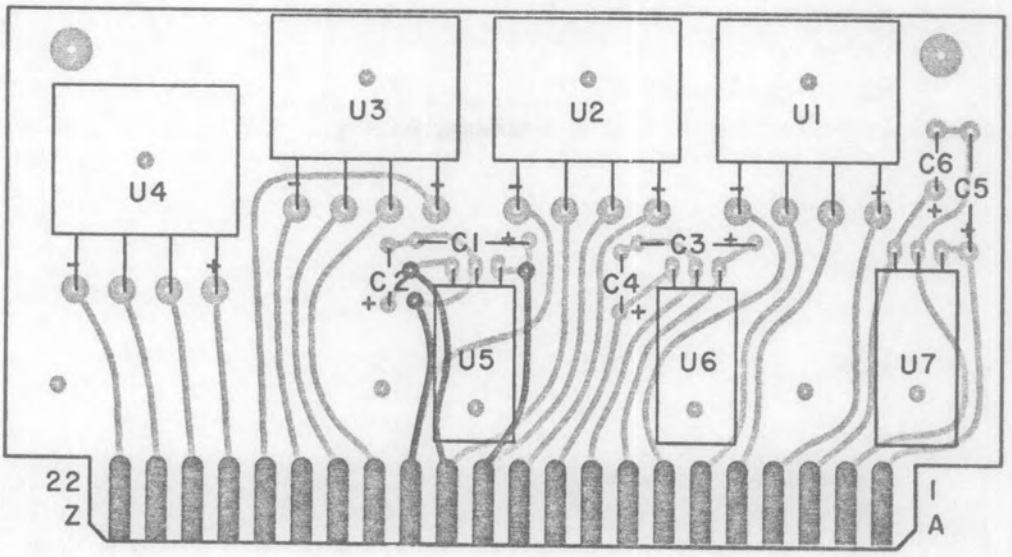


Figure 5-29. Type 76230 ±18V/+5V Power Supply Regulator (A14), Location of Components.

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1	DIODE	1	1N4446	80131	93332
1	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 μF, 20%, 25 V	4	109D107X0025F2	56289	
2	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 10%, 20 V	2	CS13BE225K	81349	56289
3	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 20%, 25 V	2	109D226X0025C2	56289	
4	Same as C1				
5	Same as C3				
6	Same as C1				
7	Same as C2				
8	Same as C1				
9	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μF, 20%, 50 V	1	109D476X0050F2	56289	
10	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μF, 10%, 100 V	1	109D475X9100C2	56289	
11	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	1	C023B101E502M	56289	
1	TRANSISTOR	1	2N2907	80131	04713
2	TRANSISTOR	2	2N2270	80131	02735
3	Same as Q2				
1	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	1	RCR07G184JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 1.1 kΩ, 5%, 1/4W	1	RCR07G112JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 430 Ω, 5%, 1/4W	1	RCR07G431JS	81349	01121
4	RESISTOR, FIXED, WIREWOUND: 1.82 kΩ, 1%, 1/4W	1	A2537-1.82KF	14193	
5	RESISTOR, VARIABLE, FILM: 500 Ω, 10%, 3/4W	2	89PR500	73138	
6	RESISTOR, FIXED, WIREWOUND: 2.8 kΩ, 1%, 1/4W	1	A2537-2.8KF	14193	

REF DESIG PREFIX A15

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
7	RESISTOR, FIXED, COMPOSITION: 2.7 Ω, 5%, 1/4W	1	RCR07G2R7JS	81349	01121
8	RESISTOR, VARIABLE, FILM: 200 Ω, 10%, 3/4W	1	89PR200	73138	
9	RESISTOR, FIXED, WIREWOUND: 4.54 kΩ, 1%, 1/4W	1	A2537-4.54KF	14193	
10	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	2	RCR07G222JS	81349	01121
11	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	RCR07G471JS	81349	01121
12	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349	01121
13	RESISTOR, FIXED, WIREWOUND: 4.64 kΩ, 1%, 1/4W	1	A2537-4.64KF	14193	
14	Same as R12				
15	Same as R10				
16	RESISTOR, FIXED, WIREWOUND: 6.65 kΩ, 1%, 1/4W	1	A2537-6.65KF	14193	
17	RESISTOR, FIXED, WIREWOUND: 3.22 kΩ, 1%, 1/4W	1	A2537-3.22KF	14193	
18	Same as R5				
19	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
20	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	RCR07G562JS	81349	01121
21	Same as R14				
22	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349	01121
P1	JACK, TIP	2	SKT103PC-RED	98291	
P2	JACK, TIP	1	SKT103PC-BROWN	98291	
P3	Same as TP1				
1	INTEGRATED CIRCUIT	3	U5B7741393	07263	
2	Same as U1				

REF DESIG PREFIX A15

REF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
3	Same as U1				
R1	DIODE, ZENER	1	1N827	80131	04713

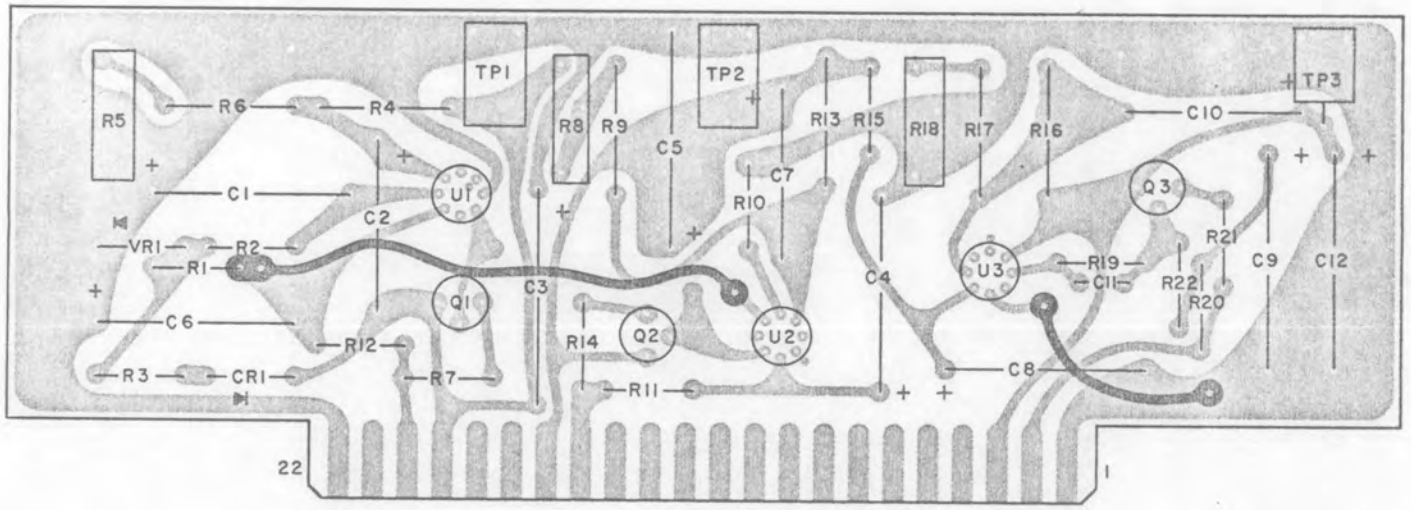


Figure 5-30. Type 76179 Precision Regulators (A15), Location of Components.

4.17 Type 791243 Video Amplifiers/Tuning Voltage Buffer — REF DESIG PREFIX A16

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R1 hru R6	DIODE	6	1N4446	80131	93332
1	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μF, 10%, 20 V	4	CS13BE476K	81349	56289
2	CAPACITOR, MICA, DIPPED: 43 pF, 2%, 500 V	1	CM05ED430G03	81349	72136
3	Same as C1				
4	Same as C1				
5	CAPACITOR, MICA, DIPPED: 15 pF, 5%, 500 V	1	CM05CD150J03	81349	72136
6	Same as C1				
7	CAPACITOR, MICA, DIPPED: 100 pF, 2%, 500 V	1	CM05FD101G03	81349	72136
8	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35 V	2	196D225X0035JE3	56289	
9	Same as C8				
1	TRANSISTOR	2	2N2223A	80131	04713
2	TRANSISTOR	2	2N3251	80131	04713
3	TRANSISTOR	2	2N2222A	80131	04713
4	TRANSISTOR	2	2N2907	80131	04713
5	Same as Q1				
6	Same as Q2				
7	Same as Q3				
8	Same as Q4				
1	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	6	RCR07G100JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	2	RCR07G102JS	81349	01121

REF DESIG PREFIX A16

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	Same as R1				
	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	2	RCR07G103JS	81349	01121
	RESISTOR, FIXED, COMPOSTION: 27 kΩ, 5%, 1/4W	2	RCR07G273JS	81349	01121
	RESISTOR, VARIABLE, FILM: 50 kΩ, 10%, 3/4W	2	89PR50K	73138	
	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	4	RCR07G471JS	81349	01121
	Same as R7				
	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	4	RCR07G221JS	81349	01121
0	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	2	RCR07G182JS	81349	01121
1	Same as R9				
2	RESISTOR, FIXED, FILM: 1.21 kΩ, 1%, 1/10W	2	RN55C1211F	81349	75042
3	Same as R12				
4	RESISTOR, FIXED, COMPOSITION: 56 Ω, 5%, 1/4W	2	RCR07G560JS	81349	01121
5	Same as R1				
6	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	2	RCR07G152JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	8	RCR07G470JS	81349	01121
8	Same as R17				
9	Same as R17				
0	Same as R1				
1	Same as R2				
2	Same as R1				
3	Same as R4				

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
24	Same as R5				
25	Same as R6				
26	Same as R7				
27	Same as R7				
28	Same as R9				
29	Same as R9				
30	Same as R10				
31	RESISTOR, FIXED, FILM: 1.0 kΩ, 1%, 1/10W	1	RN55C1001F	81349	75042
32	RESISTOR, FIXED, FILM: 3.01 kΩ, 1%, 1/10W	1	RN55C3011F	81349	75042
33	Same as R14				
34	Same as R1				
35	Same as R16				
36	Same as R17				
37	Same as R17				
38	Same as R17				
39	RESISTOR, FIXED, WIREWOUND: 20 kΩ, 1/10%, 1/10W	4	M40-20K	14193	
40	Same as R39				
41	Same as R39				
42	RESISTOR, VARIABLE, FILM: 1 kΩ, 10%, 3/4W	1	89PR1K	73138	
43	Same as R39				
44	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349	01121

REF DESIG PREFIX A16

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
5	Same as R44				
6	Same as R17				
7	Same as R17				
1	INTEGRATED CIRCUIT	1	CA6741T	02735	

