INSTRUCTION MANUAL
FOR
TYPE VH-101 TUNING HEAD

WATKINS-JOHNSON

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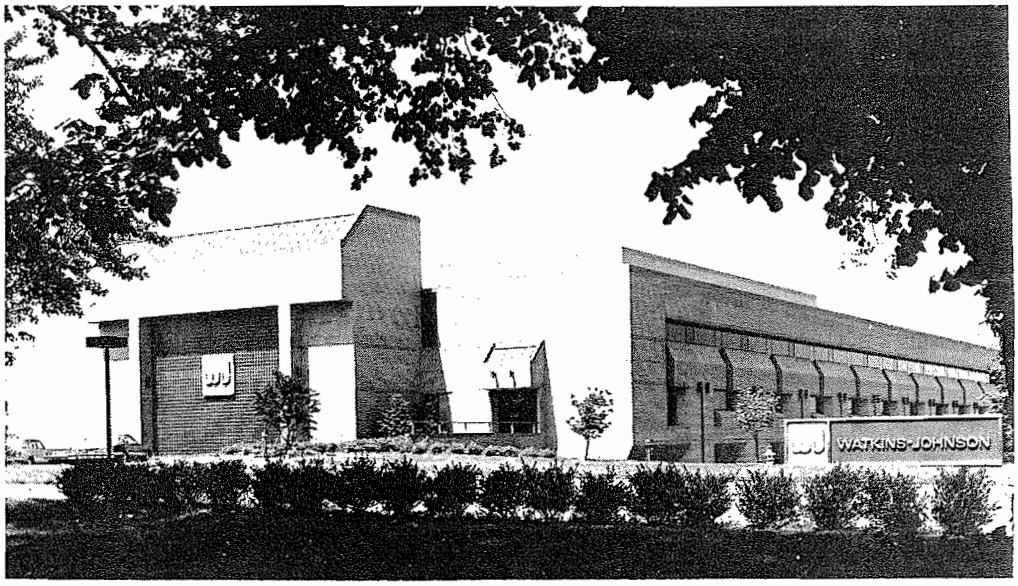

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ADDENDA
VH-101

The following changes should be incorporated into the Instruction Manual for the VH-101 Tuning Head.

1. In paragraph 4.6 TEST EQUIPMENT REQUIRED add: Watkins-Johnson Company Type 560 or 565 Receiver.

2. In paragraph 4.8 step 3, the sentence should read: Adjust capacitors A1C13, A1C17, A1C28, A1C33, A1C36, and A1A1C4 for a response similar to Figure 4-2.

3. In paragraph 4.8 step 4, add: If necessary, make compromise adjustments for best bandwidth and symmetry across band.

4. In paragraph 4.9 step 1, add: Replace the HP608B signal generator with the HP606A signal generator.

5. In paragraph 4.9 step 3, add: Activate the sweep generator 10 MHz markers.

6. In the PARTS LIST for Type 71331 20-90 MHz RF Tuner:

   a. Change C27 from: 39 pF, to: Same as C10.

   b. Change qualtity of C10 from: 1 to 2.

   c. Add C57, CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 500V; Qty. 3; Part No. SM5000PFM, Mfr. 91418.

   d. Add C58, Same as C57.

   e. Add C59, Same as C57.

7. In the PARTS LIST for Type 71332 8-21.4 MHz Converter:

   a. Add C10, CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 500V; Qty. 2; Part No. SM5000PFM; Mfr. Code 91418.

   b. Add C11: Same as C10.

8. On Figure 6-1, Type 71331 20-90 MHz RF Tuner Schematic Diagram:

   a. Change the value of C27 from: 39 to: 36.

   b. At the junction of C1 and R3 add a capacitor to ground. Label C57, 5000 pF.

   c. At the junction of C3 and R12 add a capacitor to ground. Label C58, 5000 pF.

   d. At the junction of C4 and R14, add a capacitor to ground. Label C59, 5000 pF.

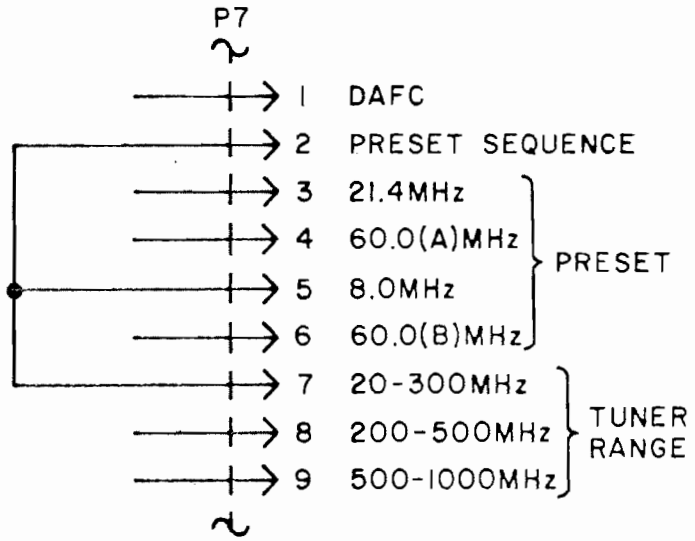
9. On Figure 6-2, Type 71332 8-21.4 MHz Converter, Schematic Diagram:

   a. At the junction of C9 and R4, add a capacitor to ground. Label C10, 5000 pF.

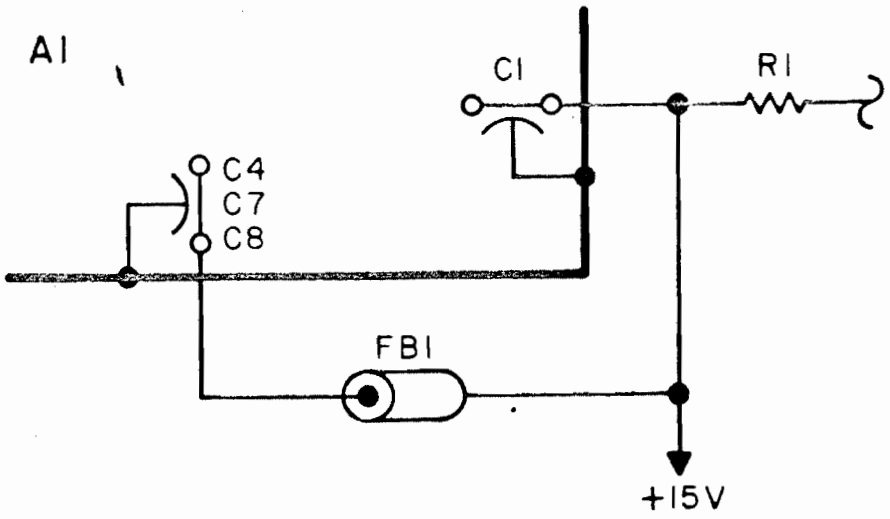
   b. At the junction of C1 and R6 add a capacitor to ground. Label C11, 5000 pF.

10. MAIN CHASSIS

   a. Change the wiring and labeling at P7, Figure 6-3; Page 6-7 as shown below:



   b. Add to and change at A1, Figure 6-3, page 6-7 as shown below:



c. Add to the parts list paragraph 5.4.1, page 5-5; FB1; FERRITE BEAD; Qty, 1; Part No. 56-590-65-4A; Mfr. Code 02114.

11. Type 71331 20-90 MHz RF Tuner (A1A1):

a. Revise the parts list, paragraph 5.4.2.1 page 5-9 as follows:

(1) C15: CAPACITOR, CERAMIC, TUBULAR: 2.2 pF, 0.1 pF, TOL, 500V; Qty. 2; Part No. 301-000-C0J0-229B; Mfr. Code. 72989.

(2) C16: Same as C15; To replace C16: CAPACITOR, CERAMIC, TUBULAR: 3.3 pF, ±.25 pF, 500V.

(3) C20: CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V; Qty. 2; Part No. SM(1000pF,GMV); Mfr. Code 91418.

Page 5-11:

(4) C40: CAPACITOR, CERAMIC, DISC: 68 pF, 5%, 50V; Qty. 1; Part No. 1U68RJ; Mfr. Code 93958.

b. Change capacitor values on Figure 6-1, page 6-3 as follows: C15 from 2.7 pF to: 2.2 pF; C16 from 3.3 pF to: 2.7 pF; C20 from 100 pF to: .001 μF.

12. Type 71332 8-21.4 MHz Converter (A2):

a. Revise the parts list, paragraph 5.4.3, page 5-21 as follows:

(1) L1: COIL, VARIABLE; Qty. 1; Part No. 1471-9 to replace: 1471-8.

(2) Delete T1 and T3.

(3) Add: L2: COIL, TOROIDAL (TAPPED); Qty. 2; Part No. 21428-21; Mfr. Code 14632.

(4) Add: L3: Same as L2.

b. Change schematic diagram Figure 6-2, page 6-5 as shown below: Replace T1 and T2 with L2 and L3.

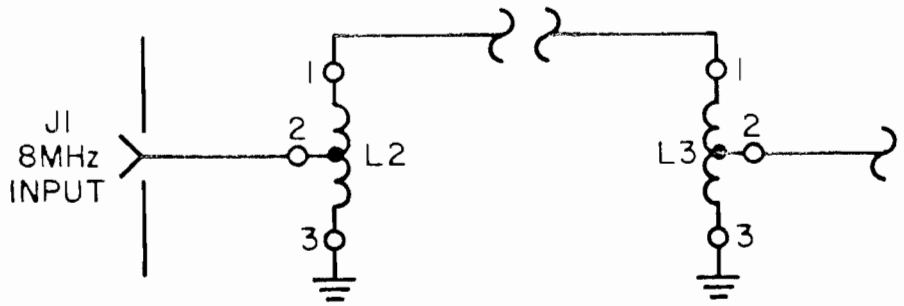


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Table 1-1. Type VH-101 Tuning Head, Specifications

Frequency Range	20-90 MHz
Input Impedance	50 ohms, nominal
Input VSWR	4:1, maximum
Noise Figure	6 dB, maximum
Frequency Stability	LO frequency drifts less than 10 kHz per hour at constant temperature after initial one-hour warm-up
IF Rejection	60 dB, minimum
Tape Dial Accuracy	±1%
Fine Tuning Range	0.05% of tuned frequency
Overall Bandwidth	1 MHz, 20 to 40 MHz; 1.5 MHz, 40 to 90 MHz
Image Rejection	60 dB, minimum
LO to Antenna Conduction	-95 dBm, maximum
Dimensions	5 inches wide, 3.25 inches high, and 16 inches deep
Weight	4 lbs, approximately

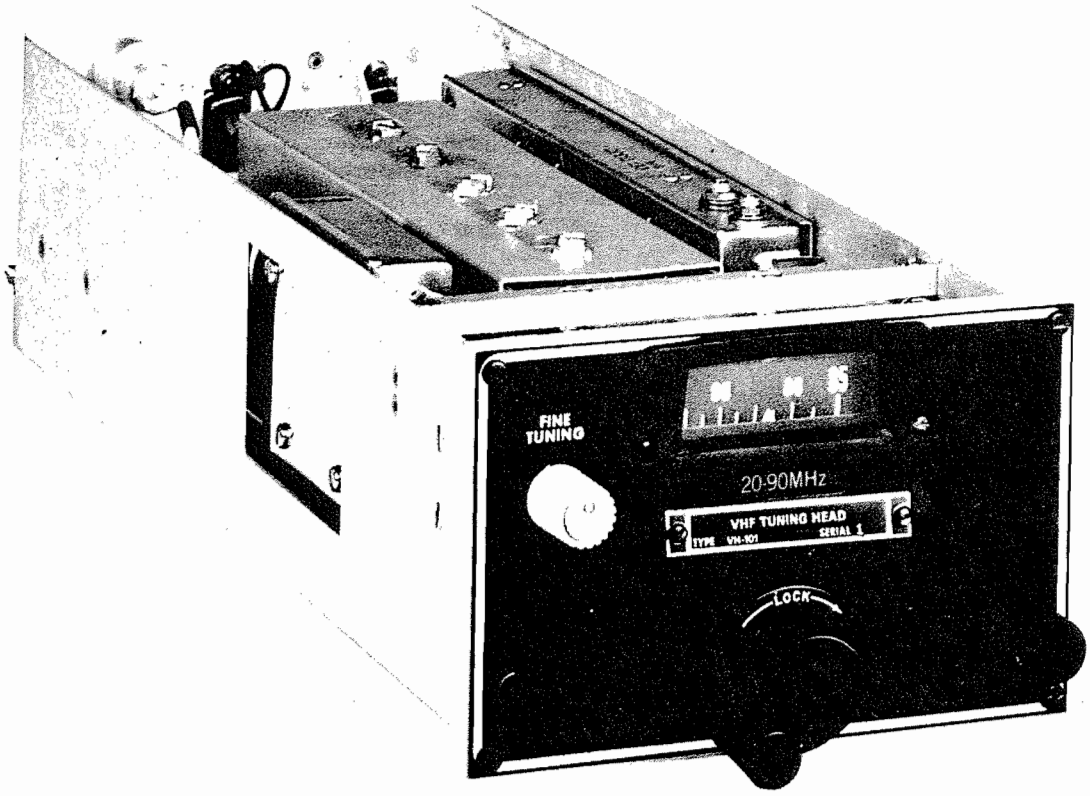


Figure 1-1. Type VH-101 Tuning Head

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The Type VH-101 Tuning Head is a double-conversion, superheterodyne unit designed for operation with the Types 560 and 565-Series Receivers. The VH-101 provides frequency coverage of the 20 to 90-MHz range in a single band. It converts RF signals within this range to a 21.4-MHz IF output. The 560 Receiver provides demodulation of AM, FM, and CW signals while the 565 Receiver provides demodulation of AM, FM, CW, and pulse modulated signals. Initial conversion of incoming signals to the tuning head are from the RF frequency down to 8 MHz. A separate subassembly in the unit then converts this signal up to the 21.4-MHz signal that is processed by the receiver. All active elements in the VH-101 are solid state.

1.1.2 Operating power for the VH-101 is supplied by the associated receiver through multi-pin connectors which are mounted on the rear apron. These connectors mate with receptacles on the receiver when the tuning head is installed.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 The front panel and the main chassis are constructed of aluminum. The front panel is finished with gray enamel and is overlaid with a black-anodized etched bezel. Mounted on the front panel are the main tuning knob and tape dial, the FINE TUNING control, and the two black knobs that are used to lock the tuner into position in the receiver.

1.2.2 The rear apron of the tuner mounts two multi-pin Deutsch connectors, plus two push-on coaxial plugs. The threaded alignment rods also protrude from the rear apron. Alignment holes found just above the rods, mate with pins which are hard-mounted at the rear of the tuner housing in the receiver and ensure that the head is properly aligned before the connectors are mated.

1.2.3 The VH-101 consists of a Type 71331 20-90-MHz RF Tuner, a Type 71332 8-21.4-MHz Converter, and a Type 8598 Tuning Drive. The RF tuner and converter are constructed on brass chassis which have been plated with precious metals to prevent tarnishing and to increase conductivity. Overall dimensions of the VH-101 are 5 inches wide, 3.25 inches high, and 16 inches deep. The tuner weights approximately 4 pounds.

