INSTRUCTION MANUAL

FOR

WJ-9080B TUNER

INTRODUCTION

The WJ-9080B Tuner is identical in design and operation to the WJ-9080A Tuner, except for the modifications covered in Section VII of this manual.

WATKINS—JOHNSON COMPANY
700 Quince Orchard Road
Gaithersburg, Maryland 20878

MGG/3/14/77

INSTRUCTION MANUAL

FOR

TYPE WJ-9080A TUNER

WATKINS—JOHNSON COMPANY
700 Quince Orchard Road
Gaithersburg, Maryland 20878

HD/7/26/74

WARNING

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

ADDENDA
WJ-9080A Tuner

The following changes should be incorporated into the Instruction Manual for the Type WJ-9080A Tuner.

1. Section V - Replacement Parts List

   A. Paragraph 5.4.1; Type WJ-9080A Tuner, Main Chassis.

      1) Add: ACCESSORY MATING CONNECTOR TO BE FURNISHED WITH EQUIPMENT.

      2) Add: CONNECTOR, PLUG, MULTIPIN; P/N L12TF10P6NA; Vendor Code 09922; Qty. 1. (Page 5-15).

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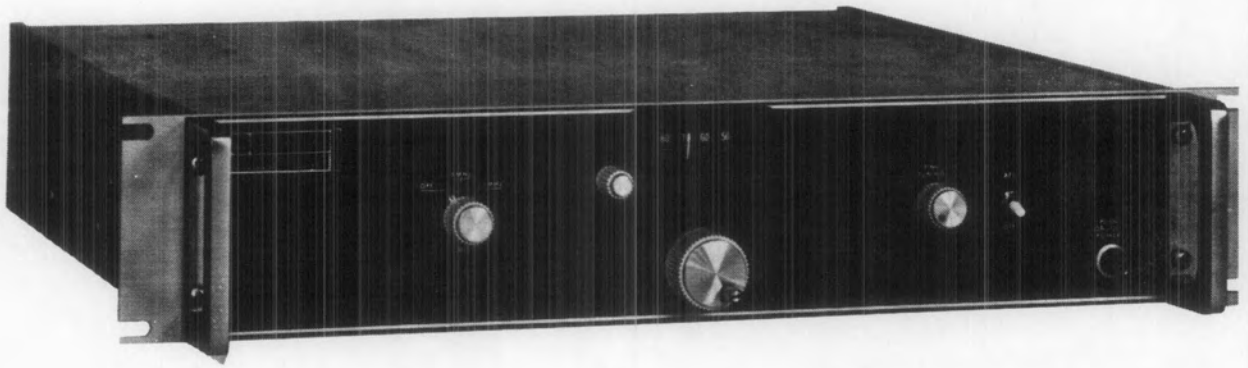


Figure 1-1. Type WJ-9080A Tuner, Front View

SECTION I
GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The Type WJ-9080A Tuner accepts signals in the range of 30 to 1000 MHz. It covers this frequency range in one continuous band and provides IF outputs of 160 MHz and 21.4 MHz. The front end is untuned. The selectivity is a function of the first, second, and third IF's. Input signals coupled through the wide band amplifier, are first mixed with the local oscillator, which tunes from 2.19 GHz to 3.16 GHz, to produce the 2.16 GHz first IF This first IF is then down converted to produce the 160 MHz second IF which is ultimately down converted to yield a 21.4 MHz IF.

1.1.2 Inputs to the tuner consist of the RF input, the AGC input and the DAFC/AFC input. The outputs available are the wide band 160 MHz IF output, narrow band 160 MHz IF output, 160 MHz SM output, DRO output, analog tune output, remote range control output and the 21.4 MHz SM and IF outputs.

1.1.3 The WJ-9080A Tuner contains two power supply regulators, the first of which supplies ± 15 V dc and the second -20 V dc. The unit is wired to operate from a 115/220 V, 50 to 400 Hz ac power line. Provisions are also made for operation from 230 V ac.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 The WJ-9080A Tuner is designed to mount into a standard 19 inch equipment rack. The main chassis is constructed of aluminum. Ten of the chassis elements, consisting of U1 through U6, FL1 through FL4, and attenuators AT1 through AT5 are sealed units mounted to the main chassis. Seven of the remaining twelve sub-assemblies are constructed in metal chassis and the five remaining are constructed on plug-in printed circuit cards. For dimensions and weight refer to Table 1-1. Figure 1-1 is an oblique view of the unit and Figures 5-1 through 5-4 give overall views of the unit.

1.3 EQUIPMENT SUPPLIED

This consists of the WJ-9080A Tuner only.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

To take advantage of the capabilities of the WJ-9080A a demodulator such as the DM-4, DM-112, or DM-212, a frequency counter such as the DRO-333-1, and a signal monitor such as the the SM-9804A are required.

Table 1-1. Type WJ-9080A Tuner, Specifications

Tuning Range	30 to 1000 MHz
IF Frequencies	Triple conversion: 2160 MHz, 160 MHz, 21.4 MHz
IF Output Bandwidth:	
160 MHz W-B Output	60 MHz, minimum, at 6 dB points
160 MHz N-B Output	20 MHz, minimum, at 3 dB points
21.4 MHz Output	8 MHz, minimum, at 3 dB points
Dial Resetability	0.5% of tuned frequency
3rd Order Input Intercept Point	0 dBm, minimum
Gain Variation with Tuning	7 dB, maximum
Input Impedance	50 ohms, nominal
Input VSWR	2.0:1, maximum
IF Output Impedance	50 ohms, nominal, all IF's
Overall Gain:	
160 MHz W-B Output	12 dB, minimum
160 MHz N-B Output	15 dB, minimum
21.4 MHz Output	17 dB, minimum
Translated LO Output (DRO Output):	
Output Frequency	F_{Tuned} +160 MHz
Output Level	-12 dBm, minimum: +5 dBm, maximum
Output Impedance	50 ohms, nominal
Fine Tuning Range	500 kHz, minimum
AFC Input Voltage Range	Up to ±3 V, factory set for non-inverting input. May be reversed by user.
AGC Input Voltage	Factory set for 0 V maximum gain to -15 V minimum gain. May be changed by user to +10 V maximum gain to +1 V minimum gain or 0 V maximum gain to -24 V minimum gain.
AGC Range	25 dB, minimum
Analog Tune Output	-10 V at 30 MHz, +10 V at 1000 MHz, linear to within 1%.
Operating Temperature	0° C to 50° C
Power Requirements:	
Input Power	115/220 Vac ±10%, 48-420 Hz
Power Consumption	25 watts, approximately
Dimensions	3.5 inches high, 16 inches deep, 19 inches wide
Weight	16.5 lbs., approximately

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

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

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

2.2 INSTALLATION

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

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

ty of the console. Forced-air ventilation may be necessary to maintain the proper ambient air temperature in a console which accommodates equipment that contributes to a high thermal density.

2.2.3 Equipment Interconnection. - Before connecting the equipment to the prime power source, insure the rear panel 115/220 V ac switch, S2, is in the appropriate position. Provision is also made for 230 V ac operation. If it is desired to operate from 230 V ac, refer to Note 6 on the main chassis schematic diagram for instructions.

2.2.3.1 All input and output connections are made on the rear panel. The inputs consist of: RF input J1, AGC input J7 and DAFC/AFC input J8. The antenna is connected to J1, which is nominally 50 Ω. The AGC and AFC control voltages from the associated demodulator unit, are applied to J7 and J8 respectively. When the DRO-333-1 Frequency Counter is used, DAFC (digital automatic frequency control) can be applied to J8. Before applying AGC or AFC/DAFC control to the WJ-9080A refer to the AFC/AGC Analog Tune schematic, Figure 6-13, for proper resistor and jumper wire connections.

2.2.3.2 The available outputs are: 160 MHz wide band IF output J2, 160 MHz narrow-band IF output J3, 160 MHz SM output J4, DRO output J5, analog tune output J6, remote range control output J10, and 21.4 MHz SM and IF outputs A11J2 and A11J3, respectively. IF outputs J2 and J3 can be connected to demodulator units like the DM-112 or DM-212. The 21.4 MHz IF output A11J3 can be used with the DM-4 demodulator unit. For signal monitoring the SM-9804A or SM-1622 signal monitors can be connected to SM outputs A11J2 or J4 respectively. When the DRO-333-1 Frequency Counter is being used, DRO output J5 is connected to the LO input J5, on the counter, and the remote range control output J10 is connected to the range/preset input on the counter. If desired, the DAFC output J3 can be connected to J8 to provide DAFC control which insures excellent long term stability.

2.3 OPERATION

2.3.1 Located on the front panel are four controls which control all phases of operation. Tuning to a desired signal is a simple operation when the DRO-333-1 frequency counter is employed. First transfer the AFC switch, S4, to the OFF position, and insure that the CMO switch, S3, is OFF. Next rotate the main tuning knob to as close as is practical to the desired frequency as displayed on the frequency counter. Then slowly adjust the FINE TUNE control until the desired frequency is obtained. Now transfer the AFC switch to the ON position and the DAFC (digital automatic frequency control) circuitry in the frequency counter will maintain this frequency ± 1 kHz indefinitely.

2.3.2 If a frequency counter is not in use, the tape dial can be accurately calibrated by using the internal calibrated marker oscillator (CMO) and monitoring one of the SM outputs with a compatible signal monitor. (A demodulator zero beat indication can be used in the absence of a signal monitor.) The following example illustrates tuning to a desired frequency of 196 MHz. Before proceeding, set the AFC switch of the WJ-9080A to OFF, set FINE TUNING to mid range, and set the CMO switch to OFF

(1) Calibrate the signal monitor for center frequency, using its intenal marker. Then turn the marker off.
(2) Tune the WJ-9080A to approximately the desired frequency. Set the CMO switch of the tuner to 25 MHz. Adjust the tuning knob until the 25 MHz marker nearest the desired frequency appears at center screen of the SM.
(3) Adjust the fiducial knob of the WJ-9080 to set the fiducial to the tuned frequency on the tape dial. The frequency will be a multiple of 25 MHz. In this case, it is 200 MHz.
(4) Set the CMO switch to 5 MHz. Counting off the 5 MHz markers on the SM screen, adjust the tuning knob to center the marker nearest the desired frequency on the SM screen.
(5) Readjust the fiducial knob to set the fiducial to the tuned frequency on the tape dial. It will be a multiple of 5 MHz. In this case, it is 195 MHz.
(6) The tape dial is now calibrated. Tune between calibration marks with the tuning knob as required to reach 196 MHz. Turn CMO off. Use FINE TUNING as required to adjust received signal on the demodulator unit.

2.3.3 When the DRO-333-1 Frequency Counter is not employed to provide DAFC, AFC voltage can be obtained from the associated demodulator unit.

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

(1) Maximum humidity: 95% (no condensation)
(2) Temperature range: -30°C to 85°C.

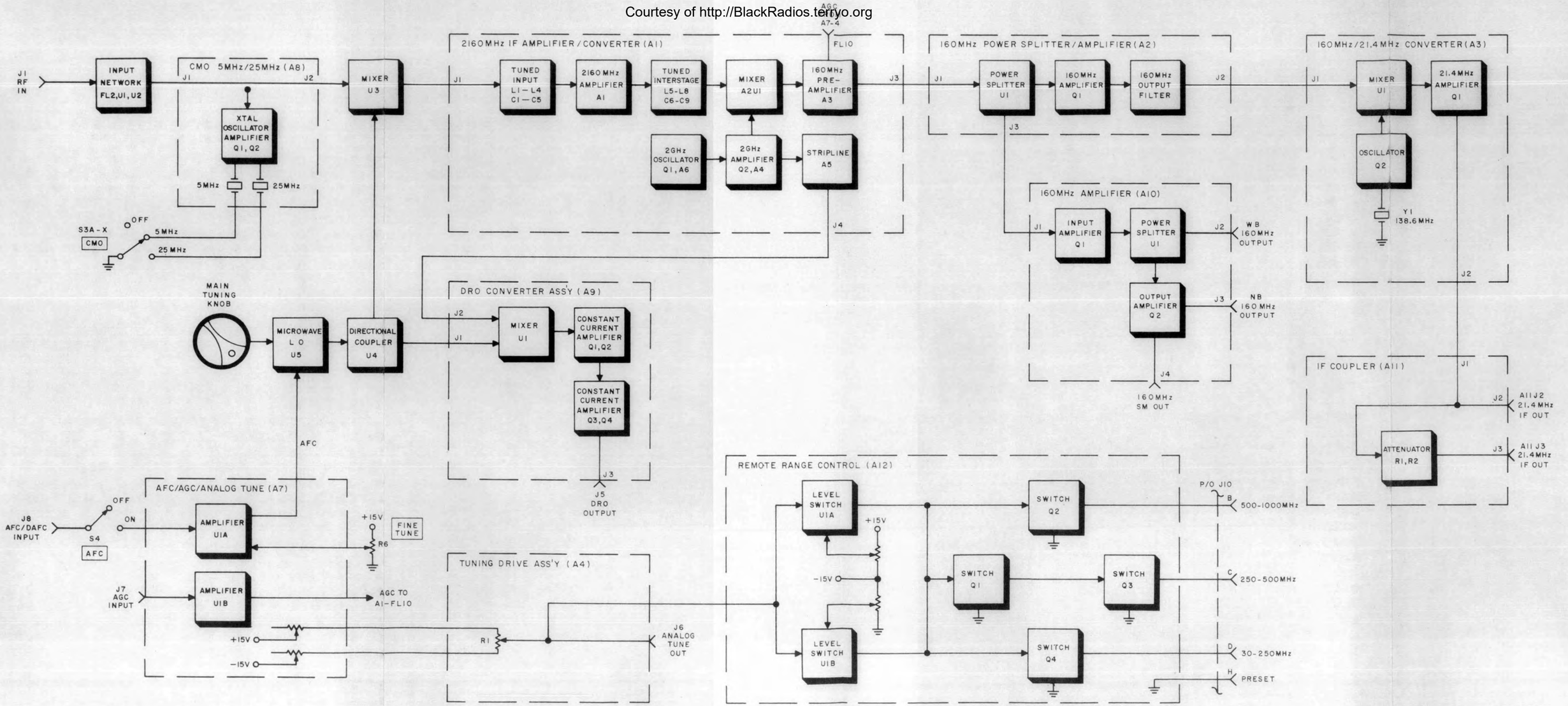


Figure 3-1. Type WJ-9080A Tuner, Functional Block Diagram

SECTION III
CIRCUIT DESCRIPTION

3.1 GENERAL

The operation of the various circuits in the WJ-9080A Tuner are described in the following paragraphs using the functional block diagram, Figure 3-1, and the schematic diagrams located in the rear of this manual. The WJ-9080A Tuner is designed to operate in conjunction with a Type DRO-333-1 Frequency Counter, a Type DM-4, DM-112 or DM-212 demodulator unit and a Type SM-9804A signal monitor. The unit numbering system is used to designate electrical components. This means that parts on subassemblies and chassis have a prefix before the usual class letter and number of the item, i.e., A1Q1 which designates the first transistor (Q1) on the first subassembly (A1).

3.2 FUNCTIONAL DESCRIPTION

The following discussion relates the functional inter-dependency of the various subassemblies in the tuner and the primary signal and control paths.

3.2.1 Input signals in the range of 30 to 1000 MHz are applied through the input network consisting of an 1100 MHz low pass filter, a limiter, a wideband amplifier, and the CMO (calibrated marker oscillator) to the input of double balanced mixer U3. Also applied to this mixer is the local oscillator signal from the microwave LO U5 through directional coupler U4. The LO tracks 2.16 GHz above the incoming RF frequency. The first IF output from mixer U3 is 2.16 GHz. This first IF is then applied to the 2.16 GHz IF Amplifier/Converter module A1. Input FIF (first IF) signals are coupled through a tuned input circuit, 2.16 GHz amplifier A1A1 and tuned interstage circuit to the input of double balanced mixer A1A2U1. A 2.0 GHz LO signal, generated by the 2 GHz oscillator A1Q1 and A1A6 and amplified by A1Q2 and A1A4, is applied to the second input port of mixer A1A2U1. The output of the mixer is the 160 MHz second IF signal. This SIF is then amplified by the 160 MHz preamplifier before being applied to 160 MHz Power Splitter/Amplifier A2. The 2 GHz LO signal is also coupled from the 2 GHz amplifier through stripline filter A1A5 to the DRO Converter Assembly A9. (Amplifier A1A3 is the only AGC controlled circuit in the WJ-9080A Tuner.)

3.2.2 The 160 MHz power splitter A2U1 divides the incoming SIF (second IF) signal between the 160 MHz amplifier A2Q2 and the input ampli-

fier on module A10. The SIF signal from amplifier A2Q2 is bandpass filtered before being coupled to the 160/21.4 MHz Converter A3 where it is translated down to a 21.4 MHz third IF. This frequency translation is accomplished by injecting the 160 MHz SIF and a 138.6 crystal oscillator signal into double-balanced mixer A3U1. The 21.4 MHz output is then amplified by A3Q1 and applied to rear panel jack A11J2 and also through an attenuator to the 21.4 MHz SM output A11J3.

3.2.3 The 160 MHz SIF signal applied to input amplifier A10Q1 is routed, by power splitter A10U1, to 160 MHz wide band IF rear panel output J2. The other portion of the SIF signal is amplified and bandwidth limited by output amplifier A10Q2 and coupled to the narrow band and SM outputs on rear panel jacks J3 and J4 respectively.

3.2.4 Two local oscillator signals, one from microwave LO U5 and the other from 2 GHz LO on module A1, are applied to the double balanced mixer U1 on the DRO Converter Assembly A9. The result of this heterodyning is a signal which will traverse from 190 MHz to 1160 MHz as the unit is tuned from 30 to 1000 MHz. This signal is then amplified by two constant current amplifiers and is available at rear panel jack J5 to operate the auxilliary frequency counter.

3.2.5 Assembly A7 is employed to translate the AFC and AGC voltages from the various auxiliary units into a form compatible with the requirements of the microwave local oscillator and the 160 MHz preamplifier, A1A3, in the WJ-9080A tuner. In addition this assembly impresses the fine tuning voltage, from the front panel FINE TUNE potentiometer, on the AFC line and provides the source potential for the analog tuning potentiometer located on Tuning Drive Assembly A4. The AFC and AGC voltage translation is performed by a dual operational amplifier IC. The operational amplifiers are programmed by the connection of jumper wires and resistors in the input and feedback circuits to provide inverting or non-inverting operations with various gains. Two potentiometers connected between plus and minus 15 V are set to provide -10 V and +10 V to the analog tuning potentiometer to correspond to 30 MHz and 1000 MHz respectively.

3.2.6 Two outputs are derived from the analog tuning potentiometer. The first is the analog tuning voltage applied to rear panel jack J6. The second, the range control output, is generated by assembly A12. A sample of the analog tuning voltage is applied simultaneously to level switches A10U1A and B which activates or de-activates them. They in turn control bi-polar switches Q1 through Q4. This action is best described by the following example. When turning from 30 MHz towards 1000 MHz the tuning voltage will traverse from -10 V to +10 V. Within the frequencies

30 to < 120 MHz the tuning voltage will be between -10 V and -7 V and level switch U1A output is approximately -15 V and the output of U1B is approximately +15 V. With U1A negative, transistor Q2 is held off and with U1B positive transistors Q1 and Q4 are saturated. This set of parameters yields a ground on pin 4 and an open circuit on pins 3 and 2. Pin 3 is open because with Q1 saturated the base of Q3 is clamped at ground holding it off. When the tuning voltage increases to > -7 V and < +1.2 V corresponding to a tuned frequency between 120 MHz and 500 MHz, U1B switches to a negative output turning Q4 off and in conjunction with the negative output from U1A turns Q1 off allowing Q3 to conduct to saturation. With this set of parameters pin 3 is grounded and pins 2 and 4 are open circuited. When the tuned frequency is 500 MHz the tuning voltage will be > +1.3 V allowing U1A to switch tuning Q2 on and Q1 on. Under these conditions Q3 will be turned off and Q4 will remain off providing a ground on pin 2 and pins 3 and 4 will be open circuits. These grounds and open circuits provide the frequency range selection for the associated frequency counter.

3.3 CIRCUIT DESCRIPTION

The following circuit descriptions cover only the repairable subassemblies A1 through A12.

3.4 TYPE 71412 2160 MHz IF AMPLIFIER CONVERTER

The schematic diagram for this module is Figure 6-1 and the reference designation prefix is A1. First IF (FIF) signals are applied through, and bandwidth limited by, the comb line filter, C1-C5 and L1-L4, to the input of the 2.16 GHz IF amplifier. Amplified FIF signals are then bandwidth limited by the interstage comb line filter and coupled to the mixer assembly, A2, Figure 6-3. The other input to mixer A2U1 is from the 2 GHz local oscillator Q1, through LO amplifier Q2. The tank circuit for LO Q1 is located on subassembly A6, Figure 6-7, and consists of a stripline and variable capacitor A6C2. Likewise, the tuned circuit for the 2 GHz LO amplifier Q2 is located on subassembly A4, Figure 6-5, and is a stripline. Two outputs are taken from subassembly A4. The first is the LO signal applied to mixer A2U1. The other is the 2 GHz LO output, through stripline A5, Figure 6-6, to the DRO Converter Assembly A9. The LO output level at J4 is approximately +8 to +10 dBm. The two signals, 2.16 GHz FIF and 2 GHz LO, are heterodyned in mixer A2U1 to produce a second IF (SIF) signal of 160 MHz. These SIF signals are then amplified by subassembly A3, the only AGC controlled circuit in the WJ-9080A, and transferred through J2 to the 160 MHz Power Splitter/Amplifier assembly A2. Assembly A1 has an overall bandwidth of 40 MHz at the 1 dB points and an average gain of 9 dB.

3.4.1 Part 17437 2160 MHz Amplifier - The reference designation prefix for this subassembly is A1A1 and the schematic diagram is Figure 6-2. This subassembly consists of the 2.16 GHz amplifier Q2 and its associated constant current source Q1. Transistor Q1 acts as a constant current source, and stabilizes the collector current of Q2 at an optimum level. The voltage established by divider R1-R3 and the base-emitter drop of Q1 establishes a fixed voltage on the emitter of Q1. Resistor R2 is therefore connected between two fixed voltage points and the current through it is constant. A portion of the current flows through R5 to the collector of Q2, and a portion of the current flows through the collector of Q1 and R4 to provide base bias for Q2. If Q2 tends to draw more collector current, as with increased temperature, it will decrease the portion of the current providing base bias thus tending to turn itself off. This change in collector current will therefore be opposed. Variable capacitor C4 is adjusted for maximum gain at 2.16 GHz.

3.4.2 Part 17439 160 MHz Preamplifier. - The reference designation prefix A1A3 has been assigned to this subassembly and the schematic diagram is Figure 6-4. This subassembly consists of a 160 MHz amplifier Q1 and its associated current source Q2. This constant current amplifier operates as described in paragraph 3.4.1. Diode CR1, a PIN diode, provides AGC control. PIN diodes exhibit an inverse resistance to forward bias characteristic. When AGC voltage from assembly A7 is applied through R1 and L1 to the anode of CR1 its resistance decreases. With more positive AGC voltage the resitance continues to decrease thus providing a lower resistance path to ground for the incoming 160 MHz signals. As the AGC voltage moves less positive the resistance of CR1 increases providing less attenuation to the incoming signals. A change in AGC voltage frp, 0 to +6 V will produce a 30 dB reduction in signal level.

3.5 TYPE 791272 160 MHz POWER SPLITTER AMPLIFIER

The schematic diagram for this assembly is Figure 6-8 and its reference designation prefix is A2. This assembly and included subassembly (A2A1) consists of power splitter A1U1, grounded base amplifier A1Q1, 117.2 MHz image trap L1 and C8, and a two-pole output filter, C1-C6 and L2-L3.

The power splitter and grounded base amplifier are located on subassembly A2A1. The schematic diagram is Figure 6-9. Input SIF signals are applied to power splitter U1. There are two outputs from the power splitter. The first is routed through a pi attenuator, R1, R2, and R3, to the emitter of ground base amplifier Q1. Transistor Q1 amplifies the SIF signals which are then coupled through the output filter to the 160/21.4 MHz Converter A3.

3.10. TYPE 78101-(X) AFC/AGC/ANALOG TUNE

The schematic diagram of this printed circuit board is illustrated in Figure 6-13. The reference designation prefix is A7. This board contains a dual operational amplifier integrated circuit, the two sections of which translate the AFC and AGC voltage into a compatible format for the microwave LO and 160 MHz preamplifier circuit respectively.

The translation is preprogrammed by jumper wires on the input of each op amp section and installation of selected resistors stipulated in Tabulations B and C on the schematic diagram Figure 6-13. The amplifiers, U1A and U1B, are programmed according to the demodulator unit and frequency counter operated in conjunction with the WJ-9080A. The programmable functions are inverting or non-inverting operation and gain. This board also supplies the source potential for the analog tuning potentiometer located on assembly A4. Potentiometers R16 and R17 are adjusted to supply +10 V and -10 V, respectively, to the analog potentiometer. This module also impresses the fine tuning voltage, from the FINE TUNE potentiometer, on the AFC voltage line for fine tuning the microwave LO, U5.

3.11 TYPE 8310 5/25 CALIBRATION MARKER OSCILLATOR

The schematic diagram for this module, reference designation prefix A8, is Figure 6-14. This module provides 5 MHz and 25 MHz crystal markers for calibrating the tape dial when the DRO-333-1 Frequency Counter is not used. The crystal oscillator and amplifier are located on subassembly A8A1. Figure 6-15 is the schematic diagram. These two crystals, 5 MHz and 25 MHz, are switched into the tank circuit of oscillator A1Q1 to establish the oscillator frequency. The switching is performed by the front panel CMO switch S3. When this switch is operated to one of the crystal positions the supply voltage is simultaneously removed from the input wideband amplifier U2. This is done to prevent the crystal frequency from beating with the incoming RF frequencies to produce extraneous beat frequencies. The output from the collector of A1Q1 is applied to the base of amplifier A1Q2. The oscillator signal is amplified and electrostatic coupling to the RF input line is provided by the physical placement of the oscillator output and the RF output jack A8J2. Diode A1CR3, a step recovery diode, provides the required harmonics to cover the tuning spectrum.

3.12 TYPE 71411 DRO CONVERTER ASSEMBLY

Reference designation prefix A9 has been assigned to this assembly. The schematic diagram is Figure 6-16. This module receives signals

3.6 TYPE 791169 160/21.4 MHz CONVERTER ASSEMBLY.

The schematic diagram for this assembly is Figure 6-10 and the reference designation prefix is A3. This assembly receives second IF signals of 160 MHz and converts them to 21.4 MHz third IF. The translation is performed by double balanced mixer A1U1 and the 138.6 MHz crystal controlled oscillator A1Q2. Third IF signals from the mixer are then amplified and filtered before being coupled to the rear panel through IF Coupler A11.

3.6.1 Part 17188 160/21.4 MHz Converter. - The schematic diagram for this subassembly is Figure 6-11. Its reference designation prefix is A3A1. Crystal oscillator Q2 is peaked at 138.6 MHz by variable capacitor C3. Second IF and LO signals are heterodyned in the mixer to produce the 21.4 MHz third IF which is then amplified by Q1, applied to tuned circuit C9, C14, and T1 and coupled to output level adjust potentiometer R17. The signal is routed to the IF Coupler module and ultimately to the rear panel jacks A11J2 and A11J3. The bandwidth of the 160/21.4 MHz Converter is 8 MHz minimum at the 3 dB points.

3.7 TYPE 85115 TUNING DRIVE ASSEMBLY.

The reference designation prefix for this assembly is A4. An exploded view of the tuning drive is illustrated in Figure 5- , located in Section V of this manual. Located within this assembly are the front panel dial lights, the tape dial and drive train and the analog tuning potentiometer R1 and its associated drive train. The voltage for potentiometer R1 is supplied by potentiometers A7R16 and A7R17.

3.8 TYPE 76210-1 ±15 V POWER SUPPLY

The schematic diagram for this assembly is Figure 6-12 and the reference designation prefix is A5. This power supply consists of two identical regulator circuits. Each regulator is composed of a full wave bridge rectifier, a monolithic IC regulator and a pass transistor. Components U1, U2 and Q1 form the +15 V regulator and U3, U4, and Q2 form the -15 V regulator. Potentiometer R2 and R5 adjust the regulated output voltage of the +15 V and -15 V sections respectively.

3.9 TYPE 76120-6 -20 V POWER SUPPLY

The schematic diagram for this assembly is Figure 6-12 and the reference designation prefix is A6. It is the same as assembly A5, discussed above, except only one regulator circuit is installed on the board.

from the microwave LO, U5, and the 2 GHz LO, located on assembly A1, and heterodynes them in double balanced mixer to produce a 190 to 1160 MHz signal compatible with the associated frequency counter. This 190 to 1160 MHz frequency range corresponds to the 30 to 1000 MHz RF tuning range of the WJ-9080A. The output of the mixer is applied to cascaded constant current amplifiers consisting of amplifier Q2 and current regulator Q1, and amplifier Q4 and current regulator Q3. These constant current amplifiers operate as described in paragraph 3.4.1. The output of the two stage amplifier is applied through the output filter, C13 through C15, and associated stripline inductors, to the DRO output jack, J5, located on the rear panel. The output level at J5 is between -12 dBm and +5 dBm.

3.13 TYPE 72436 160 MHz AMPLIFIER ASSEMBLY

The schematic diagram for this assembly is Figure 6-18. Its reference designation prefix is A10. This assembly provides a 160 MHz SM output plus a narrow-band and wide-band 160 MHz IF output. The wide-band output is a minimum 40 MHz wide at the 1 dB points. The narrow-band and SM output 3 dB bandwidths are 20 MHz minimum.

All circuitry is contained on sub-module A10A1. The schematic diagram is Figure 6-19. The 160 MHz signals from module A2 are applied to amplifer Q1. The amplified 160 MHz signals are applied to power splitter U1. There are two outputs derived from the power splitter. The first is the 160 MHz wide-band output taken through pi attenuator R8, R9, and R10 on the rear panel jack J2. The second output is coupled through common base amplifier Q2 to the narrowband output J3 and through voltage divider R15, R16, and R17 to the 160 MHz SM output J4. Variable capacitor C10 is adjusted to peak the response at 160 MHz and limit the output bandwidth.

3.14 TYPE 791335-2 IF COUPLER

The schematic diagram for this module is Figure 6-20. Its refersignation prefix is A11. This module provides straight through coupling for the 21.4 MHz IF signals to A11J3 and approximately 10 dB attenuation of the IF signal to the SM outputs A11J2.

3.15 TYPE 792434 REMOTE RANGE CONTROL.

The reference designation preix is A12. Figure 6-21 is the schematic diagram for this board. This subassembly provides the required range selection information for the associated frequency counter. The analog tuning voltage from potentiometer A4R1 is coupled through pin 18 to the

non-inverting and inverting inputs of operational amplifiers U1A and U1B respectively. These amplifiers are operated in an open loop gain configuration to provide level detection. At predetermined levels, set by potentiometers R4 and R7, they switch state, U1A switching from a negative output to a positive and U1B switching from a positive to negative output as the unit is tuned from the lower band edge to the upper band edge.

3.15.1 Initially, with the unit tuned to 30 MH op amp U1B has a positive output which turns transistor Q4 on to saturation. This provides the first range selection by grounding pin 4. In addition to turning Q4 on, Q1 is turned on to saturation holding Q3 off. Transistor Q2 is held off by the negative output of op amp U1A. As the unit is tuned towards the upper band edge the tuning voltage moves in a positive direction from -10 V At approximately -7 V, corresponding to about 120 MHz, U1B switches to a negative state turning transistor Q4 off and reverse biasing diode CR2, diode CR1 is reverse biased by the negative output from U1A, turning Q1 off allowing Q3 to conduct to saturation to provide a ground on pin 3 representing the second frequency counter range code.

3.15.2 As the unit is tuned above 120 MHz, the analog tuning voltage increased in a positive direction from -7 V to the next switch point at approximately +1.2 V. At this point op amp U1A switches to a positive output turning Q2 on and through diode CR1 turns Q1 on grounding the base of Q3 which turns it off. This is the last range select code. Module pin 2 is grounded and pins 3 and 4 are open. This +1.2 V switch point corresponds to approximately 500 MHz. The range selections are as follows:

a) from 30 MHz to 120 MHz pin 4 is ground.
b) from 120 MHz to 500 MHz pin 3 is ground.
c) from 500 MHz to 1000 MHz pin 2 is ground.

Note that when one pin is grounded, say pin 2, the other two pins, 3 and 4, are open.

SECTION IV
MAINTENANCE

4.1 GENERAL

The WJ-9080A Tuner has been conservatively designed to operate for extended periods of time with little or no routine maitenance. An occasional cleaning and inspection are the only preventative maintenance required. The intervals of these operations should be based on the operating environment. Should trouble occur, repair time will be minimized if the maintenance technician is familiar with the circuit descriptions found in Section III Reference should also be made to the functional block diagram, Figure 3-1, the schematic diagrams located in Section VI, and the component location diagrams in Section V

4.2 CLEANING AND LUBRICATION

The unit should be kept free of dust, moisture, grease and foreign objects to ensure trouble-free operation. Low velocity compressed air can be used to blow accumulated dust from interior and exterior surfaces. A soft brush or clean cloth may be used in the absence of compressed air. Occasional applications of light oil to shaft bearings and removal of dust and dirt will insure smooth tuning drive operation.

4.3 INSPECTION FOR DAMAGE OR WEAR

Many potential or existing troubles can be detected by visual inspection of the unit. For this reason, a complete visual inspection should be made for signs of mechanical and electrical defects on a periodic basis, or whenever the unit is inoperative. Electronic components that show signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Damage to components due to excessive heating is often the result of other less obvious problems. It is essential that the cause of overheating be determined and corrected before replacing the damaged components.

4.4 LIST OF TEST EQUIPMENT

The following test equipment, or its equivalent, is required to trouble shoot, test and align the WJ-9080A Tuner.