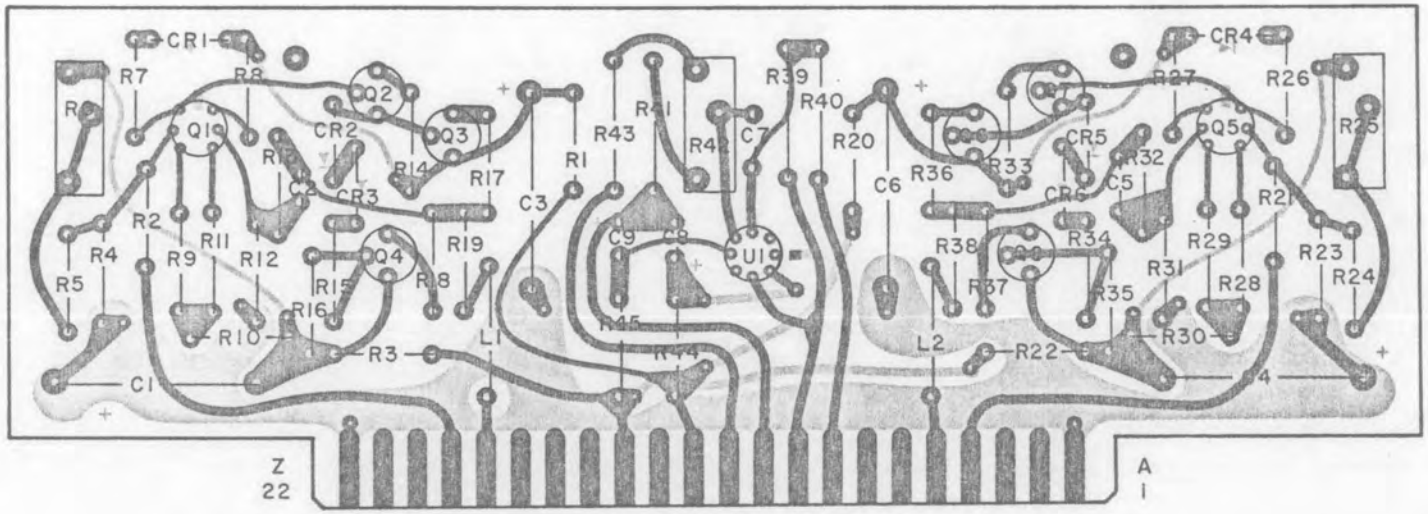
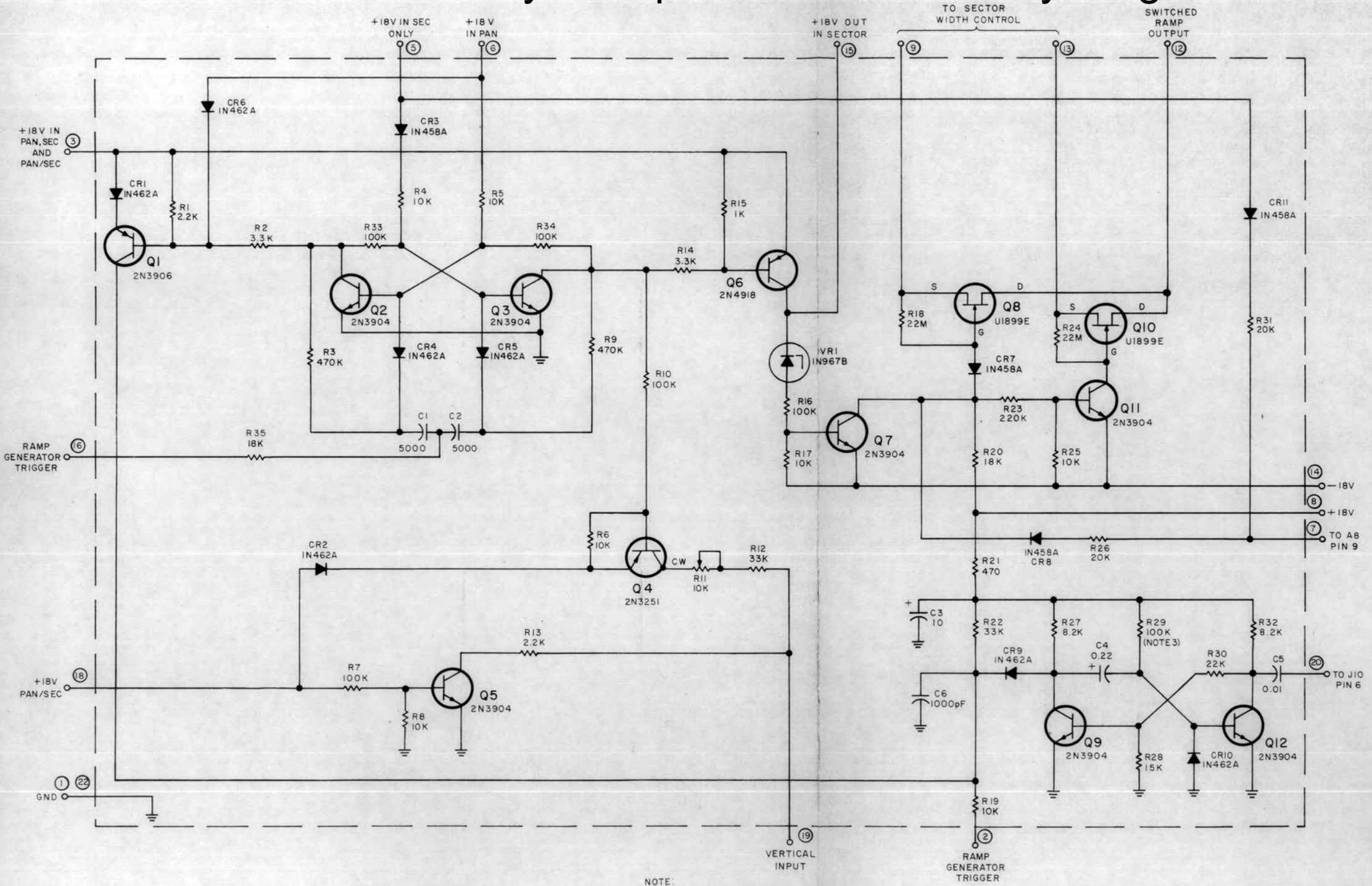


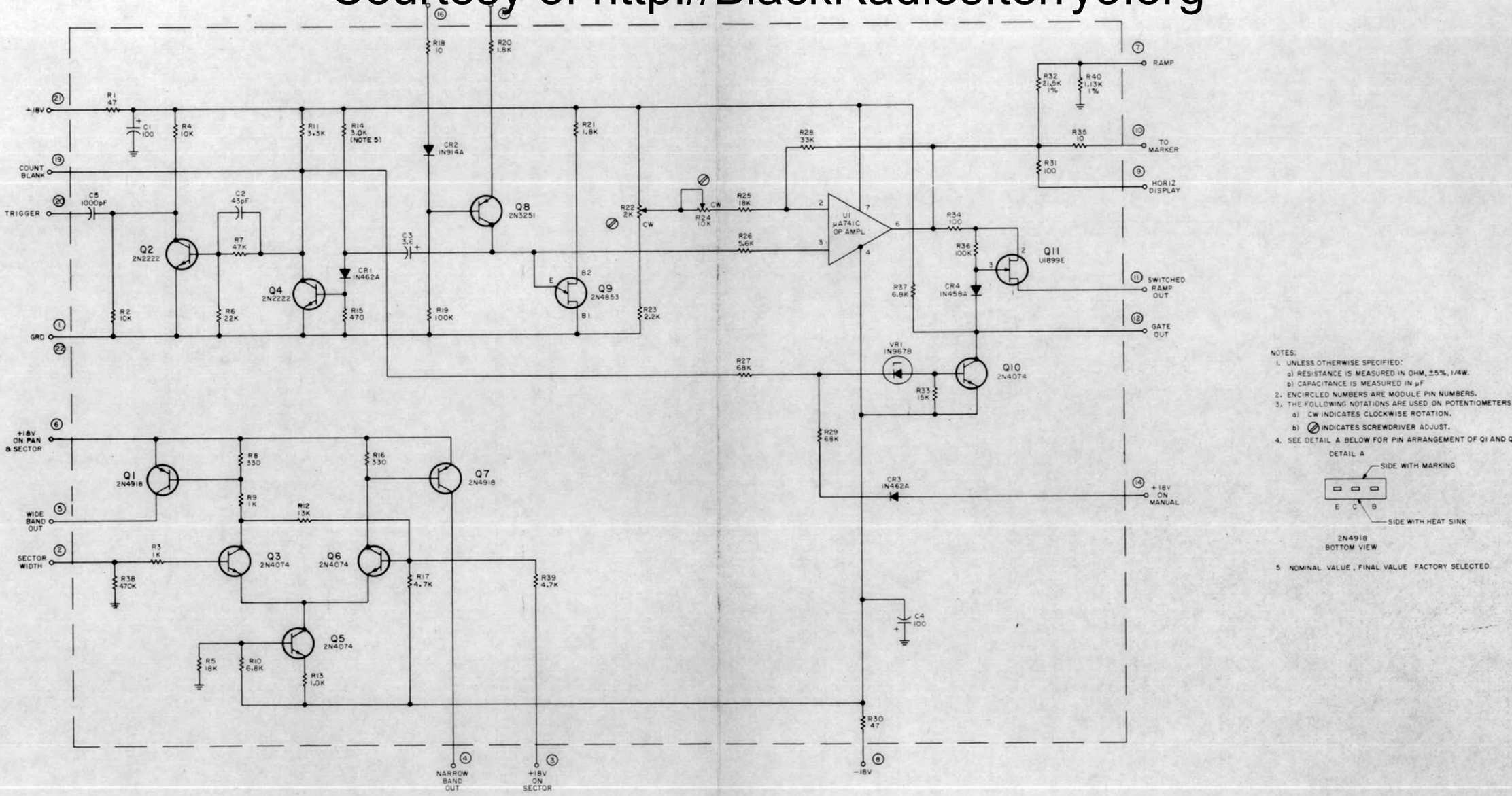
Figure 5-31. Type 791243 Video Amplifiers/Tuning Voltage Buffer (A16), Location of Components.

SECTION VI
SCHEMATIC DIAGRAMS



NOTE:
1. UNLESS OTHERWISE SPECIFIED:
   a. RESISTANCE IS MEASURED IN OHMS ± 5% 1/4W.
   b. CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS
3. NOMINAL VALUE, FINAL VALUE FACTORY SELECTED.

Figure 6-1. Type 79848 Split Display Switch (A1), Schematic Diagram



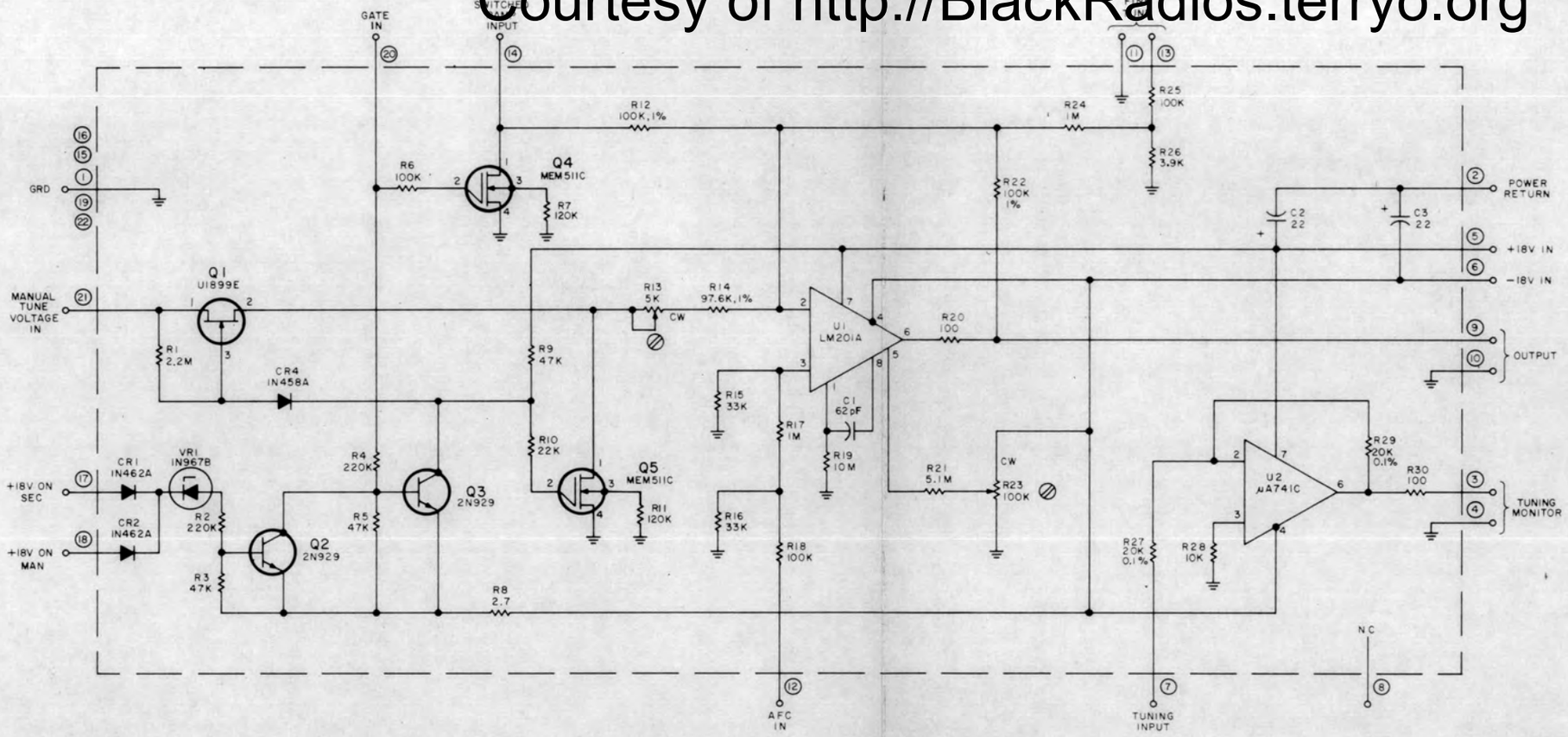
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHM, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION.
   b) ⊘ INDICATES SCREWDRIVER ADJUST.
4. SEE DETAIL A BELOW FOR PIN ARRANGEMENT OF Q1 AND Q7.

DETAIL A

2N4918
BOTTOM VIEW

5 NOMINAL VALUE, FINAL VALUE FACTORY SELECTED.

Figure 6-2. Type 79611 Ramp Generator and IF Selector Switch (A2), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION OF ADJ. KNOB.
   b) ⊘ INDICATES SCREWDRIVER ADJUSTMENT.
4. FOR U1, U2, LEAD ARRANGEMENT, SEE DETAIL A.

