

**INSTRUCTION MANUAL
FOR
TYPE 487A-(X) RECEIVER**

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

S20/300/8/30/74/HED

WARNING

The equipment frame associated with this unit employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised when working with the equipment frame with any of the protective covers removed.

TABLE OF CONTENTS

SECTION I GENERAL DESCRIPTION

<u>Paragraph</u>		<u>Page</u>
1.1	Electrical Characteristics	1-1
1.2	Mechanical Characteristics	1-1
1.3	Frequency And Bandwidth Specifications and Designations	1-1
1.4	Equipment Supplied	1-2
1.5	Equipment Required But Not Supplied	1-2

SECTION II INSTALLATION AND OPERATION

2.1	Unpacking and Inspection	2-1
2.2	Installation	2-1
2.3	Operation	2-1
2.4	Preparation For Reshipment And Storage	2-1

SECTION III CIRCUIT DESCRIPTION

3.1	General	3-1
3.2	Functional Description	3-1
3.3	Type 71400-2 20-80 MHz RF Tuner	3-3
3.4	Type 72427-(X) IF Demodulator Assembly	3-4
3.5	Type 791296-1 FM-Video Equalizer	3-5
3.6	Type 7898-(X) COS, AGC, Squelch and Video Amplifier	3-6

SECTION IV MAINTENANCE

4.1	General	4-1
4.2	Cleaning and Lubrication	4-1
4.3	Inspection For Damage or Wear	4-1
4.4	Troubleshooting	4-1
4.5	Performance Checks	4-7
4.6	Type 487A-(X) Receiver Alignment	4-9

TABLE OF CONTENTS (Cont)

SECTION V REPLACEMENT PARTS LIST

<u>Paragraph</u>		<u>Page</u>
5.1	Unit Numbering Method.	5-1
5.1	Reference Designation Prefix	5-1
5.3	List of Manufacturers	5-1
5.4	Parts List.	5-3

SECTION VI SCHEMATIC DIAGRAMS

LIST OF ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
1-1	Type 487A-(X) Receiver, Front View	1-0
2-1	Type 487A-(X) Receiver, Critical Dimensions.	2-3
3-1	Type 487A-(X) Receiver, Functional Block Diagram	3-0
4-1	Test Setup, DAFC Range Check	4-7
4-2	Test Setup, AM Output Level and Stability	4-8
4-3	Test Setup, Mixer Output Alignment	4-10
4-4	Typical Mixer Output Response Curve	4-10
4-5	Test Setup, Interstage Alignment	4-11
4-6	Typical 50 MHz Response Curve	4-12
4-7	Test Setup, IF Demodulator Gain Adjustment	4-12
5-1	Type 487A-(X) Receiver, Front View, Location of Components.	5-6
5-2	Type 487A-(X) Receiver, Rear View, Location of Components	5-6
5-3	Type 487A-(X) Receiver, Top View, Location of Components.	5-7
5-4	Type 487A-(X) Receiver, Bottom View, Location of Components	5-7
5-5	Type 487A-(X) Receiver, Right Side View, Location of Components	5-8
5-6	Type 487A-(X) Receiver, Left Side View, Location of Components	5-8
5-7	Type 71400-2 20-80 MHz RF Tuner (A1), Location of Components	5-10
5-8	Part 17489-2 Input Network (A1A1), Location of Components.	5-11
5-9	Part 17490-1 Interstage/Mixer (A1A2), Location of Components	5-13
5-10	Part 17488-2 Local Oscillator (A1A3), Location of Components	5-13
5-11	Type 72427-(X) IF Demodulator Assembly (A2), Right Side View, Location of Components.	5-16
5-12	Type 72427-(X) IF Demodulator Assembly (A2), Left Side View, Location of Components.	5-17
5-13	Part 17447-2 IF Input (A2A1), Location of Components	5-18
5-14	Part 17451-2 Filtered Output (A2A2), Location of Components	5-19
5-15	Part 17452-2 IF Output (A2A3), Location of Components	5-20
5-16	Part 17453-2 AM Detector and Output (A2A4), Location of Components	5-21
5-17	Part 17454-2 Limiter/Discriminator and FM Output (A2A5), Location of Components.	5-23
5-18	Type 791296 FM Video Equalizer (A3), Location of Components	5-24
5-19	Type 7898-1 AGC, COS, Squelch and Video Amplifier (A4), Location of Components.	5-27

LIST OF ILLUSTRATIONS (Cont)

<u>Figure</u>		<u>Page</u>
6-1	Type 71400-2 20-80 MHz Tuner (A1), Schematic Diagram. . . .	6-3
6-2	Type 72427-(X) IF Demodulator Assembly (A2), Schematic Diagram.	6-5
6-3	Type 791296-1 FM Video Equalizer (A3), Schematic Diagram. .	6-7
6-4	Type 7898-1 AGC, COS, Squelch & Video Amplifier (A4), Schematic Diagram.	6-9
6-5	Type 487A-(X) Receiver, Main Chassis Schematic Diagram . . .	6-11

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1-1	Type Number Designations.	1-2
1-2	Type 487A-(X) Receiver, Specifications.	1-3
4-1	Required Test Equipment	4-2
4-2	Troubleshooting Chart	4-4
4-3	IF Bandwidth to AM/FM Input Levels	4-9
4-4	Typical Semiconductor Element Voltages	4-14

Courtesy of <http://BlackRadios.terryo.org>

NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

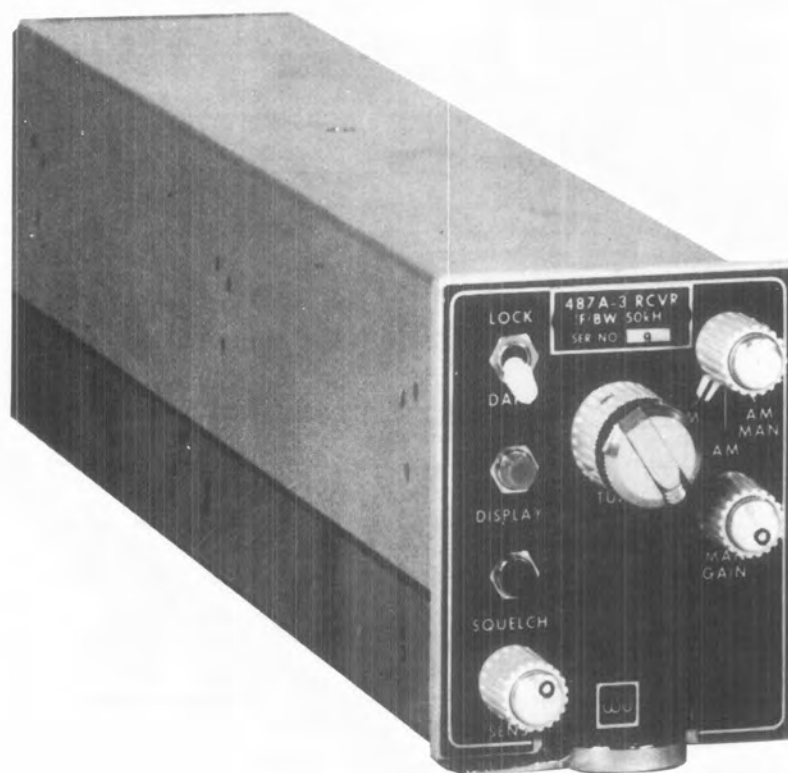


Figure 1-1. Type 487A-(X) Receiver, Front View

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The 487A Receiver is manually tuned in the frequency range of 20-80 MHz. This receiver is designed to operate as a part of the RS-180A Receiving System. The RS-180A system provides six or twelve independent single-channel receivers and a time-shared counter with DAFC. Two different equipment frames are available for the RS-180A system. All operating voltages and interface connections are provided by the equipment frame.

1.1.2 The 487A Receiver is tuned by an inductive tuning assembly. DAFC (digital automatic frequency control) is supplied by the DRO-280A Frequency Counter to lock the local oscillator of each receiver to the desired frequency. The DAFC holds the receiver within ± 1 kHz of any frequency within the receiver tuning range.

1.1.3 The 487A Receiver is designed for narrow band AM or FM reception in the 20-80 MHz range. IF bandwidths of 10, 20, 40, and 50 kHz are available as customer selected options. Crystal filters are used to establish these bandwidths.

1.1.4 The 487A Receiver operates in three manually selected modes. These are FM, AM, and AM MAN. Located on the front panel is a DAFC switch, a manual tuning control, squelch control, MAN GAIN control, and the mode selector switch. There are two indicator lights on the front panel. One operates when the squelch is disabled and the other operates in conjunction with the selector switch on the DRO-280A Frequency Counter to indicate which receiver frequency is being displayed on the counter.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 Manual tuning is accomplished by the front panel tuning knob. An induc-tuner is used to tune the receivers. The 487A Receiver is designed to plug into and operate in the EF-180A or EF-182A Equipment Frames. All input and output connections are made on the rear panel of the receiver using plug-in connectors.

1.2.2 A frontal view of the 487A Receiver is shown in Figure 1-1. Additional views are shown in Figures 5-1 through 5-4. For dimensions and weight see Table 1-2.

1.3 FREQUENCY AND BANDWIDTH SPECIFICATIONS AND DESIGNATIONS

The suffix for the Type 72427-() IF Demodulator Assembly for receiver type number suffix is as follows:

Type 487-1 Receiver	72427-4 IF Demodulator Assembly
Type 487-2 Receiver	72427-5 IF Demodulator Assembly
Type 487-3 Receiver	72427-6 IF Demodulator Assembly
Type 487-8 Receiver	72427-7 IF Demodulator Assembly

Table 1-1. Type Number Designations

BASIC TYPE	DASH NUMBER SUFFIX	IF BANDWIDTH
487A-(X)	-1	10 kHz
	-2	20 kHz
	-3	50 kHz
	-8	40 kHz

1.4 EQUIPMENT SUPPLIED

1.4.1 This equipment consists of the 487A-(X) Receiver only.

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED

1.5.1 The 487A-(X) Receiver requires either the EF-180A or EF-182A Equipment Frame, a DRO-280A Frequency Counter for DAFC operation and the EC-180 Extender cable for servicing. Provisions are also made for use of a signal monitor.

Table 1-2. Type 487A-(X) Receiver, Specifications

Tuning Range.....	20-80 MHz
Types of Reception.....	AM, FM, and AM MAN
Input Impedance	50 Ω , nominal
Noise Figure.....	7 dB, maximum
Image Rejection	60 dB, minimum
IF Rejection.....	60 dB, minimum
Antenna Conducted LO Radiation.....	15 μ V, maximum
IF Frequency.....	10 MHz
IF Bandwidth.....	Customer option: 10, 20, 40, 50 kHz
SM Output.....	10 MHz
Audio Output Level.....	1.5 V peak to peak into 91 Ω unbalanced
Output Amplifier Frequency Response...	50 Hz to 1 MHz
Local Oscillator Output Level.....	20 mV, minimum; 90 mV, maximum
Dimensions	2.5 inches wide; 3.1 inches high; and 14.5 inches deep*
Weight.....	4 lbs, approximately

* Measured from back of front panel to rear panel.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

SECTION II

INSTALLATION AND OPERATION

2.1 UNPACKING AND INSPECTION

2.1.1 Examine the shipping carton for damage during the unpacking of the equipment. If the carton has been damaged, notify the carrier's agent. Retain the shipping cartons and padding material for the carrier's inspection if damage to the equipment has occurred.

