

FOR TYPES UH-11 AND UH-11-1 TUNING HEADS

WATKINS—JOHNSON COMPANY 700 Quince Orchard Road Gaithersburg, Maryland 20760 WARNING

This equipment is used with units that employ dangerous voltage levels. Exercise caution when working with these units.

28 February 1974 Page 1 of 4 IKB:dw

ADDENDA UH-11 and UH-11-1

The following changes should be incorporated into the Instruction Manual for the UH-11 and UH-11-1 Tuning Heads.

- 1. Section IV Maintenance
 - A. Paragraph 4.5.4 Overall UH-11 (-1) RF Alignment
 - 1. Delete (-2.00 V dc) from step (3).
 - B. Table 4-3. Typical Semiconductor Element Voltages
 - 1. Change the element designations on Type 2N5397 FET as shown below: (Page 4-18)

from:

- 1. Drain
- to:
- 1. Source

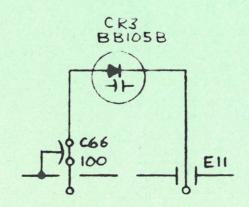
2. Source

2. Drain

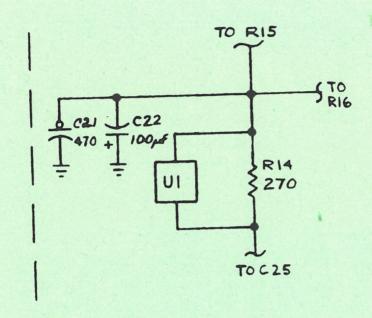
3. Gate

- 3. Gate
- 4. Bulk and Case
- 4. Bulk and Case
- 2. Section V Replacement Parts List
 - A. Paragraph 5.4.2; Types 71320-1 and 71320-2, 255-500 MHz RF Tuner (A1)
 - 1. Add C66 as follows: CAPACITOR, CERAMIC, FEEDTHRU: 100 pF, 10%, 500 V; Qty. 1; Part No. FA5C-1011; Vendor Code 01121 (Page 5-12)
 - 2. Add U1 as follows: DIODE MODULE; Qty. 1; Part No. 23911-1; Vendor Code 14632. (Page 5-16)
 - B. Paragraph 5.4.3; Type 79844-5 Shaping Amplifier (A2)
 - Change C2 from: 100 pF, 20%, 1000 V; Part No. DA141-33B;
 Vendor Code 71590 to: 1000 pF, 10%, 200 V; Part No. CK05BX102K;
 Vendor Code 81349. (Page 5-19)
 - 2. Change R10 from: Same as R9 (10 k Ω ; Part No. RCR07G103JS) to: RESISTOR, FIXED, COMPOSITION: 1 M Ω , 5%, 1/4W; Qty. 4; Part No. RCR07G105JS; Vendor Code 81349. (Page 5-20)

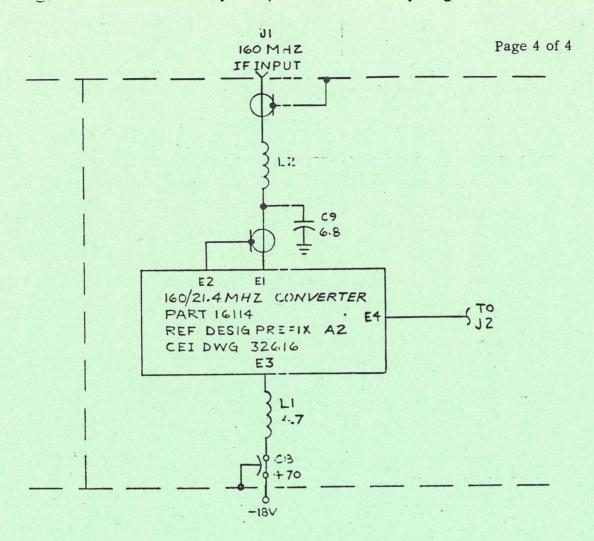
- 3. Change R11 from: RESISTOR, FIXED, COMPOSITION: $1 \text{ k}\Omega$, 5%, 1/4W; Qty. 1; Part No. RCR07G102JS; Vendor Code 81349 to: Same as R10 (1 M Ω ; Part No. RCR07G105JS). (Page 5-20)
- 4. Change R12 from: $100 \text{ k}\Omega$; Qty. 1; Part No. RCR07G104JS to: 100Ω ; Qty. 2; Part No. RCR07G101JS. (Page 5-20)
- 5. Change R49 from: RESISTOR, FIXED, COMPOSITION: 100Ω , 5%, 1/4W; Qty. 1; Part No. RCR07G101JS; Vendor Code 81349 to: Same as R12 (100Ω ; Part No. RCR07G101JS) (Page 5-21)
- C. Paragraph 5.4.5; Type 79974 AGC Shaping Circuit/160/21.4 MHz Converter Assembly (A4)
 - 1. Add L1 as follows: COIL, FIXED: 4.7 μ H; Qty. 1; Part No. 1537-28; Vendor Code 99800. (Page 5-25)
 - 2. Add L2 as follows: INDUCTOR; Qty. 1; Part No. 21210-36; Vendor Code 14632. (Page 5-25)
 - 3. Add C9 as follows: CAPACITOR, CERAMIC, TUBULAR: 6.8 pF, ±0.25 pF, 500 V; Qty. 1; Part No. 301-000-C0H0-689C; Vendor Code 72982. (Page 5-25)
- D. Paragraph 5.4.5.2; Part 16114 160/21.4 MHz Converter Assembly (A4A2)
 - 1. Add an asterisk (*) at R16 with a supporting note at the bottom of the page as follows: *Nominal value; Final value to be factory selected.
 - 2. Change Y1 from: 98202-03 to: 98204-5.
- 3. Section VI Schematic Diagrams
 - A. Figure 6-1; Page 6-3; Types 71320-1 and 71320-2 250-500 MHz RF Tuners (A1)
 - 1. Change E10 to C66 as shown below:



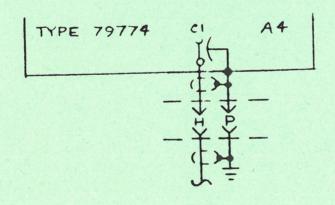
2. Add U1 as shown below:



- B. Figure 6-2; Page 6-5; Type 79844-5 Shaping Amplifier (A2)
 - 1. Change R10 from: $10 \text{ k}\Omega$ to: $1 \text{ M}\Omega$.
 - 2. Change R11 from: $1 \text{ k}\Omega$ to: $1 \text{ M}\Omega$.
 - 3. Change R12 from: $100 \text{ k}\Omega$ to: 100Ω .
- C. Figure 6-3; Page 6-7; Type 79774 AGC Shaping Circuit/160/21.4 MHz Converter Assembly (A4)
 - 1. Add C9, L1 and L2 as on page 4.
- D. Figure 6-5; Page 6-11; Part 16114 160/21.4 MHz Converter (A4A2)
 - 1. Add (Note 2) at R16.
 - 2. Add Note 2 as follows: 2. Nominal value; Final value to be factory selected.



- E. Figure 6-6; Page 6-13; UH-11(-1) Tuning Head Main Chassis
 - 1. Add pin P at A4Cl as shown below:



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Table 1-1

Table 1-1. Types UH-11 and UH-11-1 Tuning Heads, Specifications

Tuning Range	250-500 MHz
Input Impedance	50 ohms, nominal
Input VSWR	3:1, maximum
Noise Figure	10 dB, maximum
Gain x Noise Figure Product	30 ±3 dB
Image Rejection	80 dB, minimum
IF Rejection	80 dB, minimum
Gain Control Range	30 dB, minimum
1st Intermediate Frequency	160 MHz
2nd Intermediate Frequency	21.4 MHz
Overall Bandwidth	3 MHz, 5 MHz ⁺
Conducted LO Radiation	$2~\mu\mathrm{V}$, maximum
3rd Order Intermod Intercept Point*	≥ -10 dBm
LO Output Level	50 mV, minimum, across 50-ohm load
Tuning Voltage:	
Low Frequency Band Edge	+10V
High Frequency Band Edge	-10V
Linearity (volts versus frequency)	1% of tuning band
Tape Dial Accuracy	±2% of operating frequency
Dimensions	3.12 inches high, 3.0 inches wide, and 15.25 inches deep
Weight	4.0 lbs., approximately

^{*}Referenced to Input (In Band).

⁺UH-11-1

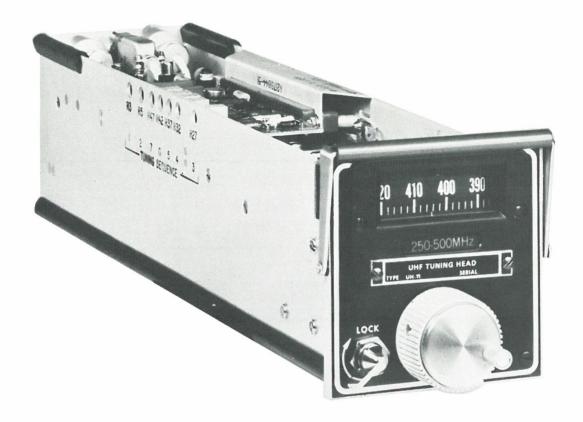


Figure 1-1. Type UH-ll Tuning Head, Front View

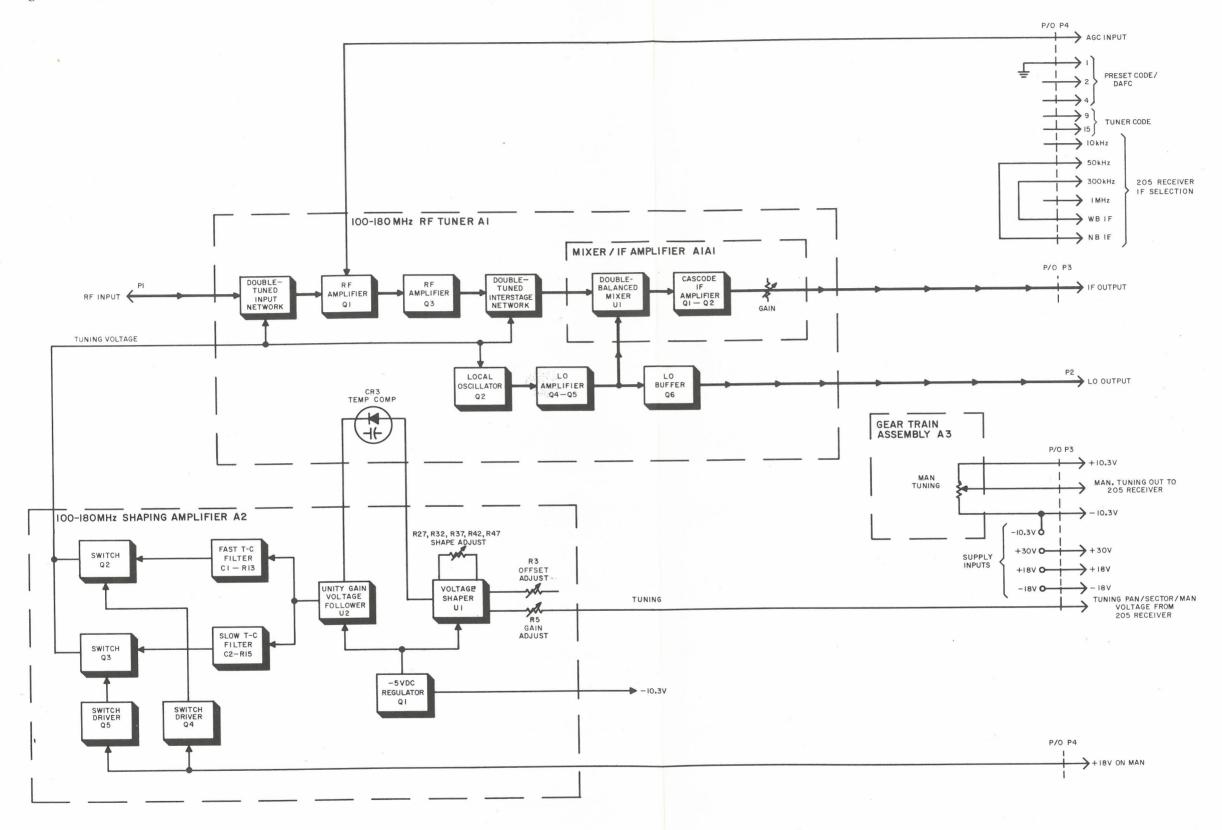


Figure 2-1. Type VH-13 Tuning Head, Functional Block Diagram

GENERAL DESCRIPTION

SECTION I GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

- 1.1.1 The Types UH-11 and UH-11-1 Tuning Heads are designed to operate as plug-in modules with the 205 Series Receivers. They tune the range of 250-500 MHz and provide a double conversion, voltage tuned front-end for the receiver. The units feature a 160 MHz first IF and provide a 21.4 MHz second IF output to the receiver. Manual or electrical tuning of the units can be utilized depending upon the operating mode of the associated receiver. A front-panel tuning knob and tape dial are provided for use in the manual tuning mode. The tuning voltage range of +10.3 to -10.3 volts from the receiver will tune the units from the low band limit to the high band limit. Special circuits within the UH-11(-1) are designed to provide linear tuning over the entire operating band.
- 1.1.2 The UH-11(-1) contains four subassemblies: (1) 250-500 MHz RF tuner, (2) shaping amplifier, (3) tuning drive assembly, and (4) AGC shaping circuit/160-21.4 MHz converter. The RF tuner subassembly contains a PIN diode attenuator and voltage tuned RF and first local oscillator circuits, first mixer and first IF amplifier stages, and a first local oscillator output stage. The shaping amplifier receives a linear tuning voltage from the receiver and provides a shaped voltage output to the RF tuner subassembly. The overall result is a linear volts-versus-frequency tuning characteristic for the UH-11(-1). To enable manual tuning of the UH-11(-1), a tuning drive with a tape dial are included. A precision potentiometer in the assembly provides a manual tuning voltage output to the associated receiver. The remaining subassembly contains AGC shaping circuitry and a 160 to 21.4 MHz converter which provides the IF output to the associated receiver. Pertinent electrical specifications for the UH-11(-1) are provided in Table 1-1. The UH-11 features an overall bandwidth of 3 MHz while the bandwidth of the UH-11-1 is 5 MHz. Electrical differences between the two units consist of component values to obtain the different bandwidths.

1.2 MECHANICAL CHARACTERISTICS

- 1.2.1 The UH-11(-1) Tuner is designed as a plug-in modular unit for the 205 Series Receivers. All electrical connections to the unit are provided through rear panel plug-in connectors. Front panel controls consist of the manual tuning knob and tape dial, and mechanical lock which secures the tuning head to the receiver.
- 1.2.2 The UH-11(-1) Tuner frame is constructed of aluminum. The unit has a 3.0 x 3.125 inch aluminum front panel. A gray enamel finish is applied to the front panel which is overlaid with a black anodized bezel. The 250-500 MHz RF tuner (A1) and the AGC shaping circuit/160-21.4 MHz converter (A4) are constructed of brass which has been plated with precious metals to increase conductivity and durability. The brass chassis contain one or more printed wiring boards. Shaping amplifier (A2) is a plug-in printed circuit board. The tuning drive and tape dial (A3) are constructed as a unit and mount on the RF tuner subassembly and the UH-11(-1) front panel.

1.3 EQUIPMENT SUPPLIED

This equipment consists of the Type UH-11(-1) Tuning Head only. The dimensions and weight are given in Table 1-1.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The UH-11(-1) is designed to operate with the 205 Series Receivers. It is not capable of independent operation. In addition, to perform any maintenance on the UH-11(-1) while it is operating, a Type EC-205 Extender Cable unit is required.

CIRCUIT DESCRIPTION

SECTION II CIRCUIT DESCRIPTION

2.1 GENERAL

Operation of the various circuits in the UH-11(-1) Tuner is described in the following paragraphs using the functional block diagram, Figure 2-1, and the schematic diagrams in Section VI of this manual. The unit numbering method is used for electrical components. This means that parts on subassemblies carry a prefix before the class letter and number of the item (such as A1Q1 and A1R6). These subassembly prefixes are omitted on illustrations and in the test except in those cases where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

- 2.2.1 250-500 MHz RF Tuner (A1). Figure 2-1 illustrates the functional interconnections between the various major components of the UH-11(-1). Input signals from P1 are applied to a PIN diode pi-attenuator on AGC board A1A1 in the 250-500 MHz RF tuner. AGC board A1A1 in conjunction with AGC shaping circuit A4A1 provides a means of controlling the front end gain of the tuner. From the AGC board, the RF signal is applied to a doubletuned input network before amplification by the first RF amplifier, A1Q1. A broadband network and 160 MHz IF trap are located in the output of the first RF amplifier. The 160 MHz IF trap increases the 160 MHz IF rejection. A second RF amplifier, A1Q2, follows these circuits. The gain of this stage is controlled by a buffered AGC voltage from A4A1. From A1Q2 the RF signal passes through a double-tuned interstage network before application to balanced mixer A1A2U1. Local oscillator signals operating 160 MHz above the RF frequency are generated by A1Q3. An LO amplifier stage (A1Q4), followed by a single tuned amplifier (A1Q5), provides the necessary voltage amplification to drive the balanced mixer and LO buffer stages. The LO buffer, AlO7, resonated by a broadband network and an attenuator pad following the broadband network increases the isolation between the LO output jack (P2) and the local oscillator. The RF input double-tuned network, double-tuned interstage network, LO tuning network, and single-tuned LO amplifier output network are all tuned by varactor diodes which receive a tuning voltage from the 250-500~MHz shaping amplifier, A2. The first mixer, A1A2U1, is followed by a 160~MHzcascode IF amplifier consisting of A1A2Q1 and A1Q6. A triple-tuned 160 MHz network at the IF amplifier output determines the overall bandwidth of the tuner.
- 2.2.2 $\underline{\text{AGC Shaping Circuit/160-21.4 MHz Converter (A4)}}$. This assembly contains the AGC shaping circuits located on printed circuit board A4A1 and a 160-21.4 MHz converter located on printed circuit board A4A2.
- 2.2.2.1 160-21.4 MHz Converter, A4A2. The 160 MHz first IF signals are applied to the 160-21.4 MHz Converter, A4A2. Double-balanced mixer A4A2U1 heterodynes the first IF signals with a 138.6 MHz signal generated by crystal oscillator A4A2Q2. Sum and difference signals from the mixer are then applied to 21.4 MHz IF Amplifier A4A2Q1 which amplifies and selects the difference output from the second mixer. The 21.4 MHz IF output signal is passed through a gain-set network to the IF output jack, a part of the rear panel connector assembly.
- 2.2.2.2 AGC Shaping Circuit, A4A1. This subassembly supplies AGC voltage to the 250-500 MHz voltage tuner (A1). The AGC input from the associated 205 Series Receiver is applied through P4 to an integrated circuit unity-gain follower, A4A1U1. This stage buffers the AGC input and drives the second RF amplifier (A1Q2) directly. In addition, it drives shape diode A4A1CR1 and another shaping network consisting of A4A1VR1 through A4A1VR3. The shaped output from A4A1CR1 provides current through the shunt branch PIN diodes in the piattenuator network on AGC board A1A1. Current through the series branch PIN diode on AGC board A1A1 is provided by unity-gain follower A4A1U2 and by unity-gain follower A4A1U1 through a shaping network consisting of A4A1VR1-VR3. The voltage difference between these two sources determines the series branch PIN diode current and thus its RF resistance. With no AGC input voltage to A4A1U1, the offset potentiometer driving A4A1U2 is adjusted to provide 10 mA current through the series PIN diode (minimum attenuation condition). As the AGC voltage swings negative, the difference voltage from the two shaped AGC sources decreases, the current through the series branch PIN diode decreases and its RF resistance increases. A complete explanation of the operation of the entire AGC circuit is provided in a later paragraph.
- 2.2.3 Shaping Amplifier (A2). This subassembly provides the tuning voltage for the variator diodes in the various tuned circuits in the 250-500 MHz voltage tuner (A1). It consists of circuits which receive a linear ramp

CIRCUIT DESCRIPTION

and summed manual tuning voltage, or manual tuning voltage from the associated receiver, depending upon the tuning mode of the receiver. It shapes the tuning voltage to provide a linear volts-versus-frequency tuning characteristic for the UH-11(-1). Operational amplifier A2U1 shapes the tuning voltage from the receiver. Its output voltage is applied through temperature compensating diode A1CR3 to another operational amplifier, A2U2. Unity-gain amplifier A2U2 drives two R-C filters which are used to remove noise from the tuning voltage output. Transistor stages A2Q2-Q5 are switching circuits to select the tuning voltage from the appropriate filter for the manual tuning and sweep tuning modes. Transistor A2Q1 functions as a voltage regulator which supplies a -5 Vdc reference voltage for A2U1 and A2U2.