DETAIL A

BOTTOM VIEW

5. FOR Q4 & Q5 LEAD ARRANGEMENT, SEE DETAIL B.

DETAIL B

1. DRAIN
2. GATE
3. CASE
4. SOURCE

BOTTOM VIEW

HIGHEST REF DESIG USED	REF DESIG NOT USED
C3	–
CR4	CR3
Q5	–
R30	–
U2	–
VR1	–

Figure 6-3. Type 791036 Sweep Control (A3), Schematic Diagram

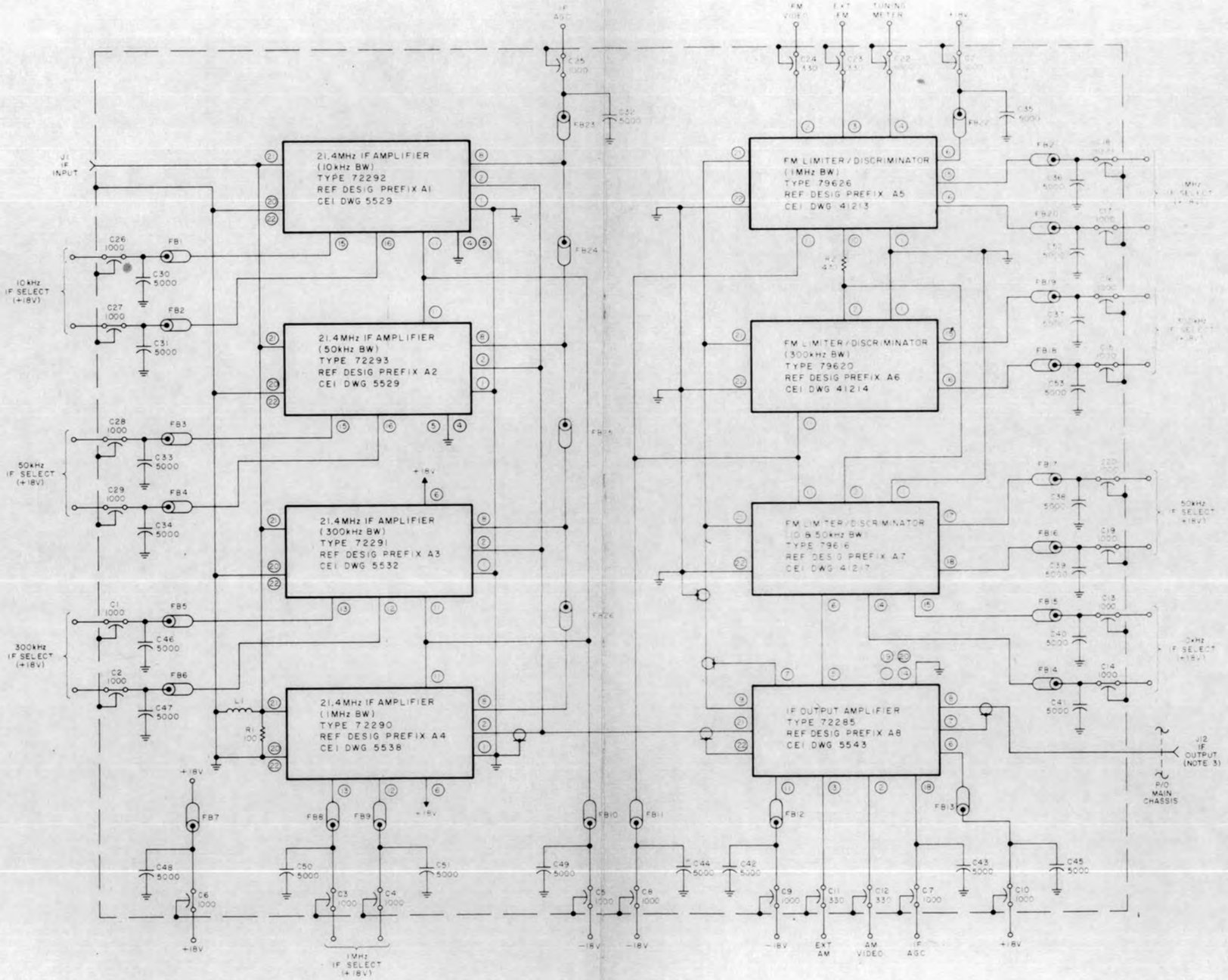
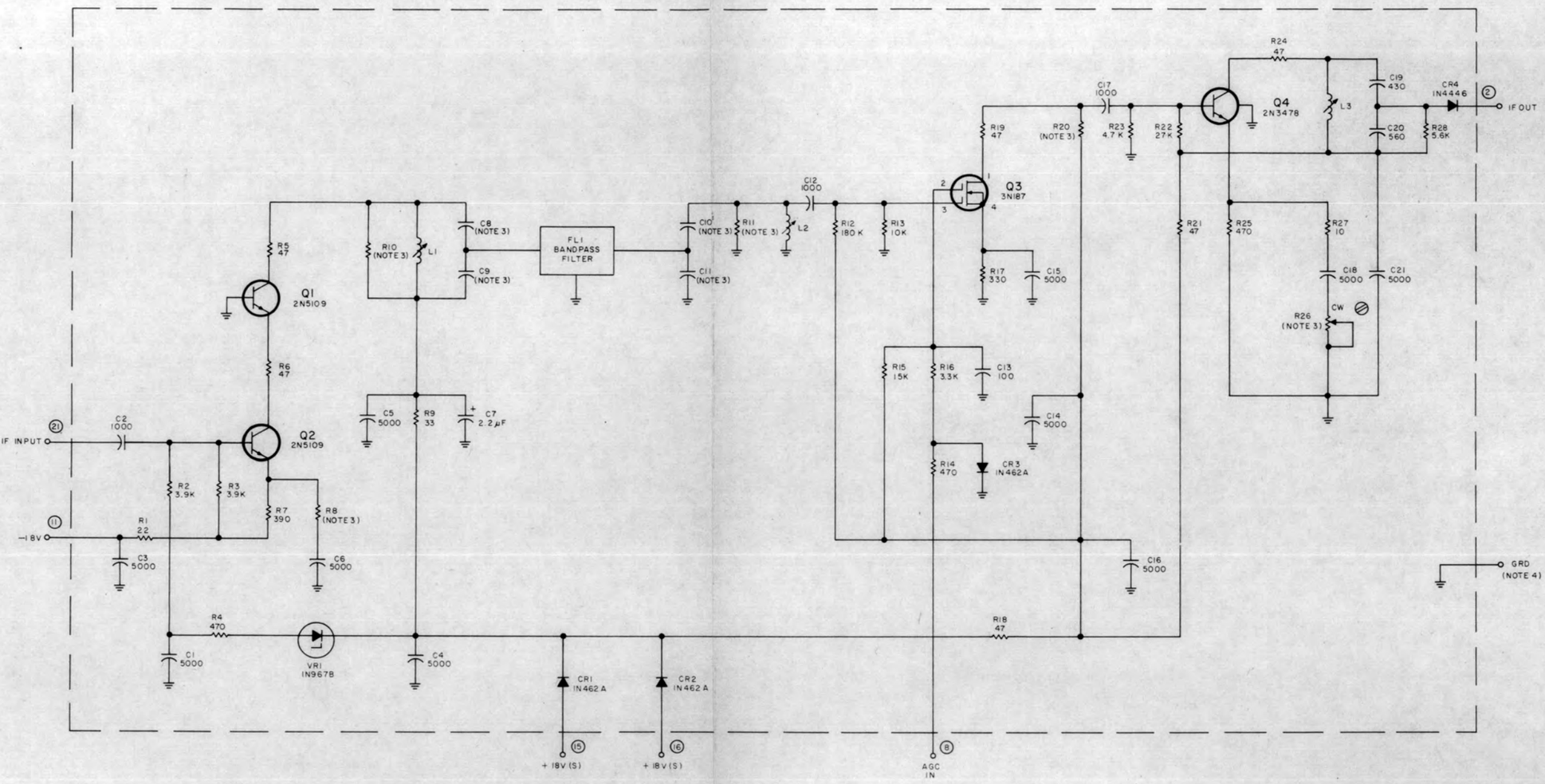


Figure 6-4. Type 72418 IF Amplitier Assembly (A4), Schematic Diagram



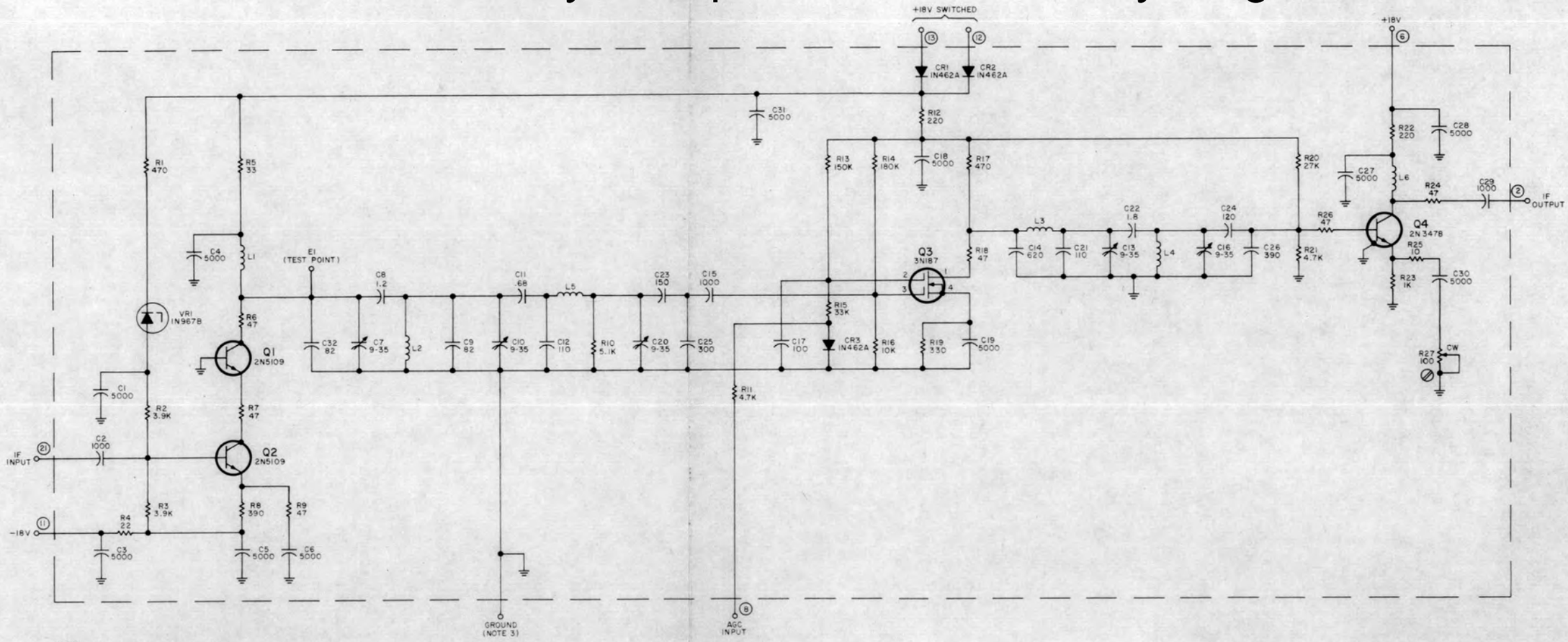
NOTES:

1. UNLESS OTHERWISE SPECIFIED.
   a) RESISTANCE IS MEASURED IN OHMS ± 5%, 1/4 W.
   b) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. DIFFERANCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK BELOW.

TYPE NO.	FL1 BANDWIDTH	R10	R11	R20	R26	R8	C8	C9	C10	C11
72292	10KHz	3K	680	1.2 K	100	33	130	240	160	160
72293-1	50KHz	4.7K	2.2K	470	500	47	130	240	160	160
72358	100KHz	8.2K	1.3K	470	500	47	110	470	110	110
72292-2	20KHz	3 K	1.2 K	1.2K	100	33	130	240	150	160
72292-3	100KHz	8.2K	1.3K	470	500	47	110	470	110	110
72293-2	50KHz	4.7K	2.2K	470	500	47	130	240	160	160

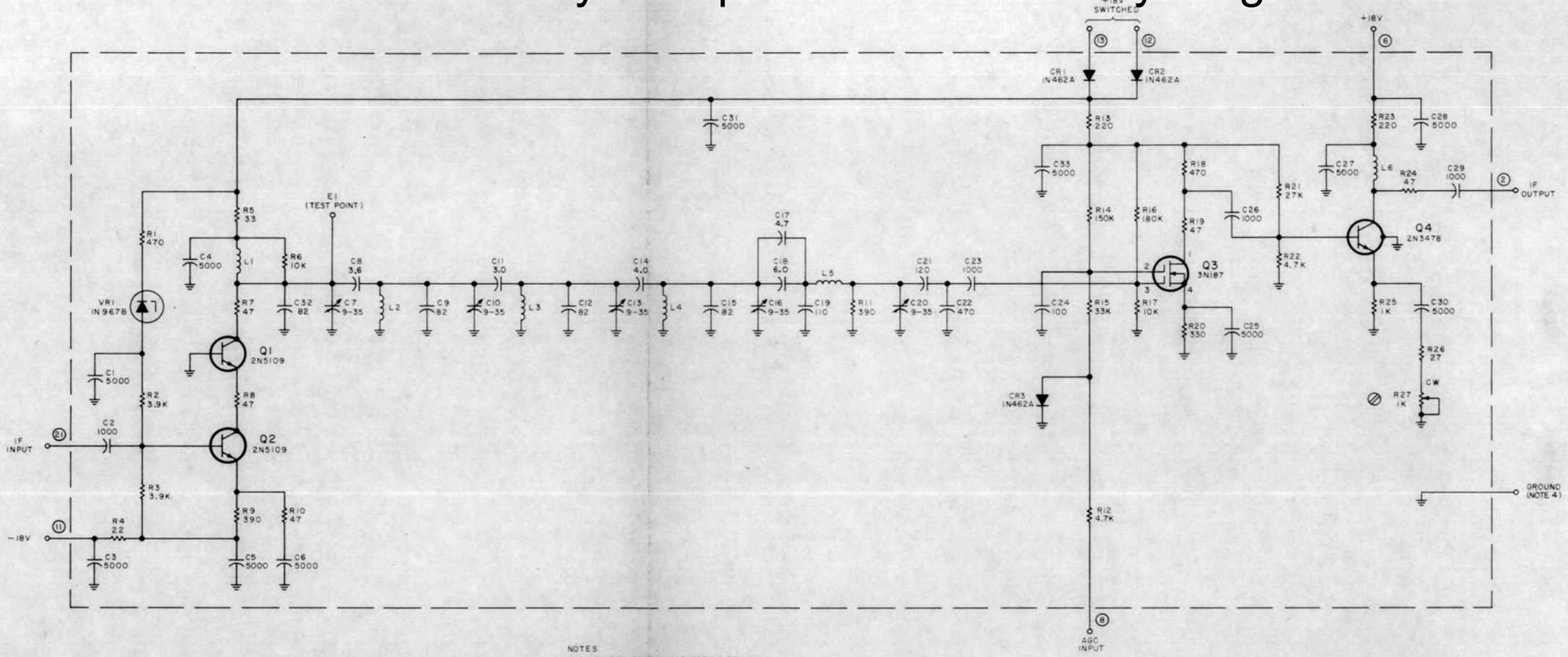
4. GROUND PINS FOR THIS MODULE ARE: 1,3 THRU 7,9,10,12,13,14,17 THRU 20,22.