1.3 EQUIPMENT SUPPLIED

This equipment consists of the Type VH-101 Tuning Head only.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The VH-101 is incapable of independent operation and requires either a Type 560 Receiver or a Type 565 Receiver. Either one of these receivers will supply the required signal inputs and outputs plus the voltages necessary for proper operation. If DAFC operation is desired, a compatible frequency counter having DAFC capability must be used.

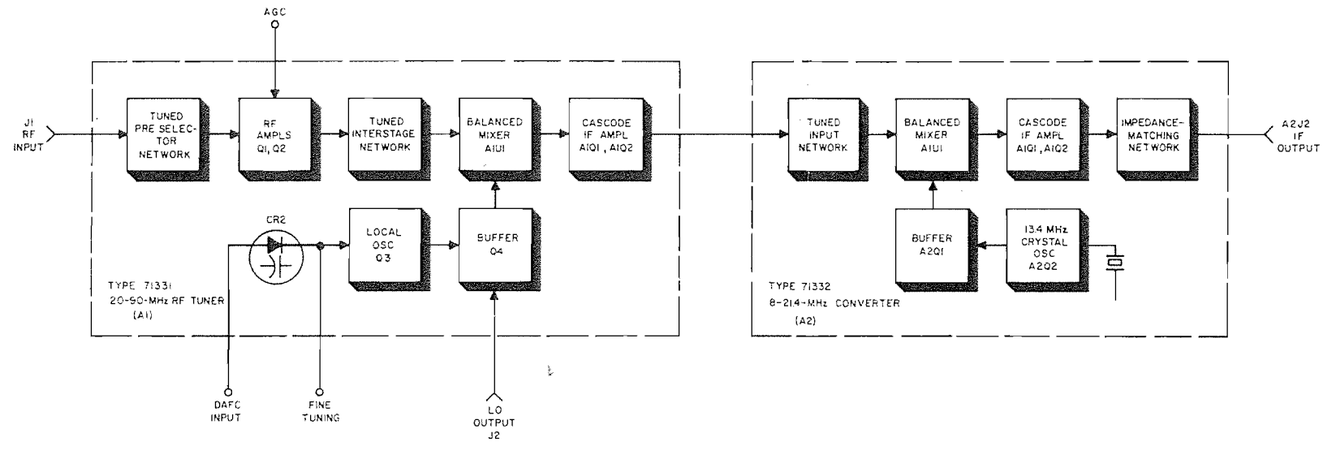


Figure 2-1. Type VII-101 Tuning Head, Functional Block Diagram

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

The following paragraphs contain functional and electrical descriptions of the circuits in the Type VH-101 Tuning Head. The functional description is oriented to the block diagram level, whereas the detailed circuit descriptions are oriented to the schematic diagram level. A functional block diagram of the VH-101 is shown in Figure 2-1. The schematic diagrams for the tuner are shown in Figures 6-1 through 6-3. Note that the unit numbering method is used for electrical components. This means that parts on the subassemblies in the tuning head carry a prefix before the usual class letter and number of the item (such as A1U1 and A1C3). These prefixes are omitted in the detailed descriptions and in the illustrations except in some cases where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

2.2.1 The Type VH-101 Tuning Head is a double-conversion, superheterodyne unit designed to receive, amplify, and convert RF signals in the 20 to 90-MHz frequency range to a 21.4-MHz IF output. This tuning head is an accessory device for use with the Type 560-Series and 565-Series Receivers. The associated receiver provides demodulation of the IF signal obtained from the VH-101.

2.2.2 Incoming RF signals to the tuning head are received from an RF limiter subassembly located on the rear apron of the associated receiver. A coaxial cable connects the signals from the limiter to a plug-in receptacle at the rear of the tuner housing in the receiver. When the VH-101 is installed, this receptacle mates with jack J1 on the rear of the unit. From the input connector, the RF signals are fed through a preselector network, which is essentially a double-tuned tunable bandpass filter. The preselector network selects the desired RF signal and matches the antenna impedance to the input impedance of the first RF stage, Q1, for the best combination of noise figure and V.S.W.R. This transistor, a dual-gate, field-effect type, is connected to Q2, a MOS field-effect type, to form the complete RF amplifier circuit. The input stage is gain-controlled by the application of AGC voltage to gate 2 of the FET. A double-tuned tunable interstage network forms the output load for the RF amplifier and develops the input signal which is fed to the first mixer.

2.2.3 The mixer, A1U1, is a self-contained double-balanced type that suppresses the RF and local oscillator inputs and produces predominantely sum and difference output frequencies. Since the output stages following the first mixer are tuned to the difference frequency of 8 MHz, only it is passed. This output is amplified by a second cascode circuit made up of A1Q1 and A1Q2, before it is applied to the 8-21.4-MHz converter assembly, A2.

2.2.4 The local oscillator in the tuner, Q3, operates over a frequency range which is 8-MHz higher than the tuned frequency, in this case 28-MHz to 98-MHz. Buffer transistor Q4 isolates the oscillator from changing load conditions and supplies the local oscillator signal to output jack J2. Small changes in the frequency to which the receiver is tuned can be made with the front-panel FINE TUNING control. This potentiometer applies a bias to a varactor diode (CR2) in the LO circuit which varies its capacitance and consequently the LO frequency. An externally supplied DAFC (digital automatic frequency control) voltage can be applied through a connector on the associated receiver to the same varactor to lock the local oscillator to a particular frequency. An external frequency counter such as the Type DRO-311 can be used when DAFC operation is desired.

2.2.5 The input circuit in the 8-21.4-MHz converter is a three-pole bandpass filter designed to match the output impedance of the tuner to the input impedance of the second mixer and at the same time eliminate the unwanted products of the first mixer. The 8-MHz signal is fed to the second mixer, A1U1, where it is heterodyned with the output of the second local oscillator, A2Q2, which is operated at a crystal-controlled frequency of 13.4-MHz. The sum and difference signals produced by the mixing action are fed to a cascode output amplifier similar to that described in paragraph 2.2.3. This circuit contains transistors A1Q1 and A1Q2 and tuned so that only summed signals of 21.4-MHz are amplified and coupled to the output jack, J2. These IF signals are then fed through a coaxial cable to pin A1 of multipin plug P7.

2.3 TYPE 71338 RF TUNING ASSEMBLY

The RF section in the VH-101 consists of three subassemblies: a Type 71331 20-90-MHz RF Tuner; a Type 71332 8-21.4-MHz Converter, and a Type 8598 Tuning Drive. This method of packaging allows the RF section to be replaced as a unit, independent of the tuner chassis. An exploded view of the tuning drive is shown in Figure 5-10.

2.3.1 Type 71331 20-90-MHz RF Tuner. - The schematic diagram for the RF tuner is shown in Figure 6-1; its reference designation prefix is A1.

2.3.1.1 RF Preselector. - Incoming RF signals to jack J1 are fed directly to an impedance matching network made up of capacitors C10 and C11. This step-up transformation matches the antenna impedance to the input impedance of the first RF stage to achive the best combination of noise figure and V.S.W.R. Resistor R1 returns to ground any static charge that may build up on the antenna. Signals from the divider are fed to a tunable pre-selection network, a double-tuned bandpass filter. Input and output sections of the filter are tuned by inductors L1A and L1B respectively. These two components are the first and second sections of a five-section inductuner. The center frequency response is set by variable capacitors C13 and C17. End inductors L3 and L4 supply the required inductance to limit the inductuner range to 20-90-MHz. Padding of the inductuner at the low end of the band is provided by inductor L2. Primary coupling through the network is by capacitor C15. As the tuning approaches the low end and the impedance of L3 and L4 is reduced, signal coupling is increased through C16. Additional loading at the low-frequency end is provided by resistor R2. Capacitor C20 couples the signals from the pre-selector to the RF amplifier stage and performs the function of dc blocking.

2.3.1.2 RF Amplifier. - Transistor Q1, a dual, insulated-gate, field-effect type (IGFET) functions as the first RF amplifier. It is ac-coupled to Q2, a junction type field-effect transistor. The input stage is operated in a common source circuit while Q2 is operated in a grounded gate configuration. The latter transistor is housed within a separate brass compartment for maximum input-to-output isolation, thereby eliminating the need for neutralization. The source of transistor Q1 is held at RF ground potential by C23. Capacitor C21 provides this function for gate no. 2. Incoming RF signals are applied to gate no. 1 (pin 3) of Q1. Amplified signals are taken from pin 1, the drain connection. Gain control of the RF amplifier circuit is accomplished by applying an AGC voltage to gate no. 2 of Q1 through R7 and R9. Before AGC action begins, the gate voltage at pin 2 is approximately +3.4V as determined by resistors R6, R7 and diode CR1. Up to the time that AGC action begins, Q1 is operating at maximum gain. Once gain control action begins, the positive bias is decreased and the gain of the stage is reduced. Signals taken from pin 1 are fed through inductor L5 and blocking capacitor C25 to the source connection of the output stage, Q2. A pi-network filter is formed by the output capacitance of Q1, inductor L5, and the input capacitance of Q2 that increases the gain of the RF amplifier at the high-frequency end to compensate for losses sustained in the circuit at this end of the tuning range. Amplified RF signals from the drain, pin 1, of Q2 are fed through parasitic suppressor R13 to the interstage network.

2.3.1.3 Interstage Network. - A double-tuned, tunable bandpass filter forms the interstage network in the VH-101. Inductuner sections L1C and L1D tune the input and output sections, respectively. Variable capacitors C28 and C36 set the low-end response center frequency while end inductors L7 and L9 affect the high-end center frequency. Signal coupling through the network near the 90-MHz end of the band is primarily through C29 and C35. In order to maintain a constant coefficient of coupling through the network as the tuning approaches 90-MHz, a compensation network is used. This network, consisting of L8 and C33 is reasonant just below the low end of the band and appears capacitive as the tuner approaches 90 MHz. The dividing action that occurs between C29 and C33 eliminates an over-coupled condition that would otherwise result. By this means the bandwidth and gain are maintained at the desired levels. Coupling through the interstage network at the low end is predominantely through C32. End inductors L7 and L9 provide the necessary inductance at the 90-MHz end as the inductuner is reaching its high-end limit. Additional loading of the network at the low end is provided by R15. Capacitor C38 is used to couple RF signals from the interstage network to the first mixer.

2.3.1.4 Local Oscillator. - The local oscillator in the tuner, Q3, operates in a Colpitts circuit at a frequency which is 8-MHz higher than the incoming RF signal, in this case, 28-98-MHz. The oscillator is tuned by inductuner section L1E. Regenerative feedback to sustain oscillation is taken from the emitter and fed through R17 and voltage step-up capacitors C40-C41 to the base. Resistor R17, in conjunction with C40 and C41, sets the feedback level. Variable capacitor C43, connected across the oscillator tank, provides a means of adjusting the frequency for precise dial tracking. End inductor L11 performs this function for high-end adjustments. Shunt

inductor L12 sets the low-frequency point. Vernier and DAFC tuning of the oscillator is accomplished through the use of varactor CR2. This is a semiconductor device whose capacitance varies inversely with the reverse bias applied across it. This bias is derived from two sources: the front-panel FINE TUNING control, R2, and an associated frequency counter when DAFC is used. The FINE TUNING control can be adjusted over a range of approximately 3.5V. The BFO frequency will then be shifted ±8 kHz, minimum. For example, if R2 is rotated in the clockwise direction, the reverse bias will be increased. The capacitance of the diode will be decreased and the oscillator frequency will be increased. Operation of the VH-101/560 or 565-Series Receiver combination with an external frequency counter permits the use of DAFC. The DAFC voltage is applied to capacitor C6 and is fed through R21 to the varactor anode. The level of the DAFC correction voltage, and thus the amount of frequency change, is a function of the amount of LO drift sensed by the counting circuits. The varactor is coupled to the tank circuit through C45. Temperature compensation to eliminate frequency drift is provided by C56, which has a negative temperature coefficient. Oscillator output signals are fed to the base of buffer amplifier Q4 through coupling capacitors C46 and C47. The buffer isolates the oscillator from the first mixer and from the LO output jack to prevent changing load conditions from affecting the frequency. Torroid transformer T2 forms the collector load for Q4 and is tapped to provide the proper impedance transformation between it and the following network. Coupling between T1 and T2 is through capacitor C48. Transformers T1 and T2 in conjunction with resistor R30 form a hybrid power splitter. A portion of the LO signal is taken from T2, pin 3, and is fed through a 50-ohm attenuator made up of R31, R32, and R36, to output jack J2. The remaining output is taken from T2, pin 2, and is fed directly to the first mixer.

2.3.2 Part 16413 Mixer/IF Amplifier. - This board carries the complete reference designation prefix A1A1. It mounts the balanced mixer and a cascode IF output stage.

2.3.2.1 Mixer. - A completely sealed module, U1, is used as the mixer. It is a balanced type which suppresses the RF and LO inputs, producing predominately sum and difference signals. The RF signal is applied to pin 8 of U1 and the LO signal is connected to pin 5. Since the following circuit is tuned to the difference frequency of 8-MHz, only it is passed. These difference signals are taken from pins 3 and 7 and are coupled through blocking capacitor C1 to the IF amplifier stage.

2.3.2.2 Cascode IF Output Amplifier. - Transistors Q1 and Q2 form a cascode IF output amplifier network. Transistor Q1 is connected in a common emitter circuit whereas Q2 operates as a grounded base amplifier. By feeding back out-of-phase signals from collector to base through C2 and R2, the dynamic range, stability, and input impedance are optimized. Output signals at 8-MHz are developed across a tuned tank circuit formed by variable capacitor C4 and inductor L14. The inductor is tapped to provide the proper impedance match between the amplifier circuit and the input of the circuits in the 8 to 21.4-MHz converter. Coupling of IF signals from the tank circuit to the output gain control (R7) is through blocking capacitor C6. The arm of the potentiometer feeds the output signals to terminal E7 on the board and then to output jack J3.

2.4 TYPE 71332 8-21.4-MHz CONVERTER

The schematic diagram for this subchassis is Figure 6-2; it carries the reference designation prefix A2. Conversion of signals at the first IF frequency of 8-MHz occurs in this subassembly. It contains an input filter assembly, a balanced mixer, a crystal oscillator, and a cascode amplifier output stage.

2.4.1 Input Filter. - A three-pole bandpass filter is included between the IF input jack, J1, and the second mixer. This 2-MHz bandwidth filter is used to eliminate spurious signals which are generated by the various combinations of fundamental and harmonic outputs from the first and second local oscillators. Transformers T1 and T2 match input and output impedances of the filter, respectively. The input pole is tuned by C5. Inductor L1 tunes the center section, and capacitor C8 tunes the output pole. A 3-dB resistive attenuator made up of R1, A1R1, and A1R2 connects the signal to the mixer module.

2.4.2 Part 16523 Mixer IF Amplifier. -

2.4.2.1 The complete reference designation prefix for this board is A2A1. The function of this board is identical to the board described in paragraph 2.3.2. Electrical differences occur in the output filter circuit. The network used in the part 16523 employs a two-section bandpass configuration. Inductor L1 tunes the input section and L2 tunes the pi-network output section. In addition to providing a 50-ohm output impedance, this filter network attenuates spurious signals generated by the mixing action. The mixer module, U1, combines the 8-MHz IF

input with the 13.4-MHz output from the crystal oscillator in this chassis, to produce predominately, sum and difference signals. Since the output filter is tuned to the sum frequency of 21.4-MHz, only it is fed to the receiver.