2.3 TYPES 71320-1 AND 71320-2 250-500 MHz RF TUNERS

Figure 6-1 is the schematic diagram for the subassembly; its reference designation prefix is A1. The tuners provide a nominal 14 dB gain from RF input to 160 MHz IF output with no AGC. The difference between types is component values in the 160 MHz IF circuit to obtain different overall bandwidths for the UH-11(-1).

- 2.3.1 Input. Input signals are applied to jack J1. Resistor R41 terminates the input and prevents antenna static charges from damaging the AGC board (A1) components. Capacitor C1 couples the input from J1 to the AGC board. AGC board A1 functions as a voltage variable pi-attenuator having a range of 0-30 dB. Conduction of diodes A1CR1, A1CR2, and A1CR3 and thus the attenuation is controlled by the AGC shaping circuit, A4A1. An explanation of the PIN diode characteristics and the attenuator operation is provided in a later paragraph. Capacitor C4 and inductor L1 couple the RF signals from the AGC board into a double-tuned input network. The input tap is adjusted for best combination of VSWR and noise figure. The input tank circuit is a voltage controlled double-tuned quarter-wave resonator. Coupling between the primary and secondary is set by series inductor L4. Varactor diodes CR1A through CR1D tune the network. Varactor diodes are semiconductor devices whose capacitance varies inversely with the reverse bias applied. Thus increasing the reverse bias decreases the capacitance and increases the resonant frequency of the tuned circuit. Capacitors C4 and C9 set the high frequency, and parallel inductors L3 and L6 allow adjustment of the low frequency portion of the resonator tuning range.
- 2.3.2 First RF Amplifier. Transistor Q1 is common emitter amplifier. Input to the base is coupled through C10. Capacitor C14 holds the emitter at RF ground and ferrite bead FB1 is a parasitic suppressor. Base bias is set by R3 and R4 while R5 sets the emitter current. A broadband network consisting of T1 and R6 functions as the collector load and provides impedance matching to the second RF amplifier. Inductor L7 and C15 form a 160 MHz trap to increase the 160 MHz IF rejection. Capacitor C16 couples the RF signals to the second RF amplifier, Q2.
- 2.3.3 Second RF Amplifier. A dual insulated gate field-effect transistor (IGFET) is used as the second RF amplifier. This transistor provides large signal handling capabilities and ease of gain control. Source biasing is provided by R13 and C14 is the RF bypass. The RF input is applied to gate 1 (pin 3) and the AGC voltage is applied to gate 2 (pin 2). Resistors R7 and R8 set the gate 1 bias, as approximately 1.2V. Resistors R9-R10 and diode CR2 set the gate 2 bias at approximately 3.8V with no AGC input. When the AGC voltage goes sufficiently negative to reverse bias CR2, the gate 2 voltage follows the AGC. Inductor L8 is an RF choke supplying drain voltage to Q2. Capacitor C27 couples the output to the double-tuned interstage network.
- 2.3.4 Interstage Network. The interstage network is a double-tuned quarter-wave resonator. Its operation is identical to the input network. Inductor L12 sets the coupling between the primary and secondary and the output tap is set to match the input impedance of balanced mixer A2U1. The overall RF amplifier gain to the mixer input is nominally $10~\mathrm{dB}$.
- 2.3.5 Mixer/IF Amplifier. Mixer IF board A2 mounts balanced mixer U1 and one-half of a 160 MHz cascode amplifier, A2Q1. The second half of the cascode stage is Q6. Balanced mixer U1 receives RF input from the double-tuned interstage network and local oscillator signals from LO amplifier Q5. The LO operates 160 MHz above the incoming RF. Transformer A2T1 and C65 select the 160 MHz difference output from the mixer. The mixer has a conversion loss of approximately 8 dB. Transistors A2Q1 and Q6 form the 160 MHz cascode amplifier which has a gain of approximately 12 dB. Coupling between the two stages is through parasitic suppressor A2R5. The 160 MHz output from the cascode is triple-tuned by L17-C52, L18-C57, and L19-C60. Capacitors C55 and C59 set the coupling between the sections and C63 couples the 160 MHz IF output to jack J2.
- 2.3.6 Local Oscillator. Transistor Q3 is the local oscillator. It operates 160 MHz above the RF frequency.

CIRCUIT DESCRIPTION

Bias is set by resistors R14 through R17. Filtering of the emitter bias is provided by C21-C22. The base bias is held at RF ground by C31. Ferrite beads FB2-FB3-FB4 prevent parasitic oscillations. Collector to emitter feedback is provided by C30 to sustain oscillation. The oscillator tuned circuit is a half-wave resonator tuned by varactor CR1J. Capacitor C33 sets the low frequency and C37 sets the high frequency portion of the oscillator tuning range. Oscillator output is taken from the coupling loop formed by C39.

- 2.3.7 LO Amplifier. Transistors Q4 and Q5 form the LO amplifier. The output from Q4 is direct coupled to the base of Q5 through low-Z strip line L23. A quarter-wave resonator tunes the amplifier output. Varactor diode CR1K provides the voltage tuning. Capacitor C50 sets the high frequency and C46 sets the low frequency portion of the tuning range. LO output to the mixer is coupled through low-Z strip line L22. Resistor R30 and C51 couple some of the LO output to LO buffer Q7. Varactor diode CR3 is included to provide temperature compensation of the tuning voltage. Its operation will be explained in a later paragraph.
- 2.3.8 LO Buffer. Transistor Q7 functions as a buffer amplifier to isolate the LO output jack from the local oscillator circuits. A broadband resonant circuit consisting of C61-C62 and L20-L21 provides the collector load for Q7. Output is taken from the junction of L20-L21 and coupled through a 5 dB pad to LO output jack J3. The pad improves the LO output isolation and VSWR on the LO output line.

2.4 TYPE 79844-5 SHAPING AMPLIFIER

Figure 6-2 is the schematic diagram for the shaping amplifier; the reference designation prefix A2 has been assigned. This circuit is constructed on a plug-in circuit board. It receives a +10.3 to -10.3 volt tuning voltage from the 205 Series Receiver and provides a shaped +2 to +25 volt output which complements the voltage versus capacitance characteristics of the varactor diodes used in the 250-500 MHz voltage tuner subassembly. The diode characteristics are such that for a given reverse bias change, a greater change in capacity occurs in the maximum capacity region than at the minimum capacity region. The shaped voltage output from this subassembly provides linear tuning over the range of 250 to 500 MHz. As shown in the functional block diagram, Figure 2-1, the circuit consists of voltage shaper U1, unity-gain voltage follower U2, R-C filters, filter switching transistors Q2 and Q3, switch drivers Q4 and Q5, and -5 Vdc regulator transistor Q1.

2.4.1 Shaping Circuit. - The voltage shaping circuit consists of integrated circuit operational amplifier U1 and its associated feedback network. Figure 2-2 simplifies the voltage shaper circuit by showing only a portion of its feedback network. Operational amplifier U1 amplifies the difference between its two inputs. The noninverting input (pin 3) of the IC is returned to ground through R8, which balances current flow through both inputs of the amplifier. The tuning voltage is applied to the inverting input (pin 2) through R5 and R6. Also connected to the inverting input is an offset voltage applied through R3 and R4, negative feedback voltage applied through R7, and negative feedback voltage applied through CR7, CR5, and R25. The voltage gain of the operational amplifier is determined by the ratio of total input resistance to total feedback resistance. The network consisting of R25 through R28 and CR6 is a biasing network for "break" diode CR7. To illustrate the circuit operation, assume that the low band edge tuning voltage (+10.3V) is applied to the shaper. At this point, the output voltage from U1 is approximately +2 volts. The first break point for the output voltage curve is determined by the setting of R27 which applies a positive voltage to the cathode of CR6. The voltage drop across R25 is such that the voltage applied to the anodes of CR7 and CR5 is sufficiently positive to forward bias them. However, CR6 is reverse biased due to the voltage applied to it through R27. Now the feedback across U1 consists of the voltage developed across R7 and the voltage across CR7, CR5, and R24. When the input tuning voltage goes negative, the output voltage of U1 swings positive from the initial +2 volt level. The output of U1 changes linearly with respect to its input until it reaches the point where CR6 becomes forward biased. When CR6 begins to conduct, the voltage at the junction of CR5, CR6, and CR7 is clamped by current flow through CR6 and CR7 and becomes reverse biased with any further positive increase at the output of U1. When CR7 becomes reverse biased, the negative feedback loop consisting of CR7, CR5, and R24 is broken, increasing the gain of U1. Diodes CR5 through CR19 and associated circuitry, as shown in the schematic diagram, are all components of the gain modifying (feedback) network. When the output voltage of U1 reaches the level set by R32 the next gain curve "break" takes place and the feedback across U1 is further reduced, increasing the voltage gain of U1 and further changing the slope of the output voltage curve. The "break" point potentiometers are all adjusted to provide linear tuning over the range of 250 to 500 MHz. Diode CR1 is included across the "permanent" feedback resistor, R7, to protect the varactor diodes in the 250-500 MHz tuner subassembly. Should the output voltage from U1 ever go negative, which would forward bias the varactor diodes and possibly damage them, diode CR1 conducts. With CR1 conducting a direct negative feedback path is provided which will hold the output voltage from U1 around zero volts.

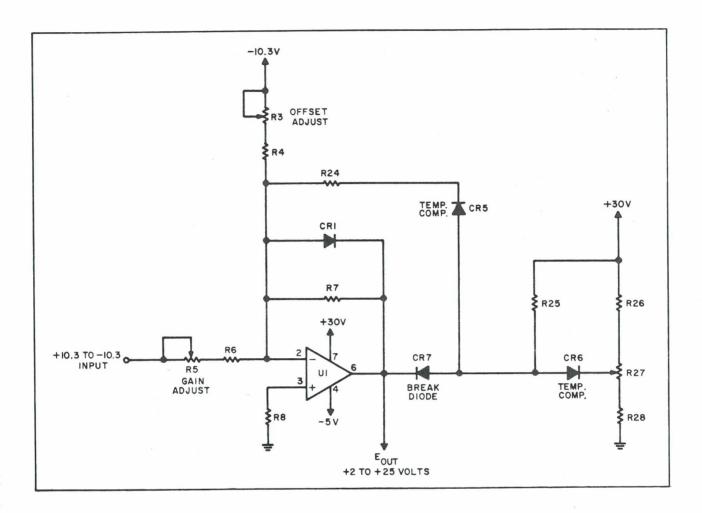


Figure 2-2. Shaping Amplifier, Simplified Diagram

- 2.4.2 Voltage Follower and -5V Regulator. The shaped output voltage from U1 is applied to operational amplifier U2 through varactor diode CR3 in the 250-500 MHz tuner subassembly. Diode A1CR3 is forward biased by the tuning voltage. Variations in the contact potential of the tuning diodes caused by temperature changes are cancelled by the drop across A1CR3 whose contact potential varies a similar amount. Operational amplifier U2 is used as a unity-gain voltage follower to provide isolation from the voltage shaper. The shaped voltage coupled through A1CR3 is applied to the non-inverting input (pin 3) of the amplifier. Negative feedback to the inverting input (pin 2), and positive feedback taken from the junction of R11 and R12 and coupled through R10, set the stage gain at one. Supply voltages for the operational amplifiers are provided by the +30 Vdc applied to pin 21 of the shaping amplifier board and the -5 Vdc supplied by Q1. Transistor Q1 functions as a series regulator. Bias for the base is taken from the junction of R1 and R2.
- 2.4.3 R-C Filters and Switching Circuits. The output voltage from U2 is applied through R-C filters to FET switches Q2 and Q3. The filters remove noise from the tuning voltage output. Resistor R13 and C1 form the slow time constant filter used in the MAN mode of operation. A faster time constant filter formed by R15 and C2 is used when the 205 Series Receiver is operated in any of its sweeping modes. Transistors Q4 and Q5 provide the switching voltage for the FETs. Positive 18 volts is applied to pin 2 of the shaping amplifier board in the MAN tuning mode of the associated receiver. In this mode, the base bias on Q5 is not sufficiently negative to cause the transistor to conduct. With Q5 off, the base voltage on Q4 goes sufficiently negative to cause it to conduct due to the voltage drop across R20, R19, and R21. The collector voltage of Q5, the non-conducting transistor, is approximately -8 Vdc which causes CR3 to conduct clamping the voltage at the gate of Q3 low and turning the transistor off. However, the positive voltage at the collector of Q4, the conducting transistor, reverse biases

CIRCUIT DESCRIPTION

CR2 allowing the gate voltage on Q2 to approach the source voltage and Q2 conducts. With Q2 conducting, the output voltage from the unity-gain voltage follower is through the slow R-C filter and transistor Q2 to output pin 3. When the 205 Series Receiver is switched to any of the sweeping modes, pin 2 of the shaping amplifier board is clamped at -2 Vdc. The low input voltage on pin 2 provides a return path from the +30 volt supply through R22, R23 and VR1. Due to the current flow through it, the voltage across R22 swings negative turning Q5 on. With Q5 on, the voltage at the base of Q4 goes positive turning it off. Now -8 volts is applied to CR2 clamping the gate of Q2 low and turning it off. The positive voltage at the collector of Q5 reverse biases CR3 allowing the gate of Q3 to approach the source voltage and Q3 conducts. With Q3 conducting, the output voltage from the shaper board is coupled through the fast R-C filter.

2.5 TYPE 8588 TUNING DRIVE ASSEMBLY

This assembly contains the manual tuning precision potentiometer and dial lamps for the tape frequency dial. Electrically the assembly is shown on the UH-11(-1) main class schematic, Figure 6-6. The reference designation prefix A3 has been assigned. Dial lamps DS1 through DS3 are series connected across the -18V supply input. The manual tuning precision potentiometer is geared to the tape dial. An exploded view of the mechanical assembly is provided in Figure 5-11. TUNE potentiometer R1 is connected between -10.3 and +10.3 volts. The arm of the potentiometer provides the manual tuning output voltage to the associated receiver.

2.6 TYPE 79774 AGC SHAPING CIRCUIT/160-21.4 MHz CONVERTER ASSEMBLY

Figure 6-3 is the schematic diagram for this assembly; its reference designation prefix is A4. The assembly contains Part 16115 AGC Shaping Circuit A4A1 and Part 16114 160/21.4 MHz Converter A4A2.