Figure 6-5. Type 72292 21.4 MHz IF Amplitier (10 kHz BW) (A4A1) and Type 72293 21.4 MHz IF Amplifier (50 kHz BW) (A4A2), Schematic Diagram



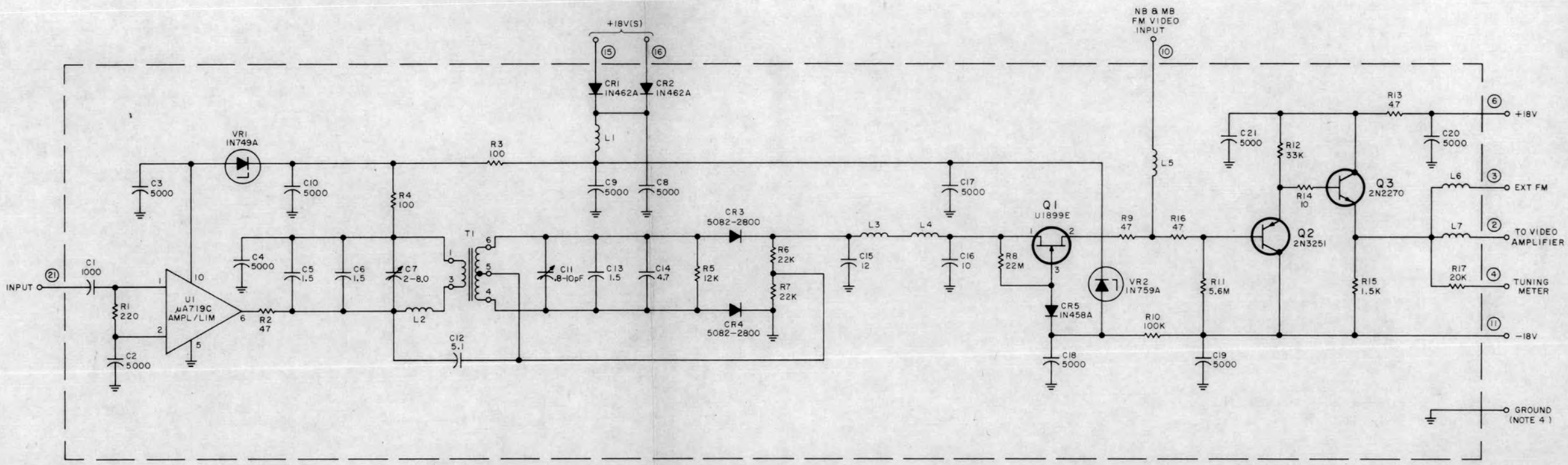
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4 W.
   b) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. GROUND PINS FOR P.C. BOARD ARE AS FOLLOWS:
   1, 3 THROUGH 5, 9, 10, 14 THROUGH 20 & 22.

Figure 6-6. Type 72291 21.4 MHz IF Amplifier (300 kHz BW) (A4A3), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN pF
2. FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION
   b) ⊘ INDICATES SCREWDRIVER ADJUSTMENT
3. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
4. GROUND PINS FOR PC BOARD ARE AS FOLLOWS:
   1,3,4,5,7,9,10,14 THRU 20, 22.

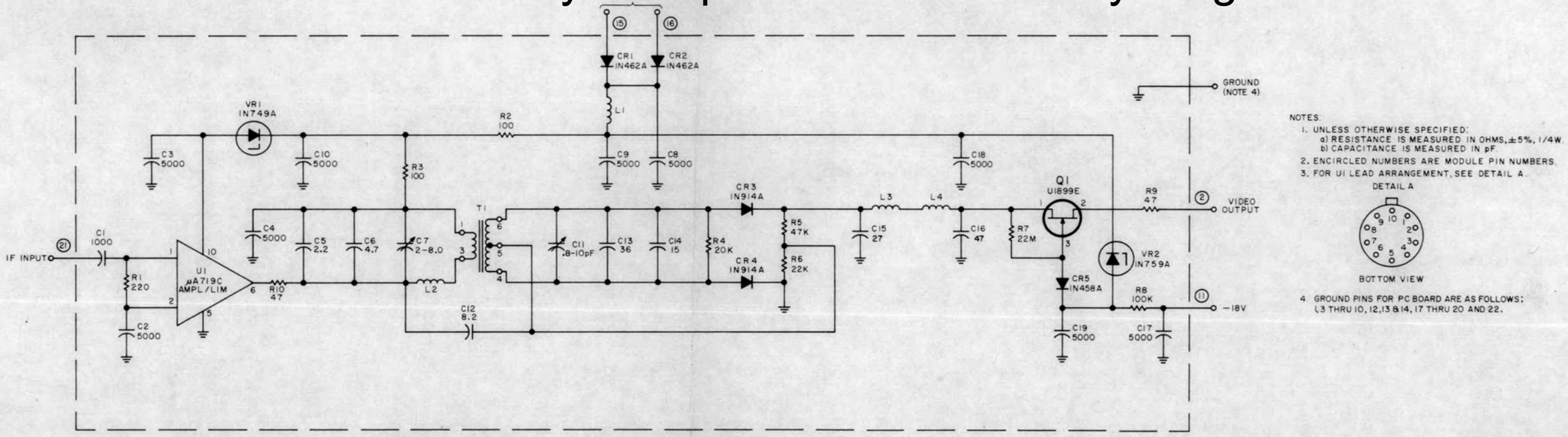
Figure 6-7. Type 72290 21.4 MHz IF Amplifier (1 MHz BW) (A4A4), Schematic Diagram



NOTES

1. UNLESS OTHERWISE SPECIFIED.
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4 W.
   b) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. FOR U1 LEAD ARRANGEMENT, SEE DETAIL A.
4. GROUND PINS FOR PC BOARD ARE AS FOLLOWS:
   1, 5, 7, 8, 9, 12, 13, 14, 17, THRU 20, 22.

Figure 6-8. Type 79626 FM Limiter/Discriminator (1 MHz BW) (A4A5), Schematic Diagram



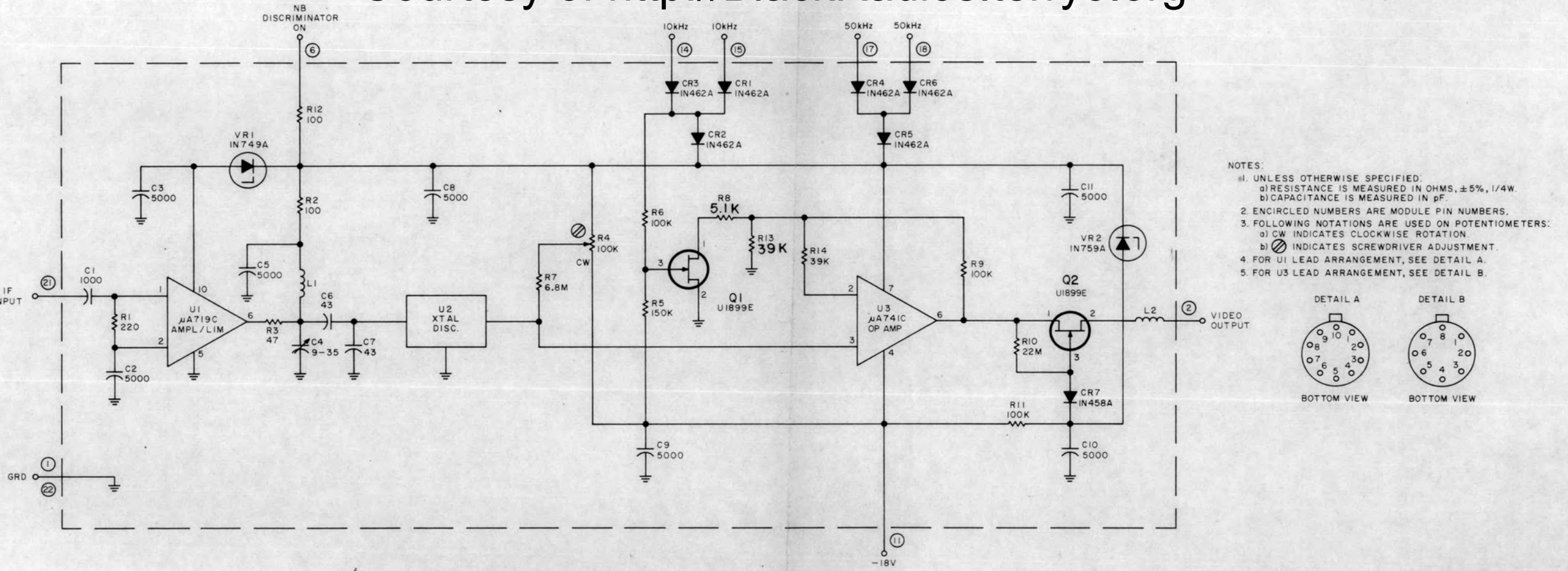
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. FOR U1 LEAD ARRANGEMENT, SEE DETAIL A.

DETAIL A

BOTTOM VIEW

4. GROUND PINS FOR PC BOARD ARE AS FOLLOWS: L3 THRU 10, 12, 13 & 14, 17 THRU 20 AND 22.

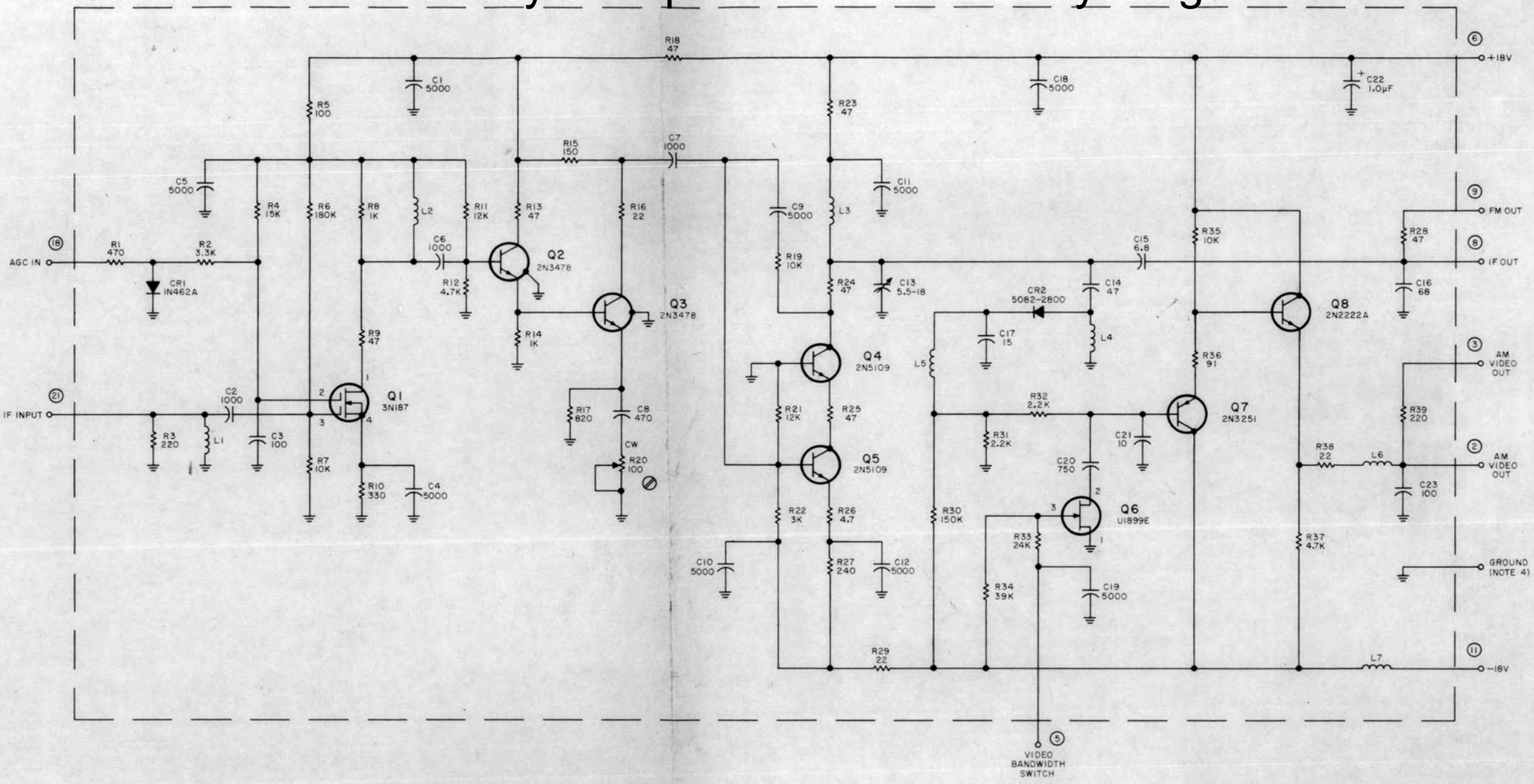
Figure 6-9. Type 79620 FM Limiter/Discriminator (300 kHz BW) (A4A6), Schematic Diagram