2.4.2.2 Part 16466 13.4-MHz Crystal Oscillator. - Parts on this board carry the reference designation prefix A2A2. This board mounts the oscillator circuit and a buffer stage. The oscillator Q2, operates in a crystal-controlled Colpitts circuit with regenerative feedback from emitter-to-base through R9 and divider capacitors C10 and C11. These components set the feedback level. Capacitor C12 holds the collector of Q2 at RF ground. Output signals developed across C9 are coupled to the base of buffer amplifier Q1 through blocking capacitor C6. Variable capacitor C8 peaks the oscillator at 13.4-MHz. Buffer amplifier Q1 isolates Q2 from the load to prevent it from being pulled off frequency. The collector load for Q1 consists of a pi-network filter made up of C3, C4, and L1. It matches the output impedance of the buffer to the input impedance of the mixer and attenuates unwanted harmonics. Blocking capacitor C5 couples signals from the filter to mixer, U1.

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 materials 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 for loose hardware.

3.2 INSTALLATION

The VH-101 Tuning Head is a plug-in unit designed to operate with the Types 560 and 565-Series Receivers. Operating voltages as well as RF input and output signals are applied to the tuning head through rear-apron connectors that mate with receptacles in the tuner housing on the receiver. To install the tuning head, insert it into the housing in the receiver and slide it all the way back until the connectors are fully seated. Tighten the two locking knobs by rotating them fully clockwise.

3.3 OPERATION

Selection of the desired frequency is made with the main tuning knob. Vernier adjustment of the frequency can be made with the FINE TUNING control. The tape dial is illuminated when the receiver is turned on and it displays the frequency selected in easy to read white numerals.

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.

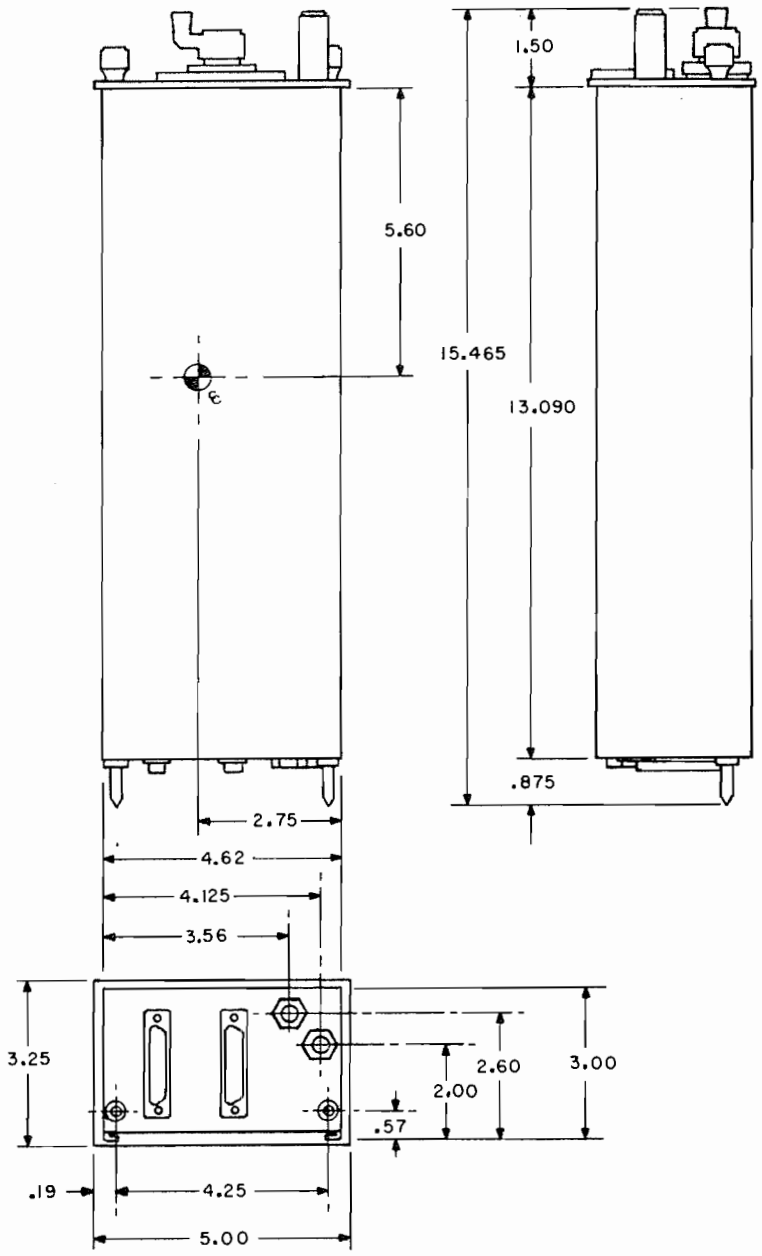


Figure 3-1. Type VH-101 Tuning Head, Critical Dimensions

SECTION IV
MAINTENANCE

4.1 GENERAL

The Type VH-101 Tuning Head has been conservatively designed to operate for extended periods of time with little or no routine maintenance. An occasional cleaning and inspection are the only preventive maintenance operations recommended. The intervals for these operations should be based on the operating environment. Should trouble occur, repair time will be minimized if the maintenance technician is familiar with the circuit descriptions found in Section II. Reference should also be made to the block diagram, Figure 2-1, and to the schematic diagrams found in Section VI. A complete parts list plus illustrations showing parts locations for the tuning head can be found in Section V.

4.2 CLEANING AND LUBRICATION

The tuning head should be kept free of dust, grease, and foreign matter to insure trouble-free operation. If available, use low-pressure compressed air to remove acculated dust from the interior and exterior. A clean dry cloth, a soft-bristled brush, or a cloth saturated with a cleaning compound may be used. Refer to paragraph 4.4 for tuning drive lubrication.

4.3 INSPECTION FOR DAMAGE OR WEAR

Many potential or existing troubles can be detected by a visual inspection of the unit. For this reason, a complete visual inspection should be made for indications of mechanical and electrical defects on a periodic basis, or whenever the unit is inoperative. Electronic components that show signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Damage to parts due to heat is often the result of other less apparent troubles in the circuit. It is essential that the cause of overheating be determined and corrected before replacing the damaged parts. Mechanical parts, and front panel controls should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4.4 MAINTENANCE

Figure 5-10 is an exploded view of the tuning drive assembly. The tuning drive requires little maintenance except for the occasional application of a few drops of light oil to the shaft bearings and removal of any accumulated dust or dirt.

4.4.1 Dial Lamp Replacement. - To replace a burned out dial lamp, proceed as follows:

(1) Referring to Figure 5-10, remove the two screws that hold the dial escutcheon. Remove the escutcheon.

(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 feed the lamps.

(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 all lamps if parts are available because if one lamp burns out, it is likely that the other lamps are nearing the end of their lives.

(6) Reassemble the unit be reversing steps (1) through (4).

4.4.2 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 fully clockwise until the tape dial stops moving.

(2) The mark to the right of the arrow should line up with the dial pointer. If it does not, proceed with the next step.

(3) Loosen the setscrew on gear no. 14 (Figure 5-10).

(4) Remove the dial escutcheon as described in paragraph 4.4.1, step (3) if necessary.

(5) By hand, move the dial tape and gear no. 14 independent of the tuning drive, to align the reference mark with the pointer.

(6) Tighten the setscrew on gear no. 14 and replace the dial escutcheon.

(7) Tune from one end of the dial to the other to determine if binding occurs in the tuning drive. If some binding is present, loosen the setscrew on gear no. 14 and slightly readjust its vertical position.

4.4.3 Removal of Tuning Assembly and Disassembly of Tuning Drive. - The RF tuner and the tuning drive can be removed from the tuning head by following the steps below. Once removed, the tuning drive can be disassembled using Figure 5-10 as a guide.

(1) Using the proper size Allen wrench, remove the tuning crank knob; loosen the lock nut securing the dial lock knob and remove the knob.

(2) Remove the dial lamp board by following steps (1) through (5) of paragraph 4.4.1.

(3) Unsolder the wires that feed the dial lamps using a low-heat iron or gun.

(4) Disconnect the following plugs from their respective jacks: plug P2 from A1J1, plug P3 from A1J2, and plug P6 from A1J3.

(5) Carefully unsolder the wires attached to the feedthrough capacitors. Be sure to mark the wires so that they can be connected to the proper places on the new RF tuner.

(6) Unsolder the wires connected to the precision potentiometer on the tuning drive.

(7) Remove the two screws that attach the tuning drive to the mounting bracket just to the rear of the drive mechanism.

(8) Support the RF tuner with one hand while removing the two mounting screws located at the rear of the assembly.

(9) Carefully remove the entire RF tuning assembly from the tuning head from the bottom.

(10) To reassemble, reverse the steps above.

4.5 TROUBLESHOOTING

Troubleshooting of the VH-101 should be done by the signal substitution method, namely inserting an RF signal into the input and checking for an output at each stage. Signal tracing should be started at the output and terminated at the input. Once the faulty stage is found, voltage measurements will usually pin point the defective part. A list of typical semiconductor element voltages is presented in Table 4-1.

4.6 TEST EQUIPMENT REQUIRED

The following test instruments or a suitable equivalent are required to align and test the Type VH-101 Tuning Head.

Item	Instrument Type	Required Characteristics	Use	Recommended Instrument(s)
1	Sweeping Signal Generator	10-MHz to 520-MHz frequency range; 0 to 10-MHz sweep width: internal 1-MHz and 10-MHz markers	RF alignment	Hewlett-Packard 675A
2	Signal Generators	50-kHz to 65-MHz and 10-MHz to 480-MHz	External Marker Source; trouble-shooting	Hewlett-Packard 606A & 608E
3	Low Impedance Detector	50-ohm	RF to DC con-version	Telonic XD-3A
4	Oscilloscope	500-kHz vertical bandwidth	Troubleshooting; alignment	Tektronix 503
5	Frequency Counter	Six digits with four-place accuracy	Signal generator calibration align-ment; trouble-shooting	Computer Measurements Corporation 738A
6	FM Signal Generator	10-MHz to 500-MHz frequency range	Performance checks	Hewlett-Packard 202H
7	AC VTVM	-60 to +50 dB and .001 to 300 V rms ranges	Performance checks	Hewlett-Packard 400L
8	Termination	50-ohm; BNC or N-Type Connector	Termination; performance checks	Microlab TA5MN-50-ohm or Telonix TRM-2
9	Extender Cable	Mate VH-Series Tuning Heads to 560 or 565 Receiver	Maintenance; alignment and test	WJ-CEI Type EC-560
10	RF VTVM	.001 to 3 V and -50 to +20 dBm input ranges	LO output level measurement	Boonton 910A-S5
11	Adapter	50-ohm input impedance	LO output level measurement	Boonton 91-8B
12	Receiver	560, 565, 0r 566	Maintenance; alignment and test	WJ-CEI Type 560, 565, or 566 re-ceiver.

NOTE

The dress of leads and the placement of components in the tuner is extremely critical. When making repairs or adjust-ments care should be taken to duplicate the exact physical placement of the original part. Do not move leads or wires to remove a component unless absolutely necessary.

4.7 POST-CORRECTIVE ALIGNMENT CHECK

The following alignment should be made after the replacement of a transistor or a frequency determining component in the preselector, interstage, oscillator, or converter input filter or oscillator networks, or if the maintenance technicial feels the alignment of the tuner would have been affected by the repair. If the response curve samples given cannot be duplicated, then the detailed alignment procedure given in paragraph 4.8 should be performed. Proceed as follows:

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

(2) Set the associated receiver controls as follows:

a. MODE - AM MAN

b. RF/IF GAIN - Fully Clockwise

c. IF BANDWIDTH kHz - Widest Bandwidth

(3) Tune the VH-101 to 20-MHz and center the FINE TUNING control.

(4) Tune the sweep generator to 20 MHz and turn on 10-MHz markers; decrease the signal generator output level to zero (-127 dBm).

(5) Adjust the sweep generator and oscilloscope controls to display a response curve. (The oscilloscope vertical sensitivity setting is shown on the left-hand margin of Figure 4-2.) The RF response should appear similar to Figure 4-2.

(6) Tune the sweep generator and VH-101 to 90-MHz.

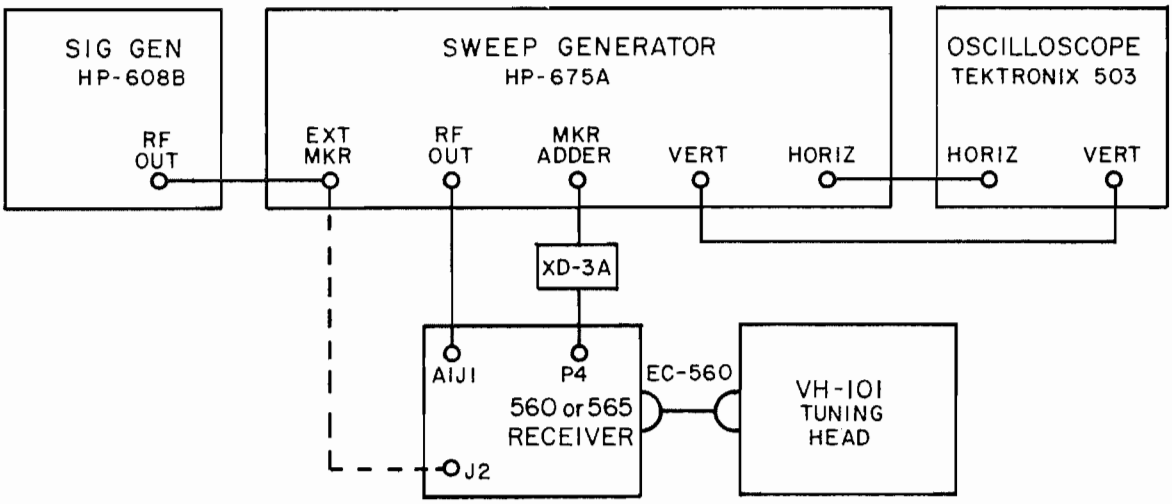


Figure 4-1. Test Setup, RF Alignment Check

(7) Adjust the sweep generator and oscilloscope controls to display a response curve. It should appear similar to Figure 4-3.

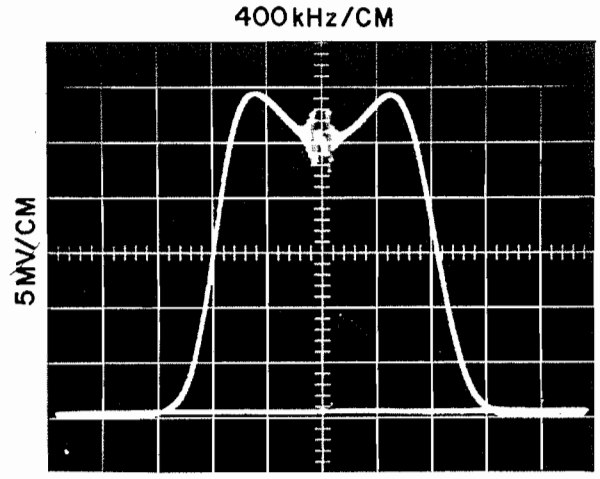


Figure 4-2. Typical Response, RF at 20-MHz

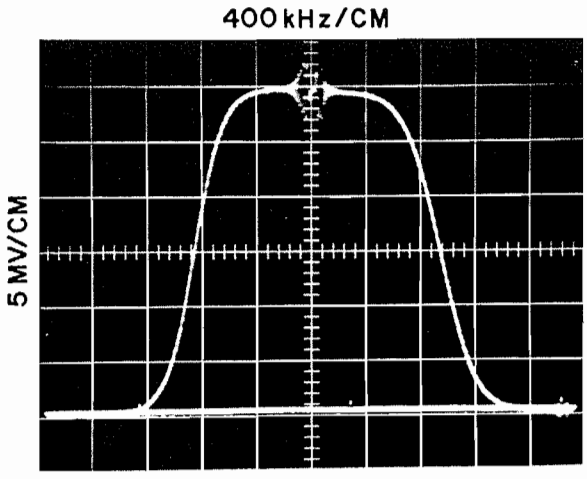


Figure 4-3. Typical Response, RF at 90-MHz

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

(9) Tune the sweep generator to 8-MHz; turn off 10-MHz markers and turn on 1-MHz markers.