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 to the unit is visible, inspect the internal components for apparent damage.

2.2 INSTALLATION

The 487A Receiver is designed to slide into the EF-180A or EF-182A Equipment Frame in which all necessary signal and power connections are made through the connectors on the rear of the receiver.

2.3 OPERATION

Functions of the 487A Receiver are controlled from the receiver front panel. Tuning the receiver is a two part function. Before attempting to tune the receiver, make sure the DAFC switch is in the unlocked position. Then tune the tuning knob to the desired frequency. After obtaining the desired signal, transfer the DAFC switch to the lock position to maintain this frequency. Squelch sensitivity control adjustment is employed to set the carrier level at which the squelch circuit will deactivate allowing an audio output. When in the AM MAN position of the function switch the manual gain control applies a control voltage to the IF and RF AGC points to prevent strong signals from overloading the circuit. There are two indicator lamps on the front panel. One is illuminated when the squelch gate opens. The second lamp is illuminated in conjunction with the selector switch on the DRO-280A Frequency Counter to indicate that the receiver has been selected for frequency readout.

2.4 PREPARATION FOR RESHIPMENT AND STORAGE

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.

2.4.1 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

Courtesy of <http://BlackRadios.terryo.org>

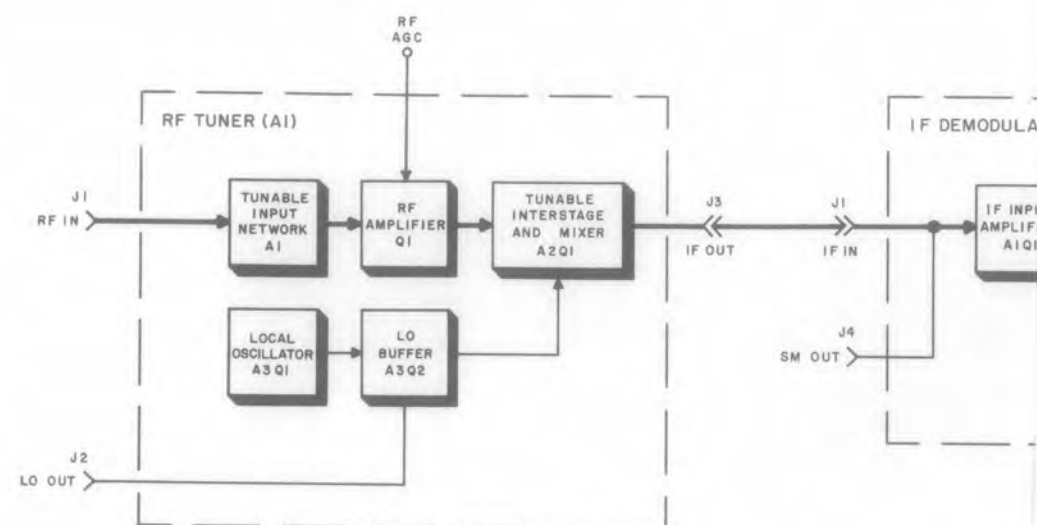
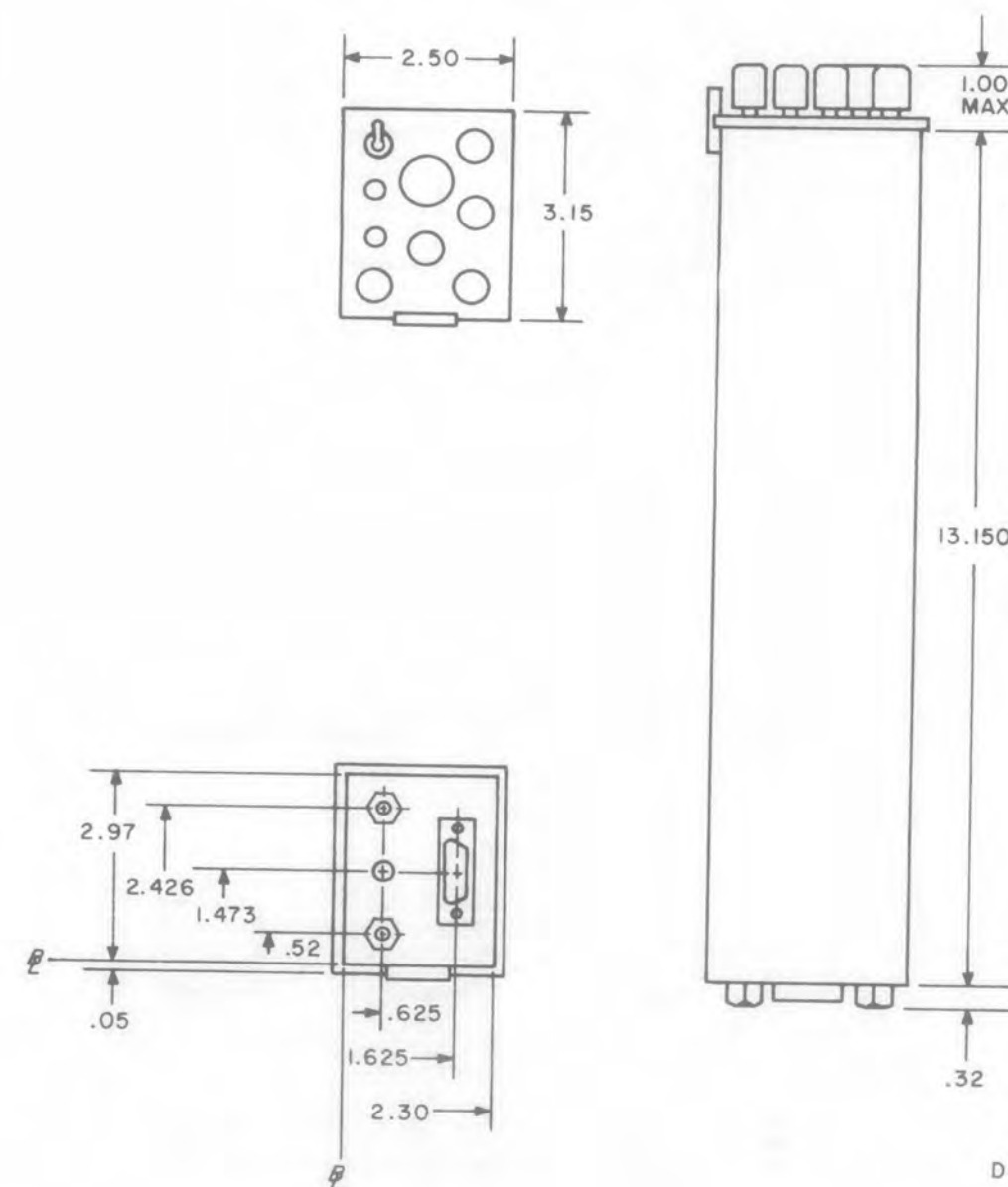


Figure 3-1. Type 487A Receiver,
Functional Block Diagram

Figure 2-1



DIMENSIONS ARE IN INCHES.
DRAWING NOT TO SCALE.

Figure 2-1. Type 487A-(X) Receiver, Critical Dimensions

Figure 3-1

Courtesy of <http://BlackRadios.terryo.org>

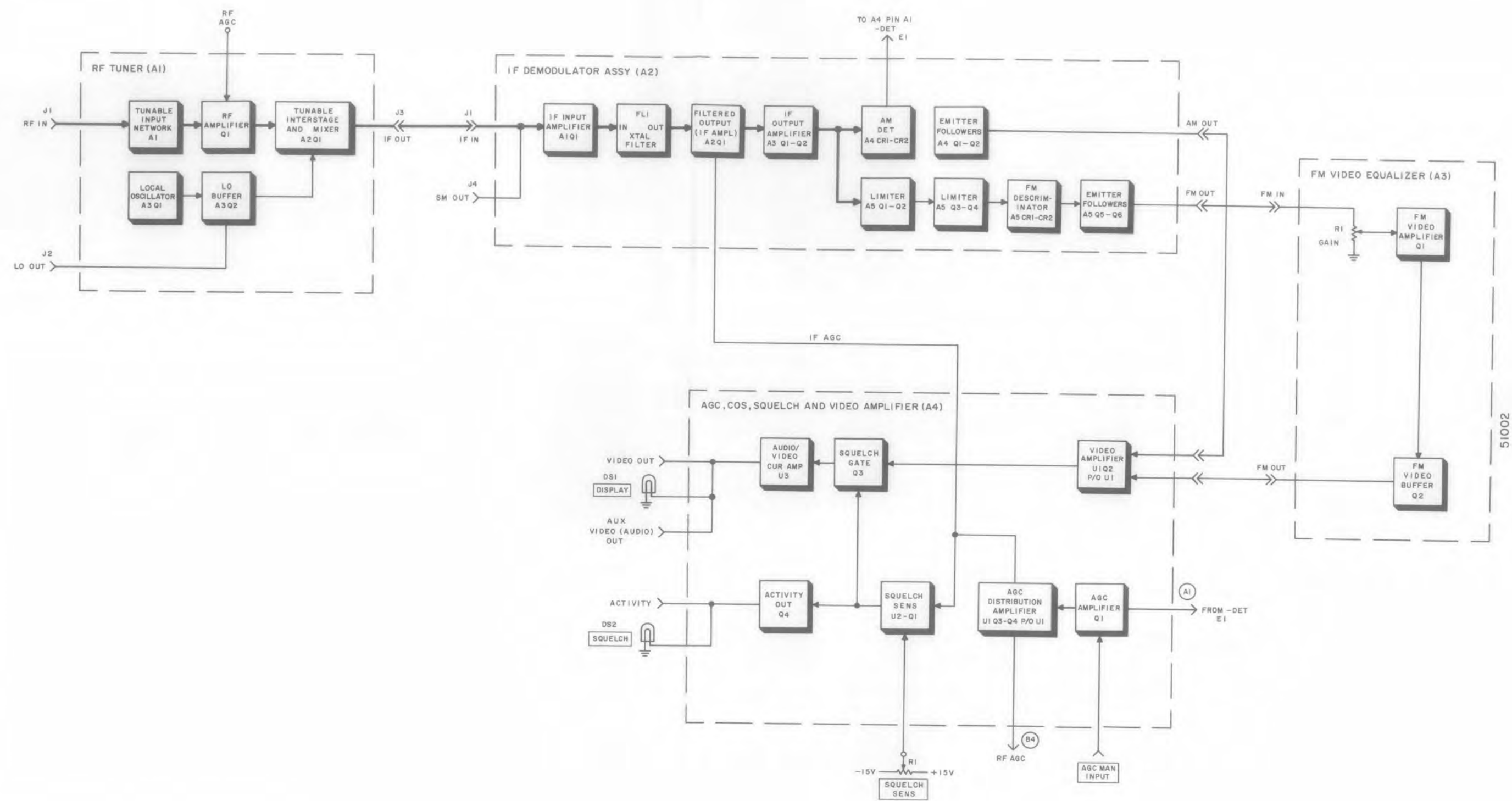


Figure 3-1. Type 487A Receiver,
Functional Block Diagram

SECTION III

CIRCUIT DESCRIPTION

3.1 GENERAL

The operation of the various circuits in the 487A-(X) Receiver are described in the following paragraphs using the functional block diagram, Figure 3-1, and schematic diagrams in Section VI. The 487A-(X) Receiver operates in conjunction with the EF-180A or EF-182A Equipment Frame and a DRO-280A Frequency Counter as a part of the RS-180A Receiving System. A signal monitor output is also provided. Notice that the unit numbering system is used to designate components. This means that parts of subassemblies and modules have a prefix before the usual class letter and number of the item, i.e., A1Q1 or A3R9. These subassembly prefixes are omitted on figures and in the text, except where confusion might occur.