NOTES:

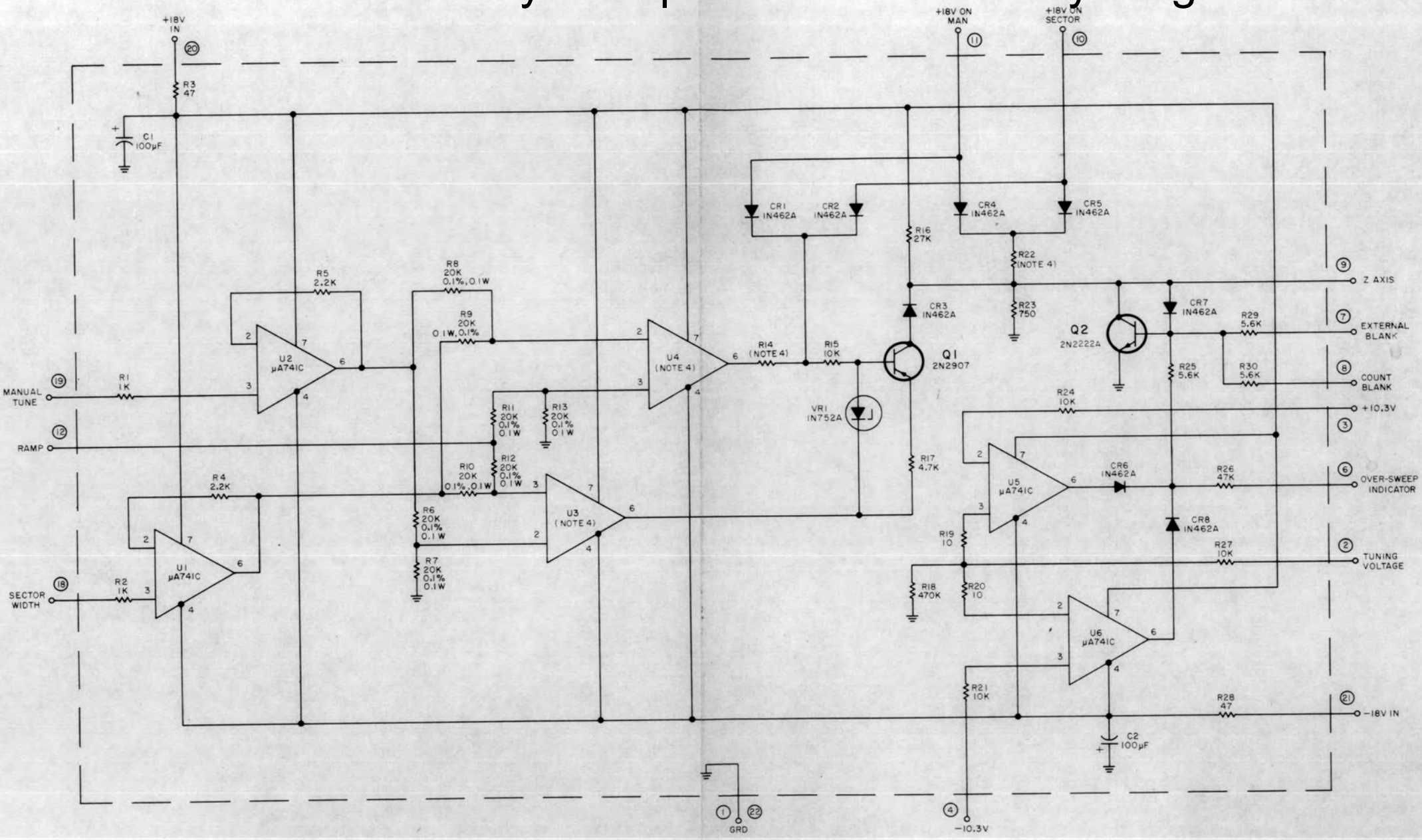
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION.
   b) ⊘ INDICATES SCREWDRIVER ADJUSTMENT.
4. FOR U1 LEAD ARRANGEMENT, SEE DETAIL A.
5. FOR U3 LEAD ARRANGEMENT, SEE DETAIL B.

Figure 6-10. Type 79616 FM Limiter/Discriminator (10 & 50 kHz BW) (A4A7), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION.
   b) ⊘ INDICATES SCREWDRIVER ADJUSTMENT.
4. GROUND PINS FOR THIS MODULE ARE AS FOLLOWS: 1, 4, 7, 10, 12 THRU 17, 19, 20 & 22.

Figure 6-11. Type 72285 IF Output Amplifier (A4A8), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
2. FOR U1 THRU U6 LEAD ARRANGEMENT SEE DETAIL A.
3. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
4. DIFFERENCE BETWEEN TYPES IS SHOWN IN DETAIL B.

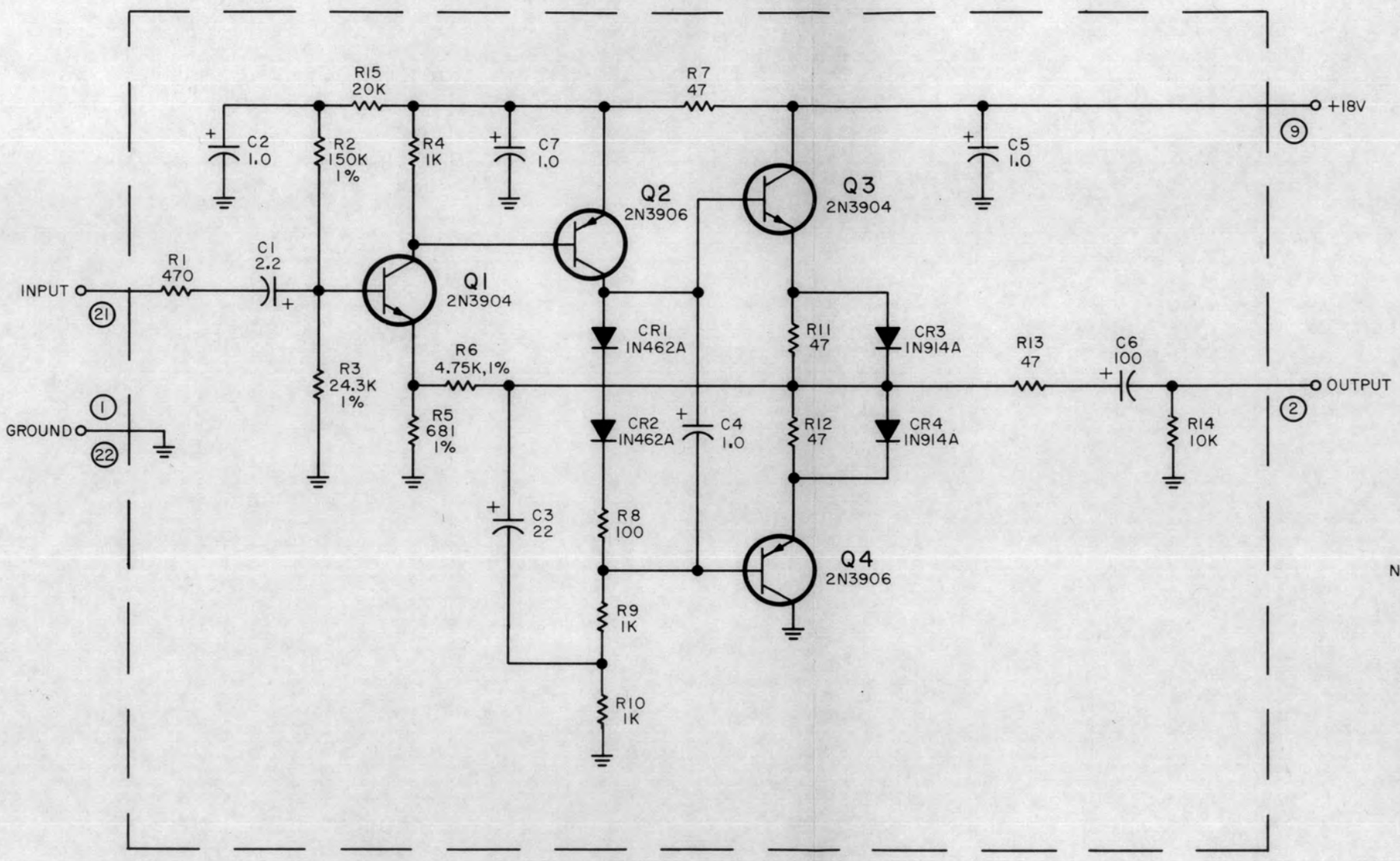
DETAIL A

BOTTOM VIEW

DETAIL B

TYPE	R22	U3	U4	R14
79612-1	15K	µA741C	µA741C	10K
79612-2	2M	LM201A	LM201A	68K

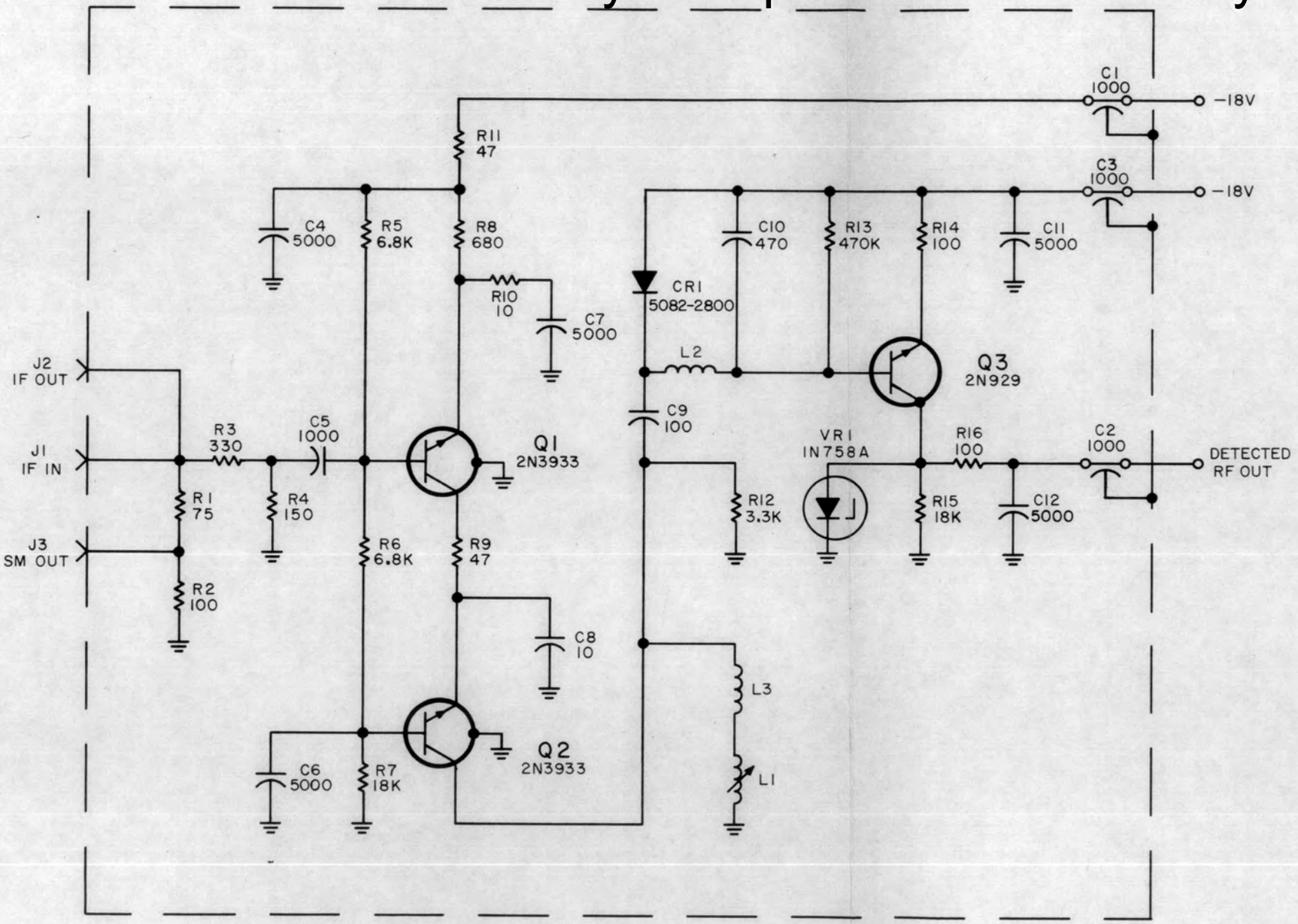
Figure 6-12. Type 79612-1 Marker Generator (A5), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN µF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