(10) Adjust the sweep generator and oscilloscope controls to display a response curve. It should appear similar to Figure 4-5.

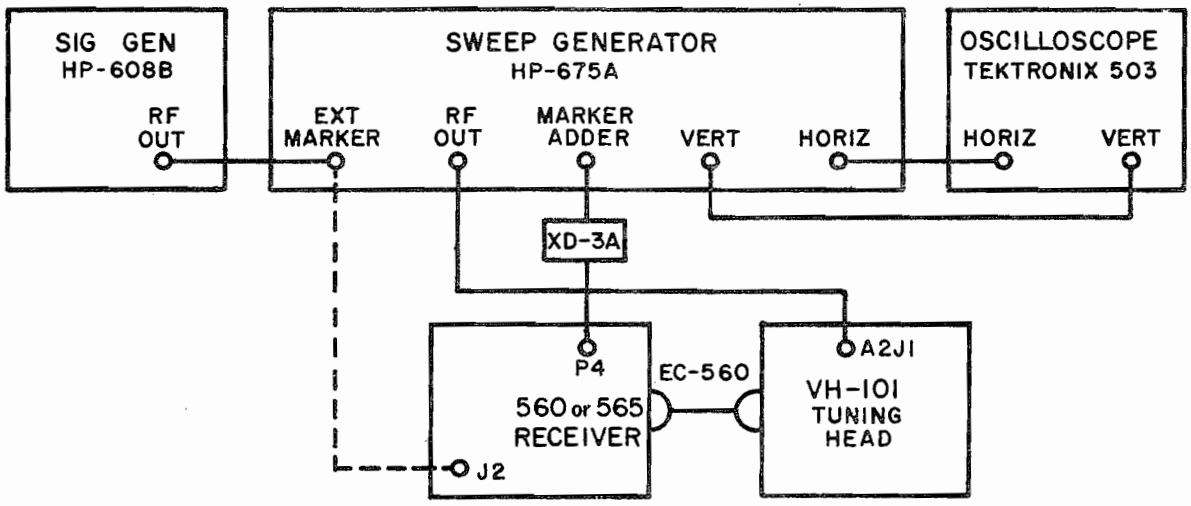


Figure 4-4. Test Setup, 8-21.4-MHz Converter Alignment

(11) If the response curves obtained do not resemble the samples given, proceed to the detailed alignment given in paragraph 4.8.

4.8 DETAILED RF ALIGNMENT

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

(2) Repeat paragraph 4.7, steps (2) through (5).

(3) Adjust capacitors A1C13, A1C17, A1C28, A1C33, A1C36 and A1A1C4 for a response similar to Figure 4-2.

(4) Repeat paragraph 4.7, steps (6) and (7). If the response obtained does not resemble Figure 4-3, again adjust the capacitors listed in step (3). Re-check the response at the high end of the band. If necessary, make compromise adjustments for best bandwidth and symmetry across the band.

NOTE

Additional adjustment of the preselector and interstage networks should not be necessary unless the five-section inductuner (L1A-E) is replaced. If this is done, end-inductor A1L3, A1L4, A1L7 and A1L9 may have to be adjusted by spreading or compressing the turns to obtain the required bandwidth and gain. This procedure should not be attempted however, unless considered absolutely necessary. If, after the complete alignment has been performed, and the response curves shown cannot be duplicated, then a factory alignment is necessary.

4.9 DIAL TRACKING

(1) Connect equipment as shown in Figure 4-1 except that the LO output from the receiver jack J2 is connected to the sweep generator EXT MKR input (dotted line on Figure 4-1). Replace the HP-608B signal generator with the HP-606A signal generator.

(2) Tune the HP-606A signal generator to 8-MHz, and adjust the controls for a CW output.

(3) Tune the sweep generator and VH-101 to 20-MHz and turn on the sweep generator 10 MHz markers.

(4) Calibrate the sweep generator to center the sweep at the 20-MHz marker.

(5) Increase the signal generator output level to produce a second marker on the response curve. This marker is the local oscillator signal.

(6) Tune the VH-101 to beat the two marker signals. Check the dial indication. If it is not within 1% of the 20-MHz, adjust capacitor C43 until it is.

(7) Tune the sweep generator and VH-101 to 90-MHz.

(8) Check the dial indication versus frequency setting. If it is not within 1% of 260-MHz, again adjust C43 slightly.

(9) Check the dial indications versus frequency settings at 10-MHz intervals from one end of the band to the other. The LO marker should beat with the frequency marker in all cases. The dial readings should be within 1% of the actual frequency.

NOTE

If required, end-inductor A1L11 can be adjusted by spreading or compressing the turns, at the 90-MHz end to minimize the relative errors across the band.

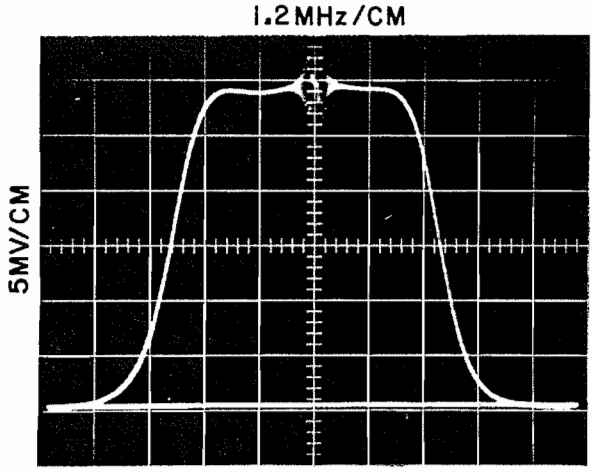


Figure 4-5. Typical Response, 8-21.4-MHz Converter

4.10 PERFORMANCE TESTS

The tests outlined in the following paragraphs provide a means of checking the relative performance of the VH-101 Tuning Head. The equipment required to perform these tests is listed in paragraph 4.6. The VH-101 should be installed in the receiver while these tests are made.

4.10.1 AM Sensitivity. - Proceed as follows:

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

(2) Set the receiver controls as follows:

a. MODE - AM MAN

b. IF BANDWIDTH kHz - 10

c. RF/IF GAIN - Full Clockwise

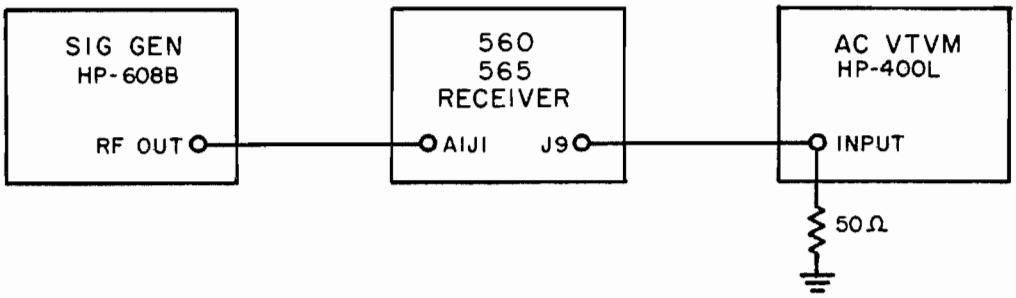


Figure 4-6. Test Setup, Performance Tests

(3) Tune the VH-101 to 90-MHz

(4) Tune the HP-608E signal generator to 90-MHz and adjust the output level to -110 dBm; adjust the modulation controls for 50% AM, at a 1-kHz rate.

(5) Using the VIDEO GAIN control on the rear apron of the receiver, set a convenient reference level on the AC VTVM (0-dBm).

(6) Remove the modulation from the input signal and note the reading on the AC VTVM. It should decrease no less than 10 dB.

4.10.2 FM Sensitivity. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-6 except that the HP-202H, FM Signal Generator should be substituted for the HP-608E.

(2) Place the receiver MODE switch in the FM position and the IF BANDWIDTH kHz switch in the 10 position.

(3) Tune the VH-101 and the signal generator to 90-MHz.

(4) Set the signal generator controls to produce a -110 dBm output, with a 3-kHz deviation at a 1-kHz rate.

(5) Using the VIDEO GAIN control on the rear apron of the receiver, set a convenient reference level on the AC VTVM (0-dBm).

(6) Change the signal generator mode to CW and note the decrease in the AC VTVM reading. It should be no less than 16 dB.

4.10.3 IF Rejection. - Proceed as follows:

(1) Connect the output of the HP-608E signal generator to jack A1J1 on the rear apron of the receiver in use.

(2) Tune the VH-101 and signal generator to 20-MHz.

(3) Set the output level of the signal generator to -110 dBm, CW mode.

(4) Using the receiver SWEEPWIDTH and GAIN controls, set a convenient full-scale reference at a center of the CRT screen.

(5) Tune the HP-608E to 8-MHz and increase the output level to again obtain full-scale deflection of the signal pip. Note the output level of the signal generator. It should be at least 60 dB greater than the level set in step (4).

4.10.4 Image Rejection. - Proceed as follows:

(1) Connect the output of the HP-608E signal generator to jack A1J1 on the rear apron of the receiver.

(2) Tune the VH-101 and the signal generator to 90-MHz.

(3) Adjust the signal generator controls for a CW output at a level of -110 dBm.

(4) Using the receiver SWEEPWIDTH and GAIN controls, set a convenient full-scale reference on the CRT screen.

(5) Tune the signal generator to 106-MHz and increase the input level to again obtain full-scale defection of the signal pip. Note the signal generator output level. It should be at least 60 dB greater than the level set in step (3).

4.10.5 Local Oscillator Output Level. - Proceed as follows:

(1) Connect the Boonton RF VTVM to jack J2 on the rear apron of the receiver, using the 50-ohm adapter.

(2) Energize the equipment and tune the VH-101 across the entire band while observing the RF VTVM. The LO output level should not be less than 50 mV at any spot in the band.

4.11 SUBASSEMBLY REMOVAL, REPAIR AND REPLACEMENT

4.11.1 The etched circuit boards located within the RF tuner may be removed by using simple hand tools and a low-heat soldering iron. Avoid prolonged application of heat to the boards.

4.11.2 8-21.4-MHz Converter Removal. - Proceed as follows:

(1) Unsolder and mark the wires attached to the three feedthrough capacitors. Disconnect plugs P4 and P9 from jacks A2J1 and A2J2, respectively.

(2) Remove the four mounting screws from the right side of the tuning head chassis.

(3) Remove the converter from the bottom.

(4) To reinstall, reverse the above steps.

Table 4-1. Typical Semiconductor Element Voltages

		Field Effect Transistor Pins				Transistor Elements		
Ref. Desig.	Type	Drain	Gate 2	Gate 1	Source	Emitter	Base	Collector
A1A1Q1	40673	14.8	3.4	1.2	1.4			
A1A1Q2	2N4416	13.3	+1.0	GND	GND			
A1A1Q3	2N3478	6.1	6.3	14.2	GND			
A1A1Q4	2N3478	2.2	3.0	14.4	GND			
A1A2A1Q1	2N5109					-12.00	-11.20	- 1.60
A1A2A1Q2	2N5109					- 0.80	GND	11.00
A1A2A2Q1	2N3933					3.20	3.80	11.20
A1A2A2Q2	2N2222					5.60	4.60	88.80

TEST CONDITIONS:

All readings are positive dc with respect to chassis unless otherwise noted. Readings taken with RCA-WV98C VTVM. No signal input; 115 Vac applied to receiver. Control settings:

MODE - AM MAN

IF BANDWIDTH - 10 kHz

RF/IF GAIN - Fully Clockwise

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 subassembly designation.

5.2 REFERENCE DESIGNATION PREFIX

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

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00328	Sterling Instrument Division of Designatronics, Inc. 76 East Second Street Mineola, New York 11501
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53204
01351	Dynamic Gear Company, Inc. 173-177 Dixon Avenue Amityville, New York 11701
02114	Ferroxcube Corporation of America Mt. Marion Road Saugerties, New York 12477
02735	RCA Corporation Solid State Division Route 202 Somerville, New Jersey 08876
04013	Taurus Corporation 1 Academy Hill Lambertville, New Jersey 08530
04941	Walsco Electronics Corporation 4 South Wyman Rockford, Illinois 61101
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, Maryland 20760
19505	Applied Engineering Products Company Div. of Samarius Inc. 26 E. Main Street Ansonia, Connecticut 06401
21604	The Buckeye Stamping Company 555 Marion Road Columbus, Ohio 43207

Mfr. Code	Name and Address
23480	Control Knobs, Inc. 180-08 Liberty Avenue Jamaica, New York 11433
25088	Siemens America, Inc. 350 5th Avenue New York, New York 10001
27925	Relay Company of America Division of Detronix Ltd. 20 Railroad Avenue East Northport, New York 11731
27956	Relcom 2164 East Middlefield Road Mountain View, California 94040
28480	Hewlett Packard Company 1501 Page Mill Road Palo Alto, California 94304
56289	Sprague Electric Company Marshall Street North Adams, Massachusetts 01247
70417	Chrysler Corporation Amplex Division 6501 Harper Avenue Detroit, Michigan 48211
71279	Cambridge Thermionic Corporation 445 Concord Avenue Cambridge, Massachusetts 02138
71468	ITT Cannon Electric Incorporated 3208 Humbolt Street Los Angeles, California 90031
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640
72136	Electro Motive Manufacturing Co., Inc. South Park & John Streets Willimantic, Connecticut 06226
72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
73899	JFD Electronics Company Div. of Stratford Retreat House 15th at 62nd Street Brooklyn, New York 11219
79136	Waldes Kohinoor Inc. 47-16 Austel Place Long Island City, New York 11101
80131	Electronic Industries Association 2001 Eye Street, N.W. Washington, D.C. 20006
81349	Military Specifications
83086	New Hampshire Ball Bearings, Inc. Peterborough, New Hampshire 03458
91293	Johanson Manufacturing Company P.O. Box 329 Boonton, New Jersey 07005
91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
91737	Gremar Manufacturing Company, Inc. 7 North Avenue Wakefield, Massachusetts 01880
95121	Quality Components, Inc. P.O. Box 113 St. Mary's, Pennsylvania 15857
96906	Military Standards Promulgated by Standardization Division Directorate of Logistic Services DSA
99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, New York 14052
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 to incorporate them in proprietary products. For this reason some transistors and diodes installed in an 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.