3.2 FUNCTIONAL DESCRIPTION

3.2.1 General. - The following description and the associated block diagram, Figure 3-1, applies to the 487A Receiver. The frequency range of 20-80 MHz is covered by the 487A-(X) unit. The 487A has an IF bandwidth of 10, 20, 40, or 50 kHz to be determined by the crystal filter in the unit. The 487A Receiver is designed for narrowband AM and FM reception.

3.2.2 VHF Tuner (A1). - RF inputs from the antenna are applied to the tunable preselector network, which is essentially a single-tuned bandpass filter. The output of the preselector is then coupled to RF amplifier A1Q1, a dual insulated gate field-effect transistor (IGFET). This type of FET is used because of its excellent intermodulation characteristics and the ease with which AGC voltage can be applied to the stage. The output of this IGFET is then capacitively coupled to the double-tuned interstage filtering network.

3.2.3 Interstage. - The interstage network is a double-tuned bandpass filter which, in conjunction with the preselector network, sets the overall RF bandwidth. The output of this filter is then capacitively coupled to the signal gate of the IGFET mixer, A1A2Q1.

3.2.4 Mixer. - The mixer, A1A2Q1, exhibits good rejection of harmonics and intermodulation characteristics. RF signals from the interstage network are connected to the gate of the mixer, and the local oscillator signal from A1A3Q1 is buffered by A1A3Q2 before being connected to the source of the mixer. The 21.4 MHz IF output from the mixer is filtered through the tuned filter, A1A2C15, A1A2C16, and A1A2L5, before being coupled to IF output A1J3.

3.2.5 Local Oscillator. - Local oscillator A1A3Q1 is a modified Colpitts oscillator. It is tuned by LID and tracks 10.0 MHz above the incoming RF signal.

The output frequency from the LO is buffered by A1A3Q2 before being applied to mixer A1A2Q1 and is also applied to the LO output A1J2. The function of this buffer before the mixer and the LO output jack is to isolate the local oscillator from changes in loading which would load down the oscillator tank circuit causing the LO to shift frequency.

3.2.6 IF Demodulator (A2). - IF output from J3 of tuner A1 is connected to the IF input J1 of the IF demodulator subassembly. This input signal is applied to one of the gates of the input IF amplifier, A2A1Q1. Automatic Gain Control voltage is applied to A2A1Q1 on the second gate. Output from transistor A2A1Q1 is then applied through transformer A2A1T1 to the input of the customer specified crystal filter, A2FL1. The output of A2FL1 is coupled through the center tap A2A2T1 to the interstage IF amplifier. AGC is applied to A2A2Q1 also. The output from A2A2Q1 is then coupled to A2A3Q1 where it is amplified further before being demodulated by the AM detectors A2A2CR1 and A2A2CR2. The output of A2A3Q1 is also connected to the FM limiter/discriminator A2A2A5. The FM signal is demodulated and coupled to FM output buffer A2A5Q5-Q6.

3.2.7 FM-Video Equalizer (A3). - Demodulated FM video from the IF demodulator assembly are coupled into the FM-video equalizer through gain adjust potentiometer A3R1 and capacitor A3C1 to the base of amplifier A3Q1. Amplified FM video is then buffered by A3Q2 before being coupled to the AGC COS squelch and Video Amplifier subassembly A4.

3.2.8 AGC, COS, Squelch and Video Amplifier (A4). - The AGC voltage is developed in module A2A3 through the negative detector A2A3CR3. Changes in carrier level are detected as increased signal voltage in A2A3T1. This level is then applied to pin A1 of the AGC module A4. The RC time constant formed by A4R5 and A4C1 filters the AM portion of the detected signal leaving just a dc component proportional to the average level of the input carrier. Transistor Q1 of module A4 then amplifies this dc level and couples it to the base of A4U1Q3 where it is further amplified and applied to the IF amplifier as IF AGC. The start of tuner AGC is delayed by A4U1Q4. Tuner AGC is delayed until the input signal has increased by about 30 to 40 dB above the point at which the IF AGC begins. RF AGC amplifier A4U1Q4 is turned on by the increasing current through A4R9, the emitter resistor of A4U1Q3. As the current through R9 increases, A4U1Q4 conducts more, thus applying more AGC voltage to the tuner.

3.2.9 Squelch and Video Amplifier Circuits. - The front panel squelch sense adjust R10, which is connected through A4R34 and A4R11 to ± 15 V dc, adjusts the threshold at which the squelch will be disabled allowing the audio to be amplified and coupled to the audio outputs. The squelch is deactivated by the IF AGC voltage through A4R15 to pin 2 of A4U2. When this AGC level reaches a level determined by the setting of R10, A4U2 changes state and causes A4Q2 to conduct, placing the cathode of A4CR2 at +15 volts allowing A4Q3, a junction FET operating in the depletion mode, to conduct the audio signal to pin 3 of audio amplifier A4U3. Also upon deactivation of the squelch circuit A4Q4 conducts illuminating

the squelch lamp on the front panel and providing a logic output for the Carrier Operated Switch. When the squelch is deactivated, the audio signal is coupled through A4Q3 to A4U3 where it is amplified and applied to the audio outputs.

3.2.10 Operating Voltages. - The operating voltage for the 487A Receiver is supplied by the EF-180A or EF-182A Equipment Frame.

3.3 TYPE 71400-2 20-80 MHz RF TUNER

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

3.3.1 RF Circuitry (A1A1). - Input signals from the RF input J1 are coupled through the single tuned input network A1 which provides input matching and the first tuned stage for selectivity. Bandwidth limited signals from the input network are then coupled to the signal gate of the RF amplifier Q1. Transistor Q1 is a dual insulated gate field effect transistor (dual IGFET). Bias for the signal gate of Q1 is taken from the +15 volt supply through the voltage divider R3 through R5. Automatic gain control (AGC) voltage is applied to the other gate of the dual IGFET. Diode CR1, in the AGC line, prevents the AGC voltage from ever going more than 0.6 V positive which would damage transistor Q1. Amplified RF signals from transistor Q1 are then applied to the double tuned interstage network (A2) where further bandwidth limiting is accomplished. Output signals from the interstage network are then applied to the gate of IGFET mixer A2Q1.

3.3.2 Local Oscillator (A1A3). - Transistor A3Q1 and the associated tuned circuits form a modified Colpitts oscillator operating 10.0 MHz above the incoming RF signals. Emitter to base regeneration to sustain oscillation is developed by voltage divider C4 and C5. The oscillator is tuned by L1D, a section of the induc-tuner, to track with the tuned circuits in the RF stages. Output signals from the LO are coupled to the LO buffer A3Q2 which isolates the local oscillator from changing load impedances in the mixer and LO output. Digital Automatic Frequency Control (DAFC) voltage is applied to varactor diode CR1 to stabilize the LO when the front panel DAFC switch is in the LOCK position. The DAFC from the DRO-280A Frequency Counter will hold the LO to within 1 kHz of the receiver tuned frequency.

3.3.3 Mixer (A1A2). - Insulated gate FET mixer A2Q1 has amplified RF signals applied to the gate and the buffered LO signals, from the emitter of A3Q2, applied to the source. The sum and difference frequencies produced by the mixing action are extracted from the drain of the mixer transistor and applied through parasitic suppressor resistor A2R5 to the tuned circuit consisting of capacitors A2C15 and A2C16 and inductor A2L5. This tuned circuit picks off the sum frequency of the mixer products and applied them to the IF OUT jack J3.

3.4 TYPE 72427-(X) IF DEMODULATOR ASSEMBLY

The schematic diagram for this assembly is Figure 6-2. The reference designation prefix is A2.

3.4.1 IF Input (A2A1). - The IF signals from the RF tuner are coupled in through jack J1. A portion of these signals is tapped off by voltage divider R2 and R3, and coupled to the SM output jack J4. The primary IF signals are coupled through tapped transformer T1 and capacitor C1 to the signal gate of dual IGFET Q1. Bias voltage for the signal gate is taken from the +15 volt supply through R1 and voltage divider R3 and R4. Bias voltage to set the small signal gain of Q1 is also taken from the +15 V supply through A1R5 and applied to the gain control gate. Automatic gain control (AGC) voltage is also applied to this gate. Diode A1CR1 is held forward biased by the positive voltage taken from the junction of the gain control gate and R5 through R2. Diode CR1 retards the start of AGC action until the AGC voltage reaches a level sufficient to reverse bias CR1. At this point the gain of amplifier Q1 is clamped. Operating voltage for Q1 is taken from the +15 volt supply through R7 and R1 to the drain. Resistor R7 and by-pass capacitor C4 are added to the source to improve stability and signal handling capabilities. Amplified IF signals from the drain of transistor A1Q1 are coupled through transformer T2 to the input of the customer selected crystal filter, FL1. Filter FL1 sets the IF bandwidth.

3.4.2 Filtered Output (A2A2). - Bandwidth limited outputs from the crystal filter are through tapped transformer T1 and capacitor C1 to the signal gate of dual IGFET Q1. The biasing and AGC description for transistor A1Q1 also apply to this transistor. Amplified IF signals from the drain of amplifier Q1 are applied to cascade IF amplifier A3Q1 and Q2.

3.4.3 IF Output (A2A3). - Dual IGFET's Q1 and Q2 form a cascade IF amplifier. The gain of both transistors is fixed, with no AGC voltage applied. The gain of Q1 is adjusted by potentiometer A3R4 applying a positive voltage to the control gate. The gain of Q2 is set in a similar manner by the positive voltage through resistor R9 to the control gate. Amplified IF signals are applied to the signal gate of transistor Q1 through coupling capacitor C1. Amplified signals from the drain of Q1 are applied through coupling capacitor C6 to the signal gate of transistor Q2. Transistor Q2 amplifies these signals still further before coupling them out through transformer T1 to the AM detector and output board A4.

3.4.4 AM Detector And Output (A2A4). - Amplified IF signals are coupled into the board at terminal E1. From E1 the IF signals are split in three directions. One portion is applied to terminal A5E1 of the Limiter/Discriminator and FM output board, A5, through voltage divider C1 and C2. The next portion is coupled through negative detector CR2 and R7, with C5 providing the high frequency by-pass, to the AGC amplifier on the AGC, COS, Squelch and Video Amplifier board A4. The third portion of the IF signals is applied to the positive AM detector CR1. Capacitor C3 by-passes the high frequency signals before the detected AM Video

signals are applied to the base of emitter follower A4Q1. Video outputs from the emitter of Q1 are then inducted through emitter follower Q2 and resistor R5 to the AM output on terminal E3.