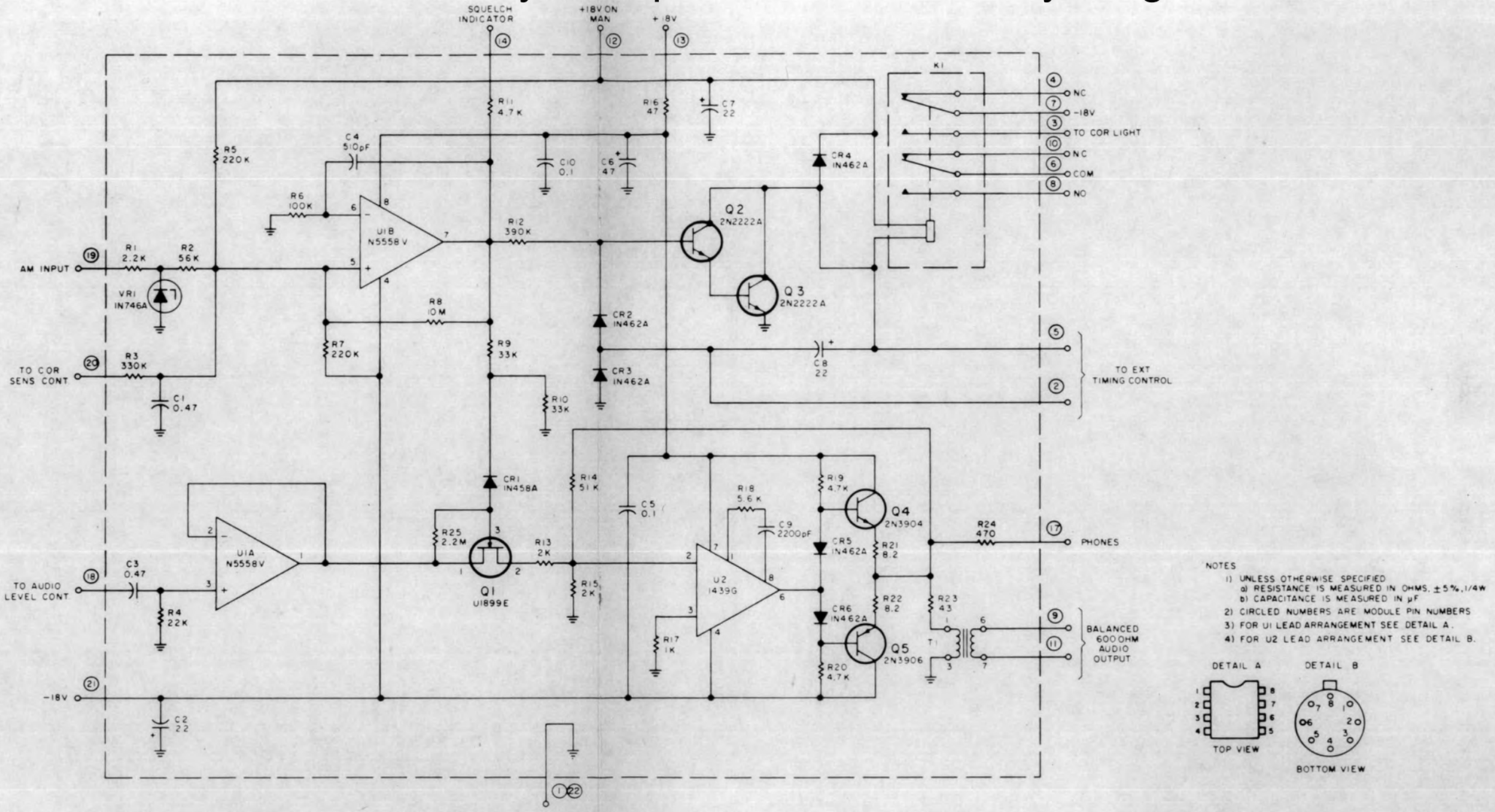
Figure 6-13. Type 7366 Video Amplifier (A6), Schematic Diagram



NOTES:

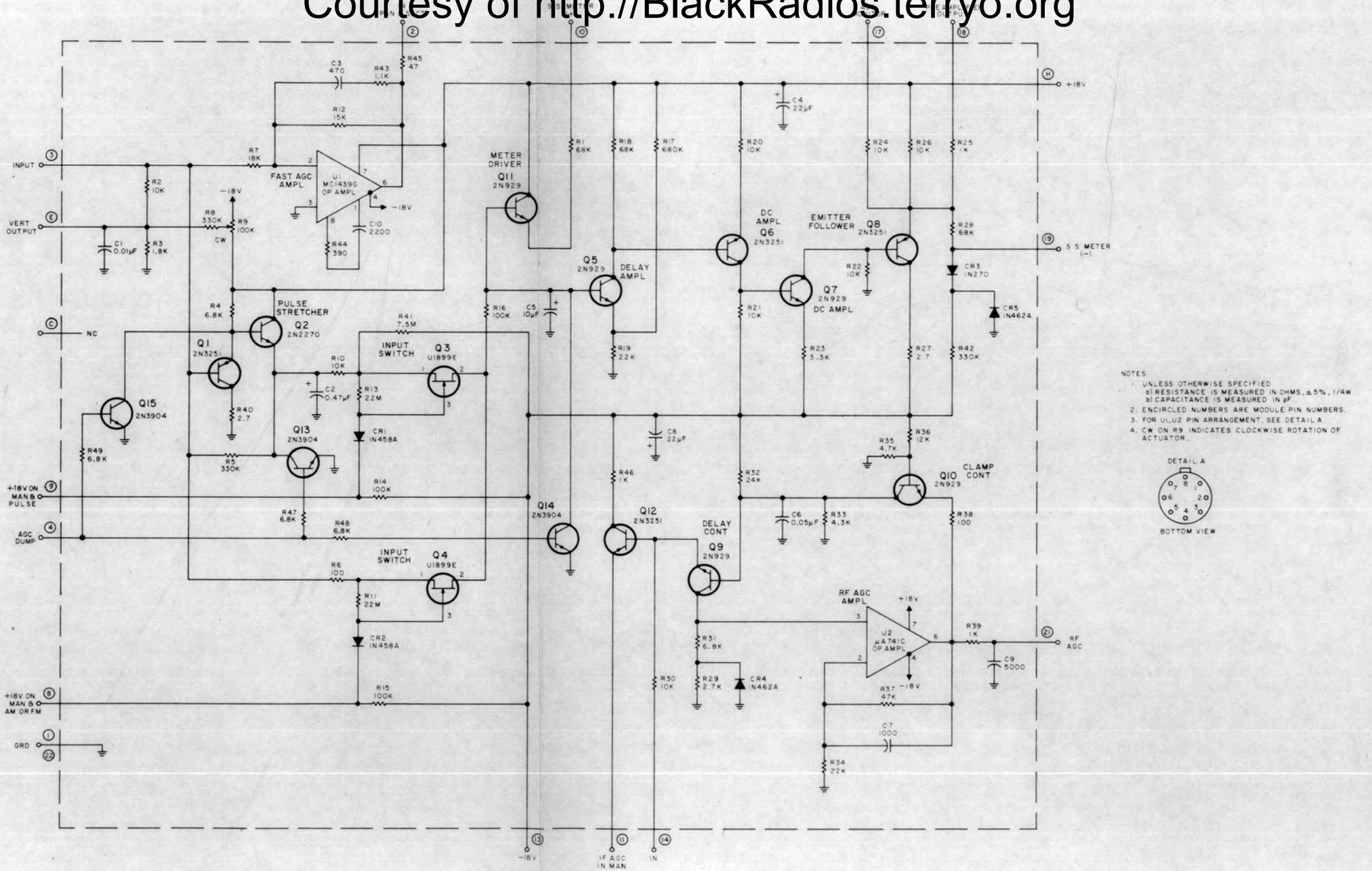
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ± 5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF

Figure 6-14. Type 71291 RF Monitor (A7), Schematic Diagram



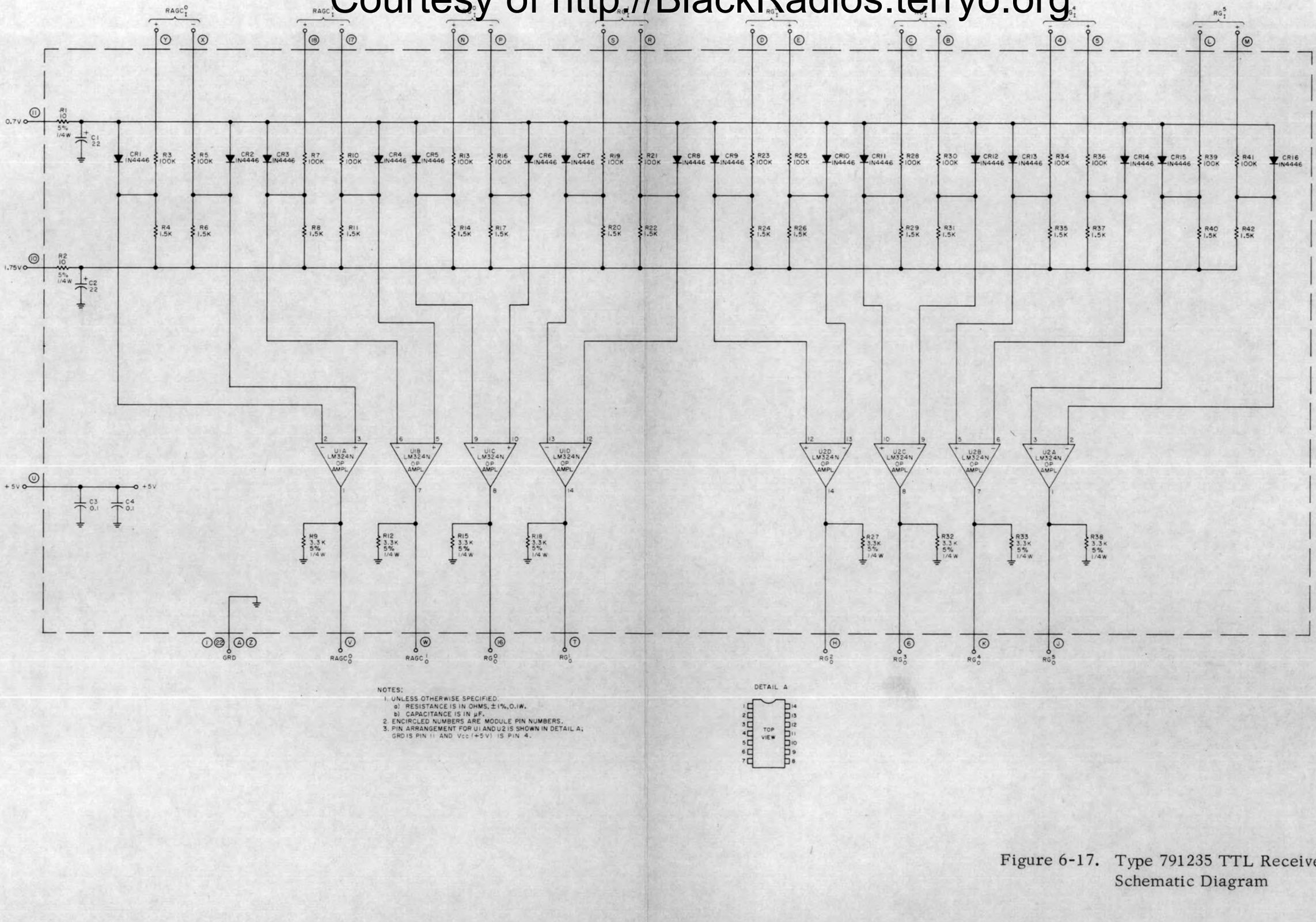
NOTES
1) UNLESS OTHERWISE SPECIFIED
a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
b) CAPACITANCE IS MEASURED IN μF
2) CIRCLED NUMBERS ARE MODULE PIN NUMBERS
3) FOR U1 LEAD ARRANGEMENT SEE DETAIL A.
4) FOR U2 LEAD ARRANGEMENT SEE DETAIL B.

Figure 6-15. Type 7443 Audio/COR (A8), Schematic Diagram



NOTES
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN pF
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. FOR U1,U2 PIN ARRANGEMENT, SEE DETAIL A
4. CW ON R9 INDICATES CLOCKWISE ROTATION OF ACTUATOR.