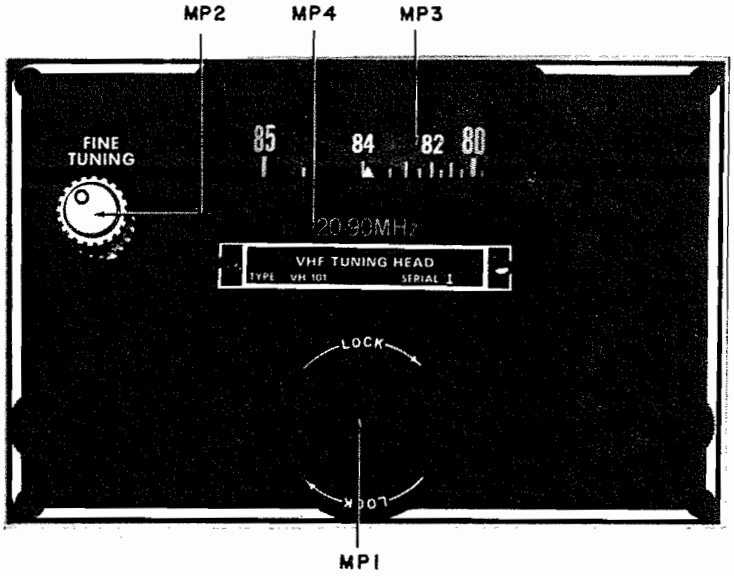


Figure 5-1. Type VH-101 Tuning Head, Front View

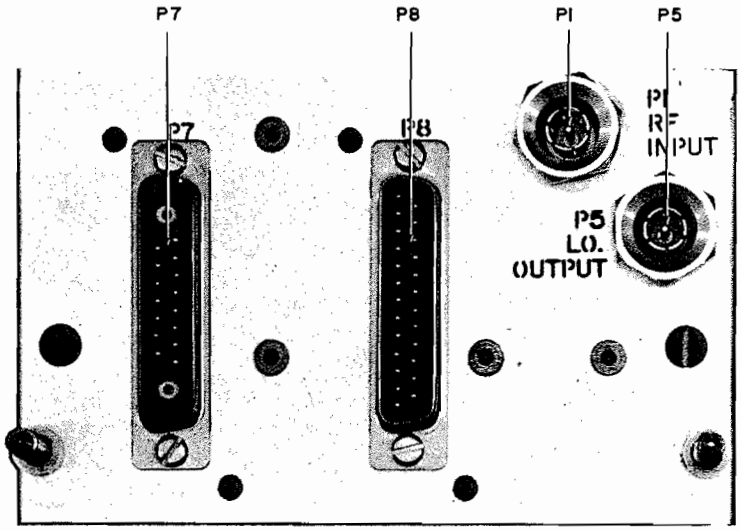


Figure 5-2. Type VH-101 Tuning Head, Rear View

5.4.1 Type VH-101 Tuning Head, Main Chassis

REF DESIG	DESCRIPTION		QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	RF TUNING ASSEMBLY		1	71338	14632
A2	8-21.4 MHz CONVERTER		1	71332	14632
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μF, 10%, 35 V		1	CS13BF475K	81349
FB1	FERRITE BEAD		1	56-590-65-4A	02114
MP1	KNOB		1	2S2S	23480
MP2	KNOB		1	Ps50D-1LG	21604
MP3	WINDOW		1	11448-1	14632
MP4	WINDOW		1	11449-1	14632
P1	CONNECTOR, PLUG, PUSH-ON SERIES	Part of W1	2	19699-1	91737
P2	CONNECTOR, PLUG, MINIATURE SERIES	Part of W1	3	UG-1466/U	81349
P3	Same as P2	Part of W2			
P4	CONNECTOR, PLUG, MINIATURE SERIES	Part of W3	2	UG-1465/U	81349
P5	Same as P1	Part of W2			
P6	Same as P2	Part of W3			
P7	CONNECTOR, PLUG, MULTIPIN		1	DBM-17W29	71468
P7A1	CONNECTOR, COAXIAL INSERT	Part of W4	1	DM53740-5001	71468
P8	CONNECTOR, PLUG, MULTIPIN		1	DBM-25P	71468
P9	Same as P4	Part of W4			
R1	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W		1	RCR07G152JS	81349
R2	RESISTOR, VARIABLE, COMPOSITION: 2.5 kΩ, 10% 1/3W		1	RV6NAYSD252A	81349
R3	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W		1	RCR07G682JS	81349
W1	CABLE AND CONNECTOR ASSEMBLY		1	30020-1571	14632
W2	CABLE AND CONNECTOR ASSEMBLY		1	30020-1572	14632
W3	CABLE AND CONNECTOR ASSEMBLY		1	30020-1573	14632
W4	CABLE AND CONNECTOR ASSEMBLY		1	30020-1574	14632

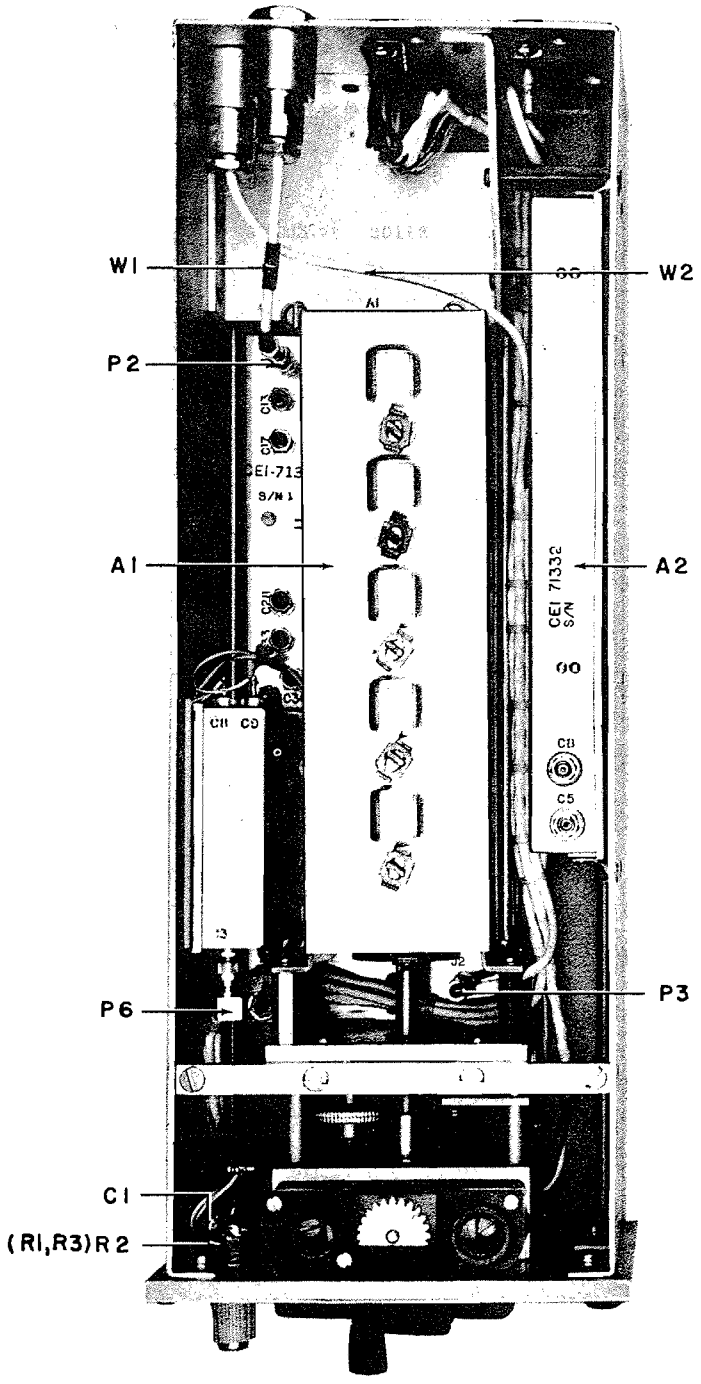


Figure 5-3. Type VH-101 Tuning Head, Top View

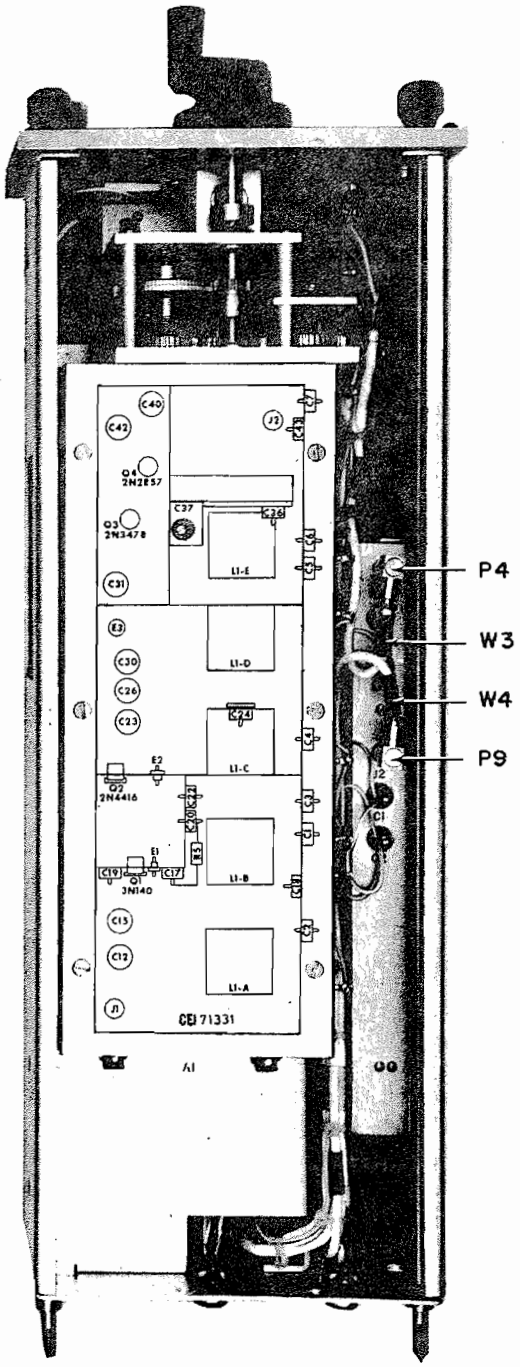


Figure 5-4. Type VH-101 Tuning Head, Bottom View

5.4.2 Type 71338 RF Tuning Assembly

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	20-90 MHz RF TUNER	1	71331	14632
A2	TUNING DRIVE	1	8598	14632

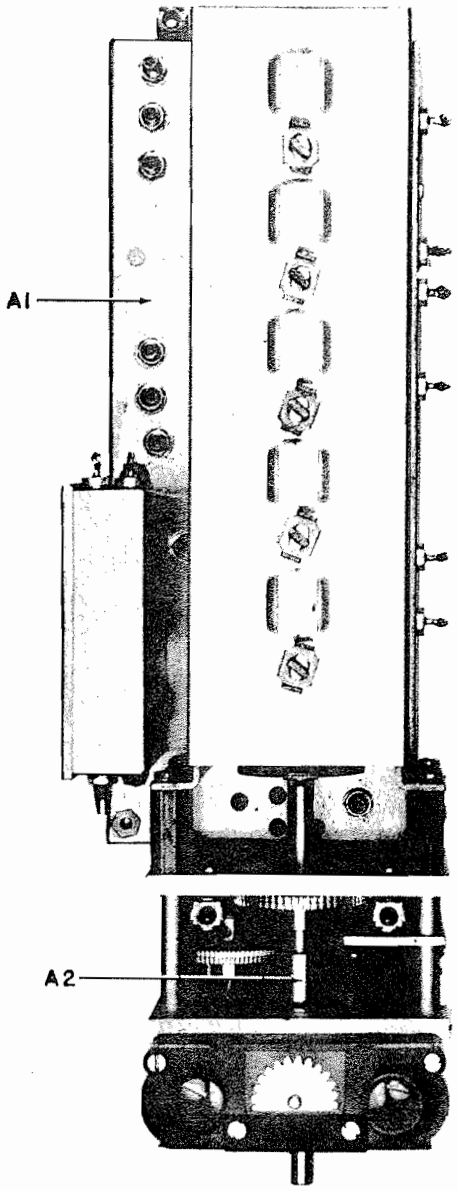


Figure 5-5. Type 71338 RF Tuning Assembly (A1), Component Locations

5.4.2.1 Type 71331 20-90-MHz RF Tuner REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	MIXER/IF AMPLIFIER	1	16413	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500 V	11	FA5C-102W	01121
C2	Same as C1			
C3	Same as C1			
C4	Same as C1			
C5	Same as C1			
C6	Same as C1			
C7	Same as C1			
C8	Same as C1			
C9	Same as C1			
C10	CAPACITOR, MICA, DIPPED: 36 pF, 5%, 500 V	2	CM05ED360J03	81349
C11	CAPACITOR, MICA, DIPPED: 82 pF, 5%, 500 V	1	CM05ED820J03	81349
C12	CAPACITOR, CERAMIC, TUBULAR: 7.5 pF, ±.5 pF, 500 V	1	301-000-C0H0-759C	72982
C13	CAPACITOR, VARIABLE, GLASS: .8-8.5 pF, 750 V	5	VC-20GY	73899
C14	CAPACITOR, CERAMIC, TUBULAR: 10 pF, ±.5 pF, 500 V	4	301-000-C0H0-100D	72982
C15	CAPACITOR, CERAMIC, TUBULAR: 2.2 pF, ±.1 pF, 500 V	2	301-000-C0J0-229C	72982
C16	Same as C15			
C17	Same as C13			
C18	Same as C14			
C19	CAPACITOR, MICA, DIPPED: 27 pF, 5%, 500 V	1	CM05ED270J03	81349
C20	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	2	1000pF, GMV	91418
C21	CAPACITOR, CERAMIC, STANDOFF: 1000 pF, GMV, 500 V	10	SS5D-102W	01121
C22	Same as C21			
C23	Same as C21			
C24	Same as C1			
C25	CAPACITOR, MICA, DIPPED: 220 pF, 5%, 500 V	1	CM05FD221J03	81349
C26	Same as C1			
C27	Same as C10			
C28	Same as C13			
C29	Same as C15			
C30	Same as C14			

