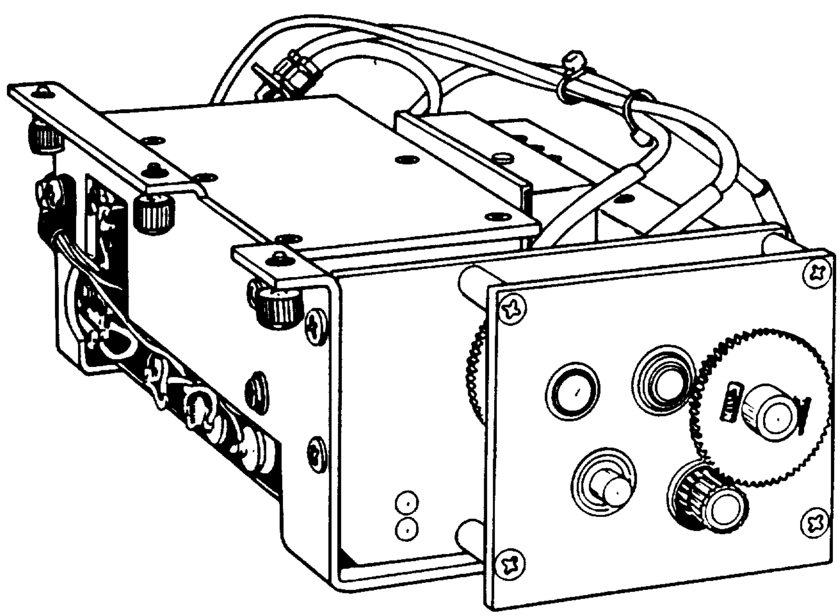
TM 11-5895-1227-14-1-3

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL



TUNER TN-585/GRR-8(V) (NSN 5895-01-073-1582)

PART OF RECEIVER, R-2200/GRR-8(V) (NSN 5895-01-060-6492)

HEADQUARTERS, DEPARTMENT OF THE ARMY

15 FEBRUARY 1988

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WARNING

The receiver uses voltages which maybe fatal if contacted. Do not be misled by the term "Low Voltage." Potentials as low as 50 volts may cause death under adverse conditions. Extreme caution should be exercised when working this equipment. Death on contact may result if personnel fail to observe safety precautions.

1. **Do not work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid.**

2. **When the technicians are aided by operators, they must be warned about dangerous areas. A periodic review of safety precautions in TB 385-4, Safety Precautions for Maintenance of Electrical/Electronic Equipment, is recommended.**

   Do not be misled by the term "Low Voltage." Potentials as low as 50 volts may cause death under adverse conditions.

3. **Do not remove the protective covers to the equipment unless you are authorized to do so.**

4. **When the technician is aided by operators, he must warn them about dangerous areas. A periodic review of safety precautions in TB 385-4, Safety Precautions For Maintenance of Electrical/ Electronic Equipment, is recomended.**

5. **Seek advice from your supervisor whenever you are in doubt about electrical safety conditions.**

6. **For Artificial Respiration, refer to FM 21-11.**

CAUTION

Extreme caution should be used in reseating the receiver's main chassis into its protective case. A problem may be caused by the failure of A9, P1-J6 to properly mate. If this problem is encountered, remove the rear mounted battery cover and reconnect the plug manually.

TECHNICAL MANUAL

NO. 11-5895-1227-14-1-3

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 February 1988

Operator, Organizational, Direct Support and General Support Maintenance Manual

TUNER TN-585/GRR-8(V) (NSN 5895-01-073-1582)

PART OF RECEIVER AN/GRR-8(V) (NSN 5895-01-060-6492)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures,please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort **Monmouth, NJ 07703-5000. A reply will be furnished direct to you.**

*This manual supersedes TM 11-5895-1227-14-1-3, 1 September 1984.

LIST OF ILLUSTRATIONS

LIST OF TABLES

Table 1-1. Type WJ-9124, 250- 500 MHz Tuner Assembly, Specifications

Tuning Range	250-500 MHz
Fine Tuning Range	0.05% of tuned frequency minimum
Main Tuning Control	Approximately 40 turns; band edge to band edge
Input Impedance	50 ohms Nominal, unbalanced
Antenna Conducted LO Radiation	5 uV, Maximum, across 50 ohms
Noise Figure	9 dB, Maximum
IF Frequency	60 MHz, 21.4 MHz
LO Output Level	-17 dBm, Minimum, across 50 ohms
Dimensions	Approximately 9.5 inches long, 5 inches wide, 2.5 inches high
Weight	Approximately 3.5 lbs.

SECTION O

INTRODUCTION

0.1 SCOPE

0.1.1 TYPE OF MANUAL. This is an Operator's, organizational, Direct Support and General Support Maintenance commercial manual.

0.1.2 MODEL NUMBERS AND EQUIPMENT NAMES. The Tuner Assembly, TN-585/GRR-8(V), is one of three separate tuners that can be used with the AN/GRR-8(V) Receiver. The Receiver is part of the Radio Receiver Direction Finder Set, AN/PRD-11. The other units of the Direction Finder Set include the Direction Finder Antenna, AS-3732/PRD-11 and AS-3733 /PRD-11, the Processor Display Control, C-11495/PRD-11, and the Panoramic Indicator IP-1355/GRR-8(V). In this manual, the TN-585 /ANGRR-8(V) Tuner Assembly will be referred to as the WJ-9124 Tuner Assembly and the tuner. The Receiver will be referred to as the Receiver, Manpack Receiver or Portable Receiver, and by its manufacturers model number, WJ-8640-1. A complete cross reference of common equipment names and nomenclatures used in this manual is provided in paragraph 0.7.

0.1.3 PURPOSE OF EQUIPMENT. The TN-585/ANGRR-8(V) Tuner Assembly is an interchangeable assembly of the receiver. The tuner assembly allows the receiver to tune in to rf signals within the 250 to 500 MHz range in the AM, FM and CW modes.

0.2 CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

0.3 MAINTENANCE FORMS. RECORDS AND REPORTS

0.3.1 REPORTS OF MAINTENANCE AND UNSATISFACTORY EQUIPMENT. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in Maintenance Management Update.

0.3.2 REPORT OF PACKAGING AND HANDLING DEFICIENCIES. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73B/AFR 400-54/MCO 4430.3H.

0.3.3 DISCREPANCY IN SHIPMENT REPORT (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/ NAVSUPINST 4610.33 C/AFR 75-18/MCO P4610.19D/DLAR4500.15.

0.4 DESTRUCTION OF ARMY ELECTRONICS MATERIEL

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

0.5 ADMINISTRATIVE STORAGE

Disassembly and repacking of equipment for shipment or limited storage are covered in section H.

0.6 TOOL AND TEST EQUIPMENT

Test equipment required for troubleshooting and maintenance of the tuner assembly is listed in paragraph 4.4 (Table 4-1).

0.7 OFFICIAL NOMENCLATURE, NAMES AND DESIGNATIONS

The list below will help you identify the official nomenclature of the major equipment items used with the tuner assembly. It also provides the common name used in the manual when it is different from the official nomenclature. Official nomenclature must be used when completing forms or when looking up technical manuals.

Common Name	Official Nomenclature
Direction Finder Set	Radio Receiver Direction Finder Set, An/PRD-11
ManPack Receiver, WJ-8640	Receiver, AN/GRR-8(V)
Tuner Assembly, WJ-9124	Tuner, RF, TN-585/GRR-8(V)

0.8 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS

If your tuner assembly needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communication-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, NJ 07703-5000. We'll send you a reply.

0.9 WARRANTY INFORMATION

The tuner assembly is warranted by Watkins-Johnson Company for a period of 1 year following delivery. It starts on the date found in block 23, DA Form 2408-9, in the logbook. This warranty may contain repair restrictions. Report all defects in material or workmanship to your supervisor.

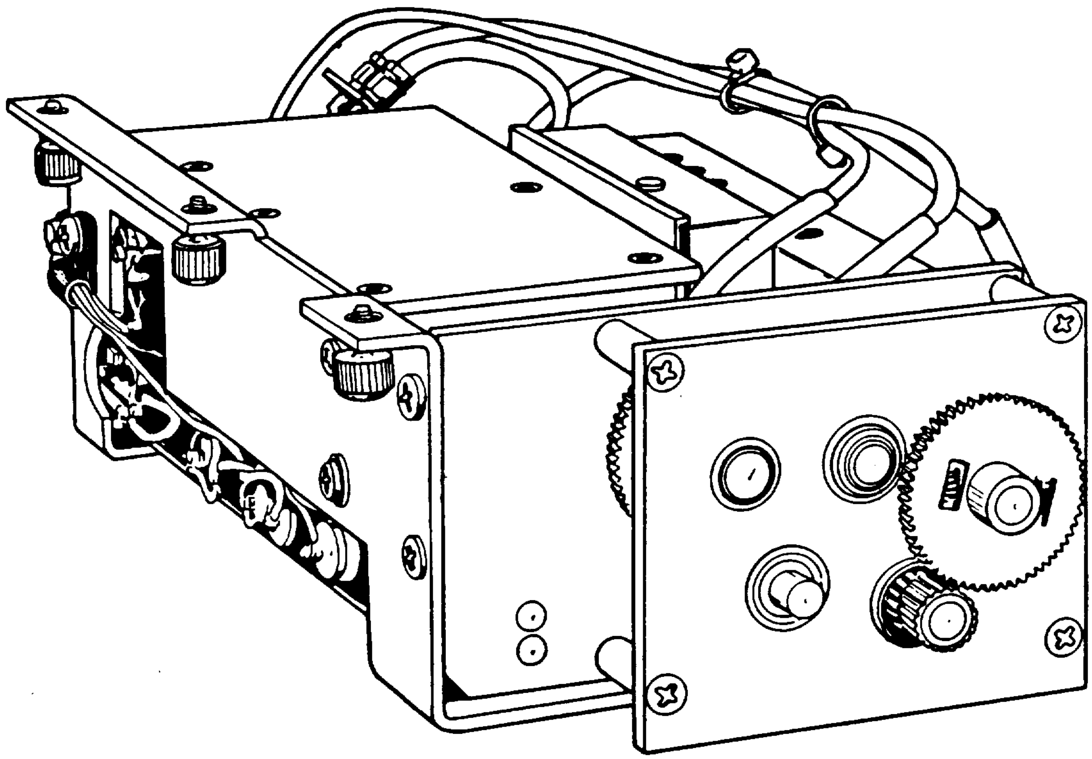


Figure 1-1. WJ-9124 250-500 MHz Tuner Assembly

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1 .1.1 The Type WJ-9124 Tuner Assembly is designed to operate with the WJ-8640, -1, -2, Manpack Receiver series. The assembly is an interchangeable drop-in unit requiring simple hand tools for installation and removal. The WJ-9124 covers the frequency range of 250-500 MHz. A five section ganged capacitor along with a dual down conversion translates the RF signals into the desired IF. The local oscillator operates at a constant 60 MHz above the incoming RF signal. A Colpitts configured oscillator in the Tuner (A1) may be tuned manually by the fine tuning control or automatically by operating in DAFC. The Balanced Mixer (A1A3U1) mixes the LO and the RF input signals to produce the difference frequency of 60 MHz. The local oscillator output is also sent to a Binary Divider (A2) which divides the input frequency by two. The Tuner Assembly tuning is manually controlled from the associated receivers front panel by a control knob.

1.2 MECHANICAL CHARACTERISITCS

1.2.1 The WJ-9124 Tuner Assembly was designed as an interchangeable drop-in unit for use in conjunction with the WJ-8640, - 1,-2 Manpack Receiver Series. Its electrical connections are composed of three-coaxial connector ended inputs/ outputs and a multipin connector which supplies operating voltages, AGC, DAFC and fine tuning controls. The Tuner Assembly’s extended shaft is attached to a coupling extender which permits front panel tuning. Located between the coupling and the tuner’s tuneable components is a gear train with an 80:1 reduction ratio. The band edge to band edge tuning requires approximately 40 turns of the main tuning knob.

1.3 EQUIPMENT SUPPLIED

1.3.1 This equipment consists of the WJ-9124 Tuner Assembly only.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

1.4.1 The WJ-9124 Tuner Assembly is incapable of independent operation and therefore requires a compatible receiver. The associated receiver will supply the required operating power and signal connections. This tuner is designed to be operated in conjunction with the WJ-8640, -1, -2 series of Manpack Receivers.

SECTION II

INSTALLATION AND OPERATION

2.1 UNPACKING AND INSPECTION

2.1.1 Examine the shipping carton for damage before the equipment is unpacked. If the carton appears to be damaged, try to have the carrier's agent present when the equipment is unpacked. If this is not possible, retain all packing material and shipping containers for the carrier's inspection if damage to the equipment is evident after it has been unpacked.

2.1.2 See that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, CEI Division, Gaithersburg, Maryland or your Watkins-Johnson representative for any discrepancies or shortages.

2.1.3 This 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, inspect the unit for dents or scratches. If external damage is evident, make an internal inspection. Check the internal cables for loose connections and printed circuit boards which may have been loosened from their receptacles. If factory seals must be broken, contact your Watkins-Johnson representative before proceeding.

2.2 REMOVAL AND INSTALLATION

(1) Place the receiver on a clean flat surface so that it rests on its top side.

(2) Turn the latches that hold the front panel cover to the receiver counterclockwise. Pull the latches away from the sides of the receiver until the cover is able to be removed.

(3) Remove the four (captive type) slot screws that hold the front panel of the receiver to the outer protective cover. These screws are located on the rear corner edges of the receiver's front panel.

(4) Holding the front panel by its protective handles, pull it away from the battery pack. After removing the receiver's main chassis from its protective case (and disconnecting its power connection) lay the receiver on a clean flat surface with its protective handles nearest you and the top side down.

(5) Using an allen wrench, loosen the allen screws on the flexible coupling (tuning shaft- spring extender) until it can be disconnected from the tuning shaft.

(6) Disconnect the three coaxial connectors labeled J2, J5 and J6 from the jack mounting that extends off the rear side of the tuner's main frame.

(7) Remove the multipin plug, P1, from the receiver receptacle J7, located directly behind the coaxial connector, by pulling it straight up from its receptacle.

(8) Using a slot-type screwdriver, release the three spring loaded captive screws that secure the (right-side) base of the tuner to the receiver's main chassis.

(9) Remove the two upper-most machine screws that are located on the left vertical side of the tuner's frame using a phillips-type screwdriver.

(10) Remove the tuner assembly from the receiver's main chassis by lifting it directly upward.

(11) To replace the tuner, reverse steps (5) through (10).

NOTE

If trouble is encountered in reseating the receiver's main chassis into its protective case, it may be caused by the failure of A9 P1 to properly mate with J6. If this is the case, remove the rear mounted battery cover and reconnect the plug manually.

2.3 OPERATION

2.3.1 Operation of the WJ-9124 Tuner is controlled entirely by the associated receiver.

2.4 PREPARATION FOR RESHIPMENT AND STORAGE

2.4.1 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.

2.4.2 The conditions for storage are:

(1) Maximum humidity: 97%

(2) 0°F to 150° F(-17.8°C to +65.6°C)

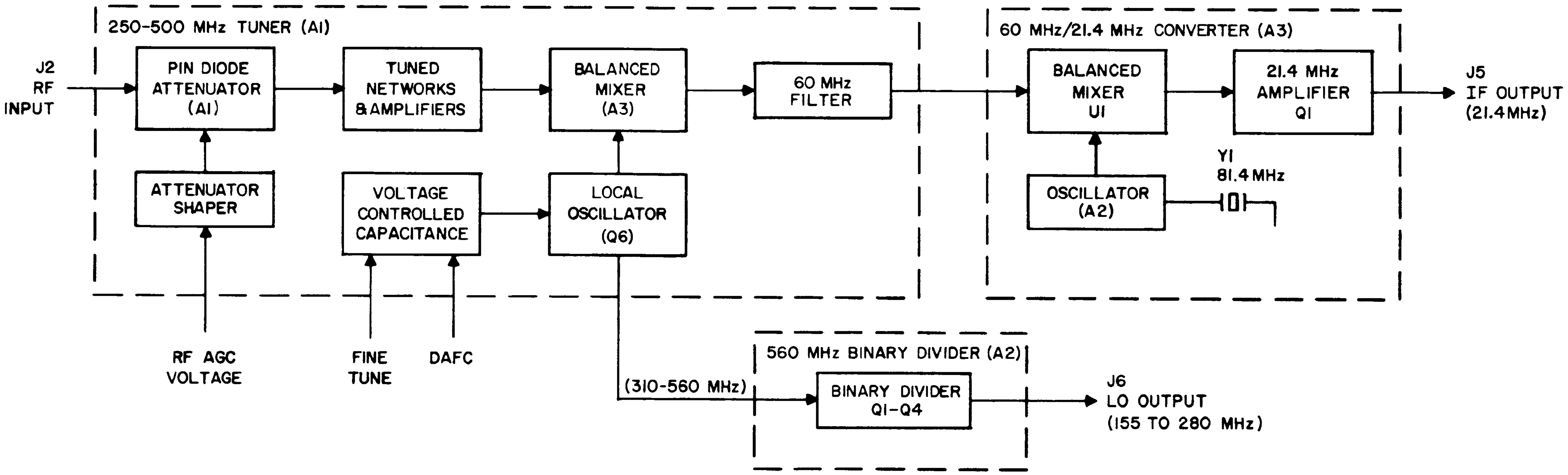


Figure 3-1. Type WJ-9124 Tuner Assembly Functional Block Diagram

SECTION 111

CIRCUIT DESCRIPTION

3.1 GENERAL

3.1.1 Operation of the circuitry found in the WJ-9124 Tuner Assembly is described in the following paragraphs. Figure 3-1 is an overall functional block diagram of the WJ-9124 and should be referred to along with the figure stated in the paragraphs. Note that the unit numbering system is used for electrical components, which means that parts on subassemblies and modules carry a prefix before the usual class letter and number of the item (such as A1Q1 and A3C1). These subassembly prefixes are omitted on illustrations and in the text except in those cases where confusion might result from their omission.

3.2 FUNCTIONAL DESCRIPTION

3.2.1 250-500 MHz TUNER (A1)

3.2.1.1 The RF input signals from the antenna are applied through the PIN Diode Attenuator (A1A1) to the double tuned RF stage. Bandwidth limited signals from the double-tuned input network are amplified by cascode RF amplifiers Q1 and Q2 before being coupled to the tuned interstage network. The interstage network provides further selectivity and bandwidth limiting. The tuned RF input stages, in conjunction with the tuned interstage network, set the overall tuner RF bandwidth. Output signals from the tuned interstage are coupled to the input of the Balanced Mixer (A1A3).

3.2.1.2 The Local Oscillator, Q6, and the associated tuning capacitor, CIE, is a modified Colpitts circuit. The oscillator's output signal is inductively coupled to the cascade LO amplifiers. The output from the first LO amplifier, Q3, *is* applied to the LO input of the Balanced Mixer, A1A3U1 . The output from Q4, the second LO amplifier, is routed to the 560 MHz Binary Divider, A2.

3.2.1.3 The sum and difference outputs from the mixer are coupled through IF amplifier Q5 to a three pole filter network, which passes only the difference output from the mixer. These signals are then connected to the 60 MHz/21.4 MHz Converter, A3.

3.2.1.4 The 560 MHz Binary Divider, A2, employs an RF amplifier with a current limiter to provide stable operation of the divide flip-flop. Local oscillator signals are applied to the input RF amplifier. Amplified LO Signals are then applied to the divide flip-flop where they are divided by two before being coupled to the LO output.

3.3 DETAILED CIRCUIT DESCRIPTION

3.3.1 TYPE 71376-6 250-500 MHz TUNER (A1)

The schematic diagram for this subassembly is Figure 6-1 and it carries the reference designation A1.

3.3.1.1 The PIN Diode Attenuator (A1A1) is the only AGC controlled RF circuit in the tuner assembly. Characteristically, PIN diodes exhibit an inverse resistance versus forward bias current relationship. As the forward bias is increased, the RF resistance decreases. For example, the RF resistance varies from approximately 10,000 ohms at 0.001 milliamperes to approximately 1 ohm at 100 milliamperes of forward bias current. The PIN diodes are connected to form a pi-network attenuator. With strong input signals, the RF AGC is developed and applied to Attenuator Shaper A1A2 where a portion of the signal is shunted to ground by PIN diodes CR2 and CR3. As the resistance of CR2 and CR3 decreases, the resistance of CR1 increases. This action provides a relatively constant input and output impedance for good VSWR. RF input signals are applied through the PIN Diode Attenuator to the double-tuned RF input stages which consist of inductors L13 and L15 and capacitors C37, C50, C51, C52 and the first two sections of the five stage ganged-tuned capacitor C1. Inductors L12 and L14 couple the signal through the input preselector network. The RF signal is then coupled to cascode amplifier Q1 and Q2. These transistors amplify the RF signals approximately 10 dB before coupling them through L 17 to the inter stage network. The interstage network along with the input network establishes an overall RF bandwidth of 3 MHz at the low end of the band and 13 MHz at the high end of the band. Output signals from the interstage network are coupled through L19, L20 and L21 to input terminal pin E5 on the Balanced Mixer printed circuit board A1A3.

3.3.1.2 The Attenuator Shaper (A1A2) converts a single AGC voltage into two shaped voltages for use by the Pin Diode Attenuator A1A1. By referring to Figure 3-2 the circuits on the board can be divided into two stages, U1A and U1B. The output of each stage is routed to the PIN Diode Attenuator, and the output of U1B drives U1A. Each stage will be described separately in the following two paragraphs.