Table 4-1. Test Equipment

INSTRUMENT	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
Oscilloscope	dc to 500 kc bandwidth, external horizontal input and (+, -) differential vertical inputs.	Tektronix 503
Sweep Generators	30 MHz to 1 GHz range, calibrated, RF output attenuator.	Wavetek 2001
	2 to 4 GHz range, leveled output	HP8690A with HP8692A plug-in
Variable dc power supply	0 to ± 30 V dc, 150 mA	HP721A
Digital Voltmeter	1.0% accuracy, 0 to 30 V dc range	HP3460B
Frequency Counter	5 MHz to 3.2 GHz range, 10 mV sensitivity	HP5340
RF VTVM	5 MHz to 1 GHz response, 1 mV sensitivity, dBm scale	Boonton 92A with 91-14A Tee and 91-15A 50 Ω termination
Spectrum Analyzer	10 MHz to 40 GHz response	HP140T with 8553B and 8552A plug-in
Signal Generators	10 MHz to 480 MHz range, 450 MHz to 1.2 GHz range, output level variable from 1 μV to .5 V, impedance 50 Ω.	HP608E HP612A
Multimeter	± dc voltage ranges 0 to 40 V dc, 40 V dc, ohms range, ac voltage ranges to 230 V ac	RCA WV-98C
Crystal detector	10 MHz to 3 GHz response	HP423A

Table 4-1. Test Equipment (Continued)

INSTRUMENT	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
Variable Attenuator	50 Ω impedance, 0 to 10 dB variable	Weinschel Engineering 953-10
Step Attenuator	50 Ω impedance, 0 to 120 dB in 10 dB steps	HP354A
Attenuator Pad	3 dB, 20 dB	HP8491A
Iso Tee	2 to 4 GHz response	Micro Labs HM-10N
Microwave Marker Generator	5, 10, 50, 100 MHz markers up to 2.2 GHz	Telonic TMS-1

4.5 TROUBLESHOOTING

4.5.1 The troubleshooting efforts should first be directed towards localizing the problems to a particular module or circuit group. As an aid in this process, refer to the troubleshooting table (Table 4-2), the functional block diagram (Figure 3-1) and the detailed circuit descriptions in Section III Once the defective module has been located the defective components can be isolated by using the schematic diagrams (Section VI) waveform photos and semiconductor voltages.

4.5.2 Failure Analysis. - Once the faulty module has been located and the defective component replaced, it is recommended that the procedures followed, thus far, be reviewed to be sure the fault discovered is the cause of the problem and not just the result of a less obvious problem. Overheated transistors are a prime example of this. Generally, when a transistor is found to be defective and shows signs of excessive heating, there will be a less obvious problem in the circuitry following which is drawing excessive current through the transistor.

Table 4-2. Troubleshooting Chart

PROBLEM INDICATION	PROBABLE CAUSE	DIAGNOSTIC PROCEDURE
Unit totally inoperative	Blown line fuses. Defective regulator cards, or defective ON/OFF switch.	With the line cord unpluged, use the ohms function of the multimeter to check the line fuses (FL1 and and FL2) and power ON/OFF switch. Plug the unit in and turn it on. Using the multimeter check the output of the power supplies A5 and A6.
	Microwave LO, U5, inoperative.	Using the RF VTVM check for the presence of a signal at U4P10 or U4P5.
	Wide-band amplifier U2 defective.	With the CMO switch off, use the multimeter to verify -20 V is being applied to U2. Next, connect the RF VTVM to the output of U2 and apply a 30 MHz CW signal at -50 dBm to the antenna input J1. The RF VTVM should indicate approximately 10 to 13 dB gain.
	2160 MHz IF Amplifier/ Converter defective.	Connect the frequency counter, through a 10 or 20 dB pad to A1J4 and note the presence of the 2 GHz LO. Tune the unit to 30 MHz and apply a 30 MHz CW signal at -50 dBm to the antenna input.

Table 4-2. Troubleshooting Chart (Continued)

PROBLEM INDICATION	PROBABLE CAUSE	DIAGNOSTIC PROCEDURE
		Connect the RF VTVM to A1J3 and note the presence of the 160 MHz signal. Approximately -35 dBm.
No readout on associated frequency counter.	DRO Converter Assembly A9 defective.	Tune the unit to 30 MHz. Using the frequency counter specified in Table 4-1, with a 10 dB pad on the input, check for the presence of the 190 MHz signal at rear panel jack J5.
	Remote Range Control A12 defective.	Using the test light, Figure 4-9, verify proper range switching per steps 4 through 11 of alignment procedure 4.7.8. If this assembly proves to be operational, refer to the manual for the associated frequency counter.
21.4 MHz IF output but no 160 MHz IF output	160 MHz Amplifier A10 defective.	With the unit tuned to 30 MHz, apply a 30 MHz CW signal at -50 dBm to the RF input. Use the RF VTVM to check the 160 MHz outputs J2, J3, and J4. The levels are approximately -38 dBm, -35 dBm and -44 dBm respectively. If all three outputs are missing check Q1 and power splitters U1. If only the narrowband

Table 4-2. Troubleshooting Chart (Continued)

PROBLEM INDICATION	PROBABLE CAUSE	DIAGNOSTIC PROCEDURE
		and SM outputs are missing check Q2 and its associated circuitry.
160 MHz IF outputs operational but no 21.4 MHz IF outputs	160 MHz Power Splitter/Amplifier A2 defective.	With the unit tuned to 30 MHz, apply a 30 MHz CW signal at -50 dBm to the RF input. Using the RF VTVM check for an output at A2J2. If no output is present check Q1.
	Output from A2 present, 160/ 21.4 MHz Conver ter A3 defective.	Use the RF VTVM, with a high impedance probe, to check for the presence of the 138.6 MHz LO signal at the LO input on mixer U1. If the LO signal is present check mixer U1 and amplifier Q1.
Neither the 21.4 MHz or the 160 MHz IF outputs are function- ing.	Power splitter A2A1U1.	Use the multimeter to verify the dc supply voltage is reaching module A2. If the volt- age is present, replace U1.
Tuner drifts with AFC on.	AFC circuitry on module A7.	Check to see that the AFC/DAFC circuitry is connected properly for the control voltage being applied. Refer to Tabulation blocks A and C on the schematic diagram. If the circui- try is correct, connect the variable power supply,

Table 4-2. Troubleshooting Chart (Continued)

PROBLEM INDICATION	PROBABLE CAUSE	DIAGNOSTIC PROCEDURE
		set to the appropriate voltage range, to the AFC input (pin 11). Connect the multimeter to module pin 19 and while varying the power supply through the appropriate voltage range, see that the output voltage varies from -0.5 V dc to +14 V dc for an input voltage change of ± 1 V dc or ± 2.5 V dc if DAFC is used. If the output voltage at pin 19 changes properly refer to the manual on the unit used to supply this voltage.
IF output distorted or clipped, SM over driven and spurious signals appearing beside the desired signal at high input signal levels.	AGC circuitry in module A7 defective or associated equipment supplying AGC voltage defective	Refer to tabulation block B on the schematic diagram for module A7 and insure proper resistors and jumper wires are installed for the AGC voltage being applied. Connect the variable power supply to module pin 5 and the multimeter to pin 4. Vary the power supply voltage over the appropriate range noting the output voltage at pin 4 varies from 0 V dc to +6 V dc. If the AGC circuit performs pro-

Table 4-2. Troubleshooting Chart (Continued)

PROBLEM INDICATION	PROBABLE CAUSE	DIAGNOSTIC PROCEDURE
		perly, refer to the manual for the equipment, supplying AGC.
When in one or both of the CMO positions no output is visible on the SM the SM.	Failure of the oscillator transistor, oscillator amplifier transistor, or switched supply voltage or ground on module A8.	Using the multimeter check for +15 V dc on FL 1 when in the 5 MHz and 25 MHz positions. If only one marker frequency is present, replace the crystal corresponding to the missing frequency. If both marker frequencies are missing check the voltages on transistors Q1 and Q2, or replace them. If only one 25 MHz marker, the one at at 25 MHz, is present and no 5 MHz markers are present replace CR3.

4.6 PERFORMANCE CHECKS

The following checks are designed to help evaluate the WJ-9080A Tuner after component replacement or as part of a periodic maintenance evaluation. They may also aid in isolating problems should the equipment be malfunctioning.

4.6.1 Power Supply Checks. -

Using the digital voltmeter check the ± 15 V and -20 V power supplies as follows:

+15.0 V ± 0.1 V on A5 pin 13
-15.0 V ± 0.1 V on A5 pin 9
-20.0 V ± 0.2 V on A6 pin 9

4.6.2 5 MHz and 25 MHz Calibration Markers. -

(1) Connect a frequency counter, if available a known operational DRO-323-1, to the DRO Output J5.
(2) Connect the signal generator, turned to 30 MHz CW at a level of -90 dBm, to the RF input, J1. Use the frequency counter listed in Table 4-1 (or equivalent) to adjust the signal generator.
(3) Tune the WJ-9080A to 30 MHz as read on the DRO-333-1. If the DRO-333-1 frequency counter is not being used, the frequency displayed on the frequency counter will be 190 MHz = 30 MHz tuned frequency + 160 MHz IF offset.
(4) Connect a known operational signal monitor to the appropriate SM output jack.
(5) With the 30 MHz signal displayed on the signal monitor adjust the signal monitor gain control for a convenient reference level. This level represents the minimum CMO marker level.
(6) Turn the CMO switch to the 25 MHz position.
(7) Observe the level of the 25 MHz markers while turning the WJ-9080A from low band edge to high band edge checking that the markers are all above the reference level set in step (5).
(8) Switch to the 5 MHz CMO position and repeat step (7).

4.6.3 Overall Gain And Bandwidth Check. -

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

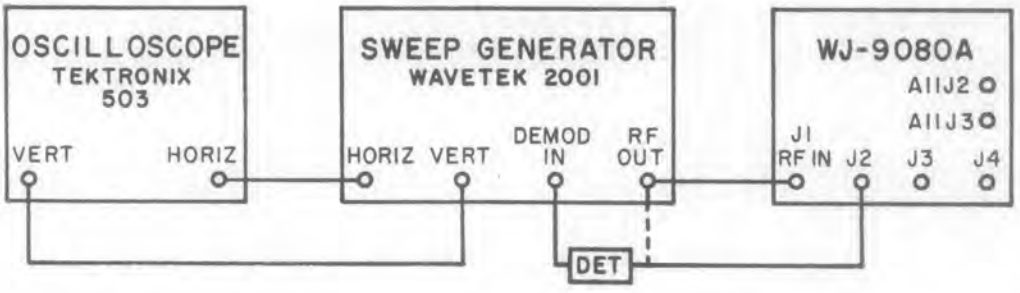


Figure 4-1. Equipment Setup, Overall Gain and Bandwidth Check

NOTE

All unused outputs must be terminated in 50 Ω.

(2) Tune the WJ-9080A to 100 MHz and adjust the sweep generator for an approximately 80 MHz wide sweep, centered at 100 MHz, at a level of -30 dBm.
(3) Adjust the oscilloscope and sweep generator to display the response.
(4) Turn on the sweep generator internal 10 MHz markers.
(5) Add and remove 1 dB of attenuation and note the 1 dB bandwidth point.
(6) Using the 10 MHz markers verify that the 1 dB bandwidth is a minimum of 40 MHz.
(7) Turn the 10 MHz markers off and, using the vertical sensitivity control on the oscilloscope, adjust the displayed response for a convenient reference level on the oscilloscope.
(8) Connect the input of the 50 Ω detector to the RF output on the sweep generator and remove attenuation until the oscilloscope again displays the reference level.
(9) The attenuation removed represents the overall tuner gain and should be 12 dB minimum.
(10) Repeat steps (5) through (9) for J3, J4, and A11J2 and J3 except measure the 3 dB bandwidth. The results should be as follows:

INPUT/OUTPUT	MINIMUM GAIN	3 dB BANDWIDTH
J1 to J3	15 dB	20 MHz
J1 to J4	3 dB	------
J1 to A11J2	12 dB	------
J1 to A11J3	23 dB	8 MHz

4.6.4 AGC Range Check. -

(1) With the equipment setup as shown in Figure 4-1, connect the variable power supply to J7 (AGC INPUT) on the rear panel.
(2) Set the voltage to 0.0 V dc for 78101 -1, -2, -3, -7, -8, or -9 AGC/AFC Analog Tune modules or +10 V dc for -4, -5, or -6 modules.
(3) Adjust the sweep generator output level to -30 dBm and the oscilloscope for a convenient reference level.
(4) Adjust the power supply voltage to -24 V dc for 78101 -1, -2, or -3 modules +1 V dc for -4, -5, or -6 or -15 V dc for -7, -8, or -9 modules.
(5) Increase the sweep generator output until the reference level is re-established.

(6) The amount of attenuation removed represents the AGC control range and should be a minimum of 30 dBm.

4.6.5 AFC and FINE TUNE Control Range Check. -

(1) Connect the frequency counter to the 160 MHz SM output J4 and the variable power supply to AFC input J8.
(2) Connect the signal generator, tuned to 30 MHz, to the RF input J1 and tune the WJ-9080A to 30 MHz. Set the signal generator RF level to -30 dBm.
(3) Set the AFC switch to ON and the FINE TUNE control to mid-range.
(4) Check the dash number of the AFC/AGC Analog Tune module. Adjust the power supply for -2.5 V dc for 78101 -3, -6, or -9 modules and +1 V dc for all other modules.
(5) Record the frequency read at J4.
(6) Adjust the power supply for +2.5 V dc for 78101 -3, -6, or -9 modules and -1 V dc for all others.
(7) Record this frequency.
(8) Subtract the lower frequency from the higher. The difference is the AFC control range and should be a minimum of 1.0 MHz.
(9) Set the power supply to zero volts and rotate the FINE TUNE control fully CCW
(10) Record the frequency at J4.
(11) Rotate the FINE TUNE control fully CW and record the frequency at J4.
(12) The difference in the frequencies should be 500 kHz minimum.

4.7 ALIGNMENT

The alignment procedures presented here are suitable for aligning the WJ-9080A Tuner after minor repairs and component replacement.

4.7.1 Type 76210-X Power Supply (A5 and A6). -

Proceed as follows:

(1) Connect the digital voltmeter to A5 pin 13 and adjust A5R2 for +15.0 V dc ± 0.1 V dc.
(2) Move the DVM to A5 pin 9 and adjust A5R5 for -15 V dc ± 0.1 V dc.
(3) Move the DVM to A6 pin 9 and adjust A6R5 for -20 V dc ± 0.2 V dc.
(4) Disconnect the DVM.

4.7.2 Type 71412 2160 MHz IF Amplifier Converter (A1). -

NOTE

The following procedure may be used for field alignment after minor component replacements. If major repairs are required for printed circuit boards A1A1, A1A2, or A1A3, the unit should be returned for factory repair and alignment. Complete alignment involves critical procedures and factory alignment is recommended.

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

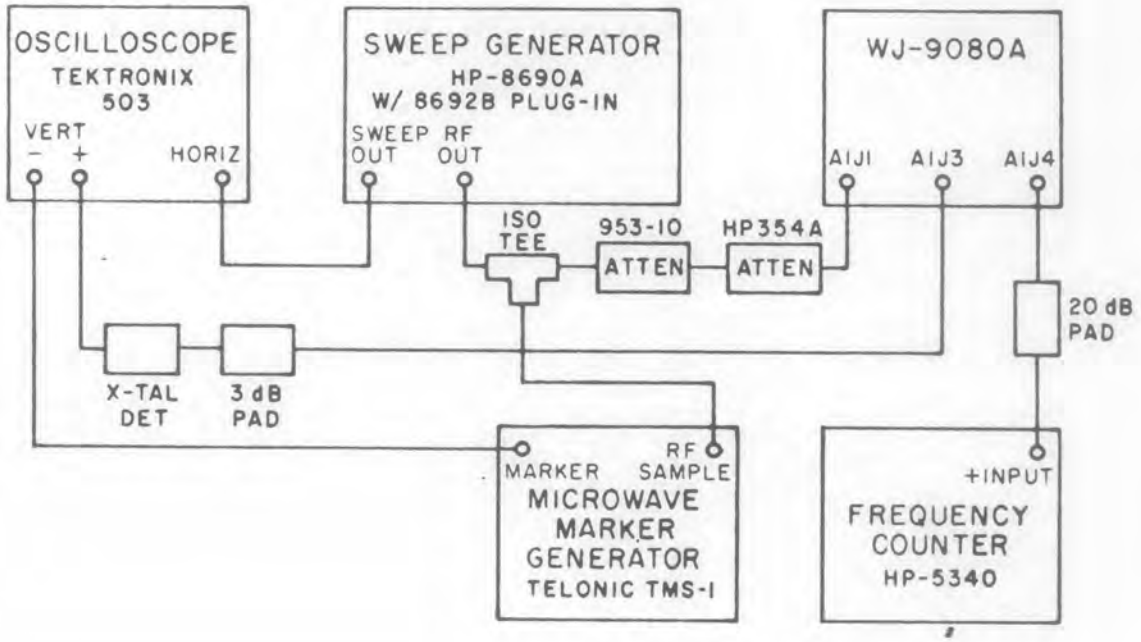


Figure 4-2. Equipment Setup, 2160 MHz IF Amplifier Converter Alignment

(2) Adjust the sweep generator set to 2160 MHz at -30 dBm, and oscilloscope to display the 160 MHz sweep response.
(3) Adjust the marker generator to produce 10 MHz markers.
(4) The displayed response should have a 1 dB bandwidth of 40 MHz minimum and should appear similar to the response illustrated in Figure 4-3.

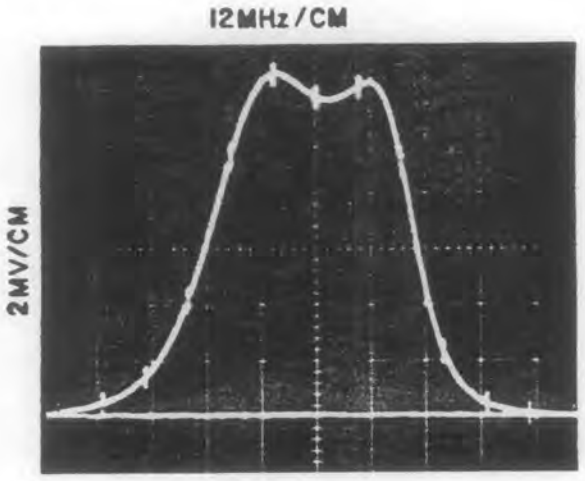


Figure 4-3. Typical 2160 MHz Amplifier/Converter Overall Response Curve

(5) If the displayed response deviates excessively from the one illustrated, check the 2 GHz LO to insure it is 2 GHz ± 300kHz.
(6) If the LO frequency is incorrect, adjust capacitor A1A6C2 until the 2 GHz ± 300 kHz specifications is met.
(7) If the displayed response still deviates excessively or the 40 MHz minimum bandwidth is not met, make very slight adjustments of capacitors A1C1 through A1C9 and A1A1C4.
(8) If the 40 MHz bandwidth at the 1 dB points, approximately 1 dB ripple and 18 ± 1 dB gain specifications cannot be met the module should be returned to the factory for a complete alignment.

4.7.3 Type 791272 160 MHz Power Splitter/Amplifier (A2). - Proceed as follows:

(1) Interconnect the test equipment as shown in Figure 4-4.
(2) Remove the input and output cables from A2J1, A2J2, and A2J3, tagging each to insure proper replacement.
(3) Adjust the signal generator to produce a 160 MHz CW signal at a level of -30 dBm and connect it to A2J1.
(4) Connect the RF VTVM to J3 and measure the insertion loss. It should be a maximum of 6 dB.

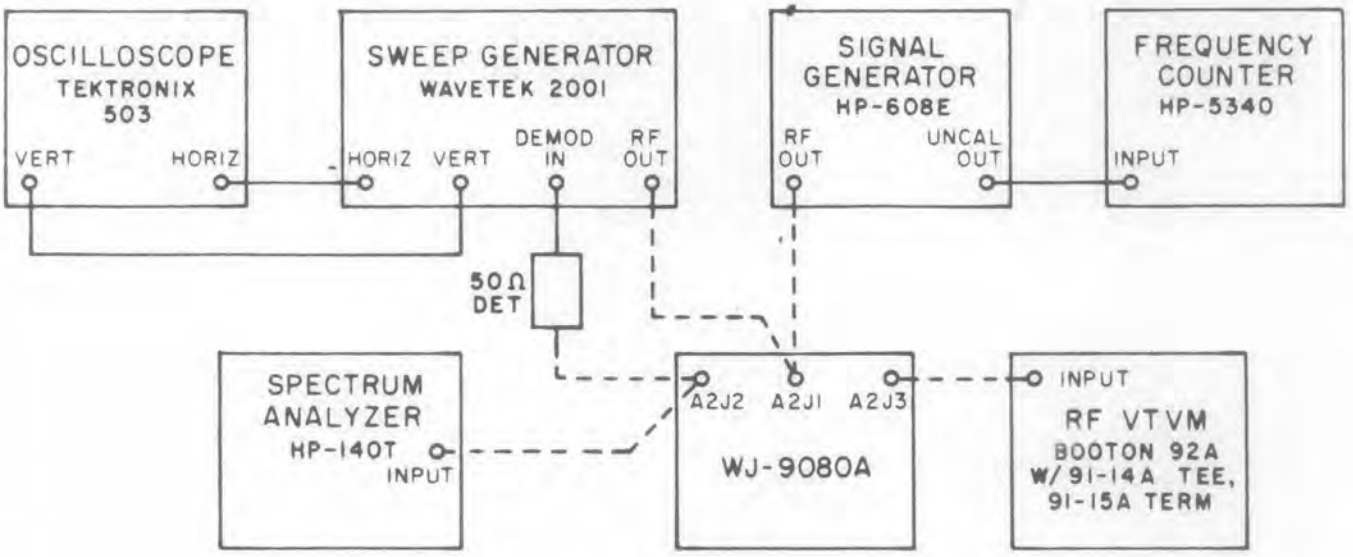


Figure 4-4. Equipment Setup, 160 MHz Power Splitter/Amplifier Alignment

(5) Replace the signal generator with the sweep generator set to sweep ± 20 MHz about 160 MHz center frequency at a level of -30 dBm.

(6) Adjust capacitors A2C2 and A2C5 to produce a round nose response with a minimum 3 dB bandwidth of 8 MHz and approximately 4 dB gain.

(7) The gain can be checked by adjusting the vernier attenuator on the sweep generator to produce a convenient reference on the oscilloscope. Then connect the DEMOD IN to the RF OUT port, through the 50 Ω detector, and adjust the vernier attenuator to re-establish the reference level on the oscilloscope. The amount the attenuator was changed is the gain of the module.

(8) Reconnect the signal generator to J1 and adjust the frequency to 117.2 MHz, using the frequency counter, and set the output level to -30 dBm.

(9) Connect the spectrum analyzer to J2 and adjust it to display the 117.2 MHz signal.

(10) Adjust C8 for minimum amplitude of this display.

(11) Repeat steps (3) through (10) as required to meet the conditions set forth in step (6).

(12) Restore normal module connections.

4.7.4 Type 791169 160/21.4 MHz Converter (A3). - Proceed as follows:

(1) Interconnect the equipment as shown in Figure 4-5.

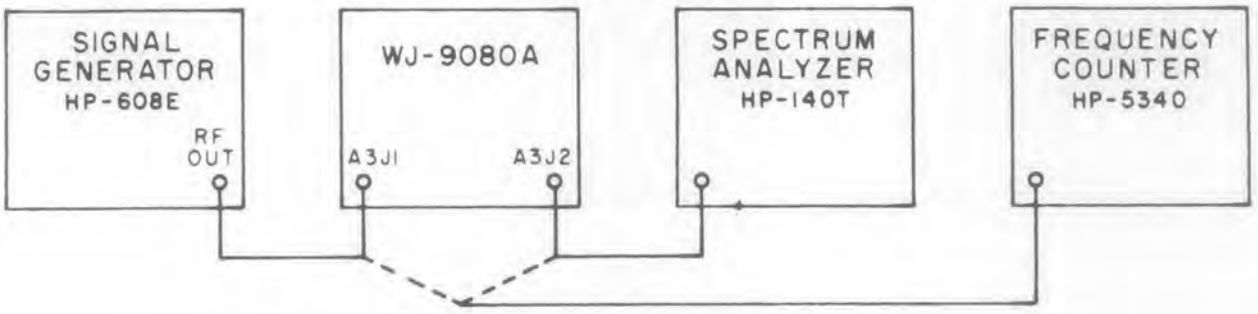


Figure 4-5. Equipment Setup, 160/21.4 MHz Converter Alignment

(2) Using the frequency counter, adjust the signal generator output to 160 MHz, CW at -40 dBm.
(3) Adjust capacitor A3A1C3 until an output is noted on the spectrum analyzer (approximately -36 dBm). Observe that when tuning A3A1C3 there is peak point at which the oscillation will stop. Do not set A3A1C3 too close to this point.
(4) Observe the output looking for any sidebands. If sidebands are present, increase the value of A3A1R16 (10 Ω is a good starting value) until the sidebands disappear.
(5) Reduce the signal generator output level to -55 dBm and verify that no sidebands appear.
(6) Using the frequency counter, adjust the signal generator frequency as close as possible to 160.000 MHz.
(7) Connect the frequency counter to A3J2 and measure the frequency. It should be 21.400 MHz ± 2 kHz ± input frequency offset.
(8) Interconnect the equipment as shown in Figure 4-6.
(9) Adjust the sweep generator to produce a 15 MHz wide sweep centered around 160 MHz.
(10) Adjust capacitor A3A1C9 for maximum output at 21.4 MHz.
(11) Adjust A3A1R17 for 4 dB gain from J1 to J2 and verify the 3 dB band width is 8 MHz minimum.
(12) Restore normal module connections.

4.7.5 Type 78101-X AFC, AGC, ANALOG Tune (A7). - Proceed as follows:

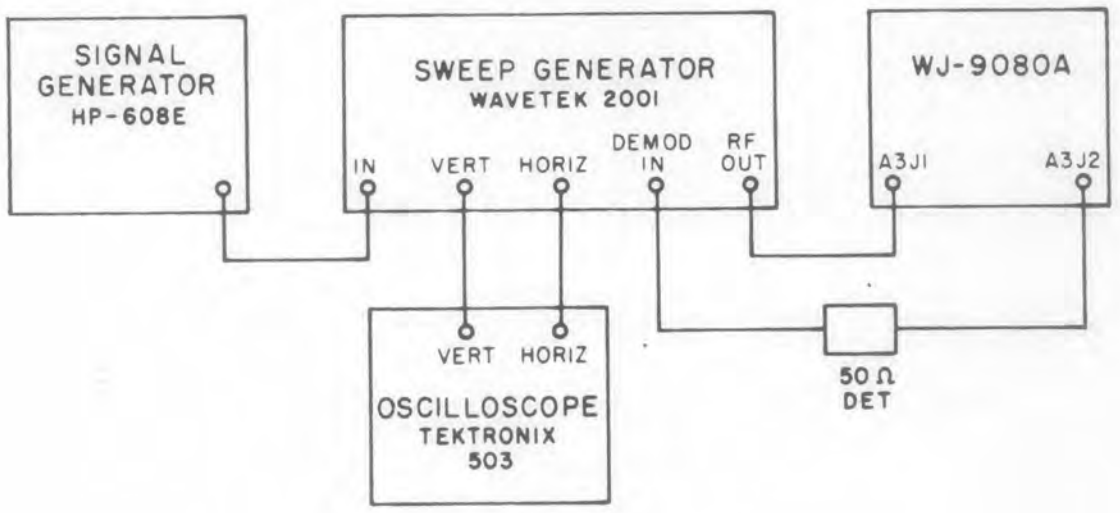


Figure 4-6. Equipment Setup, 160/21.4 MHz Converter Gain and BW

(1) Connect the digital voltmeter to A7 pin 22 and adjust A7R16 for +10.0 V dc.
(2) Move the DVM to A7 pin 21 and adjust A7R17 for -10.0 V dc.

4.7.6 Type 8310 CMO 5 MHz/25 MHz (A8). - Proceed as follows:

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

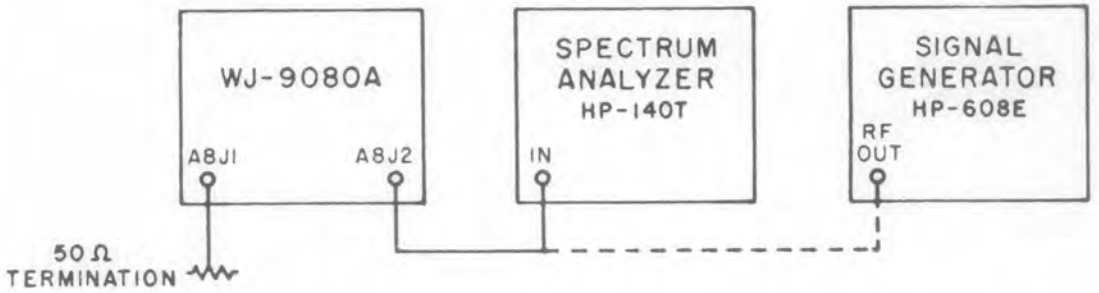


Figure 4-7. Equipment Setup, CMO Alignment

(2) Switch the CMO switch to the 5 MHz position.

(3) Note the 5 MHz spectrum from 5 to 1000 MHz. The amplitude should be -77 to -62 dBm and the variations should not exceed 6 dB.
(4) This level may be adjusted by moving the ribbon lead closer or farther from J2. Use the signal generator to set a calibrated amplitude reference on the spectrum analyzer.
(5) Switch the CMO switch to the 25 MHz position.
(6) Note the 25 MHz spectrum from 25 to 1000 MHz.
(7) Set the spectrum analyzer to observe the 25 MHz signal at 1000 MHz.
(8) Adjust A8A1C11 for the best coincidence between the 5 MHz and 25 MHz harmonics at the 1000 MHz point. This is an approximate adjustment.

4.7.7 Type 72436 160 MHz Amplifier (A10). - Proceed as follows:

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

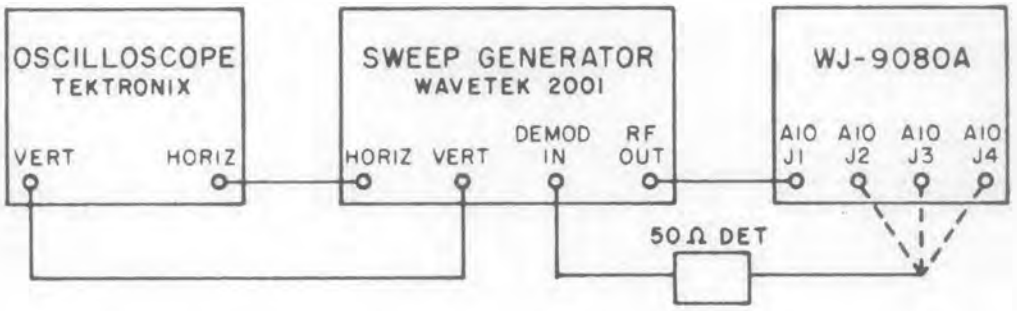


Figure 4-8. Equipment Setup, 160 MHz Amplifier Alignment

(2) Adjust the sweep generator to produce a 50 MHz wide sweep centered at 160 MHz with an output level of -30 dBm. Connect the detector to A10J3.
(3) Adjust A10C10 for maximum amplitude at 160 MHz.
(4) The gain from A10J1 to A10J3 is typically 6 dB and the 3 dB bandwidth should be a minimum of 20 MHz.
(5) Move the detector to A10J4 and measure the insertion loss. It is typically 1 dB.
(6) Move the detector to J2 and check for a gain of typically 4 dB and a 1 dB bandwidth of 40 MHz.

4.7.8 Type 791323 Remote Range Control (A12). - Proceed as follows:

(1) Connect the digital voltmeter to the analog tune input A12 pin 18 and adjust the front panel tuning knob for a reading of 0.00 V dc.
(2) Connect the LED test light (see Figure 4-9) between A12 pin 4 and ground.
(3) Using the main tuning knob, tune the unit to 118 MHz and adjust A12R4 until the LED just turns on.
(4) Move the light to pins 2 and 3 and it should be off on each.
(5) Tune the unit to 124 MHz and connect the light to pin 3. It should light.
(6) Move the light to pins 2 and 4 and it should not light.
(7) Tune the unit to 510 MHz and connect the lamp to pin 2. Adjust A12R7 until the LED just turns on.
(8) Move the lamp to pins 3 and 4 and it should not light.
(9) Tune the unit to 118 MHz and using the test light verify it lights on pin 2 and is off on pins 3 and 4.
(10) Tune the unit to 124 MHz. The light should light on pin 3 and be off on pins 2 and 4.
(11) Tune to 510 MHz. The light should light on pin 4 and be off on pins 2 and 3.
(12) Make slight adjustments of A12R4 at 118 MHz and A12R7 at 510 MHz as necessary.
(13) Disconnect the test equipment.

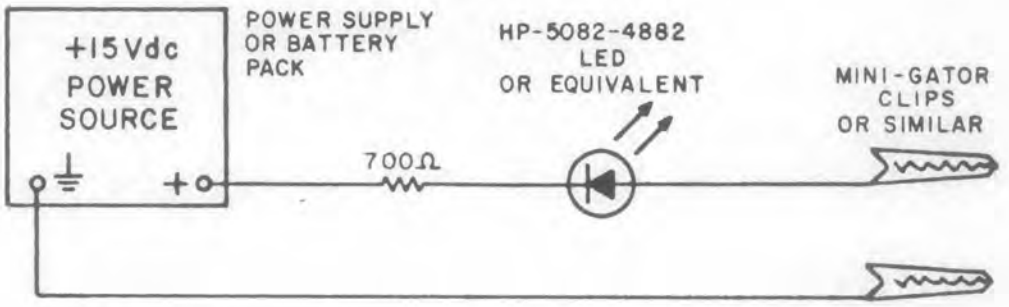


Figure 4-9. Remote Range Control Test Lamp

Table 4-3. Typical Semiconductor Element Voltages

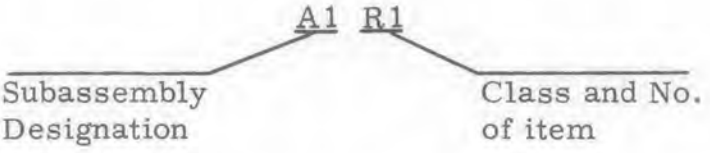
		Integrated Circuit Pin Numbers												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Transistor Elements													
Ref. Desig.	Type	Emitter	Base	Collector											
A1Q1	35833B	- 0.40	0.00	13.96											
A1Q2	35833B	- 0.68	0.00	12.15											
A1A1Q1	2N3251	10.42	9.82	1.66											
A1A1Q2	35866E	0.00	0.81	10.04											
A1A3Q1	MSC80091	0.00	0.74	12.32											
A1A3Q2	2N3251	12.55	11.93	2.93											
A2A1Q1	2N5109	3.54	4.24	14.73											
A3A1Q1	2N5109	- 8.03	- 7.21	- 0.70											
A3A1Q2	2N3478	- 9.08	- 9.08	- 0.08											
A5Q1	2N3055	15.09	15.07	21.88											
A5Q2	2N3055	0.13	0.72	9.64											
A5U2	μA723C	NC	15.09	15.00	7.13	7.13	7.13	0.00	NC	NC	15.70	21.86	21.86	16.89	NC
A5U4	μA723C	NC	0.13	0.00	- 7.88	- 7.88	- 7.88	-15.03	NC	NC	0.72	9.65	9.65	1.91	NC
A6Q2	2N3055	0.17	0.78	9.71											
A6U4	μA723C	NC	0.17	0.00	-12.86	-12.86	-12.86	-20.01	NC	NC	0.78	9.74	9.74	1.93	NC
A7U1	N5558V	0.04	0.00	0.00	-15.00	0.00	0.00	0.00	14.98						
A8A1Q1	2N2708	2.81	3.52	13.54											
A8A1Q2	2N5109	3.01	3.70	14.91											
A9A1Q1	2N3251	8.04	7.42	1.73											
A9A1Q2	35866E	0.00	0.81	6.78											
A9A1Q3	2N3251	7.93	7.31	2.37											
A9A1Q4	35866E	0.00	0.83	6.72											
A10A1Q1	2N5109	3.26	4.00	15.00											
A10A1Q2	2N5109	2.98	3.71	13.83											
A12U1	N5558V	- 4.21	0.40	0.00	- 6.23	- 2.43	0.00	- 4.20	6.16						
A12Q1	2N2222	0.00	0.00	0.65											
A12Q2	2N2222	0.00	- 0.68	0.00											
A12Q3	2N2222	0.00	0.65	0.01											
A12Q4	2N2222	0.00	- 0.68	0.00											

Note:
1. All readings are in volts, positive unless otherwise designated.
2. Main tuning control adjusted for 0.00 V dc at A12 pin 18.
3. AFC and CMO switches in the OFF position.
4. Prime power source 115 V ac.