- 2.6.1 Part 16115 AGC Shaping Circuit. Figure 6-4 is the schematic diagram; the reference designation prefix A4A1 has been assigned. The circuit is constructed on a printed circuit board which is wired into assembly A4. AGC voltage outputs from the board control the overall gain of the 250-500 MHz RF tuner, A1. The AGC shaping circuit is designed to provide controlling current for the PIN diode pi-attenuator (A1A1) and a buffered AGC output voltage for the second RF Amplifier A1Q2. The circuit provides logarithmic 1-30 dB attenuation characteristic of the pi-attenuator and logarithmic 15 dB control of the second RF amplifier stage with an AGC input range of 0 to -6 volts. Integrated circuit (IC) operational amplifier U1 functions as a unity gain voltage follower which provides buffered AGC voltage output to the second RF amplifier and voltages which are shaped by diodes to control the conduction of the PIN diodes in the pi-attenuator.
- 2.6.1.1 A simplified diagram of the PIN diode attenuator network and the shaping circuitry is provided in Figure 2-3. PIN diodes are semiconductor devices which function as current variable RF resistors at frequencies between 10 MHz and 1 GHz when forward biased. The RF resistance of the diodes is inversely related to the junction current flow, i.e., an increase in the forward junction bias causes a decrease in the RF resistance and vice-versa. The forward current versus RF resistance relationship is nearly linear over the range of approximately 2 to several thousand ohms.
- 2.6.1.2 The RF resistance characteristic of the PIN diode is utilized in the UH-11(-1) to form the pi-attenuator. PIN diodes CR1, CR2, and CR3 on AGC board A1A1 form the three voltage variable resistance elements of the attenuator. The attenuator is designed to provide nearly constant 50 ohm input and output impedances over the 1-30 dB range of attenuation to meet the VSWR requirements of the tuner. However, to maintain constant input and output impedances, the series resistance and shunt resistance branches of the attenuator must change in opposite directions in a non-linear manner over the 1 to 30 dB range of attenuation. As examples, in the minimum attenuation condition the required resistances for the series and shunt elements are in the order of 3 ohms and 1000 ohms respectively and in the maximum attenuation condition the series element resistance should be approximately 700 ohms and the shunt resistance approximately 52 ohms. This means that the series diode forward current should be high (approximately 10 mA) for minimum attenuation and decrease for maximum attenuation (approximately 10 µA). This requirement is met by supplying current from operational amplifier U2 through PIN diode CR2 and shaping Zener diodes VR1 through VR3 to the AGC buffer, U1. The output voltage from U2 is set by potentiometer R8. As the output from U1 swings negative (increasing signal and AGC) current flow through PIN diode CR2 is decreased. The current decrease through PIN diode CR2 is linear until the difference voltage between the outputs of U2 and U1 is less than 6.8V at which point Zener diode VR3 stops conducting. This in effect places resistor R5 in the current path and changes the slope of the current curve through PIN diode CR2. Current flow through PIN diode CR2 decreases again at a linear rate with further increases in AGC until the next "break point" occurs when Zener VR2 stops conducting at approximately 5.6V difference between the output

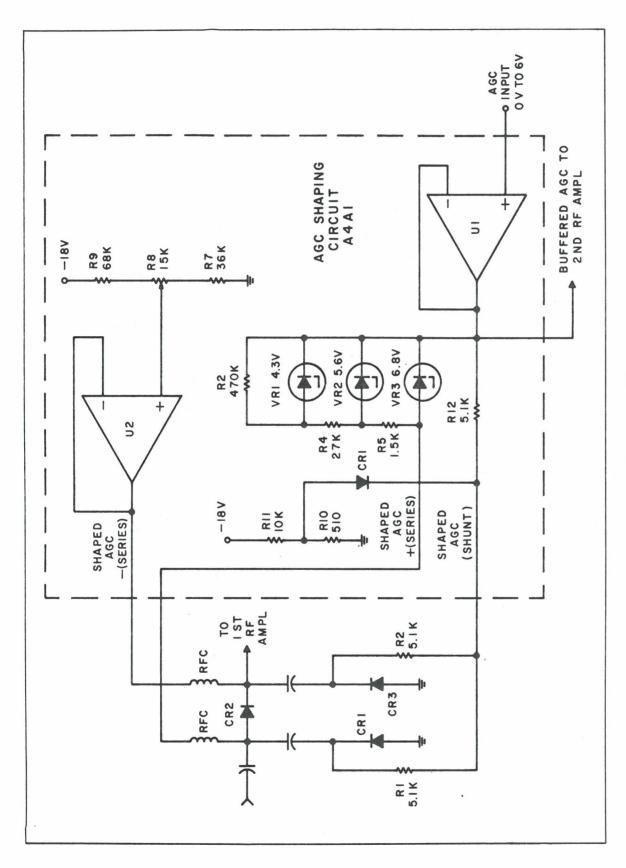


Figure 2-3. AGC Circuit, Simplified Diagram

CIRCUIT DESCRIPTION

voltages of U2 and U1. At this point R5 and R4 are both in series with the PIN diode current. With a further increase in AGC, the PIN diode current continues to decrease at the new rate until Zener diode VR1 stops conducting at a difference voltage of approximately 4.3 volts. Now resistor R2 is in series with the PIN diode current.

- 2.6.1.3 The three "break" diodes VR1, VR2, and VR3 in conjunction with resistors R2, R4, and R5 set the desired current curve for the series PIN diode. Resistance of the shunt branch of the attenuator must change from approximately 700 ohms (15 μ A forward current) at minimum attenuation to approximately 52 ohms (200 μ A forward current) at maximum attenuation. Note that the shunt PIN diodes CR1 and CR2 require an increasing current with increasing AGC. These diodes are controlled by the output of U1 through series resistors R1, R2, and R12. The slope of the current curve for the shunt diodes requires only one "break" for a satisfactory approximation. This break is accomplished by silicon diode CR1 and a voltage divider consisting of R11 and R10. These resistors are connected between -18 volts and ground. The anode of silicon diode CR1 is connected to the junction of these resistors placing it at approximately -0.9 volts. The cathode of this diode is connected at the junction of R1, R2, and R12. As the AGC output of U1 swings negative from 0 volts, the current through PIN diodes CR1 and CR3 increases linearly until silicon diode CR1 becomes forward biased. At this point, current flow through the shunt PIN diodes is reduced and the current curve slope changed with further increases in AGC.
- 2.6.2 Part 16114 160-21.4 MHz Converter. Figure 6-5 is the schematic diagram for the 160-21.4 MHz converter; its reference designation prefix is A4A2. The circuit is constructed on a wired-in printed circuit board.
- $2.6.2.1\,$ Mixer. An integrated circuit double-balanced mixer (U1) provides conversion of the $160\,$ MHz output of RF tuner A1 to $21.4\,$ MHz. The $160\,$ MHz input is applied to pin 5, the local oscillator is applied to pin 2, and the sum and difference output is taken from pin 4. Input $160\,$ MHz and local oscillator signals are cancelled at the mixer output by the balanced configuration of the device.
- 2.6.2.2 21.4 MHz IF Amplifier. Transistor Q1 functions as a 21.4 MHz IF amplifier. Sum and difference output signals from mixer U1 are coupled to the base through C2. Base bias is set by R4 and R6. Emitter self bias is set by R8. Resistor R7 provides emitter degeneration for the stage. Capacitor C6 and R5 provide collector-to-base degeneration to stabilize the amplifier. The collector is resonated by T1 and C9 with the taps of T1 adjusted for impedance matching. Potentiometer R17 provides a means of setting the 21.4 MHz output level.
- 2.6.2.3 Local Oscillator. Local oscillator signal for the 160-21.4 MHz converter is generated by crystal oscillator Q2. The circuit uses an overtone type crystal with collector to emitter feedback through the crystal. Impedance step-down to sustain oscillation is provided by C4 and C5. The base is returned to RF ground through R16 and C11 with R16 functioning as a parasitic suppressor. Biasing for the oscillator is set by R13, R14, R11, and R12. Inductor L2 is broadly resonant with the crystal holder capacitance to prevent oscillation at other than the desired overtone frequency. The oscillator tank circuit consists of L1 and C3. Output from the oscillator is coupled through C1 and a 3 dB pad consisting of R1, R2, and R3 to the double-balanced mixer.

INSTALLATION AND OPERATION

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, CEI Division, 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. Inspect the internal components for apparent damage. Check the internal cables for loose connections and the printed wiring board which may have been loosened from its receptacle.

3.2 INSTALLATION

The UH-11(-1) Tuning Head is a plug-in unit designed to operate exclusively with the Type 205 Series Receivers. All operating voltages and RF signals are provided by rear-panel connectors on the tuner, which mate with the 205 Series Receivers.

3.3 OPERATION

Operation of the UH-11(-1) Tuning Head is controlled entirely by the associated 205-() Receiver with the exception of the front-panel manual tuning knob.

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 If time permits, contract packing and packaging firms can be found in many cities. Based on an examination of the equipment and the proposed method of shipment, these firms can usually perform a reliable repackaging service.
- 3.4.3 As a minimum, cover the painted surface of the unit with wrapping paper. Pack the unit securely in a strong corrugated container (350 lb/sq inch bursting test) with 2-inch rubberized hair pads placed along all surfaces of the equipment. If rubberized hair is not available, use a 6-inch layer of excelsior. If neither of these filler materials are available, use crumpled paper, rags, or any other available materials to provide as much cushioning as possible.
- 3.4.4 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

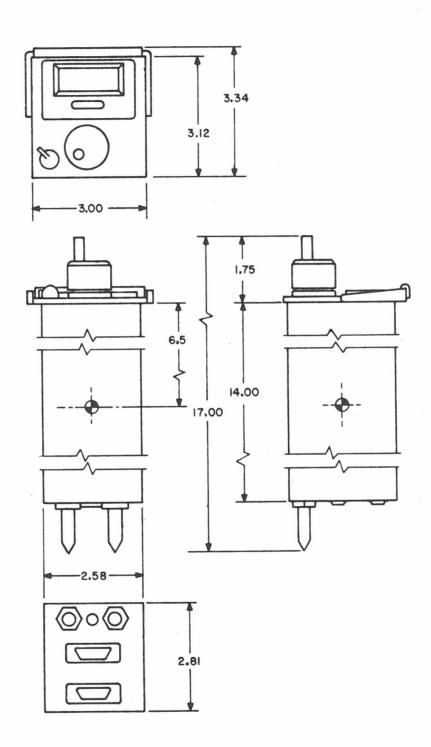


Figure 3-1. Type UH-11(-1) Tuning Head, Critical Dimensions

MAINTENANCE

SECTION IV MAINTENANCE

4.1 GENERAL

The UH-11(-1) Tuning Head has been designed to operate for extended periods of time with only routine maintenance. The unit requires no special care and normally requires only cleaning and occasional tuning drive lubrication. Alignment of the tuner requires a thorough understanding of the function of each subassembly and should be attempted only after repairs which affect the alignment and then only by experienced personnel in a well-equipped shop.

4.2 PLUG-IN MODULE

The printed circuit shaping amplifier board can be removed by unsnapping the hinge lock located on the side of the tuner and carefully swinging the board up where it can be un-plugged. Careful removal and installation of the shaper board will not disturb the UH-11(-1) alignment.

4.3 MAINTENANCE OF TUNING DRIVE ASSEMBLY

Figure 5-11 is an exploded view of the tuning drive assembly. The tuning drive assembly requires little maintenance except for the occasional application of a few drops of light oil to the shaft bearings and removal of any dust or dirt that may accumulate.

- 4.3.1 Dial Lamp Replacement. To replace the burned out dial lamp, proceed as follows:
 - (1) Remove the two screws that hold the dial escutcheon. Remove the escutcheon (refer to Figure 5-11).
 - (2) Remove the two screws that hold the light bar to the tuning drive.
 - (3) Gently pull the light bar and printed circuit light board away from the tuning drive. It may be necessary to remove some lacing cord from the wires that connect to the lamp.
 - (4) Remove the two screws that hold the light board to the light bar.
 - (5) Unsolder the burned out lamp and replace it with a new lamp. It is advisable to replace both lamps if parts are available because if one lamp burns out, it is likely that the other lamp is nearing end of its life.
 - (6) Reassemble the unit by reversing steps (1) through (4).
- 4.3.2 Alignment of Tape Dial. A calibrated steel tape is used as the tuning dial. It is geared to the assembly in such a manner that it is unlikely it will ever get out of position. However, to check the alignment or to mechanically realign the tape, follow the steps given below:
 - (1) Turn the tuning knob counterclockwise until the tape dial stops moving.
 - (2) The mark to the left of the arrow should line up with the dial pointer. It is does not, proceed with the next step.
 - (3) Loosen the setscrew on gear no. 27 (Figure 5-11).
 - (4) Remove the dial escutcheon as described in paragraph 4.3.1, step (3) if necessary.
 - (5) By hand, move the tape dial and gear no. 27 independent of the rest of the gear train, to align the reference mark with the pointer.
 - (6) Tighten the setscrew on gear no. 27 and replace the dial escutcheon.
 - (7) Tune from one end of the dial to the other to determine if binding occurs in the gear train. If some binding is present, loosen the setscrew on gear no. 27 and slightly readjust its vertical position.

MAINTENANCE

- 4.3.3 Removal and Disassembly of Tuning Drive and Tape Dial. The tuning drive and tape dial assembly may be removed from the tuner by performing the steps listed below. Once removed, the tuning drive may be disassembled using Figure 5-11 as a guide.
 - (1) Remove the tuning knob.
 - (2) Remove the two screws that hold the dial escutcheon. Remove the escutcheon.
 - (3) Remove the two screws that hold the light board to the light bar.
 - (4) Unsolder the wire providing input voltage to the lights.
 - (5) Unsolder the wires connected to the tuning potentiometer. Tag each of the leads.
 - (6) Turn the tuner assembly upside down and loosen the two screws which mount the RF tuner subassembly to the tuning drive.
 - (7) Remove the three screws from both sides of the tuner wrap-around which hold the tuning drive. Gently pull the tuning drive assembly from the tuner.
 - (8) Further disassembly should not be required. However, the front-panel may be removed from the tuning drive by removing the tuner mechanical lock, the screw in the lower right corner of the front panel, and the two screws underneath the panel bezel.
 - (9) To reassemble, reverse the above procedure.

4.4 TROUBLESHOOTING

- 4.4.1 General. Troubleshooting the UH-11(-1) while the unit is operating requires the use of an EC-205 Extender Cable. After interconnecting the UH-11(-1) and the 205 Series Receiver using the EC-205, initial investigation should be directed toward localizing the malfunction to a specific subassembly. This section contains aids for this process, including a troubleshooting chart and typical semiconductor element voltages. The alignment procedures (subsection 4.5) and performance tests (subsection 4.6) are also of value in diagnosing the causes of malfunctions. Before attempting troubleshooting and repairs of the tuner, the maintenance technician should have a thorough understanding of the tuner operation as detailed in Section II. Reference should also be made to the functional block diagram and the schematic diagrams for the unit. Utilizing all of the available information, the technician should have little trouble maintaining the UH-11(-1).
- 4.4.2 Equipment Required. The following test instruments, or their equivalents are required to troubleshoot the UH- $\overline{11(-1)}$.
 - Frequency Counter, Computer Measurements Company, Type 738A with a Type 735C plug-in.
 - (2) Digital Voltmeter, Dana Type 5500/112
 - (3) Signal Generators, HP-608E and HP-612A.
 - (4) RF Voltmeter, Boonton 910A-55 with Model 91-12E RF probe and TEE adapter Model 91-14A.
 - (5) 50 ohm terminations, adaptors, cables, etc.
- 4.4.3 <u>Localization of Faults.</u> The primary methods of localizing failed modules are discussed below.
- 4.4.3.1 Visual Inspection. A thorough visual inspection may be sufficient to locate the source of trouble. Carefully inspect the UH-11(-1) for broken wires, improperly mated connectors, and damaged components on the shaping amplifier board (A2).
- 4.4.3.2 Use of the Troubleshooting Chart. Table 4-1 provides a detailed listing of possible failure indications with procedures to be followed in diagnosing faults. The first step is to decide which of the failure symptoms listed on the left side of the chart is applicable. Follow the procedure given to isolate the defective module. Voltage measurements and injection and detection of applicable signals should then isolate the defective stage and component.

Table 4-1

Table 4-1. Troubleshooting Information

Trouble Indication	Probable Fault	Diagnostic Procedure
1) UH-11(-1) totally inoperative.	Power supply failure in the 205-() Receiver.	Check power supply inputs as follows: -18V on pin 4 of XA2; +30V on pin 21 of XA2; +10.3V on CW end of A3R1 and -10.3V on CCW end of A3R1; +18V on A4C2.
2) Power supply inputs normal, UH-11(-1) totally inoperative.	Tuning voltage failure - shaping amplifier malfunction.	(1) Set the 205-() Tuning mode selector to MAN, tune the UH-11(-1) from 250 to 500 MHz while observing the voltage at the arm of A3R1. Voltage should vary from -10.3V at 250 MHz to +10.3V at 500 MHz. (2) Check for +18V on pin 2 of XA2 (+18V on MAN). (3) Repeat step (1) observing the voltage on XA2 pin 8. Voltage should vary from +10.3V at 250 MHz to -10.3V at 500 MHz. (4) Repeat step (1) observing the voltage at pin 3 of XA2. Voltage should vary from approximately +2.5V at 250 MHz to +25V at 500 MHz.
3) Power supply inputs normal; tuning voltage and shaping amplifier normal, UH-11(-1) inoperative.	RF Circuit Failure	(1) Check operation of first local oscillator by using frequency counter to count local oscillator frequency; connect the counter to jack J2 on the 205-() Receiver and compare the LO readouts obtained with Table 4-2 (2) Refer to paragraph 4.6.1 and perform the overall gain measurement, or tune the UH-11(-1) to 250 MHz with the 205-() in the MAN tuning mode, AM/MAN reception mode, RF GAIN MAX CW; connect the HP-608E Signal Generator to the RF INPUT jack on the 205-(); connect the Boonton RF voltmeter to J5 on the EC-205 using a 50 ohm termination on one side of the TEE adapter and set the range to -20 dBm; adjust the signal generator for a 250 MHz CW output signal and set the attenuator for a -20 dBm reading on the voltmeter. Subtract 20 dBm from the signal generator attenuator reading. The difference should be approximately 17-22 dB, the overall UH-11(-1) gain. (3) Check the gain of the 160/21.4 MHz converter (A4A2); connect the signal generator to A4J1 and the RF voltmeter to A4J2; set the voltmeter range to -20 dBm and adjust the generator con-

Trouble Indication	Probable Fault	Diagnostic Procedure
		the signal generator attenutator for a -20 dBm indication on the voltmeter; subtract 20 dBm from the signal generator attenuator reading. The difference should be approximately 6-16 dB.
4) UH-11(-1) operative, poor tuning linearity	+30V regulated power supply failure; shaping amplifier failure.	Check +30V input from 205-() Receiver. Check operation of shaping amplifier A2. (See shaping amplifier alignment instructions paragraph 4.5.5)
5) Insufficient UH-11(-1) gain, bandwidth, etc.	250-500 MHz Voltage tuner (A1), or AGC Shaping Circuit/160-21.4 MHz Converter (A4).	Check RF alignment of A4 first (Refer to paragraph 4.5.3. If this does not isolate the problem, investigate the alignment of A1 (Refer to paragraph 4.5.2.5). Note that if the cover is removed from subassembly A1, a complete alignment may have to be performed.

4.5 ALIGNMENT

The alignment procedures provided in this subsection are satisfactory for alignment of the UH-11(-1) after a major component replacement. Varactor diodes in the 250-500 MHz RF tuner are matched components. If failure of a diode occurs, its replacement may not match the characteristics of the remaining units. To obtain satisfactory performance from the UH-11(-1) all varactor diodes may have to be replaced with a matched set. Alignment of the UH-11(-1) should be attempted only by trained and experienced technicians thoroughly familiar with the unit. If the alignment procedures detailed in the following paragraphs do not provide satisfactory performance from the UH-11(-1), a factory alignment is required.

CAUTION

Exercise care when performing these procedures not to short any components when power is on. Failure to observe this precaution may result in the destruction of one or more transistors.

- 4.5.1 <u>Test Equipment Required.</u> The following test instruments, or their equivalents are required to align the UH- $\overline{11(-1)}$ Tuning Head.
 - (1) Spectrum Analyzer, Hewlett-Packard Type 8551B/851B.
 - (2) Frequency Counter, Computer Measurements Company Type 738A with a Type 735C plug-in.
 - (3) Signal Generators, Hewlett-Packard Types 608E and 612A.
 - (4) Sweeping Signal Generator, Texscan Type VS-80A with 1 MHz, and 50 MHz markers.
 - (5) Digital Voltmeter, Dana Type 5500/112.
 - (6) Regulated Variable Power Supply 0-30 Vdc, Hewlett-Packard Harrison Type 6206B.
 - (7) Oscilloscope, Tektronix Type 503.
 - (8) 50 ohm Detector, Singer Model 1001.

- (9) Extender Cable, WI-CEI Type EC-205.
- (10) Assorted Cables, Connectors, and Alignment Tools.
- (11) High-Z Detector (Refer to Figure 4-1).