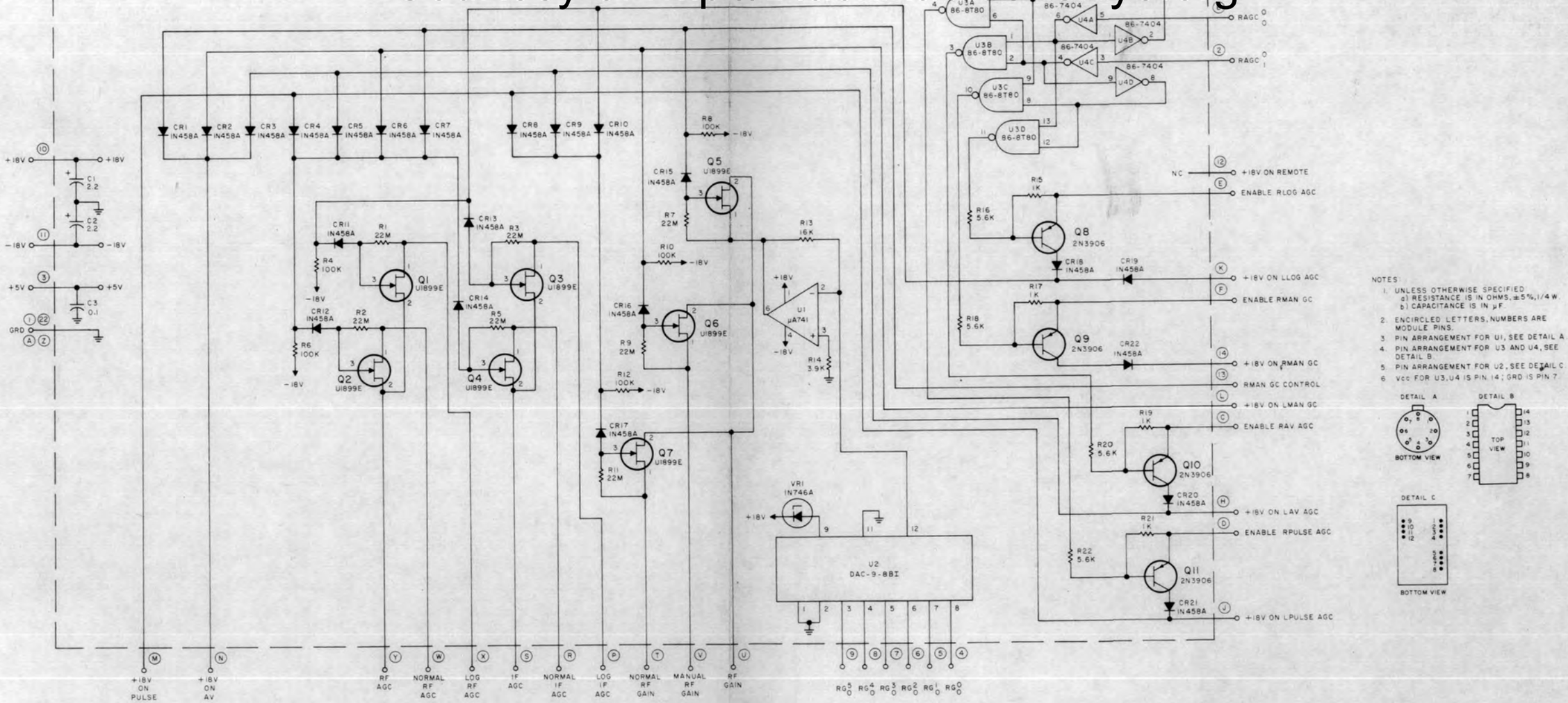
Figure 6-16. Type 78100 AGC Amplifier (A9), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±1%, 0.1W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. PIN ARRANGEMENT FOR U1 AND U2 IS SHOWN IN DETAIL A; GRD IS PIN 11 AND Vcc (+5V) IS PIN 4.

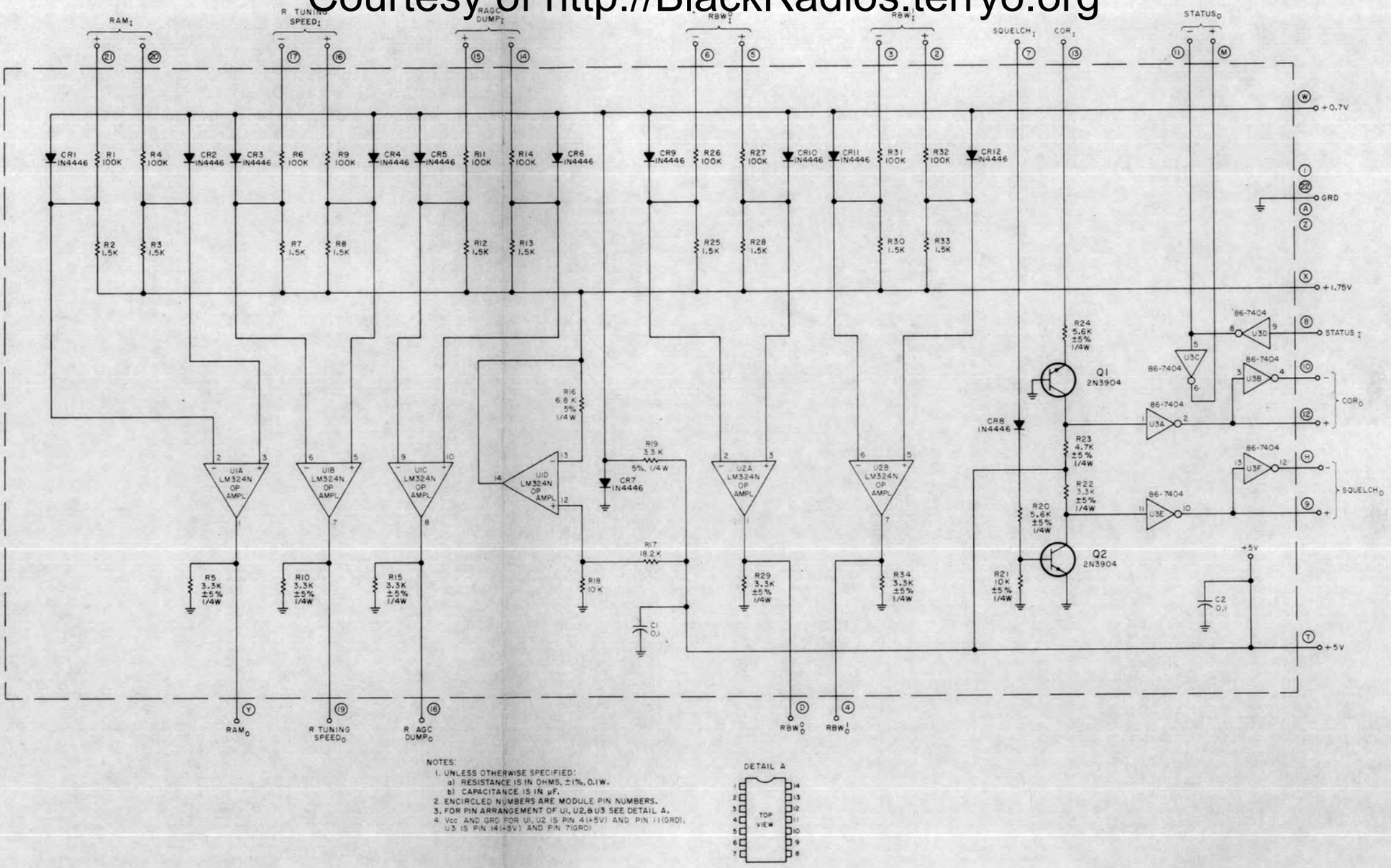
DETAIL A

Figure 6-17. Type 791235 TTL Receivers (A10), Schematic Diagram



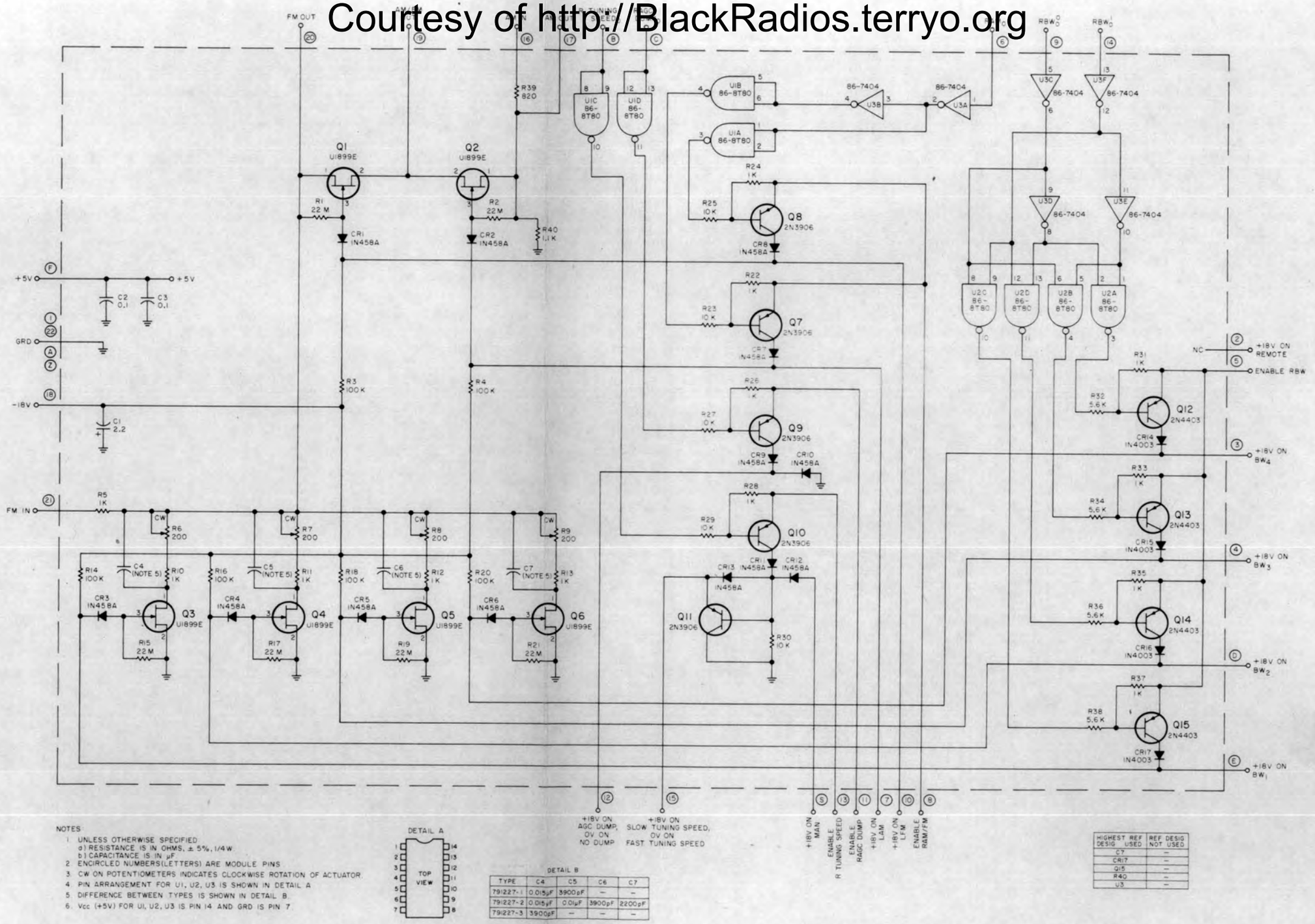
NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ±5%, 1/4 W
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED LETTERS, NUMBERS ARE MODULE PINS.
3. PIN ARRANGEMENT FOR U1, SEE DETAIL A.
4. PIN ARRANGEMENT FOR U3 AND U4, SEE DETAIL B.
5. PIN ARRANGEMENT FOR U2, SEE DETAIL C.
6. Vcc FOR U3, U4 IS PIN 14; GRD IS PIN 7.

Figure 6-18. Type 791223 AGC Select (A11), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±1%, 0.1W.
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. FOR PIN ARRANGEMENT OF U1, U2, & U3 SEE DETAIL A.
4. Vcc AND GRD FOR U1, U2 IS PIN 4 (+5V) AND PIN 11 (GRD); U3 IS PIN 14 (+5V) AND PIN 7 (GRD)

Figure 6-19. Type 791233 TTL Receivers/Drivers (A12), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ± 5%, 1/4 W
   b) CAPACITANCE IS IN μF
2. ENCIRCLED NUMBERS(LETTERS) ARE MODULE PINS
3. CW ON POTENTIOMETERS INDICATES CLOCKWISE ROTATION OF ACTUATOR
4. PIN ARRANGEMENT FOR U1, U2, U3 IS SHOWN IN DETAIL A
5. DIFFERENCE BETWEEN TYPES IS SHOWN IN DETAIL B.
6. Vcc (+5V) FOR U1, U2, U3 IS PIN 14 AND GRD IS PIN 7

DETAIL A

DETAIL B

TYPE	C4	C5	C6	C7
791227-1	0.015μF	3900pF	—	—
791227-2	0.015μF	0.01μF	3900pF	2200pF
791227-3	3900pF	—	—	—