SECTION V
REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

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



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

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

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. 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
00779	AMP, Incorporated P.O. Box 3608 Harrisburg, Penn. 17105
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53212
01351	Dynamic Gear Co., Inc. 175 Dixon Avenue Amityville, N.Y. 11701
02735	RCA Corporation Solid State Division Route 202 Somerville, N.J. 08876

Mfr. Code	Name and Address
04713	Motorola Semiconductor Products, Inc. 5005 East McDowell Road Phoenix, Arizona 85008
07263	Fairchild Camera and Instrument Corporation Semiconductor Division 464 Ellis Street Mountain View, Calif. 94040
09922	Burndy Corporation Richards Avenue Norwalk, Conn. 06852
13103	Thermalloy Company 8717 Diplomacy Row Dallas, Texas 75247
14632	**WATKINS—JOHNSON COMPANY** **700 Quince Orchard Road** **Gaithersburg, Maryland 20878**
15542	Mini-Circuits Laboratory Division of Scientific Components Corp. 2913 Quentin Road Brooklyn, New York 11229
16179	Omni-Spectra, Incorporated 24600 Hallwood Court Farmington, Mich. 48024
18203	Engelmen Microwave Co. Skyline Drive Montville, N.J. 07045
18324	Signetics Corporation 811 East Argues Avenue Sunnyvale, Calif. 94086
19505	Applied Engineering Products Company Div. of Samarius Inc. 26 E. Main Street Ansonia, Conn. 06401
21604	The Buckeye Stamping Co. 555 Marion Road Columbus, Ohio 43207
21912	Anzac Electronics Div. of Adams-Russell Co., Inc. 39 Green Street Waltham, Mass. 02154
23615	Mark 1 Engineering Co. P.O. Box 32 Glendale, Calif. 91209
24602	E.M.C. Technology, Inc. 1300 Arch Street Phila., Penn. 19107
26805	Americon Microwave Industries, Incorporated 87 Rumford Avenue Waltham, Mass. 02154
27338	Addington Laboratories, Inc. 1043 Digiulio Avenue Santa Clara, Calif. 95050
27956	Relcom 3333 Hillview Avenue Palo Alto, Calif. 94304
28480	Hewlett Packard Company 1501 Page Mill Road Palo Alto, Calif. 94304

Mfr. Code	Name and Address
80058	Joint Electronic Type Designation System
80131	Electronic Industries Assoc. 2001 Eye Street, N.W. Washington, D.C. 20006
81349	Military Specifications
82389	Switchcraft, Inc. 5555 North Elston Avenue Chicago, Illinois 60630
83086	New Hampshire Ball Bearings, Incorporated Peterborough, N.H. 03458
87034	Marco-Oak Industries, Div. of Oak Electro/Netics Corporation 207 South Helena Street Anaheim, Calif. 92803
89110	AMP, Incorporated 155 Park Street Elizabethtown, Penn. 17022
91293	Johanson Manufacturing Co. P.O. Box 329 Boonton, New Jersey 07005
91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
91637	Dale Electronics, Inc. P.O. Box 609 Columbus, Nebraska 68601
91984	Maida Development Company 214 Academy Street Hampton, Virginia 23369
92825	Whitso Incorporated 9330 Byron Street Schiller Park, Ill. 60176
93332	Sylvania Electric Proc., Inc. Semiconductor Products Div. 100 Sylvan Road Woburn, Mass. 01801
93958	Republic Electronics Corp. 176 East 7th Street Paterson, New Jersey 07524
95146	Alco Electronics Prod., Inc. 3 Walcott Avenue Lawrence, Mass. 01843
96341	Microwave Associates Inc. South Avenue Burlington, Mass. 01801
96733	San Fernando Electric Manufacturing Co. 1501 First Street San Fernando, Calif. 91341
96906	Military Standards
99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, N.Y. 14052
99848	Wilco Corporation 4030 West 10th Street P.O. Box 22248 Indianapolis, Indiana 46222

Mfr. Code	Name and Address
29990	American Technical Ceramics Div. of Phase Industries 1 Norden Lane Huntington Station, N.Y. 11746
50140	K and L Microwave, Inc. 203 Newton Street Salisbury, Md. 21801
56289	Sprague Electric Company Marshall Street North Adams, Mass. 01247
71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, Mss. 02138
71400	Bussman Manufacturing Div. of McGraw-Edison Co. 2536 W. University Street St. Louis, Missouri 63107
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640
71785	Cinch Manufacturing Co. Howard B. Jones Division 1026 South Homan Avenue Chicago, Illinois 60624
72259	Nytronics, Incorporated 10 Pelham Parkway Pelham Manor, N.Y. 10803
72982	Erie Technological Prod., Inc. 644 West 12th Street Erie, Penn. 16512
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, Calif. 92634
73734	Federal Screw Products, Inc. 3917 North Kenzie Avenue Chicago, Illinois 60618
73899	JFD Electronics Co. Div. of Stratford Retreat House 15th at 62nd Street Brooklyn, N.Y. 11219
74306	Piezo Crystal Company 100 K Street Carlisle, Penn. 17013
74868	Bunker Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, Conn. 06810
75042	IRC Division of TRW Inc. 401 North Broad Street Phila., Penn. 19108
75915	Littelfuse, Incorporated 800 E. Northwest Highway Des Plaines, Illinois 60016
78189	Illinois Tool Works, Inc. Shakeproof Division St. Charles Road Elgin, Illinois 60126
79136	Waldes Kohinoor, Inc. 47-16 Austel Place Long Island City, N.Y. 11101

5.4 PARTS LIST

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

NOTE

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

5.4.1 Type WJ-9080A Tuner, Main Chassis

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	2160 MHz IF AMPLIFIER/CONVERTER	1	71412	14632	
A2	160 MHz POWER SPLITTER/AMPLIFIER	1	791272	14632	
A3	160/21.4 MHz CONVERTER	1	791169	14632	
A4	TUNING DRIVE ASSEMBLY	1	85115	14632	
A5	POWER SUPPLY	1	76210-1	14632	
A6	POWER SUPPLY	1	76210-6	14632	
A7+	AFC/ANALOG TUNE	1	78101-X	14632	
A8	CRYSTAL MARKER OSCILLATOR	1	8310	14632	
A9	CONVERTER	1	71411	14632	
A10	160 MHz AMPLIFIER	1	72436	14632	
A11	IF COUPLER	1	791335-2	14632	
A12	REMOTE RANGE CONTROL	1	791323	14632	
AT1*	ATTENUATOR	2	A401M	18203	
AT1*	ATTENUATOR	2	A402M	18203	
AT1*	ATTENUATOR	2	A403M	18203	
AT1*	ATTENUATOR	2	A406M	18203	
AT2	TERMINATION	1	T150N	24602	
AT3	Same as AT1				
AT4	ATTENUATOR	1	A420M	18203	

\+ Customer selected
* Factory selectable from 1, 2, 3, or 6 dB, or may not be required.

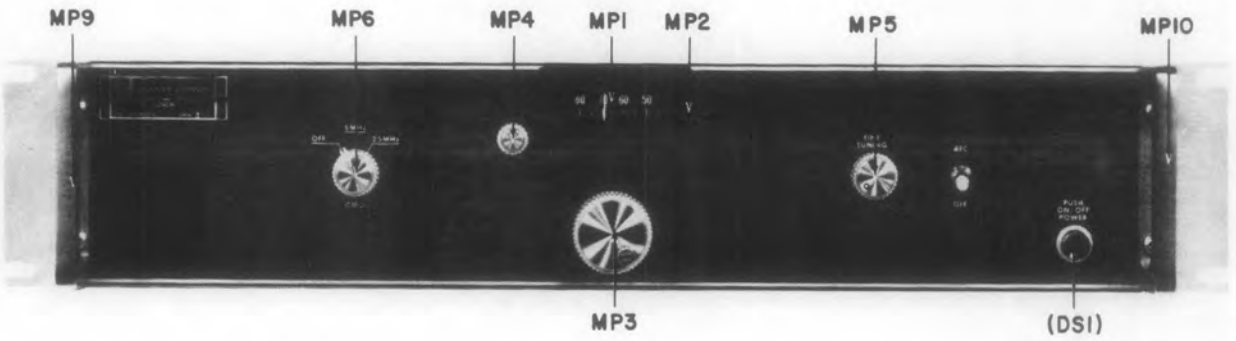


Figure 5-1. Type WJ-9080A Tuner, Front View, Location of Components

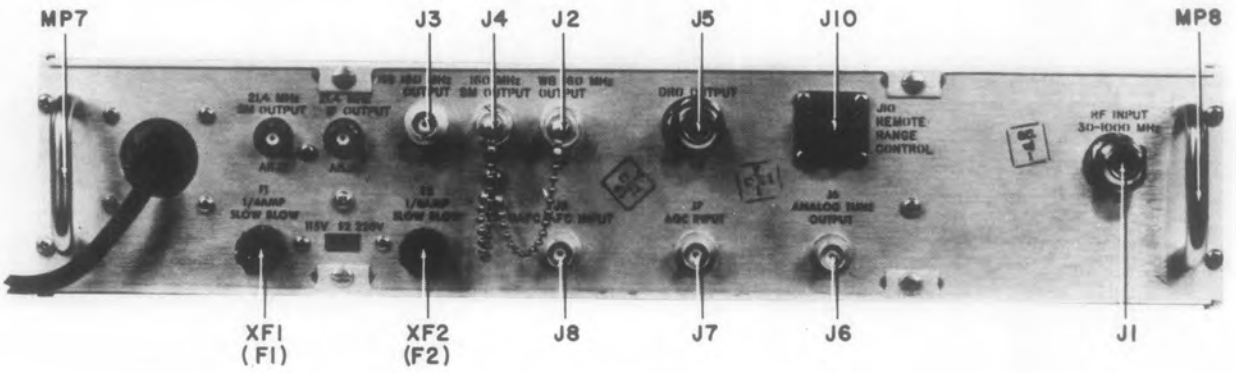


Figure 5-2. Type WJ-9080A Tuner, Rear View, Location of Components

REF DESIG	DESCRIPTION		QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
T5**	Same as AT1					
T6	ATTENUATOR		1	4402	24602	
T7	TERMINATION		2	35650-0051	74868	
T8	Same as AT7					
1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 1000 μF, +75-10%, 40 V		1	39D108G040GP4	56289	
2	CAPACITOR, ELECTROLYTIC, ALUMINUM: 500 μF, +75-10%, 30 V		1	39D507G030FL4	56289	
3	CAPACITOR, ELECTROLYTIC, ALUMINUM: 350 μF, +75-10%, 50 V		2	39D357G050FL4	56289	
4	Same as C3					
5	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.33 μF, 10%, 35 V		1	CS13BF334K	81349	01121
S1	LAMP, NEON	Part of S1	1	A1H	87034	
L1	POWER LINE FILTER		1	23154-1	14632	
L2	FILTER, LOW-PASS		1	5L120-1100-0	50140	
L3	FILTER, LOW-PASS		1	7L250-1500-0	50140	
L4	FILTER, LOW-PASS		1	6L250-5100-0	50140	
1	FUSE, CARTRIDGE: 1/4 AMP, 3AG		1	MDL1/4	71400	
2	FUSE, CARTRIDGE: 1/8 AMP, 3AG		1	MDL1/8	71400	
	CONNECTOR, RECEPTACLE	Part of W1	1	3004-7188-10	26805	
2	CONNECTOR, RECEPTACLE	Part of W16	5	17825-1002	74868	
3	Same as J2	Part of W17				
4	Same as J2	Part of W18				
	** Factory selectable from 1 or 2 dB.					

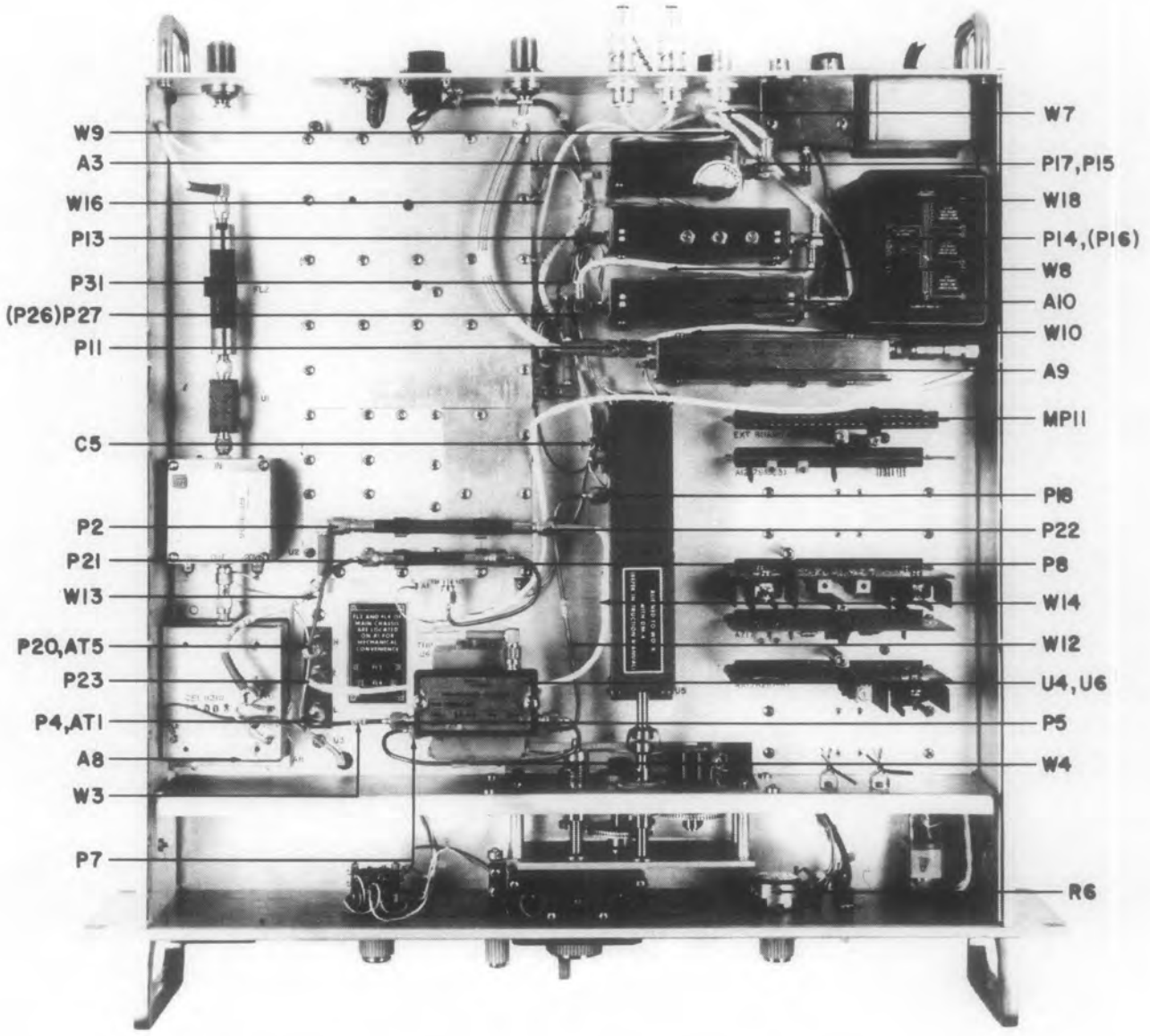


Figure 5-3. Type WJ-9080A Tuner, Top View, Location of Components

REF DESIG	DESCRIPTION		QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
5	CONNECTOR, JACK	Part of W11	1	3004-7141-10	26805	
6	CONNECTOR, RECEPTACLE		5	17825-1002	74868	
7	Same as J2					
8	Same as J2					
9	ADAPTER, CONNECTOR		1	218	16179	
10	CONNECTOR, RECEPTACLE		1	L12TE10S2NA	09922	
MP1	WINDOW		1	11448-4	14632	
MP2	WINDOW		1	11449-1	14632	
MP3	KNOB		1	11755-5	14632	
MP4	KNOB		1	PS50-1 (GREY)	21604	
MP5	KNOB		1	PS70D2 (GREY)	21604	
MP6	KNOB		1	PS70PL2 (GREY)	21604	
MP7	HANDLE		2	415-1252-02-02	71279	
MP8	Same as MP7					
MP9	HANDLE		2	32306-2	14632	
MP10	Same as MP9					
MP11	EXTENDER CARD		1	79878	14632	
MP12	COVER		2	32574-3	14632	
MP13	Same as MP12					
	CONNECTOR, PLUG	Part of W1	7	521-3	16179	
2	CONNECTOR, PLUG	Part of W2	3	501-3	16179	

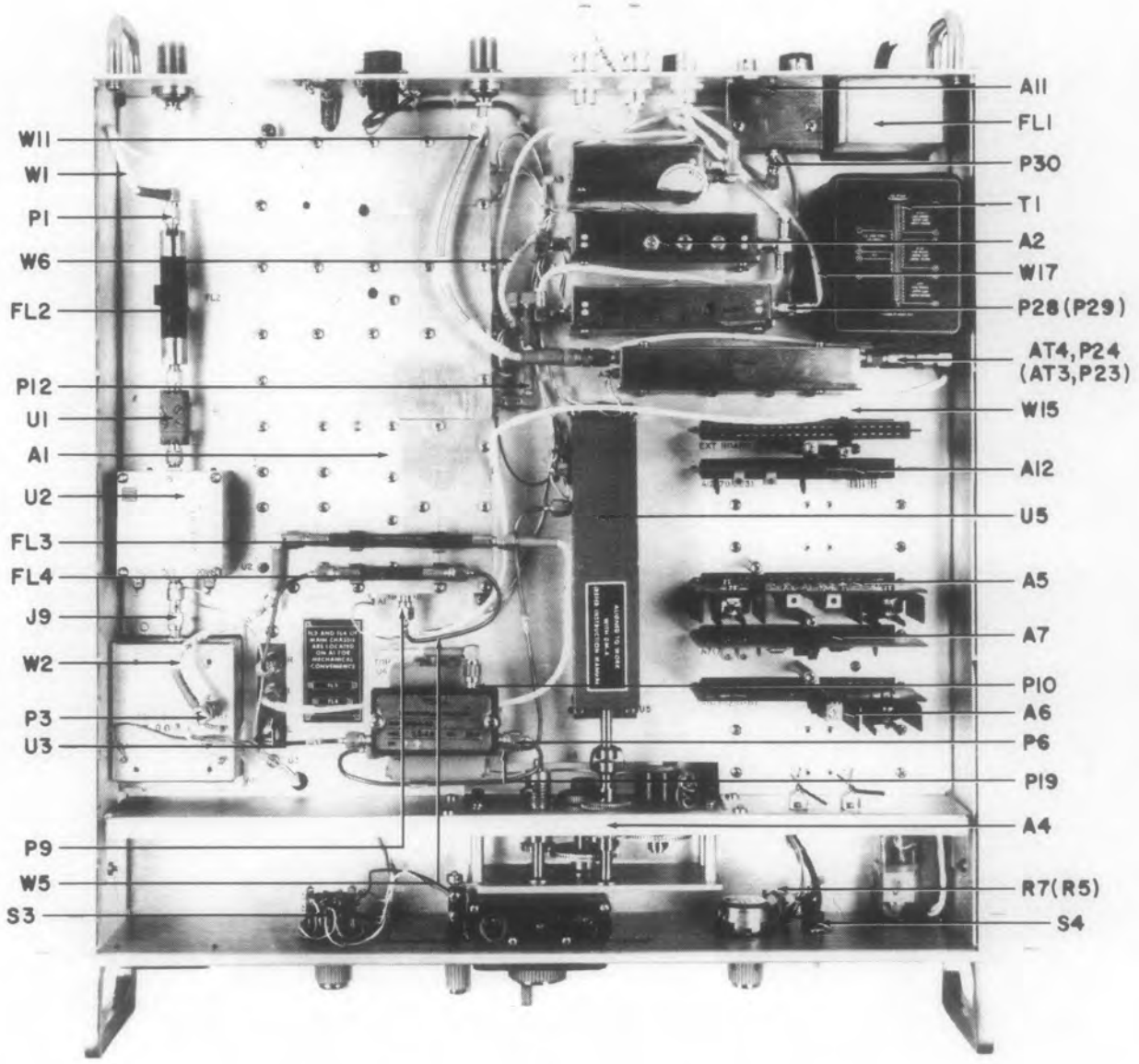


Figure 5-4. Type WJ-9080A Tuner, Top View, Location of Components

REF DESIG	DESCRIPTION		QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
3	Same as P1	Part of W2				
4	CONNECTOR, PLUG	Part of W3	10	201-2A	16179	
5	Same as P4	Part of W3				
6	Same as P4	Part of W4				
7	Same as P4	Part of W4				
8	Same as P4	Part of W5				
9	Same as P4	Part of W5				
10	Same as P1	Part of W10				
11	CONNECTOR, PLUG	Part of W11	1	521-1	16179	
12	Same as P1	Part of W6				
13	CONNECTOR, PLUG	Part of W6	10	UG-1466/U	80058	74868
14	Same as P13	Part of W7				
15	Same as P13	Part of W7				
16	Same as P13	Part of W8				
17	Same as P13	Part of W9				
18	Same as P4	Part of W12				
19	Same as P4	Part of W12				
20	Same as P4	Part of W13				
21	Same as P4	Part of W13				
22	Same as P2	Part of W14				
23	Same as P2	Part of W14				

REF DESIG	DESCRIPTION		QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
24	Same as P1	Part of W10				
25	Same as P1	Part of W15				
26	Same as P13	Part of W16				
27	Same as P13	Part of W8				
28	Same as P13	Part of W17				
29	Same as P13	Part of W18				
30	Same as P13	Part of W9				
31	Same as P1	Part of W15				
1	RESISTOR, FIXED, COMPOSITION: 27 k, 5%, 1/2W		1	RCR20G273JS	81349	01121
2	RESISTOR, FIXED, WIRE-WOUND: 0.22 Ω, 5%, 2W		1	BWH0.22J	75042	
3	RESISTOR, FIXED, WIRE-WOUND: 1.0 Ω, 5%, 2W		2	BWH10HMJ	75042	
4	Same as R3					
5	RESISTOR, FIXED, COMPOSITION: 5.1 k, 5%, 1/4W		1	RCR07G512JS	81349	01121
6	RESISTOR, VARIABLE, COMPOSITION: 10 k, 10%, 2W		1	RV4NAYSD103A	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 10 k, 5%, 1/4W		1	RCR07G103JS	81349	01121
1	SWITCH, PUSH		1	671-6A1H	87034	
2	SWITCH, SLIDE		1	11A11211	82389	
3	SWITCH, ROTARY		1	1128-03	14632	
4	SWITCH, TOGGLE		1	MST115D	95146	
1	TRANSFORMER		1	17359-1	14632	
1	RF LIMITER		1	791317	14632	

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
2	AMPLIFIER	1	17468	14632	
3	MIXER, DOUBLE BALANCED	1	M1K	27956	
4	COUPLER, DIRECTIONAL	1	20054-20	16179	
5	OSCILLATOR, MICROWAVE TUNED	1	17335-1	14632	
6	ISOLATOR	1	217-0300	27338	
1	CABLE ASSEMBLY	1	17300-30-1	14632	
2	CABLE ASSEMBLY	1	17300-30-2	14632	
3	CABLE ASSEMBLY	1	17300-30-3	14632	
4	CABLE ASSEMBLY	1	17300-30-4	14632	
5	CABLE ASSEMBLY	1	17300-30-5	14632	
6	CABLE ASSEMBLY	1	17300-30-6	14632	
7	CABLE ASSEMBLY	1	17300-30-7	14632	
8	CABLE ASSEMBLY	1	17300-30-8	14632	
9	CABLE ASSEMBLY	1	17300-30-9	14632	
10	CABLE ASSEMBLY	1	17300-30-10	14632	
11	CABLE ASSEMBLY	1	17300-30-11	14632	
12	CABLE ASSEMBLY	1	17300-30-12	14632	
13	CABLE ASSEMBLY	1	17300-30-13	14632	
14	CABLE ASSEMBLY	1	17300-30-14	14632	
15	CABLE ASSEMBLY	1	17300-30-15	14632	
16	CABLE ASSEMBLY	1	17300-30-16	14632	

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
W17	CABLE ASSEMBLY	1	17300-30-17	14632	
W18	CABLE ASSEMBLY	1	17300-30-18	14632	
XA5	CONNECTOR, PC BOARD	4	250-22-30-170	71785	
XA6	Same as XA5				
XA7	Same as XA5				
XA12	Same as XA5				
XF1	FUSEHOLDER	2	342004	75915	
XF2	Same as XF1				

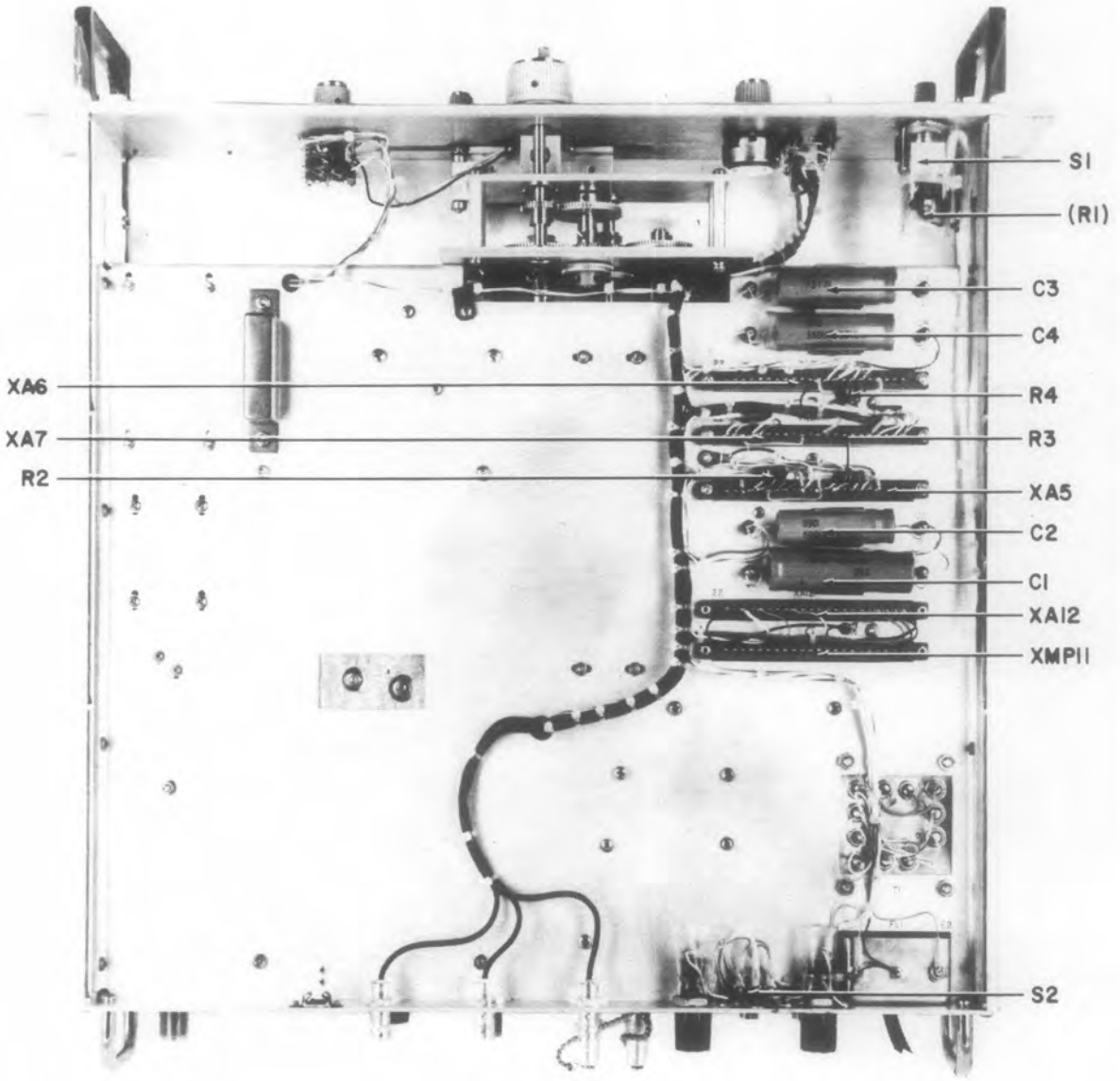


Figure 5-5. Type WJ-9080A Tuner, Bottom View, Location of Components

5.4.2 Type 71412 2160 MHz IF Amplifier/Converter

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	2160 MHz IF AMPLIFIER	1	17437	14632	
A2	MIXER	1	17438	14632	
A3	160 MHz PREAMPLIFIER	1	17439	14632	
A4	2.0 GHz OSCILLATOR	1	17637	14632	
A5	STRIPLINE CARD	1	17443	14632	
A6	2 GHz OSCILLATOR	1	17638	14632	
AT1	TERMINATION	1	08-125T	24602	
C1	TUNING SLUG CAPACITOR	5	6925	91293	
C2	Same as C1				
C3	TUNING SLUG CAPACITOR	4	6926	91293	
C4	Same as C3				
C5	Same as C1				
C6	Same as C1				
C7	Same as C3				
C8	Same as C3				
C9	Same as C1				
C10	CAPACITOR, ELECTROLYTIC, TANTALUM: 220 µF, 20%, 10 V	1	196D227X0010TE4	56289	
C11	CAPACITOR, ELECTROLYTIC, TANTALUM: 150 µF, 10%, 15 V	1	CS13BD157K	81349	56289
L1 thru L5	FILTER, LOW-PASS	9	859249-1	00779	
L6	NOT USED				

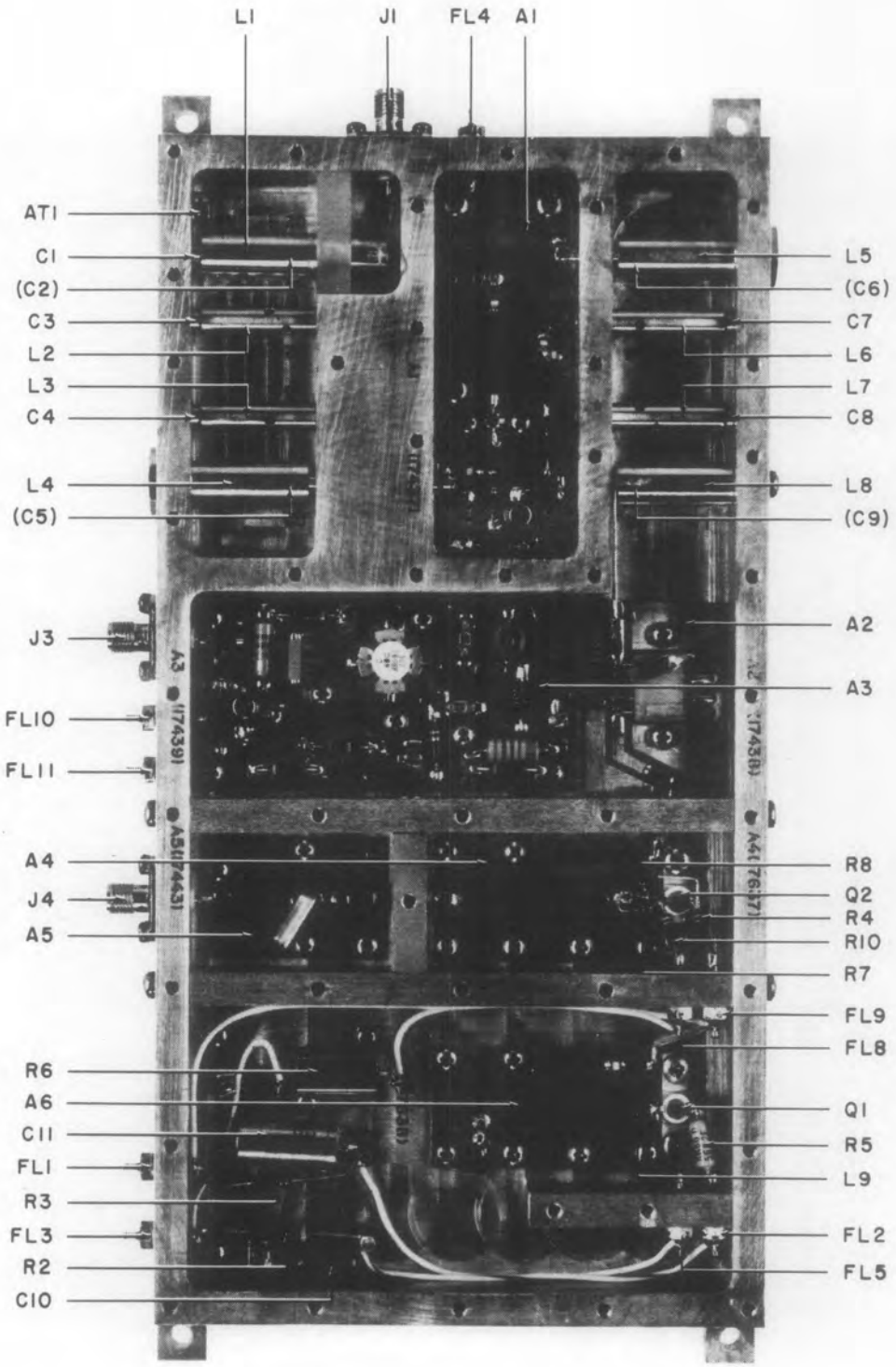


Figure 5-6. Type 71412 2160 MHz IF Amplifier/Converter (A1), Location of Components