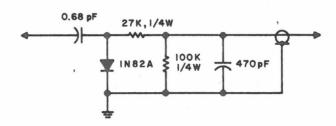


Figure 4-1. High-Z Detector, Schematic Diagram

- (12) One 1.8k ohm 1/4 watt and one 82 ohm 1/4 watt resistors.
- 4.5.2 250-500 MHz RF Tuner Alignment. To align the 250-500 MHz RF Tuner (A1) proceed as follows:
- 4.5.2.1 Input Double-tuned Circuit. -
 - (1) Connect the equipment as shown in Figure 4-2.
 - (2) Remove the UH-11(-1) shaper board (A2).
 - (3) Connect a jumper wire from A1C1 to ground and connect a 1.8k ohm resistor from A1C2 to A1C13.

CAUTION

Before energizing the equipment, make sure that the regulated power supply voltage will not exceed +2 to $+28\,\mathrm{Vdc}$. Failure to observe this caution may result in the destruction of matched varactor diodes in the 250-500 MHz voltage tuner.

NOTE

The regulated power supply is used to provide tuning voltage for the 250-500 MHz voltage tuner. Succeeding steps in this procedure refer to this voltage as the tuning voltage. Its level can be read on the digital voltmeter. Operating controls on the associated 205-() receiver may be left in any position.

- (4) Set the tuning voltage to +25V as displayed on the digital voltmeter. Adjust the sweep generator and oscilloscope controls to display a 500 MHz response. Use either the HP-612A Signal Generator or the sweep generator 50 MHz marker to provide a 500 MHz center frequency marker.
- (5) Adjust A1C4 and A1C9 for a maximum amplitude response about the 500 MHz marker. Figure 4-3 shows a typical response.

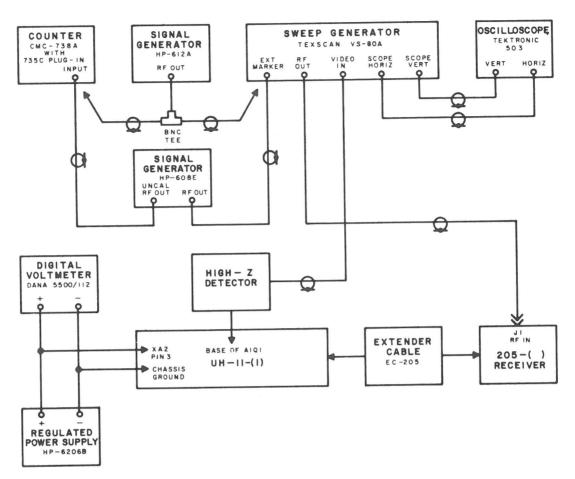


Figure 4-2. Tuner Alignment, Equipment Connections

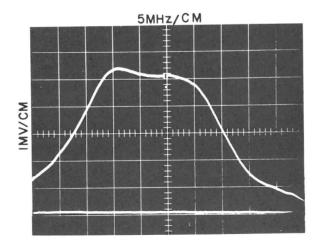


Figure 4-3. Typical 500 MHz RF Response

- (6) Set the tuning voltage to approximately 2.5V and adjust the sweep generator to display the 250 MHz response. Use the HP-608E signal generator to provide a 250 MHz marker, or use the sweep generator internal 50 MHz markers.
- (7) Adjust the tuning voltage to center the displayed response about the 250 MHz marker and adjust the orientation of A1L3 and A1L6 for a response similar to Figure 4-4.

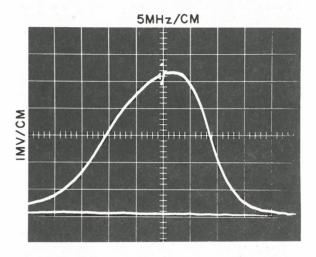


Figure 4-4. Typical 250 MHz RF Response

- (8) Repeat steps (4) through (7) until the band edge RF responses are correctly set. Record the 250~MHz tuning voltage and use this voltage in all succeeding steps which require tuning to 250~MHz.
- 4.5.2.2 Interstage Double-Tuned Circuit. -
 - (1) Disconnect the jumper wire from A1E5 which connects to A1A2E1. Remove the high-Z detector cable from the sweep generator VIDEO IN jack, but leave the high-Z detector connected to A1Q1. Connect a 50 ohm detector between A1E5 and the sweep generator VIDEO IN jack.
 - (2) Set the tuning voltage to +25V and adjust the sweep generator controls to display a 500 MHz response with a 500 MHz marker. Adjust A1C29 and A1C35 for a symmetrical response centered about the marker. Figure 4-5 shows a typical response.
 - (3) Set the tuning voltage to 250 MHz and adjust the sweep generator to display the 250 MHz response curve. Adjust the orientation of A1L10 and A1L15 for a maximum amplitude response centered about the 250 MHz marker. Adjust the tapping of A1L12 at A1L9, and A1E5 at A1L13 if necessary to achieve transitional coupling with a bandpass of 10 to 13 MHz as shown in Figure 4-6.
 - (4) Repeat step (2) and check for a bandwidth of approximately 25 MHz at the 3 dB points on the response.
 - (5) Repeat steps (2) through (4) until the bandpass tuning and responses are correctly set.
 - (6) Set the tuning voltage and sweep generator to 500 MHz. Remove the high-Z detector connection from AlQ1. Adjust AlC1 to restore the bandpass response obtained in step (4), if necessary.

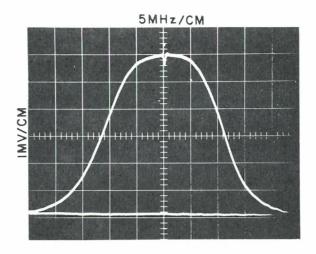


Figure 4-5. Typical 500 MHz Response

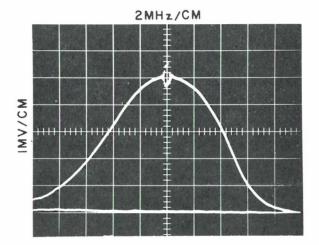


Figure 4-6. Typical 250 MHz Response

(7) Adjust the tuning voltage and the sweep generator over the entire 250 to 500 MHz range while observing the displayed response. The response should remain nearly symmetrical over this range. Set a 0 dB reference on the oscilloscope. (Connect the sweep generator RF output to the 50 ohm detector and set a 0 dB level on the oscilloscope.) Restore the sweep connections as in step (1) and measure the RF gain by increasing the attenuator setting until the scope deflection at the center of the frequency display is the same deflection as the 0 dB reference. The RF gain should be approximately 10 dB over the 250-500 MHz range. Remove the 50 ohm detector and reconnect the jumper from A1E5 to A1A2E1.

4.5.2.3 160 MHz IF.

(1) Connect the sweep generator RF output to A1A2U1, pin 3. (Mixer output.) Connect the 50 ohm detector to A1J2. Adjust the sweep generator controls to display a 160 MHz response. Use the HP-608E signal generator to provide a 160 MHz marker.

Figure 4-7

(2) Adjust A1C52, A1C57, A1C65, and A1C60 for maximum amplitude 160 MHz response. The response should be 3 to 5 MHz wide at the 3 dB points for a UH-11 and 5 to 7 MHz wide for a UH-11(-1). The response should show critical coupling or a maximum of 1/2 dB ripple at the center. Figure 4-7 shows a typical UH-11 160 MHz IF response.

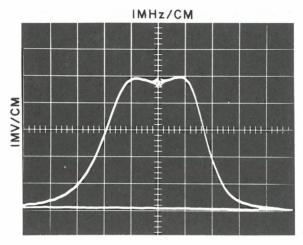


Figure 4-7. Typical 160 MHz IF Response (UH-11)

(3) Repeat step (2) until the proper 160 MHz IF response is obtained.

4.5.2.4 Local Oscillator. -

- (1) Connect the spectrum analyzer to A1J3.
- (2) Set the tuning voltage to 500 MHz. Adjust the spectrum analyzer to display the local oscillator signal (approximately 660 MHz). Adjust A1C37 to set the local oscillator frequency as close to 660 MHz as possible using the spectrum analyzer display.
- (3) Adjust A1C50 for maximum local oscillator output.
- (4) Set the tuning voltage to 250 MHz and using A1C33 tune the local oscillator to $410 \; \text{MHz}$ as displayed on the spectrum analyzer. Adjust A1C46 for maximum local oscillator output.
- (5) Repeat steps (2) through (4) until the local oscillator frequency is approximately set. Final local oscillator frequency adjustment will be made later using the frequency counter.

NOTE

If the local oscillator adjustment is being made due to changing the LO transistor A1Q3, proceed to step (6).

(6) Adjust the tuning voltage from 250 to 500 MHz while observing the LO output on the spectrum analyzer. If the LO signal abruptly jumps in frequency, or spurious signals appear around the LO signal, it may be necessary to adjust the loading on A1Q3. If necessary, shunt A1L11 with a 1/4 watt resistor between 8.2 K and 4.7 K ohms. Use the largest value resistor which provides the necessary loading. Keep

- the resistor leads as short as possible. Recheck the LO signal over the 410 to 660 MHz range. In some cases it may be necessary to change C30 to a smaller value or complete removal of C30 may be necessary to achieve a clean oscillator signal.
- (7) Connect the frequency counter to AlJ3. Set the tuning voltage to 500 MHz and adjust AlC37 to set the local oscillator to 660.00 MHz. Adjust the tuning voltage to 250 MHz and set the local oscillator frequency to 410.00 MHz with AlC33.

4.5.2.5 250-500 MHz RF Tuner Overall Alignment. -

- (1) Install the tuner cover. Connect the sweep generator RF output to AlJ1 and the 50 ohm detector to AlJ2.
- (2) Set the tuning voltage to 500 MHz and adjust the sweep generator to 500 MHz. Use a 500 MHz marker. Observe the response displayed on the oscilloscope. The IF response should be centered on the 500 MHz marker. Tune A1C37 and observe the IF response track across the RF response. If tilt is noticed on the response a slight adjustment of A1C35 will restore the symmetry.
- (3) Using the frequency counter to measure the local oscillator frequency, set the LO to 664.00 MHz with A1C37. Use a 504 MHz RF marker and observe that the IF response is now centered about the 504 MHz marker. A typical response is shown in Figure 4-8.

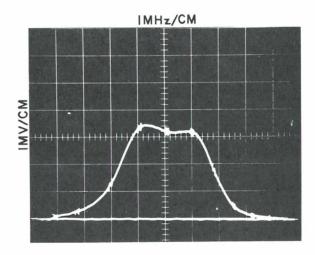


Figure 4-8. Typical 500 MHz Overall Voltage Tuner Response

- (4) Tune to 250 MHz and reset the LO frequency to 410.00 MHz using the counter. Set the tuning voltage to 500 MHz and set the LO to 664.00 MHz with A1C37 if required. Repeat step (4) until the LO frequency range is set correctly.
- (5) Tune to 250 MHz with the tuning voltage and sweep generator. A typical 250 MHz overall response is shown in Figure 4-9.

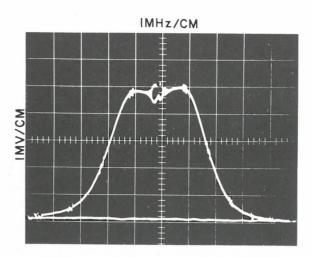


Figure 4-9. Typical 250 MHz Overall Voltage Tuner Response

- (6) Tune from 250 to 500 MHz with the tuning voltage and sweep generator while observing gain variations over the band. Adjust A1C60 to minimize IF response tilt across the entire tuning range. Measure the overall 250-500 MHz RF tuner gain across the band. The overall tuner gain should be nominally 14 dB. Adjust A1C65 to minimize gain change noted across the 250-500 MHz range.
- 4.5.2.6 160 MHz Trap. -
 - (1) Connect the HP-608E signal generator to AlJ1 and adjust for a 160 MHz CW output signal.
 - (2) Connect the spectrum analyzer to A1J2 and adjust to observe the 160 MHz IF output signal.
 - (3) Increase the signal generator output level until the 160 MHz feedthrough can be observed on the spectrum analyzer. Adjust A1C15 for minimum 160 MHz signal feedthrough. Remove the jumper connected between A1C1 and ground. Remove the 1.8 K ohm resistor between A1C2 and A1C13.
- 4.5.3 AGC Shaping Circuit/160-21.4 MHz Converter. To align this module proceed as follows:
- 4.5.3.1 AGC Shaping Circuit. -
 - (1) Remove the 250-500 MHz RF tuner plug (A1P1) from its receptacle.
 - (2) Connect an 82 ohm 1/4 watt resistor between A4C3 and A4C5. Connect the digital voltmeter test leads across the resistor just installed. (Note: remove the digital voltmeter ground strap.)
 - (3) Adjust A4A1R8 for a voltmeter reading of 0.82 Vdc (10 mA).
 - (4) Remove the 82 ohm resistor installed in step (2). Reconnect plug A1P1 to its receptacle.
- 4.5.3.2 160-21.4 MHz Converter. -
 - Connect the sweep generator RF output to A4J1. Connect the 50 ohm detector to A4J2.
 - (2) Set the sweep generator controls for a 160 MHz center frequency sweep output. Use the HP-608E to provide a 160 MHz marker.
 - (3) Adjust A4A2C3 to obtain a 21.4 MHz output response on the oscilloscope as the local oscillator starts and center the response about the marker.

(4) Adjust A4A2C9 to set the high-end roll-off of the bandpass to obtain the response shown in Figure 4-10.

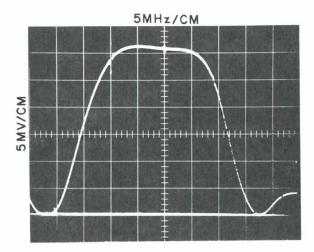


Figure 4-10. Typical 21.4 MHz IF Response

- (5) Readjust A4A2C3 to obtain maximum amplitude of the response. Turn the 205-()Receiver power off and back on to ensure reliable oscillator starting. The converter gain adjustment will be made in a following alignment.
- (6) Remove the sweep generator and detector connections and restore all normal connections to A4.

4.5.4 Overall UH-11(-1) RF Alignment. - Proceed as follows:

- (1) Connect the sweep generator RF output to A1J1 and connect the 50 ohm detector to A4J2.
- (2) Tune the sweep generator and UH-11(-1) across the 250 to 500 MHz tuning range. Adjust A1C60 to minimize tilt in the response across the tuning range if necessary. Figure 4-11 shows a typical response.

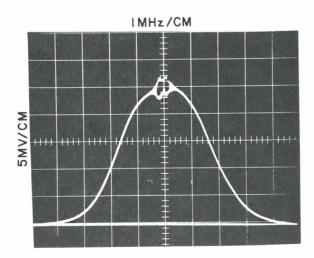


Figure 4-11. Typical Overall Response (250 MHz)

(3) Adjust the sweep generator controls for a 350 MHz sweep output with a 350 MHz marker. Set the tuning voltage to 350 MHz (-2.00 Vdc). Figure 4-12 shows a typical response.

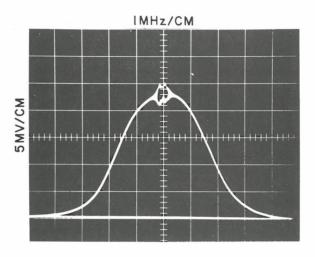


Figure 4-12. Typical Overall Response (350 MHz)

(4) Set the tuning voltage and the sweep generator to 500 MHz with a 500 MHz marker. Figure 4-13 shows a typical response.

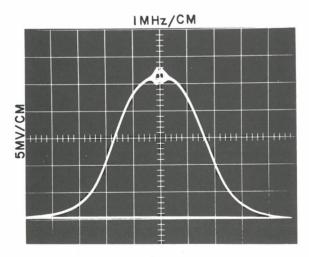


Figure 4-13. Typical Overall Response (500 MHz)

(5) Tune from 250-500 MHz with the sweep generator and tuning voltage noting the maximum and minimum amplitude variation points in the IF response. Tune halfway between the points noted and set A4A2R17 for an overall UH-11(-1) gain of 20 dB. Remove the sweep generator and detector connections. Restore the normal connection to A4J2. Replace shaping amplifier A2 in its receptacle.

4.5.5 Shaping Amplifier. - The shaping amplifier receives a +10.3 Vdc to -10.3 Vdc tuning voltage from the 205-() Receiver and provides a +2.5 Vdc to +25 Vdc voltage output that is shaped to complement the characteristics

of the varactor tuning diodes in the RF tuner, A1. Accurate alignment of the shaping amplifier will provide tuning linearity greater than the 1% specification. This alignment procedure is complex and should be attempted only when absolutely necessary. Proceed as follows:

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

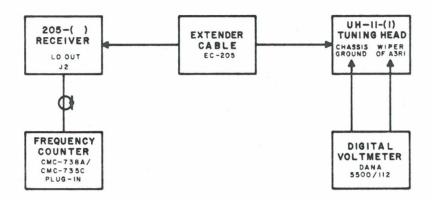


Figure 4-14. Equipment Connections, Shaping Amplifier Alignment

- (2) Set the 205-() Receiver controls as follows:
 - a. FINE TUNING Midrange
 - b. Reception Mode AM MAN
 - c. Tuning Mode MAN

NOTE

Controls not specifically referred to may be left in any position, and will not affect the alignment procedure.

(3) Manually tune the UH-11(-1) for a voltmeter reading of -10.00 Vdc and note the frequency counter readout. Compare the readout obtained to the LO frequency specified in Table 4-1. Tune the UH-11(-1) over the entire range of 250-500 MHz, stopping at 1 volt (tuning voltage) intervals and comparing the LO readouts obtained to Table 4-1. If the readouts obtained are within the ±2.5 MHz tolerance, no alignment should be attempted. If the readouts obtained are out of tolerance, proceed to step (4) and perform a complete shaping amplifier alignment.