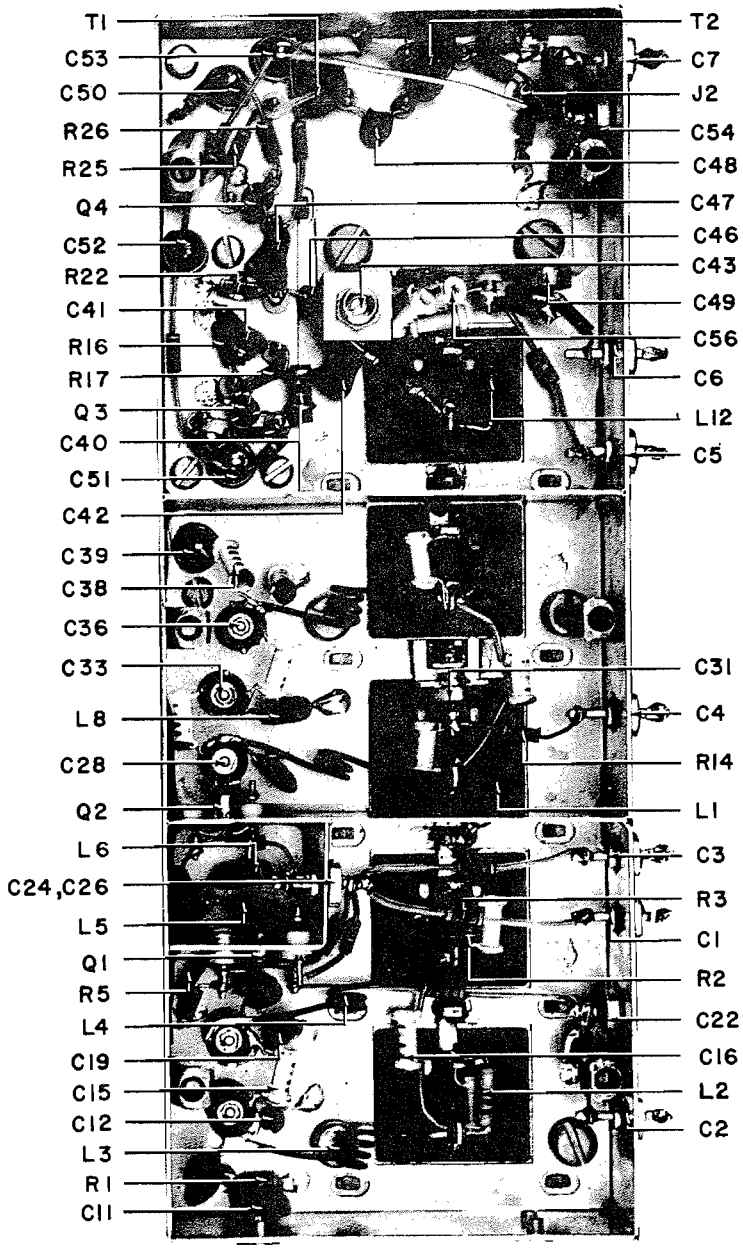


Figure 5-6. Type 71331 20-90-MHz RF Tuner (A1A1), Component Locations

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C31	Same as C21			
C32	CAPACITOR, CERAMIC, TUBULAR: 2.4 pF, ±.25 pF, 500 V	1	301-000-C0J0-249C	72982
C33	Same as C13			
C34	Same as C14			
C35	Same as C15			
C36	Same as C13			
C37	CAPACITOR, CERAMIC, TUBULAR: 18 pF, 5%, 500 V	1	301-000-C0G0-180J	72982
C38	CAPACITOR, CERAMIC, TUBULAR: 22 pF, 5%, 500 V	1	301-000-C0G0-220J	72982
C39	CAPACITOR, CERAMIC, FEEDTHRU: 330 pF, 10%, 500 V	1	FA5C-3311	01121
C40	CAPACITOR, CERAMIC, DISC: 68 pF, 5%, 50 V	1	1U68RJ	93958
C41	Same as C27			
C42	CAPACITOR, MICA, DIPPED: 20 pF, 5%, 500 V	1	CM05ED200J03	81349
C43	CAPACITOR, VARIABLE, AIR: ,8-10 pF, 250 V	1	2954	91293
C44	CAPACITOR, CERAMIC, TUBULAR: 15 pF, 5%, 500 V	1	301-000-C0G0-150J	72982
C45	CAPACITOR, CERAMIC, TUBULAR: 1.8 pF, ±.25 pF, 500 V	1	301-000-C0K0-189C	72982
C46	CAPACITOR, COMPOSITION, TUBULAR: .68 pF, 10%, 500 V	1	QC(.68 pF,K)	95121
C47	Same as C20			
C48	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM(1000pF,GMV)	91418
C49 thru C54	Same as C21			
C55	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μF, 10%, 35 V	1	CS13BF105K	81349
C56	CAPACITOR, CERAMIC, TUBULAR: 3 pF, ±.25 pF, 500 V	1	301-000-U2J0-309C	72982
C57 thru C59	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 500 V	3	SM5000PFM	91418
CR1	DIODE	1	1N462A	80131
CR2	DIODE	1	BB105B	25088
E1	TERMINAL FEEDTHRU	2	SFU-16	04013
E2	Same as E1			
FB1	FERRITE BEAD	2	56-590-65/4A	02114
FB2	Same as FB1			

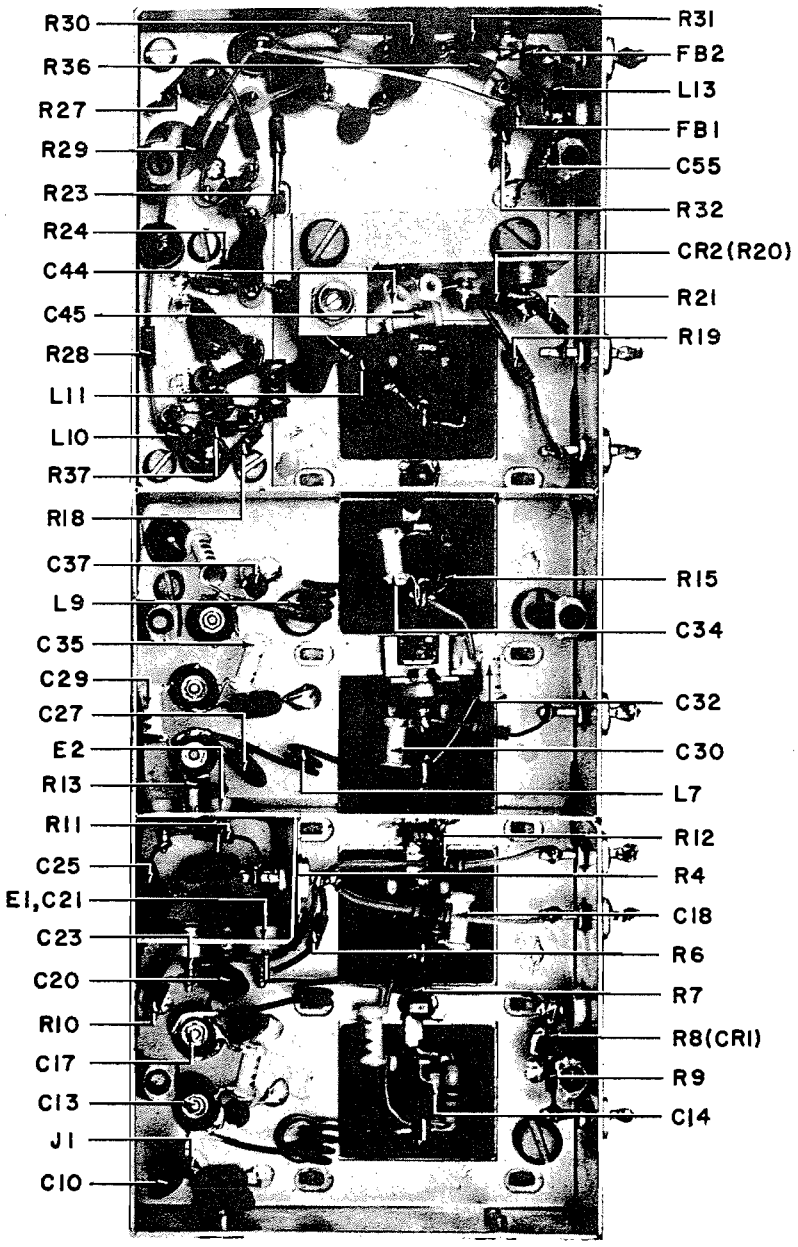


Figure 5-7. Type 71331 20-90-MHz RF Tuner (A1A1), Component Locations

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
J1	CONNECTOR, RECEPTACLE, MINIATURE SERIES	3	10-0104-002	19505
J2	Same as J1			
J3	Same as J1			
L1	INDUCTOR, MODIFIED	1	21701-8	14632
L2	COIL, FIXED: 12 μH	1	1537-38	99800
L3	INDUCTOR, AIR CORE	2	22292-33	14632
L4	INDUCTOR, AIR CORE	2	22292-41	14632
L5	COIL, FIXED: .56 μH	1	202-11	99848
L6	COIL, FIXED: 1.2 μH	1	1537-14	99800
L7	Same as L4			
L8	INDUCTOR	1	21210-106	14632
L9	Same as L3			
L10	INDUCTOR (RESISTOR FORM)	1	21209-10	14632
L11	INDUCTOR	1	21210-33	14632
L12	INDUCTOR	1	21210-113	14632
L13	COIL, FIXED: 4.7 mH	1	3635-45	71279
MP1	COVER, RF TUNER	1	22590-2	14632
MP2	COVER, MIXER	1	16207-1	14632
Q1	TRANSISTOR	1	3N187	02735
Q2	TRANSISTOR	1	2N4416	80131
Q3	TRANSISTOR	2	2N3478	80131
Q4	Same as Q3			
R1	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	RCR07G104JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	2	RCR07G682JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	3	RCR07G470JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 510 kΩ, 5%, 1/4W	1	RCR07G514JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	RCR07G473JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	1	RCR07G124JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	RCR07G333JS	81349
R8	Same as R2			
R9*	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 300 Ω, 5%, 1/4W	1	RCR07G301JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	2	RCR07G332JS	81349
R12	Same as R3			

* Nominal value; Final value factory selected.

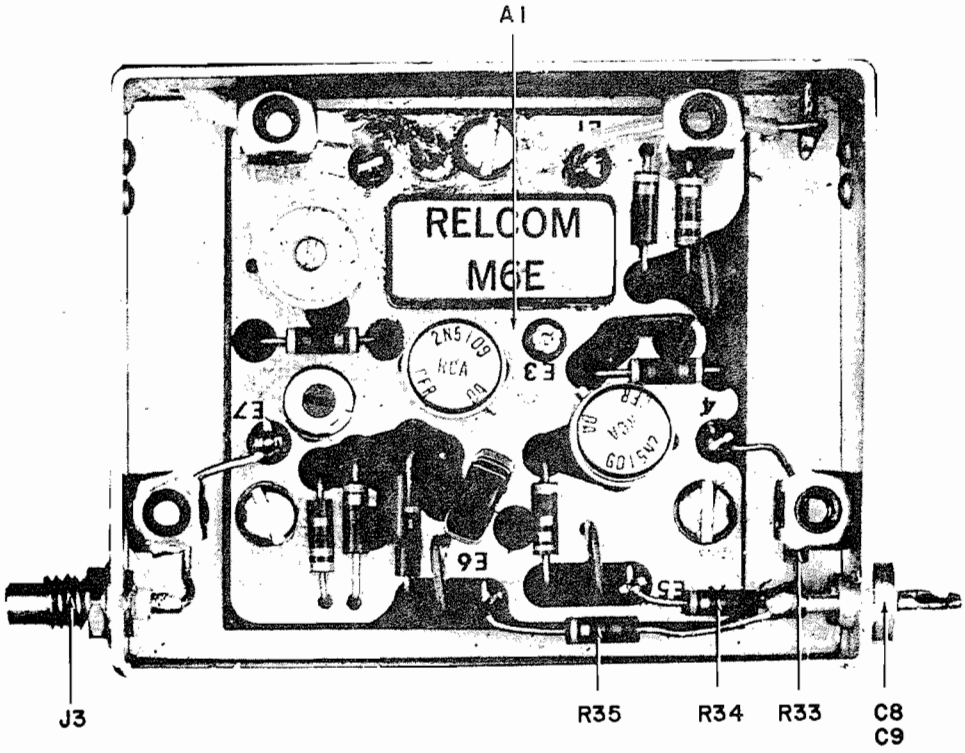


Figure 5-8. Type 7J331 20-90-MHz RF Tuner (A1A1) Side View, Component Locations

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R13	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	3	RCR07G100JS	81349
R14	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349
R15	RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W	2	RCR07G272JS	81349
R16	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	1	RCR07G821JS	81349
R17	Same as R3			
R18	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	2	RCR07G103JS	81349
R19	Same as R1			
R20	Same as R1			
R21	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	RCR07G102JS	81349
R22	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	2	RCR07G101JS	81349
R23	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	RCR07G822JS	81349
R24	Same as R15			
R25	Same as R13			
R26	Same as R13			
R27	RESISTOR, FIXED, COMPOSITION: 180 Ω, 5%, 1/4W	1	RCR07G181JS	81349
R28	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	2	RCR07G220JS	81349
R29	Same as R28			
R30	Same as R22			
R31	RESISTOR, FIXED, COMPOSITION: 75 Ω, 5%, 1/4W	2	RCR07G750JS	81349
R32	Same as R31			
R33	Same as R11			
R34	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	1	RCR07G151JS	81349
R35	RESISTOR, FIXED, COMPOSITION: 270 Ω, 5%, 1/4W	1	RCR07G271JS	81349
R36	RESISTOR, FIXED, COMPOSITION: 120 Ω, 5%, 1/4W	1	RCR07G121JS	81349
R37	Same as R18			
T1	TRANSFORMER, TOROIDAL	1	21727-4	14632
T2	TRANSFORMER, TOROIDAL	1	21278-7	14632

5.4.2.1.1 Part 16413 Mixer/IF Amplifier REF DESIG PREFIX A1A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: .01 μF, 20%, 200V	5	CK06BX103M	81349
C2	Same as C1			
C3	Same as C1			
C4	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350V	1	538-011-D9-35	72982
C5	Same as C1			
C6	Same as C1			
Q1	TRANSISTOR	2	2N5109	80131
Q2	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	RCR07G822JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 4.7 Ω, 5%, 1/4W	1	RCR07G4R7JS	81349
R5	Same as R3			
R6	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	1	RCR07G151JS	81349
R7	RESISTOR, VARIABLE, FILM: 100 Ω, 10%, 1/2W	1	62PR100	28480
R8	RESISTOR, FIXED, COMPOSITION: 33 Ω, 5%, 1/4W	1	RCR07G330JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	1	RCR07G152JS	81349
T1	TRANSFORMER, TOROIDAL	1	21428-19	14632
U1	MIXER	1	M6E	27956

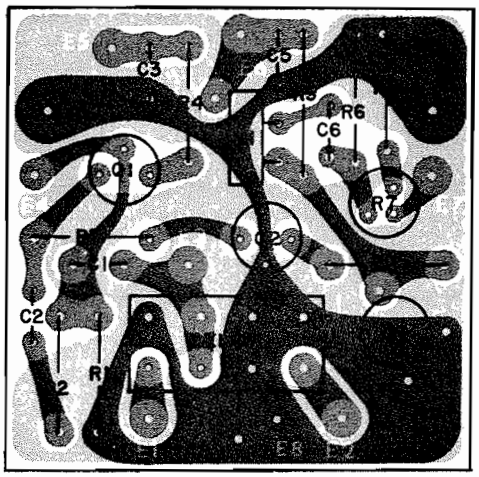


Figure 5-9. Part 16413 Mixer/IF Amplifier (A1A1A1), Component Locations

5.4.2.2 Type 8598 Tuning Drive REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
DS1	LAMP, INCANDESCENT: 5V, .06A	3	CM8-683	71744
DS2	Same as DS1			
DS3	Same as DS1			
R1	RESISTOR, VARIABLE, PRECISION: 500 Ω, 1%, 1-1/2W	1	7223-962-1	73138

NOTE: For mechanical parts, see exploded view.