3.4.5 Limiter/Discriminator and FM Output (A2A5). - The IF signals coupled to terminal E1 are applied through C1 to the first pair of limiters Q1-Q2. Transistors Q1 and Q2 are biased class "C". As the input signal starts positive emitter follower Q1 turns on harder until it goes into saturation clipping the positive portion of the signal. The negative portion is unaffected. There is no signal inversion in either transistor. The signal is then coupled through capacitor C3 to the emitter of Q2. The negative excursion of the signal turns Q2 on to saturation thus clipping the negative portion of the input signal. Limiter transistors A5Q3-Q4 function the same as the ones described above. The output of this second set of limiters is then applied to the FM discriminator. The FM discriminator is of the Foster-Seeley type. Transformer T1 and inductor L1 form the primary of the discriminator transformer and are tuned to 10 MHz by capacitors C8-C10. The output of the limiter stage is applied to the primary of the discriminator transformer and is also capacitively coupled through C12 to the secondary of the discriminator transformer. The secondary is tuned to 10 MHz by capacitors C13-C15. The line between the center tap of T1 secondary and the junction of R20 and R21 provides a dc return path for the diode cathode current. With an unmodulated 10 MHz signal applied to the primary of the discriminator transformer the voltage between terminals 4 and 5, and 5 and 6 of the secondary will be equal in level but 180° out of phase and 90° out of phase with the primary. With this condition the voltage across R20 will be positive at the junction of CR1 and negative at the junction with R21; the voltage across R21 will be positive at the junction of CR2 and negative at the junction with R21. As R20 and R21 are equal in value the voltage across each will be equal in magnitude but of opposite polarity with respect to ground. The output of the discriminator is equal to the sum of these two voltages and is therefore zero. When a signal above or below the IF center frequency of 10 MHz is applied, as in an FM modulated signal, the phase relationships change. This phase change between the primary and the two secondary winding causes the discriminator output to increase positively with increasing frequency and decrease negatively with decreasing frequency. It should now be evident that the output will be an alternative voltage with the value and rate dependent upon the audio signals that produced the FM signal. Output voltage from the demodulator are then coupled through resistor R22 to the base of emitter follower Q5. Buffered signals from the emitter of Q5 are coupled through emitter follower Q6 and R26 to the FM output at E2.

3.5 TYPE 791296-1 FM-VIDEO EQUALIZER

The schematic diagram for this board is Figure 6-3 and it has the reference designation prefix A3. This subassembly consists of a potentiometer, R1, to adjust the input level, an amplifier, Q1, and an output buffer, Q2. Demodulated FM video from FM output A2E2 is coupled through a portion of potentiometer R1 and

capacitor C1 to the base of amplifier Q1. Amplified FM video from the collector the collector of transistor Q1 is direct coupled through emitter follower Q2 to output terminal E3.

3.6 TYPE 7898-(X) AGC, COS, SQUELCH AND VIDEO AMPLIFIER

This printed circuit board contains the IF and RF AGC, and the MAN gain control amplifiers; the AM-FM video amplifiers; and the squelch and COS circuitry. Figure 6-4 is the schematic diagram; the reference designation prefix is A4.

3.6.1 AGC. - The AGC voltage for the IF strip and RF tuner is developed from the average dc component of the AM detector coupled in on module pin A1. Resistor R5 and capacitor C1 form an R-C filter to eliminate the amplitude modulation components allowing only the average dc level to be amplified by transistor Q1. The amplified dc voltage is then applied to the base of U1Q3 where it is amplified and coupled out for IF AGC. Transistor U1Q3 also serves to delay the start of tuner AGC until the signal level increases an additional 30 to 40 dB above the start of the IF AGC. Transistor U1Q4 is turned on by the increasing current through R9, the emitter resistor of U1Q3. Once U1Q4 starts conducting it will follow the IF AGC voltage.

3.6.2 Video Amplifier. - There are two video amplifiers. The first is transistor U1Q2 and the second is operational amplifier U3. Detected AM or FM signals are applied to module pin B3 and are coupled through capacitor C10 to the base of U1Q2. Amplified video signals from the collector of U1Q2 are coupled through deactivated squelch gate Q3, discussed below, to current amplifier U3. Both video and display indication outputs are taken from the output of U3.

3.6.3 Squelch. - The squelch circuitry consists of squelch threshold detector U2, squelch control Q2, squelch gate Q3, and activity switch Q4. The squelch threshold detector U2 is activated by a combination of the IF AGC voltage coupled through R15 and the squelch sense voltage coupled through module pin A10 and R1 to the inverting input of U2. The output of U2 is held negative by the negative voltage applied to the non-inverting input (pin 3). This negative voltage at the output of U2 reverse biases diode CR1 and the negative voltage through R12 reverse biases the gate of Q2 holding both in an off state. With Q2 turned off, -15 V through R13 forward biases CR2 and holds Q3 off by reverse biasing its gate. Transistor Q3 is a junction FET operating in the depletion mode. Transistor Q4, which illuminates the squelch closed indicator lamp and provides the logic shift for the COS function, is held off by the negative voltage through R13 and R19. It reverse biases CR3 thus placing the base at approximately zero volts. The squelch gate is closed by either a negative AGC voltage being applied to U2 pin 2 through R15 or by adjusting the squelch control clockwise to apply a negative voltage to U2 pin 2. When the negative voltage at pin 2 exceeds the voltage at pin 3 by a few millivolts, the output of U2 switches to a positive state. At this time, CR1 becomes forward biased elevating the gate voltage of Q2 towards +15 V allow-

487A

CIRCUIT DESCRIPTION

ing it to conduct applying a positive voltage to the cathode of CR2 reverse biasing it and allowing the gate voltage of Q3 to approach the source voltage. This allows Q3 to conduct the video signals to the video amplifier U3. At the same time CR3 is forward biased, through R19, applying a positive voltage to the base of Q4 causing it to conduct to saturation. This illuminates the squelch indicator lamp and provides the logic shift output.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
84

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, typical of notebook or primary school writing paper. The background is white, and there are no margins, text, or other markings present.

SECTION IV

MAINTENANCE

4.1 GENERAL

The Type 487A Receiver has been conservatively designed to operate for extended periods of time with little or no routine maintenance. An occasional cleaning and inspection are the only preventative maintenance operations recommended. The intervals for these operations should be based on the operating environment. Should trouble occur, repair time will be minimized if the maintenance technician is familiar with the circuit descriptions found in Section III. Reference should also be made to the block diagram, Figure 3-1, and to the schematic diagrams found in Section VI. A complete parts list and illustrations showing part locations can be found in Section V.

4.2 CLEANING AND LUBRICATION

The unit should be kept free of dust, moisture, grease and foreign matter to ensure trouble-free operation. If available use low velocity compressed air to blow accumulated dust from the exterior and interior of the unit. A clean, dry cloth, a soft bristled brush, or a cloth saturated with cleaning compound may also be used. The Type 487A Receiver does not require lubrication.

4.3 INSPECTION FOR DAMAGE OR WEAR

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

4.4 TROUBLESHOOTING

Troubleshooting efforts should first be directed toward localizing the problems to a particular module or circuit group. As aids in the process, this manual contains a troubleshooting table (Table 4-2), waveforms taken at key points, a functional block diagram (Figure 3-1), and a complete circuit description (Section III). Once the faulty module has been located, the defective component should

Table 4-1

487A

be isolated using data obtained from the circuit descriptions, voltage measurements (Table 4-4), and detailed schematic diagrams (Figure 6-1 through 6-5).

4.4.1 Localizing Troubles. - The troubleshooting table has been designed to show the methods by which logical troubleshooting can be applied to the Type 487A Receiver. This table lists possible trouble indications, probable faults which could cause the symptoms to appear, and a diagnostic procedure to follow.

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

4.4.3 Equipment Required. - Trouble isolation to the module or subassembly level, alignment and testing can be accomplished using the equipment, or their equivalents specified in Table 4-1.

Table 4-1. Required Test Equipment

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
Frequency Counter	1 MHz to 90 MHz	HP-5245L with HP-5253B plug-in head
Wideband Amplifier	20 dB gain, 20 to 90 MHz	HP-461A
Signal Generator	10 MHz to 90 MHz, attenuator calibrated in dBm (50 Ω) from -110 dBm to -10 dBm. AM modulation 50% at 1 kHz.	HP-608E
Regulated dc power supply	0.0 V dc to ± 4 V dc at 100 mA.	HP-721A
VTVM	0.0 V dc to ± 15 V dc accuracy 3% of full scale.	RCA WV-98C

Table 4-1. Required Test Equipment (Continued)

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
RF VTVM	20 mV minimum sensitivity, 10 MHz to 90 MHz, 50 Ω dBm scale.	Boonton 92A with 91-14A Tee adapter and 91-15A 50 Ω termination
Sweep Generator	Frequency range 10 MHz to 90 MHz, variable attenuator	Wavetek 2001
Step Attenuator	50 Ω impedance, 10 to 90 MHz, 0 to 120 dB in 10 dB steps.	HP-355D
AM, FM Signal Generator	Frequency range 10 MHz to 90 MHz. AM and FM modulation, variable attenuator -10 dBm to -120 dBm.	Boonton 102A
Oscilloscope	dc to 500 kc bandwidth, 1 mV sensitivity, external horizontal input.	Tektronic 503
50 Ω Detector	50 Ω input impedance	Telonic XD-3A
AC VTVM	-50 to +10 dB range 100 Hz to 10 kHz, input impedance 1 M Ω	HP-400FL

NOTE

The EC-180 Extender Cable must be installed in equipment frame and receiver must be connected to EC-180 before maintenance procedures are begun.

Table 4-2

487A

Table 4-2. Troubleshooting Chart

TROUBLE INDICATION	PROBABLE FAULT	DIAGNOSTIC PROCEDURE
1. All receivers in equipment frame inoperative.	EF-180A or EF-182A Equipment Frame defective.	Check or replace fuses. Remove one receiver from the equipment frame. Insert the EC-180 Extender Cable in the frame. Use the multimeter to verify power supply voltages as follows: +15 V on pin 4, -15 V in pin 5, and +5 V on pin 10 of the multi-pin connector.
2. One receiver in equipment frame inoperative.	That slot in the equipment frame defective.	Substitute one of the operational receivers in the questionable slot. If this receiver does not operate, the equipment frame is defective. If the substituted receiver operates, the receiver removed is defective. Install the EC-180 and receiver in the equipment frame and proceed to step 3.
3. Original receiver defective.	Local oscillator defective.	Connect the RF VTVM with 50 Ω load to the appropriate LO output jack on the rear of the equipment frame and verify a minimum 20 mV level across the band.
	Failure of RF mixer or IF Assembly circuitry.	Connect the signal generator set to 20 MHz at -50 dBm, CW, to the appropriate RF input jack on the rear panel of the equipment frame. Remove the tuner IF cable from J3 and connect the RF VTVM with 50 Ω load to this point. Slowly tune the receiver

Table 4-2. Troubleshooting Chart (Continued)

TROUBLE INDICATION	PROBABLE FAULT	DIAGNOSTIC PROCEDURE
4. No IF output at A1J3 of the tuner.	Mixer inoperative.	around the lower band edge (20 MHz) looking for the presence of the 10 MHz IF signal. If the IF signal is located, use the main tuning knob to peak the signal on the RF VTVM and proceed to step 5. If no IF signal is located, proceed to step 4.
	RF amplifier inoperative.	Refer to procedure 4.6.1 Mixer output alignment.
5. IF output from tuner but no video output.	IF Amplifier Assembly inoperative.	Refer to procedure 4.6.2 RF Alignment.
		Reconnect the IF cable to J3 of the tuner. Set the signal generator to produce 50% AM at a 1 kHz rate. Connect the oscilloscope to the AM output E3 on the IF Assembly. If the 1 kHz signal is present, the trouble is located in the AGC/COS/Squelch and Video Amplifier assembly. If no signal is present, move the oscilloscope to the negative detector output E1. If the 1 kHz signal is present, the problem is located in the AM buffer amplifier A2A4Q1 and Q2 or detector diode CR1. If neither output is present, refer to procedure 4.6.3 IF Demodulator Assembly Alignment.