Table 4-2. Tuning Voltage Versus Frequency

Tuning Voltage	Tuned Frequency MHz	LO Frequency MHz	Tuning Voltage	Tuned Frequency MHz	LO Frequency MHz
-10.00	250, 00	410.00 <u>Set R5</u>	-7.00	287.50	447.50
-9.50	256, 25	416.25	-6.50	293.75	453.75
-9.00	262, 50	422.50	-6.00	300.00	460.00
-8.50	268, 75	428.75	-5.50	306.25	466.25
-8.00	275, 00	435.00	-5.00	312.50	472.50
-7.50	281, 25	441.25	-4.50	318.75	478.75

Table 4-2. Tuning Voltage Versus Frequency (Continued)

Tuning Voltage	Tuned Frequency MHz	LO Frequency MHz	Tuning Voltage	Tuned Frequency MHz	LO Frequency MHz
-4.00 -3.50 -3.00 -2.50 -2.00 -1.50 -1.00 -0.50 0.00 +0.50 +1.00 +1.50 +2.00 +2.50 +3.00	325. 00 331. 25 337. 50 343. 75 350. 00 356. 25 362. 50 368. 75 375. 00 381. 25 387. 50 393. 75 400. 00 406. 25 412. 50	485. 00 491. 25 497. 50 503. 75 510. 00 516. 25 522. 50 528. 75 535. 00 Set R3 541. 25 547. 50 553. 75 560. 00 566. 25 572. 50 Set R27	+3.50 +4.00 +4.50 +5.00 +5.50 +6.00 +6.50 +7.00 +7.50 +8.00 +8.50 +9.00 +9.50 +10.00	418.75 425.00 431.25 437.50 443.75 450.00 456.25 462.50 468.75 475.00 481.25 487.50 493.75 500.00	578. 75 585. 00 Set R32 591. 25 597. 50 603. 75 610. 00 616. 25 622. 50 Set R37 628. 75 635. 00 641. 25 647. 50 Set R42 653. 75 660. 00 Set R47

- (4) Tune the UH-11(-1) for a voltmeter reading of 0.00 Vdc and adjust A2R3 for a counter readout of 535.00 MHz.
- (5) Tune for a voltmeter reading of -10,00 Vdc and adjust A2R5 for a counter readout of 410,00 MHz.
- (6) Repeat steps (4) and (5) making adjustments which correct one-half the counter readout error until the low band half limits are correctly set.
- (7) Tune for a voltmeter reading of +3.00 Vdc and adjust A2R27 for a counter readout of 572.50 MHz.
- (8) Tune for a voltmeter reading of +4.00 Vdc and adjust A7R32 for a counter readout of 585.00 MHz.
- (9) Tune for a voltmeter reading of +7.00 Vdc and adjust A2R37 for a counter readout of 622.50 MHz.
- (10) Tune for a voltmeter reading of +9.00 Vdc and adjust A2R42 for a counter readout of 647.50 MHz.
- (11) Tune for a voltmeter reading of +10.00 Vdc and adjust A2R47 for a counter readout of 660.00 MHz.
- (12) Tune the UH-11(-1) in 1 volt steps from -10.00 Vdc to 0.00 Vdc comparing the frequency readouts obtained with Table 4-1. If the frequencies obtained exceed the specified tolerances over this range, make compromise adjustments between A2R3 and A2R5 until tracking of the lower band half is obtained.
- (13) Tune the UH-11(-1) in 1 volt steps from 0.00 Vdc to +10.00 Vdc noting the displayed frequencies at each point and compare to Table 4-1. If the frequency tolerances specified are exceeded, adjust the appropriate controls as noted in Table 4-1. Make the adjustments starting at the lowest voltage reading and proceed in increasing voltage sequence to +10.00 Vdc. Making adjustments in this manner will result in minimum interaction between the adjustments.
- (14) Repeat step (13) until the high band half tracking is obtained.

Figure 4-15

4.6 PERFORMANCE CHECKS

Selected tests are presented in subsequent paragraphs which can be used to determine the relative performance of the UH-11(-1). The following test instruments or their equivalents are required:

- 1) Signal Generator, HP-608E
- 2) Extender Cable, WJ, EC-205
- 3) Signal Monitor, WJ, SM-7301(A)
- 4) RF Voltmeter, Boonton 91DA-S5 with a 91-14A TEE adapter and a 50 ohm termination
- 5) Misc. cables, connectors, adapters, etc.

4.6.1 Overall Gain and AGC Range. - Proceed as follows:

1) Connect the test equipment as shown in Figure 4-15.

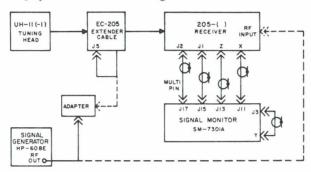


Figure 4-15. Equipment Connections, Overall Gain and AGC Range Tests

- 2) Set the following 205-() controls:
 - A. Reception mode AM/MAN
 - B. Tuning mode MAN
 - C. RF GAIN MAX CW
- 3) Set the SM-7301(A) controls as follows:
 - A. SWEEP WIDTH kHz 500
 - B. VERT DISPLAY LOG
 - C. CENTER FREQ Activate marker and center; switch marker off
 - D. GAIN MAX CW
- 4) With no signal input to the UH-11(-1) note the signal monitor noise level, i.e., height of "grass" deflection. Remove the plug connected to J5 on the EC-205 and connect the signal generator to the plug using an appropriate adapter. Tune the generator to 21.4 MHz and adjust the controls for a CW output signal centered on the signal display screen with an amplitude equal to the noise level noted previously. Increase the signal generator output level 20 dB and record the attenuator dBm setting. Adjust the signal monitor gain control for a convenient reference level of the displayed signal. Note the reference line and do not disturb the gain control after setting.
- 5) Remove the signal generator connection from the EC-205 plug and return the plug to J5 on the adapter. Connect the signal generator to the RF INPUT jack on the 205-() rear panel. Adjust the signal generator for a 250 MHz CW output and center the displayed signal on the SM-7301(A).
- 6) Decrease the signal generator attenuator setting until the displayed signal amplitude equals the reference noted in step 4.
- 7) Record the attenuator dBm reading and subtract the reading noted in step 4. The difference should be approximately 17-22 dB.

Figure 4-16

- 8) Set the 205-() RF GAIN control to MAX CCW.
- 9) Increase the signal generator attenuator until the displayed signal returns to the signal display reference. Record the attenuator dBm reading. Subtract the attenuator reading from the reading recorded in step 7. The difference should be greater than 30 dB.
- 10) Set the 205-() RF GAIN to MAX CW and repeat steps 5 through 9 checking the UH-11(-1) gain and AGC range at 300, 350, 400, and 450 MHz.

4.6.2 LO Output Level. - Proceed as follows:

1) Connect the equipment as shown in Figure 4-16.

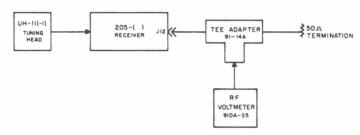


Figure 4-16. Equipment Connections, LO Output Level Test

2) Tune the UH-11(-1) slowly over the range of 250-500 MHz checking the LO output level. The levels should be greater than 50 mV.

Table 4-3. Typical Semiconductor Element Voltages

β β β						Integra	Integrated Circuit Pin Numbers	t Pin Numk	ers			
sig. Type Drain Gate 2 Gate 1 Source 2N2857 TA7153 14.0 3.6 1.0 1.3 2N2857 2N2857 14.0 3.6 1.0 1.3 2N2857 2N2857 14.0 1.3 1.3 2N5109 4A714C 4A714C 1.0 1.3 2N5109 2N5109 2N5109 1.0 1.0 1.0			1	2	8	4	ß	9	7	∞	6	10
sig. Type Drain Gate 2 Gate 1 Source 2N2857 TA7153 14, 0 3, 6 1, 0 1, 3 2N2616 2N2857 14, 0 3, 6 1, 0 1, 3 2N2857 2N2857 2N5109 4A714C 4A714C 4A714C 2N5109 2N5109 2N5109			Fie	ld Effect T	ransistor P	ins				Transistor Elements	stor nts	
2N2857 TA7153 14.0 3.6 1.0 1.3 2N2857 2N2857 2N2857 2N5109 \$\mu A714C\$ \$\mu A714C\$ 2N5109 \$\mu A714C\$ 2N5109	Desig.	Type	Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
TA7153 14.0 3.6 1.0 1.3 2N2616 2N2857 2N2857 2N5109 μA714C μA714C 2N5109 1 2N5109	21	2N2857								-10.7	6.6-	0.2
2N2616 2N2857 2N2857 2N5109 2N2857 2N5109 μA714C μA714C	72	TA7153	14.0	3.6	1.0	1.3						
1 2 1 2	23	2N2616					¥			-10.1	-10,3	0
	74	2N2857								-14.5	-13.0	-9.2
	25	2N2857								-10.2	-9.2	0
	98	2N5109	5							-6.4	-7.3	0
	27	2N2857								-11.9	-11.2	0
	1201	2N5109								-13.3	-12.3	-7.3
	AIUI	μΑ714C										
	AIU2	μΑ714C										
	1201	2N5109										
	A4A2Q2	2N3478										

1. Drain 2. Source 3. Gate 4. Bulk and Case
2N 5 3 9 7
1. Drain 2. Gate No. 2 3. Gate No. 1 4. Source
TA 7 1 5 3
JA 714 C
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

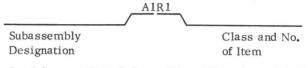
readings positive with respect to ground unless otherwise specified. Measurements taken with a Dana Type 5500/112 Digital Voltmeter. TEST CONDITIONS: 205-() Receiver in MAN mode, 115 Vac input; UH-11(-1) tuned to 250 MHz, no signal input; all

REPLACEMENT PARTS LIST

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:



Read from right to left as: First (1) resistor (R) of first (1) subassembly (A)

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

5.2 REFERENCE DESIGNATION PREFIX

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

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address	Mfr. Code	Name and Address
00328	Sterling Instrument Division of Designatronics, Inc. 76 East Second Street Mineola, New York 11501	04013	Taurus Corporation 1 Academy Hill Lambertville, New Jersey 08530
01037	Pyroferric - N. Y., Incorporated Bronx Blvd. at 216th Street Bronx, New York 10467	04941	Walsco Electronics Corporation 4 South Wyman Rockford, Illinois 61101
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53204	07263	Fairchild Camera & Instrument Corp. Semiconductor Division 313 Frontage Road Mountain View, California 94040
01351	Dynamic Gear Company, Inc. 173-177 Dixon Avenue Amityville, New York 11701	08524	Deutsch Fastener Corporation P. O. Box 90925 7001 West Imperial Highway Los Angeles, California 90009
02114	Ferroxcube Corp. of America Mt. Marion Road Saugerties, New York 12477	14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, Maryland 20760
02735	RCA Corporation Solid State Division Route 202 Somerville, New Jersey 08876	15818	Teledyne, Incorporated Amelco Semiconductor Division P. O. Box 1030 Mountain View, California 94042

REPLACEMENT PARTS LIST

Mfr. Code	Name and Address	Mfr. Code	Name and Address
16179	Omni-Spectra, Incorporated 24600 Hallwood Court Farmington, Michigan 48024	72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512
19505	Applied Engineering Products Company Division of Samarius Inc. 26 E. Main Street Ansonia, Connecticut 06401	73138	Beckman Instruments, Incorporated Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
25088	Siemens America, Incorporated 350 5th Avenue New York, New York 10001	73899	JFD Electronics Company Division of Stratford Retreat House 15th at 62nd Street Brooklyn, New York 11219
26805	Americon Corporation 87 Rumford Avenue Waltham, Massachusetts 02154	79136	Waldes Kohinoor, Incorporated 47-16 Austel Place Long Island City, New York 11101
27956	Relcom 2164 East Middlefield Road Mountain View, California 94040	80131	Electronic Industries Association 2001 Eye Street N. W. Washington, D. C. 20006
28480	Hewlett-Packard Company 1501 Page Mill Road Palo Alto, California 94304	81312	Winchester Electronics Division Litton Industries, Inc. Main Street & Hillside Avenue Oakville, Connecticut 06779
56289	Sprague Electric Company Marshall Street North Adams, Massachusetts 01247	81349	Military Specifications
70417	Chrysler Corporation Amplex Division 6501 Harper Avenue Detroit, Michigan 48211	83086	New Hampshire Ball Bearings, Inc. Peterborough, New Hampshire 03458
71468	ITT Cannon Electric Incorporated 3208 Humbolt Street Los Angeles, California 90031	91293	Johanson Manufacturing Company P.O. Box 329 Boonton, New Jersey 07005
71590	Globe-Union Incorporated Centralab Division P.O. Box 591 Milwaukee, Wisconsin 53201	91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640	91737	Gremar Manufacturing Co., Inc. 7 North Avenue Wakefield, Massachusetts 01880
71785	Cinch Manufacturing Company Howard B. Jones Division 1026 S. Homan Avenue Chicago, Illinois 60624	95121	Quality Components, Inc. P. O. Box 113 St. Mary's, Pennsylvania 15857

Courtesy of http://BlackRadios.terryo.org

UH-11 UH-11-1

REPLACEMENT PARTS LIST

Mfr. Code	Name and Address	Mfr. Code	Name and Address
96906	Military Standards Promulgated by Standardization Division Directorate of Logistic Services DSA	99848	Wilco Corporation 4030 West 10th Street P.O. Box 22248 Indianapolis, Indiana 46222

5.4 PARTS LIST

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

NOTE

As improved semiconductors become available it is the policy of CEI Division 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.

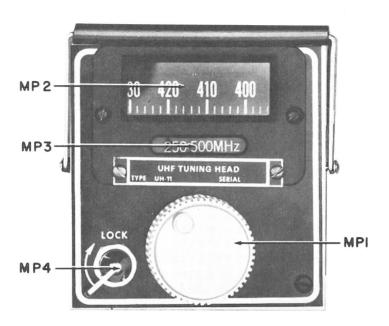


Figure 5-1. Type UH-11(-1) Tuning Head, Front View Location of Components

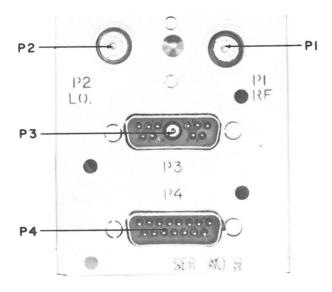


Figure 5-2. Type UH-11(-1) Tuning Head, Rear View Location of Components

REPLACEMENT PARTS LIST

5.4.1 Types UH-11 and UH-11-1 Tuning Heads

REF DESIG	DESCRIPTION		QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
A1	RF TUNER 250-500 MHz (UH-11)		1	71320-1	14632
A1	RF TUNER 250-500 MHz (UH-11-1)		1	71320-2	14632
A2	SHAPING AMPLIFIER		1	79844-5	14632
А3	TUNING DRIVE ASSEMBLY		1	8588	14632
A4	AGC SHAPING CIRCUIT/160 to 21.4 MHz COASSEMBLY	ONVERTER	1	79774	14632
Ј1	CONNECTOR, RECEPTACLE, MULTIPIN		2	SRE-14SNSS	81312
J2	Same as J1				
MP1	CRANK ASSEMBLY		1	11755-5	14632
MP2	WINDOW		1	11448-4	14632
МР3	WINDOW		1	11449-1	14632
MP4	LOCK ASSEMBLY		1	15788-1	14632
P1	CONNECTOR, PLUG, PUSH-ON SERIES	Part of W3	2	19699-1	91737
P2	Same as P1	Part of W2			
Р3	CONNECTOR, PLUG, MULTIPIN		1	DAM-11W1P	71468
P3A1	CONNECTOR, PLUG, COAXIAL INSERT	Part of W1	1	DM53740-5001	71468
P4	CONNECTOR, PLUG, MULTIPIN		1	DAM-15P	71468
P5	CONNECTOR, PLUG, SMA SERIES	Part of W3	3	521-3	16179
P6	Same as P5	Part of W2			
P7	Same as P5	Part of W4		,	
P8	CONNECTOR, PLUG, MINIATURE SERIES	Part of W4	2	UG-1466/U	81349
P9	Same as P8	Part of W1			
W1	CABLE AND CONNECTOR ASSEMBLY		1	30020-1365	14632
W2	CABLE AND CONNECTOR ASSEMBLY		1	30020-1366	14632
W3	CABLE AND CONNECTOR ASSEMBLY		1	30020-1367	14632
W4	CABLE AND CONNECTOR ASSEMBLY		1	30020-1368	14632
XA2	CONNECTOR, PRINTED CIRCUIT CARD		1	250-22-30-170	71785

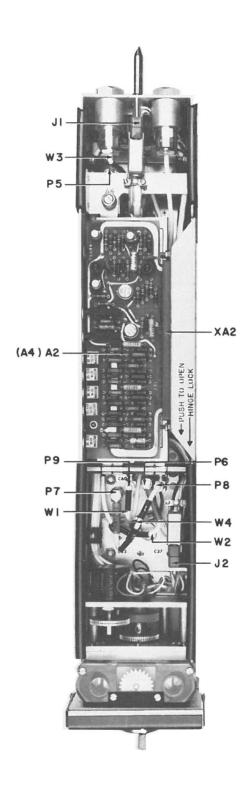


Figure 5-3. Type UH-11(-1) Tuning Head, Top View Location of Components

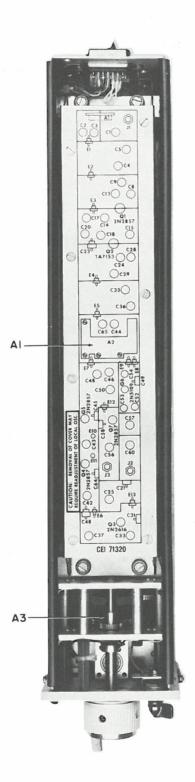


Figure 5-4. Type UH-11(-1) Tuning Head, Bottom View Locations of Components

5.4.2 Types 71320-1 and 71320-2 250-500 MHz RF Tuners

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
A1	AGC BOARD	1	15980	14632
A2	MIXER IF BOARD	1	16016	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU: 470 pF, 20%, 500V	19	FA5C-4712	01121
C2	Same as C1			
C3	Same as C1		#1 100	
C4	CAPACITOR, VARIABLE, AIR: 0.4-6 pF, 250V	6	MVM-006	73899
C5	Same as C1		9	
C6	CAPACITOR, CERAMIC, DISC: 470 pF, 5%, 300V	8	UY03-471J	73899
C7	Same as C6			
C8	Same as C1			
C9	Same as C4			
C10	CAPACITOR, CERAMIC, DISC: 100 pF, 5%, 300V	7	UY02-101J	73899
C11	Same as C6			
C12	Same as C6			
C13	Same as C1			
C14	CAPACITOR, CERAMIC, STANDOFF: 470 pF, 20%, 500V	10	SS5D-4712	01121
C15	CAPACITOR, VARIABLE, AIR: 0.8-10 pF, 250V	6	2954	91293
C16	Same as C10			
C17	Same as C1			
C18	Same as C14			,
C19	CAPACITOR, CERAMIC, DISC: 0.01 pF, 20%, 100V	1	C023B101F103M	56289
C20	Same as C1			
C21	Same as C14			
C22	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 μ F, 20%, 25 V	1	109D107X0025F2	56289
C23	Same as C1			
C24	Same as C14			
C25	Same as C1			
C26	Same as C6			
C27	Same as C10			
C28	Same as C1			
C29	Same as C4			
C30**	CAPACITOR, CERAMIC, TUBULAR: 0.68 pF, ±.1 pF, 500V	1	301-000-C0K0-688B	72982
C31	Same as C14			

^{**} Nominal value. Final value factory selected. Component may be omitted.