HIGHEST REF DESIG USED	REF DESIG NOT USED
C7	—
CR17	—
Q15	—
R40	—
U3	—

Figure 6-20. Type 791227-1 IF BW, AM/FM Select (A13), Schematic Diagram

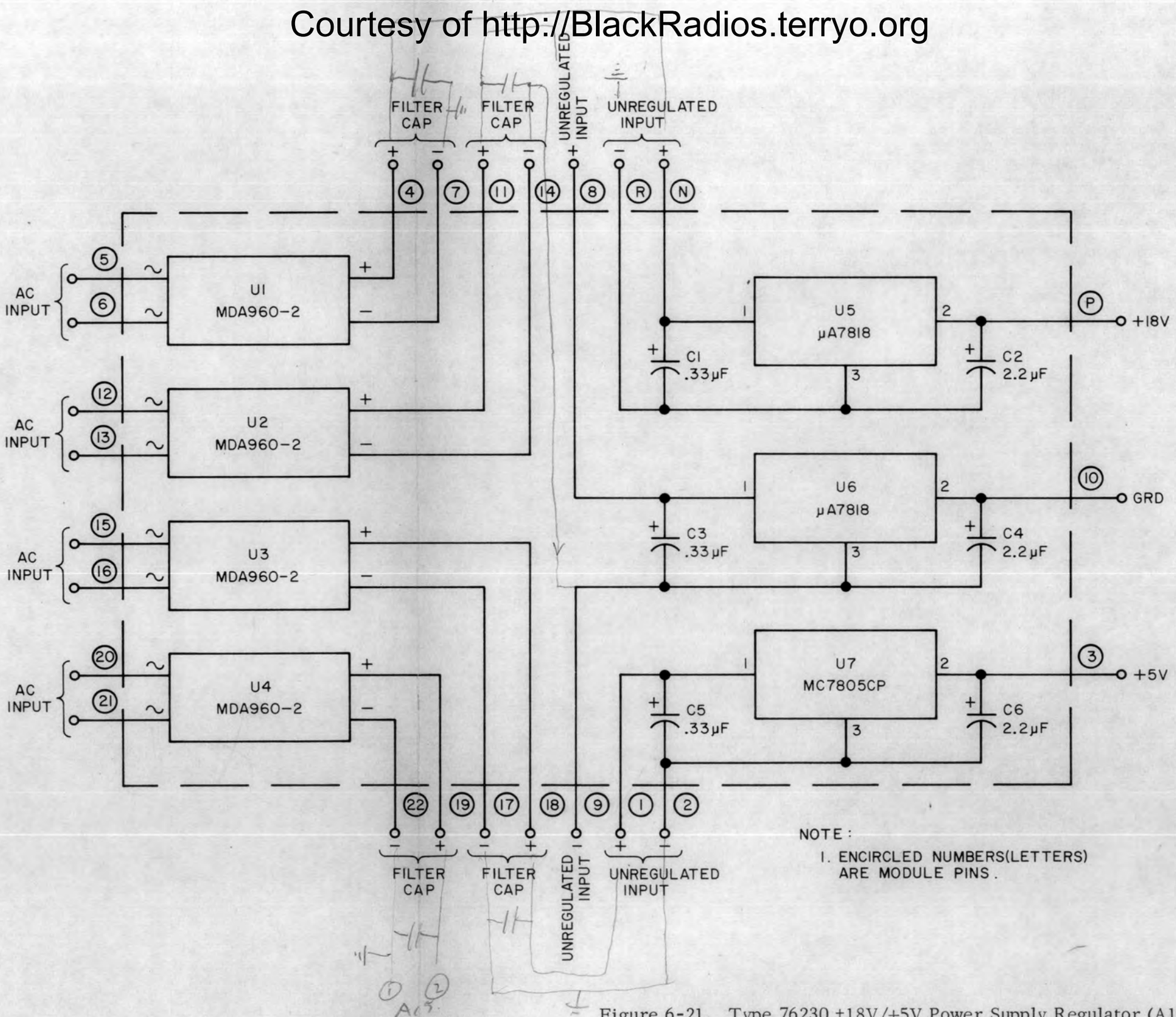
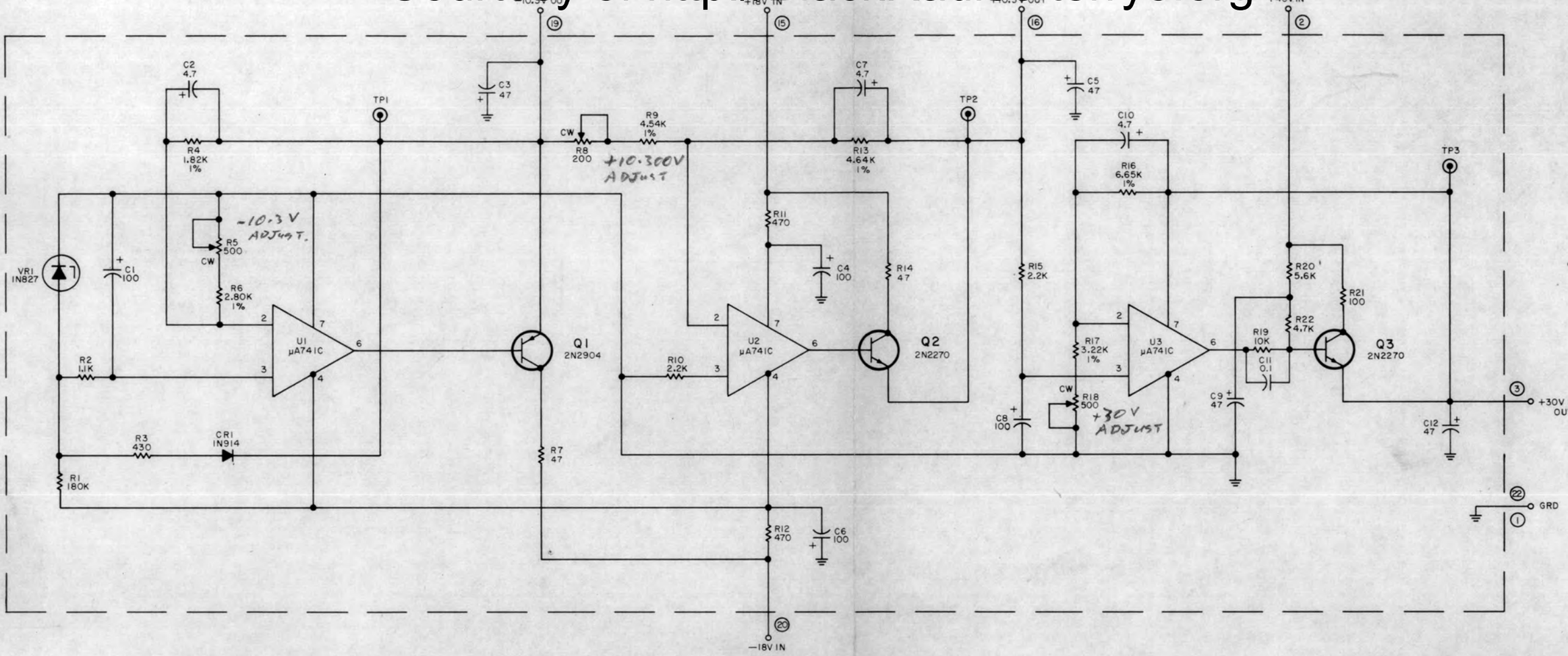


Figure 6-21. Type 76230 ±18V/+5V Power Supply Regulator (A14), Schematic Diagram



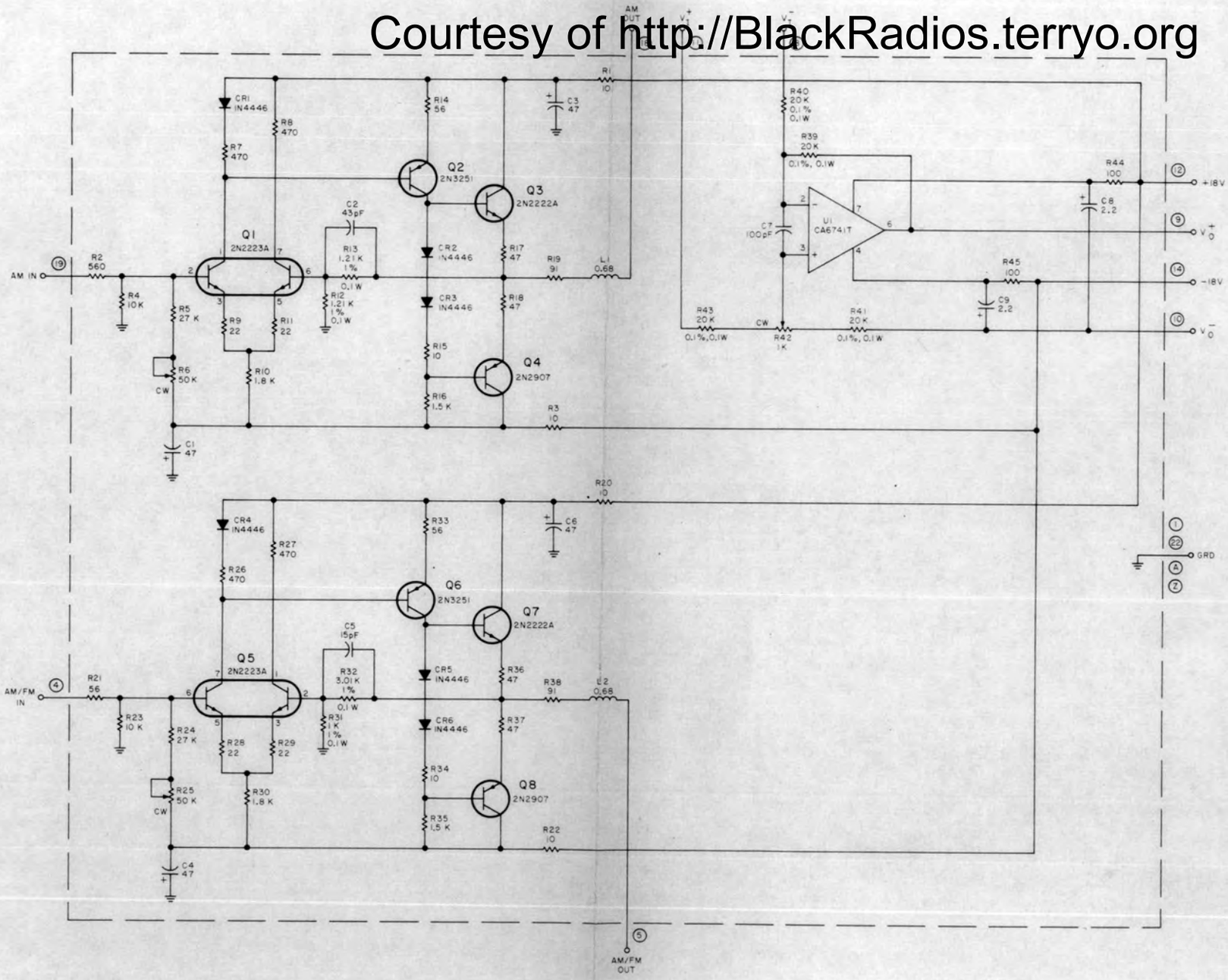
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION.
   b) ⊘ INDICATES SCREWDRIVER ADJUST.
4. FOR U1 THRU U3 LEAD ARRANGEMENT SEE DETAIL A.
5. DIFFERENCE BETWEEN TYPES IS MECHANICAL ONLY.

DETAIL A

BOTTOM VIEW

Figure 6-22. Type 76179 Precision Regulator (A15), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4.
   b) CAPACITANCE IS IN μF.
   c) INDUCTANCE IS IN μH.
2. ENCIRCLED NUMBERS (LETTERS) ARE MODULE PINS.
3. CW ON R6, R25, R42 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
4. PIN ARRANGEMENT OF U1 IS SHOWN IN DETAIL A.

DETAIL A

BOTTOM VIEW

HIGHEST REF DESIG USED	REF DESIG NOT USED
C9	–
CR6	–
L2	–
Q8	–
R45	–
U1	–

Figure 6-23. Type 791243 Video Amplifier/Tuning Voltage Buffer (A16), Schematic Diagram

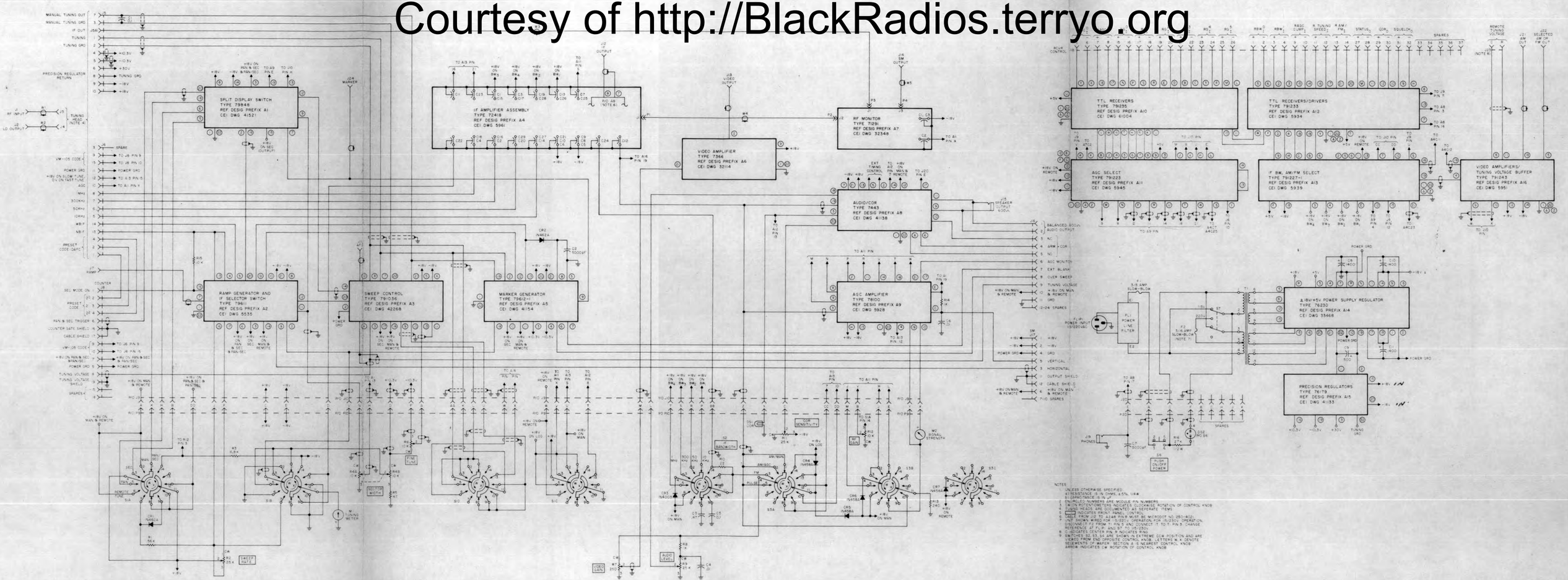


Figure 6-24. Type 215 Receiver, Main Chassis Schematic Diagram