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
L7	NOT USED				
L8 thru L11	Same as FL1				
	CONNECTOR, RECEPTACLE	3	2052-1352	26805	
	NOT USED				
	Same as J1				
	Same as J1				
1	RESONATOR	1	23500-1	14632	
2	RESONATOR	4	17429-1	14632	
3	Same as L2				
4	RESONATOR	1	17434-1	14632	
5	RESONATOR	1	17434-2	14632	
6	Same as L2				
7	Same as L2				
8	RESONATOR	1	23501-1	14632	
9	INDUCTOR	1	17436-1	14632	
P1	COVER	1	33514-1	14632	
P2	COVER	2	QTXR-4996	28480	
	TRANSISTOR			28480	
2	Same as Q1				
	NOT USED				

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R2	RESISTOR, FIXED, COMPOSITION: 620 Ω, 5%, 1/2W	1	RCR20G621JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 51 Ω, 5%, 1/4W	3	RCR07G510JS	81349	01121
R4	Same as R3				
R5	RESISTOR, FIXED, FILM: 56.2 Ω, 1%, 1/4W	1	RN60D56R2F	81349	75042
R6	RESISTOR, FIXED, WIRE-WOUND: 200 Ω, 1%, 5W	1	RH5-200PORM1PCT	91637	
R7	RESISTOR, FIXED, COMPOSITION: 4.7 Ω, 5%, 1/8W	2	RCR05G4R7JS	81349	01121
R8	Same as R7				
R9	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349	01121
R10	Same as R3				

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	CAPACITOR, CERAMIC, DISC: 100 pF, 10%, 50 V	4	ATC100A101KC50	29990	
C2	Same as C1				
C3	Same as C1				
C4	CAPACITOR, VARIABLE, AIR: .3-1.2 pF, 500 V	1	7263	91293	
C5	Same as C1				
C6	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 200 V	1	8131A200Z5U103M	72982	
Q1	TRANSISTOR	1	2N3251	80131	04713
Q2	TRANSISTOR	1	35866E	28480	
R1	RESISTOR, FIXED, COMPOSITION: 2.4 k, 5%, 1/8W	1	RCR05G242JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 560 Ω, 5%, 1/8W	1	RCR05G561JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 4.7 k, 5%, 1/8W	1	RCR05G472JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 5.6 k, 5%, 1/8W	1	RCR05G562JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/8W	1	RCR05G470JS	81349	01121

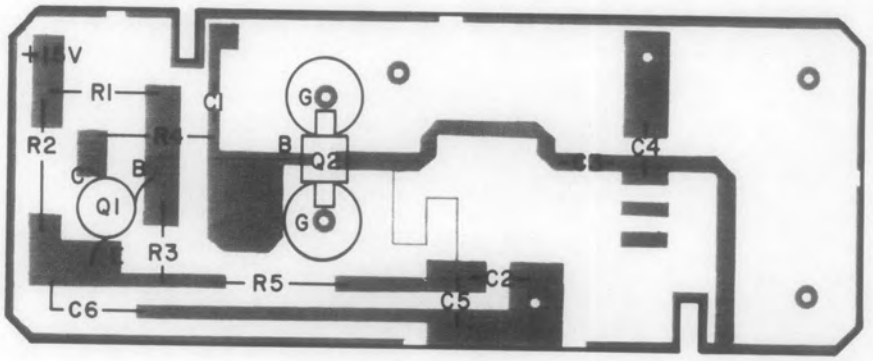


Figure 5-7. Part 17437 2160 MHz IF Amplifier (A1A1), Location of Components

4.2.2 Part 17438, 2.16 GHz Mixer

REF DESIG PREFIX A1A2

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	MIXER, BALANCED	1	MD123	21912	

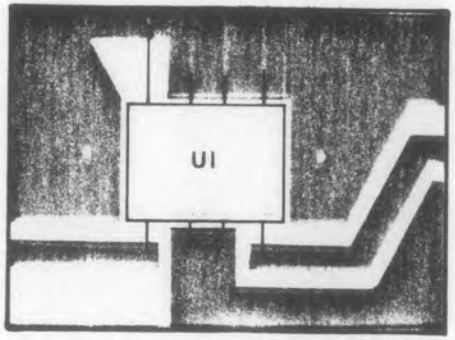


Figure 5-8. Part 17438 2.16 GHz Mixer (A1A2), Location of Components

REF DESIG PREFIX A1A3

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	DIODE	1	MA47200	96341	
C1	CAPACITOR, CERAMIC, CHIP: 3300 pF, 10%, 25 V	3	SC25BX332K	96733	
C2	CAPACITOR, CERAMIC, DISC: 20 pF, 5%, 300 V	1	UY01200J	73899	
C3	CAPACITOR, CERAMIC, DISC: 39 pF, 5%, 300 V	1	UY01390J	73899	
C4	Same as C1				
C5	CAPACITOR, CERAMIC, DISC: 0.01 μF, 10%, 200 V	1	CK05BX103K	81349	56289
C6	Same as C1				
L1	COIL, FIXED: 0.82 μH, 10%	1	1537-10	99800	
L2	COIL	1	1129-47	14632	
L3	COIL, FIXED: 0.33 μH, 10%	1	1537-04	99800	
Q1	TRANSISTOR	1	MCS-80091	32421	
Q2	TRANSISTOR	1	2N3251	80131	04713
R1	RESISTOR, FIXED, COMPOSITION: 620 Ω, 5%, 1/4W	2	RCR07G621JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 5.1 k, 5%, 1/4W	1	RCR07G512JS	81349	01121
R3	Same as R1				
R4	RESISTOR, FIXED, COMPOSITION: 2.4 k, 5%, 1/4W	1	RCR07G242JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 51 Ω, 5%, 1/4W	1	RCR07G510JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 4.7 Ω, 5%, 1/4W	1	RCR07G4R7JS	81349	01121

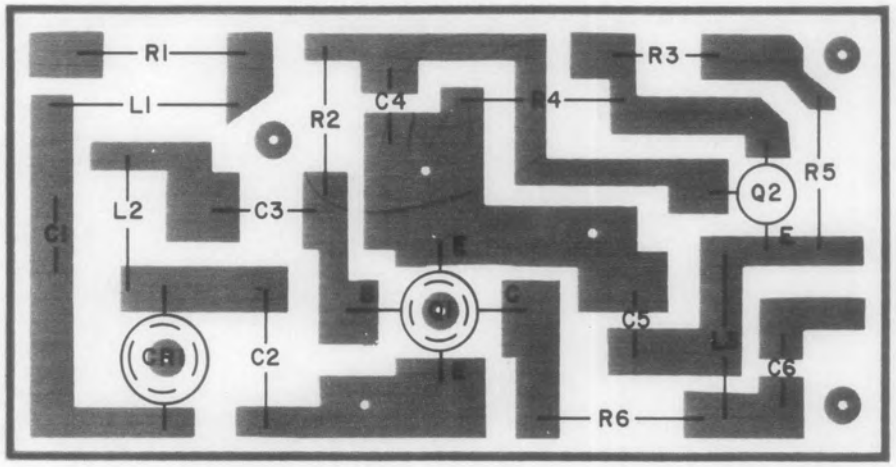


Figure 5-9. Part 17439 160 MHz Preamplifier (A1A3), Location of Components

4.2.4 Part 17637, 2 GHz Amplifier

REF DESIG PREFIX A1A4

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	CAPACITOR, CERAMIC, CHIP: 3300 pF, 10%, 25 V	1	SC25BX332K	96733	

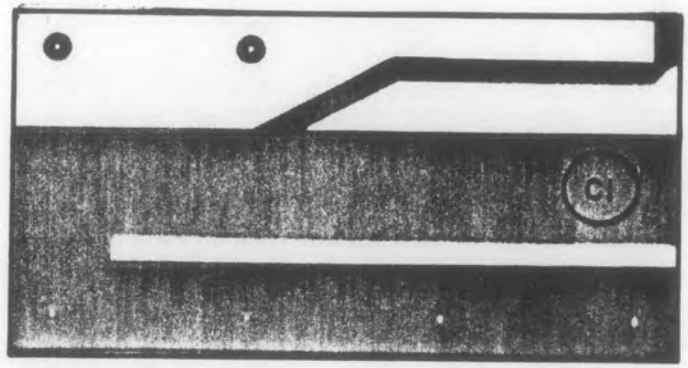


Figure 5-10, Part 17637 2 GHz Amplifier (A1A4), Location of Components

4.2.4 Part 17638 2 GHz Oscillator REF DESIG PREFIX A1A6

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	CAPACITOR, CERAMIC, DISC: 100 pF, 10%, 50 V	2	ATC100A101KC50	29990	
	CAPACITOR, VARIABLE, AIR: .3-1.2 pF, 500 V	1	7263	91293	
	Same as C1				

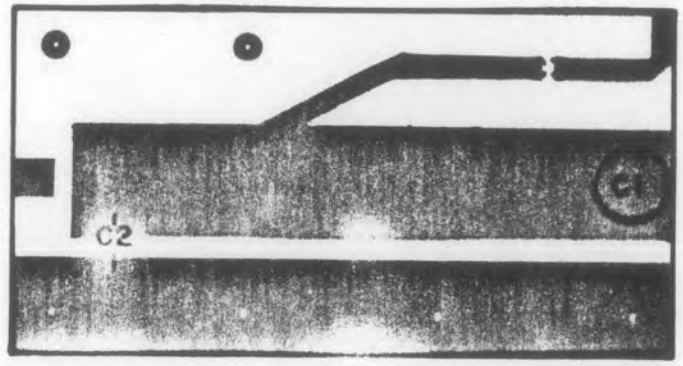


Figure 5-11. Part 17638 2 GHz Oscillator (A1A6), Location of Components

5.4.3 Type 791272, 160 MHz Power Splitter/Amplifier

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	POWER SPLITTER/AMPLIFIER	1	17409	14632	
C1	CAPACITOR, CERAMIC, TUBULAR: 10 pF, ±0.5 pF, 500 V	1	301-000C0H0-100D	72982	
C2	CAPACITOR, VARIABLE, AIR: 0.8-10.0 pF, 250 V	3	5202	91293	
C3	CAPACITOR, CERAMIC, TUBULAR: 22 pF, 5%, 500 V	2	301-000C0G0-220J	72982	
C4	CAPACITOR, CERAMIC, TUBULAR: 2.0pF, ± .25pF, 500 V	1	301-000C0K0-209C	72982	
C5	Same as C2				
C6	Same as C3				
C7	CAPACITOR, CERAMIC, TUBULAR: 6.8 pF, ±0.25 pF, 500 V	1	301-000C0H0-689C	72982	
C8	Same as C2				
L1	FILTER	1	1-859249-1	89110	
	CONNECTOR, RECEPTACLE	3	10-0104-002	19505	
J2	Same as J1				
J3	Same as J1				
L1	COIL, FIXED: .47 μH, 10%	1	1537-06	99800	
L2	COIL, FIXED	2	1129-47	14632	
L3	Same as L2				
MP1	COVER	1	17399-1	14632	

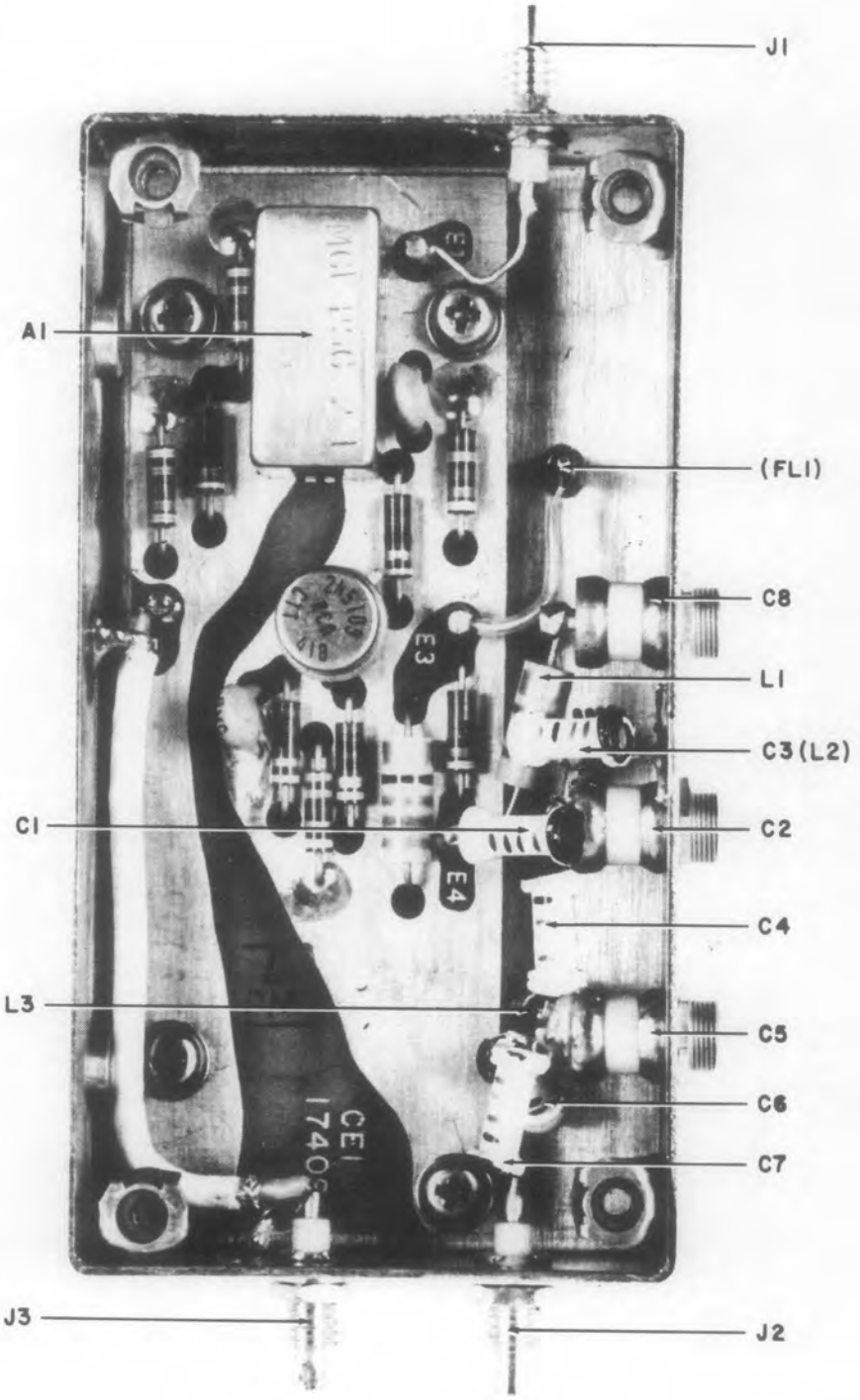


Figure 5-12. Type 791272 160 MHz Power Splitter/Amplifier (A2), Location of Components

5.4.3.1 Part 17409, 160 MHz Power Splitter and Amplifier

REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	2	SM1000PFP	91418	
C2	Same as C1				
L1	COIL, FIXED, MOLD: 1.8 μH, 10%	1	1537-18	99800	
Q1	TRANSISTOR	1	2N5109	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 430 Ω, 5%, 1/4W	2	RCR07G431JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 12 Ω, 5%, 1/4W	1	RCR07G120JS	81349	01121
R3	Same as R1				
R4	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	RCR07G220JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 130 Ω, 5%, 1/4W	1	RCR07G131JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	1	RCR07G682JS	81349	01121
R8	RESISTOR, FIXED, COMPOSITION: 510 Ω, 5%, 1/4W	1	RCR07G511JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349	01121
T1	DIVIDER, POWER	1	PSC2-1	15542	

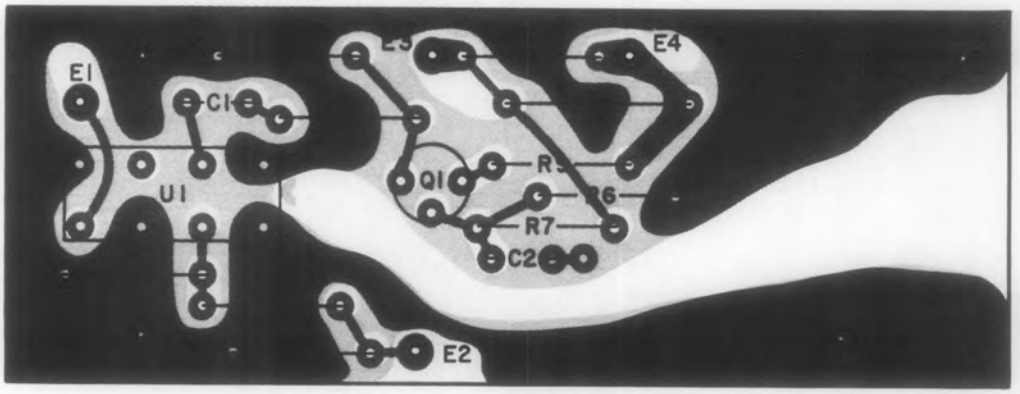


Figure 5-13. Part 17409 160 MHz Power Splitter/Amplifier (A2A1), Location of Components

5.4.4 Type 791169,160/21.4 MHz Converter

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	CONVERTER	1	17188	14632	
FL1	FILTER	1	859550-1	00779	
J1	CONNECTOR, RECEPTACLE	2	10-0104-002	19505	
J2	Same as J1				
MP1	COVER	1	23272-1	14632	

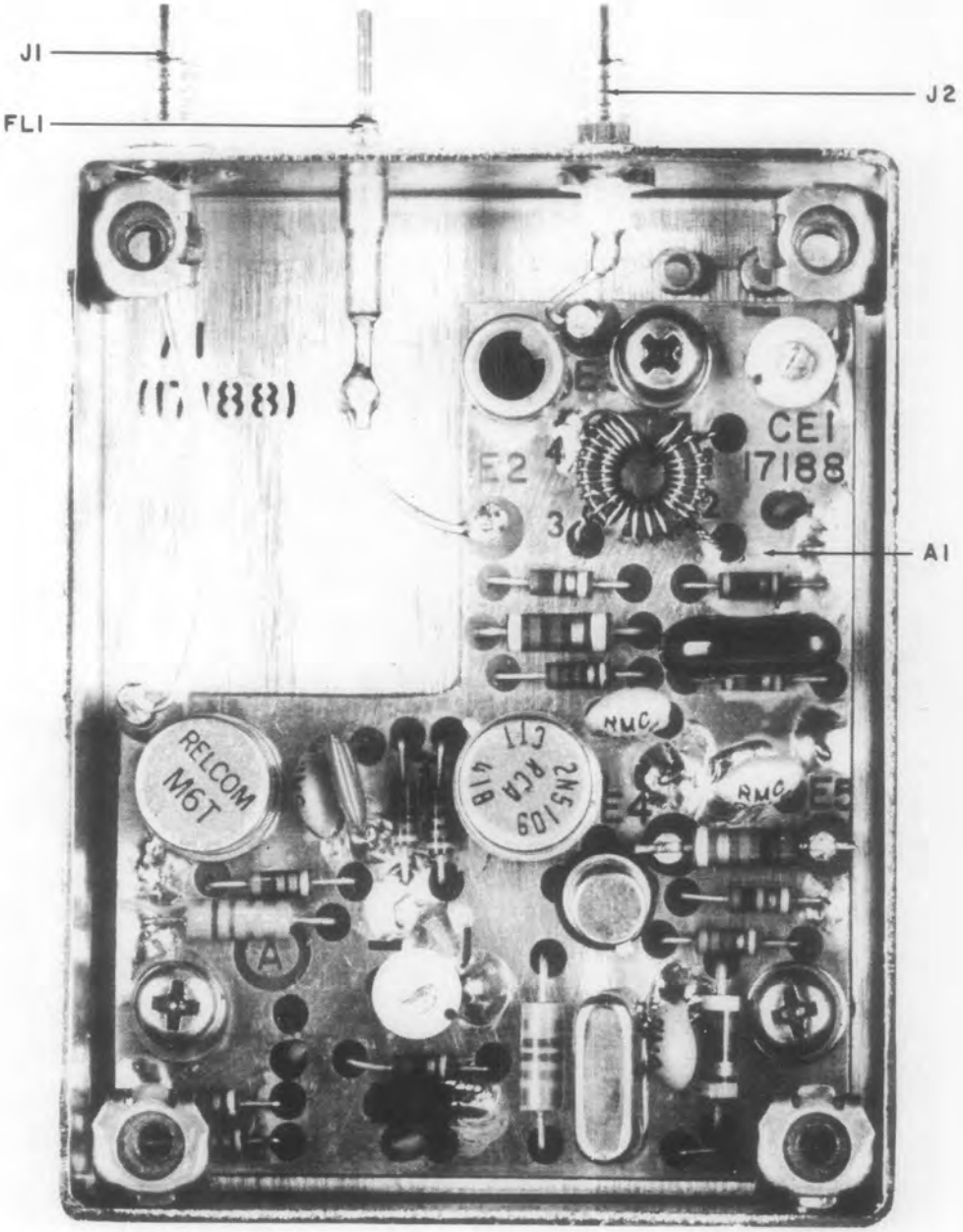


Figure 5-14. Type 791169 160/21.4 MHz Converter (A3), Location of Components

.4.4.1 Part 17188,160/21.4 MHz Converter

REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	CAPACITOR, CERAMIC, DISC: 1 pF, ±0.25 pF, 50 V	1	1C1RC	93958	
2	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	4	SM1000PFP	91418	
3	CAPACITOR, VARIABLE, CERAMIC: 2.5-9 pF, 25 V	1	518-000A2.5-9	72982	
4	CAPACITOR, CERAMIC, DISC: 2.5 pF, 10%, 50 V	1	1C2.5RK	93958	
5	CAPACITOR, CERAMIC, DISC: 22 pF, 10%, 200 V	1	CK05BX220K	81349	56289
6	Same as C2				
7	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 200 V	1	8131A200Z5U103M	72982	
8	Same as C2				
9	CAPACITOR, VARIABLE, CERAMIC: 5-25 pF, 25 V	1	518-000A5-25	72982	
10	NOT USED				
11	Same as C2				
12	NOT USED				
13	CAPACITOR, MICA, DIPPED: 47 pF, 2%, 500 V	1	CM05ED470G03	81349	72136
14	CAPACITOR, CERAMIC, DISC: 5 pF, 10%, 50 V	1	1C5RK	93958	
1 thru 5	TERMINAL	5	1019-2	71279	
1	COIL, FIXED: 0.10 μH, 10%	1	DD0.10	72259	
2	COIL, FIXED: 0.22 μH, 10%	1	1025-04	99800	
	TRANSISTOR	1	2N5109	80131	02735
	TRANSISTOR	1	2N3478	80131	02735
	RESISTOR, FIXED, COMPOSITION: 8.2 Ω, 5%, 1/8W	2	RCR05G8R2JS	81349	01121

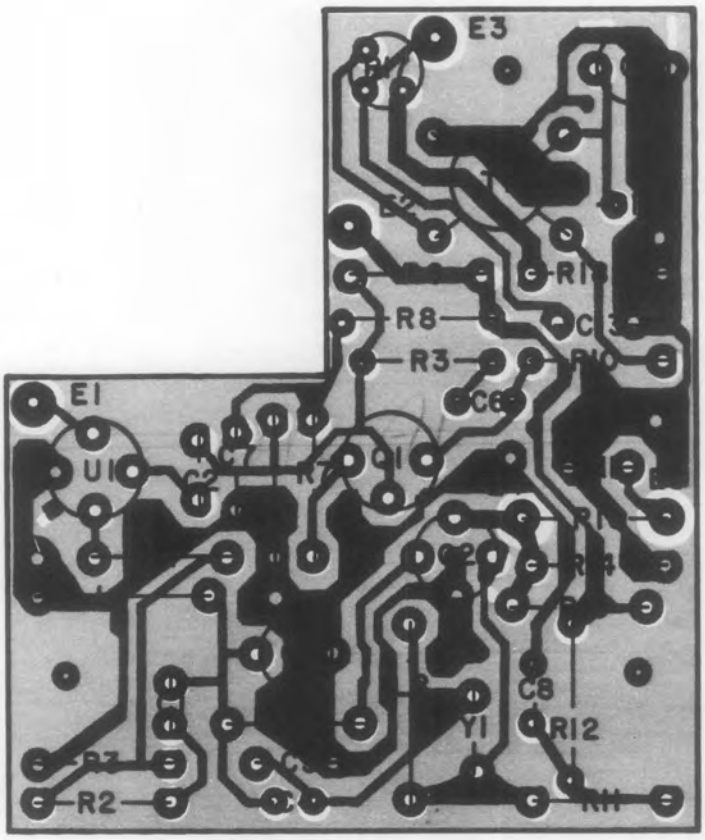


Figure 5-15. Part 17188 160/21.4 MHz Converter (A3A1), Location of Components

REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R2	Same as R1				
R3	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/8W	1	RCR05G151JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/8W	1	RCR07G822JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/8W	1	RCR05G821JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 12 kΩ, 5%, 1/8W	1	RCR05G123JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 5.6 Ω, 5%, 1/8W	1	RCR05G5R6JS	81349	01121
R8	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	RCR07G471JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/8W	1	RCR05G220JS	81349	01121
R10	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/8W	1	RCR05G470JS	81349	01121
R11	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/8W	1	RCR05G102JS	81349	01121
R12	Same as R8				
R13	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/8W	1	RCR05G682JS	81349	01121
R14	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/8W	1	RCR05G103JS	81349	01121
R15	NOT USED				
R16*	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/8W	1	RCR05G100JS	81349	01121
R17	RESISTOR, TRIM, FILM: 100 Ω, 10%, 1/2W	1	62PR100	73138	
R18	RESISTOR, FIXED, COMPOSITION: 62 Ω, 5%, 1/8W	1	RCR05G620JS	81349	01121
T1	COIL, TOROIDAL	1	22692-1	14632	
U1	MIXER, BALANCED	1	M6T	27956	
Y1	CRYSTAL, QUARTZ	1	98204-5	14632	

* Nominal value. Final value factory selected.

5.4.5 Type 85115 Tuning Drive Assembly

REF DESIG PREFIX A4

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
DS1	LAMP, INCANDESCENT	3	CM8-683	71744	
DS2	Same as DS1				
DS3	Same as DS1				
R1	RESISTOR, VARIABLE, WIRE-WOUND: 10 kΩ, 10%, 2W	1	8106R10K-L.25	73138	
R2	RESISTOR, FIXED, COMPOSITION: 2.0 kΩ, 5%, 1/4W	1	RCR07G202JS	81349	01121

Note: For mechanical parts, see exploded view.

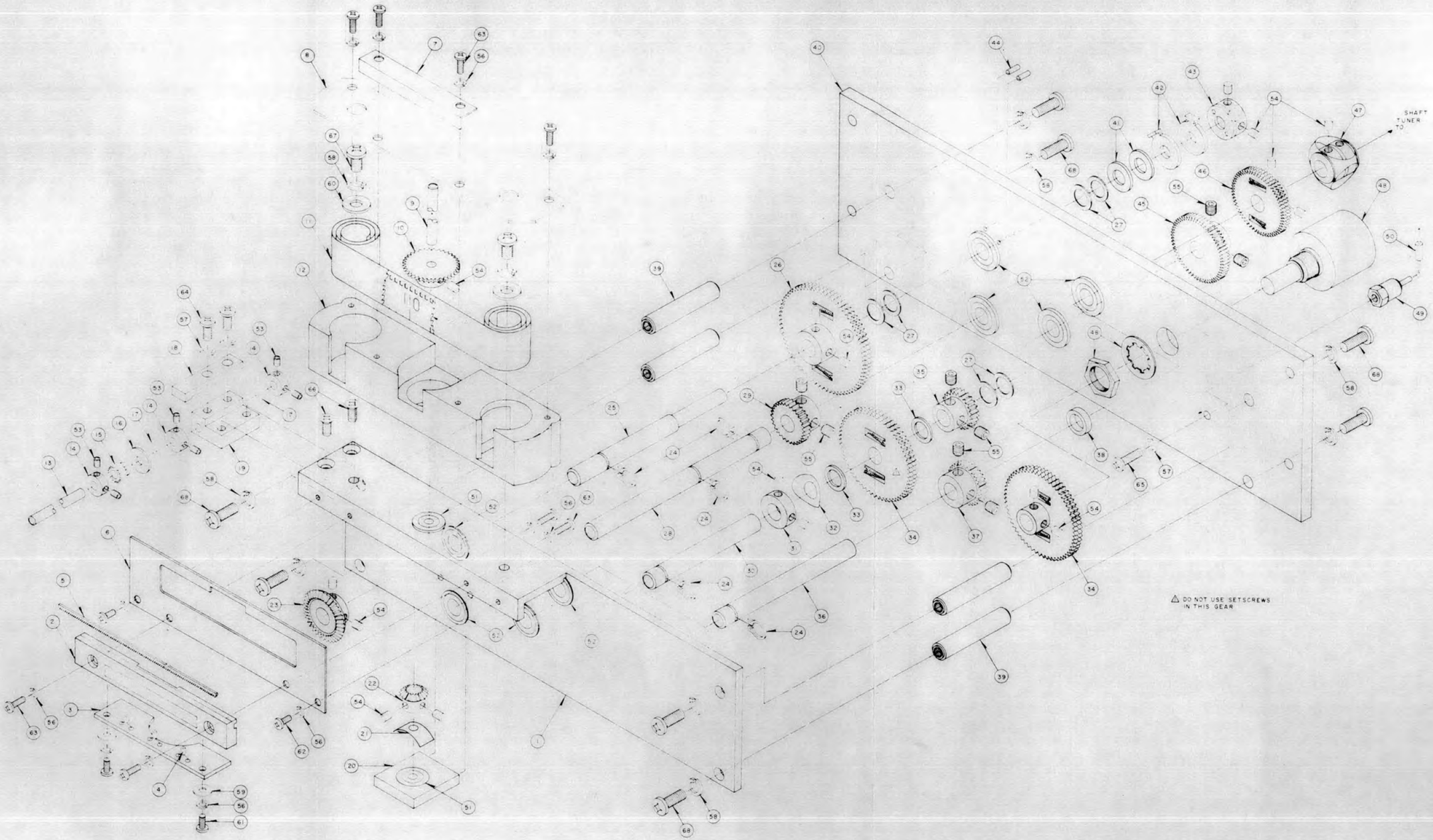


Figure 5-16 Type 85115 Tuning Drive, Exploded View (A4), Location of Components

REF DESIG PREFIX A5

G	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	CAPACITOR, MICA, DIPPED: 500 pF, 5%, 500 V	2	DM15-501J	72136	
	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35 V	2	196D225X0035JE3	56289	
	Same as C1				
	Same as C2				
	TRANSISTOR	2	2N3055	80131	04713
	Same as Q1				
	HEATSINK	2	6103B	13103	
	Same as RA1				
	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	2	RCR07G332JS	81349	01121
	RESISTOR, TRIM, FILM: 1 kΩ, 10%, 1/2W	2	62PAR1K	73138	
	RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W	2	RCR07G272JS	81349	01121
	Same as R1				
	Same as R2				
	Same as R3				
	DIODE	2	MDA920A3	04713	
	INTEGRATED CIRCUIT	2	U6A7723393	07263	
	Same as U1				
	Same as U2				

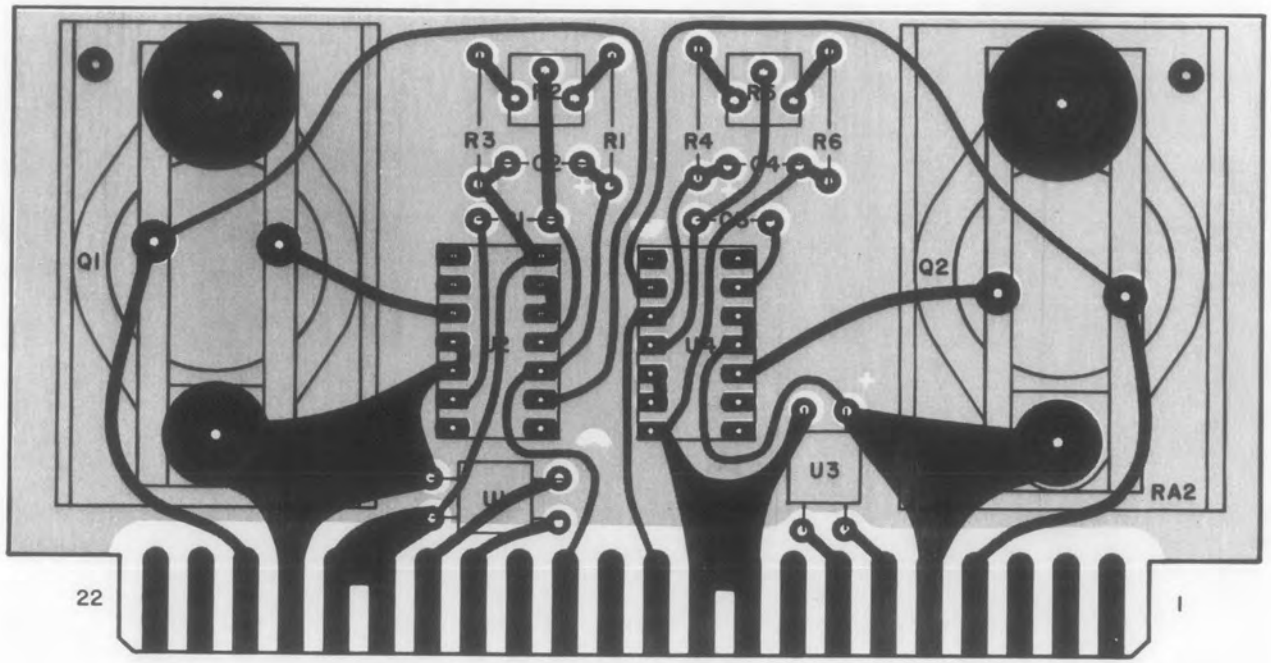


Figure 5-17. Type 76210-X Power Supply (A5, A6)
Location of Components

5.4.7 Type 76210-6 Power Supply

REF DESIG PREFIX A6

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	NOT USED				
C2	NOT USED				
C3	CAPACITOR, MICA, DIPPED: 500 pF, 5%, 500 V	1	DM15-501J	72136	
C4	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35 V	1	196D225X0035JE3	56289	
Q1	NOT USED				
Q2	TRANSISTOR	1	2N3055	80131	04713
HA1	NOT USED				
HA2	HEATSINK	1	6103B	13103	
R1	NOT USED				
R2	NOT USED				
R3	NOT USED				
R4	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349	01121
R5	RESISTOR, VARIABLE, FILM: 1 kΩ, 10%, 1/2W	1	62PAR1K	73138	
R6	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349	01121
U1	NOT USED				
U2	NOT USED				
U3	DIODE	1	MDA920A3	04713	
U4	INTEGRATED CIRCUIT	1	U6A7723393	07263	