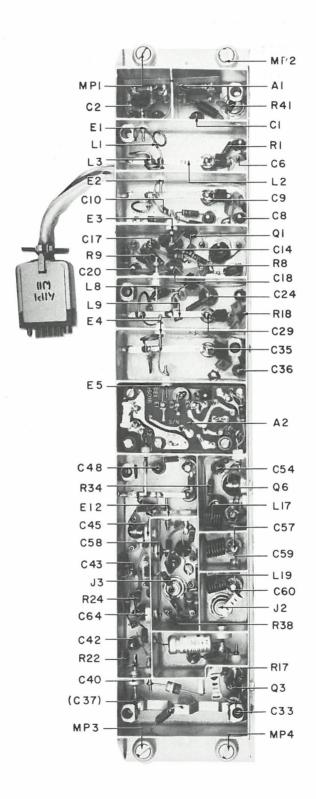


Figure 5-5. Types 71320-1 and 71320-2 250-500 MHz RF Tuners (A1), Locations of Components

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
C32	Same as C6			
C33	Same as C15		1	
C34	Same as C6			
C35	Same as C4			
C36	Same as C1		4	
C37	Same as C4			
C38	Same as C6		,	
C39	CAPACITOR, COMPOSITION, TUBULAR: 1.0 pF, 10% 500V	1	QC(1pF,K)	95121
C40	Same as C1			
C41	Same as C10			
C42	Same as C1			-,
C43	Same as C1			-
C44	Same as C1			
C45	Same as C14			
C46	CAPACITOR, VARIABLE, AIR: 1.0-14 pF, 250V	1	4480	91293
C47	CAPACITOR, CERAMIC, DISC: 12 pF, 5%, 300V	1	UY01-120J	73899
C48	Same as C1			
C49	Same as C14		147	
C50	Same as C4			
C51	Same as C10			
C52	Same as C15			
C53	Same as C14			
C54	Same as C1			
C55	CAPACITOR, COMPOSITION, TUBULAR: 0.22 pF, 10%, 500V (Type 71320-1)	1	QC(.22pF,K)	95121
C55	CAPACITOR, COMPOSITION, TUBULAR: 0.24 pF, 10%, 500V (Type 71320-2)	1	QC(.24pF,K)	95121
C56	Same as C1		* *	
C57	Same as C15			
C58	Same as C14			
C59	CAPACITOR, COMPOSITION, TUBULAR: 0.24 pF, 10%, 500V (Type 71320-1)	1	QC(.24pF,K)	95121
C59	CAPACITOR, COMPOSITION, TUBULAR: 0.33 pF, 10%, 500V (Type 71320-2)	1	QC(.33pF,K)	95121
C60	Same as C15			

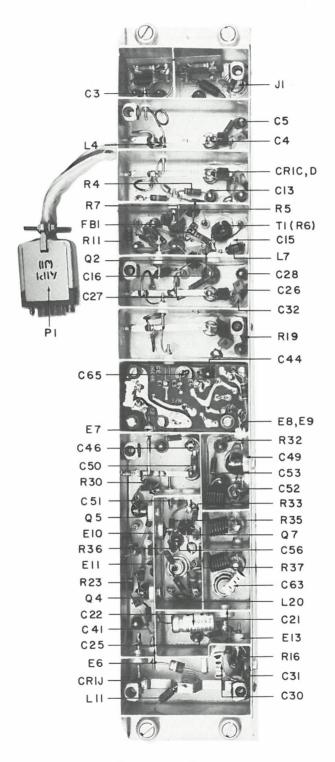


Figure 5-6. Types 71320-1 and 71320-2 250-500 MHz RF Tuners (A1), Locations of Components

REPLACEMENT PARTS LIST

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C61	CAPACITOR, COMPOSITION, TUBULAR: 0.47 pF, 10%, 500V	1	QC(.47pF,K)	95121
C62	CAPACITOR, COMPOSITION, TUBULAR: 0.39 pF, 10%, 500V	1	QC(.39pF,K)	95121
C63	CAPACITOR, CERAMIC, TUBULAR: 1.5 pF, ±.1 pF, 500V (Type 71320-1)	1	301-000-C0K0-159B	72982
C63	CAPACITOR, CERAMIC, TUBULAR: 1.8 pF, ±.1 pF, 500V (Type 71320-2)	1	301-000-C0K0-189B	72982
C64	Same as C14			-
C65	Same as C15			
CR1	DIODE	1	15781-1	14632
CR2	DIODE	1	1N462A	80131
CR3	DIODE	1	BB105B	25088
E1	TERMINAL, FEEDTHRU	13	SFU-16	04013
E2	Same as E1			
E3	Same as E1			
E4	Same as E1			
E5	Same as E1			
E6	Same as E1			
E7	Same as E1			
E8	Same as E1			
E9	Same as E1			
E10	Same as E1		,,	
E11	Same as E1			
E12	Same as E1			
E13	Same as E1			
FB1	FERRITE BEAD	1	56-590-65/4A	02114
FB2	FERRITE BEAD	3	P5-1288	01037
FB3	Same as FB2			
FB4	Same as FB2			
ј1	CONNECTOR, RECEPTACLE, SMA SERIES	3	2058-0000	26805
Ј2	Same as J1			
Ј3	Same as J1			
L1	COIL, FIXED	3	22292-19	14632
L2	INDUCTOR	1	16101-4	14632
L3	COIL, FIXED	4	16105-1	14632

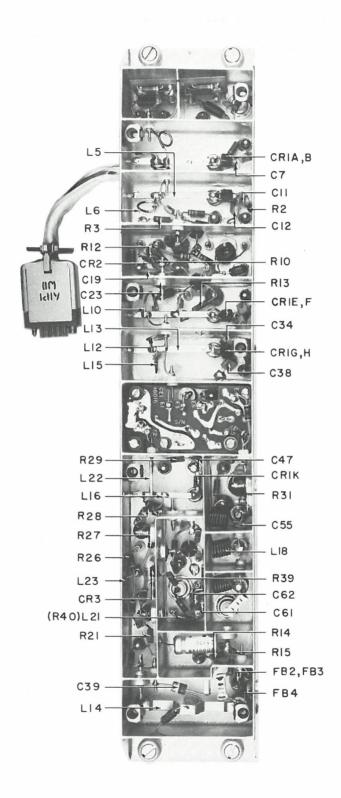


Figure 5-7. Types 71320-1 and 71320-2 250-500 MHz RF Tuners (A1), Location of Components

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
L4	Same as L1			
L5	COIL, FIXED	1	16101-3	14632
L6	Same as L3			
L7	COIL, FIXED: 0.47 μ H	1	201-11	99848
L8	COIL, FIXED: $0.68 \mu H$	1	203-11	99848
L9	COIL, FIXED	1	16101-2	14632
L10	Same as L3			
L11*	COIL, FIXED	1	21209-8	14632
L12	Same as L1			
L13	COIL, FIXED	1	16101-1	14632
L14	INDUCTOR	1	16103-1	14632
L15	Same as L3		ž	
L16	INDUCTOR	1	16102-1	14632
L17	COIL, FIXED	1	22292-21	14632
L18	COIL, FIXED (Type 71320-1)	1	22292-21	14632
L18	COIL, FIXED (Type 71320-2)	1	22292-39	14632
L19	COIL, FIXED (Type 71320-1)	1	22292-21	14632
L19	COIL, FIXED (Type 71320-2)	1	22292-39	14632
L20	COIL, FIXED	2	22292-20	14632
L21	Same as L20			
L22	INDUCTOR	1	16104-1	14632
L23	INDUCTOR	1	15542-4	14632
MP1	SCREW, PANEL FASTENER	4	D7500-6A1	08524
MP2	Same as MP1			
MP3	Same as MP1			
MP4	Same as MP1			
MP5	COVER (Type 71320-1)	1	22512-1	14632
MP5	COVER (Type 71320-2)	1	22512-2	14632
P1	CONNECTOR, PLUG, MULTIPIN	1	SRE-14PNSSH13	81312
Q1	TRANSISTOR	4	2N2857	80131
Q2	TRANSISTOR	1	TA7153	02735
Q3	TRANSISTOR	1	2N2616	80131
Q4	Same as Q1			
Q5	Same as Q1			
				1

Nominal value. Final value to be factory selected.

REPLACEMENT PARTS LIST

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
Q6	TRANSISTOR	1	2N5109	80131
Q7	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 2.2 k Ω , 5%, 1/4W	6	RCR07G222JS	81349
R2	Same as R1			
R3	RESISTOR, FIXED, COMPOSITION: 22 k Ω , 5%, 1/4W	2	RCR07G223JS	81349
R4	Same as R3			
R5	RESISTOR, FIXED, COMPOSITION: 820 Ω , 5%, 1/4W	2	RCR07G821JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 22 Ω , 5%, 1/4W	1	RCR07G220JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 150 k Ω , 5%, 1/4W	2	RCR07G154JS	81349
R8	RESISTOR, FIXED, COMPOSITION: $10 \text{ k}\Omega$, 5% , $1/4\text{W}$	1	RCR07G103JS	81349
R9	Same as R7			
R10	RESISTOR, FIXED, COMPOSITION: $33 \text{ k}\Omega$, 5% , $1/4\text{W}$	1	RCR07G333JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 4.7 k Ω , 5%, 1/4W	2	RCR07G472JS	81349
R12	RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4W	1	RCR07G471JS	81349
R13	RESISTOR, FIXED, COMPOSITION: 150 Ω , 5%, 1/4W	1	RCR07G151JS	81349
R14	RESISTOR, FIXED, COMPOSITION: 270 Ω , 5%, 1/4W	1	RCR07G271JS	81349
R15	RESISTOR, FIXED, COMPOSITION: 680 Ω , 5%, 1/4W	1	RCR07G681JS	81349
R16	RESISTOR, FIXED, COMPOSITION: 7.5 k Ω , 5%, 1/4W	1	RCR07G752JS	81349
R17	RESISTOR, FIXED, COMPOSITION: 8.2 k Ω , 5%, 1/4W	1	RCR07G822JS	81349
R18	Same as R1			
R19	Same as R1		,	
R20	NOT USED		,,	
R21	RESISTOR, FIXED, COMPOSITION: 13 k Ω , 5%, 1/4W	2	RCR07G133JS	81349
R22	Same as R1			
R23	Same as R11			
R24	RESISTOR, FIXED, COMPOSITION: 390 Ω , 5%, 1/4W	1	RCR07G391JS	81349
R25	NOT USED			
R26	RESISTOR, FIXED, COMPOSITION: $1 \text{ k}\Omega$, 5%, $1/4\text{W}$	1	RCR07G102JS	81349
R27	Same as R5			
R28	RESISTOR, FIXED, COMPOSITION: 4.7 Ω , 5%, 1/4W	2	RCR07G4R7JS	81349
R29	Same as R1			
R30	RESISTOR, FIXED, COMPOSITION: 220 Ω , 5%, 1/4W	2	RCR07G221JS	81349
R31	RESISTOR, FIXED, COMPOSITION: 33 Ω , 5%, 1/4W	1	RCR07G330JS	81349
R32	Same as R21			

REPLACEMENT PARTS LIST

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
R33	RESISTOR, FIXED, COMPOSITION: 39 $k\Omega$, 5%, 1/4W	1	RCR07G393JS	81349
R34	Same as R30			
R35	RESISTOR, FIXED, COMPOSITION: 27 k Ω , 5%, 1/4W	1	RCR07G273JS	81349
R36	RESISTOR, FIXED, COMPOSITION: 1.8 k Ω , 5%, 1/4W	1	RCR07G182JS	81349
R37	Same as R28			_
R38	RESISTOR, FIXED, COMPOSITION: 30 Ω , 5%, 1/4W	1	RCR07G300JS	81349
R39	RESISTOR, FIXED, COMPOSITION: 180 Ω , 5%, 1/4W	2	RCR07G181JS	81349
R40	Same as R39		A 3	
R41	RESISTOR, FIXED, COMPOSITION: 100 k Ω , 5%, 1/4W	1	RCR07G104JS	81349
T1	TRANSFORMER	1	21428-14	14632

Figure 5-8

5.4.2.1 Part 15980 AGC Board

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
C1	CAPACITOR, CERAMIC, DISC: 100 pF, 5%, 300V	4	UY02-101J	73899
C2	Same as C1			
C3	Same as C1			
C4	Same as C1			
CR1	DIODE	3	5082 -3003	28480
CR2	Same as CR1			
CR3	Same as CR1			
L1	COIL, FIXED: 1 μH	2	205 -11	99848
L2	Same as L1			
R1	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/4W	2	RCR07G512JS	81349
R2	Same as R1			

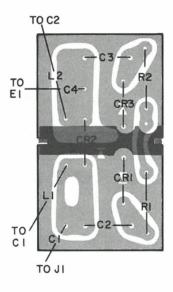


Figure 5-8. Part 15980 AGC Board (A1A1), Location of Components

Figure 5-9

5.4.2.2 Part 16016 Mixer IF Board

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
C1	CAPACITOR, CERAMIC, TUBULAR: 2.0 pF, ±.25 pF, 500V	1	301-000-C0K0-209C	72982
C2	CAPACITOR, MICA, DIPPED: 220 pF, 5%, 300V	2	UY03-221J	73899
C3	Same as C2			
C4	CAPACITOR, CERAMIC, DISC: 470 pF, 5%, 300V	1	UY03-471J	73899
Q1	TRANSISTOR	1	2N5109	80131
R1	RESISTOR, FIXED, COMPOSITION: 680 Ω , 5%, 1/4W	1	RCR07G681JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 3.9 k Ω , 5%, 1/4W	2	RCR07G392JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 3.3 Ω , 5%, 1/4W	1	RCR07G3R3JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 240 Ω , 5%, 1/4W	1	RCR07G241JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 47 Ω , 5%, 1/4W	1	RCR07G470JS	81349
R6	Same as R2			
T1	TRANSFORMER	1	11464-62	14632
U1	BALANCED MIXER	1	M7A	27956

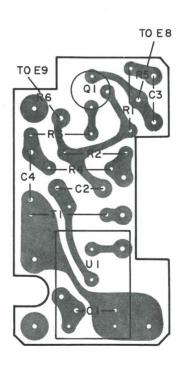


Figure 5-9. Part 16016 Mixer IF Board (A1A2), Location of Components

REPLACEMENT PARTS LIST

5.4.3 Type 79844-5 Shaping Amplifier

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μ F, 10%, 100V	1	109D475X9100C2	56289
C2	CAPACITOR, CERAMIC, DISC: 1000 pF, 20%, 1000V	1	DA141-33B	71590
C3	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100V	1	C023B101E502M	56289
CR1	DIODE	18	1N458A	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	NOT USED			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1	ŀ	4	
CR8	Same as CR1			
CR9	Same as CR1		2 (B)	
CR10	Same as CR1			
CR11	Same as CR1		*	
CR12	Same as CR1			
CR13	Same as CR1		, , , , , , , , , , , , , , , , , , , ,	
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
Q1	TRANSISTOR	3	2N2907	80131
Q2	TRANSISTOR	2	U1899E	15818
Q3	Same as Q2			
Q4	Same as Q1		, 1	
Q5	Same as Q1		y * 1	
R1	RESISTOR, FIXED, COMPOSITION: 5.6 k Ω , 5%, 1/4W	1	RCR07G562JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 4.7 k Ω , 5%, 1/4W	1	RCR07G472JS	81349
R3	RESISTOR, VARIABLE, FILM: 5 kΩ, 10%, 3/4W	2	89PR5K	73138
R4*	RESISTOR, FIXED, FILM: 21.1 k Ω , 1%, 1/4W	1	RN60D1212F	81349
R5	Same as R3			
R6*	RESISTOR, FIXED, FILM: 18.2 k Ω , 1%, 1/4W	1	RN60D1822F	81349
R6*	RESISTOR, FIXED, FILM: 18.2 kΩ, 1%, 1/4W	1	RN60D1822F	

Nominal value. Final value to be factory selected.

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
R7*	RESISTOR, FIXED, FLIM: 127 kΩ, 1%, 1/4W	2	RN60D1273F	81349
R8	RESISTOR, FIXED, COMPOSITION: 12 k Ω , 5%, 1/4W	1	RCR07G123JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 10 k Ω , 5%, 1/4W	2	RCR07G103JS	81349
R10	Same as R9			
R11	RESISTOR, FIXED, COMPOSITION: $1\ k\Omega$, 5%, $1/4W$	1	RCR07G102JS	81349
R12	RESISTOR, FIXED, COMPOSITION: 100 k Ω , 5%, 1/4W	1	RCR07G104JS	81349
R13	RESISTOR, FIXED, COMPOSITION: 2.7 k Ω , 5%, 1/4W	2	RCR07G272JS	81349
R14	RESISTOR, FIXED, COMPOSITION: 22 M Ω , 5%, 1/4W	2	RCR07G226JS	81349
R15*	Same as R13			
R16	Same as R14			
R17	RESISTOR, FIXED, COMPOSITION: 3.9 M Ω , 5%, 1/4W	2	RCR07G395JS	81349
R18	RESISTOR, FIXED, COMPOSITION: 1 M Ω , 5%, 1/4W	2	RCR07G105JS	81349
R19	Same as R17			5
R20	RESISTOR, FIXED, COMPOSITION: 470 k Ω , 5%, 1/4W	2	RCR07G474JS	81349
R21	Same as R18			
R22	Same as R20			
R23	RESISTOR, FIXED, COMPOSITION: 2.2 M Ω , 5%, 1/4W	1	RCR07G225JS	81349
R24*	Same as R7			
R25*	RESISTOR, FIXED, FILM: 210 kΩ, 1%, 1/4W	1	RN60D2103F	81349
R26*	RESISTOR, FIXED, FILM: $10 \text{ k}\Omega$, 1% , $1/4\text{W}$	3	RN60D1002F	81349
R27	RESISTOR, VARIABLE, FILM: $2 \text{ k}\Omega$, 30% , $1/2\text{W}$	5	62PAR2K	73138
R28*	RESISTOR, FIXED, FILM: 2.94 k Ω , 1%, 1/4W	1	RN60D2941F	81349
R29*	RESISTOR, FIXED, FILM: $100 \text{ k}\Omega$, 1% , $1/4\text{W}$	1	RN60D1003F	81349
R30*	RESISTOR, FIXED, FILM: 56.2 kΩ, 1%, 1/4W	1	RN60D5622F	81349
R31*	RESISTOR, FIXED, FILM: 6.81 k Ω , 1%, 1/4W	2	RN60D6811F	81349
R32	Same as R27			
R33*	Same as R31			
R34*	RESISTOR, FIXED, FILM: $68.1 \text{ k}\Omega$, 1% , $1/4\text{W}$	2	RN60D6812F	81349
R35*	RESISTOR, FIXED, FILM: 24.3 k Ω , 1%, 1/4W	1	RN60D2432F	81349
R36*	RESISTOR, FIXED, FILM: 5.36 k Ω , 1%, 1/4W	1	RN60D5361F	81349
R37	Same as R27			
R38*	RESISTOR, FIXED, FILM: 8.06 kΩ, 1%, 1/4W	1	RN60D8061F	81349
R39*	RESISTOR, FIXED, FILM: 90.9 k Ω , 1%, 1/4W	1	RN60D9092F	81349
R40*	RESISTOR, FIXED, FILM: 21.5 k Ω , 1 $\%$, 1/4W	1	RN60D2152F	81349
R41 *	RESISTOR, FIXED, FILM: 3.92 kΩ, 1%, 1/4W	1	RN60D3921F	81349

Nominal value. Final value to be factory selected.