Table 4-2. Troubleshooting Chart (Continued)

TROUBLE INDICATION	PROBABLE FAULT	DIAGNOSTIC PROCEDURE
6. IF demodulator assembly operational, no video output.	AGC/COS/Squelch and Video Amplifier defective.	If the IF demodulator output is present, connect the oscilloscope to A4 pin B3. Connect the signal generator, set to an in-band frequency at a level of -80 dBm, to the RF input. Verify an audio signal at A4-B3. Move the oscilloscope to A4-B1. If no video signal is present, rotate the Squelch sensitivity control fully CW and CCW looking for the presence of the signal on the oscilloscope. If no signal appears, check the squelch circuitry to insure proper operation. Connect the oscilloscope to A4 pin B10. Rotate the squelch sensitivity control fully CW and CCW looking for the approximate 10 V dc logic shift. If the logic shift is present the video amplifier is probably defective. If the logic shift is missing work backwards to the squelch switch U2, rotating the squelch sensitivity control, looking for the switching voltage.
7. Distortion or compression of video output at medium and high RF input levels.	Loss of AGC.	Refer to paragraph 4.5.3 and perform check.

4.5 PERFORMANCE CHECKS

The following performance checks are designed to aid in troubleshooting and evaluating the operation of the receiver. They can also serve as part of a periodic maintenance check.

4.5.1 Local Oscillator Output Check. -

- (1) Connect the RF VTVM, with 50 Ω load, to the LO output A1J2.
- (2) Tune the receiver from 20 to 80 MHz noting the LO level on the RF VTVM.
- (3) The minimum level should be 20 mV rms into 50 Ω .
- (4) Restore normal connections.

4.5.2 DAFC Range Check. -

- (1) Interconnect the equipment as shown in Figure 4-1.
- (2) Set the wide band amplifier for 20 dB gain.
- (3) Tune the receiver and signal generator to 20 MHz. The LO reading on the frequency counter will be 30 MHz; 10 MHz IF Offset +20 MHz Tuned Frequency.

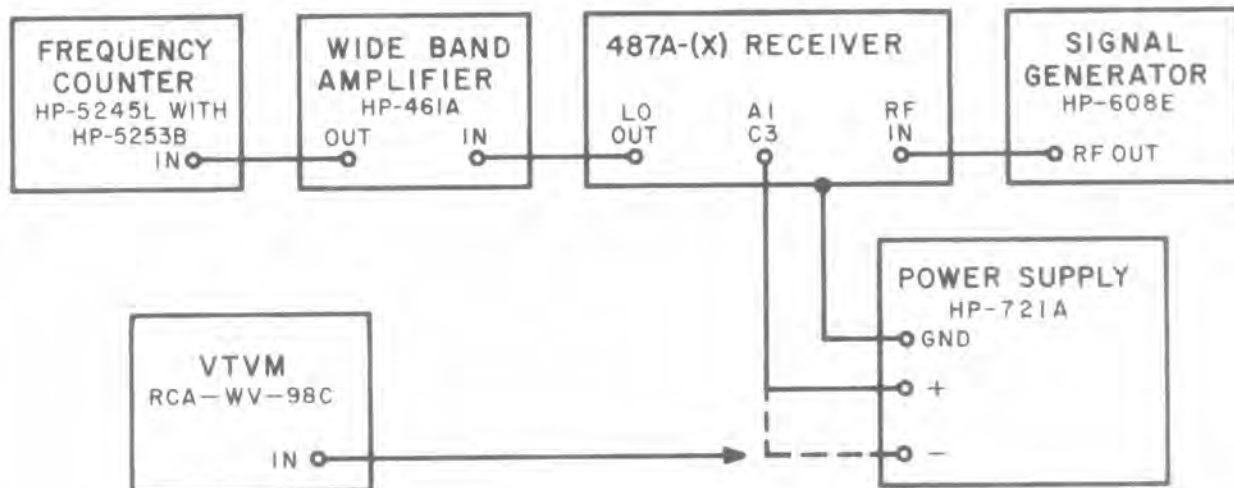


Figure 4-1. Test Setup, DAFC Range Check

Figure 4-3
Figure 4-4

487A

4.6.1 Mixer Output Alignment. - Proceed as follows:

- (1) Interconnect the receiver and test equipment as shown in Figure 4-3.

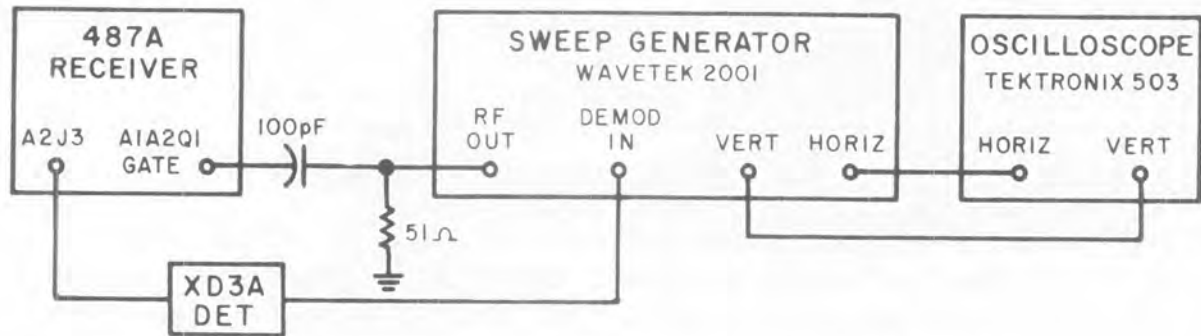


Figure 4-3. Test Setup, Mixer Output Alignment

- (2) Adjust the sweep generator to produce an approximately 1 MHz wide sweep centered at 10 MHz. Use the sweep generator internal 10 MHz marker.
- (3) Adjust the sweep generator and oscilloscope to display the response curve.
- (4) Adjust capacitor A2A2C16 to peak the response and center it about the 10 MHz marker.
- (5) A typical response is shown in Figure 4-4.

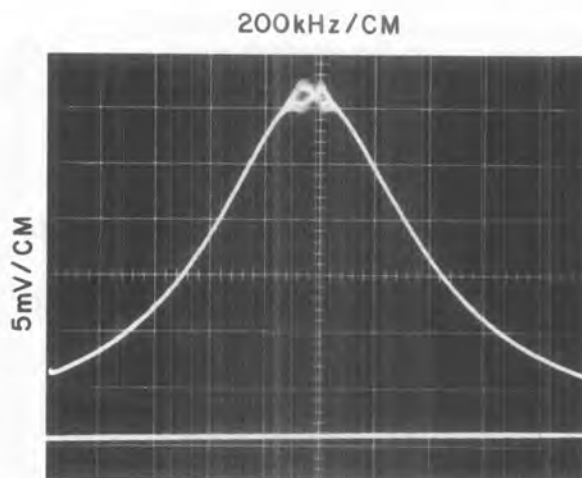


Figure 4-4. Typical Mixer Output Response Curve

487A

Figure 4-5

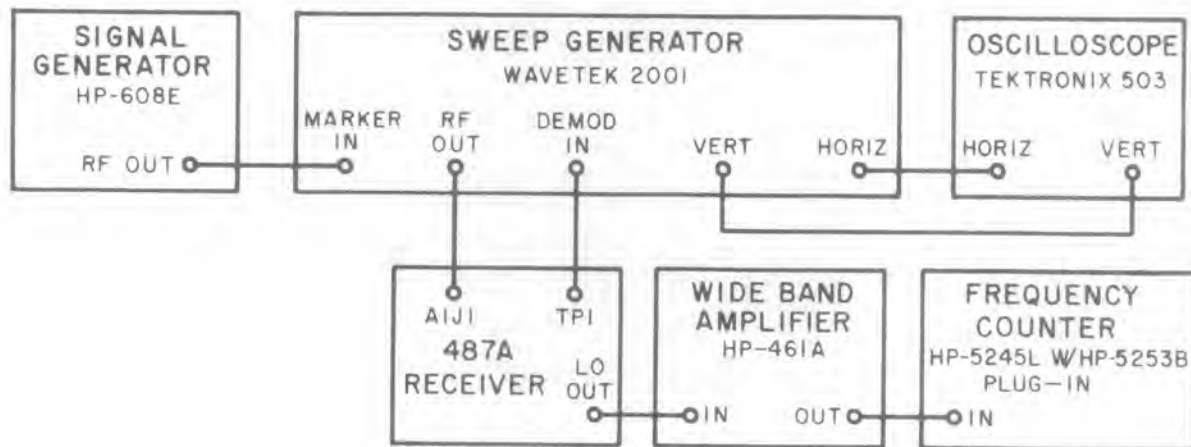


Figure 4-5. Test Setup, Interstage Alignment

4.6.2 RF Alignment. - Proceed as follows:

- (1) Place the receiver function switch in the AM MAN position and set the MAN GAIN control fully clockwise.
- (2) Interconnect the receiver and test equipment as shown in Figure 4-5.
- (3) Tune the receiver to 80 MHz; the frequency counter will read 80 MHz + 10 MHz IF offset = 90 MHz.
- (4) Adjust the signal generator to produce a 80 MHz marker.
- (5) Adjust the sweep generator and oscilloscope to display the response curve.
- (6) Adjust capacitors A2A1C3, A2A2C3, and A2A2C12 for an over-coupled response centered about the 80 MHz marker. A typical 80 MHz response curve is shown in Figure 4-6.
- (7) Check the response across the band. The response shape will vary but the marker should remain on or between the peaks.
- (8) Disconnect the test equipment and restore normal connections.