3.3.1.3 Stage U1B receives AGC signals at pin E5. When no signals are being processed there will be zero voltage present at this pin. When strong signals are present, and full AGC has been developed, the voltage at E5 will be at a negative 10 volts. If diode CR3 was not present, an AGC voltage applied to the inverting input of U1B would cause the output to go positive in some linear relationship. Having CR3 in the circuit however, modifies that relationship by holding the anode of CR3 at -1.5 volts dc by R20 and R21, thereby maintaining a reverse bias on the diode. Not until the cathode becomes more negative than the anode does

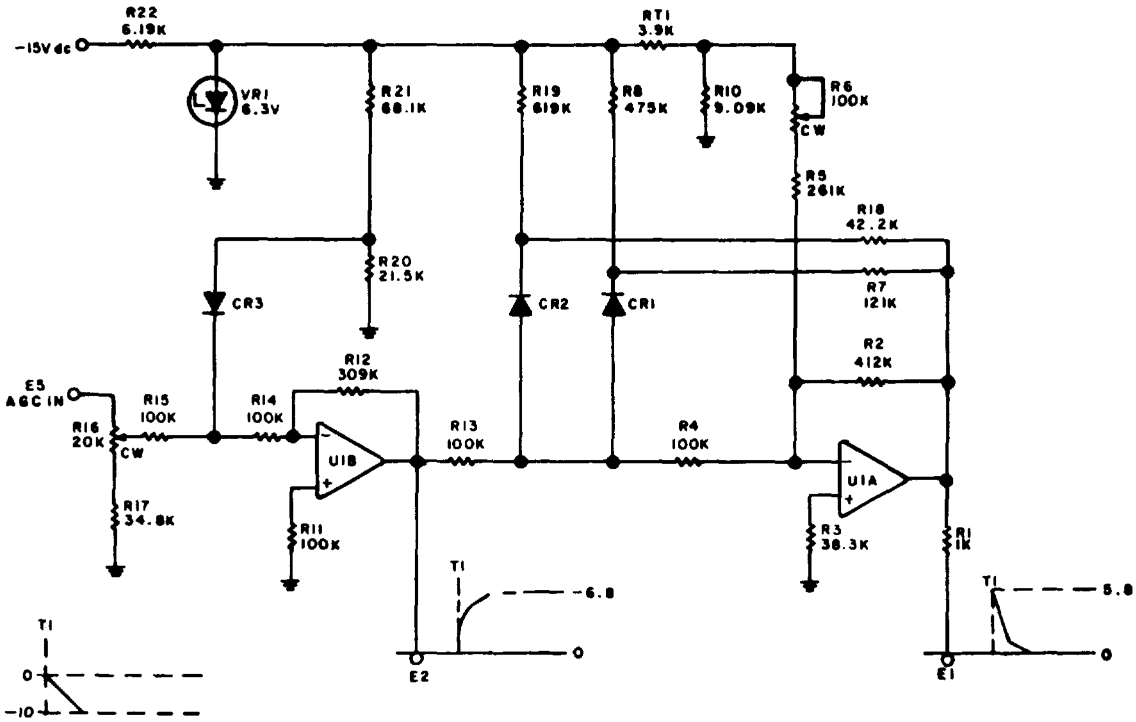


Figure 3-2. Simplified Schematic Diagram, Attenuator Shaper

CR3 become a part of the circuit. When that action occurs, further increases in AGC voltage are attenuated, and the slope of the voltage curve at E2 is reduced. This effect gives an output voltage curve at E2 similar to the one shown next to E2. This same voltage curve is applied through R13 to the next stage, U1A.

3.3.1.4 Stage U1A receives the shaped voltage from the output of U1B. If diodes CR1 and CR2 were not in the circuit, the output from U1A would be a negative-going voltage curve having a single break point. With the two diodes in the circuit however, two additional break points occur, and the resulting output voltage will resemble the curve shown at E1. A more detailed explanation follows. When the input voltage to R13 rests at zero volts, the inverting input of U1A is biased slightly negative from R5 so that the output is at +5.8 volts. With this voltage at the output of U1B, the cathode of CR1 is biased to about +3.35 volts and the cathode of CR2 is biased to about +5.0 volts. Under this condition, the two diodes are reversed biased and effectively out of the circuit. As the input voltage to R13 moves from zero volts towards +6.8 volts, the output of U1A moves from +5.8 volts towards zero volts. In doing so, first CR1 then CR2 becomes forward biased. This effect places first R7 then R18, parallel with feedback resistor R2. Doing so decreases the gain of U1A and reduces the slope of the output curve at E1. Combined with the break points of CR1 and CR2 is the break point of CR3 in the preceding stage, U1B. The overall effect of the diodes is a voltage curve consisting of three break points and four slopes.

3.3.1.5 The Local Oscillator, Q6, is maintained 60 MHz above the RF input by Section E of the main tuning Capacitor, C1. Fine tuning and Digital Automatic Frequency Control (DAFC) is provided by voltage applied to varactor diodes CR 1 and CR2 in the oscillator tank circuit. Varactors are semiconductor devices whose capacitance is inversely related to the reverse bias applied to them. Oscillator transistor, Q6, operates as a modified Colpitts oscillator with internal emitter to base regeneration sustaining oscillation. Oscillator signals from L22 are inductively coupled by L8 to the base of LO amplifier Q3. Amplified L.O. signals from the collector of Q3 are coupled to terminal E4 of balanced mixer A3U1 and to LO amplifier Q4. The output of Q4 is connected to LO output jack, J2 .

3.3.1.6 The Balanced Mixer and IF Amplifier board (A1A3) contains a double balanced mixer A3U1 , and the first half (A3Q1) of the 60 MHz cascode IF amplifier. RF signals from the interstage are coupled to A3E5 and then to the R port of U1. The LO signal is coupled to the L port. Sum and difference frequencies from mixer port I are coupled to the base of A3Q1, the first half of the cascode IF amplifier. Amplified IF signals from A3Q1 are coupled through Q5, the second half of the cascade stage, to the tuned 60 MHz IF output filter consisting of C30 through C34, L10 and L11. This output filter is tuned to the difference frequency of the mixer output. The 60 MHz IF amplifier filter has a bandwidth of approximately 6 MHz and a gain of 10 dB. The gain and bandwidth of the RF and IF stages set the overall tuner bandwidth and gain at approximately 5 MHz and 14 dB, respectively.

3.3.2 TYPE 791834 560 MHz BINARY DIVIDER (A2)

3.3.2.1 The reference drawings for this assembly are Figures 6-3 and 6-4. They carry the reference designation A2 and A2A1 respectively.

3.3.2.2 Local oscillator signals from the RF tuner module are coupled to the A2A1 subassembly via input terminal E1. Resistor R16 matches the output impedance of the LO output to the input impedance of the divider board. Capacitor C1 prevents the dc bias voltage from being shunted to ground through R 16. LO signals are coupled through capacitor C1 to the base of RF amplifier Q2. Its operating point is maintained by constant current source Q1. Any attempt of Q2 to draw more collector current results in an increased voltage drop across R5

which will in turn decrease the conduction of Q1, thereby reducing the base currents of transistor Q2. Reducing the base current on Q2, will tend to turn it off, thereby canceling the original condition. By this means, a state of equilibrium is maintained with changes in temperature and LO level. The output of the RF amplifier is coupled through capacitor C5 to the input of the divide-by-two circuit, Q3 and Q4 .

3.3.2.3 A simplified schematic diagram of the dynamic frequency divider is shown in Figure 3-3. The circuit structure is similar to a conventional steered flip-flop, but there are major differences in switching operations. Determination of which transistor will be triggered by the input signal is not by initial conduction states of the diodes, but by the charges stored in the emitter RC networks. Output waveforms from the transistor's collectors are not always complementary but are negative-going pulses alternating between the collectors, interspersed with periods when both collectors stand high.

3.3.2.4 The switching sequence of the circuit can be best explained by a step-by-step consideration of switching operation, with one-half cycle of the input waveform considered at a time. The following explanation is in conjunction with the simplified schematic diagram and waveforms shown in Figure 3-3. It will be assumed that Q4 was the heavier conducting of the two transistors in the half-cycle prior to the first cycle shown in the diagram.

3.3.2.5 In the first half-cycle, as the input signal swings negative, it is conducted to the bases of Q3 and Q4 by the input diodes .CR2 and CR3. The diodes are forward biased by R7, R13 and R10. The negative signals present on the bases of the transistors keep both cutoff, and the collectors remain high. As the voltages on C9 and C12 discharge through R8 and R14, both emitter voltages fall. Since Q3 was the less conducting transistor during the previous half-cycle, its emitter capacitance has less charge. The Q3 emitter voltage will fall then to a minimum just prior to the second half-cycle.

3.3.2.6 In the second half cycle, as the input signal swings positive, both Q3 and Q4 tend to turn on, with the emitter of Q3 at a lower voltage than that of Q4. Therefore, Q3 begins conducting first while developing a negative-going pulse at its collector. Capacitor C8 couples the collector pulse of Q3 to the base of Q4, preventing turn on and reverse biasing CR3 to further block the input signal. As Q3 conducts through the second half-cycle the voltage drop across R8 charges C9 to its highest value.

3.3.2.7 In the third half-cycle, as the input signal swings negative, it cuts off both transistors through the forward biasing of the diodes as in the first half-cycle. Since Q4 was cutoff in the previous half-cycle, C12 has less charge than C9, and it is the emitter voltage of Q4 that decays to a minimum.

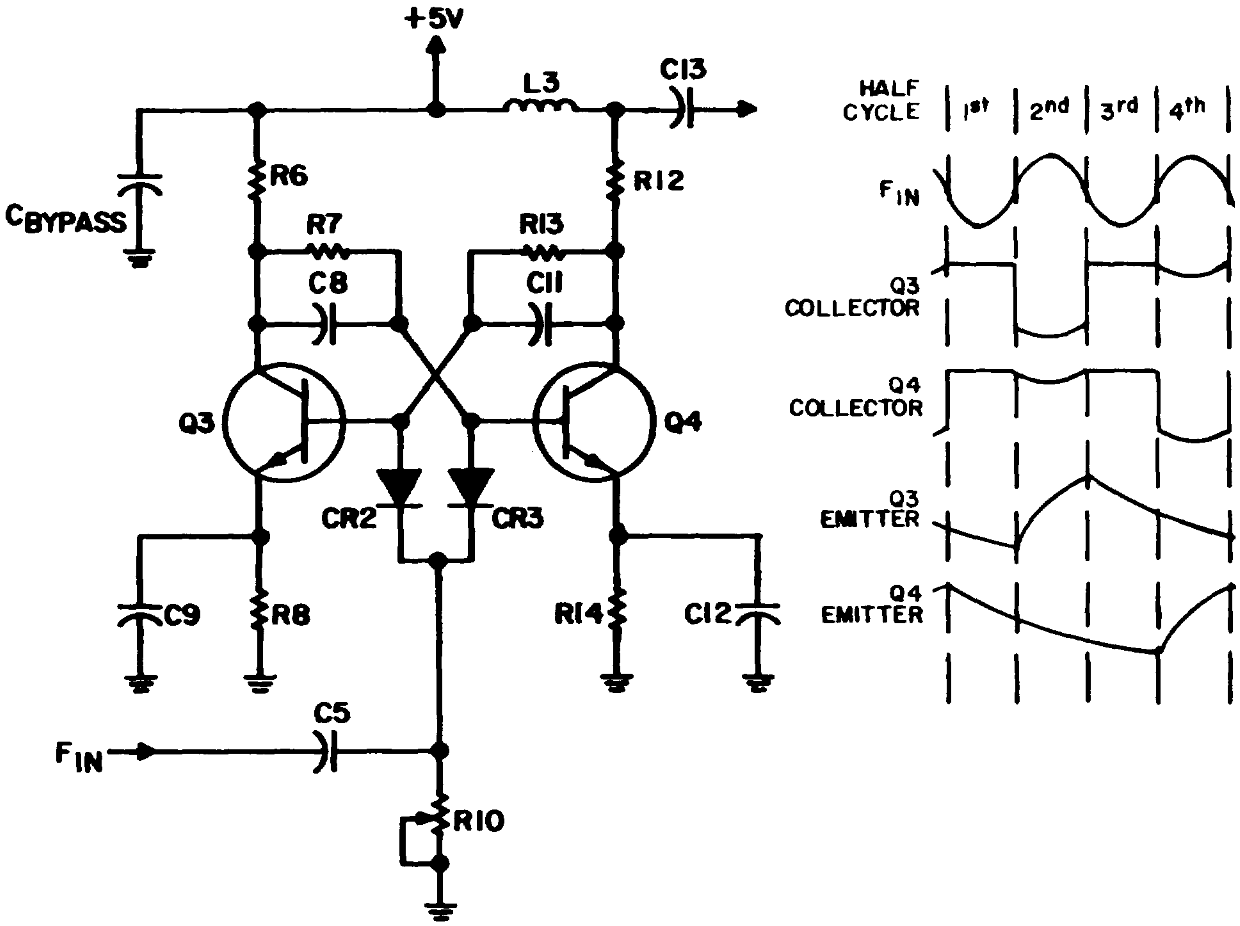


Figure 3-3. Simplified Schematic Diagram, Dynamic Frequency Divider

3.3.2.8 In the fourth half-cycle, as the input signal swings positive, both transistors tend to turn on as during the second half-cycle. This time it is Q4 that has the lower emitter voltage, and it turns on first, preventing Q3. The negative-going pulse which appears at the collector of Q4 has been developed in response to two cycles of the input signal, and this Q4 collector waveform is taken as the divided-by-two output signal.

3.3.2.9 Circuit Details - To minimize the loading of Q4, the output signal is taken from inductor L3 rather than directly from the collector of Q4. Potentiometer R10 allows adjustment of the base bias on the two transistors to obtain the widest frequency range. The divider will run with no input signals and produce output frequencies in the vicinity of 500 MHz. The extremely high frequencies achieved by the dynamic frequency divider is obtained by use of microwave transistors, fast switching (schottky barrier) diodes and stripline printed circuit boards.

3.3.3 TYPE 71347-4 60/21.4 MHz CONVERTER ASSEMBLY (A3)

3.3.3.1 The schematic diagram for this subassembly is Figure 6-5, and it carries the reference designation A3.

3.3.3.2 The crystal oscillator consists basically of transistor Q2 and an 81.4 MHz crystal, Y1. The oscillator stage operates in the common base configuration with collector- to-emitter regeneration coupled through crystal Y1 from the junction of divider C4 and C5. The collector circuit is peaked by capacitor C3. Output signals from the oscillator are injected into pin #1 of balanced mixer U1 . The 60 MHz IF signals from the tuner module are injected into mixer pin #6. The mixer produces sum and difference frequencies from pin #3. These signals are then coupled to the 21.4 MHz Amplifier by C2. Transistor Q1 forms a single-stage IF amplifier with the collector circuit tuned to pass the mixers difference frequency product at 21.4 MHz. These signals centered around 21.4 MHz are amplified, and their bandwidth is limited before being coupled to the associated receiver's IF Demodulator stage. The 21.4 MHz amplifier has approximately 8 dB gain and a 10 MHz bandwidth centered at 21.4 MHz.

NOTE

The troubleshooting, performance check, alignment and adjustment procedures, and subassembly removal, repair and replacement actions contained in section IV are not to be performed at the direct support maintenance level.

SECTION IV

MAINTENANCE

4.1 GENERAL

4.1.1 The WJ-9124 Tuner Assembly has been designed to operate for extended periods of time with only routine maintenance. The unit requires only cleaning and occasional tuning gear train lubrication. The duration between cleaning and inspection of the unit should depend on its usage and the environmental conditions . Alignment of the tuner requires a thorough understanding of the function of each subassembly and should be attempted only after repairs affecting the alignment and then only by experienced personnel in a well-equipped shop.

4.2 CLEANING AND LUBRICATION

4.2.1 The WJ-9124 Tuner Assembly should be kept free of grease, dust, dirt and foreign matter to insure trouble-free operation. If available, low pressure compressed air should be used to remove accumulated dust from the interior and exterior of the unit when needed. A clean dry cloth, a soft-bristled brush or a cloth saturated with a cleaning solution may be used.

4.3 INSPECTION FOR DAMAGE OR WEAR

4.3.1 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 on a periodic basis, or whenever the unit is inoperative, for indications of electrical or mechanical defects. Electronic components that show signs of deterioration, such as overheating, should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Damage of parts due to heat is often the result of other less apparent troubles in the circuit. It is essential that the cause of the overheating be determined and corrected before replacing the damaged parts. All mechanical parts should be checked for looseness, excessive wear, corrosion and other signs of deterioration.

4.4 TEST EQUIPMENT REQUIRED

Equipment Type	Required Characteristics	Recommended Equipment
Power Supply (3)	Voltage: 15 VDC Current: 200mA	HP 6215A
Oscilloscope	Sensitivity: lmV Inputs: Horiz. and Vert.	Tektronic 503

4.4 TEST EQUIPMENT REQUIRED (Continued)

Equipment Type	Required Characteristics	Recommended Equipment
Frequency Counter	Freq. Range: 21.4 to 580 MHz Sensitivity: 50m V	HP 5245 L with 5253B and 5254C
Signal Generator	Frequency Range: 21.4 to 580 MHz Levels: 1 V to 70mV	HP 608E, 612A
Sweep Generator	Freq. Range: 20-500 MHz	Wavetek Model 2001
Detector	Impedance: 50 ohms Frequency: 21.4 MHz to 500 MHz	Telonic XD-3A
Spectrum Analyzer (display section, IF section, RF section)	Sensitivity: 2mV Range: 2 GHz	HP 140T, 8552A, 8555A
RF Voltmeter	Frequency: 140 to 560 MHz	Boonton 910A-S5 with 91-12F RF probe and 91-8B N to BNC 50
Impedance Comparator with Terminations	Impedance: 50 ohms nominal 50 1:1 125 2.5:1	Telonic Rho-tector TRM-1-1.00F TRM-1-2 50F
Frequency Counter	Frequency Range: 140 to 250 MHz Sensitivity: 20mV	Watkins-Johnson DRO-280A or Hewlett Packard 5340A

4.5 TROUBLESHOOTING PROCEDURES

4.5.1 Troubleshooting the WJ-9124 should include its operating connection to the associated receiver. Initial investigation should be directed towards isolating the problem to a specific subassembly, and then a component. By utilizing acceptable troubleshooting techniques, inject the proper input signal and trace it back from the output. This method should identify the faulty component. Before attempting troubleshooting and repairs of the tuner, the maintenance technician should have a thorough understanding of the tuner's operation as detailed in Section III. Reference should also be made to the functional block diagram and the schematic diagrams for the unit.

4.6 PERFORMANCE TESTS

4.6.1 TYPE 71376-6 TUNER (A1) PERFORMANCE TEST - The tests are divided into two parts: local oscillator tests include output level, fine tune range and DAFC range; signal path tests include overall gain and bandwidth. Note that the 60 MHz output stage of the tuner consists of three tuned stages. They will tend to mask any problems in preceding stages, so do not assume the overall sweep response is a faithful indication of tuner performance. For more complete testing of the tuner, refer to the alignment procedure in paragraph 4.7.1.1. Use those test setups and procedures to determine which, if any, stage requires alignment.

4.6.1.1 Local Oscillator Tests include output level, band coverage, fine tuning range and DAFC range. Proceed as follows:

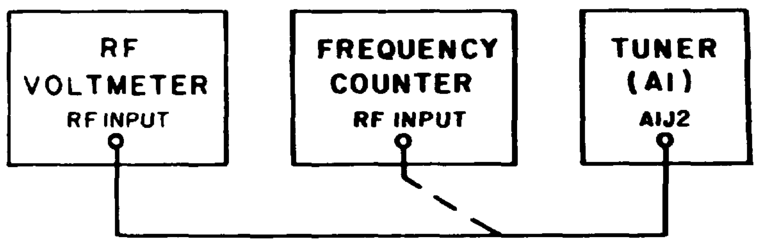


Figure 4-1. Test Setup, LO Performance Test

(1) Connect the equipment as shown in Figure 4-1 and 4-6. Dashed lines indicate no connection at this time.

(2) Tune the tuner over its frequency range. The LO level must be in the range of 0 to -13 dBm.

(3) Connect the frequency counter in place of the RF voltmeter.

(4) At the upper and lower band edges, vary the FINE TUNE control from the full CCW to full CW. The range should be at least 50 kHz.

(5) Set the receiver to the low band edge.

(6) Connect the power supply for negative 4 volts to FL5 of the Tuner. Record the frequency indication.

(7) Connect the power supply for positive 4 volts to FL5 of the tuner. Record the frequency indication.

(8) The difference in the two frequency counter indications must be at least 250 kHz.

(9) Set the receiver to the upper band edge and repeat steps (6) and (7). The difference must be at least 500 kHz.

4.6.1.2 Tuner Overall Gain is established in this paragraph. Proceed as follows :

(1) Connect the equipment as shown in Figure 4-2. Set the oscilloscope vertical sensitivity to view a 6 mV signal.

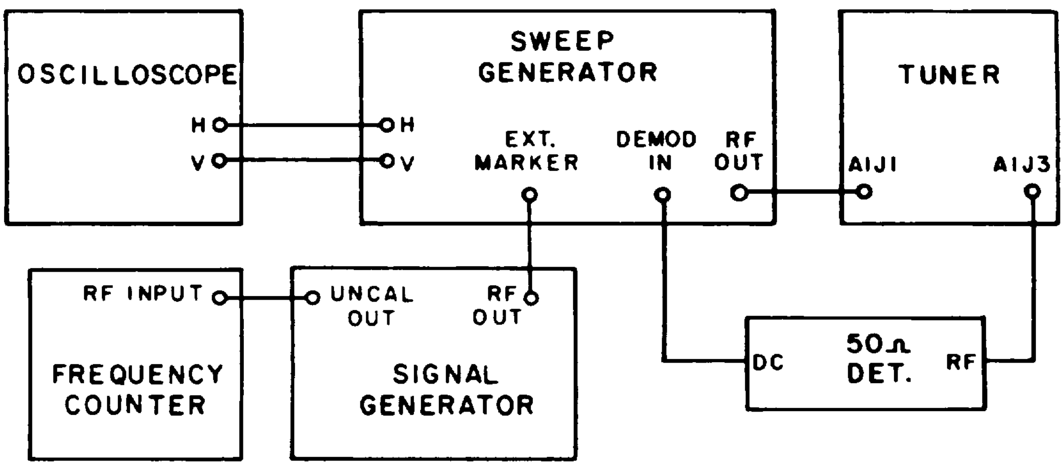


Figure 4-2. Test Setup, Overall Tuner Gain

(2) Track the tuner and sweep generator through the band and note the minimum and maximum gain levels. Vary the sweep generator attenuator to place the response peak to the two levels noted. The attenuator variation should be no more than 6 dB.

(3) Tune to a nominal gain point.

(4) With the tuner at the nominal gain frequency, establish a convenient reference by varying the sweep generator output. Note the attenuator setting.

(5) Remove the cable from A1J1 and connect it to the RF input of the 50 ohm detector.

(6) Increase the output level of the sweep generator to regain the reference set in setup (4). Note the attenuator setting.

(7) The difference between the attenuator setting in step (4) and in step (6) is the overall tuner gain at that nominal gain frequency. It should be 19 dB. Minimum and maximum gains throughout the band should be 16 and 22 dB, respectively.

4.6.2 TYPE 791834 560 MHz BINARY DIVIDER (A2) PERFORMANCE TEST - Input signals in the range of 310 to 560 MHz are divided by two and appear at the output as signals in the range of 155 to 280 MHz. For proper operation, input signal levels must be in the range of 0 to -13 dBm; output signals should then be at least -17 dBm (35 mV). A 35 mV signal will not drive most test type frequency counters. Therefore, Figure 4-3 shows a Watkins-Johnson Type DRO-280A Frequency Counter for testing the Divider output. If a counter having the required sensitivity is available (such as the Hewlett-Packard Model 5340A), the DRO-280A is not required. To test the Divider proceed as follows:

(1) Connect +5 volts to input pin E5 of the Divider subassembly.