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
R42	Same as R27			
R43*	RESISTOR, FIXED, FILM: $9.09 \text{ k}\Omega$, 1% , $1/4\text{W}$	1	RN60D9091F	81349
R44*	Same as R34			
R45*	Same as R26			
R46*	RESISTOR, FIXED, FILM: 2.61 k Ω , 1%, 1/4W	1	RN60D2611F	81349
R47	Same as R27			
R48*	Same as R26			
R49	RESISTOR, FIXED, COMPOSITION: 100 Ω , 5%, 1/4W	1	RCR07G101JS	81349
U1	INTEGRATED CIRCUIT	2	U5B7741393	07263
U2	Same as U1			
VR1	VOLTAGE REGULATOR	1	1N759A	80131

Nominal value. Final value to be factory selected.

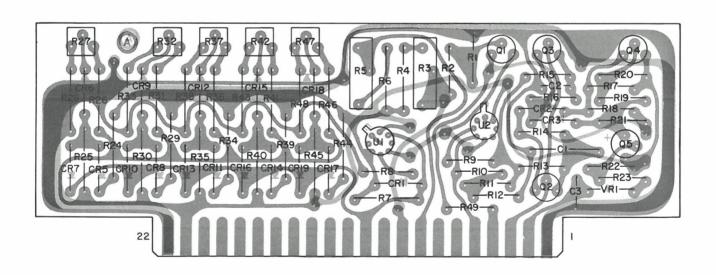


Figure 5-10. Type 79844-5 Shaping Amplifier (A2), Location of Components

REPLACEMENT PARTS LIST

5.4.4 Type 8588 Tuning Drive Assembly

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
DS1	LAMP, INCANDESCENT	3	CM8-683	71744
DS2	Same as DS1			
DS3	Same as DS1			
R1	RESISTOR, VARIABLE, PRECISION: 10 k Ω , 10%, 2W	1	8106-R10K-L. 25	73138

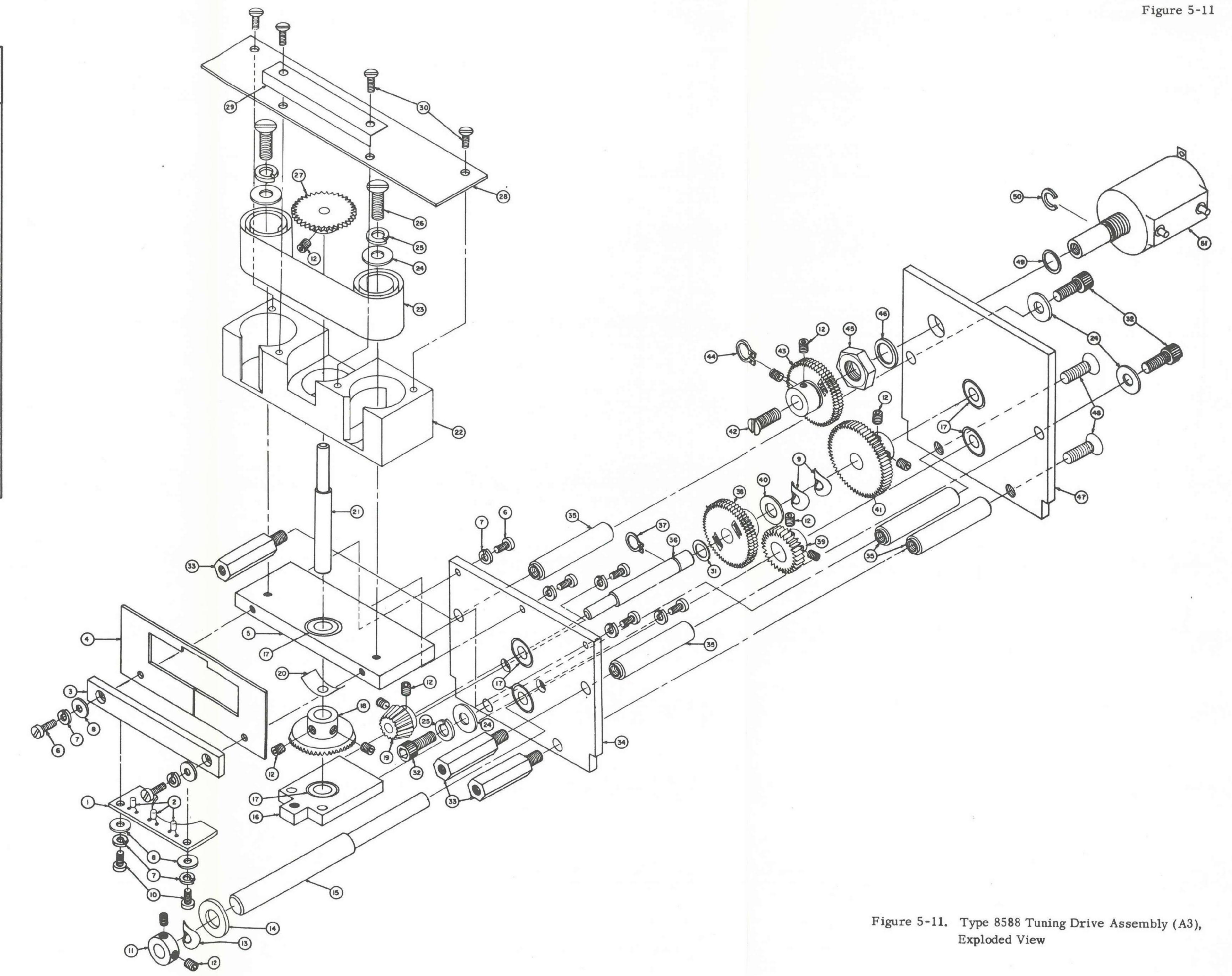
NOTE: For Mechanical Parts, see exploded view.

REF	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
1	LIGHT BOARD ASSEMBLY	1	15531	14632
2	LAMP, INCANDESCENT	REF	CM8-683	71744
3	LIGHT BAR	1	13963	14632
4	GUIDE PLATE	1	14122-1	14632
5	TOP GEAR PLATE	1	15652-1	14632
6	#2-56 x 1/4 PAN HEAD MACHINE SCREW	7	MS35233-3	96906
7	#2 LOCKWASHER	9	MS35338-78	96906
8	#2 FLAT WASHER	3	MS15795-802	96906
9	TENSION SPRING	2	7752	04941
10	#2-56 x 1/4 FILLISTER HEAD MACHINE SCREW	2	AN500D2-4	88044
11	COLLAR	1	11581-10	14632
12	#4-40 x 1/8 SETSCREW	13	AN565DC4-2	88044
13	TENSION SPRING	1	7754	04941
14	THRUST WASHER	1	TT504	70417
15	SHAFT	1	15641-1	14632
16	SUPPORT PLATE	1	15655-1	14632
17	BEARING	6	SFR-33MM	83086
18	BEVEL GEAR	1	11135-2	14632
19	PINION BEVEL GEAR	1	11136-1	14632
20	TENSION SPRING	1	15654-1	14632
21	SHAFT	1	12974-7	14632
22	TAPE CHAMBER	1	15356-1	14632
23	DIAL, TAPE	1	32418-1	14632
24	#6 FLAT WASHER	5	MS15795-805	96906
25	#6 LOCKWASHER	3	MS35338-79	96906
26	#6-32 x 1/4 PAN HEAD MACHINE SCREW	2	MS35233-26	96906
27	TAPE DRIVE GEAR	1	14065	14632
28	GUIDE PLATE	1	14122-1	14632
29	ANGLE PLATE	1	15357-1	14632
30	#2-56 x 1/4 FLAT HEAD MACHINE SCREW	4	MS35249-10	96906
31	SHIM	1	SSS-23	01351
32	#6-32 x 3/8 HEXAGON SOCKET CAP SCREW	3	MS35457-7	96906
33	SHOULDER-SPACER	3	20755-71	14632
34	FRONT GEAR PLATE	1	22245-1	14632

CHANGE	1	4/27/72

REF	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
35	SPACER	4	20757-32	14632
36	SHAFT	1	12974-8	14632
37	RETAINING RING	1	5100-18	79136
38	ANTIBACKLASH GEAR, 64P-60T	1	20178-2	14632
39	SPUR GEAR, 64P-30T	1	20189-16	14632
40	CLUTCH BEARING	1	11582-7	14632
41	SPUR GEAR, 64P-60T	1	20189-18	14632
42	SCREW	REF	Part of Potentiometer	-
43	ANTIBACK LASH GEAR, 64P-60T	1	20178-3	14632
44	RETAINING RING	REF	Part of Potentiometer	-
45	NUT	REF	Part of Potentiometer	-
46	WASHER	REF	Part of Potentiometer	-
47	REAR GEAR PLATE	1	22246-1	14632
48	#6-32 x 1/2 FLAT HEAD MACHINE SCREW	2	MS35249-37	96906
49	SPACER	REF	Part of Potentiometer	-
50	RETAINING RING	REF	Part of Potentiometer	-
51	POTENTIOMETER	REF	8106R-10K-L.25	73138

CHANGE 1 4/27/72



REPLACEMENT PARTS LIST

5.4.5 Type 79774 AGC Shaping Circuit/160-21.4 MHz Converter Assembly

REF DESIG	DESCRIPTION		MANUFACTURER'S PART NO.	MFR.
A1	AGC SHAPING CIRCUIT	1	16115	14632
A2	160-21.4 MHz CONVERTER	1	16114	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU: 470 pF, 20%, 500V	8	FA5C-4712	01121
C2	Same as C1		6 2	
C3	Same as C1		T No	
C4	Same as C1			
C5	Same as C1		,	
C6	Same as C1		19	
C7	Same as C1			
C8	Same as C1			
FB1	FERRITE BEAD	2	56-590-65/4A	02114
FB2	Same as FB1			
Ј1	CONNECTOR, RECEPTACLE, MINIATURE SERIES	2	10-0104-002	19505
J2	Same as J1			
MP1	COVER	1	16119-1	14632
MP2	SCREW, PANEL FASTENER	1	D7500-6A1	08524
P1	CONNECTOR, PLUG, MULTIPIN	1	SRE-14PNSSH13	81312

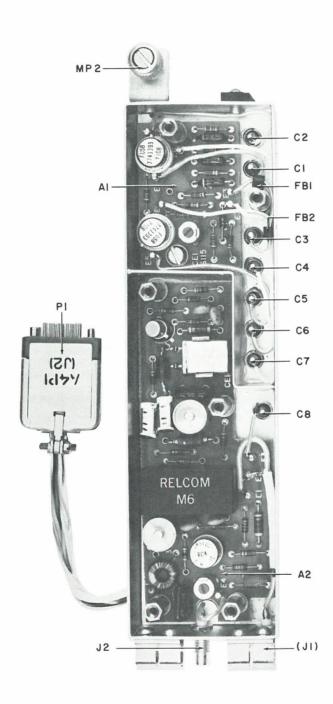


Figure 5-12. Type 79774 AGC Shaping Circuit/160-21.4 MHz Converter Assembly (A4), Location of Components

Figure 5-13

5.4.5.1 Part 16115 AGC Shaping Circuit

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
CR1	DIODE	1	1N916B	80131
R1	RESISTOR, FIXED, COMPOSITION: 47 k Ω , 5%, 1/8W	1	RCR05G473JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 47 0 k Ω , 5%, 1/8W	1	RCR05G474JS	81349
R3	NOT USED		9	
R4	RESISTOR, FIXED, COMPOSITION: 27 k Ω , 5%, 1/8W	1	RCR05G273JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 1.5 k Ω , 5%, 1/8W	1	RCR05G152JS	81349
R6	NOT USED			
R7	RESISTOR, FIXED COMPOSITION: 36 kΩ, 5%, $1/8W$	1	RCR05G363JS	81349
R8	RESISTOR, VARIABLE, FILM: $20~\text{k}\Omega$, 10% , $1/2\text{W}$	1	62PR20K	73138
R9	RESISTOR, FIXED, COMPOSITION: $68 \text{ k}\Omega$, 5% , $1/8\text{W}$	1	RCR05G683JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 510 Ω , 5%, 1/8W	1	RCR05G511JS	81349
R11	RESISTOR, FIXED, COMPOSITION: $10 \text{ k}\Omega$, 5% , $1/8\text{W}$	1	RCR05G103JS	81349
R12	RESISTOR, FIXED, COMPOSITION: 5.1 k Ω , 5%, 1/8W	1	RCR05G512JS	81349
U1	INTEGRATED CIRCUIT	2	U5B7741393	07263
U2	Same as U1		s ·	
VR1	VOLTAGE REGULATOR	1	1N749A	80131
VR2	VOLTAGE REGULATOR	1	1N752A	80131
VR3	VOLTAGE REGULATOR	1	1N754A	80131

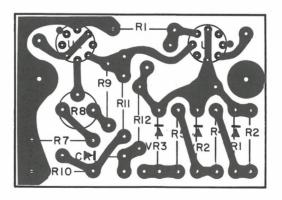


Figure 5-13. Part 16115 AGC Shaping Circuit (A4A1), Location of Components

5.4.5.2 Part 16114 160/21.4 MHz Converter Assembly

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, TUBULAR: 1.0 pF, ±.1 pF, 500V	1	301-000-C0K0-109B	72982
C2	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	4	SM(1000pF,GMV)	91418
C3	CAPACITOR, VARIABLE, CERAMIC: 2.5-11 pF, 350V	1	538-011-B2.5-11	72982
C4	CAPACITOR, CERAMIC, TUBULAR: 2.7 pF, ±.25 pF, 500V	1	301-000-C0J0-279C	72982
C5	CAPACITOR, MICA, DIPPED: 22 pF, 5%, 500V	1	CM05ED220J03	81349
C6	Same as C2		-	
C7	CAPACITOR, CERAMIC, DISC: 0.01 μ F, 20%, 500V	1	C023B101F103M	56289
C8	Same as C2			
C9	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350V	1	538-011-D9-35	72982
C10	NOT USED			
C11	Same as C2			
C12	NOT USED			
C13	CAPACITOR, MICA, DIPPED: 47 pF, 5%, 500V	1	CM05ED470J03	81349
L1	INDUCTOR	1	21210-29	14632
L2	COIL, FIXED: 0.24 μH	1	200-11	99848
Q1	TRANSISTOR	1	2N5109	80131
Q2	TRANSISTOR	1	2N3478	80131
R1	RESISTOR, FIXED, COMPOSITION: 8.2 Ω , 5%, 1/8W	2	RCR05G8R2JS	81349
R2	Same as R1		, ,	
R3	RESISTOR, FIXED, COMPOSITION: 150 Ω , 5%, 1/8W	1	RCR05G151JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 8.2 k Ω , 5%, 1/8W	1	RCR05G822JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 820 Ω , 5%, 1/8W	1	RCR05G821JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 13 k Ω , 5%, 1/8W	1	RCR05G133JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 5.6 Ω , 5%, 1/8W	1	RCR05G5R6JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4W	2	RCR07G471JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 22 Ω , 5%, 1/8W	1	RCR05G220JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 47 Ω , 5%, 1/8W	1	RCR05G470JS	81349
R11	RESISTOR, FIXED, COMPOSITION: $1 \text{ k}\Omega$, 5%, $1/8\text{W}$	1	RCR05G102JS	81349
R12	Same as R8			
R13	RESISTOR, FIXED, COMPOSITION: 6.8 k Ω , 5%, 1/8W	1	RCR05G682JS	81349
R14	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/8W	1	RCR05G103JS	81349
R15	NOT USED			
R16	RESISTOR, FIXED, COMPOSITION: 10Ω , 5%, $1/8W$	1	RCR05G100JS	81349

Figure 5-14

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.
R17	RESISTOR, VARIABLE, FILM: 100 Ω, 10%, 1/2W	1	62PR100	73138
R18	RESISTOR, FIXED, COMPOSITION: 62 Ω , 5%, 1/8W	1	RCR05G620JS	81349
T1	COIL, TOROIDAL	1	22692-1	14632
U1	MIXER, DOUBLE BALANCED	1	M6	27956
Y1	CRYSTAL, QUARTZ: 138.600 MHz	1	98202-03	14632

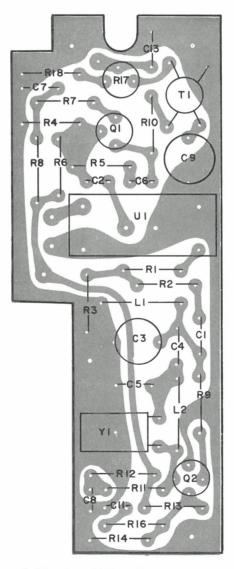
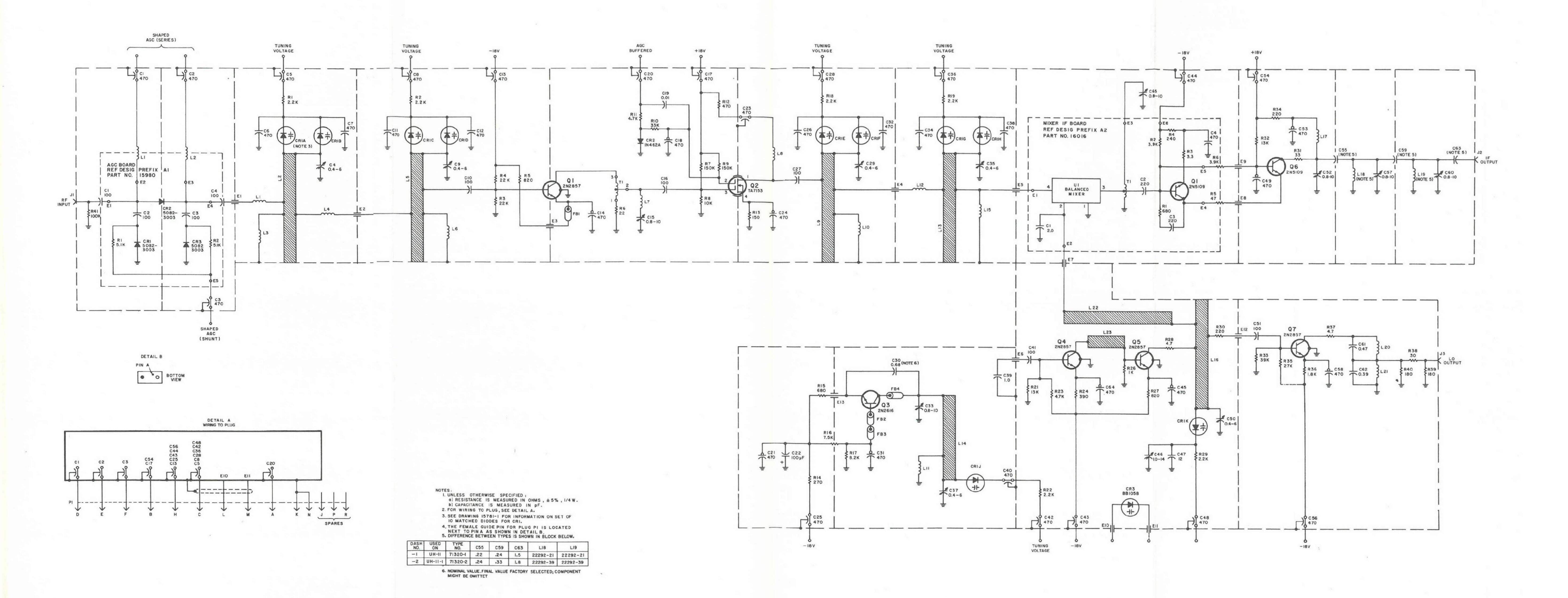