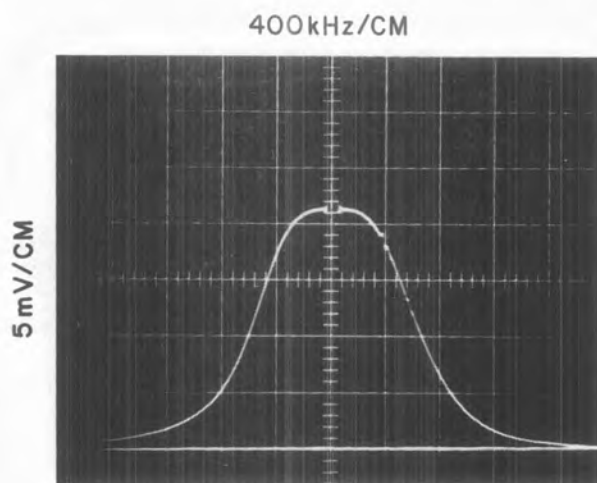


Figure 4-6. Typical 80 MHz Response Curve

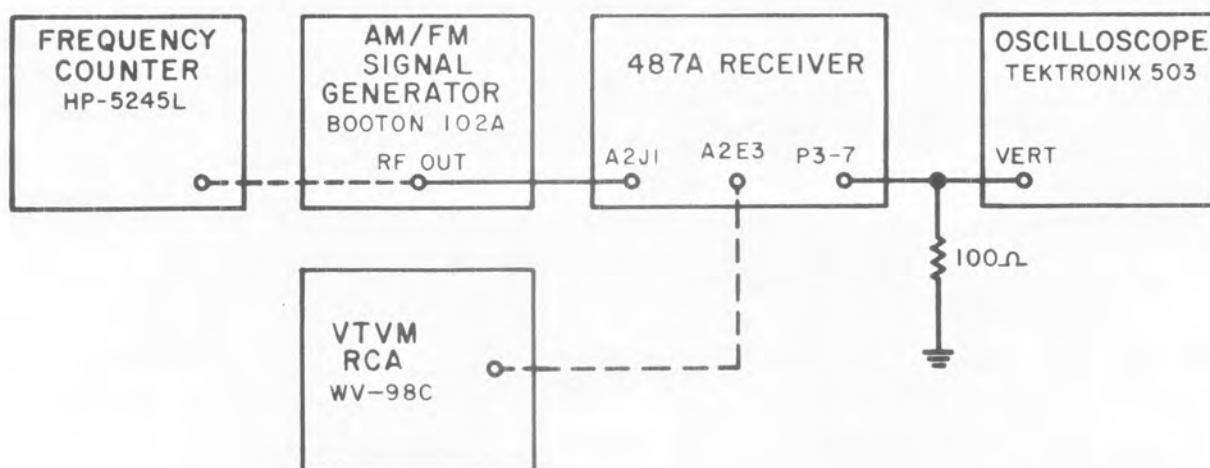


Figure 4-7. Test Setup, IF Demodulator Gain Adjustment

4.6.3 IF Demodulator Assembly Alignment. - Proceed as follows:

- (1) Interconnect the test equipment as shown in Figure 4-7.
- (2) Set the signal generator to produce a 10 MHz CW signal at the level specified below for the IF bandwidth installed.
- (3) Set the receiver function switch to AM MAN and turn the MAN gain control fully CW.
- (4) Adjust A2A3R4 for a +1 V dc reading on the VTVM.
- (5) Insure the signal generator is set to exactly 10 MHz.
- (5) Adjust capacitors A2A5C15 for 0 V dc on the VTVM. at 10 MHz.
- (7) Adjust the signal generator to produce an FM signal with a peak deviation of 1/3 the IF bandwidth at a 1 kHz rate. Set the receiver to FM
- (8) Adjust capacitor A2A5C10 for maximum output on the oscilloscope.
- (9) Adjust resistor A3R1 on the FM-Video Equalizer for 1.5 V peak to peak on the oscilloscope.
- (10) Disconnect the test equipment and restore all normal connections.

<u>BW (kHz)</u>	<u>Generator Output</u>
50	-84
20	-88
10	-91
40	-85

Table 4-4. Typical Semiconductor Element Voltages

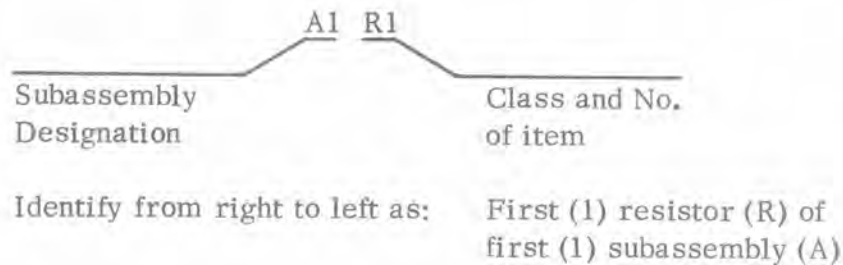
Integrated Circuit Pin Numbers															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ref. Design.	Type	Transistor Elements			Field Effect Transistor Elements										
		Emitter	Base	Collector	Source	Gate 1	Gate 2	Drain							
1Q1	3N187														
1A2Q1	3N128														
1A3Q1	2N3478	8.83	9.67	14.19											
1A3Q2	2N3478	9.45	9.38	14.44											
2A1Q1	3N187														
2A2Q1	3N187														
2A3Q1	3N187														
2A3Q2	3N187														
2A4Q1	2N3251	0.98	0.37	15.0											
2A4Q2	2N2222	0.35	0.98	14.90											
2A5Q1	2N3478	2.09	2.78	13.45											
2A5Q2	2N3478	1.96	2.65	11.57											
2A5Q3	2N3478	2.52	2.70	13.37											
2A5Q4	2N3478	2.20	2.89	14.29											
2A5Q5	2N3251	1.90	1.43	-15.00											
2A5Q6	2N2222	1.36	1.90	15.00											
3A1Q1	2N2222	1.37	2.13	6.03											
3A1Q2	2N2222	5.13	6.03	12.28											
4AQ1	2N3251	0.02	0.0	-15											
4AQ2	41899E	15	14.6	13.4											
4AQ3	2N4416	0.0	-0.045	0.0											
4AQ4	2N2222A	0.0	0.0	15											
4AUI	CA3018A	-15	-14.2	-9.9	-12	-1.03	NC	NC	NC	-15	NC	.24	-15		
4AUI	4A741C	NC	-1.2	.21	-15	NC	14	15	NC						
4AUI	LH0002CH	15	13.5	NC	.04	NC	-14	-15	.045						
TEST CONDITIONS: All readings positive with respect to ground unless otherwise specified. Receiver in the AM MAN mode, no signal input, squelch control full CCW, MAN GAIN control full CW.															

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:



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

<u>Mfr. Code</u>	<u>Name and Address</u>	<u>Mfr. Code</u>	<u>Name and Address</u>
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53212	04013	Taurus Corporation 1 Academy Hill Lambertville, New Jersey 08530
02735	RCA Corporation Solid State Division Route 202 Somerville, New Jersey	04713	Motorola Semiconductor Products, Incorporated 5005 East McDowell Road Phoenix, Arizona 85008

REPLACEMENT PARTS LIST

487A

<u>Mfr. Code</u>	<u>Name and Address</u>	<u>Mfr. Code</u>	<u>Name and Address</u>
05574	Viking Industries, Inc. 21001 Nordhoff Chatsworth, California 91311	27014	National Semi-Conductor Corp. 2950 San Ysidro Way Santa Clara, California 95051
07263	Fairchild Camera and Instrument Corporation Semiconductor Division 464 Ellis Street Mountain View, California 94040	33095	Spectrum Control, Incorporated 152 E. Main Street Fairview, Pennsylvania 16415
08717	Sloan Company 7704 San Fernando Road Sun Valley, California 91352	56289	Sprague Electric Company Marshall Street North Adams, Massachusetts 01247
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, Maryland 20760	71468	ITT Cannon Electric 666 E. Dryer Road Santa Ana, California 92702
15818	Teledyne Semiconductor 1300 Terra Bella Avenue Mountain View, California 94040	72136	Electro Motive Manufacturing Company, Inc. South Park & John Streets Willimantic, Connecticut 06226
17537	Lamps, Inc. 19220 South Normandie Avenue Torrance, California 90502	72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512
19505	Applied Engineering Products, Co. Division of Samarius, Inc. 26 E. Main Street Ansonia, Connecticut 06401	73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
21604	The Buckeye Stamping Company 555 Marion Road Columbus, Ohio 43207	73899	JFD Electronics Company Div. of Stratford Retreat House 15th at 62nd Street Brooklyn, New York 11219
25088	Siemens America, Inc. 350 5th Avenue New York, New York 10001	74868	Bunker Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, Connecticut 06810

<u>Mfr. Code</u>	<u>Name and Address</u>	<u>Mfr. Code</u>	<u>Name and Address</u>
75042	IRC Division of TRW Inc. 401 North Broad Street Philadelphia, Pa. 19108	91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
80058	Joint Electronic Type Designation System	93332	Sylvania Electric Products, Inc. Semiconductor Products Division 100 Sylvan Road Woburn, Massachusetts 01801
80131	Electronic Industries Assoc. 2001 Eye Street, N.W. Washington, D.C. 20006	95121	Quality Components, Inc. P.O. Box 113 St. Mary's, Pennsylvania 15857
81073	Grayhill Incorporated 561 Hillgrove Avenue LaGrange, Illinois 60525	95146	Alco Electronics Products, Inc. 3 Wolcott Avenue Lawrence, Massachusetts 01843
81312	Winchester Electronics Div. Litton Industries, Inc. Main Street & Hillside Avenue Oakville, Connecticut 06779	98291	Sealelectro Corporation 225 Hoyt Mamaroneck, New York 10544
81349	Military Specifications	99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, New York 14052

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 487A-(X) Receiver, Main Chassis

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	20-80 MHz RF TUNER	1	71400-2	14632	
A2	IF DEMODULATOR ASSEMBLY (487A-1)	1	72427-4	14632	
A2	IF DEMODULATOR ASSEMBLY (487A-2)	1	72427-5	14632	
A2	IF DEMODULATOR ASSEMBLY (487A-3)	1	72427-6	14632	
A2	IF DEMODULATOR ASSEMBLY (487A-8)	1	72427-7	14632	
A3	FM-VIDEO EQUALIZER	1	791296-1	14632	
A4	AGC COS SQUELCH & VIDEO AMPLIFIER	1	7898-1	14632	
DS1	LAMP, INCANDESCENT	1	682	08717	
DS2	LAMP, INCANDESCENT	1	86	17537	
MP1	KNOB	2	PS50D1	21604	
MP2	Same as MP1				
MP3	KNOB	1	PS50PL1	21604	
MP4	CRANK ASSEMBLY	1	33541-1	14632	
P1	CONNECTOR, PLUG	2	52-010-0000	98291	
P2	Same as P1				
P3	CONNECTOR, PLUG	1	DAM11W1P	71468	
P3A1	CONNECTOR, PLUG	1	DM53741-5001	71468	
P4	CONNECTOR, PLUG	5	UG-1465/U	80058	74868
P5	Same as P4				
P6	Same as P4				
P7	Same as P4				
P8	Same as P4				
P9	CONNECTOR, PLUG	1	16375-1	14632	
P10	CONNECTOR, PLUG	1	16759-1	14632	
R1	RESISTOR, VARIABLE, COMPOSITION: 50 k, 10%, 1/2W	1	RV6NAYSD503A	81349	01121
R2	RESISTOR, FIXED, FILM: 33.2 k, 1%, 1/10W	1	RN55C3322F	81349	75042
R3	RESISTOR, VARIABLE, COMPOSITION: 2.5 k, 10%, 1/2W	1	RV6NAYSD252A	81349	01121
R4	RESISTOR, FIXED, FILM: 3.24 k, 1%, 1/10W	1	RN55C3241F	81349	75042
R5	RESISTOR, FIXED, COMPOSITION: 330 k, 5%, 1/4W	1	RCR07G334JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 1.2 k, 5%, 1/4W	1	RCR07G122JS	81349	01121
S1	SWITCH, TOGGLE	1	MST115D	95146	
S2	SWITCH, ROTARY	1	51C30-01-4-3N	81073	
W1	CABLE ASSEMBLY	1	17300-27-1	14632	
W2	CABLE ASSEMBLY	1	17300-27-2	14632	