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

(3) Set the signal generator to 310 MHz, -13 dBm.

(4) Set the spectrum analyzer to view a signal in the range of 140 to 290 MHz. Establish a -17 dBm reference.

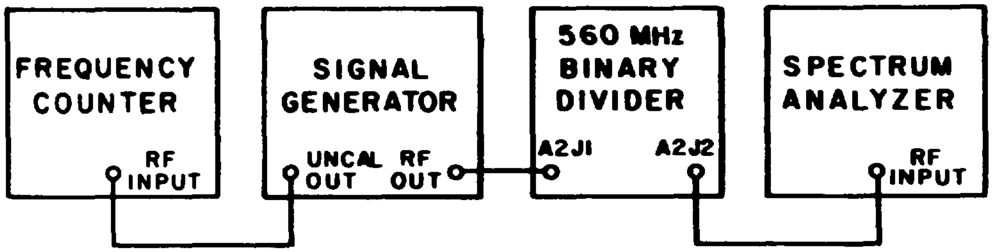


Figure 4-3. Test Setup, 560 MHz Binary Divider Performance Test

(5) Ensure that the Divider output signal is at 155 MHz and at least -17 dBm in level.

(6) Decrease the signal generator output level until the signal indication suddenly drops.

(7) Then, slowly increase the signal generator output level until the signal appears again.

(8) The signal generator level should be no more than -13 dBm.

(9) Set the signal generator level to -13 dBm.

(lo) Tune the signal generator to 560 MHz while observing the signal on the spectrum analyzer for a minimum indication not less than -17 dBm. Also observe for spurious signals and skipping, squegging or dropout of the desired signal.

(11) Slowly tune across the divider's range while insuring that the output is one-half of the subassembly's input.

4.6.3 TYPE 71347-4 60 MHz/21.4 MHz CONVERTER (A3) PERFORMANCE TEST - This assembly converts 60 MHz tuner signals to 21.4 MHz signals for use by the IF Demodulator module. Proceed as follows:

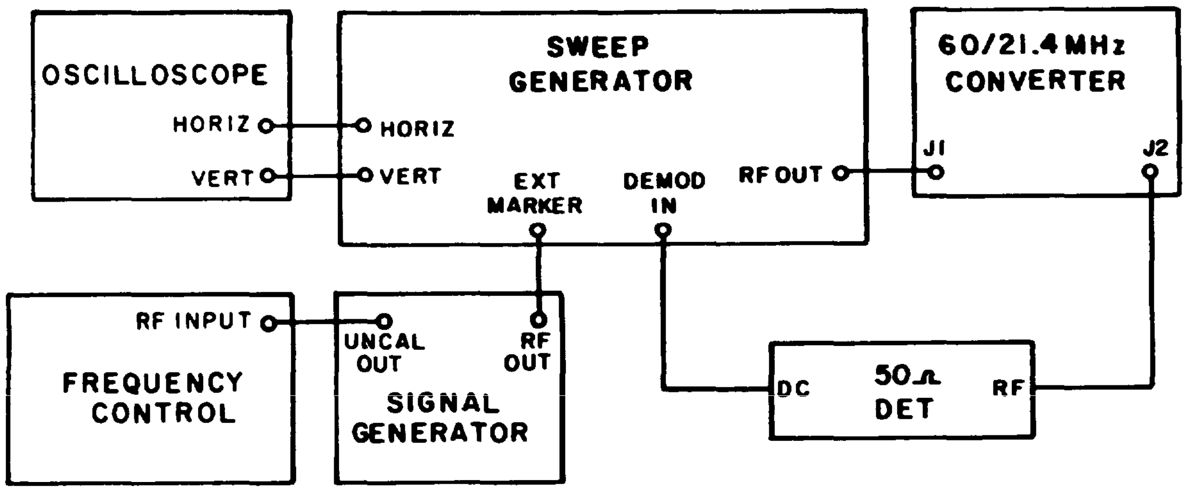


Figure 4-4. Test Setup, 60MHz/21 .4 MHz Converter Performance Test

(1) Connect the equipments shown in Figure 4-4.

(2) Set the oscilloscope controls to view a sweep response. Set the vertical sensitivity to view a 60 mV signal and a 15 MHz sweep width. Set the level to -10 dBm.

(3) Set the signal generator controls for a 60 MHz CW output at a level sufficient to produce a marker.

(4) Set the sweep generator controls for a 60 MHz center frequency and a 15 MHz sweep width. Set the level to -10 dBm.

(5) Refer to Figure 4-5 for a typical response. Bandwidth should be approximately 10 MHz at 3 dB.

(6) To measure the gain, first ensure that the sweep generator output level is still at -10 dBm. Then note the response level.

(7) Connect the RF output of the sweep generator directly to the RF jack of the 50 ohm detectors. Maintain the same approximate cable lengths.

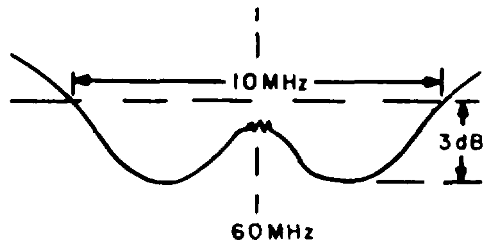


Figure 4-5. Typical Response, 60 MHz to 21.4 MHz Converter

(8) Increase the sweep generator output level until the oscilloscope base line is at the same level as the response reference level noted in step (6).

(9) The output level on the sweep generator should now be at -4 to -6 dBm. This indicates a nominal gain of 5 dB. If the gain or bandwidth is outside of these limits, refer to the alignment procedures in the following section. This completes the converter performance test.

4.7 ALIGNMENT AND ADJUSTMENT PROCEDURES

4.7.1 TYPE 71376-6 TUNER (A1) ALIGNMENT - Alignment of this tuner should only be performed by personnel thoroughly familiar with RF tuner alignments. Component placement and lead lengths are optimized during manufacture and alignment. Any deviation from those optimum conditions will probably result in a tuner not performing to full factory standards. Therefore, neither replace a component nor make an adjustment without a specific reason. When replacing components duplicate the original layout exactly. Adjustments should not be made without a test setup to show the effect of the adjustment. Also, read through the complete alignment procedure until a complete understanding of each step and procedure is acquired. Only then should an alignment be attempted. Perform the following steps to prepare the tuner for the alignment procedure.

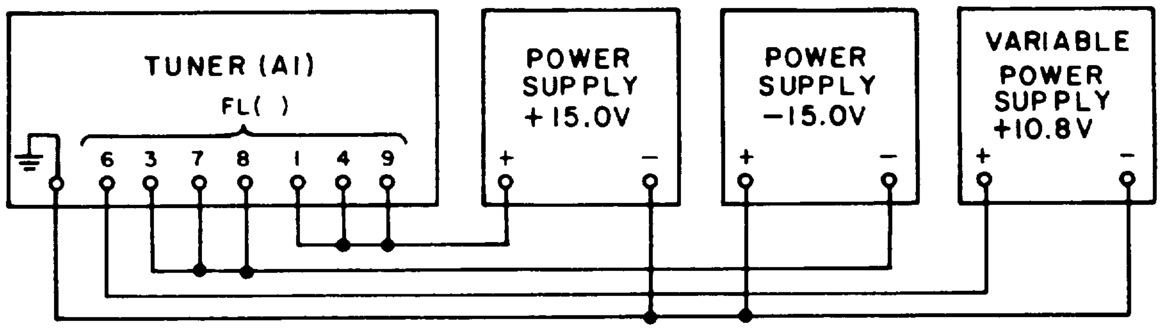


Figure 4-6. Test Setup, Tuner Power Connections

(1) Remove the tuner from the associated receiver's chassis (if any) according to the procedure given in paragraph 2.2.

(2) Connect operating voltage to the tuner as shown in Figure 4-6.

4.7. 1.1 IF Output Amplifier Alignment (250-500 MHz Tuner, Al) - This stage receives 60 MHz signals from Balanced Mixer, A1A3. The Output Amplifier consists of common base stage Q5 and three tuned stages comprising an output filter for the tuner. To align this portion of the tuner, proceed as follows:

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

(2) Set the oscilloscope controls for viewing a sweep response. Set the vertical gain control to view a 30 mV signal.

(3) Set the sweep generator controls for a 60 MHz center frequency output and a sweep width of about 1 MHz/cm. Output level should be about -27 dBm. Also, establish a marker at 60 MHz.

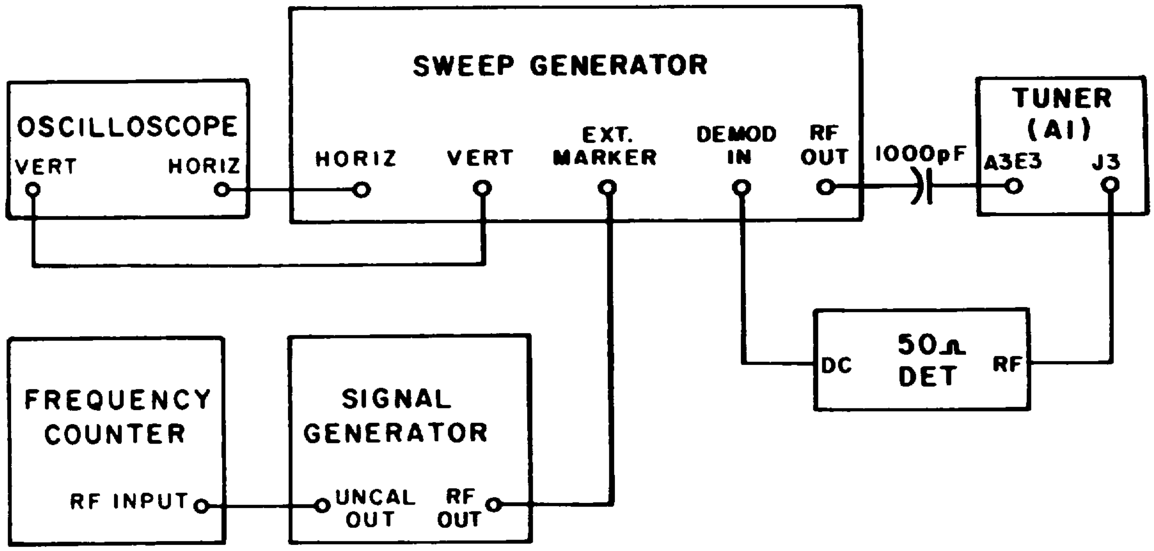


Figure 4-7. Test Setup, Tuner IF Output Amplifier Alignment

(4) Adjust C30, C32 and C34 for a maximum amplitude symmetrical response centered on the 60 MHz marker. The 3 dB bandwidth should be 6±1 MHz. Refer to Figure 4-8 for a typical response.

(5) If the bandwidth specification cannot be met by adjusting the capacitors, change the value of R21 and repeat the preceding alignment.

(6) Steps (6) through (10) determine the gain of the IF Output Amplifier stage. Begin by removing -15 V from FL7. Then set the sweep generator output level to 10 mV (-27 dBm).

(7) Observe the level of the waveform on the oscilloscope.

(8) Connect the output of the sweep generator to the input of the detector.

(9) Increase the output level of the sweep generator until the baseline of the oscilloscope is at the same level as was the peak level of the sweep response.

(lo) The difference between the sweep generator attenuator settings in step (6) and in step (9) is the gain of the output Amplifier Stage. It must be 10 dB + 3 dB.

(11) Reconnect -15 volts to FL7.

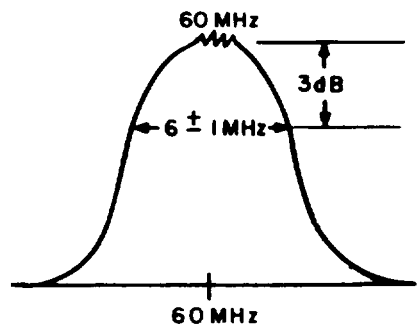


Figure 4-8. Typical Response, IF Output Amplifier Alignment

4.7.1.2 Oscillator Stage Alignment for minor corrections can be performed without removing the tuner from the main chassis. To do so, adjust C40 and C45 at the two band extremes. Refer to the detailed procedure for exact frequencies and tolerances. Throughout the alignment procedure keep in mind the general considerations given in step (1). Also, the caution given here applies throughout the oscillator alignment procedure.

CAUTION

The ceramic post support in the stator may be damaged if any force is applied to either the post or the stator.

(1) Keep the following considerations in mind while performing the alignment:

a. Transistor Q6 must not touch the chassis. It must have the shortest possible leads and the ferrite beads must be cemented to prevent any movement.

b. Adjustable capacitor C45 should never be set within 1.5 turns of maximum clockwise.

c. Capacitor C46 must have a short lead at the end connected to the stator.

d. Inductor L8 must not be coupled too tightly to the oscillator or tracking at the low band edge will not be possible. Correct coupling is determined after the oscillator has been tracked.

(2) Provide power to the tuner by connecting the power supplies as shown in Figure 4-6. Then connect the test equipment as shown in Figure 4-9.

NOTE

Throughout this procedure, the cover plates must be in place when observing the effects of any adjustments.

(3) Rotate the tuner shaft fully counterclockwise (CCW). The rotor plates should be fully meshed with the stator plates so that they are level with each other.

(4) Adjust C45 for a counter reading of 246 MHz ± 1 MHz.

(5) Rotate the tuner shaft fully clockwise (CW) and adjust C40 for a counter reading of 504 MHz ± 1 MHz.

(6) Repeat steps (4) and (5) until the conditions of both steps are met; however, if that is not possible, continue to step (7).

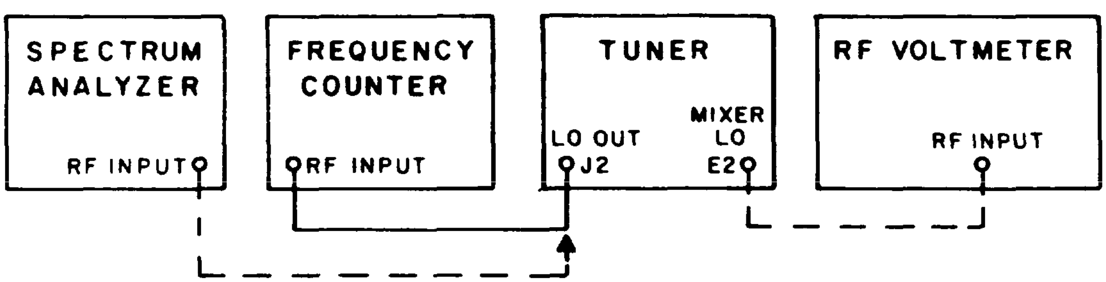


Figure 4-9. Test Setup, Oscillator Stage Alignment

(7) Inductor L22 has the most effect at the high end of the band. If tracking at that end of the band tends to be low, L22 needs less inductance. If the tracking at that end of the band tends to be high, L22 needs more inductance. To adjust L22, first unsolder it from the stator, being careful not to apply pressure or excessive heat to the stator. Decrease inductance by winding L22 tighter; conversely, increase inductance by unwinding L22. After the adjustment, resolder L22 to the stator, being careful not to damage the stator.

(8) Repeat steps (5) and (6) until the conditions of both steps are met.

(9) Steps (9) through (12) provide for correct coupling of the buffer stage to the oscillator stage. Begin by unsoldering R34 from Teflon feedthrough E6.

(10) The RF voltmeter must be connected to E6. To do this, make up a two-inch test cable having one end stripped and the other end containing a connector suitable for mating with the RF voltmeter adapter. Solder the center conductor of the test cable to E6 and the shield to the tuner chassis.

(11) Tune through the entire range of the tuner, observing for a minimum level. Then retune to the minimum level observed and adjust L8 for an indication of + 5 dBm.

(12) Again tune through the entire band, this time observing for a maximum level. It should be no greater than + 14 dBm, decrease the value of C17 and repeat steps (11) and (12). Continue to repeat steps (11) and (12) until the conditions of both steps are met.

(13) Unsolder the test cable from E6 and the chassis. Then resolder R34 to E6.

(14) With top and bottom covers installed, rotate the tuner shaft fully clockwise. The indication of the frequency counter must be 504 MHz ± 1 MHz.

(15) Rotate the tuner shaft fully counterclockwise. The frequency counter indication must be 246 MHz ± 1 MHz.

(16) If the conditions of steps (14) and (15) are not met, slight adjustments can be made with C45 at the low end and C40 at the high end. Otherwise, repeat steps (3) through (8). Then proceed to step (17).

(17) With the RF voltmeter connected to J2, tune through the entire band, watching for local oscillator output that is within the range of 0 to -13 dBm. If this condition is not met, adjust the value of R13 to bring the level in tolerance.

(18) Connect the spectrum analyzer to J2. Set the analyzer controls to scan 0 to 2 GHz, with 20 dB attenuation.

(19) Observe the spectrum analyzer display as the local oscillator is tuned through its full range. All harmonics should typically be at least 20 dB below the fundamental.

(20) Set the spectrum analyzer controls to display the local oscillator fundamental frequency at a scan width of approximately 10 MHz. Tune slowly through the band, tracking the local oscillator with the spectrum analyzer. There should be no signal instability or frequency skipping. If either condition occurs, change the value of C55 until the condition is suppressed. Then repeat steps (3) through (20). Step (21) lists other considerations relating to oscillator performance.

(21) The following items may also affect local oscillator performance:

a. The emitter of Q3 should be as short as possible.

b. Changing the physical placement of T1 may improve oscillator performance.

c. Dividing action in the oscillator buffer section usually results from its being overdriven. If Q3 was replaced, the new transistor may have high gain. Try replacing it with a lower gain transistor of the same type. If that does not cure the problem, increase the value of C55 slightly.

4.7. 1.3 Tuner RF Alignment

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

(2) Refer to Figure 5-8, the component locations for Attenuator Shaper A1A2. Locate the end of R7 that is connected to pin 9 of U1 . Connect the dc voltmeter to the exposed lead of R7. Adjust A1A2R6 for an indication between + 5.7 and + 6.2 Vdc.

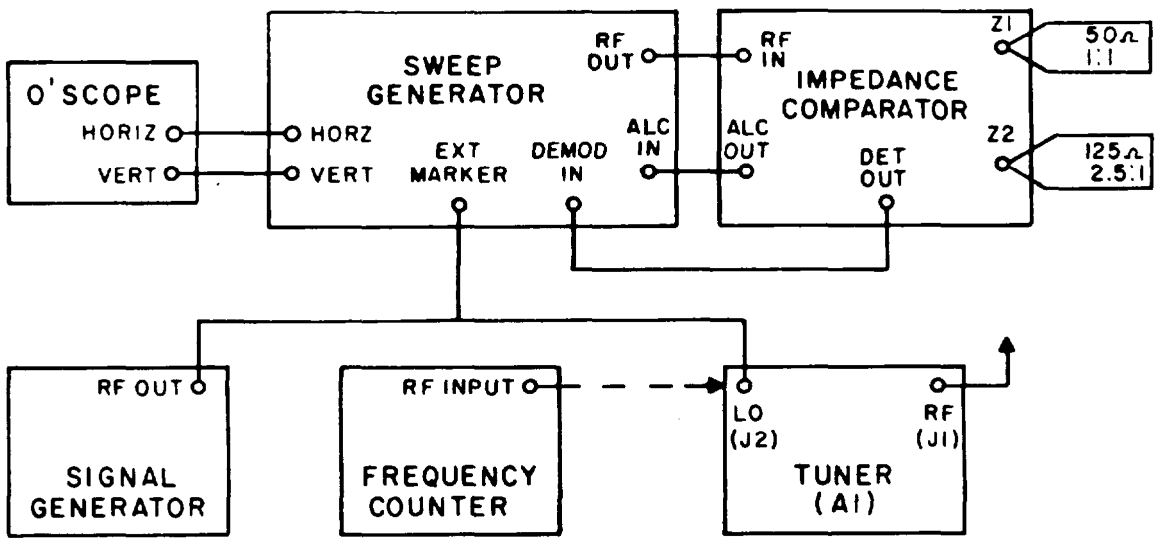


Figure 4-10. Test Setup, Tuner VSWR Alignment Circuit

(3) Set the sweep generator to a 250 MHz center frequency and to a 50 MHz sweep width.

(4) Set the oscilloscope controls to view the sweep response.

(5) Set the signal generator to 60 MHz at a level sufficient to produce a marker.

(6) Rotate the tuner shaft fully counterclockwise.

(7) Be sure both the bottom cover and the oscillator cavity cover are in place.

(8) Establish a convenient 2.5:1 VSWR reference level. Then connect J1 of the tuner in place of the 2.5:1 termination on the impedance comparator.

(9) To adjust coils L13, L15, L18 and L20 in the following steps requires unsoldering them from the stators. When doing so observe the caution given in paragraph 4.7.1.2.

(lo) Adjust coils L13 and L15 for a symmetrical response centered on the marker. Refer to Figure 4-11 for a typical response.

(11) Obtain a 6 MHz peak-to-peak separation by adjusting the tap position of L14 on both L13 and L15 (Inductor L14 passes through the Teflon feedthrough between cavities).

(12) Repeat steps (10) and (11) until the interaction is minimized.

(13) The response center must now be adjusted so that it approaches the 2.5:1 VSWR reference. Again refer to Figure 4-11 for the desired condition.

NOTE

For responses shown in Figures 4-11 through 4-19 the 2.5:1 reference level is the x-axis. In addition, the y-axis is the center of the desired bandpass. Local oscillator markers shown on all VSWR response figures appear at a typical position for the frequency being swept.

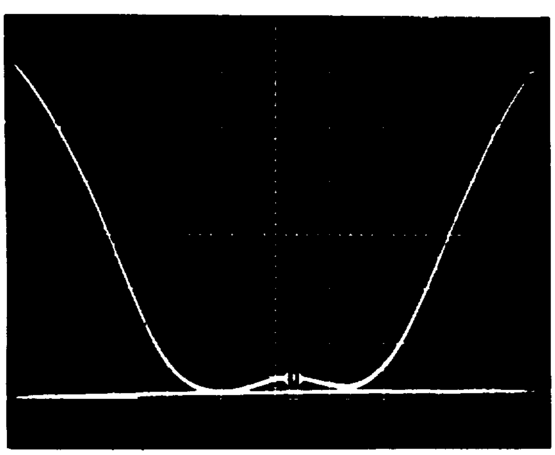


Figure 4-11. Typical Response, 250 MHz VSWR Alignment

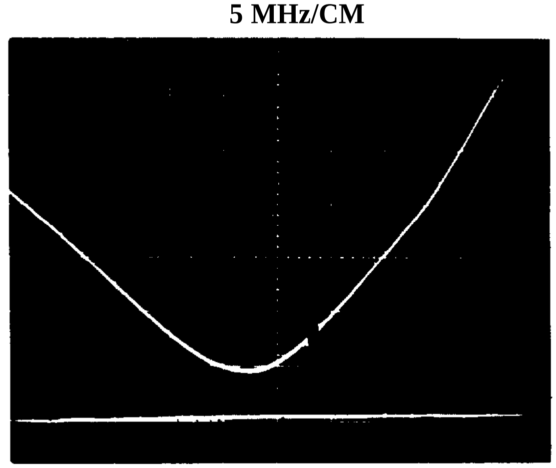


Figure 4-12. Typical Response, 500 MHz VSWR Alignment

(14) Adjust the tap point of L12, L13, L16 and L15. In each case, the tap point should be approximately 1/4 turn above L14, and together they should be maintained the same relative distance from L14.