Figure 5-14. Part 16114 160-21.4 MHz Converter (A4A2), Location of Components

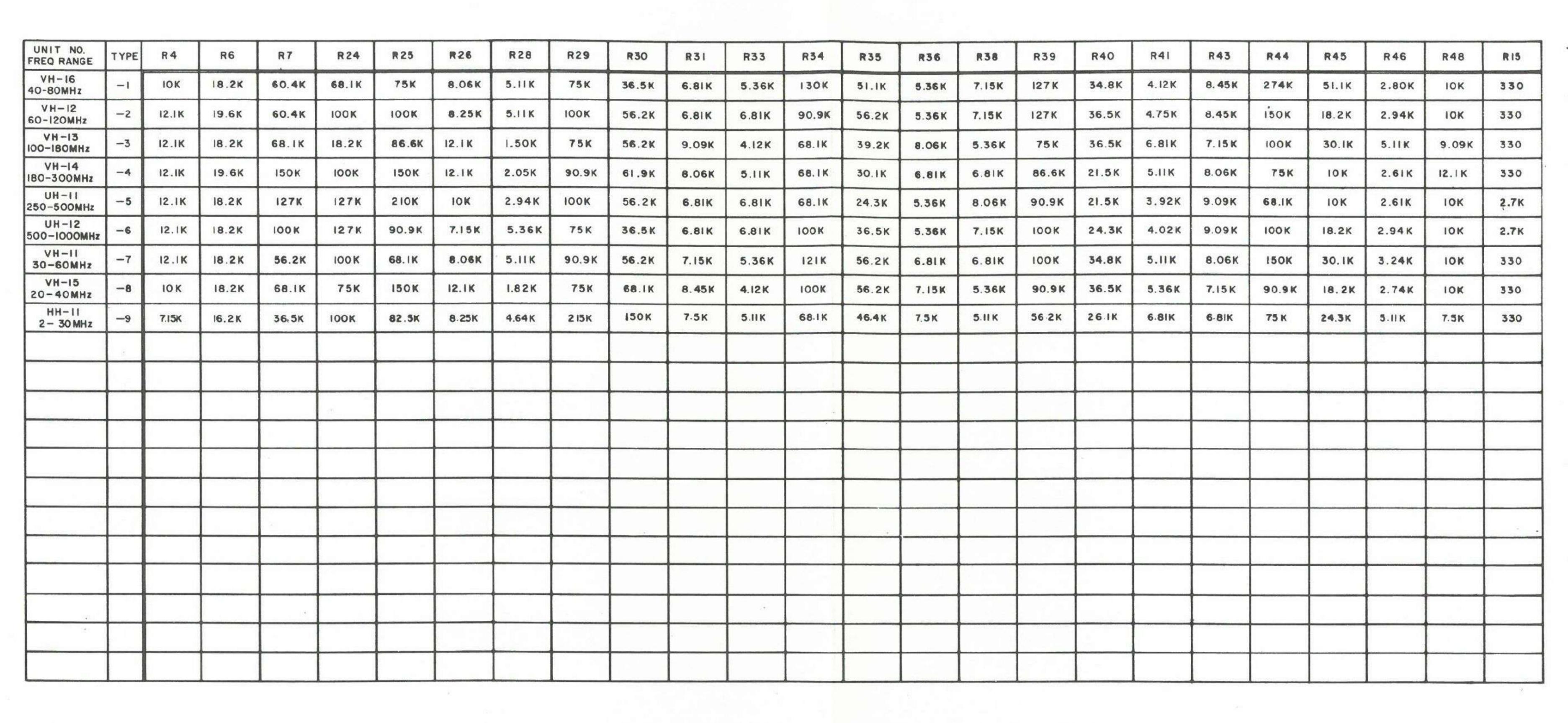
SCHEMATIC DIAGRAMS

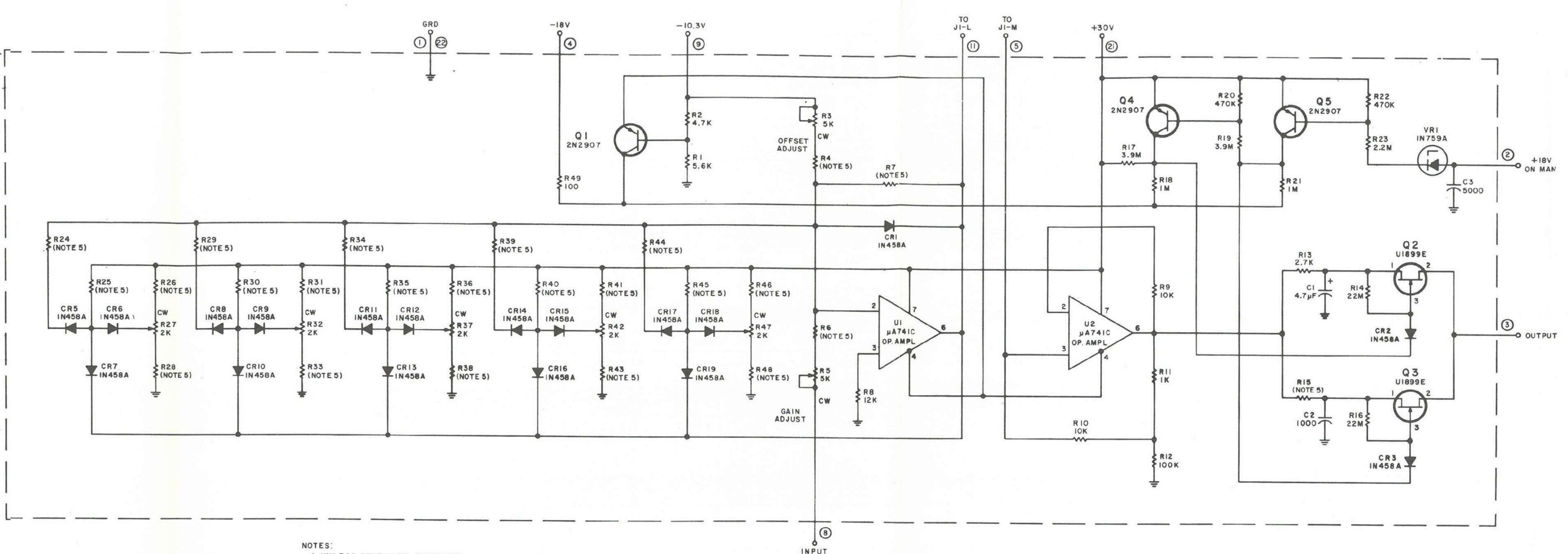
SECTION VI SCHEMATIC DIAGRAMS



Courtesy of http://BlackRadios.terryo.org

Figure 6-1. Types 71320-1 and 71320-2 250-500 MHz RF Tuners (A1), Schematic Diagram





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

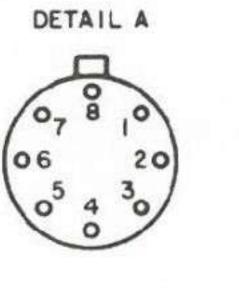
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

3. CW ON POTENTIOMETERS DENOTE CLOCKWISE ROTATION OF ACTUATOR. 4. FOR UI,U2 PIN ARRANGEMENT, SEE DETAILA.

5. DIFFERENCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK. ALL VALUES ARE NOMINAL; FINAL VALUES TO BE FACTORY SELECTED. ALL RESISTANCES IN TABULATION BLOCK ARE IN OHMS, ±1%, 1/4 W.

6. SHAPING AMPLIFIERS WITH PREVIOUSLY ASSIGNED TYPE NUMBERS ARE LISTED BELOW WITH THEIR CORRESPONDING 79844 SERIES NUMBER THESE OLD TYPE NUMBERS ARE LISTED FOR REFERENCE ONLY.

TUNING	OLD	79844-
VH-II	79618	-7
VH-12	79655	-2
VH-13	79656	-3
VH-14	79658	-4
VH-16	79844	-1
UH-II	79871	-5



BOTTOM VIEW

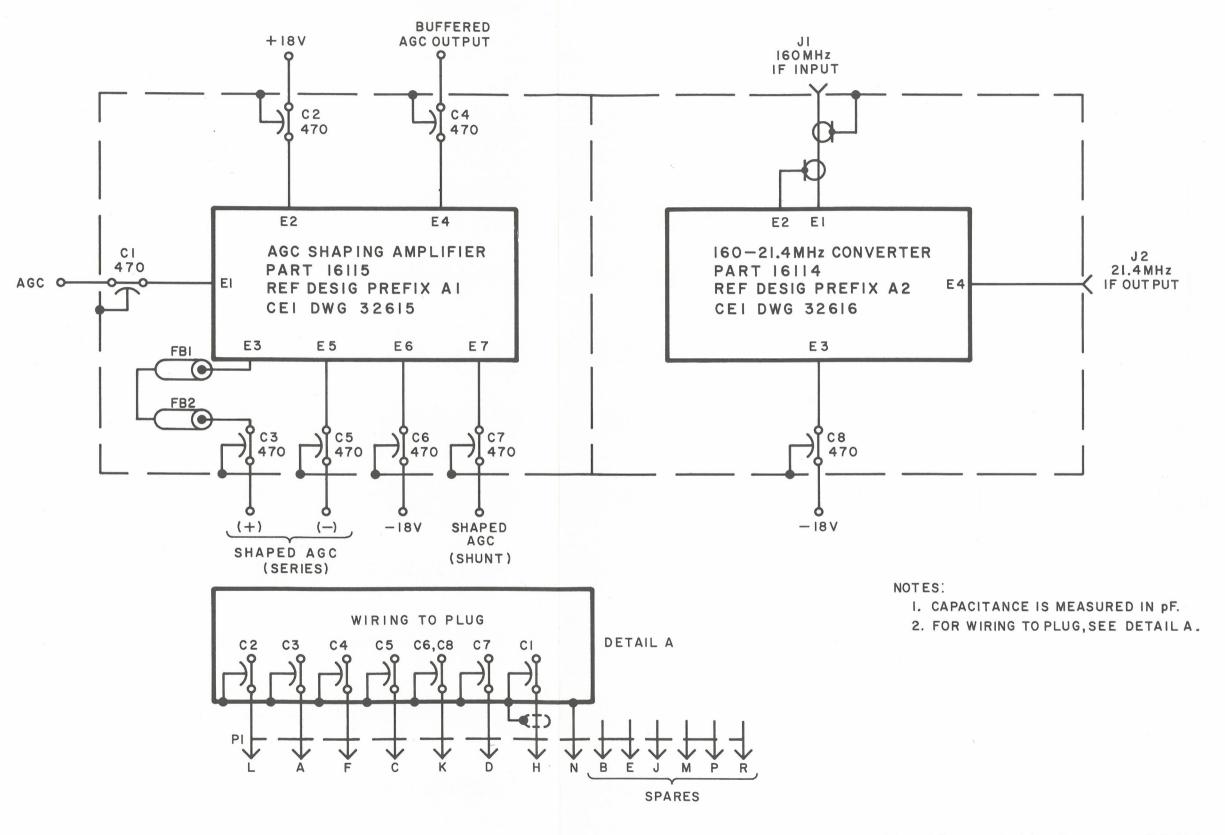


Figure 6-3. Type 79774 AGC Shaping Circuit/160-21.4 MHz Converter Assembly (A4), Schematic Diagram

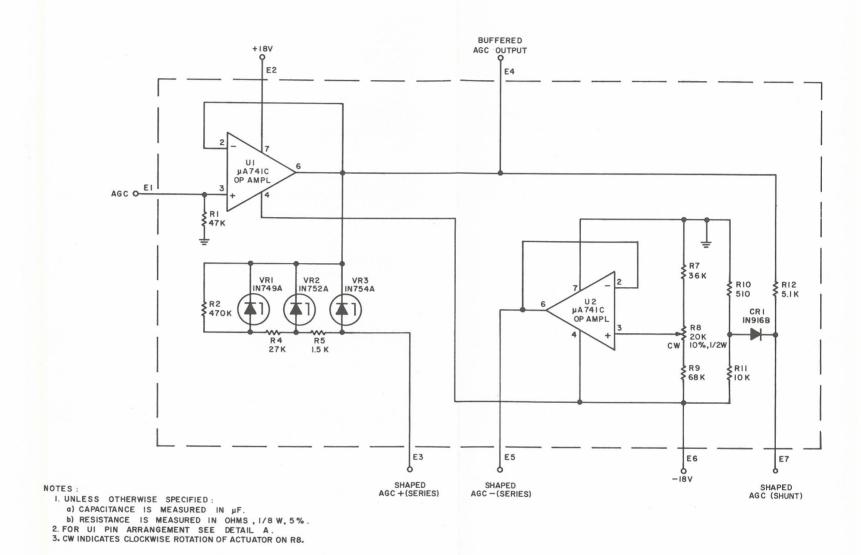
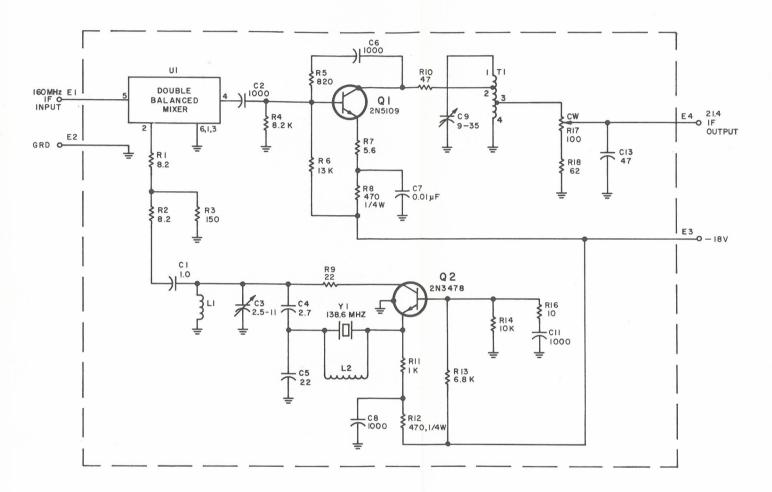


Figure 6-4. Part 16115 AGC Shaping Circuit (A4A1), Schematic Diagram



- LUNLESS OTHERWISE SPECIFIED:

 a) CAPACITANCE IS MEASURED IN pf.
 b) RESISTANCE IS MEASURED IN OHMS, 1/8 W, 5 %.

Figure 6-5. Part 16114 160-21.4 MHz Converter (A4A2), Schematic Diagram

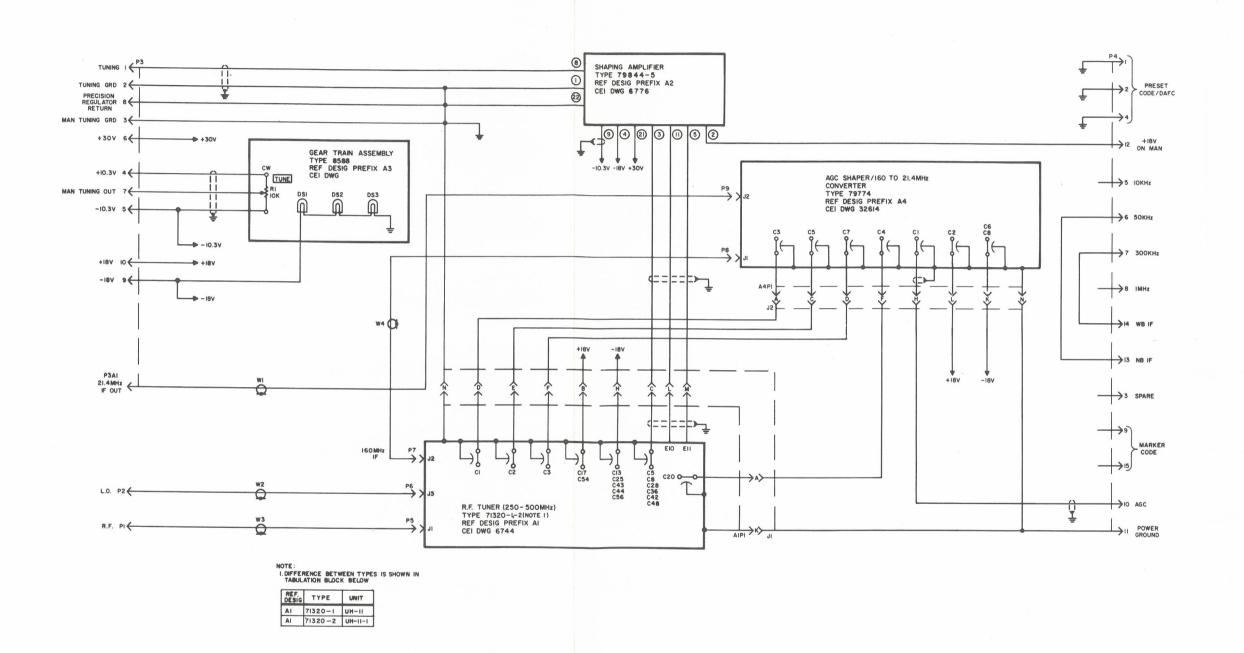


Figure 6-6. Type UH-11(-1) Tuning Head, Main Chassis Schematic Diagram