Figure 5-1
Figure 5-2

487A

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
W3	CABLE ASSEMBLY	1	17300-27-3	14632	
W4	CABLE ASSEMBLY	1	17300-27-4	14632	
XA4	CONNECTOR, PRINTED CIRCUIT CARD	1	3VH10/1JN5	05574	
XDS1	LAMPHOLDER	1	102SA	08717	
XDS2	LAMPHOLDER	1	102SG	08717	

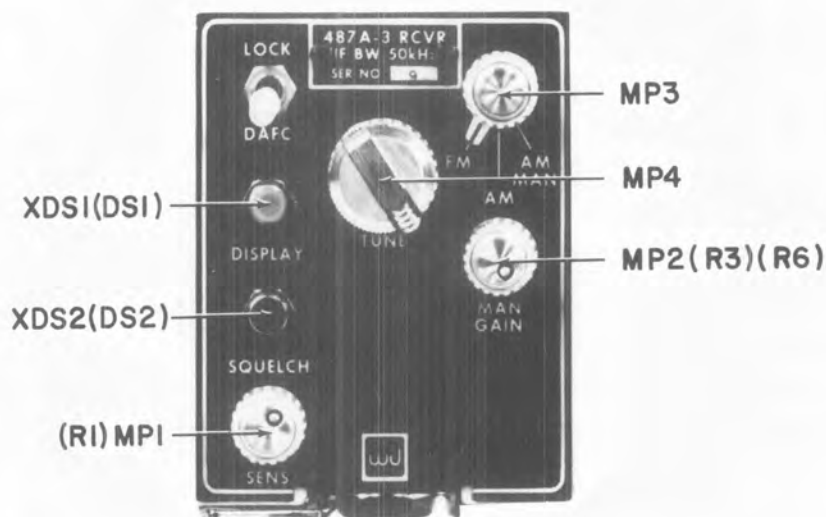


Figure 5-1. Type 487A-(X) Receiver, Front View, Location of Components

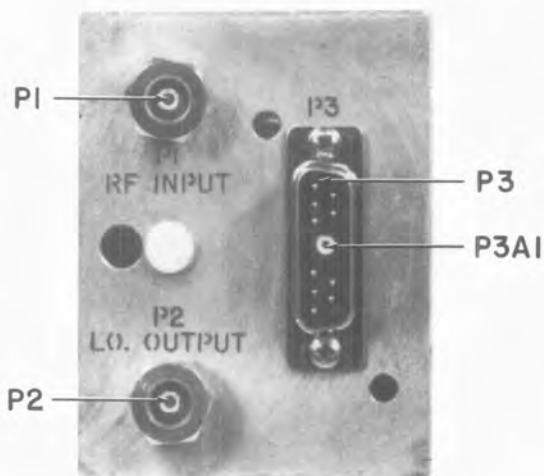


Figure 5-2. Type 487A-(X) Receiver, Rear View, Location of Components

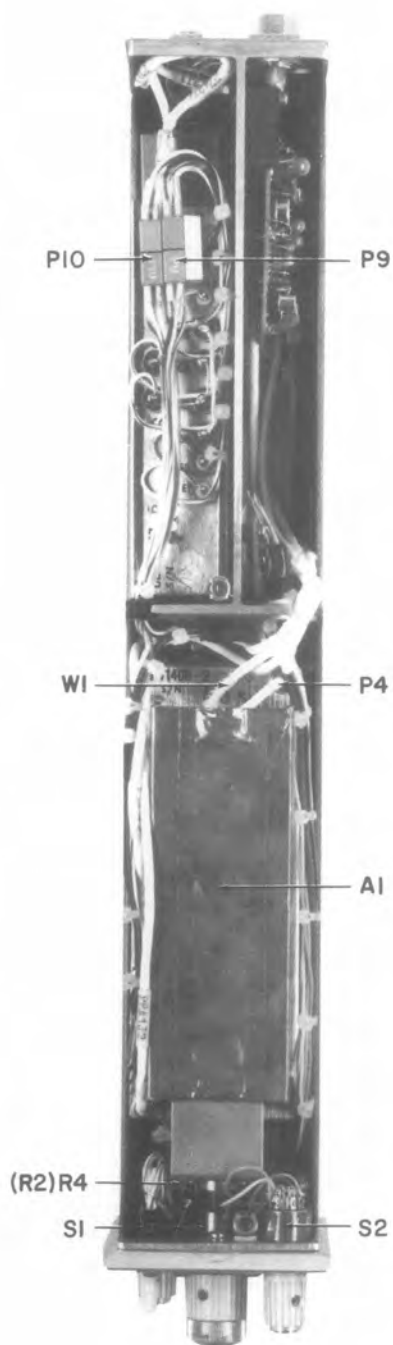


Figure 5-3. Type 487A-(X) Receiver, Top View, Location of Components



Figure 5-4. Type 487A-(X) Receiver, Bottom View, Location of Components

Figure 5-5
Figure 5-6

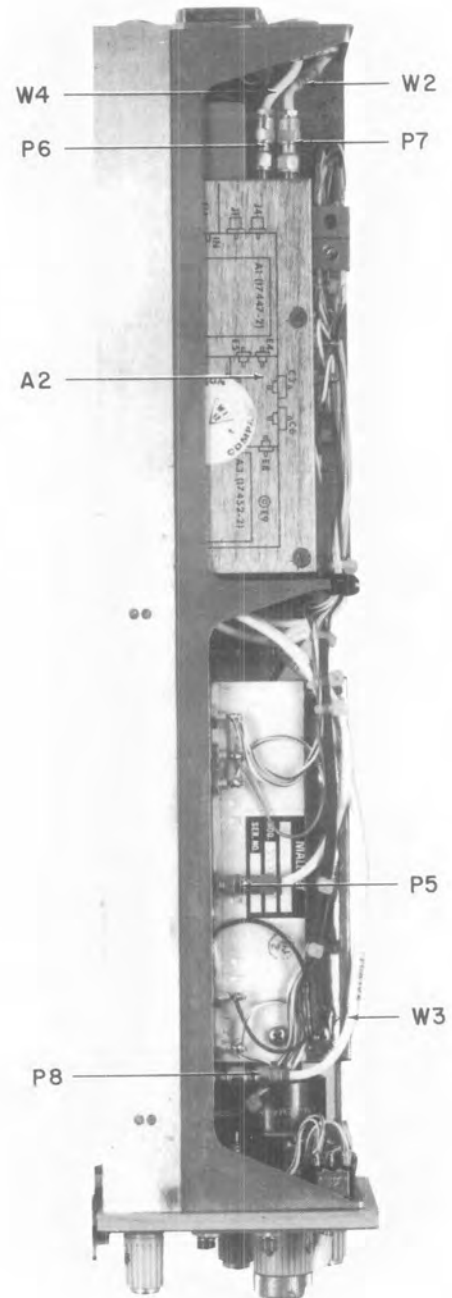
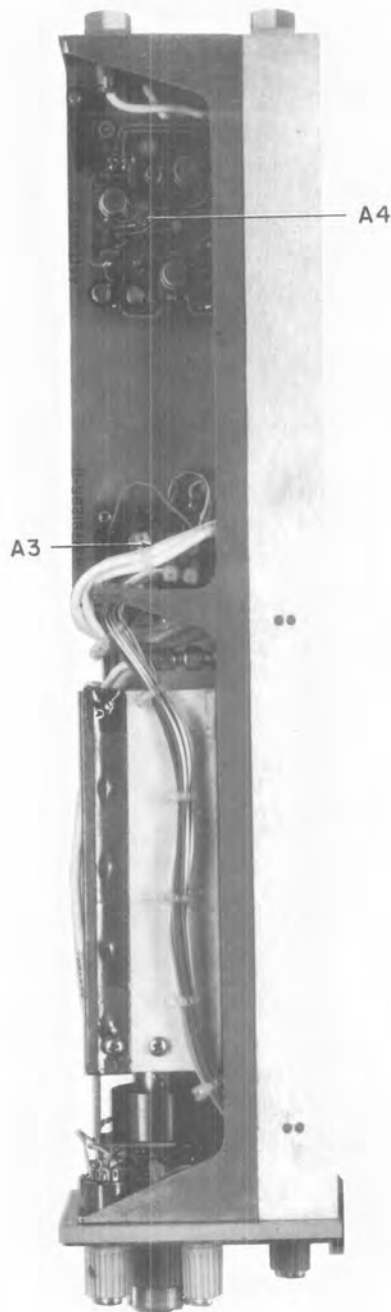


Figure 5-5. Type 487A-(X) Receiver, Right Side View,
Location of Components

Figure 5-6. Type 487A-(X) Receiver, Left Side View,
Location of Components

5.4.2 Type 71400-2 20-80 MHz RF Tuner

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	INPUT NETWORK	1	17489-2	14632	
A2	INTERSTAGE, MIXER	1	17490-1	14632	
A3	LOCAL OSCILLATOR	1	17488-2	14632	
CR1	DIODE	1	1N462A	80131	93332
C1 thru C5	CAPACITOR, CERAMIC, FEEDTHRU: .05 μ F, GMV, 300 V	5	MT001DA503P	33095	
C6	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	3	SM1000PPF	91418	
C7	Same as C6				
C8	CAPACITOR, CERAMIC, STANDOFF: 330 pF, 10%, 500 V	1	SS5D3311	01121	
C9	Same as C6				
E1	TERMINAL FEEDTHRU, INSULATED	1	SFU16	04013	
J1	CONNECTOR, RECEPTACLE	3	10-0104-002	19505	
J2	Same as J1				
J3	Same as J1				
L1	INDUCTUNER	1	33569-1	14632	
MP1	COVER	1	23523-2	14632	
Q1	TRANSISTOR	1	3N187	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 100 Ω , 5%, 1/4W	3	RCR07G101JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 1.8 k, 5%, 1/4W	1	RCR07G182JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	1	RCR07G104JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 15 k, 5%, 1/4W	1	RCR07G153JS	81349	01121
R5	Same as R1				
R6	RESISTOR, FIXED, COMPOSITION: 62 Ω , 5%, 1/4W	1	RCR07G620JS	81349	01121
R7	Same as R1				