(15) Rotate the tuner shaft fully clockwise.

(16) Set the sweep generator center frequency to 500 MHz and the sweep width to about 18 MHz. Readjust the controls as necessary for a convenient display of the marker and the response.

(17) Adjust trimmer capacitors C37, C50, C51 and C52 for a symmetrical response centered on the marker. Refer to Figure 4-12 for a typical response.

(18) Tune down the frequency about 25 MHz, tracking the tuner with the sweep generator. Observe the symmetry and shifting of the response about the marker. Use a “finger” to introduce capacitance to C1A and C1B noting in each case if the response is improved or not.

(19) Adjust the rotors of C1A and C1B for the required change in capacitance determined in step (18).

NOTE

When adjusting capacitor rotor plates in the following steps, be sure to distribute the required capacitance among all four plates associated with each frequency range. Throughout the alignment procedure, periodically rotate the tuner shaft through its range watching for uniform rotor/statorspacing and for possible shorting of plates.

(20) Reset the tuner shaft fully cw and readjust C37, C50, C51 and C52 to compensate for C1A and C1B adjustments.

(21) Repeat steps (18) and (19) until the interaction is minimized and the response appears as shown in Figure 4-13 throughout the 25 MHz range.

NOTE

Keep the VSWR response center under the marker to the extent possible. This will aid in interstage alignment in paragraph 4.7.1.4. Also, rotor plates may require an angular bend as shown in Figure 4-14 to maintain tracking requirements.

6MHz/cM

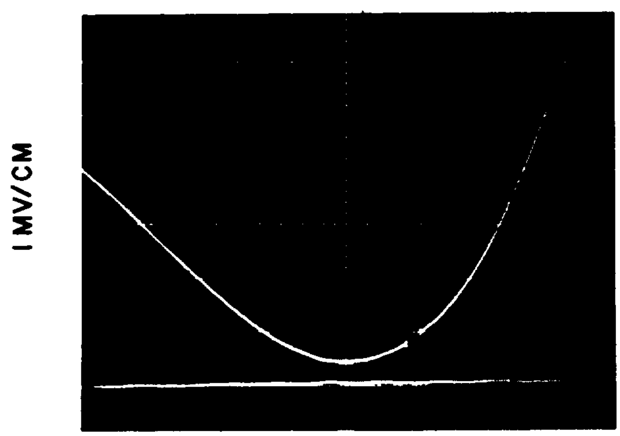


Figure 4-13. Typical Response, 500-475 MHz VSWR

(22) Tune from 475-425 MHz while adjusting the second set of rotor plates on C1A and C1B. Refer to Figure 4-15 for the desired response.

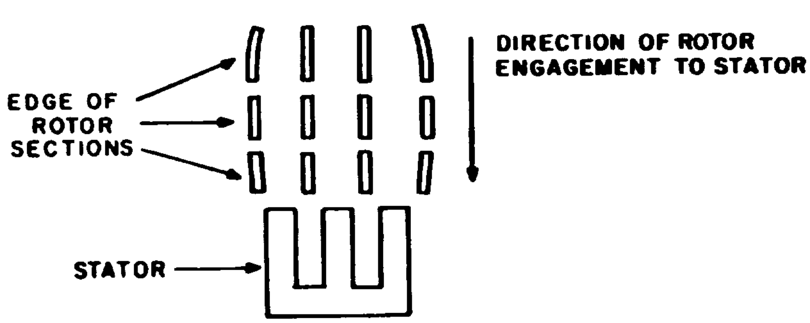


Figure 4-14. Rotor Plate Adjustment

(23) Continue to tune down the band by adjusting the remaining rotor plates on C1A and C1B. The response may change from that shown in Figure 4-15 to a double-lobed response. Do not allow the response to exceed the 2.5:1 VSWR reference.

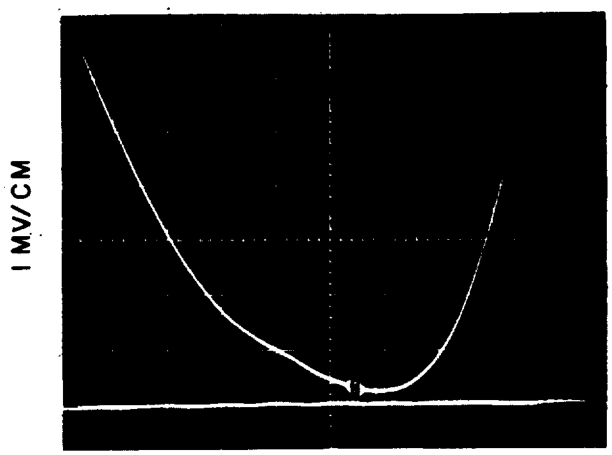


Figure 4-15. Typical Response, 475-425 MHz VSWR Alignment

(24) Recheck all previously aligned sections and make necessary corrections to their alignment. Then proceed to the interstage alignment.

4.7. 1.4 Interstage Alignment should be performed only after insuring correct alignment of the RF stages. This is because the interstage receives sweep voltage from the RF stage.

(1) Connect the equipment as shown in Figure 4-16. The lead between the 50 ohm detector and A3E6 should be less than 2 inches in length. Also, the shield must be short and grounded to the tuner chassis, preferably soldered.

(2) Refer to Figure 5-9 for the location of A1A3L1. Then remove the inductor from the circuit.

(3) Rotate the tuner shaft fully counterclockwise.

(4) Set the sweep generator to a center frequency of 250 MHz and to a sweep width of approximately 30 MHz.

(5) Set the oscilloscope controls to view the sweep response.

(6) Set the signal generator to 60 MHz at a level sufficient to produce a marker.

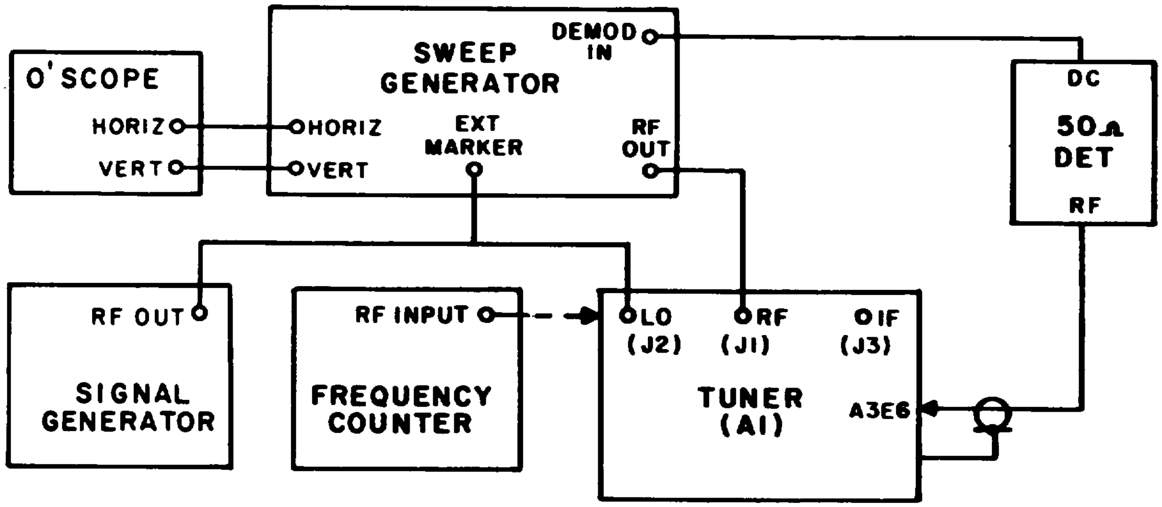


Figure 4-16. Test Setup, Tuner Interstate Alignment

(7) To adjust coils L18 and L20 in the following steps requires unsoldering them from the stators. When doing so, observe the caution given in paragraph 4.7.1.2.

(8) Adjust L18 and L20 for a maximum amplitude, symmetrical response centered on the marker.

(9) Adjust the tap position of L19 on both L18 and L20 for a response as shown in Figure 4-17.

(lo) If necessary, adjust the tap point of L17 on L18 and of L20 on L21 for the 6 MHz ± 1 MHz 3 dB bandwidth. In each case the tap point should be approximately 1/4 turn above L9 and together they should be maintained the same relative distance from L19.

(11) Rotate the tuner shaft fully clockwise and set the sweep generator to 500 MHz.

(12) Adjust C38, C39, C53 and C54 for a symmetrical response as shown in Figure 4-18.

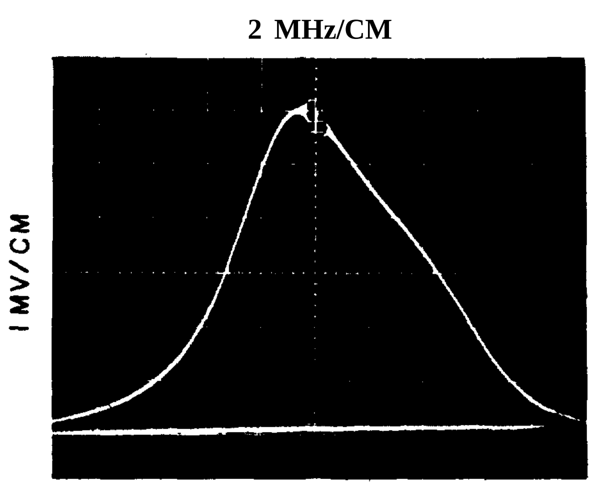


Figure 4-17. Typical Response, 250 MHz Interstage Response

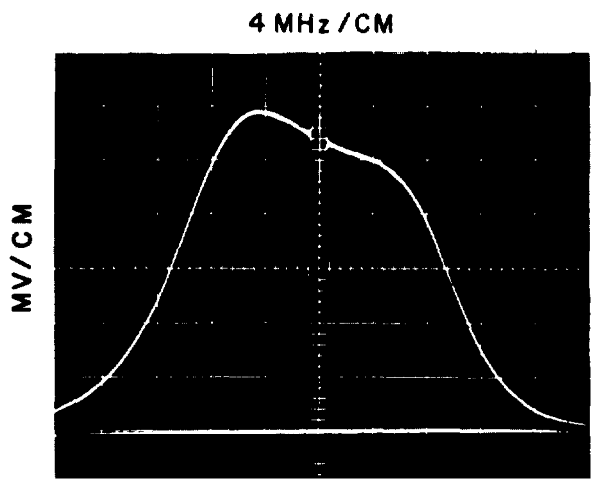


Figure 4-18. Typical Response, 500 MHz Response

(13) As a check on correct tuning, introduce "finger" capacitance to stage C1D. The response should "rock" on the marker thereby indicating proper tuning.

(14) Tune down the frequency about 25 MHz, tracking with the sweep generator. Observe the symmetry and shifting of the response relative to the marker. Introduce "finger" capacitance to C1C and C1D noting in each case if the response is improved or not.

(15) Adjust the rotors of C1C and C1D for the required change in capacitance determined in step (14).

(16) Reset the tuner shaft fully clockwise and readjust C38, C39, C53 and C54 to compensate for C1C and C1D adjustments. Refer to Figure 4-19 for the typical response.

(17) Repeat steps (14) through (16) until the interaction is minimized, and the response appears as shown in Figure 4-19 for the top 25 MHz of the band.

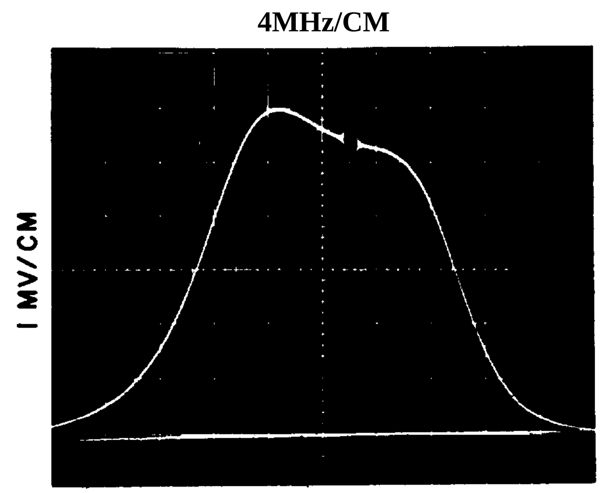


Figure 4-19. Typical Response, 500-475 MHz Interstage Response

(18) After adjusting the top 25 MHz of the band, continue with the next 25 MHz, adjusting the second section of C1C and C1D rotor plates.

(19) Continue adjusting the rotor plates down the band always checking to ensure that previously aligned plates remain tuned. Refer to Figure 4-19 when performing these adjustments. After ensuring correct alignment, proceed to the next step to measure the gain through the RF stage and interstage. Perform steps (20) through (23) at both band edges and at mid-band.

(20) Establish a convenient reference on the oscilloscope by varying the attenuator on the sweep generator. Note the attenuator setting.

(21) Connect the sweep generator RF output to the 50 ohm detector RF input.

(22) Increase the sweep generator output level until the reference set in step (20) is regained. Note the attenuator setting on the sweep generator. The difference between this reading and the one noted in step (20) is the gain. At the

upper and lower band edge, the gain should be 15 dB ± 2 dB. At midband the gain should decrease to 12 dB ± 2 dB.

(23) If the gain conditions cannot be met, recheck the tuner alignment paying close attention to the bandwidth adjustments.

(24) Disconnect the test cable from both A1A3E6 and the chassis and reinstall A1A3L1. The equipment should be left connected for use in the next paragraph. Proceed to the next paragraph.

4.7.1.5 Tuner Overall Gain and AGC Range is established in this paragraph.

(1) Connect the equipment as shown in Figure 4-16, except the RF jack of the 50 ohm detector should be connected to A1J3, the IF output.

(2) Vary the tuner and sweep generator through the band and note the minimum and maximum gain points. Vary the sweep generator attenuator to place the response peak to those two levels. The attenuator variation should be no more than 6 dB.

(3) Tune through the band to relocate a nominal gain point.

(4) With the tuner at the nominal gain frequency, adjust the value of R23 to set the gain at 19 dB. To measure the gain, perform steps (5) through (8).

(5) With the tuner at a nominal gain frequency, establish a convenient reference by varying the sweep generator output. Note the attenuator setting.

(6) Remove the cable from A1J1 and connect it to the RF input of the 50-ohm detector.

(7) Increase the output level of the sweep generator to regain the reference set in step (5). Note the attenuator setting.

(8) The difference between the attenuator setting in step (5) and in step (7) is the overall tuner gain at that frequency. It should be 19 dB. Minimum and maximum gains should be 16 and 22 dB, respectively.

(9) Set the tuner and sweep generator to 500 MHz. Establish a reference level and note the sweep generator attenuator setting. Set the variable power supply to -10 volts and connect to FL2.

(10) Increase the sweep generator output 31 dB and adjust A1A2R16 for the same response amplitude set in step (9). This completes the tuner alignment.

4.7.2 TYPE 791834 560 MHz BINARY DIVIDER (A2) - Alignment of this assembly consists of a single adjustment, potentiometer A2A1R10. It establishes optimum base bias for related transistors Q3 and Q4, thereby providing maximum frequency coverage. If R10 must be adjusted, proceed as follows:

(1) Remove the subassembly from the tuner by disconnecting jacks J1, J2 and the connection to A2C1.

(2) Remove the subassembly from the tuner's chassis by removing the screws at its sides.

(3) Remove the cover that exposes the parts. Connect +6 volts to A2C1.

(4) Refer to Divider performance test in paragraph 4.6.2. Use that procedure to determine the best setting of R10 for optimum performance. As an initial setting, adjust R10 for 1.65 Vdc at the junction of R9 and R10. The cover should be in place for the performance testing steps.

4.7.3 TYPE 71347-4 60/21.4 MHz CONVERTER ASSEMBLY (A3) - This assembly converts 60 MHz tuner signals to 21.4 MHz signals for use by the IF Demodulator module of the associated receiver. Contained on the board are circuits which perform two basic functions: one performs the mixing operation, the other amplifies the resulting 21.4 MHz signals. Alignment can be accomplished by performing the following:

(1) Connect the equipment as shown in Figure 4-20. Use J1 for the input and J2 for the output of the Converter.

(2) Set the oscilloscope controls to view a sweep response. Set the vertical sensitivity to view a 60 mV signal.

(3) Set the sweep generator controls for a center frequency of 60 MHz and a level of -10 dBm.

(4) Set the signal generator controls for a 60 MHz CW output at a level sufficient to produce a marker.

(5) Readjust the sweep width controls to display a 2 MHz/cm response.

(6) Carefully adjust A1C3 for a maximum amplitude response centered on the 60 MHz marker.

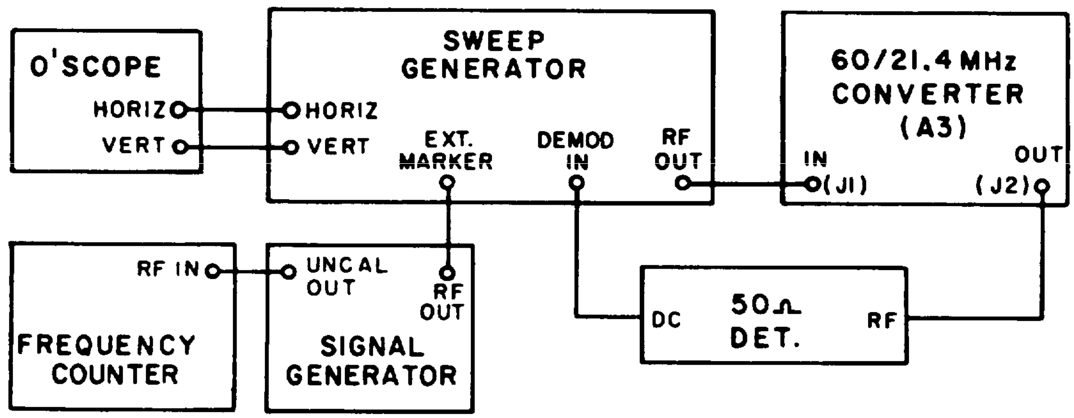


Figure 4-20. Test Setup, 60 MHz/ 21.4 MHz Converter Assembly Alignment

(7) Adjust A1C9 and A1C11 for a symmetrical response centered on the 60 MHz marker. Refer back to Figure 4-5 for a typical response. Note that the 3 dB bandwidth is approximately 10 MHz.

(8) Repeat steps (6) and (7) to optimize the response.

(9) To measure the gain through the Converter, first note the maximum level of the response on the oscilloscope. (The sweep generator output should still be at -10 dBm).

(10) Connect the RF output of the sweep generator directly to the RF jack of the 50 ohm detector. Maintain the same approximate cable lengths.

(11) Increase the sweep generator output level until the oscilloscope base line moves to the same level as the response reference level noted on step (9).

(12) The output level on the sweep generator should now be 5 dBm ± 1 dB higher. This indicates a nominal gain of 4 to 6 dB. If the gain is outside of these limits, potentiometer A3A1R16 must be adjusted. To do so requires removing the Tuner Assembly from the receiver. Refer to paragraph 4.8 for instructions.

4.8 SUBASSEMBLY REMOVAL , REPAIR AND REPLACEMENT

4.8.1 All of the tuner’s assemblies are mounted on printed circuit cards. Before a subassembly is removed, any coaxial cable connections or plug assemblies must be unsoldered or disconnected. Repair procedures are straightforward and conventional. Observe the usual precautions regarding temperature on semiconductors and damage to circuit patterns on boards.