5.4.8 Type 78101-X AFC/AGC/Analog Tune

REF DESIG PREFIX A7

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	DIODE	1	1N4449	80131	93332
C1	CAPACITOR, CERAMIC, DISC: 0.1 μF, 20%, 100 V	3	8131M100-651-104M	72982	
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μF, 10%, 35 V	2	CS13BF105K	81349	56289
C3	Same as C2				
C4	Same as C1				
C5	Same as C1				
R1 Thru R14	SEE SCHEMATIC, FIGURE 6-13				
R15	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	1	RCR07G104JS	81349	01121
R16	RESISTOR, VARIABLE, FILM: 1 kΩ, 10%, 3/4W	2	89PR1K	73138	
R17	Same as R16				
R18	RESISTOR, FIXED, COMPOSITION: 75 kΩ, 5%, 1/4W	1	RCR07G753JS	81349	01121
R19	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	2	RCR07G100JS	81349	01121
R20	Same as R19				
R21	RESISTOR, FIXED, COMPOSITION: 1.1 kΩ, 5%, 1/4W	2	RCR07G112JS	81349	01121
R22	Same as R21				
U1	INTEGRATED CIRCUIT	1	MC1458V	18324	

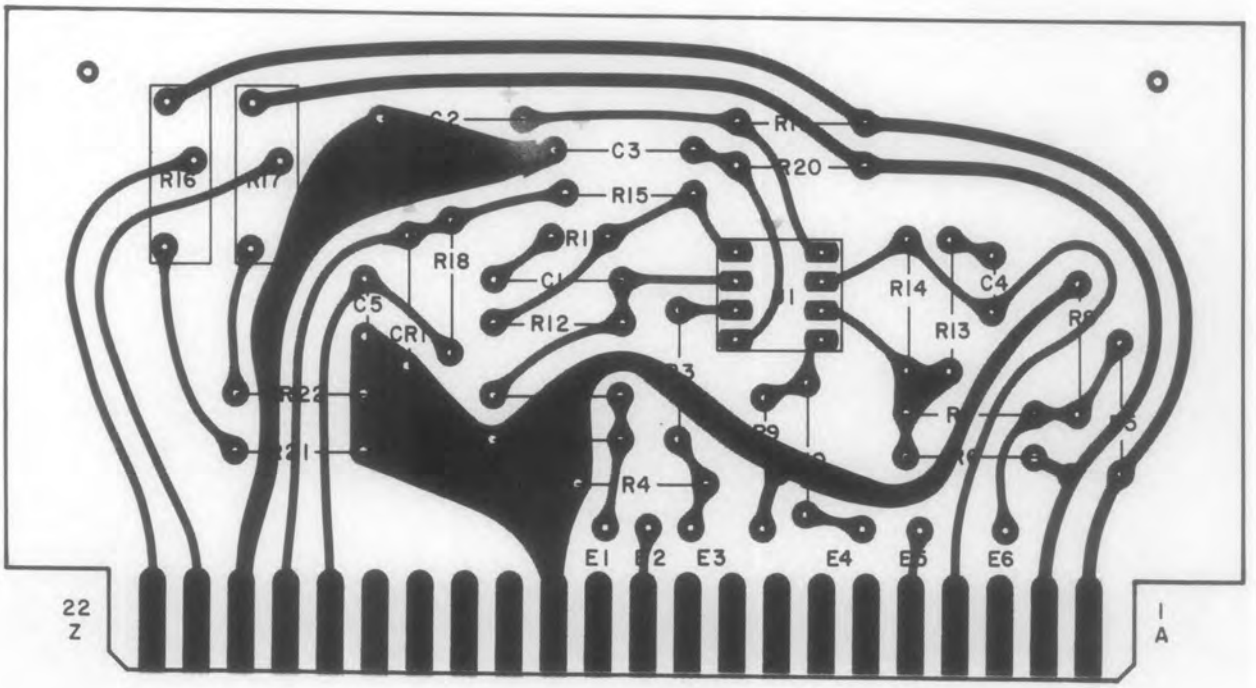


Figure 5-18. Type 78101-X AFC/AGC/Analog Tune (A7), Location of Components

4.9 Type 8310 Crystal Marker Oscillator

REF DESIG PREFIX A8

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	CRYSTAL MARKER OSCILLATOR	1	17410	14632	
L1	FILTER	3	1-859249-1	89110	
L2	Same as FL1				
L3	Same as FL1				
	CONNECTOR, RECEPTACLE	2	211	16179	
	Same as J1				
P1	COVER	1	17402-1	14632	
	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349	01121

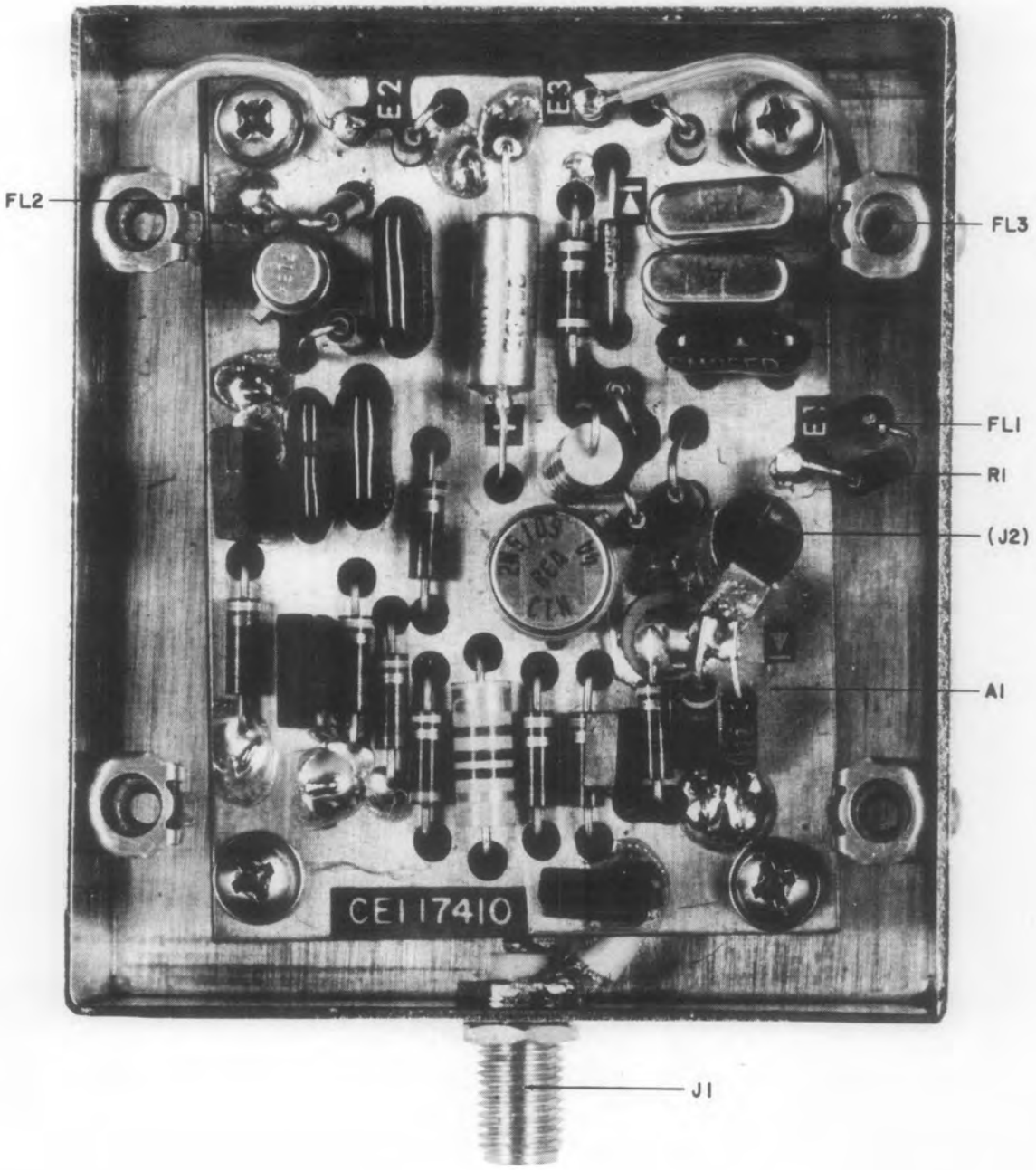


Figure 5-19. Type 8310 Crystal Marker Oscillator (A8), Location of Components

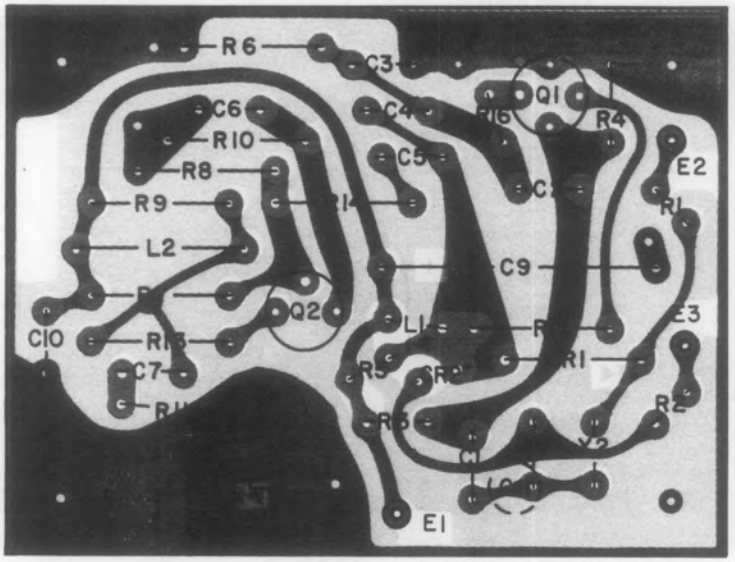


Figure 5-20. Part 17410 5/25 MHz CMO (A8A1), Location of Components

REF DESIG PREFIX A8A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
3	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	RCR07G822JS	81349	01121
4	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349	01121
5	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	2	RCR07G102JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 510 Ω, 5%, 1/4W	1	RCR07G511JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 3.0 kΩ, 5%, 1/4W	1	RCR07G302JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	1	RCR07G821JS	81349	01121
9	Same as R5				
10	RESISTOR, FIXED, COMPOSITION: 110 Ω, 5%, 1/4W	1	RCR07G111JS	81349	01121
11	RESISTOR, FIXED, COMPOSITION: 20 Ω, 5%, 1/4W	1	RCR07G200JS	81349	01121
12	RESISTOR, FIXED, COMPOSITION: 51 Ω, 5%, 1/4W	1	RCR07G510JS	81349	01121
13	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	3	RCR07G100JS	81349	01121
14	Same as R13				
15	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349	01121
16	Same as R13				
	CRYSTAL, QUARTZ	1	CR64U-5.000MHZ	81349	74306
	CRYSTAL, QUARTZ	1	CR64U-25.000MHZ	81349	74306

5.4.10 Type 71411 DRO Converter

REF DESIG PREFIX A9

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	CONVERTER	1	23658	14632	
FL1	FILTER, RFI	1	859249-2	89110	
J1	CONNECTOR, RECEPTACLE	3	244-2	16179	
J2	Same as J1				
J3	Same as J1				
L1	COIL, FIXED: 0.24 μH, 15%	1	200-11	99848	
MP1	COVER	1	23668-1	14632	

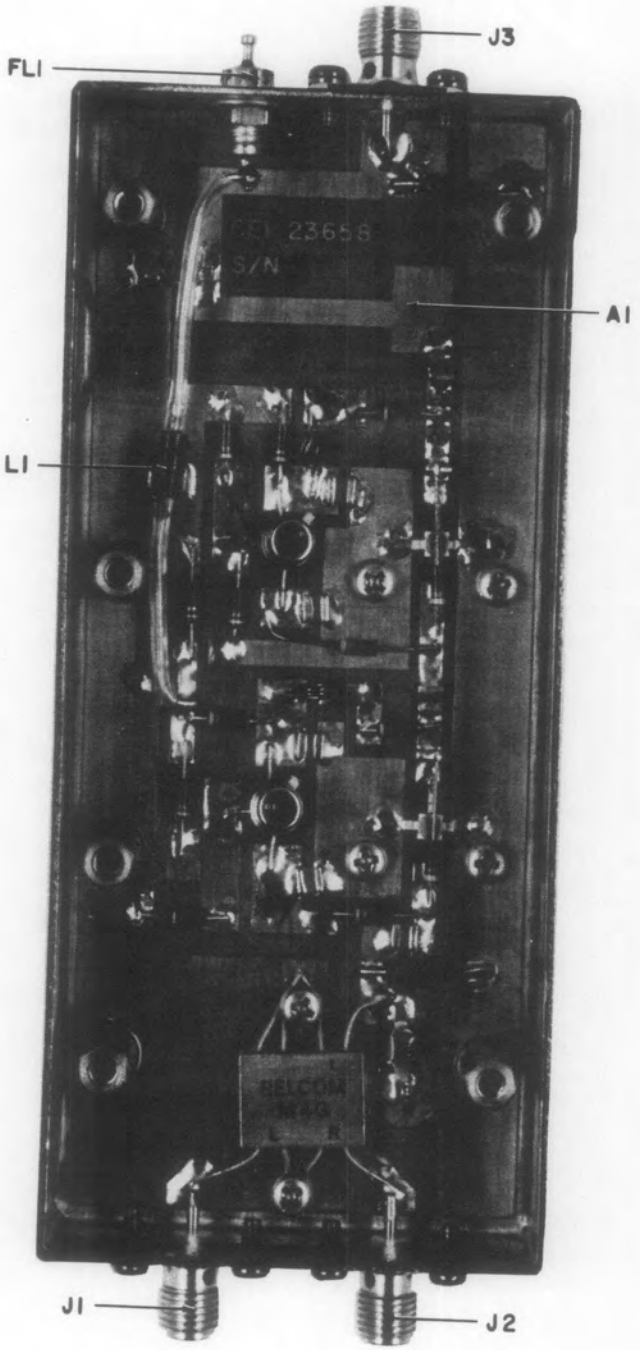


Figure 5-21. Type 71411 DRO Converter (A9), Location of Components

REF DESIG PREFIX A9A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	CAPACITOR, CERAMIC, DISC: 2.2 pF, ±0.25 pF, 300 V	1	UY012R2C	73899	
2 thru 12	CAPACITOR, CERAMIC, CHIP: 3300 pF, 10%, 25 V	11	SC25BX332K	96733	
13	NOT USED				
14	CAPACITOR, CERAMIC, DISC: 1.5 pF, ±0.25 pF, 300 V	1	UY011R5C	73899	
1	INDUCTOR	2	22292-84	14632	
2	Same as L1				
1	TRANSISTOR	2	2N3251	80131	04713
2	TRANSISTOR	2	35866E	28480	
3	Same as Q1				
4	Same as Q2				
1	RESISTOR, FIXED, FILM: 56.2 Ω, 1%, 1/10W	2	RN55C56R2F	81349	75042
2	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/8W	2	RCR05G512JS	81349	01121
3	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/8W	4	RCR05G222JS	81349	01121
4	Same as R3				
5	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/8W	2	RCR05G151JS	81349	01121
6	RESISTOR, FIXED, COMPOSITION: 560 Ω, 5%, 1/8W	2	RCR05G561JS	81349	01121
7	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/8W	2	RCR05G101JS	81349	01121
8	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/8W	1	RCR05G100JS	81349	01121
9	Same as R2				
10	Same as R5				

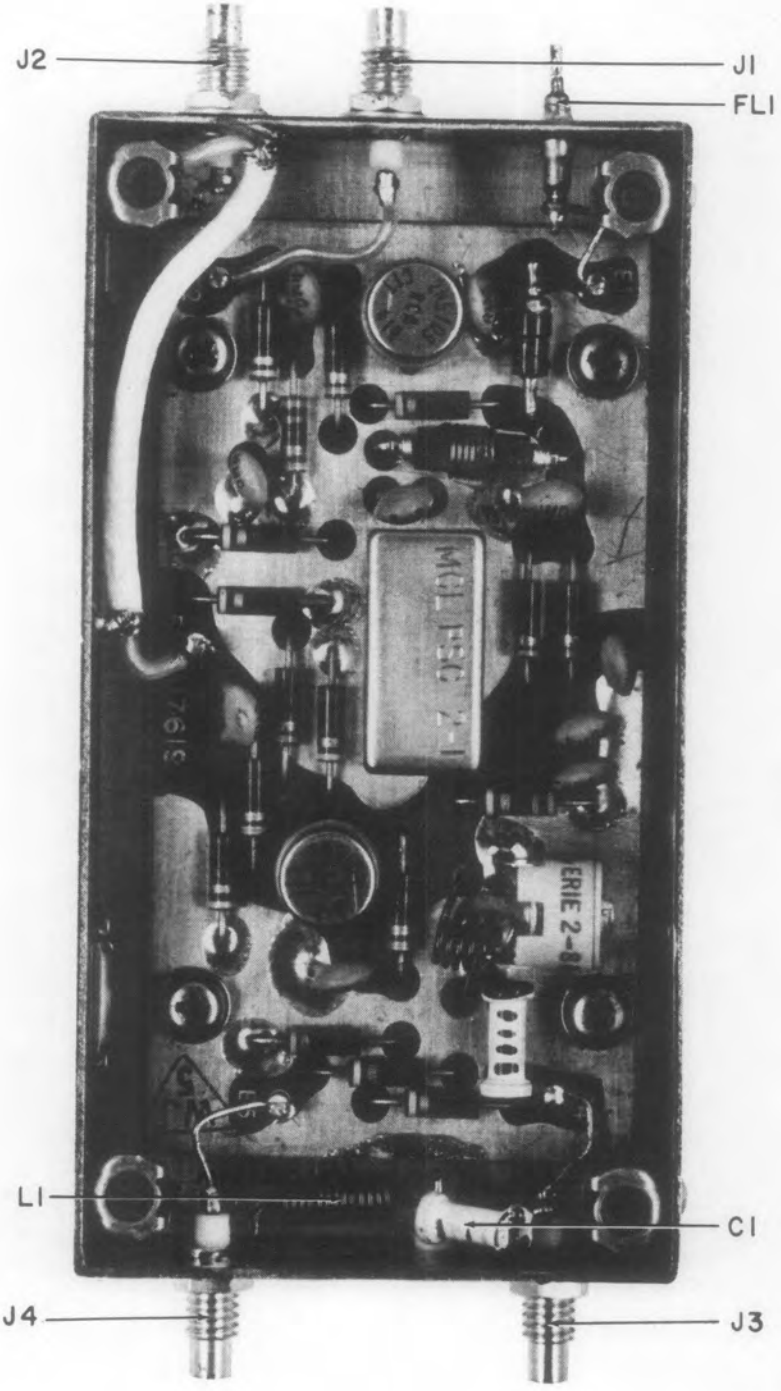


Figure 5-23. Type 72436 160 MHz Amplifier (A10), Location of Components

5.4.11.1 Part 17619,160 MHz Amplifier

REF DESIG PREFIX A10A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1 Thru C9	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	10	SM1000PFP	91418	
C10	CAPACITOR, VARIABLE, CERAMIC: 2-8 pF, 350 V	1	538-006A2-8	72982	
C11	CAPACITOR, CERAMIC, TUBULAR: 15 pF, 5%, 500 V	1	301-000C0G0-150J	72982	
C12	Same as C1				
L1	COIL, FIXED: 0.24 μH, 15%	1	200-11	99848	
L2	INDUCTOR	1	21210-162	14632	
L3	INDUCTOR	1	22292-85	14632	
Q1	TRANSISTOR	2	2N5109	80131	02735
Q2	Same as Q1				
R1	NOT USED				
R2	RESISTOR, FIXED, COMPOSITION: 7.5 kΩ, 5%, 1/4W	2	RCR07G752JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	2	RCR07G332JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	4	RCR07G100JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	3	RCR07G151JS	81349	01121
R6	Same as R4				
R7	Same as R2				
R8	Same as R5				
R9	Same as R4				
R10	Same as R5				
R11	Same as R3				

REF DESIG PREFIX A9A1

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	Same as R3				
2	Same as R3				
3	Same as R6				
4	Same as R7				
5	Same as R1				
	MIXER, BALANCED	1	M4G	27956	

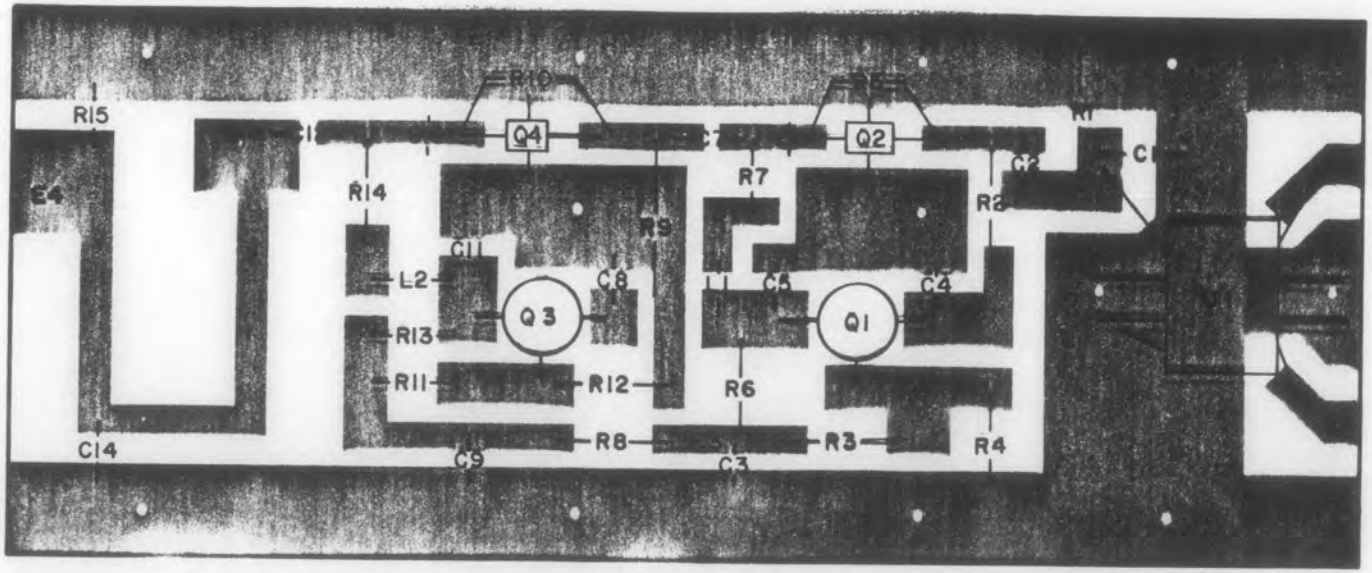


Figure 5-22. Part 23658 Converter (A9A1), Location of Components

5.4.11 Type 72436,160 MHz Amplifier

REF DESIG PREFIX A10

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	160 MHz AMPLIFIER	1	17619	14632	
FL1	FILTER	1	1-859249-1	98110	
J1 Thru J5	CONNECTOR, RECEPTACLE	4	10-0104-002	19505	
MP1	COVER	1	23672-1	14632	
C1	CAPACITOR, TUBULAR, COMPOSITION: 43pF, 10%, 500 V	1	QC 4.3PFK	95121	

REF DESIG PREFIX A10A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
12	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	2	RCR07G220JS	81349	01121
13	Same as R4				
14	RESISTOR, FIXED, COMPOSITION: 51 Ω, 5%, 1/4W	3	RCR07G510JS	81349	01121
15	Same as R14				
16	Same as R12				
17	Same as R14				
1	DIVIDER, POWER	1	PSC2-1	15542	
3	CAPACITOR, CERAMIC, TUBUAR: 5.0pF, ± .25pF, 500 V	1	301-000-C0H0-509C	72982	
13	CAPACITOR, CERAMIC, CHIP: 560pF, 10%, 50 V	2	ATC200A561KP50	29990	
14	SAME AS C13				

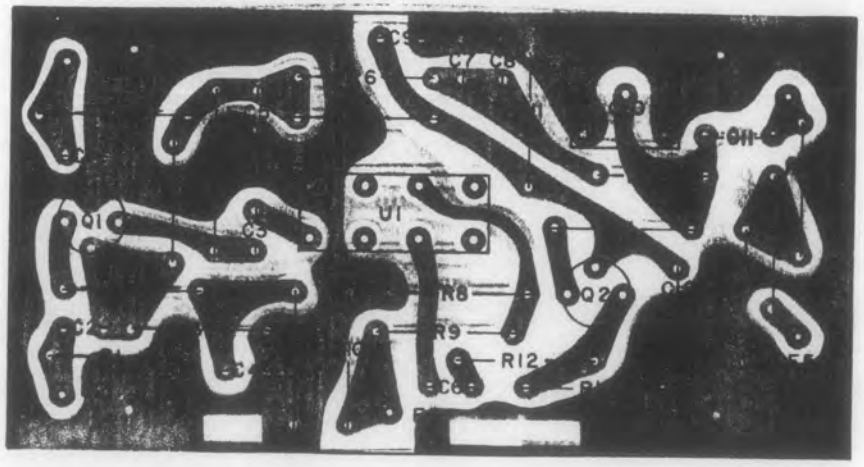


Figure 5-24. Part 17691 160 MHz Amplifier (A10A1), Location of Components

4.12 Type 791335-2 IF Coupler

REF DESIG PREFIX A11

EF SIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
	CONNECTOR, RECEPTACLE	1	10-0104-002	19505	
	CONNECTOR, RECEPTACLE	2	UG-1094/U	80058	74868
	Same as J1				
1	RESISTOR, FIXED, COMPOSITION: 91 Ω, 5%, 1/4W	1	RCR07G910JS	81349	01121
2	RESISTOR, FIXED, COMPOSITION: 68 Ω, 5%, 1/4W	1	RCR07G680JS	81349	01121

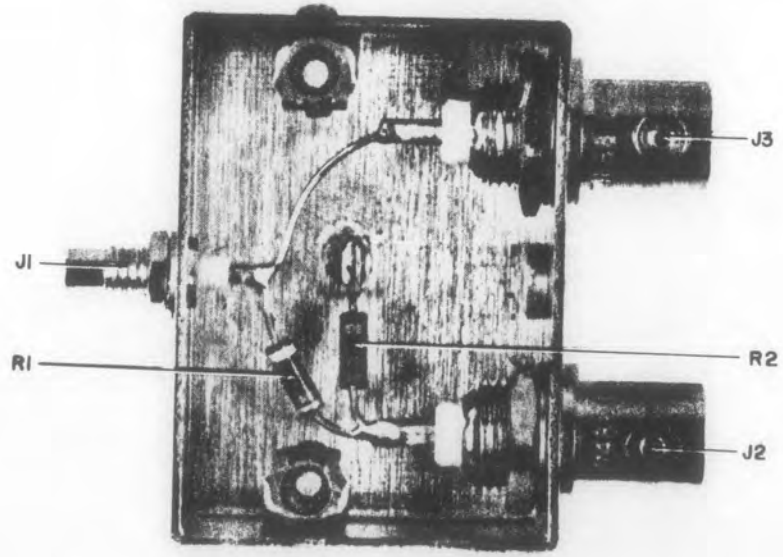


Figure 5-25. Type 791335-2 IF Coupler (A11), Location of Components

5.4.13 Type 791323 Remote Range Control Board

REF DESIG PREFIX A12

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1 Thru CR4	DIODE	4	1N462A	80131	93332
C1	CAPACITOR, CERAMIC, DISC: 0.1 μF, -20+80%, 25 V	2	DFJ3	73899	
C2	Same as C1				
Q1 Thru Q4	TRANSISTOR	4	2N2222A	80131	04713
R1	RESISTOR, FIXED, COMPOSITION: 20 kΩ, 5%, 1/4W	1	RCR07G203JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	3	RCR07G103JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 6.2 kΩ, 5%, 1/4W	1	RCR07G622JS	81349	01121
R4	RESISTOR, VARIABLE, FILM: 10 kΩ, 10%, 3/4W	2	89PR10K	73138	
R5	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	5	RCR07G472JS	81349	01121
R6	Same as R2				
R7	Same as R4				
R8	Same as R2				
R9	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	RCR07G104JS	81349	01121
R10	Same as R9				
R11	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	RCR07G471JS	81349	01121
R12	Same as R9				
R13	Same as R11				
R14	Same as R5				
R15	Same as R5				

REF DESIG PREFIX A12

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R16	Same as R5				
R17	Same as R5				
U1	INTEGRATED CIRCUIT	1	MC1458V	18324	
VR1	DIODE, ZENER	2	1N753A	80131	04713
VR2	Same as VR1				
R18*	RESISTOR, FIXED, COMPOSITION: 22ohm, 5%, .25w	1	RCRO7G226JS	81349	
R19*	RESISTOR, FIXED, COMPOSITION: 2.2ohm, 5% .25w	1	RCRO7G225JS	81349	

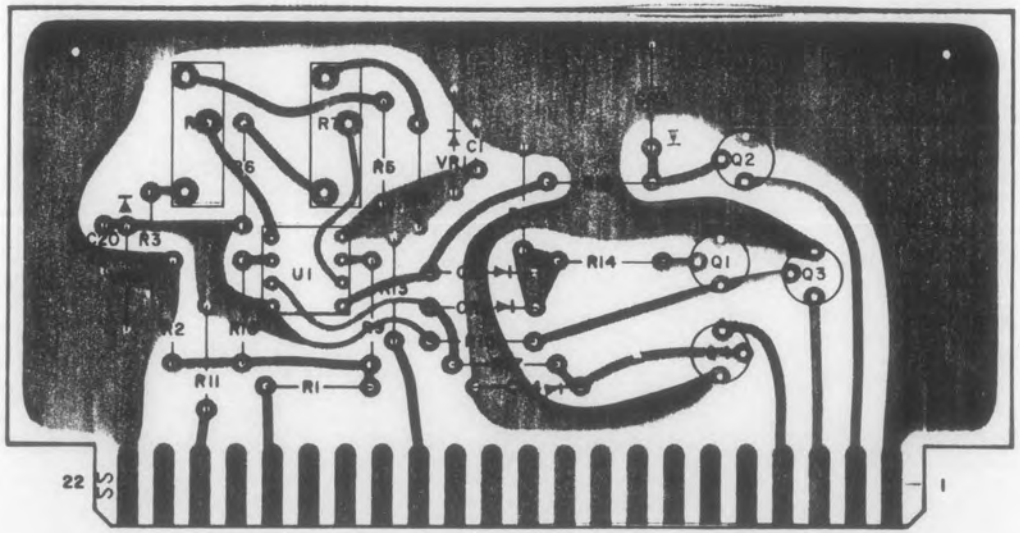
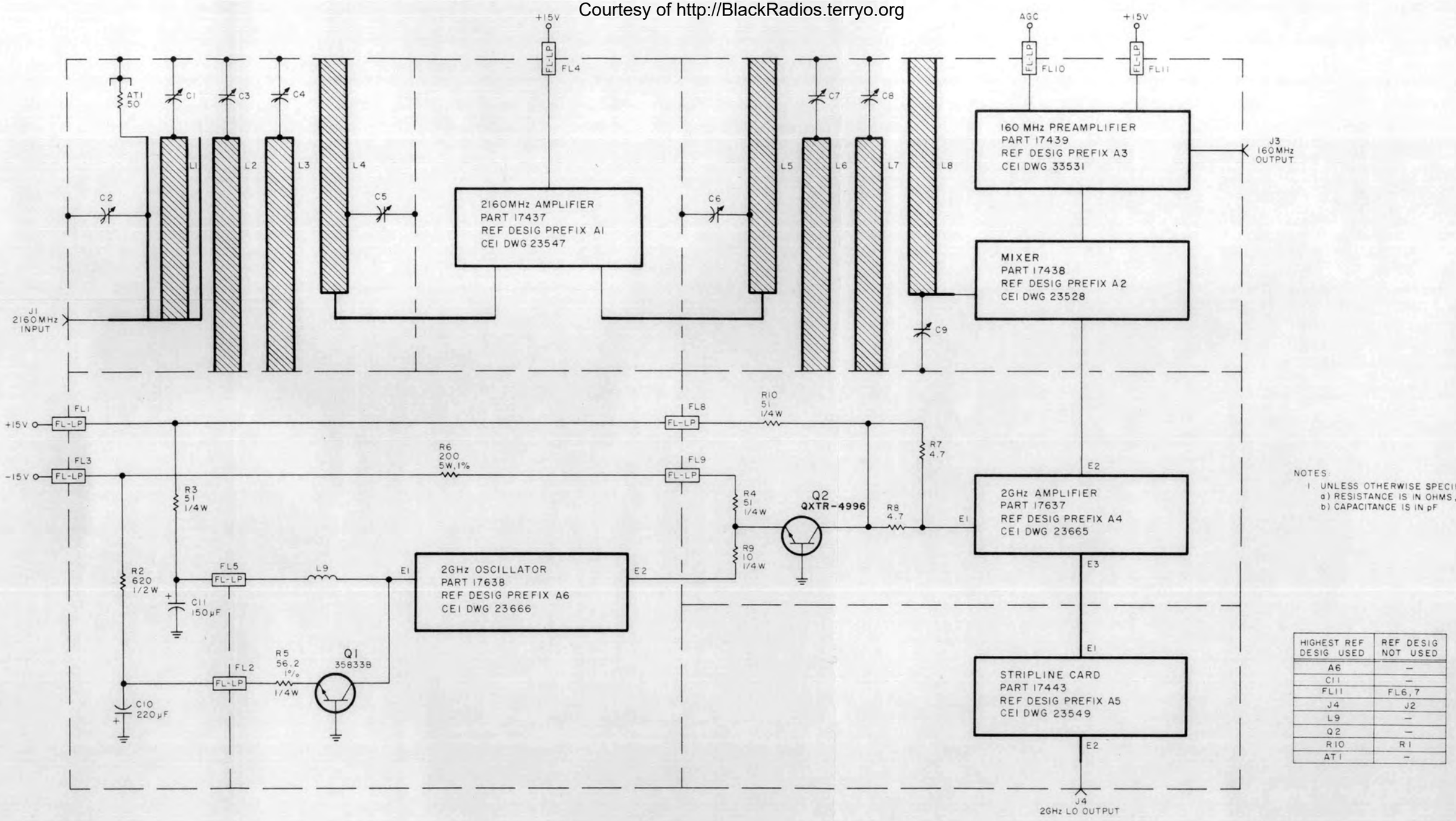