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
1	FRONT GEAR PLATE	1	21349-1	14632
2	BALL BEARING	2	SFR2-63MM	83086
3	BALL BEARING	2	SFR33MM	83086
4	BALL BEARING	3	SFR1883MM	83086
5	LIGHT BAR	1	13963	14632
6	LIGHT BOARD ASSEMBLY	1	14004	14632
7	LAMP, INCANDESCENT: 5V, .06A (DS1, DS2, DS3)	Ref	CM8-683	71744
8	GUIDE PLATE	1	14122-1	14632
9	ANGLE PLATE	1	15357-1	14632
10	COVER	1	14044-2	14632
11	CALIBRATED TAPE	1	32902-1	14632
12	TAPE CHAMBER MODIFIED	1	15356-1	14632
13	SHAFT	1	13908-4	14632
14	SPUR GEAR, TAPE DRIVE	1	14065-1	14632
15	PINION GEAR MODIFIED	1	11136-1	14632
16	TENSION SPRING	1	13944-1	14632
17	SUPPORT PLATE	1	11147-5	14632
18	COLLAR	1	11581-2	14632
19	SPRING, TENSION	AR	7754	04941
20	THRUST WASHER (BRONZE)	1	TT-504	70417
21	DRIVE SHAFT	1	1002-96	14632
22	RING RETAINING	2	5100-25	79136
23	GEAR, SPUR	1	13955-2	14632
24	GEAR, MODIFIED (BEVEL)	1	11135-1	14632
25	RING, RETAINING	1	5100-18	79136
26	IDLER SHAFT	1	21352-2	14632
27	COLLAR	1	11581-6	14632
28	SPRING, TENSION	AR	7752	04941
29	CLUTCH BEARING	2	11582-7	14632
30	GEAR, ANTI-BACKLASH	1	20182-18	14632
31	GEAR, SPUR	1	2984-59	14632
32	SHIM SPACER	AR	SSS-23	01351
33	GEAR, ANTI-BACKLASH	1	20180-6	14632
34	SPACER	2	20757-26	14632
35	SPACER	2	20757-27	14632

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
36	PLATE, POTENTIOMETER	1	11131-2	14632
37	CLAMP, SYNCRO MTG	3	C2	00328
38	POTENTIOMETER	Ref	7223-962-1	73138
39	GEAR, SPUR	1	2984-68	14632
40	SPACER	2	11151-1	14632
41	REAR GEAR PLATE	1	16202-1	14632
42	SPACER-SHOULDER	4	20755-77	14632
43	INDUCTUNER	Ref	21701-6	14632
44	SET SCREW #4-40 x 1/8 Lg	AR	MS51021-9	96906
45	SET SCREW #6-32 x 1/8 Lg	AR	MS51021-21	96906
46	#2 FLAT WASHER	AR	MS15795-802	96906
47	#6 FLAT WASHER	AR	MS15795-805	96906
48	#2 LOCK WASHER (SPLIT)	AR	MS35338-134	96906
49	#4 LOCK WASHER (SPLIT)	AR	MS35338-135	96906
50	#6 LOCK WASHER (SPLIT)	AR	MS35338-136	96906
51	#2-56 x 3/16 Lg PAN HEAD MACHINE SCREW	AR	MS35233-2	96906
52	#2-56 x 1/4 Lg PAN HEAD MACHINE SCREW	AR	MS35233-3	96906
53	#2-56 x 1/4 Lg FIL. HEAD MACHINE SCREW	AR	MS35275-10	96906
54	#2-56 x 1/4 Lg FLAT HEAD MACHINE SCREW	AR	MS35249-10	96906
55	#4-40 x 3/8 Lg PAN HEAD MACHINE SCREW	AR	MS35233-15	96906
56	#6-32 x 1/4 Lg PAN HEAD MACHINE SCREW	AR	MS35233-26	96906
57	#6-32 x 3/8 Lg SCH CAP SCREW	AR	MS16995-17	96906
58	#6-32 x 1.00 Lg FLAT HEAD MACHINE SCREW	AR	MS35249-41	96906

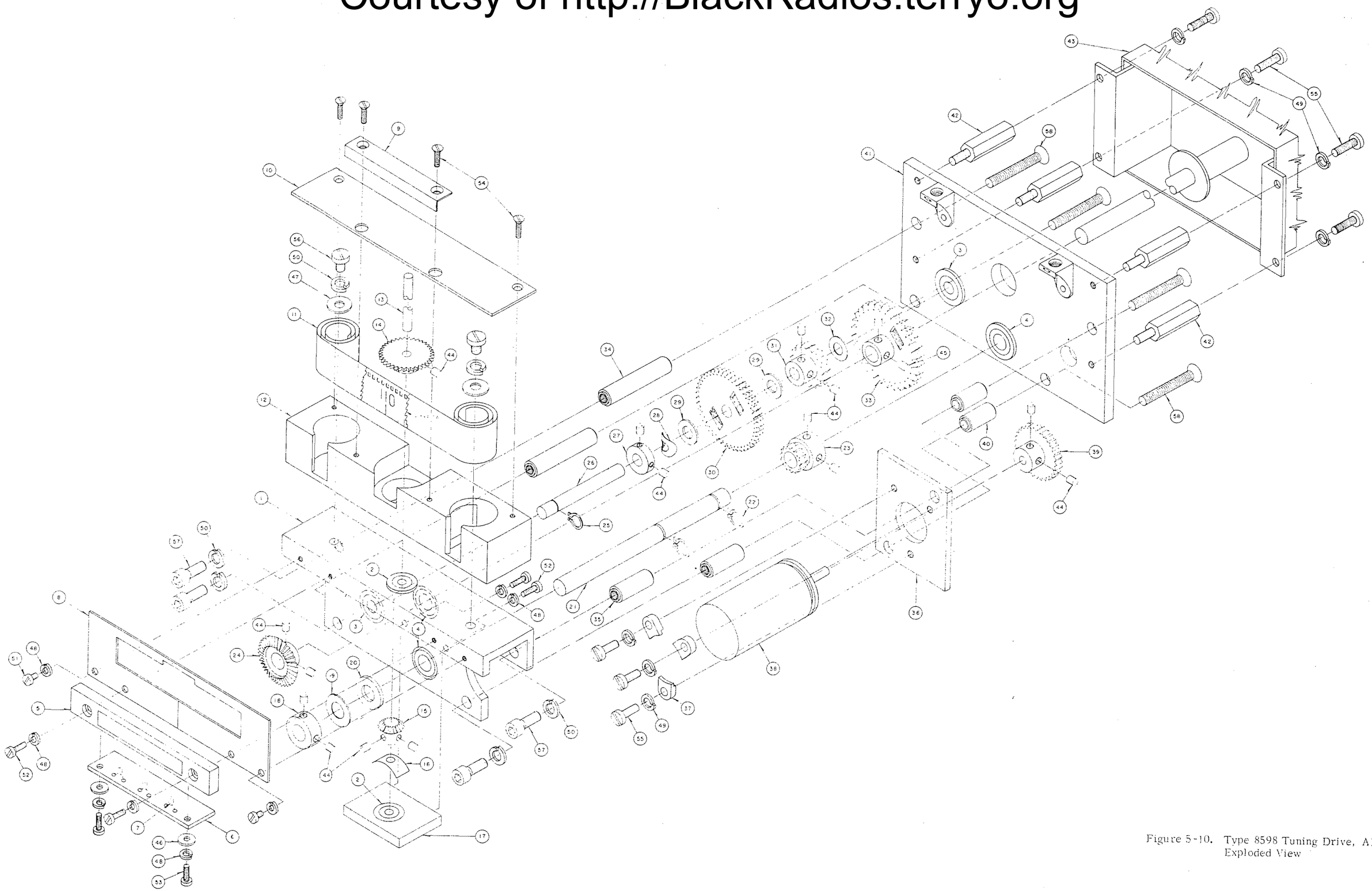


Figure 5-10. Type 8598 Tuning Drive, A1A2, Exploded View

5.4.3 Type 71332 8-21.4-MHz Converter REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	MIXER/IF AMPLIFIER	1	16523	14632
A2	13.4 MHz OSCILLATOR	1	16466	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500 V	4	FA5C-102W	01121
C2	Same as C1			
C3	Same as C1			
C4	CAPACITOR, MICA, DIPPED: 500 pF, 5%, 500 V	2	DM15-501J	72136
C5	CAPACITOR, VARIABLE, GLASS: 1-28 pF, 1000 V	2	MC603	73899
C6	CAPACITOR, MICA, DIPPED: 15 pF, 5%, 500 V	1	CM05CD150J03	81349
C7	Same as C4			
C8	Same as C5			
C9	Same as C1			
C10	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 500 V	2	SM5000PFM	91418
C11	Same as C10			
E1	TERMINAL, FEEDTHRU	3	SFU-16	04013
E2	Same as E1			
E3	Same as E1			
J1	CONNECTOR, RECEPTACLE, MINIATURE SERIES	2	10-0104-002	19505
J2	Same as J1			
L1	COIL, VARIABLE	1	1471-8	14632
L2	COIL, TOROIDAL (TAPPED)	2	21428-21	14632
L3	Same as L2			
MP1	COVER	1	22796-1	14632
R1	RESISTOR, FIXED, COMPOSITION: 8.2 Ω, 5%, 1/4W	1	RCR07G8R2JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 110 Ω, 5%, 1/4W	2	RCR07G111JS	81349
R3	Same as R2			
R4	RESISTOR, FIXED, COMPOSITION: 270 Ω, 5%, 1/4W	1	RCR07G271JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	1	RCR07G151JS	81349
T1	TRANSFORMER	2	22295-20	14632
T2	Same as T1			

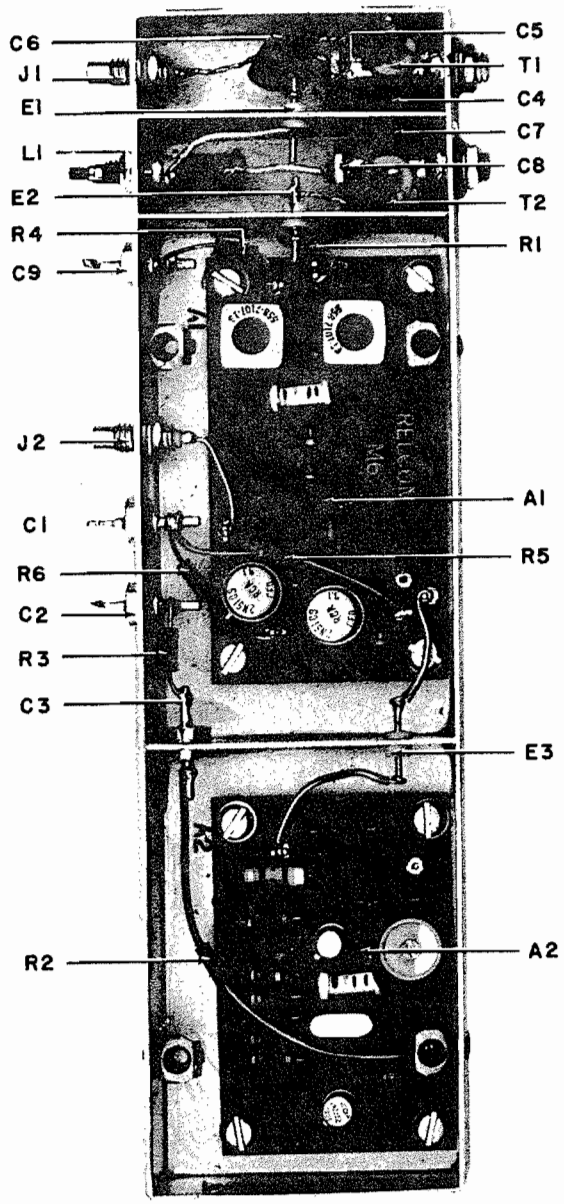


Figure 5-11. Type 71332 8-21.4-MHz Converter (A2), Component Locations

5.4.3.1 Part 16523 Mixer/IF Amplifier REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: .01 μF, 20%, 200V	3	8131-A200-Z5U-103M	72982
C2	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	1	SM(1000pF, GMV)	91418
C3	Same as C1			
C4	Same as C1			
C5	CAPACITOR, MICA, DIPPED: 51 pF, 5%, 500V	1	CM05ED510J03	81349
C6	CAPACITOR, CERAMIC, TUBULAR: 7.5 pF, ±.5 pF, 500V	1	301-000-C0H0-759D	72982
C7	CAPACITOR, MICA, DIPPED: 56 pF, 5%, 500V	1	CM05ED560J03	81349
C8	CAPACITOR, MICA, DIPPED: 220 pF, 5%, 500V	1	CM05FD221J03	81349
L1	COIL, VARIABLE	2	7107-13	71279
L2	Same as L1			
Q1	TRANSISTOR	2	2N5109	80131
Q2	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 130 Ω, 5%, 1/4W	1	RCR07G131JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 8.2 Ω, 5%, 1/4W	1	RCR07G8R2JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	RCR07G822JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 360 Ω, 5%, 1/4W	1	RCR07G361JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 6.8 Ω, 5%, 1/4W	1	RCR07G6R8JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349
R7	Same as R6			
R8	RESISTOR, FIXED, COMPOSITION: 27 Ω, 5%, 1/4W	2	RCR07G270JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 30 Ω, 5%, 1/4W	1	RCR07G300JS	81349
R10	Same as R8			
U1	DOUBLE BALANCED MIXER	1	M6	27925

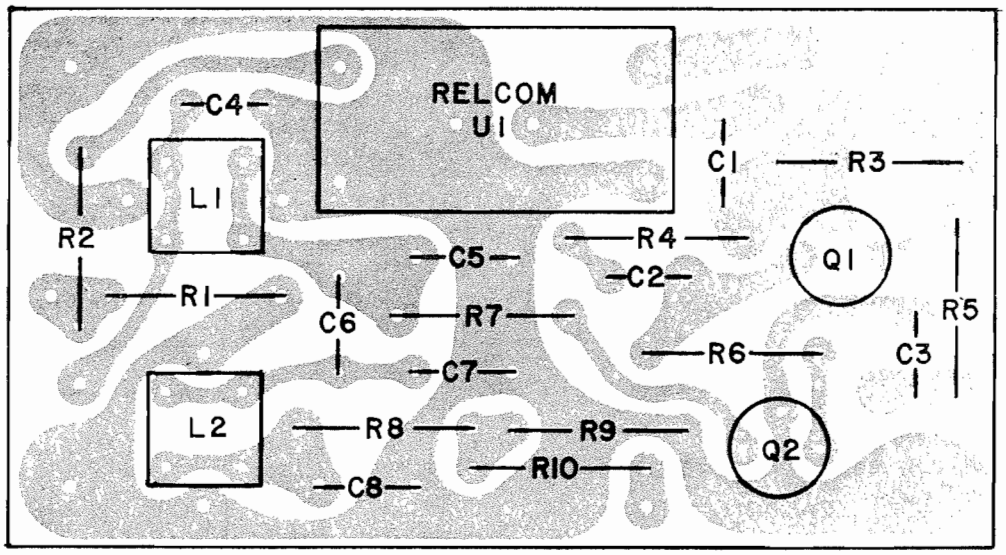


Figure 5-12. Part 16523 Mixer/IF Amplifier (A2A1), Component Locations

5.4.3.2 Part 16466 13.4 MHz Oscillator REF DESIG PREFIX A2A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: .01 μF, 20%, 500V	2	C023B101F103M	56289
C2	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 500V	1	C023B101E502M	56289
C3	CAPACITOR, MICA, DIPPED: 270 pF, 5%, 500V	1	CM05FD271J03	81349
C4	CAPACITOR, MICA, DIPPED: 82 pF, 5%, 500V	1	CM05ED820J03	81349
C5	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	2	SM(1000pF, GMV)	91418
C6	CAPACITOR, CERAMIC, TUBULAR: 2 pF, ±.25 pF, 500V	1	301-000-C0K0-209C	72982
C7	Same as C1			
C8	CAPACITOR, VARIABLE, CERAMIC: 2-8 pF, 350V	1	538-011-A2-8	72982
C9	CAPACITOR, MICA, DIPPED: 30 pF, 5%, 500V	1	CM05ED300J03	81349
C10	CAPACITOR, MICA, DIPPED: 110 pF, 5%, 500V	2	CM05FD111J03	81349
C11	Same as C10			
C12	Same as C5			
L1	COIL, FIXED: 2.2 μF	1	1537-20	99800
Q1	TRANSISTOR	1	2N3478	80131
Q2	TRANSISTOR	1	2N2222	80131
R1	RESISTOR, FIXED, COMPOSITION: 56 Ω, 5%, 1/4W	1	RCR07G560JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	1	RCR07G391JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 82 kΩ, 5%, 1/4W	1	RCR07G823JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	1	RCR07G124JS	81349
R9	Same as R2			
R10	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	1	RCR07G821JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	RCR07G182JS	81349
Y1	CRYSTAL, QUARTZ: 13.400 MHz	1	CR-64U(13.4 MHz)	81349