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 (modules), and parts. An example of the unit method follows:

Subassembly Designation A1	R1 Class and No. of Item
Identify from right to left as:	First (1) resistor (R) of first (1) subassembly (A)

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

5.2 REFERENCE DESIGNATION PREFIX

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

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
01037	Pyroferric-New York, Inc. 621 E. 216th Street Bronx, NY 10467
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, WI 53204
01351	Dynamic Gera Co. , Inc. 175 Dixon Avenue Amityville, NY 11701
02114	Ferroxcube Corp. P.O. Box 359 Mt. Marion Road Saugerties, NY 12477
02735	RCA Corporation Solid State Division Route 202 Somerville, NJ 08876
04013	Taurus Corporation 1 Academy Hill Lambertville, NJ 08530

Mfr. Code	Name and Address
05972	Loctite Corporation 705 North Mountain Road Newington, CT 06111
07263	Fairchild Camera & Inst. Corp. Semiconductor Division 464 Ellis Street Mountain View, CA 94040
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, Maryland 20878
15454	Rodan Industries, Incorporated 2905 Blue Star Street Anaheim, CA 92634
15653	Kaynar Mfg. Co., Inc. P.O. Box 3001 800 South State College Blvd. Fullerton, CA 92634
19505	Applied Engineering Prod., Co. Division of Samarius Inc. 300 Seymour Avenue Derby, Ct 06418
25088	Siemens Ameica, Inc. 186 Wood Avenue S. Iselin, NJ 08830
27956	Relcom 3333 Hillview Avenue Palo Alto, CA 94304
28480	Hewlett-Packard Company Corporated Headquarters 1501 Page Mill Road Palo Alto, CA 94304
31433	Union Carbide Corporation Highway 276, S.E. Greenville, SC 29606
33095	Spectrum Control Inc. 152 E. Main Streeet Fairview, PA 16415
56289	Sprague Electric Company Marshall Street North Adams, MA 01247
56878	Standard Pressed Steel co. Box 608 Benson East Jenkintown, PA 19046
71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, MA 02138
72982	Erie Technological Prod., Inc. 644 West 12th Street Erie, PA 16512
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, CA 92634
73899	JFD Electronics Company 15th at 62nd Street Brooklyn, NY 11219
75042	TRW Electronic Components IRC Fixed Resistors 401 North Broad Street Philadelphia, PA 19108

Mfr. Code	Name and Address
76055	Mallory Controls Division P.O. Box 327 State Road 28 W Frankfort, IN 46041
78189	Illinois Tool Works Inc. Shakeproof Division St. Charles Road Elgin, IL 60120
79136	Waldes Kohinoor Inc. 47-16 Austel Place Long Island City, NY 11101
80031	Electra-Midland Corp. MEPCO Division 22 Columbia Road Morristown, NJ 07960
80058	Joint Electronic Type Designation System
80131	Electronic Ind. Association 2001 Eye Street, N.W. Washington, DC 20006
81312	Winchester Electronics Div. Litton Industries, Inc. Main Street & Hillside Avenue Oakville, CT 06779
81349	Military Specifications
83086	New Hampshire Ball Bearings, Inc. Route 202 Peterborough, NH 03458
91293	Johanson Manufacturing Co. P.O. Box 329 Boonton, NJ 07005
91418	Radio Materials Company 4242 West Bryn Mawr Av. Chicago, IL 60646
91984	Maida Development Co. 214 Academy Street Hampton, VA 23369
95121	Quality Components, Inc. P.O. Box 113 St. Mary's, PA 15857
96909	Military Standards
99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, NY 14052
99848	Wilco Corporation 4030 West 10th Street P.O. Box 22248 Indianapolis, IN 46222

5.4 PARTS LIST

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

NOTE

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

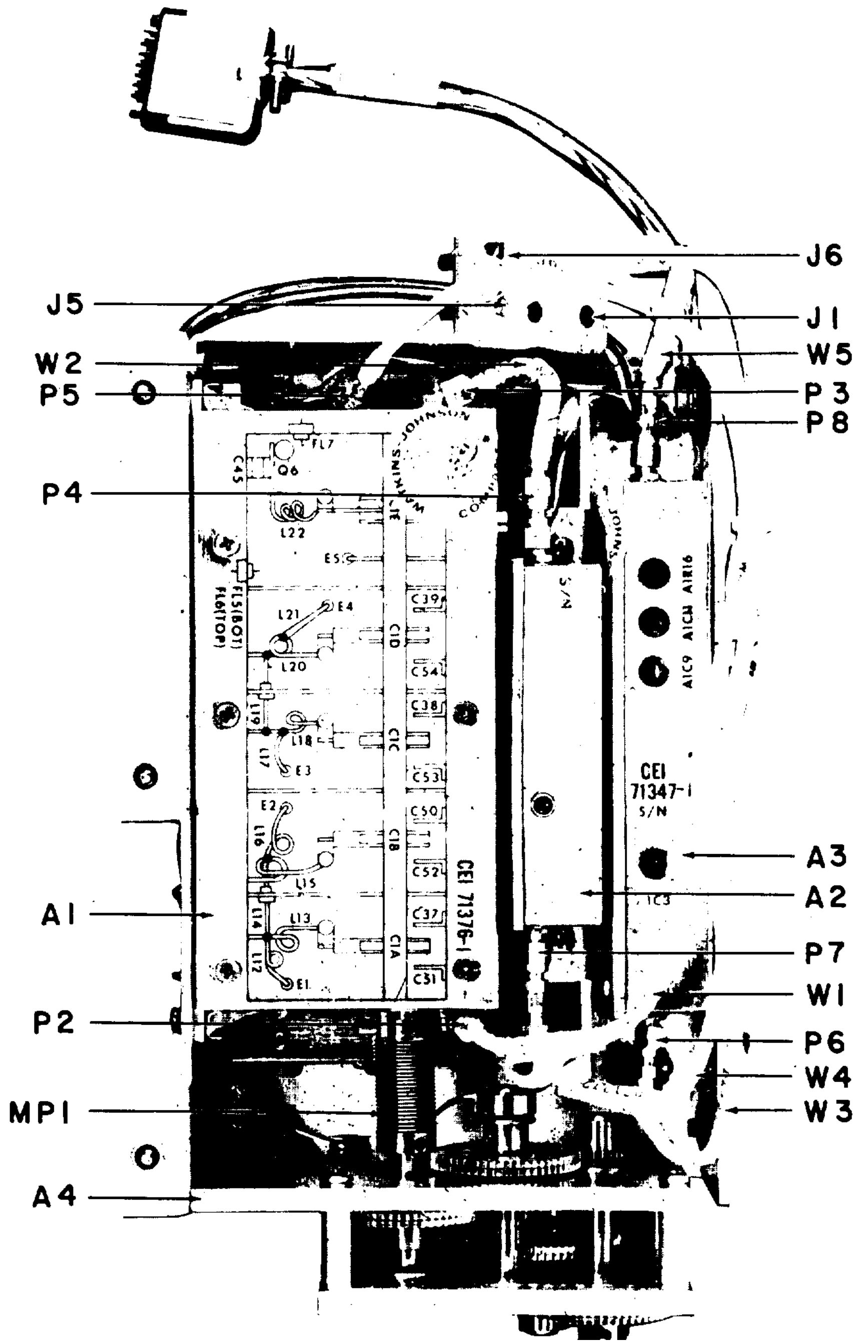


Figure 5-1. WJ-9124 250-500 MHz Tuner Assembly, Top View, Location of Components

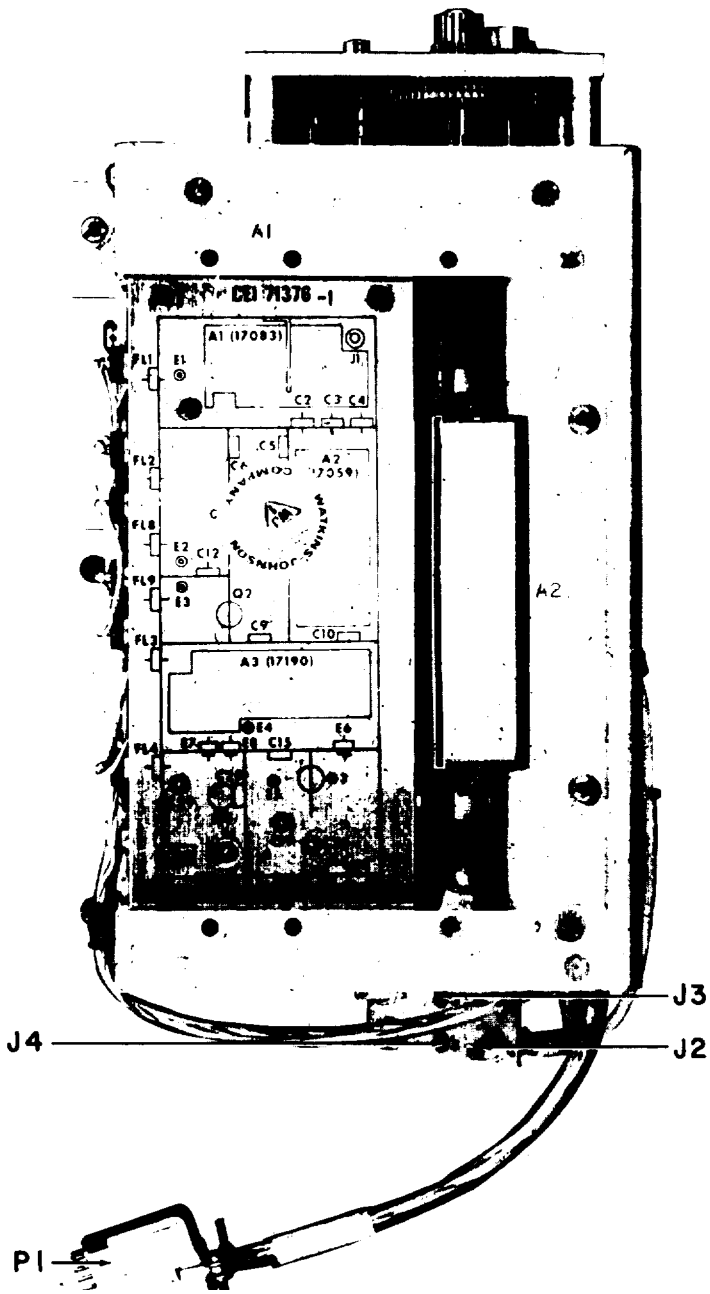


Figure 5-2. WJ-9124 250-500 MHz Tuner Assembly, Bottom View, Location of Components

5.5 TYPE WJ-9124 250-500 MHZ TUNER ASSEMBLY, MAIN CHASSIS

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	250-500 MHz Tuner	1	71376-6	14632	
A2	560 MHz Binary Divider	1	791834	14632	
A3	60/21.4 MHz Converter	1	71347-4	14632	
A4	Tuning Dr9ve	1	85131	14632	
J1	Connector, Receptacle: SMC Series	6	UG1468/U	80058	19505
J2 Thru J6	Same as J1				
MP1	Coupling	1	FC9	18469	
P1	Connector, Plug: SRE Series	1	SRE20PNSSH13	81312	
P2	Connector, Plug: SMC Series	5	UG1465/U	80058	19505
P3 Thru P5	Same as P2				
P6	Connector, Plug	2	UG1466/U	80058	
P7	Same as P6				
P8	Same as P2				
W1	Cable Assembly	1	17300 -144-1	14632	
W2	Cable Assembly	1	17300 -144-2	14632	
W3	Cable Assembly	1	17300 -144-3	14632	
W4	Cable Assembly	1	17300 -144-4	14632	
W5	Cable Assembly	1	17300 -144-5	14632	

5.5.1 TYPE 71376-6 250-500 MHz TUNER REF DESIG PREFX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	Pin Diode Attenuator	1	17083	14632	
A2	Attenuator Shaper	1	17059	14632	
A3	Balanced Mixer	1	17190-2	14632	
C1	Tuner Shaft Assembly	1	23164-1	14632	
C2	Capacitor, Ceramic, Feedtbru: 1000 PF, GMV, 500 V	3	54-794-009-102W	33095	
C3	Same as C2				
C4	Same as C2				
C5	Capacitor, Mica, Feedtbru: 250 pF, 10%, 250 V	5	2830-000-251K	72982	
C6	Same as C5				
C7	Capacitor, Ceramic, Disc: 100 pF, 5%, 300 V	3	UYO2-101J	73899	
C8	Capacitor, Ceramic, Disc: 200 pF, ±50%, 500 V	7	32-257578-40	91984	
C9	Same as C 5				
C10	Same as C5				
C11	Same as C7				
C12	Capacitor, Ceramic, Standoff: 470 pF, 20%, 500 V	3	54-803-003-4712	33095	
C13	Same as C8				
C14	Same as C7				
C15	Same as C 5				
C16	Same as C8				
C17¤	Capacitor, Ceramic, Tubular: 3.6 pF±0. 25 pF, 500 V	1	301-000COJO-369C	72982	
C18	Not Used				
C19	Same as C12				
C20	Capacitor, Composition, Tubular: 0.47 pF, 10%, 500 V	2	QC(0.47 pF, K)	95121	
C21	Not Used				
C 22	Same as C8				
C 23	Same as C 17				
C24	Not Used				
C 25	Same as C 12				
C26	Same as C 20				
C27	Not Used				
C28	Capacitor, Ceramic, Standoff: 1000 pF, GMV 500 V	2	54-803-003-102W	33095	
C28	Same as C28				
C30	Capacitor, Variable, Air: 0.8-10.0 pF, 250 V	4	5202	91293	
C31	Capacitor, Composition, Tubular: 1.2 pF, 10%, 500 V	1	QC(1. 2 pF, K)	95121	
C32	Same as C30				
C33	Capacitor, Composition, Tubular: 0.75 pF, 10%, 500 V	1	QC(0. 75 pF, K)	95121	

¤NominalValue, Final Value Factory Selected.

*DENOTES HIDDEN PART

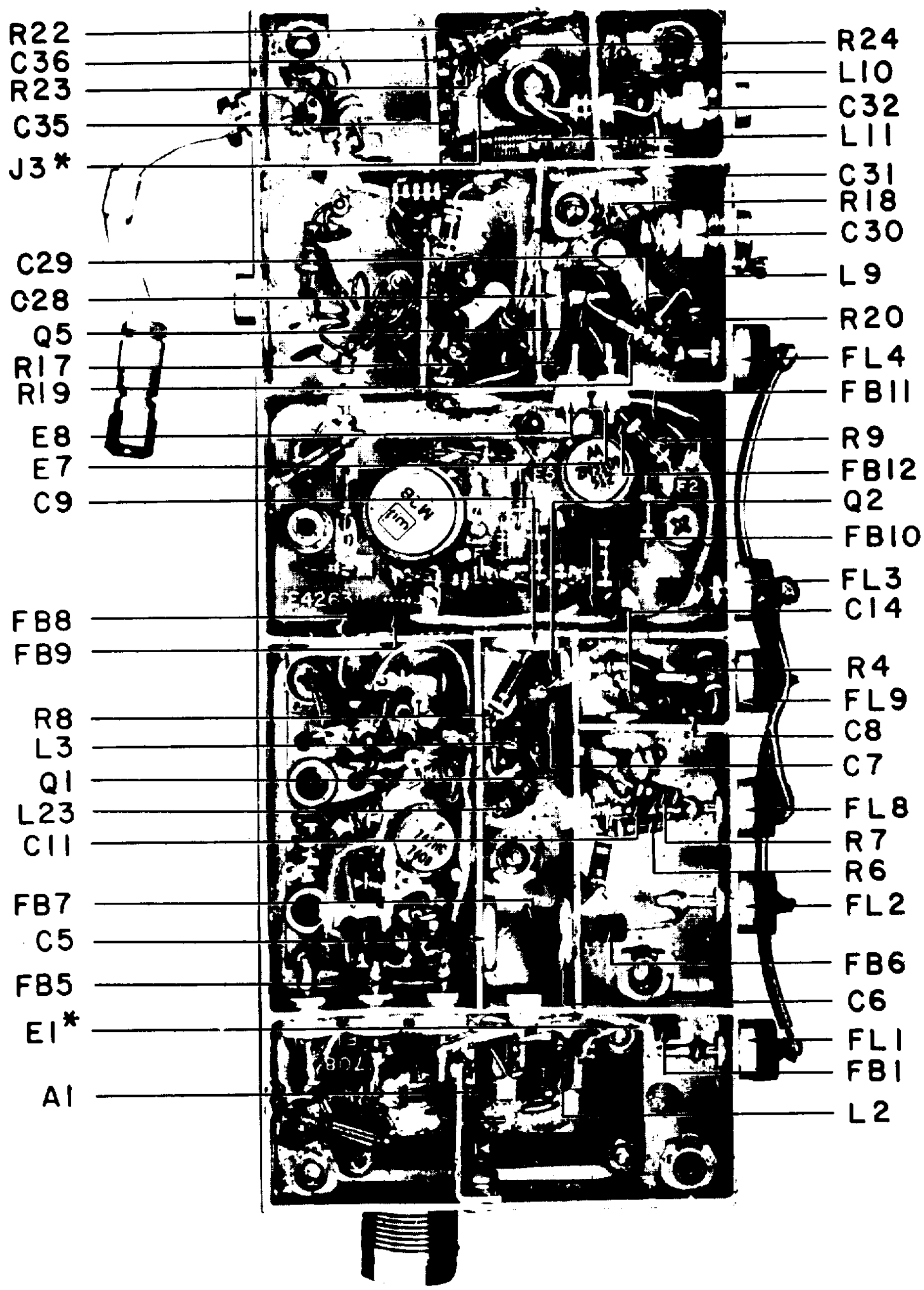


Figure 5-3. Type 71376-6 250/500 MHz Tuner (A1), Location of Components

*DENOTES HIDDEN PART

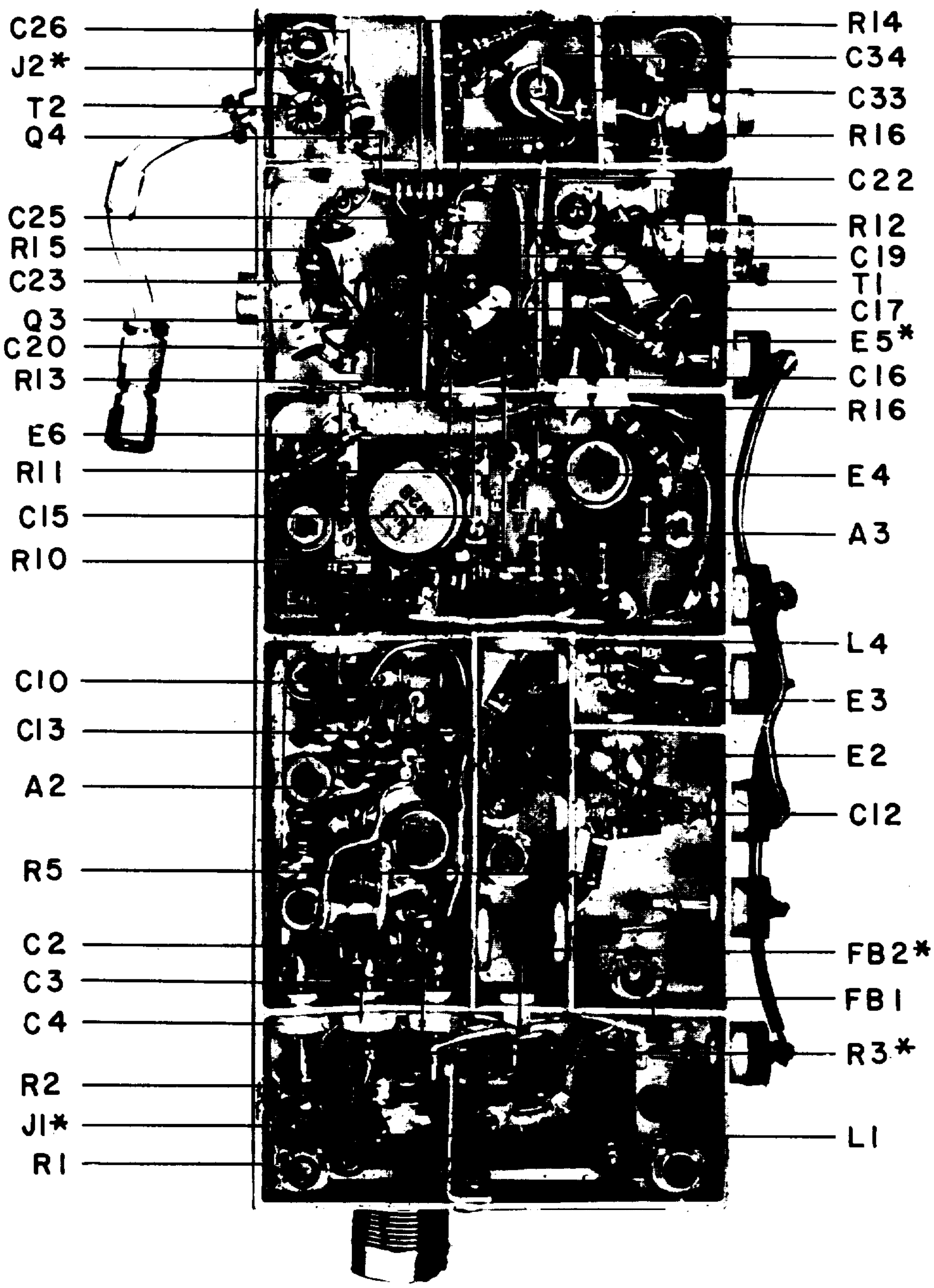


Figure 5-4. Type 71376-6 250-500 MHz Tuner (A1), Location of Components

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C34	Same as C30				
C35	Capacitor, Ceramic, Disc: 24pF, 5%, 500V	2	603U2J240J	91984	
C36	Same as C35				
C37	RF Trimmer Plate	8	17833-1	14632	
C 38	Same as C37				
C39	Same as C37				
C40	Tuning Slug Capacitor	1	6927	91293	
C41	Capacitor, Electrolytic, Tantalum: 100 µF, 20%, 35 V	1	MTP107MO35P1C	76055	
C42	Same as C8				
C43	Capacitor, Ceramic, Chip: 1 pF±0.1 pF, 500 V	2	603M7KO1O8	91984	
C44	Same as C8				
C45	Same as C30				
C46	Capacitor, Composition, Tubular: 0.68 pF, 10%, 500 V	1	QC(0.68 pF, K)	95121	
C47	Same as C43				
C48	Capacitor, Ceramic, Chip 1.8 pF±0. 1 pF, 500 V	1	603P2G1R88	91984	
C49	Same as C8				
C50 Thru C54	Same as C37				
C55¤	Capacitor, Composition, Tubular: 1.0 pF, 10%, 500 V	1	QC(1. 0 pF, K)	95121	
CR1	Diode, Varicap	2	BB105B	25088	
CR2	Same as CR1				
El	Terminal, Feedthru, Insulated	8	SFU16Y	04013	
E2 Thru E8	Same as E1				
FB1	Ferrite Bead	10	56-590-66-4A	02114	
FB2	Same as FB1				
FB3	Ferrite Bead	3	P5-1288	01037	
FB4	Same as FB3				
FB5 Thru FB12	Same as FB1				
FB13	Same as FB3				
FL1	Capacitor Modified	9	33728-4	14632	
FL2 Thru FL9	Same as FL1				

¤Nominal Value, Final Value Factory Selected.