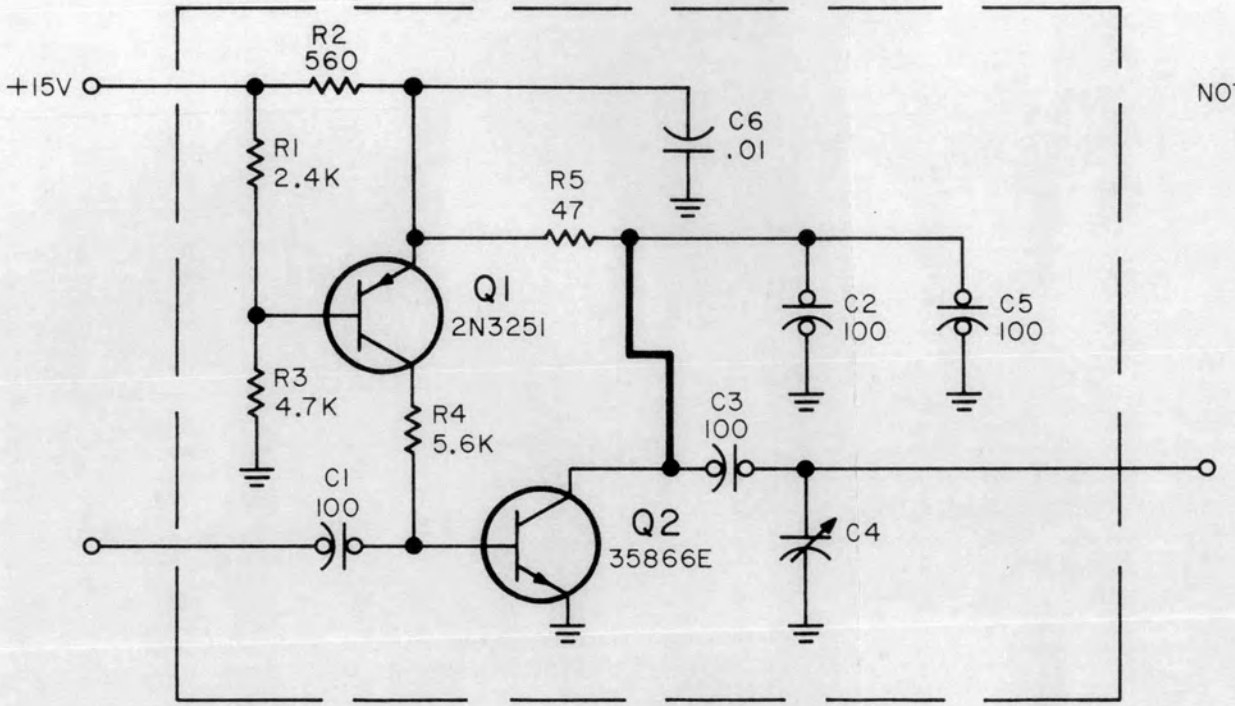
Figure 5-26. Type 791323 Remote Range Control (A12), Location of Components



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, 5%, 1/8W.
   b) CAPACITANCE IS IN pF

HIGHEST REF DESIG USED	REF DESIG NOT USED
A6	–
C11	–
FL11	FL6,7
J4	J2
L9	–
Q2	–
R10	R1
AT1	–

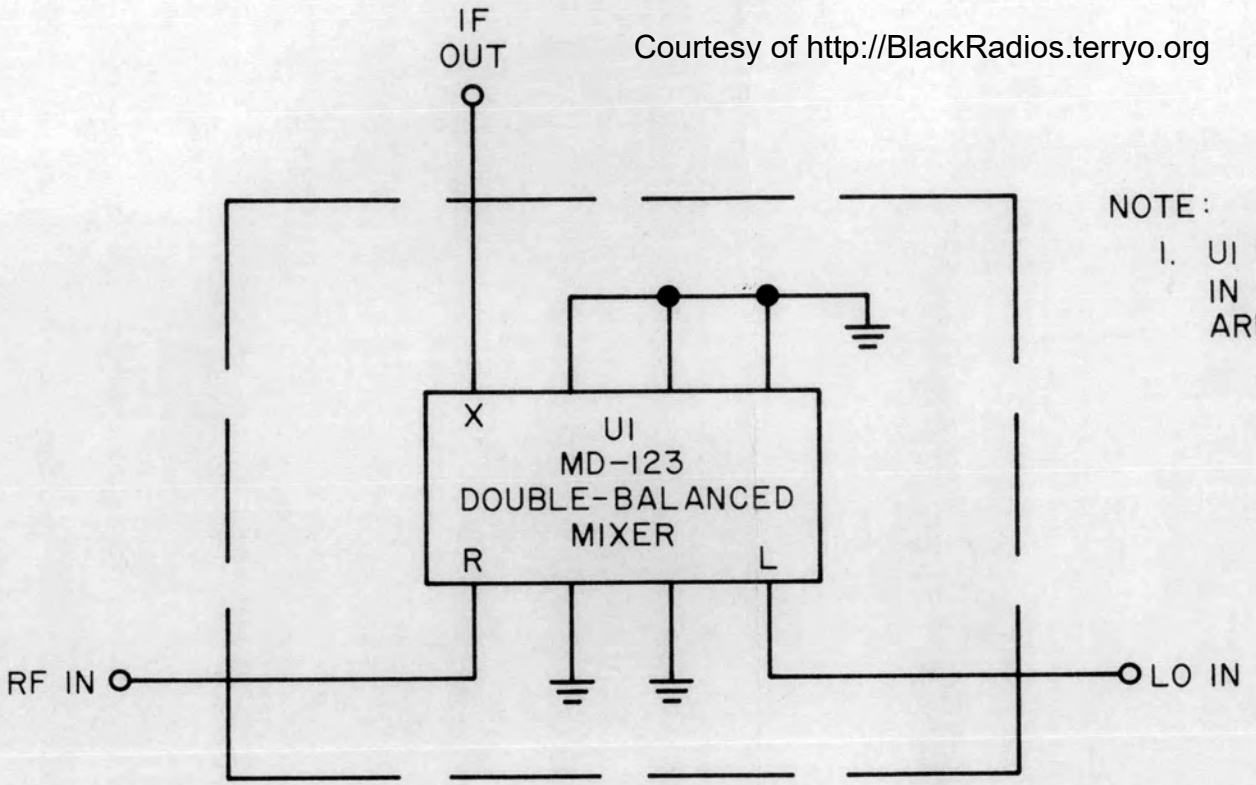
Figure 6-1. Type 71412 2160 MHz Amplifier Converter (A1), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/8 W.
   b) CAPACITANCE IS IN pF.

Figure 6-2. Part 17437 2160 MHz Amplifier (A1A1), Schematic Diagram



NOTE:

1. U1 PIN ARRANGEMENT IS SHOW IN DETAIL A. (PINS NOT MARKED ARE GROUND)

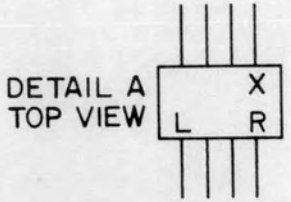
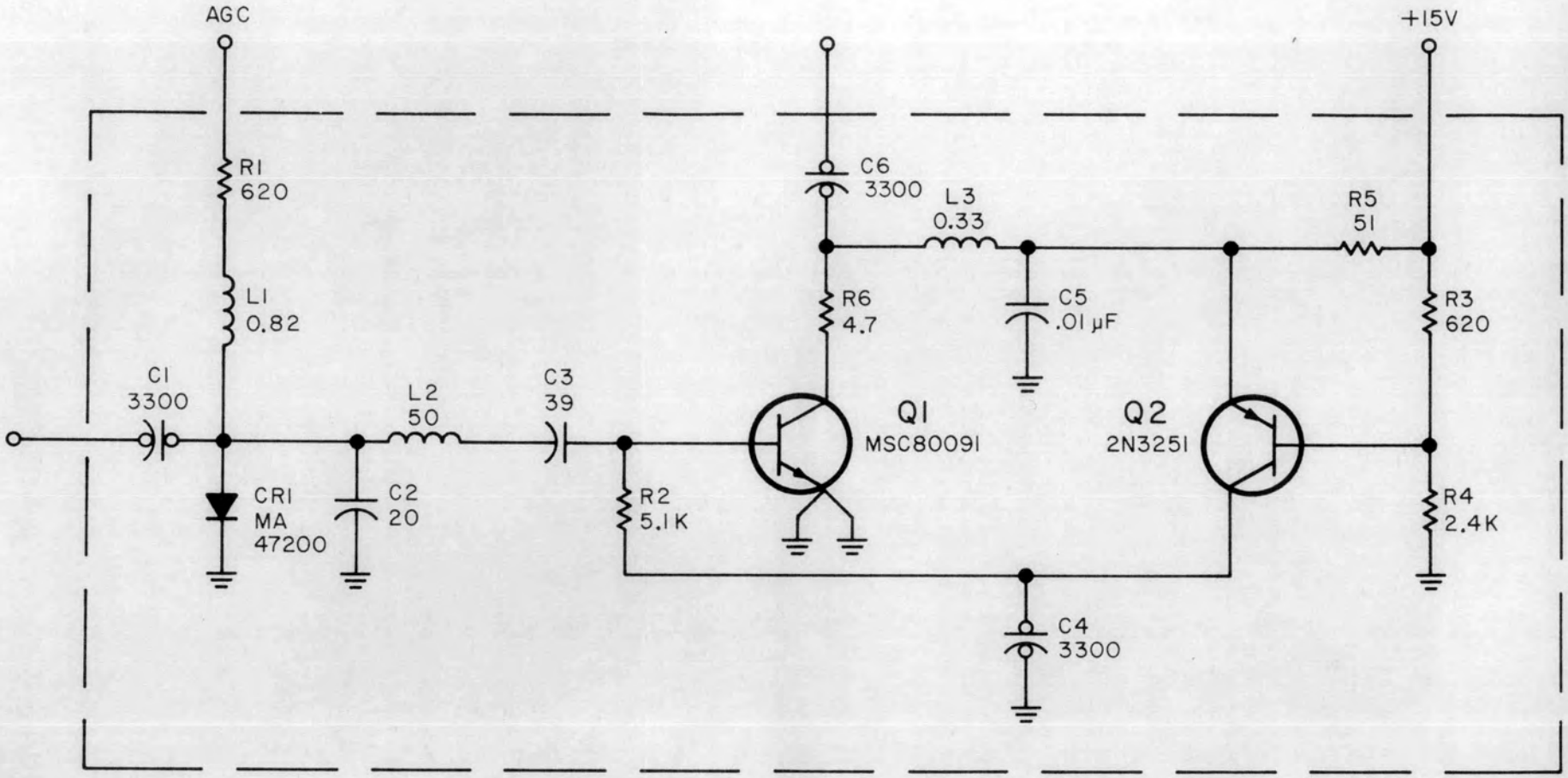


Figure 6-3. Part 17438 Mixer Assembly (A1A2), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
   c) INDUCTANCE IS IN µH.
2. ALL COMPONENTS ARE SOLDERED ON TOP OF BOARD.

Figure 6-4. Part 17439 160 MHz Preamplifier (A1A3), Schematic Diagram

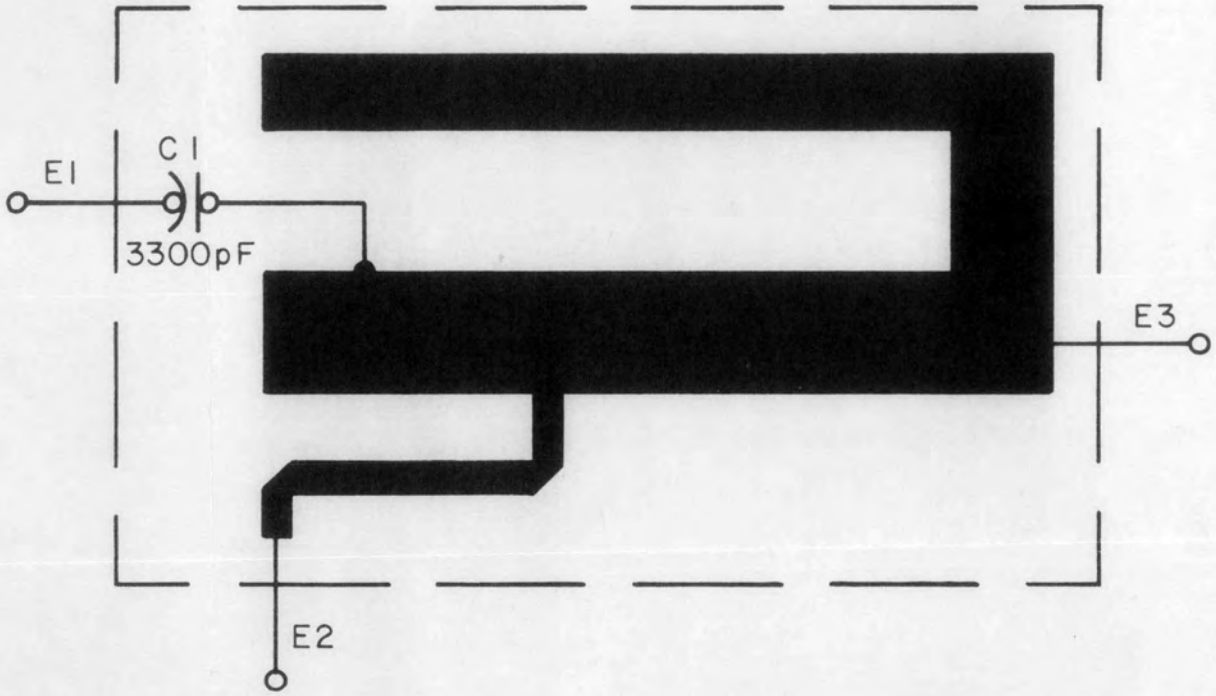


Figure 6-5. Part 17637 2 GHz Amplifier (A1A4), Schematic Diagram

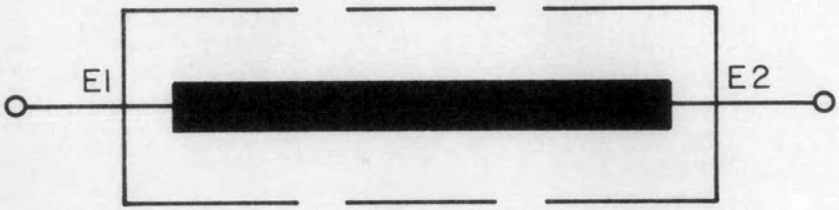


Figure 6-6. Part 17443 Stripline (A1A4), Schematic Diagram

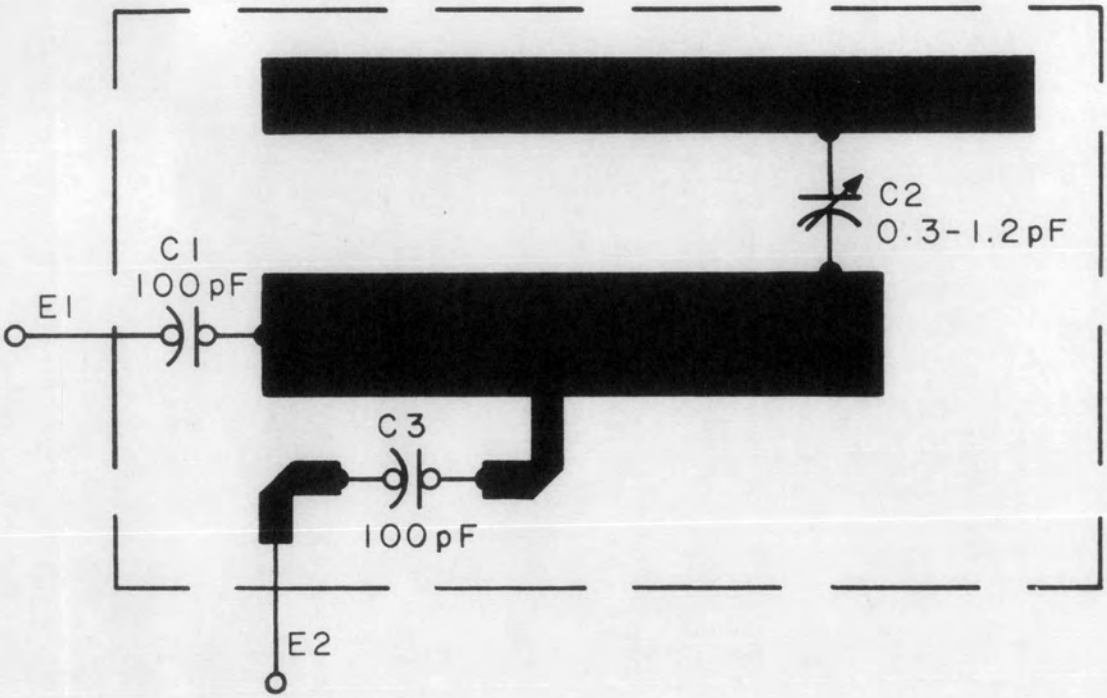


Figure 6-7. Part 17638 2 GHz Oscillator (A1A6), Schematic Diagram

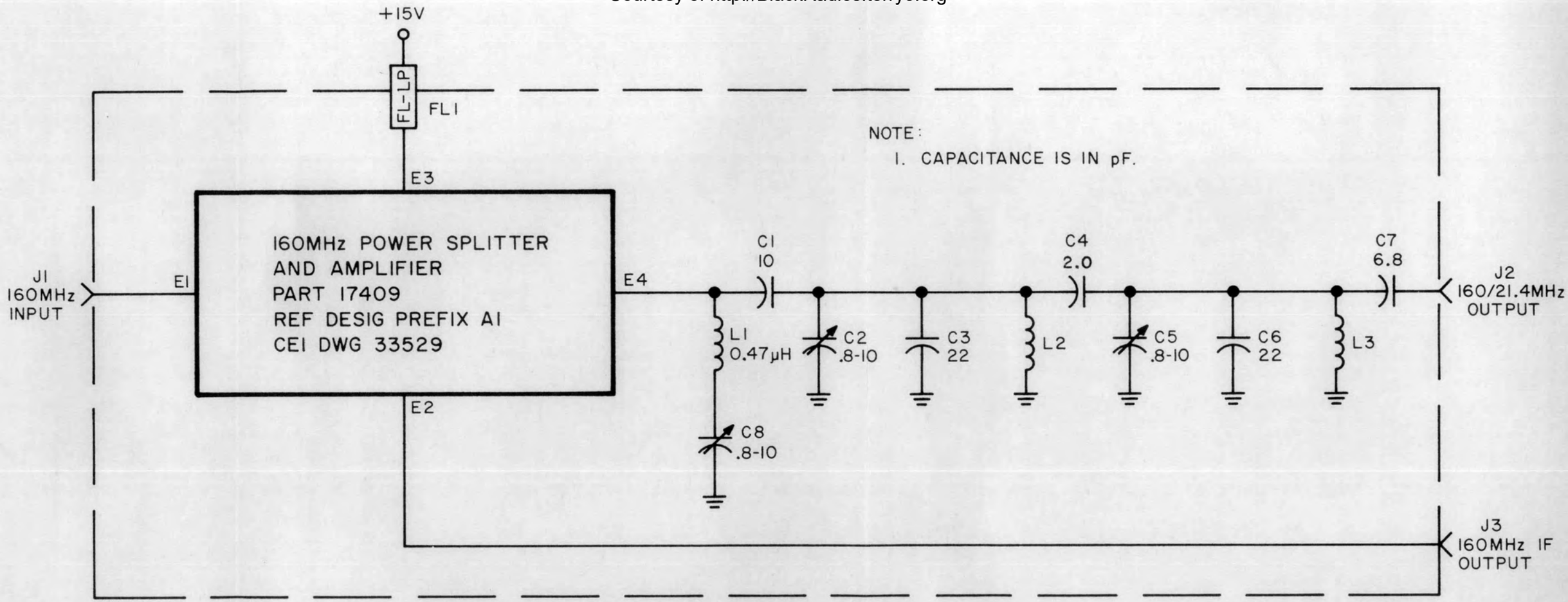
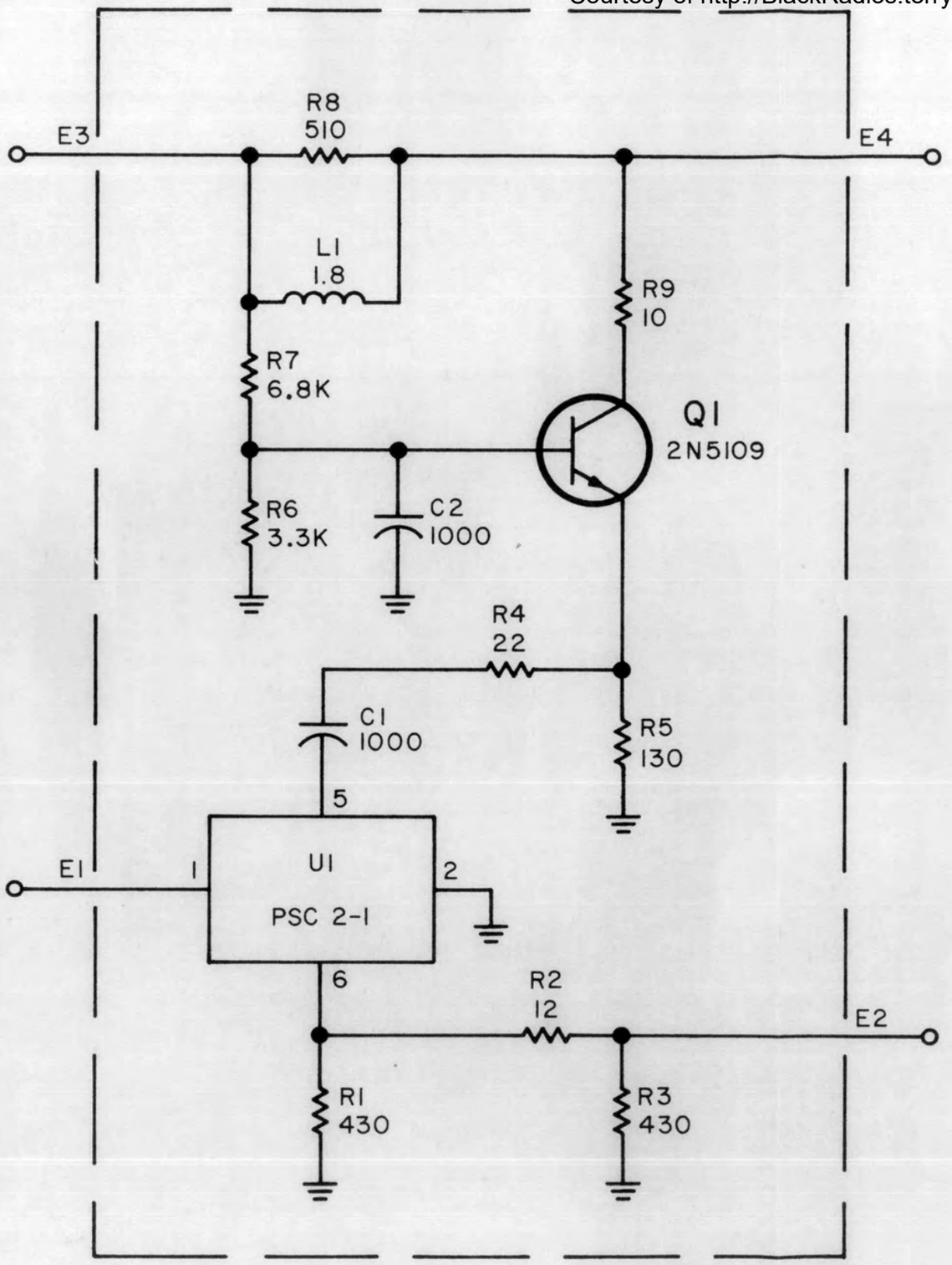


Figure 6-8. Type 791272 160 MHz Power Splitter And Amplifier (A2), Schematic Diagram



NOTES:

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

Figure 6-9. Part 17409 160 MHz Power Splitter And Amplifier (A2A1), Schematic Diagram

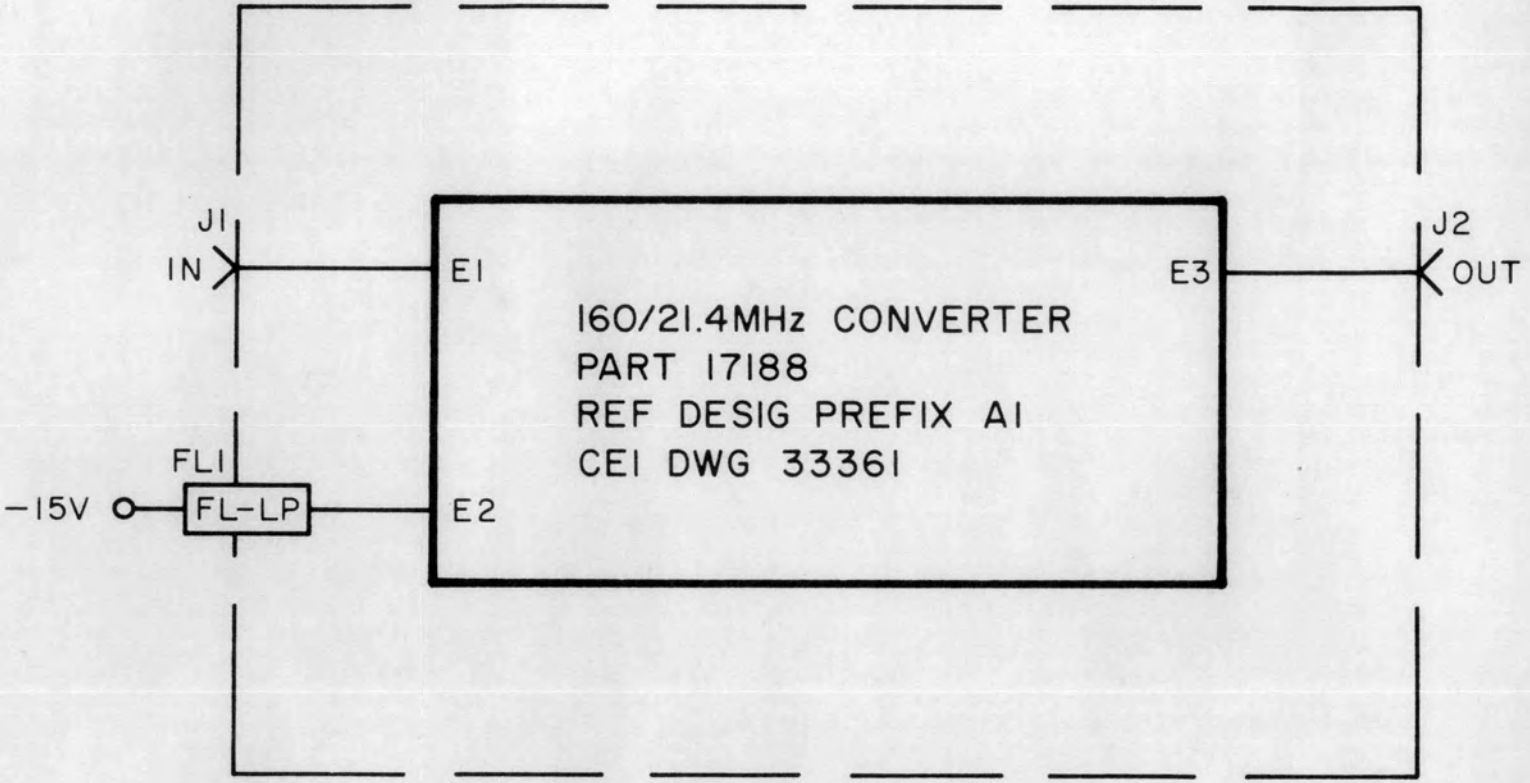


Figure 6-10. Type 791169 160/21.4 MHz Converter Assembly (A3), Schematic Diagram

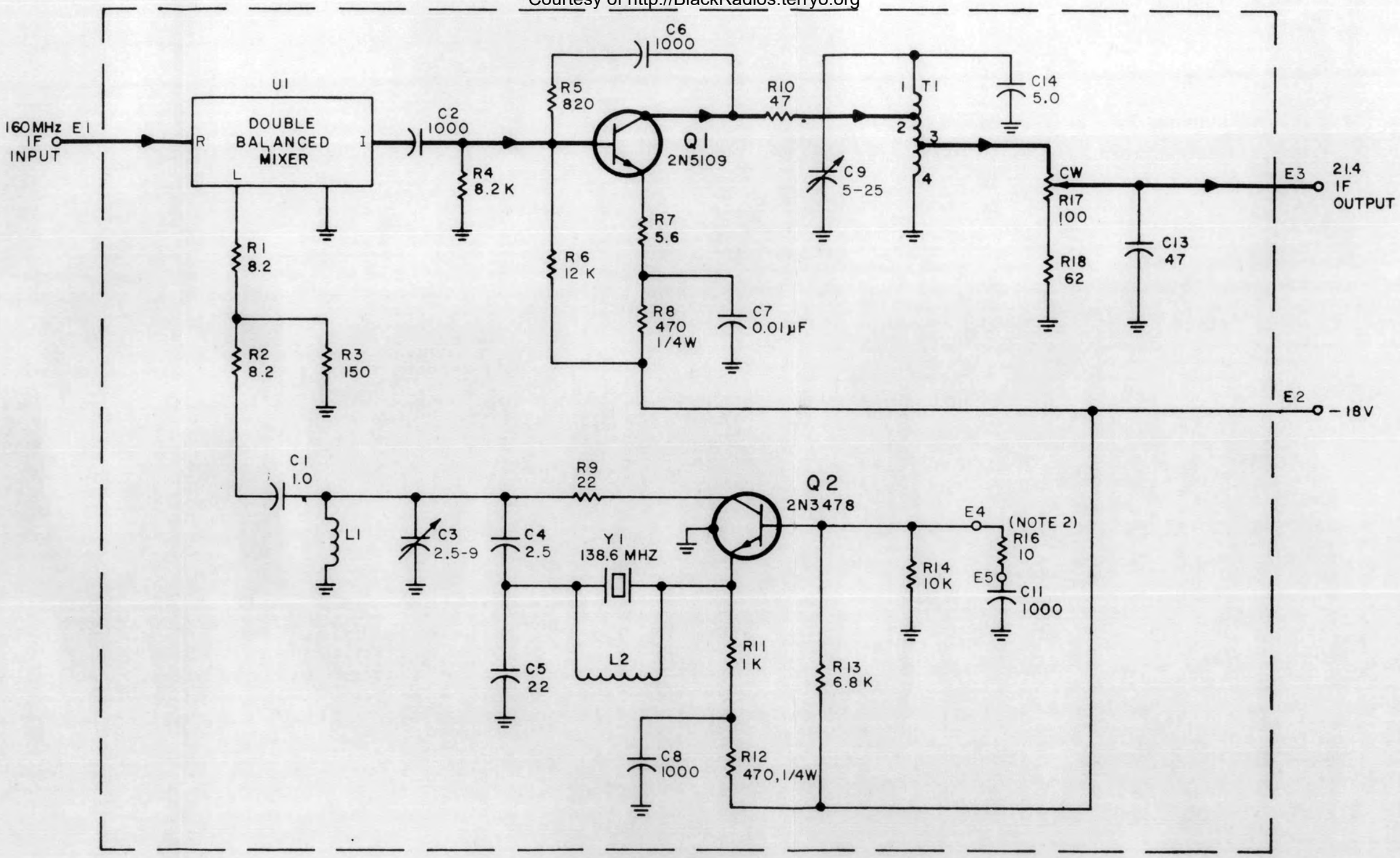
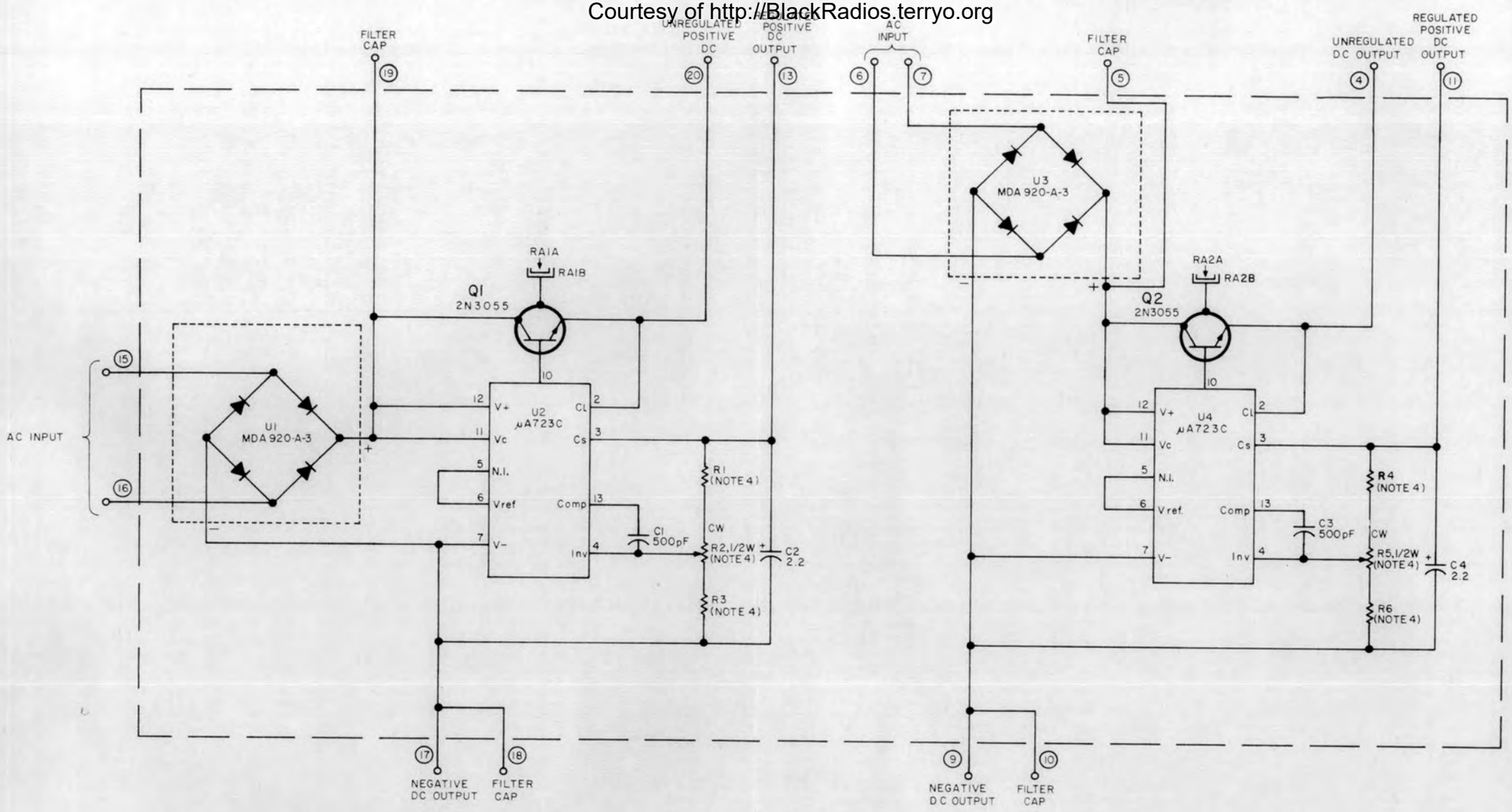


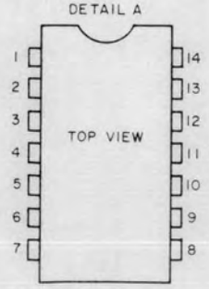
Figure 6-11. Part 17188 160/21.4 MHz Converter (A3A1), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN µF
2. ENCIRCLED NUMBERS ARE PIN MODULE NUMBERS
3. FOR LEAD ARRANGEMENT OF U2 & U4, SEE DETAIL "A"
4. THE DIFFERENCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK
5. TYPE 76210-3 USED ON G472C00000-1 RECEIVER.