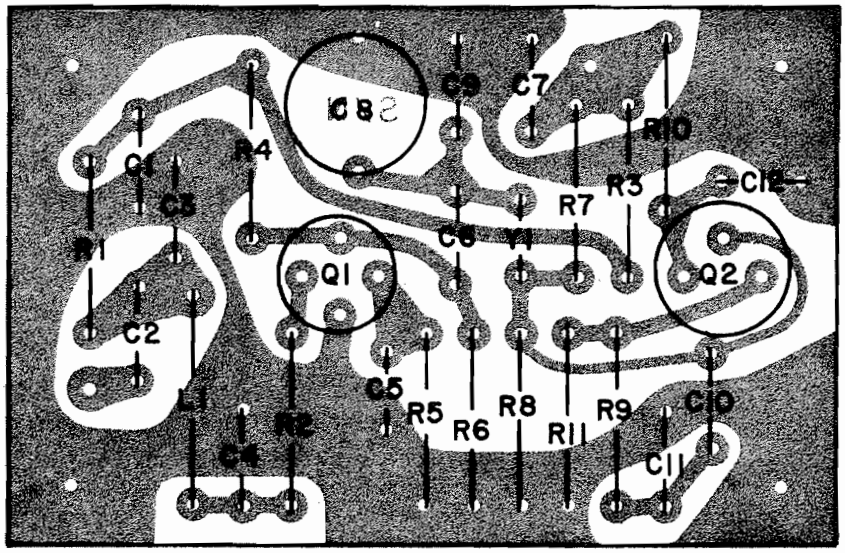


Figure 5-13. Part 16466 13.4-MHz Oscillator (A2A2), Component Locations

SECTION VI

SCHEMATIC DIAGRAMS

DETAIL A

TYPE	R31	R36	R32
-1	75	120	75
-2	120	51	120

NOTES:
1. UNLESS OTHERWISE SPECIFIED,
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
2. CW ON A1R7 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
3. L1-A THRU L1-E ARE GANDED SECTIONS OF INDUCTUNER L1.
4. HEAVY LINE INDICATES MAIN SIGNAL PATH.
5. DIFFERENCE BETWEEN TYPES IS AT R31, R36, R32 AS SHOWN IN DETAIL A
6. NOMINAL VALUE, FINAL VALUE FACTORY SELECTED.

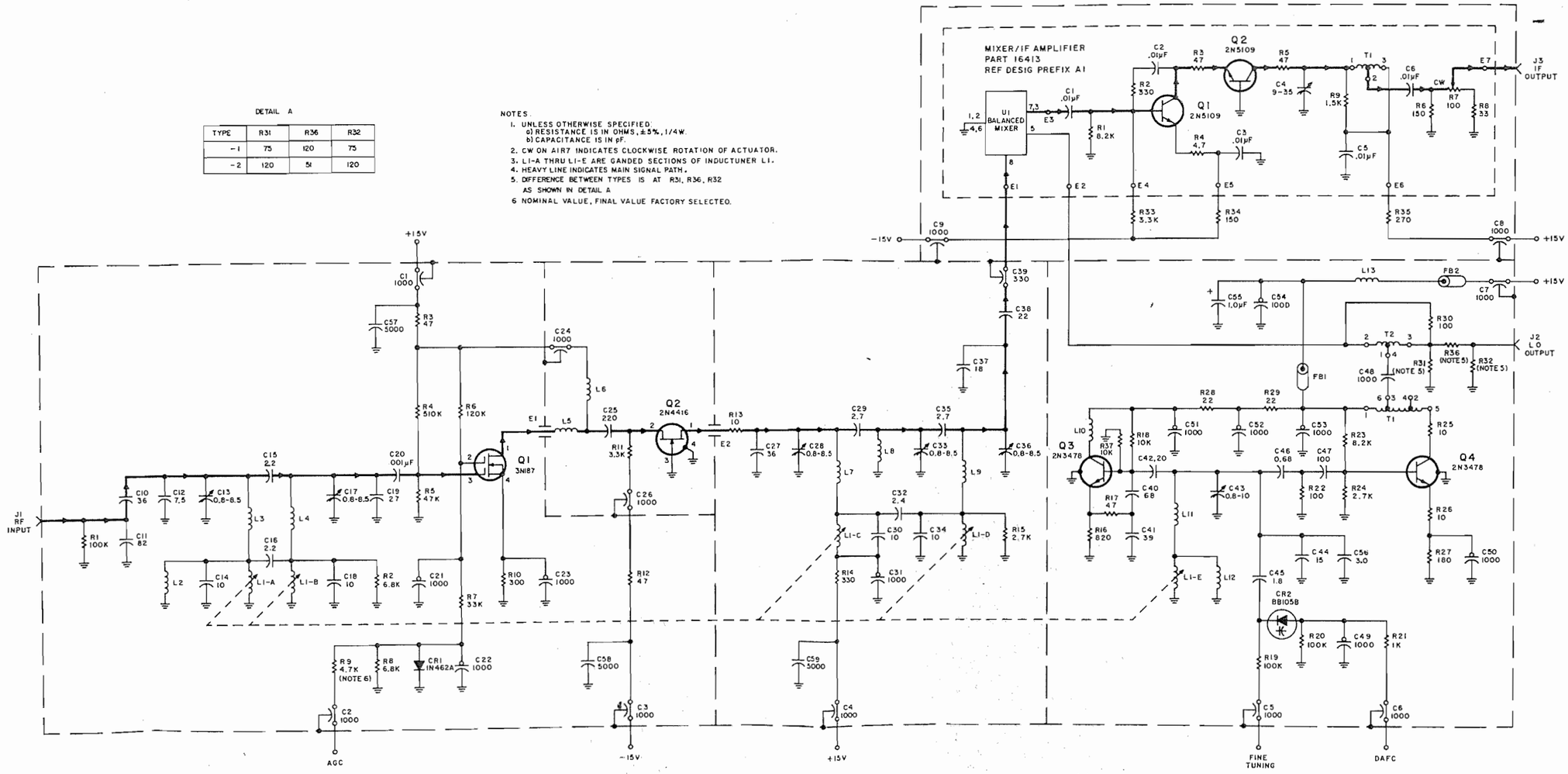
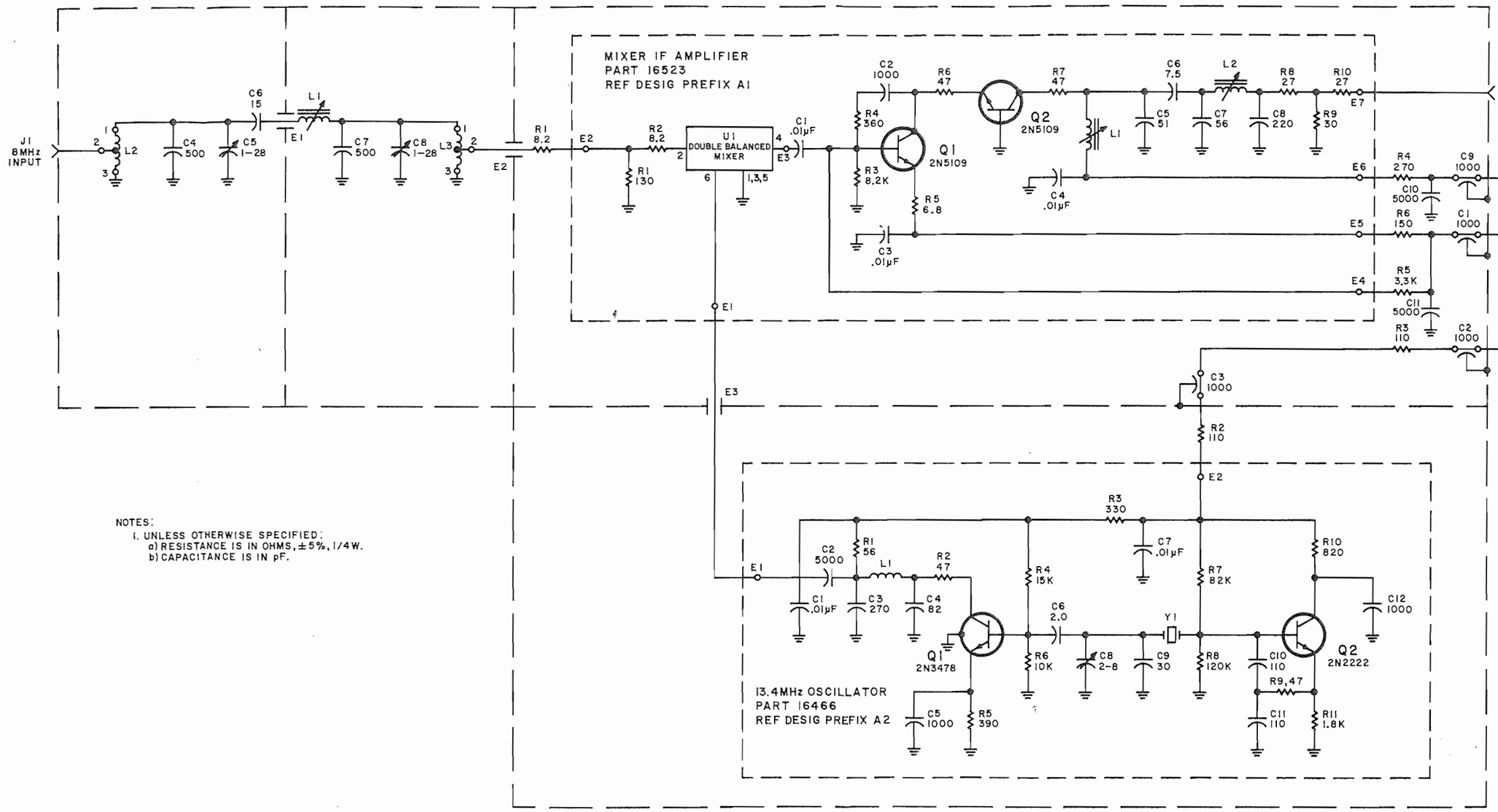
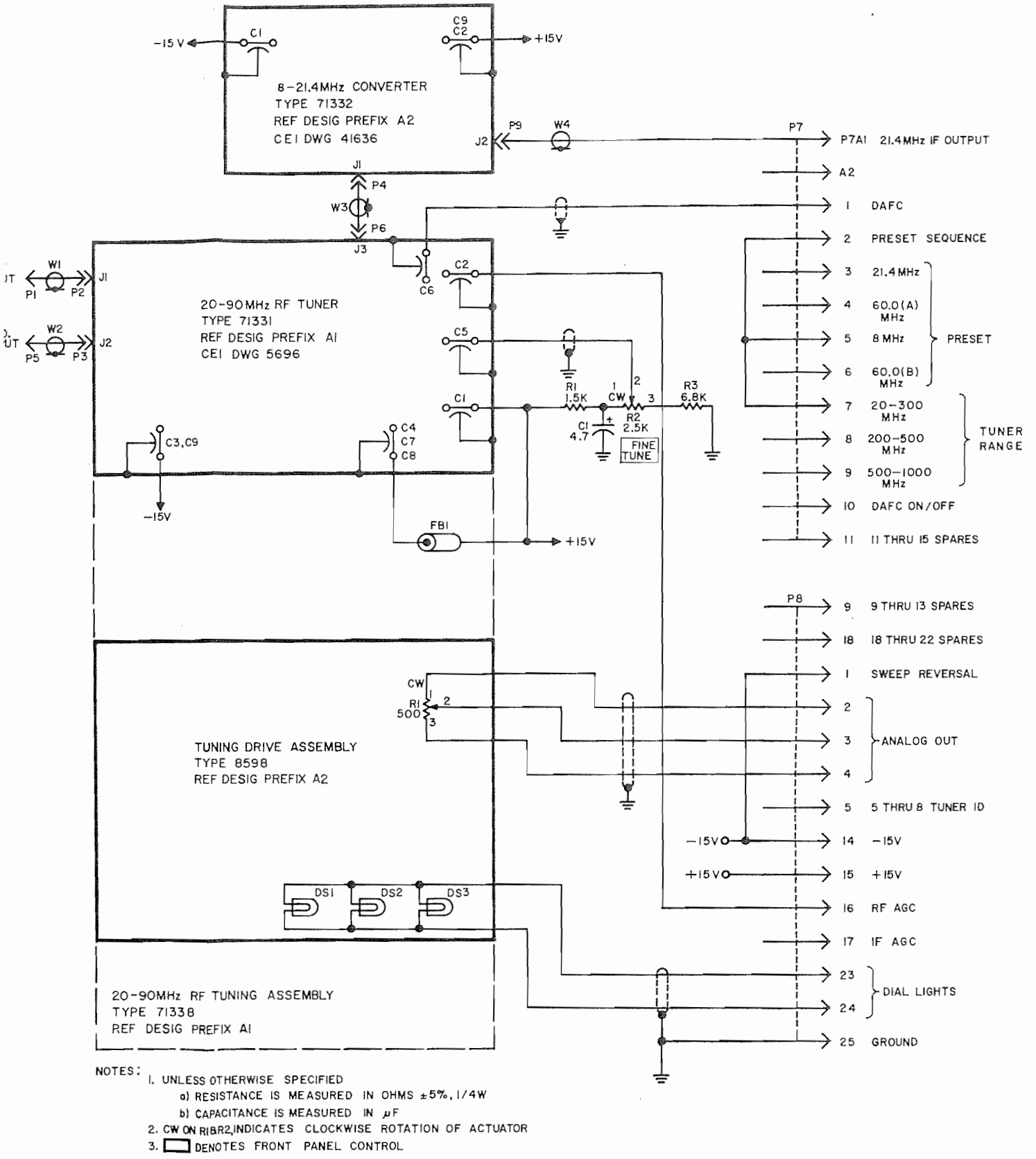


Figure 6-1. Type 71331 20-90-MHz RF Tuner (A1), Schematic Diagram



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

Figure 6-2. Type 71332 8-21.4-MHz Converter (A2) Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS MEASURED IN OHMS ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN μF
2. CW ON R1&R2 INDICATES CLOCKWISE ROTATION OF ACTUATOR
3. ▭ DENOTES FRONT PANEL CONTROL

Figure 6-3. Type VH-101 Tuning Head, Main Chassis Schematic Diagram