*DENOTES HIDDEN PART

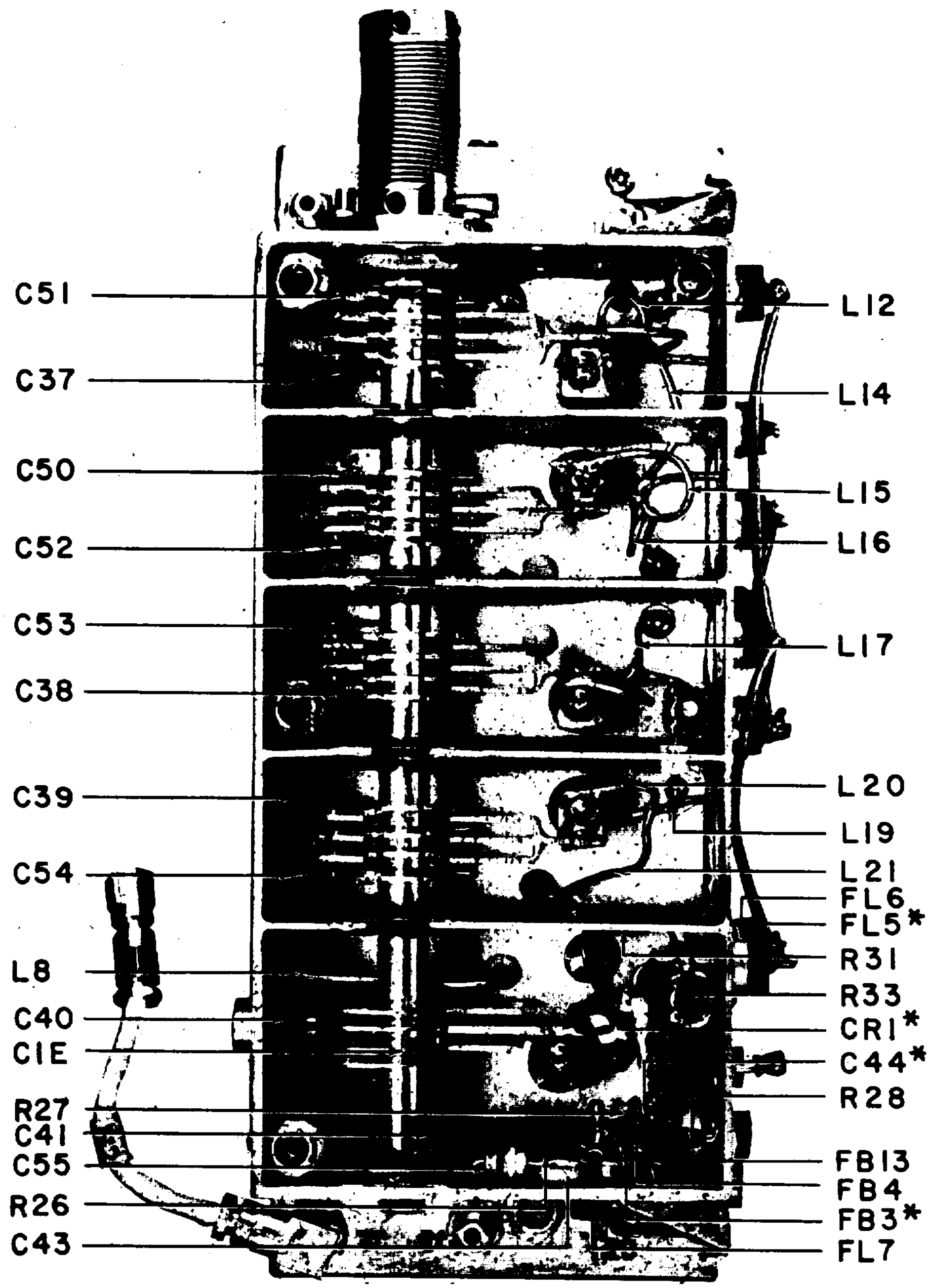


Figure 5-5. Type 71376-6 250-500 MHz Tuner (A1), Location of Components

*DENOTES HIDDEN PART

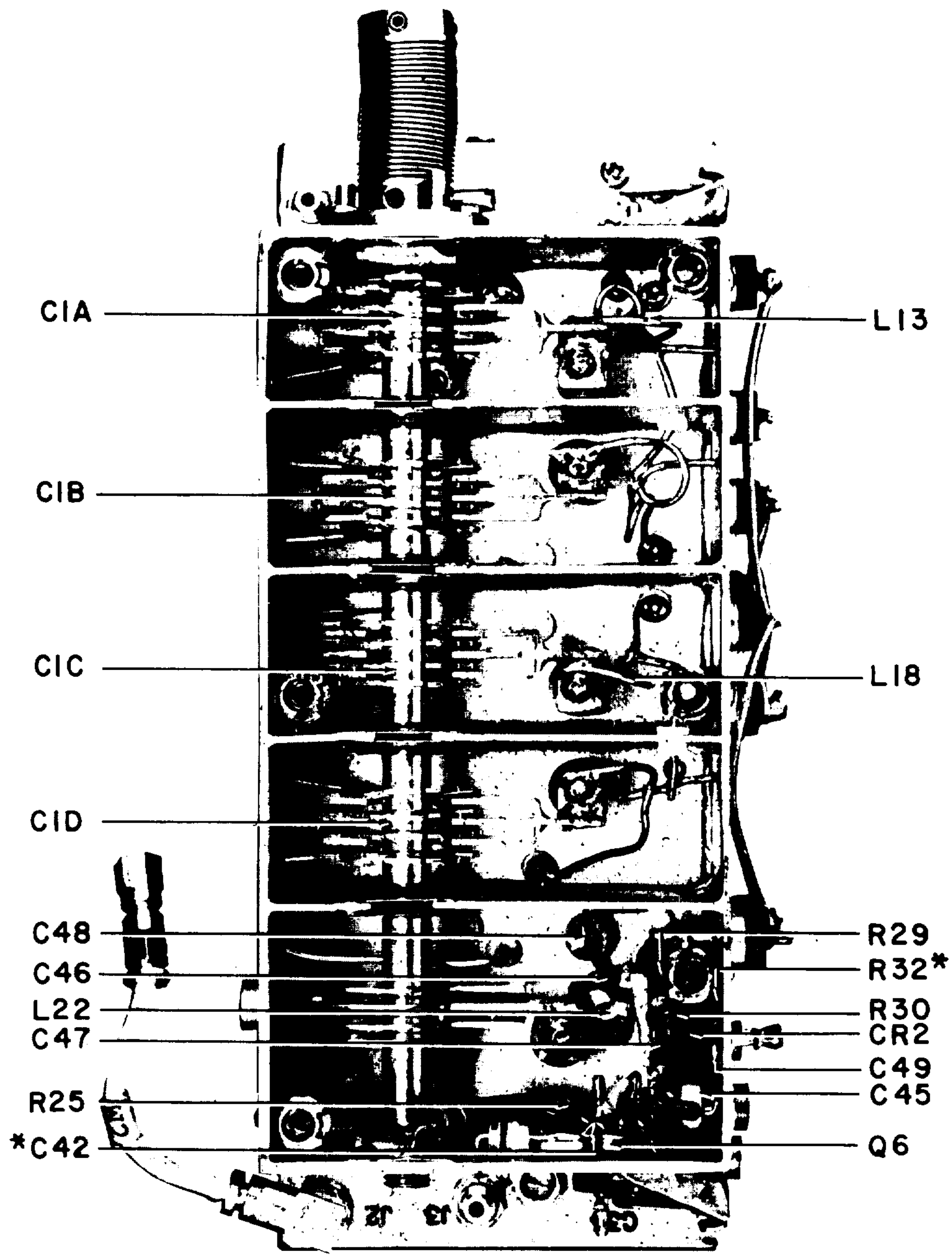


Figure 5-6. Type 71376-6 250-500 MHz Tuner, (A1), Location of Components

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURES PART NO.	MFR. CODE	RECM. VENDOR
J1	Connector Receptacle: SMC Series	3	10-0104-002	19505	
J2	Same as J1				
J3	Same as J 1				
L1	Coil, Fixed: 1.0 µH, 15%	2	205-11-10	99848	
L2	Same as L1				
L3	Coil, Fixed: 0.24 µH, 15%	2	200-11	99848	
L4	Same as L3				
L5	Not Used				
L6	Not Used				
L7	Not Used				
L8	Inductor, Fixed	1	17275-5	14632	
L9	Inductor	1	21210-132	14632	
L1O	Inductor	1	21210-133	14632	
L11	Inductor	1	21210-134	14632	
L12	Inductor Air Core	2	22292-69	14632	
L13	Inductor Air Core	2	22292-68	14632	
L14	Inductor Fixed	2	17475-1	14632	
L15	Inductor Air Core	2	22292-15	14632	
L16	Same as L12				
L17	Inductor Fixed	2	17475-2	14632	
L18	Same as L15				
L19	Same as L14				
L20	Same as L13				
L21	Same as L17				
L22	Inductor, Fixed	1	17317-1	14632	
L23	Inductor	1	21210-145	14632	
MP1	RF Cover	1	23376-6	14632	
MP2	RF Cover	1	23377-6	14632	
Q1	Transistor	1	2N5652	80131	
Q2	Transistor	1	2N5397	80131	
Q3	Transistor	1	2N3570	80131	
Q4	Transistor	1	2N2857	80131	
Q5	Transistor	1	2N5109	80131	
Q6	Transistor	1	23342-4	14632	
R1	Resistor, Fixed, Film: 100 kΩ, l%, 1/10 W	6	RN55C1003F	81349	75042
R2	Resistor, Fixed, Film: 5.11 kΩ, 1%, 1/10 W	2	RN55C511F	81349	75042

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R3	Same as R2				
R4	Resistor, Fixed, Composition: 470 Ω, 5%, l/4W	2	RCR07G471Js	81349	01121
R5	Resistor, Fixed, Composition: 4.3 kΩ, 5%, 1/4 W	1	RCR07G432JS	81349	01121
R6	Resistor, Ftxed, Composition: 8.2 kΩ, 5%, 1/4 W	1	RCR07G822JS	81349	01121
R7	Resistor, Fixed, Composition: 1.6 kΩ, 5%, 1/4 w	1	RCR07G162JS	81349	01121
R8	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 w	1	RCR07G222JS	81349	01121
R9	Resistor, Ftxed, Composition: 47 Ω, 5%, 1/4 w	2	RCR07G470JS	81349	01121
R10	Resistor, Fixed, Composition: 6.8 kΩ, 5%, 1/4 w	2	RCR07G682JS	81349	01121
Rll	Same as R10				
R12	Same as R4				
R13	Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/4 W	1	RCR07G152JS	81349	01121
R14	Resistor, Fixed, Composition: 39 kΩ, 5%, 1/4 w	1	RCR07G393JS	81349	01121
R15	Resistor, Fixed, Composition: 33 kΩ, 5%, 1/4 W	1	RCR07G333JS	81349	01121
R16	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/4 W	1	RCRO7G1O2JS	81349	01121
R17	Resistor, Fixed, Composition: 3.3 kΩ, 5%, 1/4 W	2	RCR07G332JS	81349	01121
R18	Same as R9				
R19	Resistor, Fixed, Composition: 11 kΩ, 5%, 1/4 W	1	RCR07G113JS	81349	01121
R20	Resistor, Fixed, Composition: 220 Ω, 5%, 1/4 W	1	RCR07G221JS	81349	01121
R21¤	Same as R17				
R22	Resistor, Fixed, Composition: 100 Ω, 5%, 1/4 W	2	RCR07G101Js	81349	01121
R23¤	Resistor, Fixed, Composition: 75 Ω, 5%, 1/4 W	1	RCR07G750JS	81349	01121
R24	Same as R22				
R25	Resistor, Fixed, Film: 274 Ω, 1%, 1/10 W	1	RN55C2740F	81349	75042
R26	Resistor, Fixed, Film: 681 Ω, 1%, 1/10 W	1	RN55C681OF	81349	75042
R27	Resistor, Fixed, Film: 6.19 kΩ 1%, 1/10 W	1	RN55C6191F	81349	75042
R28	Resistor, Fixed, Film: 8.25 kΩ 1%, 1/10 W	1	RN55C8251F	81349	75042
R29 Thru R33	Same as R1				
R34	Resistor, Fixed, Composition: 10 Ω, 5%, 1/8 W	1	RCR05G100JS	81349	01121
T1	Transformer	2	22294-20	14632	
T2	Same as T 1				

¤NominalValue, Final Value Factory Selected.

5.5.1.1 Part 17083 Pin Diode Attenuator

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Chip: 2200 pF, 10%, 50 V	6	C1210C221K5G1H	31433	
C2 Thru C6	Same as C1				
CR1	Diode	1	5082-3039	28480	
CR2	Diode	2	5082-3080	28480	
CR3	Same as CR2				

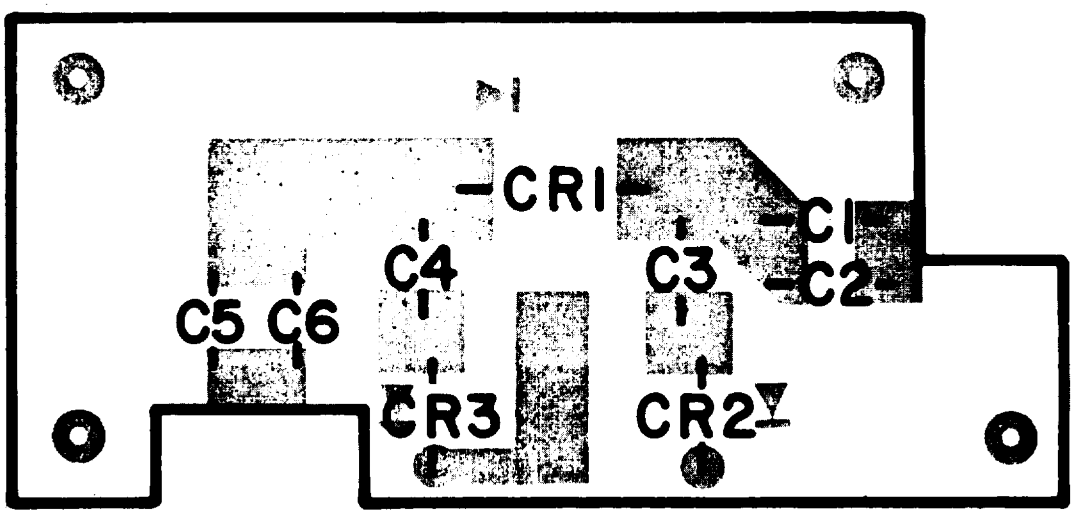


Figure 5-7. Part 17083 Pin Diode Attenuator (A1A1), Location of Components

5.5.1.2 Part 17059 Attenuator Shaper

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 0. 01 μ F, 20%, 200V	2	8131A200Z5U103M	72982	
C2	Same as C1				
CR1	Diode	3	5082-2800	28480	
CR2	Same as CR1				
CR3	Same as CR1				
R1	Resistor, Fixed, Film: 1.0 kΩ, 1%, 1/10 w	1	RN55C1OO1F	81349	75042
R2	Resistor, Fixed, Film: 412 kΩ, 1%, 1/4 w	1	CC4123F	01121	
R3	Resistor, Fixed, Film: 38.3 kΩ, 1%, 1/10 w	1	RN55C3832F	81349	75042
R4	Resistor, Fixed, Film: 100 kΩ, 1%, 1/10 W	5	RN55C1003F	81349	75042
R5	Resistor, Fixed, Film: 261 kΩ, 1%, 1/4 w	1	MF4C/261K/F	80031	
R6	Resistor, Trim, Film: 100 kΩ, 10%, 1/2 w	1	62PR100K	73138	
R7	Resistor, Fixed, Film: 121 kΩ, 1%, 1/4 W	1	MF4C/121K/F	80031	
R8	Resistor, Fixed, Film: 475 kΩ, 1%, 1/4 W	1	CC4753F	01121	
R9	Not Used				
R10	Resistor, Fixed, Film: 9.09 kΩ 1%, 1/10 W	1	RN55C9091F	81349	
R11	Same as R4				
R12	Resistor, Fixed, Film: 309 kΩ,1%, 1/4 W	1	CC3093F	01121	
R13	Same as R4				
R14	Same as R4				
R15	Same as R4				
R16	Resistor, Trim, Film: 20 kΩ 10%, 1/2 W	1	62PR20K	73138	
R17	Resistor, Fixed, Film: 34.8 kΩ 1%, 1/10 W	1	RN55C3482F	81349	75042
R18	Resistor, Fixed, Film: 42.2 kΩ, 1%, 1/10 W	1	RN55C4222F	81349	75042
R19	Resistor, Fixed, Film: 619 kΩ, 1%, 1/4 W	1	CC6193F	01121	
R20	Resistor, Fixed, Film: 21.5 kΩ, 1%, 1/10 W	1	RN55C2152F	81349	75042
R21	Resistor, Fixed, Film: 68.1 kΩ, 1%, 1/10 W	1	RN55C6812F	B 1349	75042
R22	Resistor, Fixed, Film: 6.19 kΩ, 1%, 1/10 W	1	RN55C6191F	B1349	75042
RT1	Thermistor: 3.9 kΩ, 5%, 1/8 W	1	DG125-392J	15454	
U1	Integrated Circuit	1	747HC	07263	
VR1	Diode, Zener: 6.3 V, Silicon	1	.4M6.3AZ2	04713	

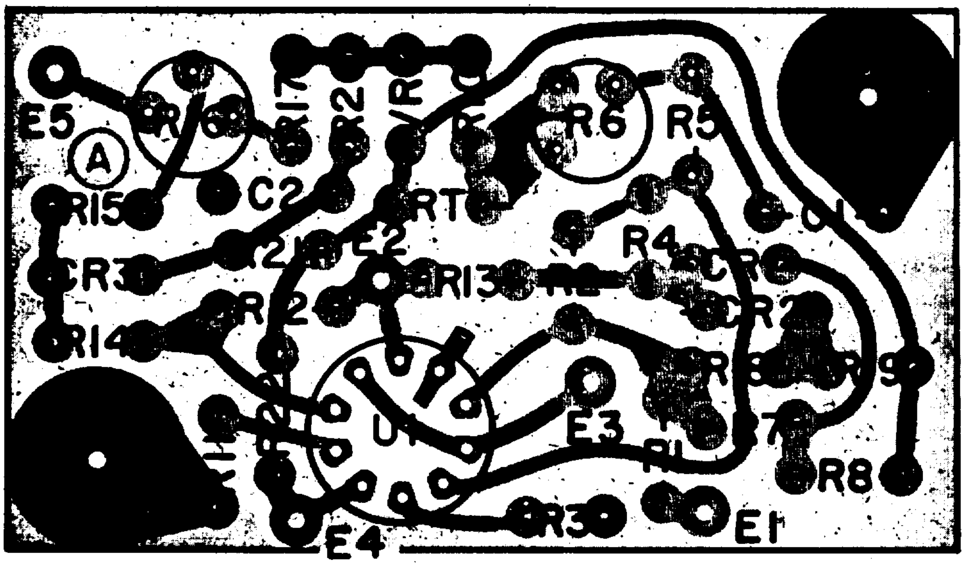


Figure 5-8. Part 17059 Attenuator Shaper (A1A2),
Location of Components

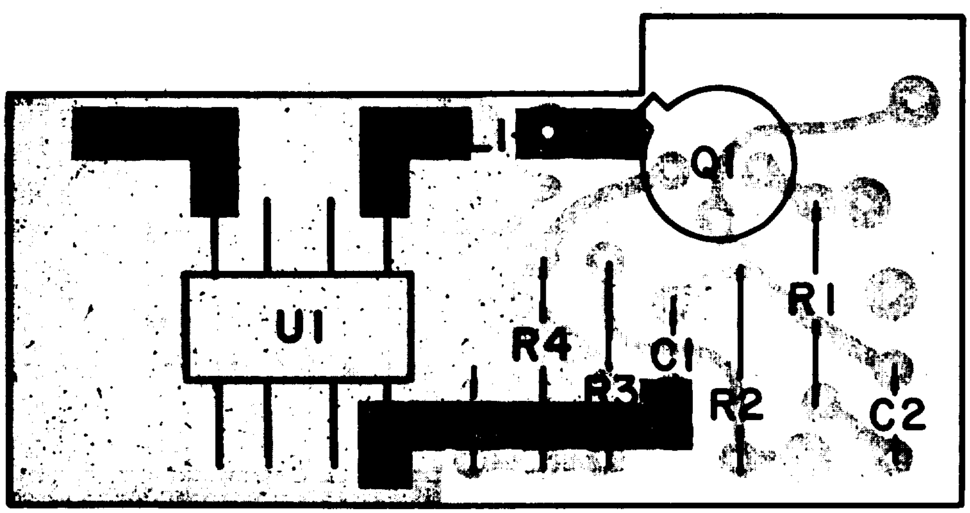


Figure 5-9. Part 17190-2 Balanced Mixer (A1A3),
Location of Components

5.5.1.3 Part 17190-2 Balanced Mixer **REF DESIG PREFIX A1A3**

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 470 pF, 10%, 200 V	2	CK05BX471K	81349	56289
C2	Same as C1				
C3	Capacitor, Ceramic, Disc: 1000 pF, 10%, 200 V	1	CKO5BX1O2K	81349	56289
L1	Coil Fixed	1	17471-1	14632	
Q1	Transistor	1	2N5109	80131	02735
R1	Resistor, Fixed, Composition: 360 Ω, 5%, 1/4 W	1	RCR07G361JS	81349	01121
R2	Resistor, Fixed, Composition: 3.3 kΩ, 5%, 1/4 W	1	RCR07G332JS	81349	01121
R3	Resistor, Fixed, Composition: 820 Ω, 5%, 1/4 W	1	RCR07G821JS	81349	01121
R4	Resistor, Fixed, Composition: 4.7 Ω, 5%, 1/4 W	1	RCR07G4R7JS	81349	01121
U1	Mixer	1	17154	14632	

5.5.2 TYPE 791834 560 MHz BINARY DIVIDER ASSEMBLY REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	560 MHz Binary Divider P. C. Assembly	1	17129	14632	
C1	Capacitor, Ceramic, Feedthru: 1000 pF, GMV, 500 V	1	54-794-001-102W	33095	
C2	Capacitor, Ceramic, Standoff: 1000 pF, GMV, 500 V	1	54-803-003-102W	33095	
FB1	Ferrite Bead	2	56-590-65-4A	02114	
FB2	Same as FB1				
J1	Connector, Receptacle: SMC Series	2	10-0104-002	19505	
J2	Same as J1				
MP1	Cover Assembly	1	25069-1	14632	
RI	Resistor, Fixed, Composition: 56 Ω, 5%, 1/8 W	1	RCR05G560JS	81349	01121

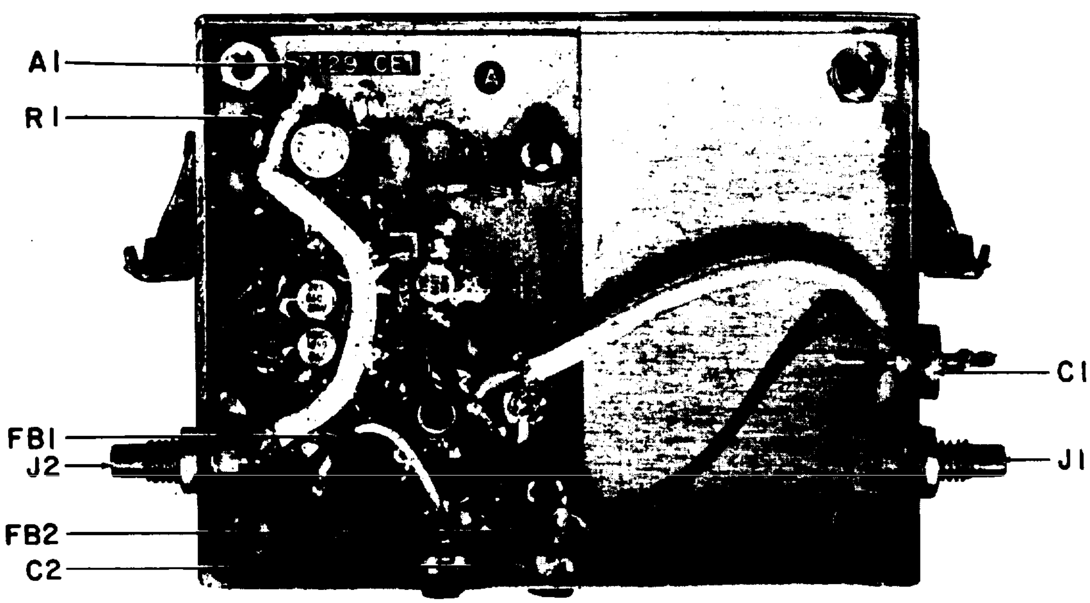


Figure 5-10. Type 791834 560 MHz Binary Divider Assembly (A2), Location of Components