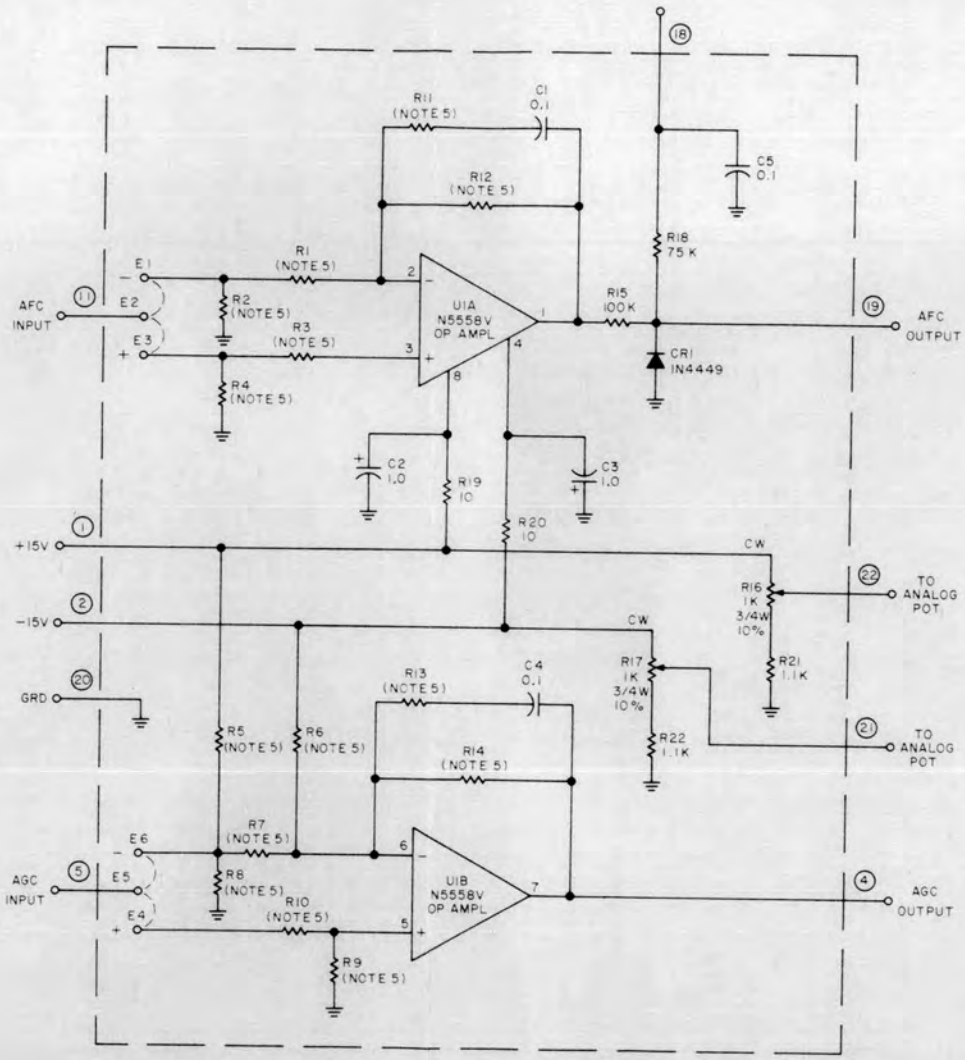
TYPE	VOLTAGE OUT	R1	R2	R3	R4	R5	R6	
76210-1	± 15-18	3.3K	1K	2.7K	3.3K	1K	2.7K	
76210-2	± 15&24	5.1K	1K	2K	3.3K	1K	2.7K	
76210-3	± 15-18	3.3K	1K	2.7K	3.3K	1K	2.7K	(NOTE 5)
76210-4	± 24	5.1K	1K	2K	5.1K	1K	2K	
76210-5	± 12	2K	1K	3K	2K	1K	3K	
76210-6	±20	—	—	—	4.7K	1K	2.2K	



FOR −6 ONLY

HIGHEST REF DESIG USED	REF DESIG NOT USED
C4 Q2 RA2 R6 U4	C1, C2 Q1 RA1 R1, 2 & 3 U1 & U2

Figure 6-12. Type 76210-(X) Power Supply (A5 And A6), Schematic Diagram



TABULATION A

TYPE NO	AGC IN	AFC	DAFC
78101-1	0V TO -24V	INVERTING	———
78101-2	0V TO -24V	NON-INVERTING	———
78101-3	0V TO -24V	———	OPERATION
78101-4	+10V TO +1V	INVERTING	———
78101-5	+10V TO +1V	NON-INVERTING	———
78101-6	+10V TO +1V	———	OPERATION
78101-7	0V TO -15V	INVERTING	———
78101-8	0V TO -15V	NON-INVRTING	———
78101-9	0V TO -15V	———	OPERATION

NOTES

1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. CW ON R16, R17 INDICATE CLOCKWISE ROTATION OF ACTUATORS.
4. PIN ARRANGEMENT OF U1 IS SHOWN IN DETAIL A.
5. SEE TABULATION BLOCKS A, B & C FOR PARTICULAR FUNCTION DESIRED. UNLESS OTHERWISE SPECIFIED THE DASH 9 CONFIGURATION SHALL BE CONNECTED.

DETAIL A

TABULATION B

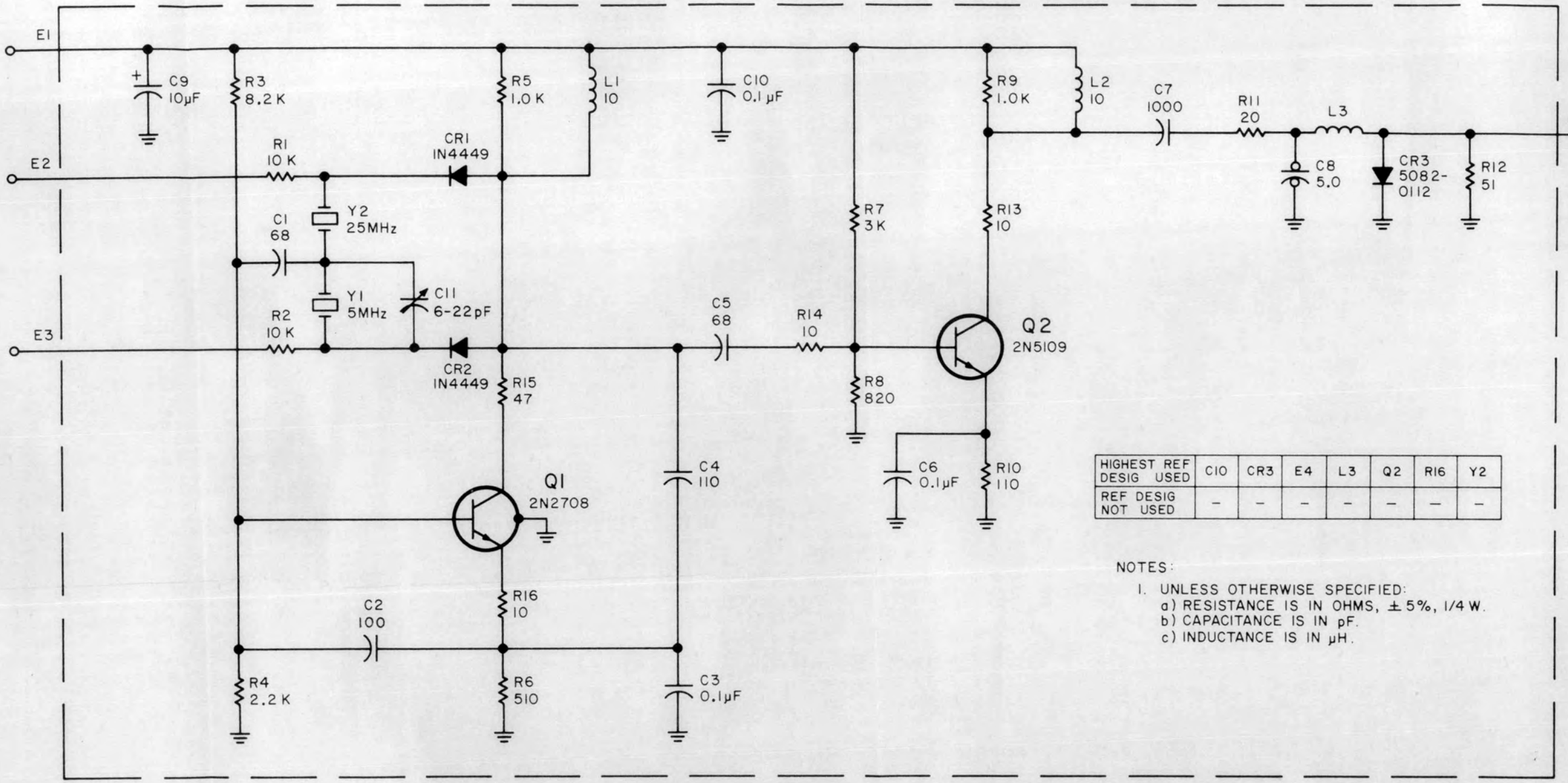
	FUNCTION	R5	R6	R7	R8	R9	R10	R13	R14	CONNECTION
AGC IN	0V TO -24V	N/U	N/U	7.5K	1.5K	1.3K	N/U	2K	2K	E5 TO E6
	0V TO -15V	N/U	N/U	3.9K	1.5K	1.3K	N/U	2K	2K	E5 TO E6
	+10V TO +1V	5.1K	16K	10K	N/U	5.1K	N/U	2K	12K	E5 TO E4

TABULATION C

	FUNCTION	R1	R2	R3	R4	R11	R12	CONNECTION
AFC	NON-INVERT	51K	1K	1K	1K	2K	510K	E1 TO E2
	INVERTING	51K	1K	1K	1K	2K	510K	E2 TO E3
DAFC	OPERATION	100K	1K	1K	1K	2K	510K	E1 TO E2

Figure 6-13. Type 78101-(X) AFC/AGC/ Analog Tune (A7), Schematic Diagram

Figure 6-14. Type 8310 5/25 MHz Calibration Marker Oscillator (A8), Schematic Diagram



HIGHEST REF DESIG USED	C10	CR3	E4	L3	Q2	R16	Y2
REF DESIG NOT USED	–	–	–	–	–	–	–

NOTES:

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

Figure 6-15. Part 17410 5/25 MHz CMO (A8A1), Schematic Diagram

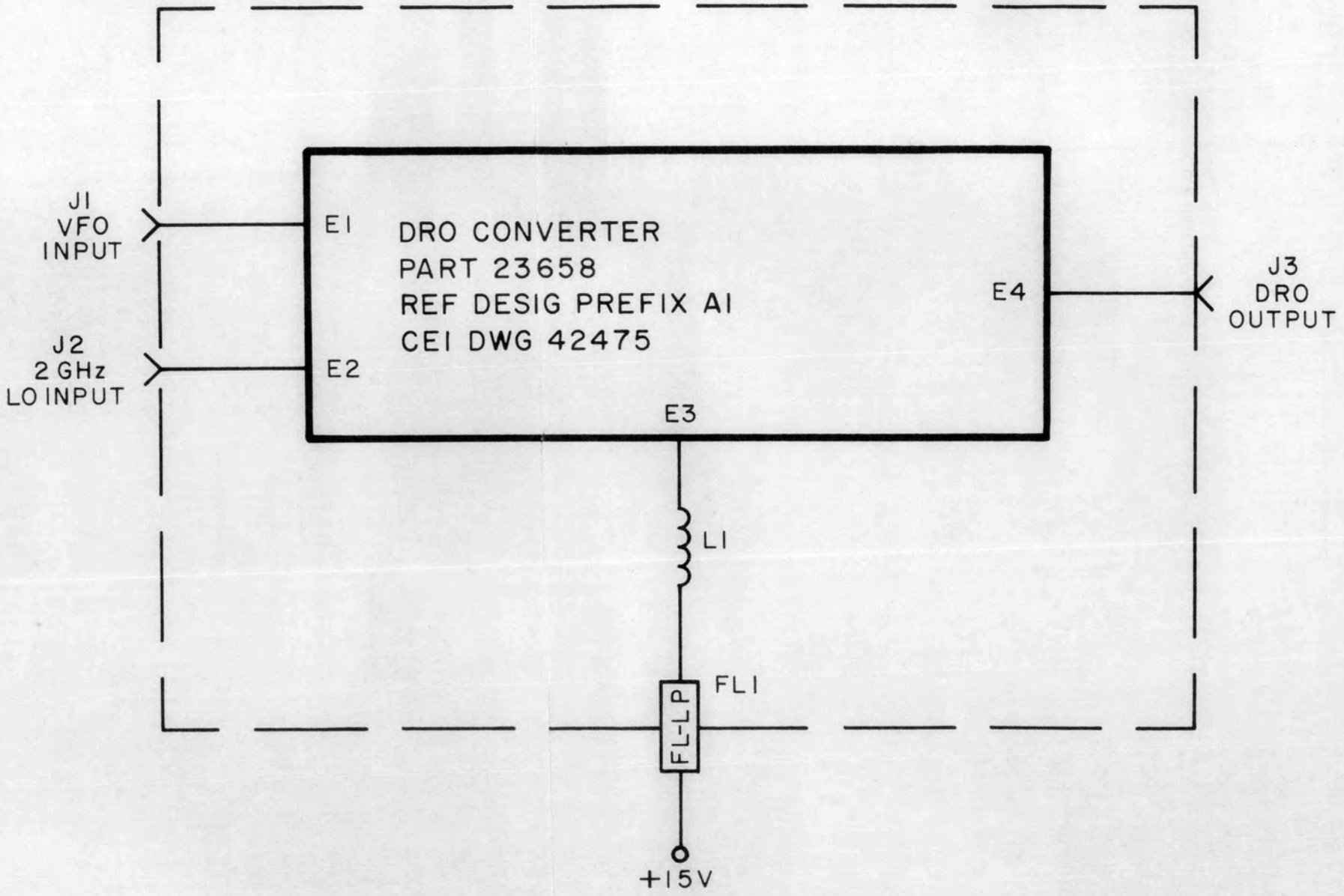
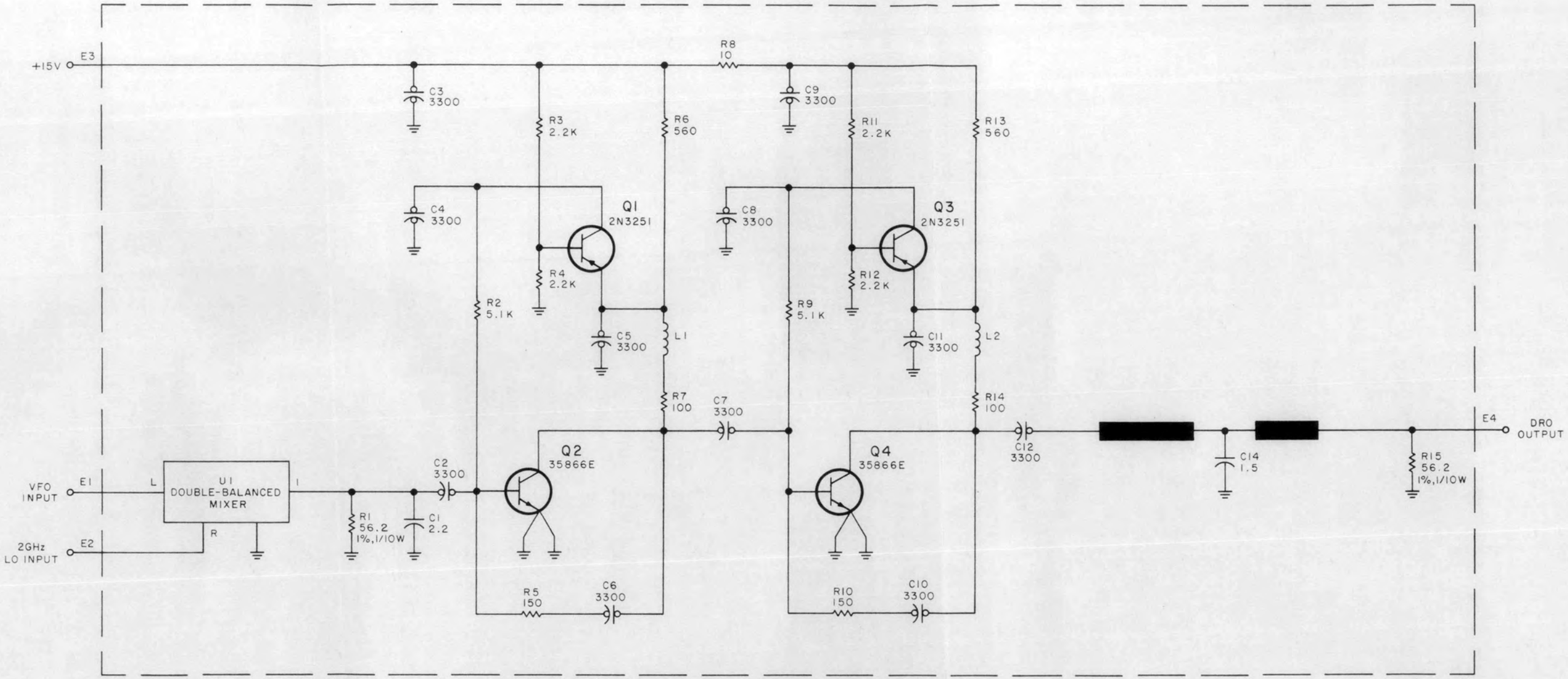


Figure 6-16. Type 71411 DRO Converter Assembly (A9), Schematic Diagram



NOTE:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
   b) CAPACITANCE IS pF.

Figure 6-17. Part 23658 DRO Converter (A9A1), Schematic Diagram

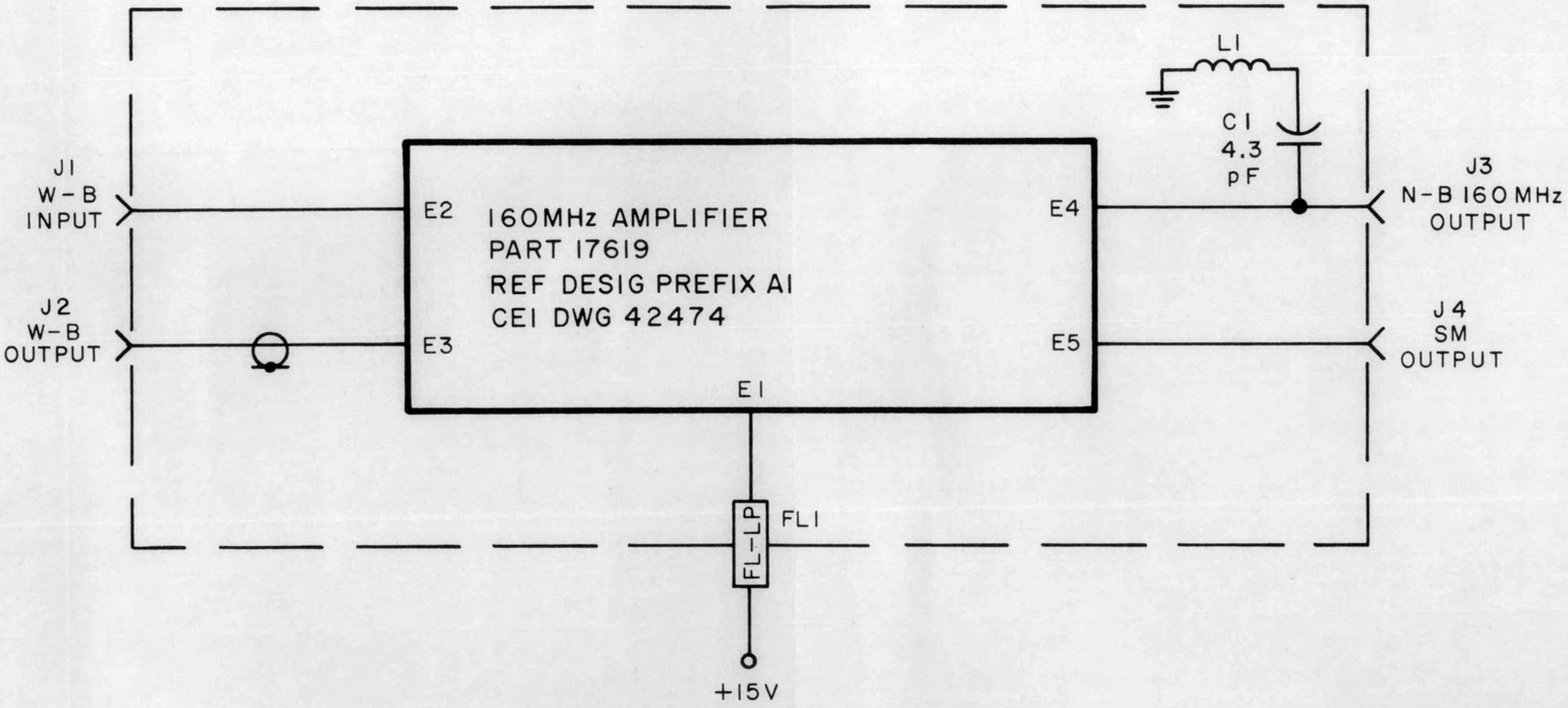
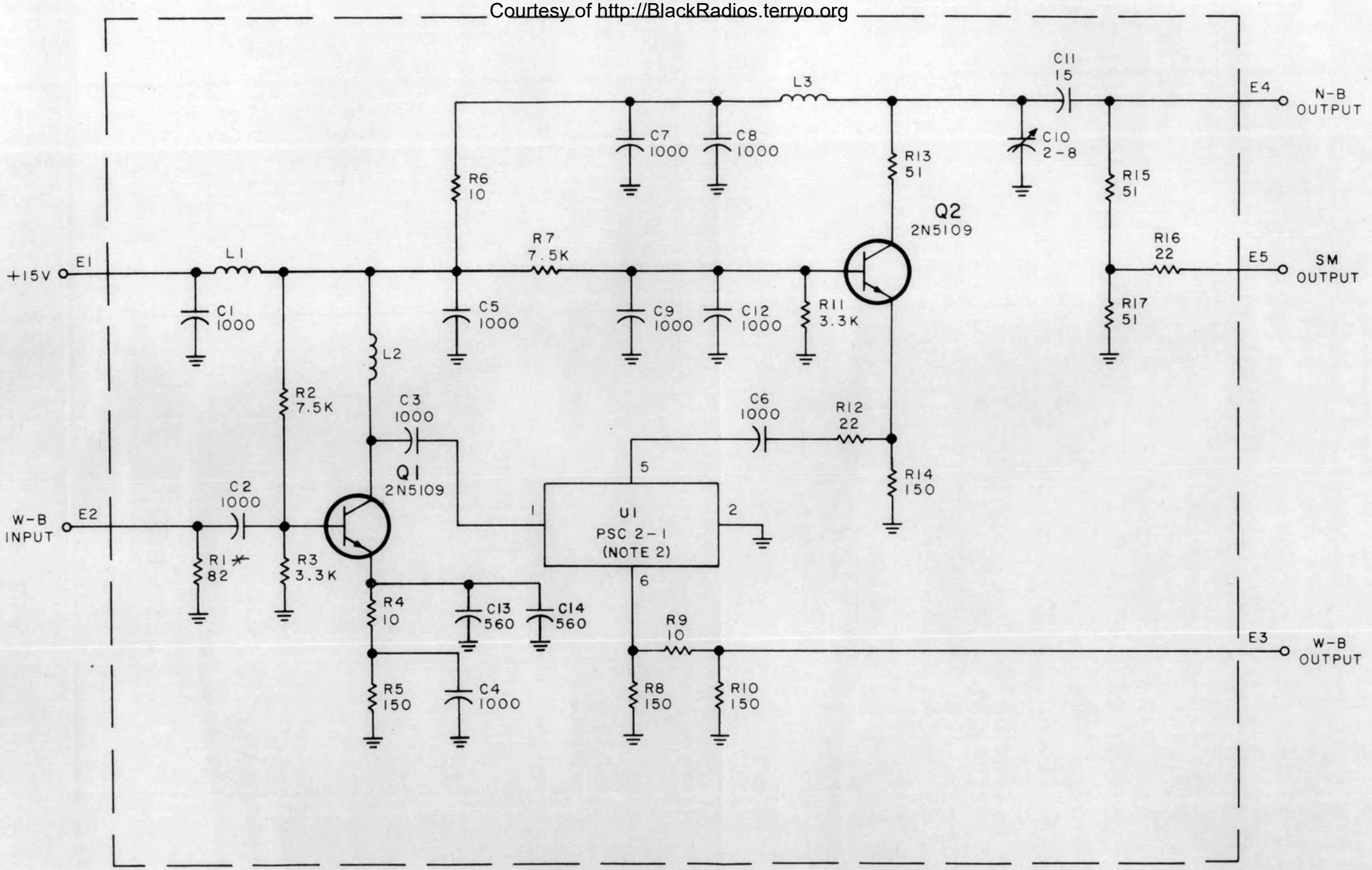


Figure 6-18. Type 72436 160 MHz Amplifier Assembly (A10), Schematic Diagram

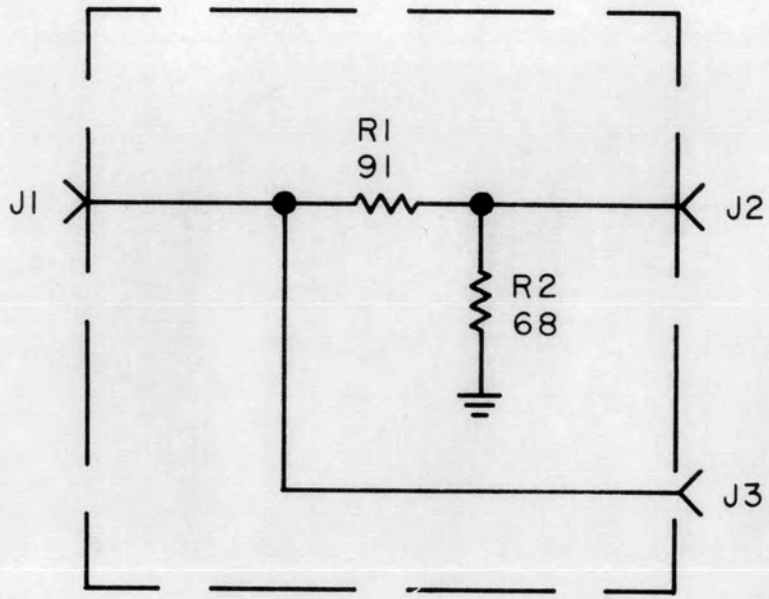


NOTE:

1. UNLESS OTHERWISE SPECIFIED;
   a) RESISTANCE IS IN OHMS ±5%, 1/4 W.
   b) CAPACITANCE IS IN pF.
2. "BLUE DOT" ON PART DENOTES PIN 1.

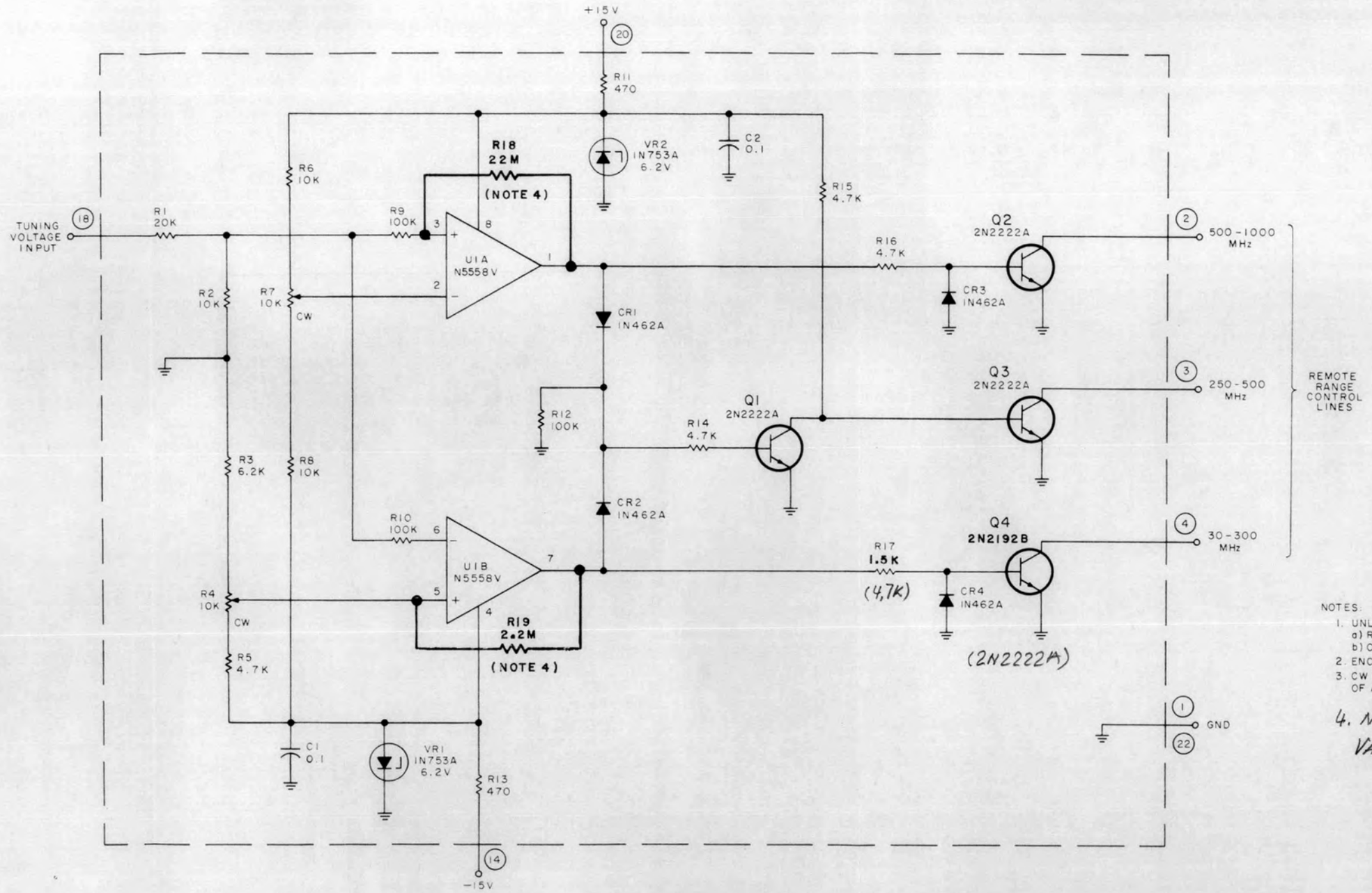
* MAY BE NOT USED

Figure 6-19. Part 17619 160 MHz Amplifier (A10A1), Schematic Diagram



NOTE:
RESISTANCE IS IN OHMS, ±5%, 1/4W.

Figure 6-20. Type 791335-2 IF Coupler (A11), Schematic Diagram

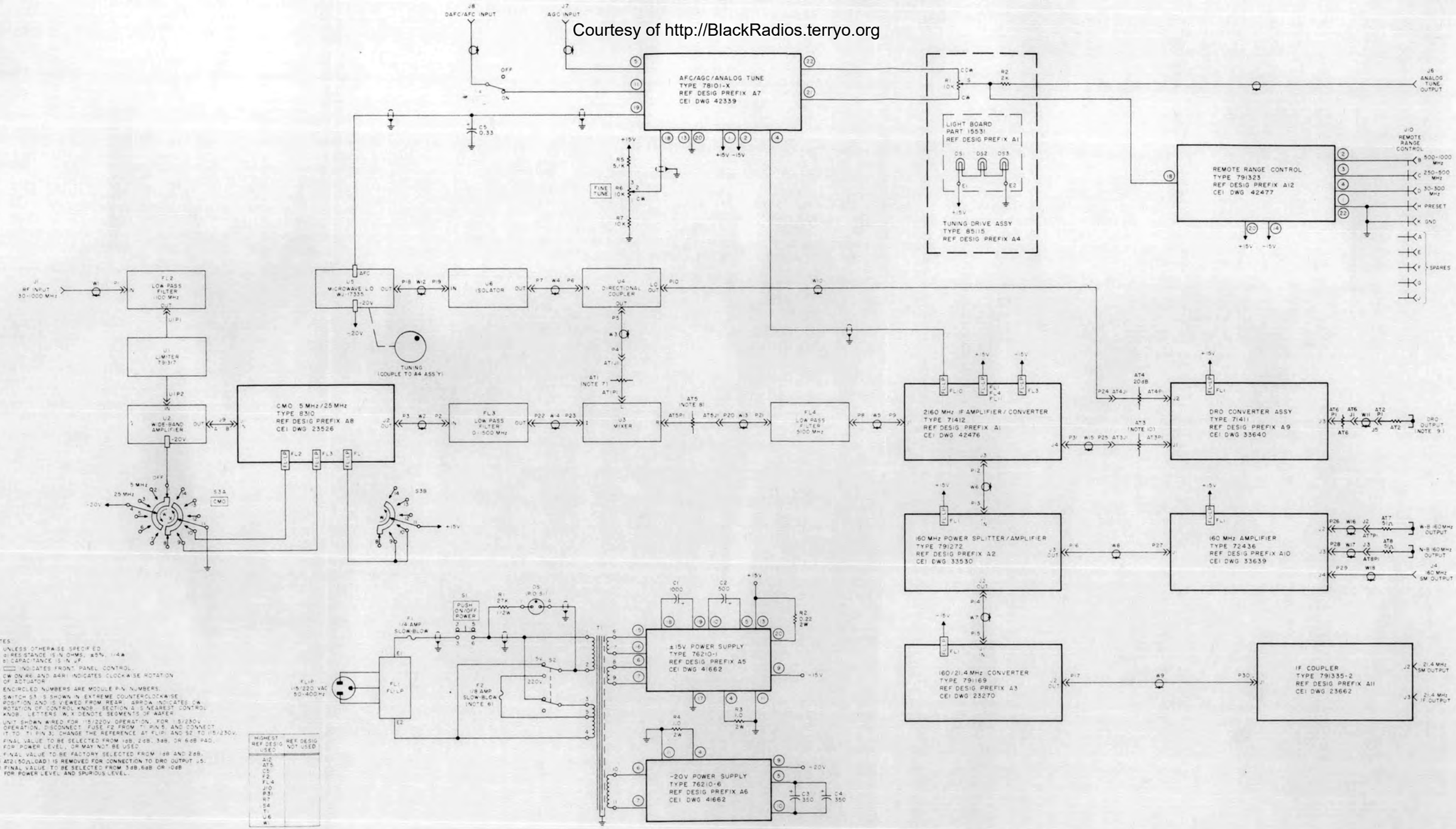


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4 W.
   b) CAPACITANCE IS μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. CW ON R4, R7 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
4. NOMINAL VALUE, FINAL VALUE FACTORY SELECTED.