5.5.2.1 Part 17129 560 MHz Binarv Divider **REF DESIG PREFIX A2A1**

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	Capacitor, Ceramic, Disc: 1000 pF, GMV, 500 V	2	SM(1000 pF, P)	91418	
C2	Capacitor, Electrolytic, Tantalum: 2.2 µF, 20%, 35 V	1	196D225X0035JE3	56289	
C3	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	2	B(470 pF, M)	91418	
C4	Capacitor, Ceramic, Disc: 0.01µ F, 20%, 200 V	3	8131A200Z5U103M	72982	
C5	Capacitor, Ceramic, Disc: 100 pF, 10%, 300 V	1	UYO2-101K	73899	
C6	Not Used				
C7	Same as C4				
C8	Capacitor, Ceramic, Disc: 4.7 pF±0. 25 pF, 300 V	2	UYO1-4R7C	73899	
C9	Capacitor, Ceramic, Disk: 15 pF, 5%, 300 V	2	UYO1-150J	73899	
C10	Same as C3				
C11	Same as C8				
C12	Same as C9				
C13	Same as C1				
C14	Same as C4				
CR1	Diode	1	1N4446	80131	
CR2	Diode	2	5082-2900	28480	
CR3	Same as CR2				
E1	Terminal, Forked	5	140-1019-02-01	71279	
E2 Thru E5	Same as E 1				
L1	Coil Fixed	2	16209-3	14632	
L2	Coil Fixed	1	22282-40	14632	
L3	Same as L1				
Q1	Transistor	1	2N3251	80131	04713
22	Transistor	3	22840-2	14632	
23	Same as Q2				
24	Same as Q2				
R1	Resistor, Fixed, Composition: 330 Ω, 5%, 1/8 W	1	RCR05G331Js	81349	01121
R2	Resistor, Fixed, Composition: 4.7 kΩ, 5%, 1/8 W	1	RCR05G472JS	81349	01121
R3	Resistor, Fixed, Composition: 1.0 kΩ, 5%, 1/8 W	1	RCRO5G1O2JS	81349	01121
R4	Not Used				
R5	Resistor, Fixed, Composition: 18 Ω, 5%, 1/8 W	1	RCR05G180JS	81349	01121
R6	Resistor, Fixed, Composition: 200 Ω, 5%, 1/8 W	2	RCR05G201LJS	81349	01121
R7	Resistor, Fixed, Composition: 1.5 kΩ, 5%, 1/8 W	2	RCR05G152JS	81349	01121
38	Resistor, Fixed, Composition: 470 Ω, 5%, 1/8 W	2	RCR05G471JS	81349	01121

REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R9	Resistor, Fixed, Composition: 220 , Ω, 5%, 1/8 W	1	RCR05G221JS	81349	01121
R10	Resistor, Trim, Film: 1 kΩ, 10%, 1/2 W	1	62PR1K	73138	
R11	Not Used				
R12	Resistor, Fixed, Composition: 150 Ω, 5%, 1/8 W	1	RCR05G151JS	81349	01121
R13	Same as R7				
R14	Same as R8				
R15	Same as R6				
R16	Resistor, Fixed, Composition: 100 Ω, 5%, 1/8 W	1	RCRO5G1O1JS	81349	01121

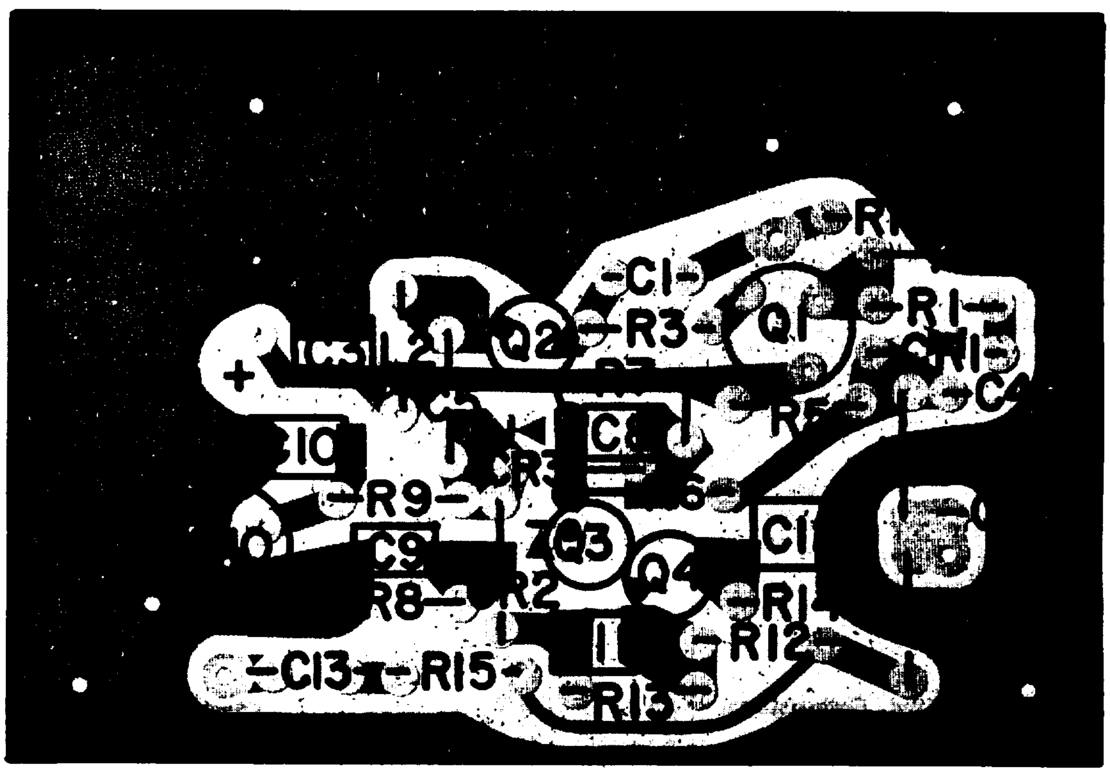


Figure 5-11. Part 17129 560 MHz, Binary Divider (A2A1), Location of Components

5.5.3 TYPE 71347-4 60/21.4 MHz CONVERTER ASSEMBLY REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASST.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	60/21. 4 MHz Converter	1	16697-2	14632	
C1	Capacitor, Ceramic, Feedthru: 1000 pF, GMV, 500 V	1	54-794-009-102W	33095	
C2	Capacitor, Ceramic, Disc: 24 pF, 5%, 500 V	1	603U2J240J	91984	
J1	Connector, Receptacle: SMC Series	2	10-0104-002	19505	
J2	Same as J1				
L1	Inductor	1	21210-14	14632	
MP1	Cover Converter	1	22914-1	14632	

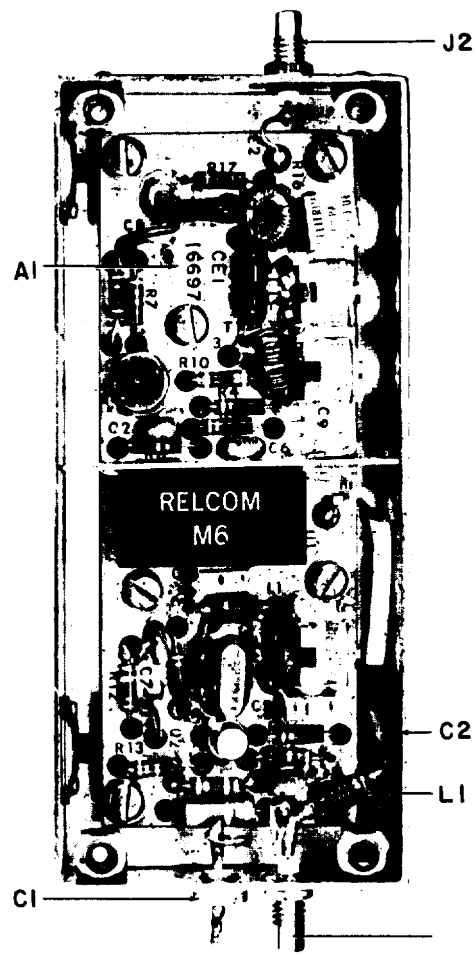


Figure 5-12. Type 71347-4 60/21. 4 Converter Assembly (A3), Location of Components

5.5.3.1 Part 16697-2 60/21.4 MHz Converter REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Tubular: 3.6 PF±0.25PF, 500V	1	301-000C0J0-369C	72982	
C2	Capacitor, Ceramic, Disc: 1000pF, GMV, 500V	4	SM(1000 pF, P)	91418	
C3	Capacitor, Variable, Ceramic: 2-8 pF, 350 V	1	538-006A2-8	72982	
C4	Capacitor, Mica, Dipped: 22pF, 5%, 500 V	1	CM05ED220J03	81349	72136
C5	Capacitor, Ceramic, Tubular: 1.0 pF±0.1 pF, 500 V	1	30l-000C0K0-109B	72982	
C6	Same as C2				
C7	Same as C2				
C8	Capacitor, Ceramic, Disc: 0.01 pF, 20%, 200 V	2	8131A200Z5U103M	72982	
C9	Capacitor, Variable, Ceramic: 9-35 pF, 350 V	2	538-006D9-35	72982	
C10	Capacitor, Mica, Dipped: 15 pF, 5%, 500 V	1	CM05CD150J03	81349	72136
C11	Same as C9				
C12	Capacitor, Mica, Dipped: 82 pF, 2%, 500 V	1	CM05ED820G03	81349	72136
C13	Same as C2				
C14	Same as C8				
L1	Inductor	1	21210-74	14632	
L2	Coil, Fixed: 0.56 µH, 15%	1	202-11	99848	
L3	Coil	1	20681-109	14632	
L4	Coil, Fixed: 4.7 µH 10%	1	1537-28	99800	
Q1	Transistor	1	2N5109	80131	02735
Q2	Transistor	1	2N3478	80131	34156
R1	Not Used				
R2	Not Used				
R3	Not Used				
R4	Resistor, Fixed, Composition: 6.8kΩ 5%, 1/4 W	1	RCR07G682JS	81349	01121
R5	Resistor, Fixed, Composition: 820 Ω, 5%, 1/4 W	2	RCR07G821JS	81349	01121
R6	Resistor, Fixed, Composition: 11 kΩ, 5%, 1/4 W	1	RCR07G113JS	81349	01121
R7	Resistor, Fixed, Composition: 5.6 Ω, 5%, 1/4 W	1	RCR07G5R6JS	81349	01121
R8	Resistor, Fixed, Composition: 820 Ω, 5%, 1/4 W	1	RCR07G821JS	81349	01121
R9	Resistor, Fixed, Composition: 22 Ω, 5%, 1/4 W	1	RCR07G220JS	81349	01121
R10	Resistor, Fixed, Composition: 47 Ω, 5%, 1/4 W	1	RCR07G470JS	81349	01121
R11	Same as R5				
R12	Resistor, Fixed, Composition: 390 Ω, 5%, 1/4 W	1	RCR07G391JS	81349	01121
R13	Resistor, Fixed, Composition: 10 kΩ, 5% 1/4 W	1	RCRO7G1O3JS	81349	01121
R14	Resistor. Fixed, Composition: 5.1 kΩ 5%, 1/4 W	1	RCR07G512JS	81349	01121
R15	Resistor, Fixed, Composition: 150 Ω, 5%, 1/4 W	1	RCR07G151JS	81349	01121

REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURES PART NO.	MFR. CODE	RECM. VENDOR
R16	Resistor, Trim, Film: 100 Ω, 10%, 1/2 W	1	62PAR100	73138	
R17	Resistor, Fixed, Composition: 62 Ω, 5%, 1/4 W	1	RCR07G620JS	81349	
T1	Coil	1	21428-26	14632	
U1	Mixer, Balanced	1	M6	27956	
Y1	Crystal, Quartz	1	98204-3	14632	

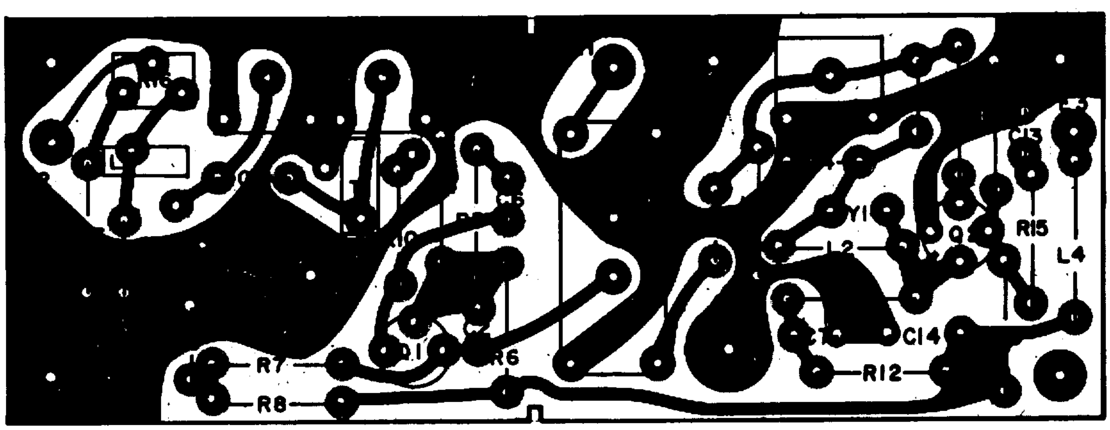


Figure 5-13. Part 16697-2 60/21. 4 MHz Converter (A3A1), Location of Components

5.5.4 TYPE 85131 TUNING DRIVE

REF DESIG PREFIX A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RUM. VENDOR
1	Gear Plate, No. 1	1	25096-1	14632	
2	Gear Plate, No. 2	1	25097-1	14632	
3	Spacer	4	18668-2	14632	
4	Gear, Assembled	1	170124-1	14632	
5	Shaft	1	18672-1	14632	
6	Shaft	1	18673-1	14632	
7	Shaft	1	18673-2	14632	
8	Shaft	1	18671-1	14632	
9	Gear, Anti-Backlash 48 D. P., 58T	2	20180-25	14632	
10	Gear, Anti-Backlash 48 D. P., 64T	1	20180-6	14632	
11	Gear, Spur 48 D. P., 20T	4	2984-55	14632	
12	Shaft Collar	1	11581-8	14632	
13	Thrust Washer	2	11582-14	14632	
14	Spring Washer	1	3502-1447	78189	
15	Ball Bearing	10	SFR1883PP	83086	
16	Retaining Ring	5	5100-25	79136	
17	Screw, Pan Head#6-32 X 7/16	4	MS51957-29	96906	
18	Washer, Lock, Split #6	4	MS35338-136	96906	
19	Screw, Flat Head 100 # 6-32X 3/8	4	MS24693-C26	96906	
20	Shim Washer	AR	SSS32	01351	
21	Socket Set Screw #4-40 X 1/8	6	SSCR4-40X1/8HTTR	56878	
22	Socket Set Screw #6-32 X 1/8	8	SSCR6-32X1/8HTTR	56878	
23	Retaining Compound	AR	75-13	05972	

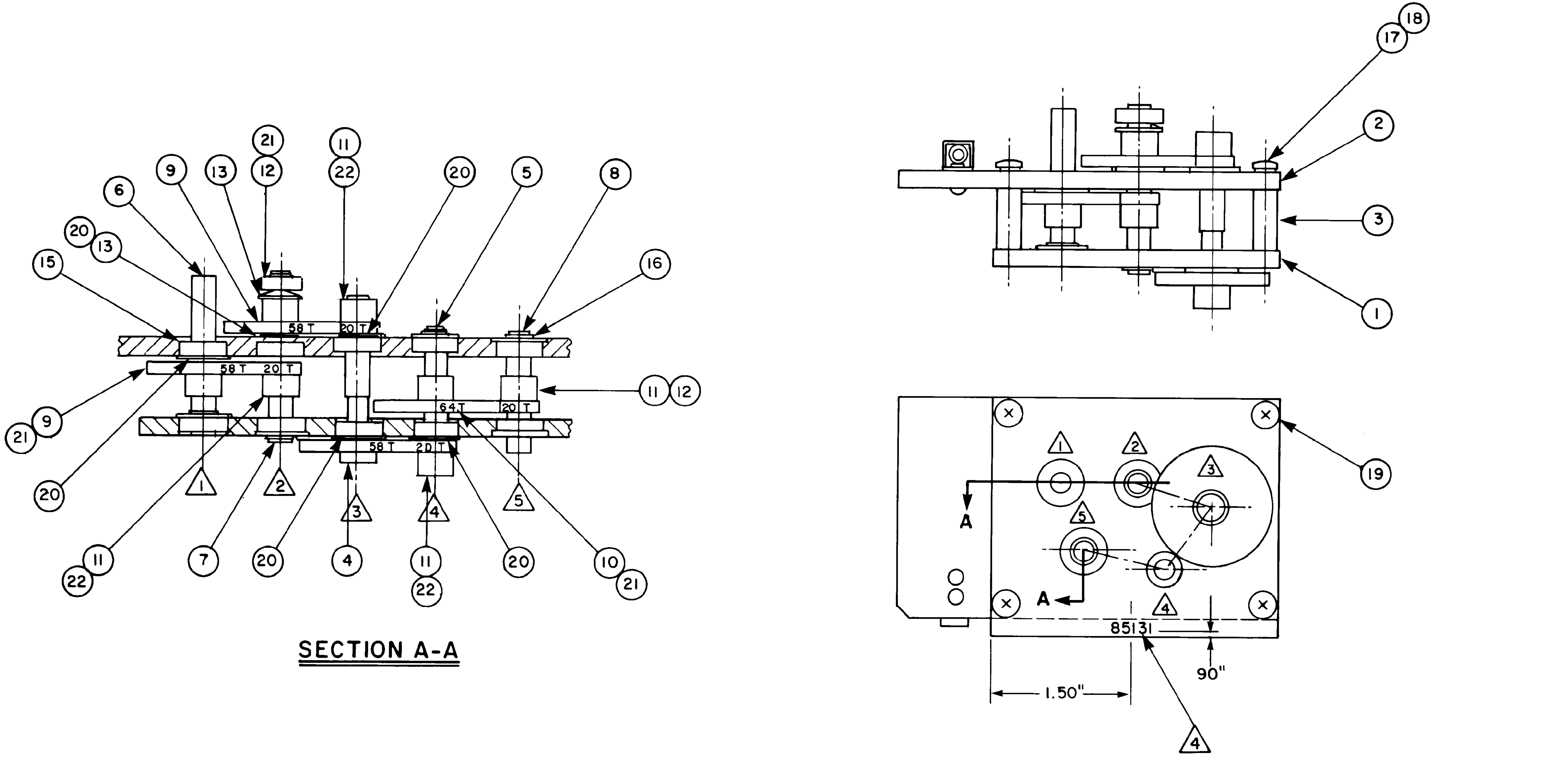
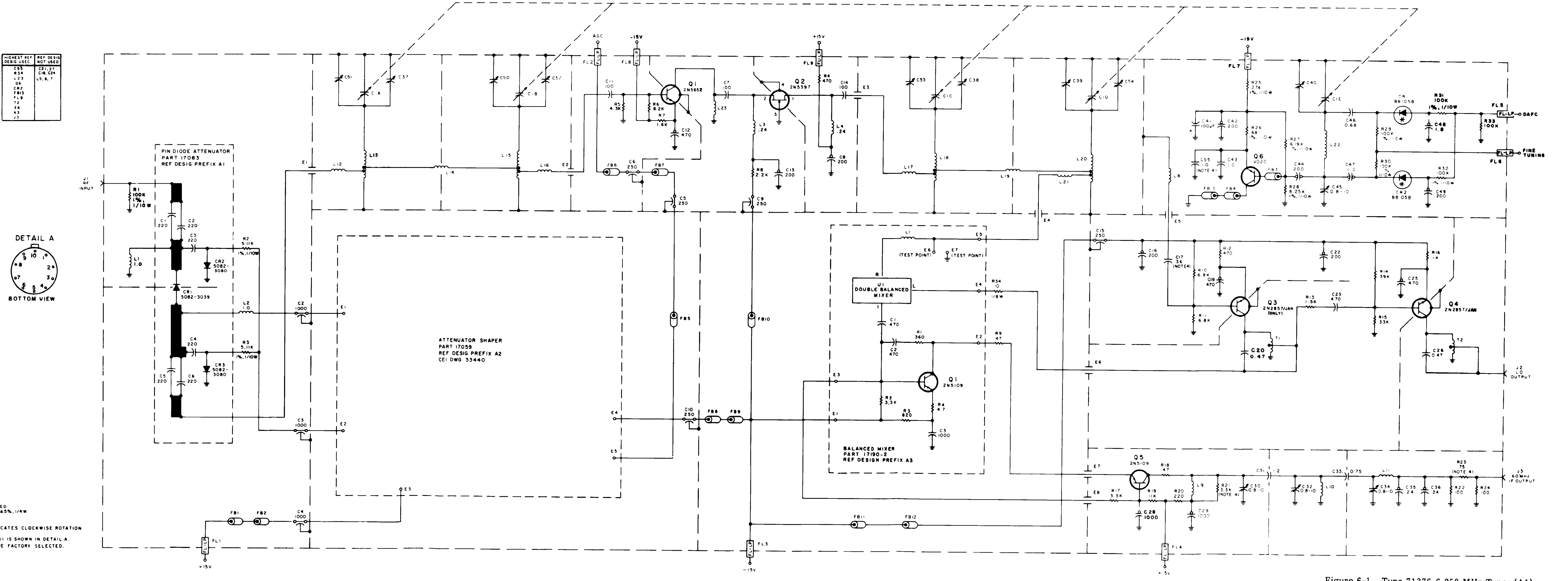


Figure 5-14. Type 85131 Tuning Drive (a4), Location of Components

SECTION VI

SCHEMATIC DIAGRAMS

HIGHEST REF DESIG USED	REF DESIG NOT USED
C55	C21, 27
R34	C18, C24
L23	L5, 6, 7
Q6	
CR2	
FB13	
FL9	
T2	
E8	
A3	
J3	

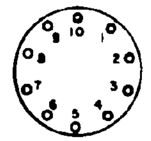


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4 W.
   b) CAPACITANCE IS IN pF.
   c) INDUCTANCE IS IN μH.
2. CW ON A2R6 AND A2R16 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
3. PIN ARRANGEMENT FOR A2U1 IS SHOWN IN DETAIL A.
4. NOMINAL VALUE; FINAL VALUE FACTORY SELECTED.

Figure 6-1. Type 71376-6 250 MHz Tuner (A1), Schematic Diagram 61348

DETAIL A



BOTTOM VIEW

NOTES:

1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ±1%, 1/10W.
   b) CAPACITANCE IS IN μF.
2. CW ON R6, R16 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
3. PIN ARRANGEMENT FOR U1 IS SHOWN IN DETAIL A.