(791323)

Figure 6-21. Type 792434 Remote Range Control (A12), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS IN μF
2. ▭ INDICATES FRONT PANEL CONTROL
3. CW ON RF AND AFR INDICATES CLOCKWISE ROTATION OF ACTUATOR
4. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
5. SWITCH S3 IS SHOWN IN EXTREME COUNTERCLOCKWISE POSITION AND IS VIEWED FROM REAR. ARROW INDICATES CW ROTATION OF CONTROL KNOB. SECTION A IS NEAREST CONTROL KNOB. LETTERS W,X DENOTE SEGMENTS OF WAFER
6. UNIT SHOWN WIRED FOR 115/220V OPERATION. FOR 115/230V OPERATION, DISCONNECT FUSE F2 FROM T1 PIN 5, AND CONNECT IT TO T1 PIN 3. CHANGE THE REFERENCE AT FLIP1 AND S2 TO 115/230V.
7. FINAL VALUE TO BE SELECTED FROM 1dB, 2dB, 3dB, OR 6dB PAD, FOR POWER LEVEL, OR MAY NOT BE USED
8. FINAL VALUE TO BE FACTORY SELECTED FROM 1dB AND 2dB.
9. AT2 (50Ω LOAD) IS REMOVED FOR CONNECTION TO DRO OUTPUT J5.
10. FINAL VALUE TO BE SELECTED FROM 3dB, 6dB OR 10dB FOR POWER LEVEL AND SPURIOUS LEVEL.

HIGHEST REF DESIG USED	REF DESIG NOT USED
A12	
AT5	
C5	
F2	
FL4	
J10	
P31	
R7	
S4	
T1	
U6	
W1	

Figure 6-22. Type WJ-9080A, Main Chassis, Schematic Diagram

Table 7-1. WJ-9080B Specifications

Tuning	30-1000 MHz
IF Frequency	Triple-conversion: 2160 MHz, 160 MHz and 21.4 MHz
IF Output Bandwidth:	
160 MHz W-B Output	a) 40 MHz min. at 6 dB points (30-50 MHz) b) 60 MHz min. at 6 dB points (50-1000 MHz)
160 MHz N-B Output	20 MHz min. at 3 dB points
21.4 MHz Output	8 MHz min. at 3 dB points
3rd Order Intercept Point	0 dBm minimum
Gain Variation with Tuning	7 dB maximum
Input Impedance	50 ohms, nominal
Input VSWR	2.0 to 1, maximum
IF Output Impedance	50 ohms, nominal
Overall Gain:	
160 MHz W-B Output	12 dB, minimum
160 MHz N-B Output	15 dB, minimum
21.4 MHz Output	17 dB, minimum
Translated LO Output (DRO Output)	
Output Frequency	F tuned +160 MHz
Output Level	-12 dBm minimum; +5 dBm maximum
Output Impedance	50 Ω, nominal
Fine Tuning Range	500 kHz, minimum
AFC Input Voltage Range	Up to ±3 V (set for non-inverting input)
AGC Input Voltage Range	Factory Set for 0 V maximum Gain to -15 V
AGC Range	25 dB, minimum
Analog Tune Output	-10 V at 30 MHz, +10 V at 1000 MHz, linear to within 1%
Operating Temperature	0° C to 50° C
Power Requirements:	
Input Power	115/220 Vac ±10% 48-420 Hz
Power Consumption	25 watts, approximately
Dimensions	3.5 inches high, 16 inches deep, 19 inches wide
Weight	16.5 lbs. approximately

NOTE: The design of the WJ-9080B Tuner allows coverage down to 10 MHz, but with deviations from the specifications listed above. The tape dial is marked to indicate the frequencies below 30 MHz.

7.1 ELECTRICAL CHARACTERISTICS

Information in this section provides a listing of the changes made throughout the receiver. The majority of these changes are minor and for the most part, only concern one assembly addition and minor component changes concerning the other assemblies.

A) Isolator U7 is added between the output of Mixer U3 and the input of the low pass filter FL4.

B) Attenuator AT5 is moved from the output of mixer U3 to its input for improving the impedance match at the input of mixer U3.

C) The Type 791272-2 160 MHz Power Splitter/Amplifier is modified to include value changes for Resistors R5 and R6, which are implemented to match the impedance at the input of the 160 MHz Amplifier (A10).

D) The Type 8310 CMO Assembly is modified to include a new semi-rigid cable at its input for a better impedance match.

E) Type 71412-2 2160 MHz IF Amplifier/Converter (A1) is modified to include the replacement of Type 17438 2 GHz mixer with Type 18200, along with modifications in the 160 MHz Preamplifier and component value changes in the 2160 MHz Amplifier Subassembly.

F) Type 791525 160 MHz SM Filter (A13) is added to the output of Type 72436, 160 MHz Amplifier (A10) to eliminate an image signal from appearing on the signal monitor.

7.2 MECHANICAL CHARACTERISTICS

Since the majority of the changes are electrical and are implemented to improve performance, the mechanical characteristics for the WJ-9080B are identical to those described in the WJ-9080A manual.

7.3 INSTALLATION AND OPERATION

The installation and operation procedures for the WJ-9080B Tuner are identical to the WJ-9080A and are obtainable in section two of this manual.

7.4 CIRCUIT DESCRIPTIONS

Information in the succeeding paragraphs is prepared to give a detailed description of the changes incorporated within the major assemblies. The assemblies not listed below, are identical in design and operation to those used in the WJ-9080A Tuner.

7.4.1 TYPE 71412-2 2160 MHz IF AMPLIFIER/CONVERTER ASSEMBLY (A1)

The modifications o this assembly only pertain to subassembly changes. These changes include the replacement of Type 17438 2 GHz mixer with Type 18200, modifications made on the 160 MHz preamplifier and minor changes on the 2160 MHz Amplifier.

7.4.1.1 Part 17437-2 2160 MHz Amplifier (A1A1)

The changes on this subassembly are minor and only include the addition of variable capacitor C6 to the emitter of Q1 and a change in value for capacitor C1 to 10 PF. The result of these changes eliminate previous instability problems with the 2 GHz 2nd LO.

7.4.1.2 Part 18200 2160 GHz Mixer (A1A2)

The modifications included on this subassembly are the addition of Transformer T1 which is added to the IF output of Double-Balanced Mixer U1. This provides a 25 Ω wideband impedance match for the input to the next stage.

7.4.1.3 Part 17439-2 160 MHz Preamplifier (A1A3)

The only change included on this subassembly is the elimination of an impedance matching network consisting of C2 and L2 which is replaced by Transformer T1. The circuit description included in Section 3 of this manual is applicable.

7.4.2 TYPE 8310-2 CMO 5 MHz/25 MHz ASSEMBLY (A8)

The modifications made on this assembly only include the replacement of an RG188 cable to a semi-rigid type for a better impedance match to the next stage. The circuit description included in Section 3 for this assembly is applicable.

7.4.3 TYPE 791272-2 160 MHz POWER/SPLITTER AMPLIFIER (A2)

The modifications made on the Power/Splitter Amplifier only pertain to value changes for Resistors R5 and R6. These changes are implemented for impedance matching at the input of the 160 MHz Amplifier (A10).

7.4.4 TYPE 791525 160 MHz SM FILTER (A13)

7.4.4.1 Since the Type 791525 SM Filter is a new addition to the Tuner, a description of its operation is given. The filter is a 3-pole Chebyshev type having a 1.0 dB bandwidth of approximately 20 MHz min.

7.4.4.2 The output from the 160 MHz amplifier enters the first stage of filtering, consisting of filter network C4, C5, L1 and variable capacitor C1, through input jack A13J1. The remaining stages are identical to the first with capacitors C2 and C3,

concerning the last two stages, being adjustable. The SM input for the signal monitor is available from Rear Panel Jack J4.

7.4.5 WJ-9080B MAIN CHASSIS

The information in this section describes the changes made on the main chassis. These changes are minor and only concern the addition of an SM Filter Assembly (A13) to the output of the 160 MHz amplifier and the insertion of isolator (U7) between the output of mixer U3 and the input low pass filter FL4. All input and output connections along with the operator controls remain identical in operation to those used with the WJ-9080A Receiver. The descriptions in Sections 1, 2 and 3, concerning the usage of these controls and connectors, are applicable.

7.5 MAINTENANCE

The information in this section concerns changes in Performance Specifications related to paragraph 4.6.3 on page 4.9, in the Maintenance Section. The updated specifications related to this section are listed below:

*A) The gain specification for rear panel Output Jack A11J2 is now 6 dB min.

*B) The gain specification for rear panel Output Jack A11J3 is now 17 dB min.

C) The AGC range specification is now 25 dB min. instead of 30 dB min.

*These readings were taken with a 100 MHz (swept) input signal applied to rear panel Input Jack J1.

7.6 REPLACEMENT PARTS LIST AND SCHEMATIC DIAGRAMS

The following list of manufacturers, parts lists, and schematic diagrams are a supplement for the WJ-9080B and are to be used in conjunction with Sections V and VI of this manual.

Mfr. Code	Name and Address
26618	Piconics Incorporated Cummings Road Tyngsboro, Mass. 01879
32252	Olektron Corporation 6 Chase Avenue Dudley, Mass. 01570
72136	Electro Motive Manufacturing Co. South Park and John Streets Willimantic, Conn. 06226

7.7 PARTS LIST

The parts list which follow contain 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 7.6 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 parts 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 semi-conductors 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 semi-conductors designated in the manual may be substituted in every case with satisfactory results.

7.7 TYPE WJ-9080B TUNER, MAIN CHASSIS

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
	With the exception of those items listed below, the WJ-9080B Tuner is identical electrically to the WJ-9080A Tuner.				
A1	2160 MHz IF Amplifier Converter	1	71412-2	14632	
A2	160 MHz Power Splitter/Amplifier	1	791272-2	14632	
A8	Crystal Marker Oscillator	1	8310-2	14632	
A13	160 MHz Signal Monitor Filter	1	791525	14632	
J1	Connector Jack, N Series	2	3004-7141-10	26805	
J5	Same as J1				
P1	Connector Plug, SMA Series	2	521-1	16179	
P2	Connector Plug, SMA Series	8	521-3	16179	
P3	Same as P2				
P4	Connector Plug, SMA Series	12	201-2A	16179	
P10	Same as P2				
P11	Same as P1				
P12	Same as P2				
P13	Connector Plug, SMC Series	12	UG1466/U	80058	19505
P22	Connector Plug, SMA Series	1	501-3	16179	
P25	Same as P2				
P31	Same as P2				
P32	Same as P13				
P33	Same as P13				

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
P34	Same as P4				
P35	Same as P4				
U7	Same as U6				
W3	Cable Assembly	1	24208-1	14632	
W4	Cable Assembly	1	24209-1	14632	
W5	Cable Assembly	1	24210-1	14632	
W12	Cable Assembly	1	24211-1	14632	
W13	Cable Assembly	1	24212-1	14632	
W19	Cable Assembly	1	24213-1	14632	
W20	Cable Assembly	1	17300-30-19	14632	

7.7.1 TYPE 2160 MHz IF AMPLIFIER CONVERTER

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
	With the exception of those items listed below, the 71412-2 2160 MHz IF Amplifier Converter is identical electrically to the 71412 2160 MHz IF Amplifier Converter.				
A1	2160 MHz IF Amplifier	1	17437-2	14632	
A2	Mixer	1	18200	14632	
A3	160 MHz Preamplifier	1	17439-2	14632	
C12	Capacitor, Variable, Ceramic: .35 μF - 3.5 μF	2	5802	91293	
L9	Inductor	1	S350K	26618	
R7	Not Used				
R8	Not Used				
C13	SAME AS C 12				

7.7.1.1 Part 17437-2 2160 MHz IF Amplifier

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
	With the exception of those items listed below, the 17437-2 2160 MHz IF Amplifier is identical electrically to the 17437 2160 MHz IF Amplifier.				
C1	Capacitor, Ceramic, Disc: 10 pF, 10%, 50 V	1	ATC100A100KC50	29990	
C2	Capacitor, Ceramic, Disc: 100 pF, 10%, 50 V	3	ATC100A101KC50	29990	
C3	Same as C2				
C5	Same as C2				

7.7.1.2 Part 18200 Mixer

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
T1	Transformer	1	T2-1	15542	
U1	Mixer	1	FPCHD253	32252	

7.7.1.3 Part 17439-2 160 MHz Preamplifier

REF DESIG PREFIX A1A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
	With the exception of those items listed below, the 17439-2 160 MHz Preamplifier is identical electrically to the 17439 160 MHz Preamplifier.				
C1	Capacitor, Ceramic, Disc: 100 pF, 5%, 300 V	2	UY02-101J	73899	
C2	Capacitor, Ceramic, Disc; 20pF, 5%. 300V	1	UY01-200J	73899	
C3	Not Used				
C4	Capacitor, Ceramic, Disc: 3300 pF, 10%, 25 V	2	SC25BX332K	96733	
C6	Same as C4				
L2	Not Used				

7.7.2 TYPE 791272-2 160 MHz POWER SPLITTER/AMPLIFIER

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
	With the exception of those items listed below, the 791272-2 160 MHz Power Splitter Amplifier is identical electrically to the 791272 160 MHz Power Splitter/Amplifier.				
A1	160 MHz Power Splitter/Amplifier	1	17409-2		

7.7.2.1 Part 17409-2 160 MHz Power Splitter/Amplifier

REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
	With the exception of those items listed below, the 17409-2 160 MHz Power Splitter/Amplifier is identical electrically to the 17409 160 MHz Power Splitter/Amplifier.				
R5	Resistor, Fixed, Composition: 82 Ω, 5%, 1/4 W	1	RCR07G820JS	81349	01121
R6	Resistor, Fixed, Composition: 2.2 kΩ, 5%, 1/4 W	1	RCR07G222JS	81349	01121

7.7.3 TYPE 8310-2 CRYSTAL MARKER OSCILLATOR

REF DESIG PREFIX A8

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
	With the exception of those items listed below, the 8310-2 Crystal Marker Oscillator is identical electrically to the 8310 Crystal Marker Oscillator.				
J1	Connector Receptacle, SMA Series	1	210-2	16179	
J2	Connector Receptacle, SMA Series	1	211	16179	

7.7.4 TYPE 791525 160 MHz SIGNAL MONITOR FILTER

REF DESIG PREFIX A13

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR CODE	RECM VENDOR
C1	Capacitor, Air, Variable: .8-10 pF	3	5202	91293	72136
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Mica, Dipped: 24 pF, 5%, 500 V	2	CM04ED240J03	81349	72136
C5	Capacitor, Ceramic, Tubular: 12 pF, 5%, 500 V	2	301-000C0G0-120J	72982	
C6	Capacitor, Ceramic, Tubular: 1.5 pF, ± 0.1 pF, 500 V	1	301-000C0K0-159B	72982	
C7	Capacitor, Ceramic, Tubular: 7.5 pF, ± 0.5 pF, 500 V	1	301-000C0H0-759D	72982	
C8	Capacitor, Ceramic, Tubular: 1.8 pF, ± 0.1 pF, 500 V	1	301-000C0K0-189B	72982	
C9	Same as C5				
C10	Same as C4				
J1	Connector Receptacle, SMC Series	2	10-0104-002	19505	
J2	Same as J1				
L1	Coil	3	20681-170	14632	
L2	Same as L1				
L3	Same as L1				

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, 5%, 1/8W.
   b) CAPACITANCE IS IN pF.

HIGHEST REF DESIG USED	REF DESIG NOT USED
A6	—
C12	—
FL11	FL6, 7
J4	J2
L9	—
Q2	—
R10	R1, R7, R8
AT1	—

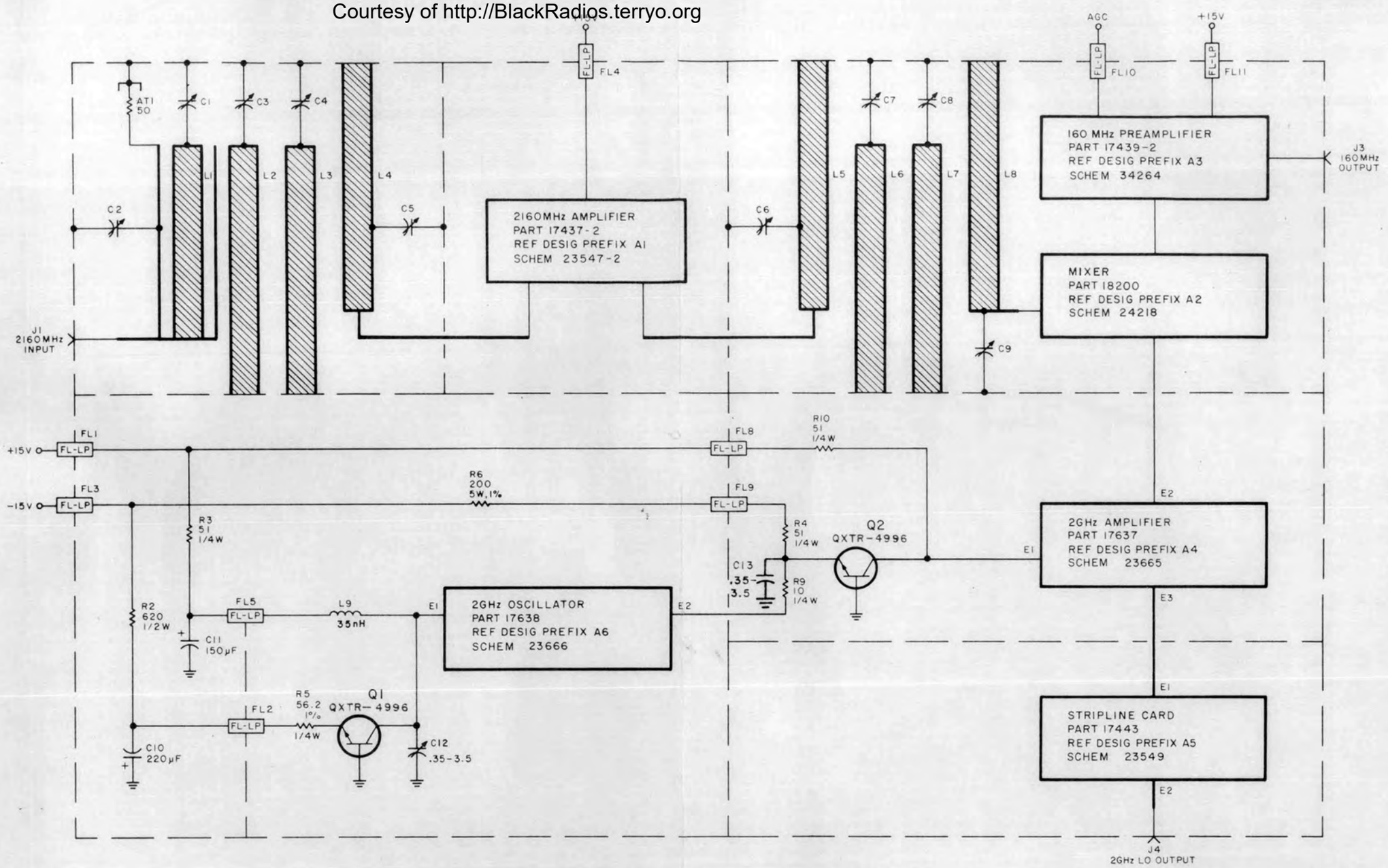


Figure 7-1. Type 71412-2 2160 MHz IF Amplifier/Converter (A1), Schematic Diagram

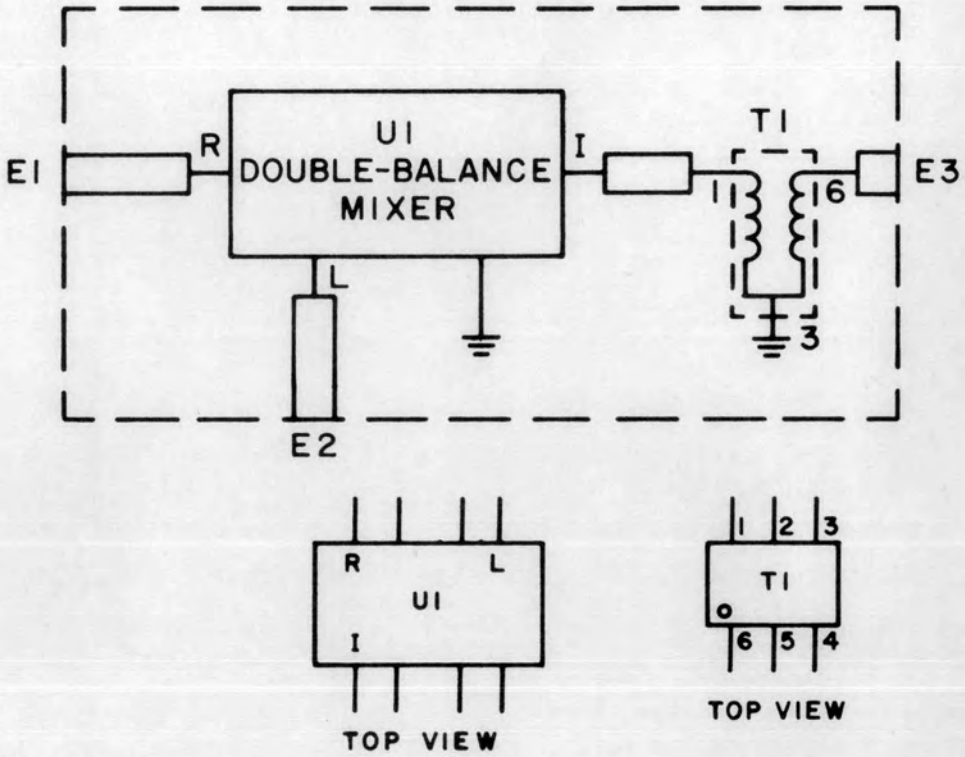
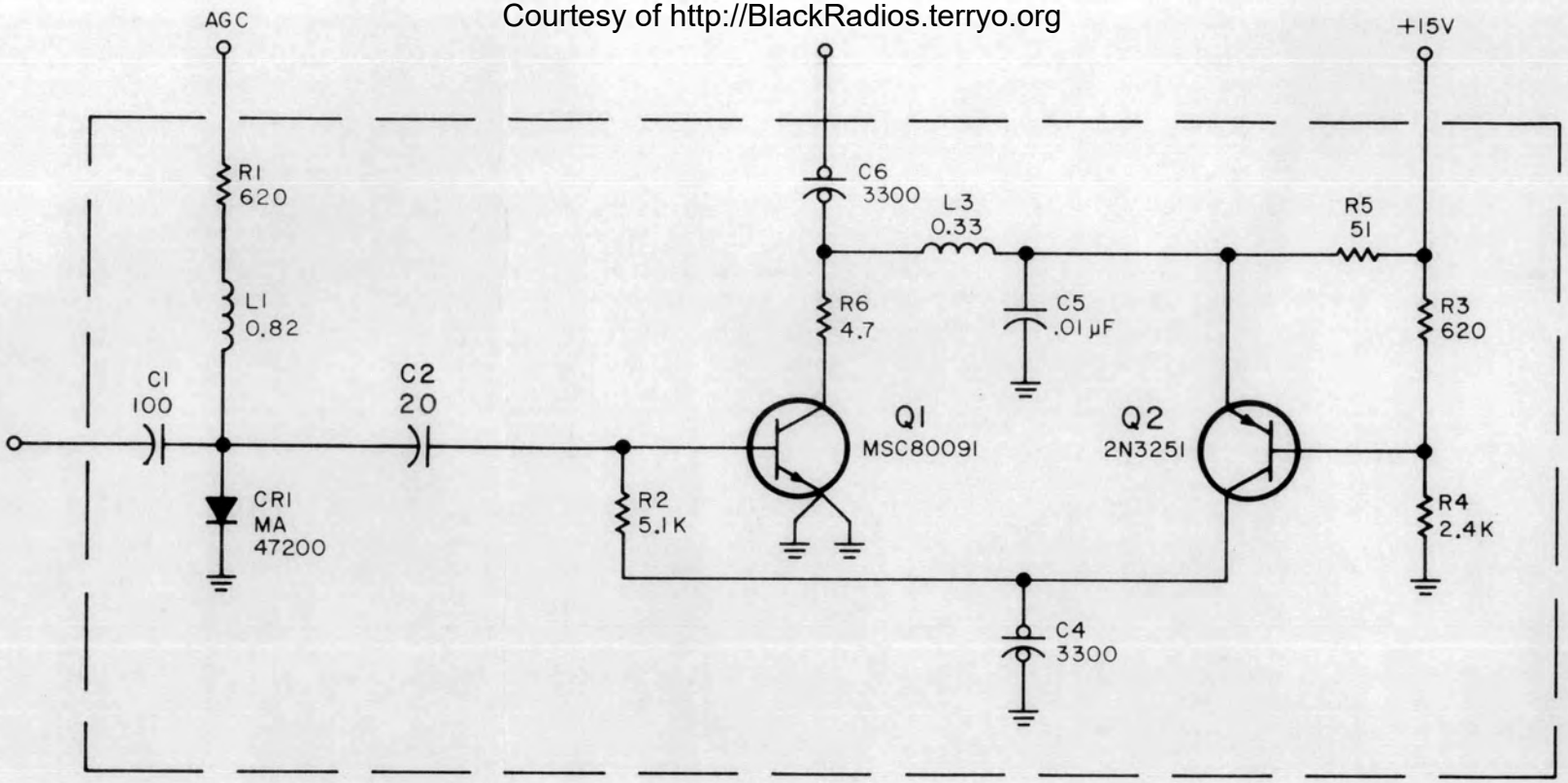


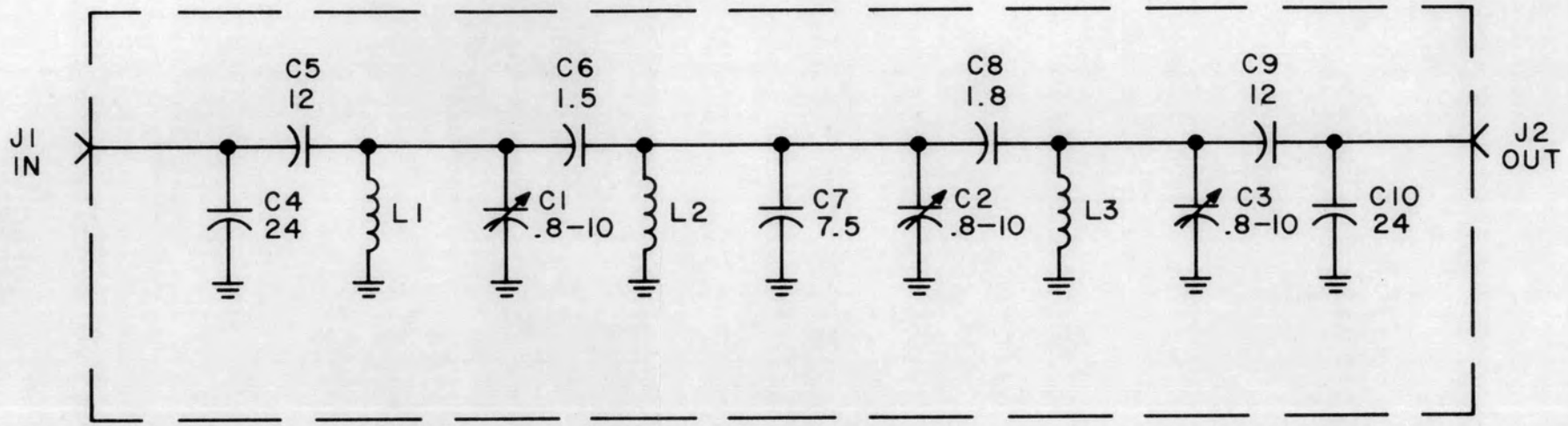
Figure 7-2. Part 18200 Mixer (A1A2), Schematic Diagram



NOTES:

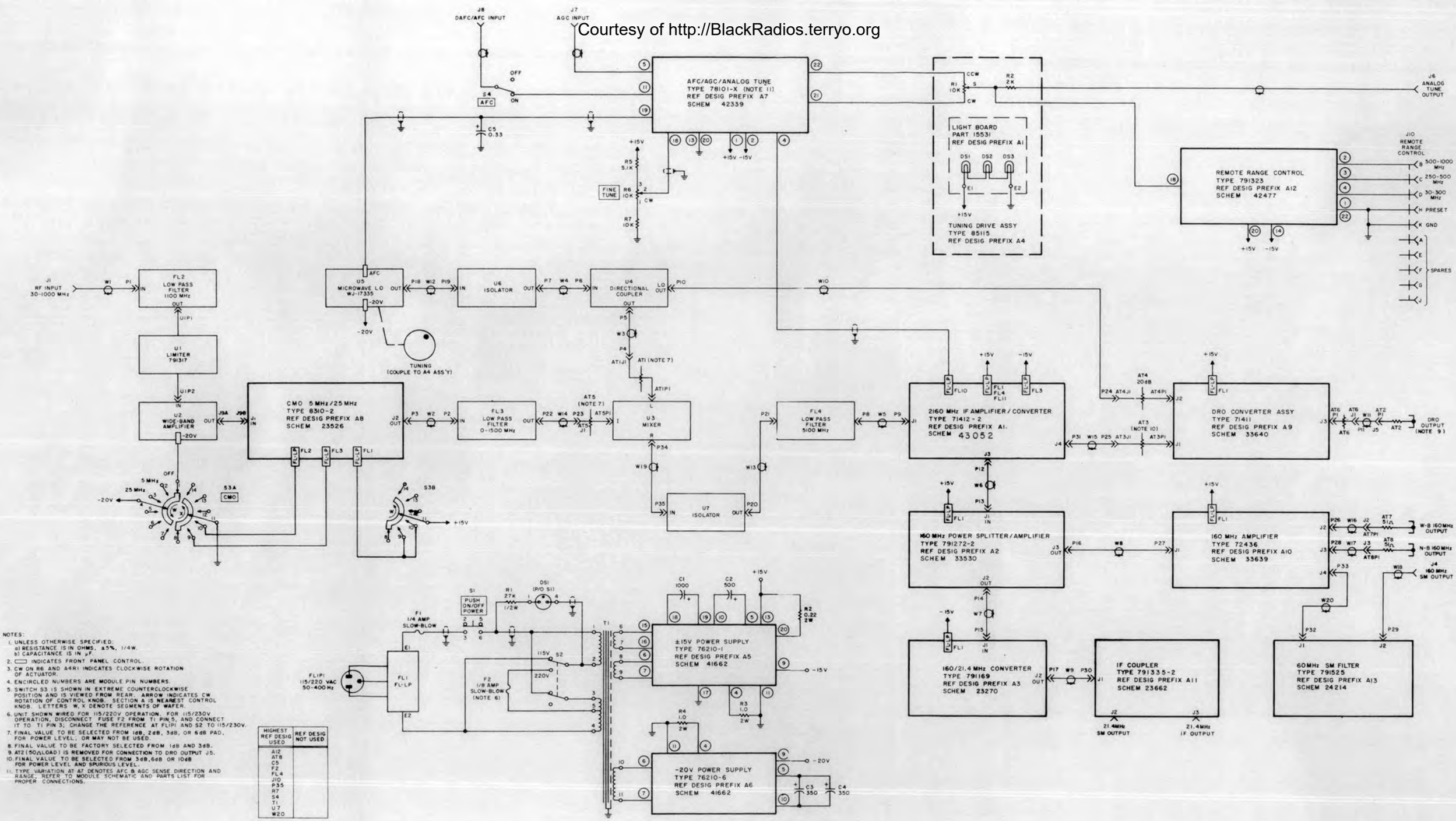
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
   c) INDUCTANCE IS IN µH.
2. ALL COMPONENTS ARE SOLDERED ON TOP OF BOARD.

Figure 7-3. Part 17439-2 160 MHz Preamplifier (A1A3), Schematic Diagram



NOTE:
CAPACITANCE IS IN pF.

Figure 7-4. Type 791525 160 MHz Signal Monitor Filter (A13), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
2. ▭ INDICATES FRONT PANEL CONTROL.
3. CW ON R6 AND A4R1 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
4. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
5. SWITCH S3 IS SHOWN IN EXTREME COUNTERCLOCKWISE POSITION AND IS VIEWED FROM REAR. ARROW INDICATES CW ROTATION OF CONTROL KNOB. SECTION A IS NEAREST CONTROL KNOB. LETTERS W, X DENOTE SEGMENTS OF WAFER.
6. UNIT SHOWN WIRED FOR 115/220V OPERATION. FOR 115/230V OPERATION, DISCONNECT FUSE F2 FROM T1 PIN 5, AND CONNECT IT TO T1 PIN 3; CHANGE THE REFERENCE AT FLIPI AND S2 TO 115/230V.
7. FINAL VALUE TO BE SELECTED FROM 1dB, 2dB, 3dB, OR 6dB PAD, FOR POWER LEVEL, OR MAY NOT BE USED.
8. FINAL VALUE TO BE FACTORY SELECTED FROM 1dB AND 3dB.
9. AT2 (50Ω LOAD) IS REMOVED FOR CONNECTION TO DRO OUTPUT J5.
10. FINAL VALUE TO BE SELECTED FROM 3dB, 6dB OR 10dB FOR POWER LEVEL AND SPURIOUS LEVEL.
11. TYPE VARIATION AT A7 DENOTES AFC & AGC SENSE DIRECTION AND RANGE; REFER TO MODULE SCHEMATIC AND PARTS LIST FOR PROPER CONNECTIONS.

HIGHEST REF DESIG USED	REF DESIG NOT USED
A12	
AT8	
C5	
F2	
FL4	
J10	
P35	
R7	
S4	
T1	
U7	
W20	

Figure 7-5. Type WJ-9080B Tuner, Schematic Diagram