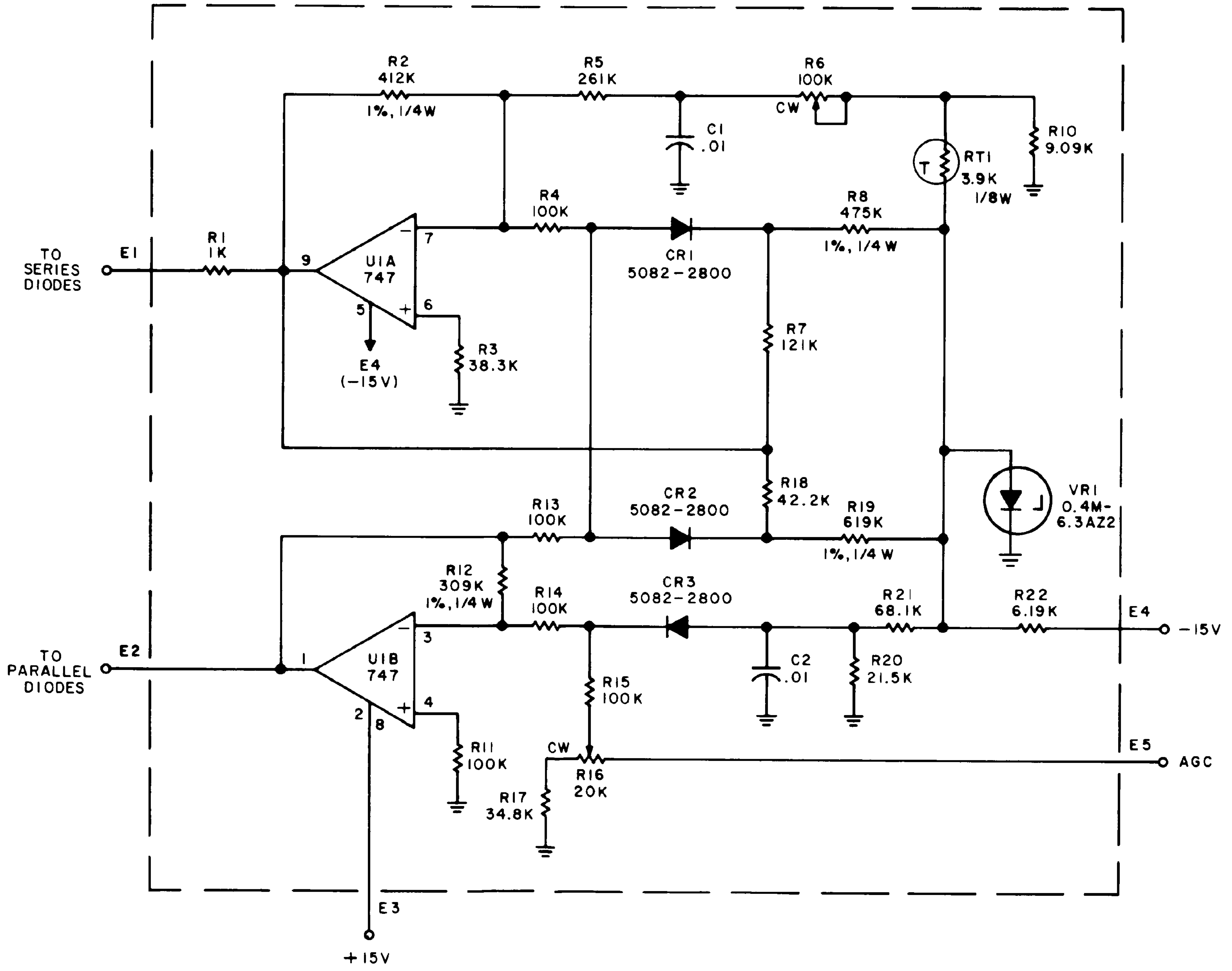


Figure 6-2. Part 17059 Attenuator Shaper (A1A2), Schematic Diagram 33440

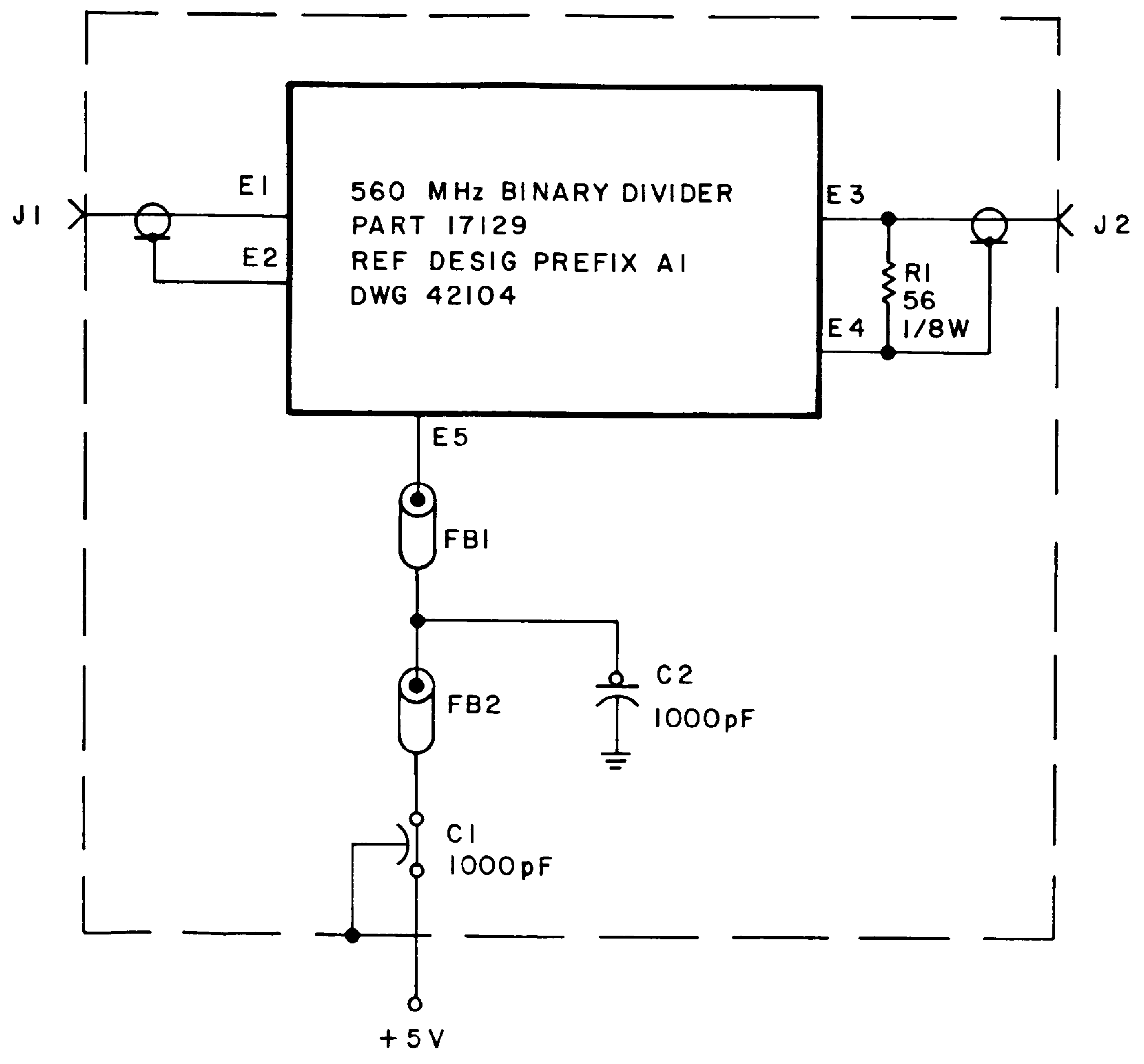
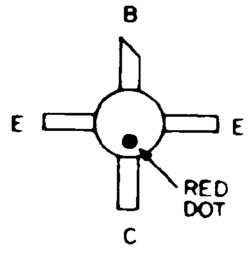
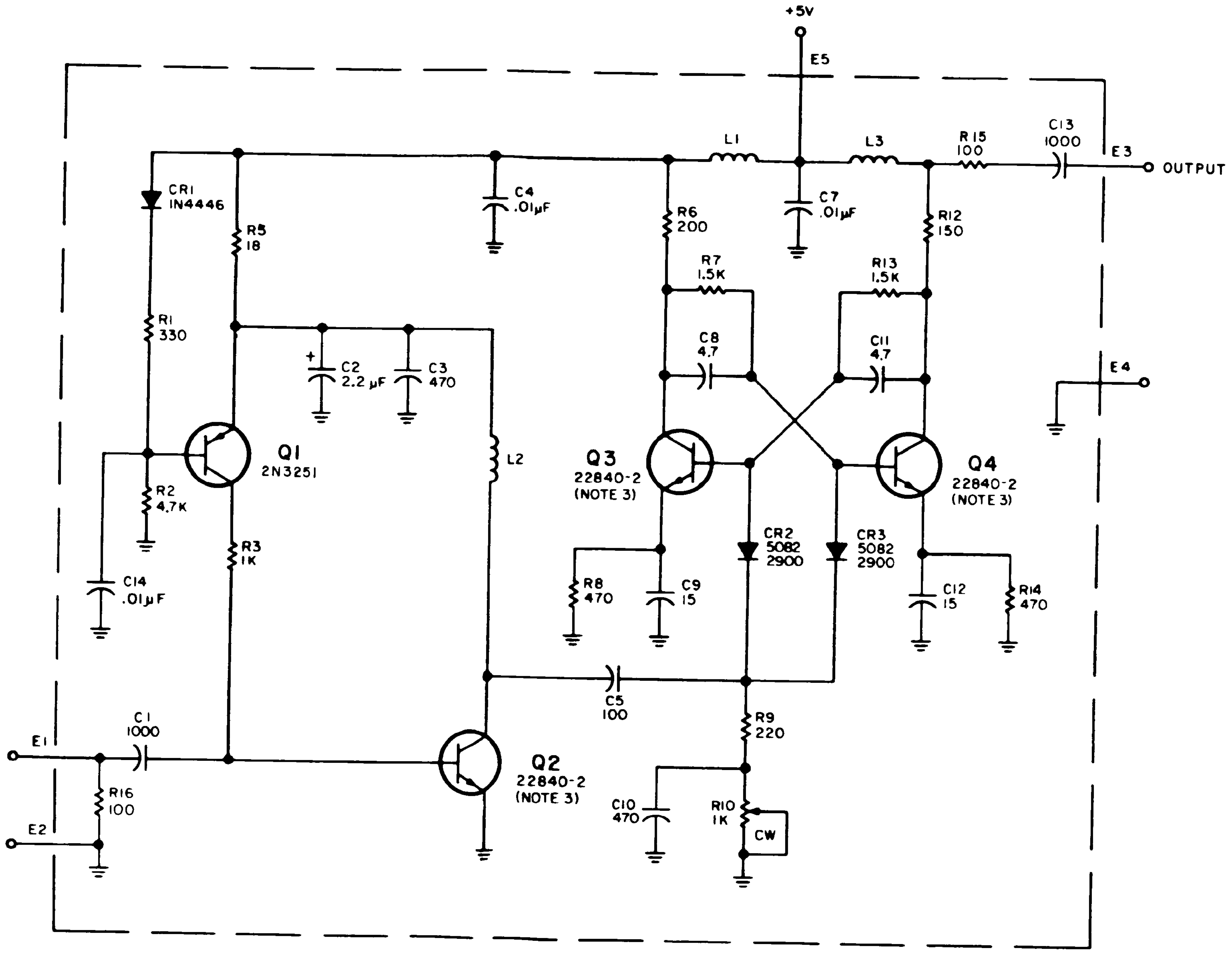


Figure 6-3. Type 791834 560 MHz Binary Divider (A2), Schematic Diagram 34957

DETAIL A



TOP VIEW



NOTES:

1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ±5%, 1/8W
   b) CAPACITANCE IS IN pF.
2. CW ON R10 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
3. FOR Q2, Q3, Q4 LEAD ARRANGEMENT SEE DETAIL A.
4. NOMINAL VALUE, FINAL FACTORY SELECTED.

Figure 6-4. Part 17129 560 MHz Binary Divider (A2A1), Schematic Diagram 42104

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
   c) INDUCTANCE IS IN μH.
2. CW ON R16 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
3. NOMINAL VALUE, FINAL FACTORY SELECTED.

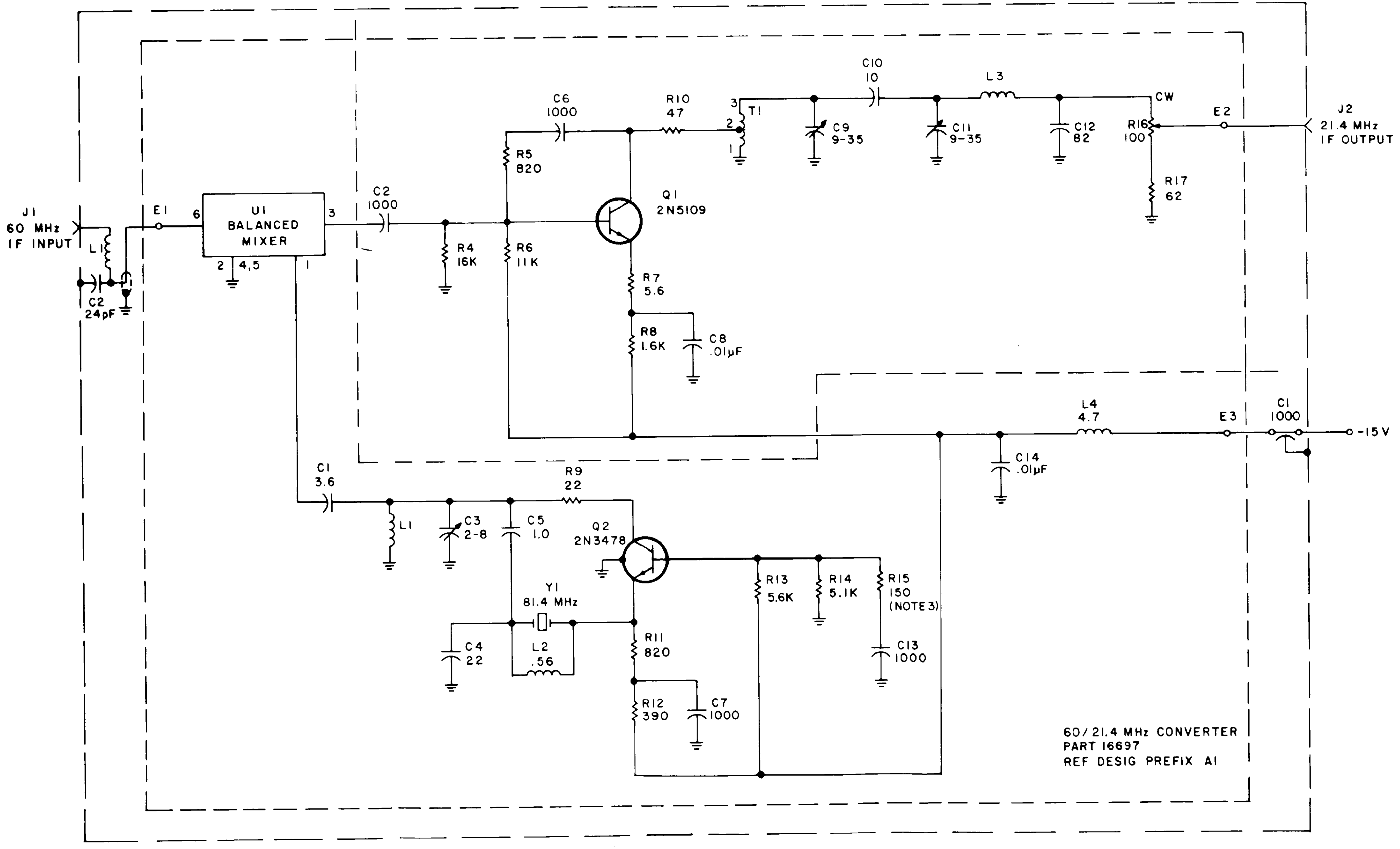


Figure 6-5. Type 71347-4 60 MHz/21.4 MHz Converter (A3), Schematic Diagram 43777

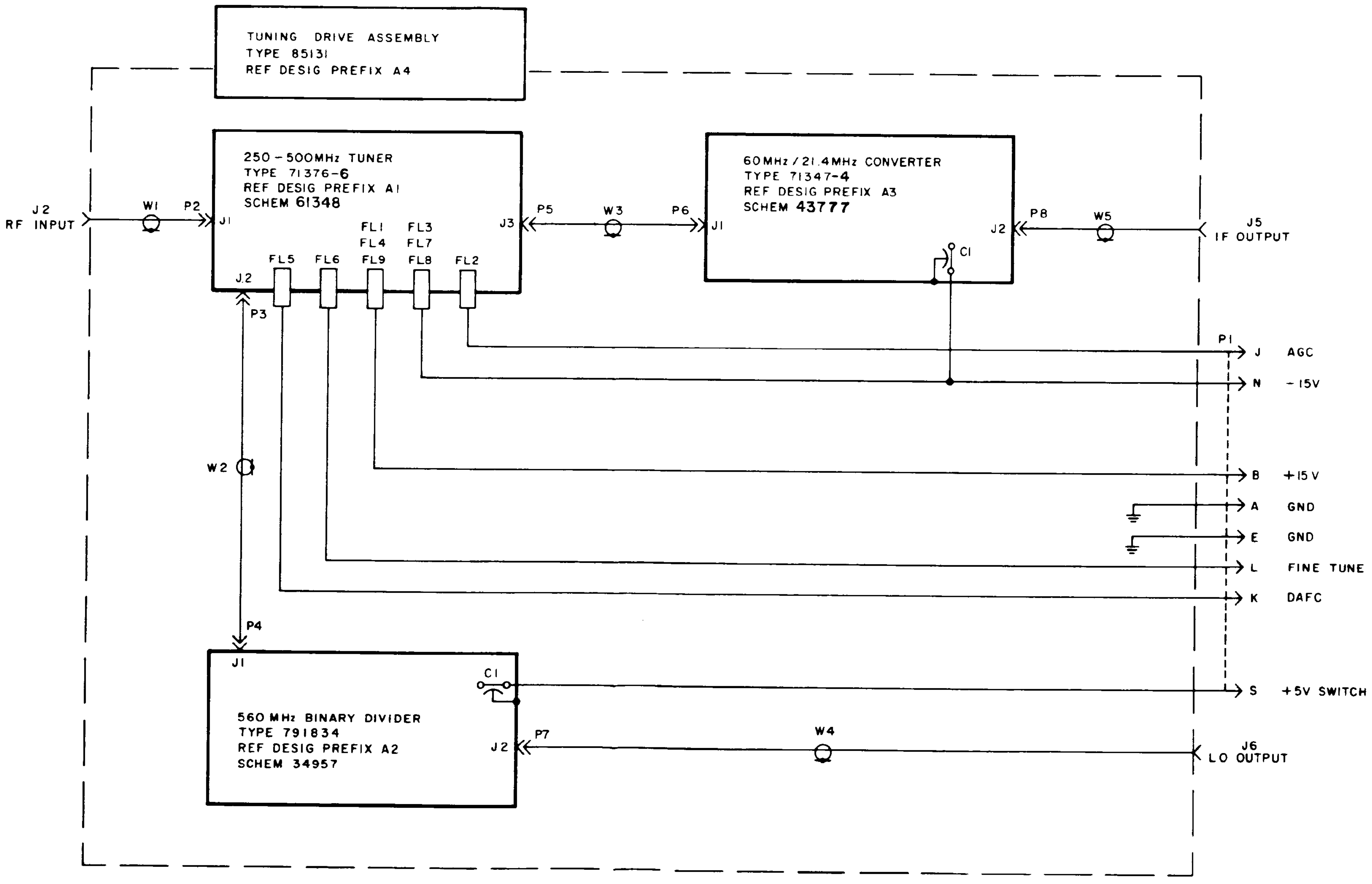


Figure 6-6. Type WJ-9124 250 - 500 MHz Tuner Assembly, Main Chassis, Schematic Diagram 43616

APPENDIX A

REFERENCES

Refer to TM 11-5895-1227-14-1 for references.

APPENDIX B

NOTE

The Tuner, TN-585/GRR-8(V), is an assembly of the Receiver, AN/GRR-8(V). The Maintenance Allocation Chart covering maintenance actions on the tuner is located in TM 11-5895-1227-14-1, Operator, Organizational Direct Support and General Support Maintenance Technical Manual.

APPENDIX C

NOTE

The Tuner, TN-585/GRR-8(V), is an assembly of the Receiver AN/GRR-8(V). The Basic Issue Items List covering the basic issue items for the receiver to help you inventory items required for safe and efficient operation on the tuner is located in TM 11-5895-1227-14-1, operator, organizational, Direct Support and General Support Maintenance Technical Manual.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
Commander
Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703-5007

DATE SENT: 10 July 1975

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

BE EXACT . . PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER: SSG I. M. DeSpiritof 999-1776

SIGN HERE: SSG I. M. DeSpiritof

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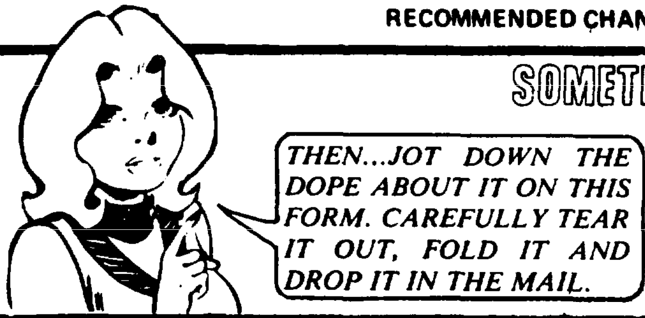

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TM 11-5895-1227-14-1-3	15 Feb 1988	Tuner TN-585/GRR-8(V)

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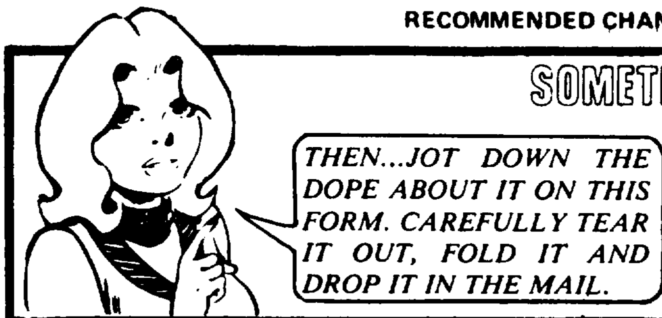

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