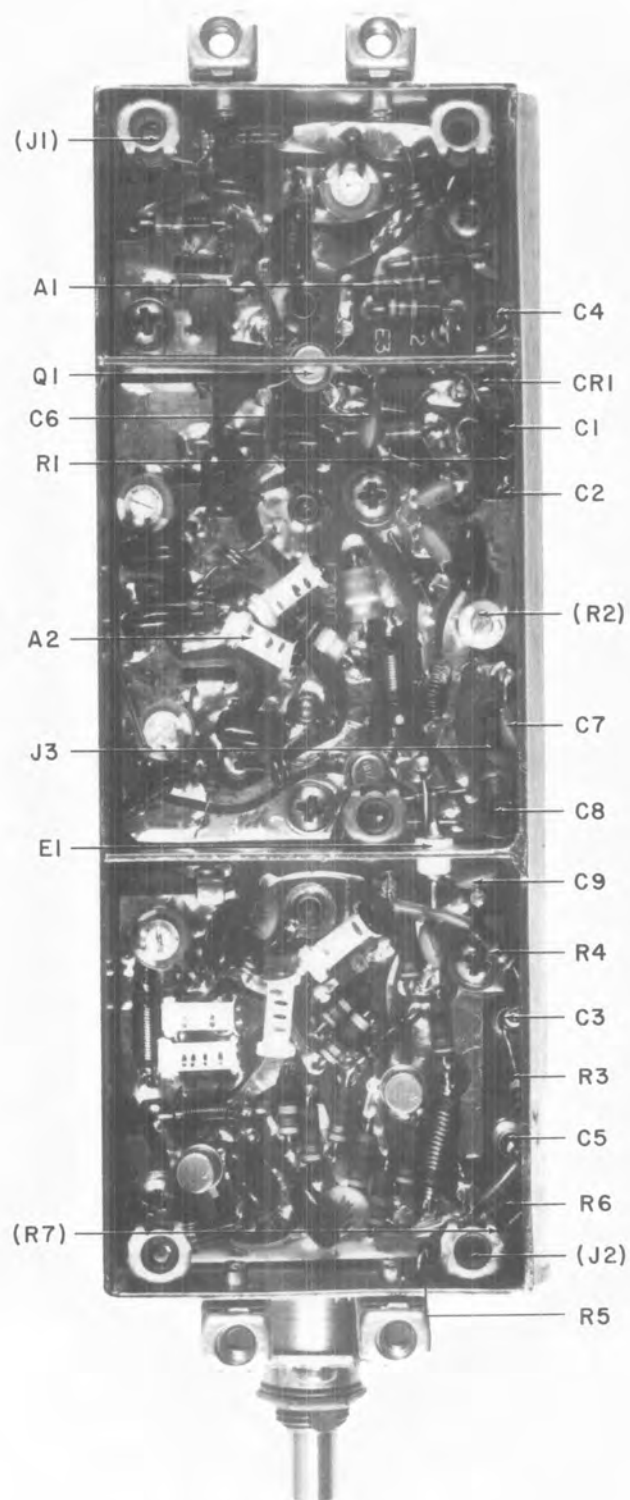


Figure 5-7. Type 71400-2 20-80 MHz RF Tuner (A1), Location of Components

5.4.2.1 Part 17489-2 Input Network

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	CAPACITOR, MICA, DIPPED: 24 pF, 5%, 500 V	1	CM04ED240J03	81349	72136
C2	CAPACITOR, MICA, DIPPED: 51 pF, 2%, 500 V	2	CM04ED510G03	81349	72136
C2	CAPACITOR, VARIABLE, CERAMIC: 1.7-10 pF, 500 V	1	DVJ302A	73899	
C4	CAPACITOR, MICA, DIPPED: 270 pF, 2%, 500 V	1	CM04FD271G03	81349	
C5	Same as C2				
C6	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	1	SM1000PFP	91418	
L1	COIL, FIXED	1	1129-39	14632	
R1	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	1	RCR07G104JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 20 k, 5%, 1/4W	2	RCR07G203JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 270 k, 5%, 1/4W	1	RCR07G274JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 3.3 Ω , 5%, 1/4W	1	RCR07G3R3JS	81349	01121
R5	Same as R2				
R6	RESISTOR, FIXED, COMPOSITION: 300 Ω , 5%, 1/4W	1	RCR07G301JS	81349	01121

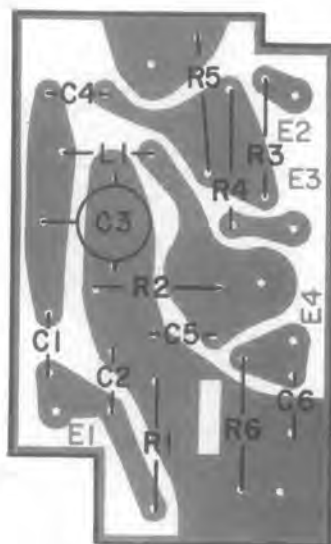
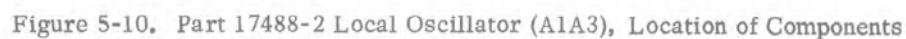


Figure 5-8. Part 17489-2 Input Network (A1A1), Location of Components

5.4.2.2 Part 17490-1 Interstage/Mixer

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	2	SM1000PPF	91418	
C2	CAPACITOR, MICA, DIPPED: 270 pF, 2%, 500 V	1	CM04FD271G03	81349	72136
C3	CAPACITOR, VARIABLE, CERAMIC: 1.7-10 pF, 500 V	2	DVJ302A	73899	
C4	CAPACITOR, MICA, DIPPED: 27 pF, 2%, 500 V	1	CM04ED270G03	81349	72136
C5	CAPACITOR, MICA, DIPPED: 39 pF, 2%, 500 V	2	CM04ED390G03	81349	72136
C6	CAPACITOR, COMPOSITION, TUBULAR: 1.0 pF, 10%, 500 V	1	QC1.0PFK	95121	
C7	CAPACITOR, CERAMIC, TUBULAR: 5.6 pF, ± 0.25 pF 500 V	2	301-000C0H0-569C	72982	
C8	Same as C7				
C9	CAPACITOR, MICA, DIPPED: 15 pF, 5%, 500 V	1	CM04CD150J03	81349	72136
C10	CAPACITOR, MICA, DIPPED: 24 pF, 5%, 500 V	1	CM04ED240J03	81349	72136
C11	Same as C5				
C12	Same as C3				
C13	CAPACITOR, COMPOSITION, TUBULAR: 3.3 pF, 10%, 500 V	1	QC3.3PFK	95121	
C14	Same as C1				
C15	CAPACITOR, MICA, DIPPED: 18 pF, 5%, 500 V	1	CM05CD180J03	81349	72136
C16	CAPACITOR, VARIABLE, CERAMIC: 6-22 pF, 25 V	1	518-000A6-22	72982	
L1	COIL, FIXED: 18 μ H, 10%	1	1025-50	99800	
L2	COIL	2	1129-48	14632	
L3	INDUCTOR	1	21210-13	14632	
L4	Same as L2				
L5	COIL, TOROIDAL	1	20681-119	14632	
Q1	TRANSISTOR	1	3N128	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 10 Ω , 5%, 1/8W	2	RCR05G100JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 56 k, 5%, 1/8W	1	RCR05G563JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 150 k, 5%, 1/8W	1	RCR05G154JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 1.5 k, 5%, 1/8W	1	RCR05G152JS	81349	01121
R5	Same as R1				
R6	RESISTOR, FIXED, COMPOSITION: 1.6 k, 5%, 1/8W	1	RCR05G162JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 22 k, 5%, 1/8W	1	RCR05G223JS	81349	01121
T1	INDUCTOR, TAPPED	1	11464-40	14632	



5.4.2.3 Part 17488-2 Local Oscillator

REF DESIG A1A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	DIODE, VARICAP	1	BB109	25088	
C1	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500 V	3	SM1000PFP	91418	
C2	Same as C1				
C3	CAPACITOR, CERAMIC, TUBULAR: 20 pF, 2%, 500 V	1	301-000U2J0-200G	72982	
C4	CAPACITOR, MICA, DIPPED: 68 pF, 2%, 500 V	1	CM04ED680G03	81349	72136
C5	CAPACITOR, MICA, DIPPED: 39 pF, 2%, 500 V	2	CM04ED390G03	81349	72136
C6	CAPACITOR, VARIABLE, CERAMIC: 1.7-10 pF, 500 V	1	DVJ302A	73899	
C7	Same as C5				
C8	CAPACITOR, CERAMIC, TUBULAR: 2.4 pF, ± 0.25 pF, 500 V	1	301-000C0J0-249C	72982	
C9	CAPACITOR, CERAMIC, TUBULAR: 4.7 pF, ± 0.25 pF, 500 V	1	301-000U2J0-479C	72982	
C10	CAPACITOR, CERAMIC, TUBULAR: 10 pF, ± 0.5 pF, 500 V	1	301-000U2J0-100D	72982	
C11	Same as C1				
L1	INDUCTOR	1	21209-1	14632	
L2	INDUCTOR	1	21210-1	14632	
L3	COIL, FIXED	1	1129-51	14632	
Q1	TRANSISTOR	2	2N3478	80131	02735
Q2	Same as Q1				
R1	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/4W	2	RCR07G104JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/4W	2	RCR07G222JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 100 Ω , 5%, 1/4W	1	RCR07G101JS	81349	01121
R4	Same as R1				
R5	Same as R2				
R6	RESISTOR, FIXED, COMPOSITION: 47 Ω , 5%, 1/4W	2	RCR07G470JS	81349	01121
R7	Same as R6				
R8	RESISTOR, FIXED, COMPOSITION: 8.2 k, 5%, 1/4W	1	RCR07G822JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: 18 k, 5%, 1/4W	1	RCR07G183JS	81349	01121
R10	RESISTOR, FIXED, COMPOSITION: 82 Ω , 5%, 1/4W	1	RCR07G820JS	81349	01121
R11	RESISTOR, FIXED, COMPOSITION: 820 Ω , 5%, 1/4W	1	RCR07G821JS	81349	01121
R12	RESISTOR, FIXED, COMPOSITION: 200 Ω , 5%, 1/4W	1	RCR07G201JS	81349	01121
T1	INDUCTOR, TAPPED	1	11464-16	14632	
VR1	DIODE, ZENER	1	1N758A	80131	04713

5.4.3 Type 72427-4 thru 72427-7 IF Demodulator Assembly

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	IF INPUT	1	17447-2	14632	
A2	FILTERED OUTPUT	1	17451-2	14632	
A3	IF OUTPUT	1	17452-2	14632	
A4	AM DETECTOR AND OUTPUT	1	17453-2	14632	
A5	LIMITER/DISCRIMINATOR AND FM OUTPUT	1	17454-2	14632	
C1 thru C6	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500 V	6	FA5C102W	01121	
C7	CAPACITOR, CERAMIC, DISC: 0.1 μ F, 20%, 100 V	2	8131M100-651-104M	72982	
C8	Same as C7				
C9	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	1	C023B101E502M	56289	
E1 thru E9	TERMINAL, FEEDTHRU, INSULATED	9	SFU16	04013	
FB1	FERRITE BEAD	1	56-590-65/4A	02114	
FL1	FILTER (72427-4)	1	15973-1	14632	
FL1	FILTER (72427-5)	1	15973-2	14632	
FL1	FILTER (72427-6)	1	92041	14632	
FL1	FILTER (72427-7)	1	92040	14632	
J1	CONNECTOR, RECEPTACLE	2	10-0104-002	19505	
J2	CONNECTOR, RECEPTACLE	1	JF3P1SACD	81312	
J3	CONNECTOR, RECEPTACLE	1	JF3S1PACD	81312	
J4	Same as J1				
L1	COIL, FIXED: 12 μ H, 10%	1	1537-38	99800	
L2	COIL, FIXED: 15 μ H, 10%	1	1537-40	99800	
MP1	COVER (72427-4)	1	23531-4	14632	
MP1	COVER (72427-5)	1	23531-5	14632	
MP1	COVER (72427-6)	1	23531-6	14632	
MP1	COVER (72427-7)	1	23531-7	14632	
MP2	COVER (72427-4)	1	23532-4	14632	
MP2	COVER (72427-5)	1	23532-5	14632	
MP2	COVER (72427-6)	1	23532-6	14632	
MP2	COVER (72427-7)	1	23532-7	14632	
R1	RESISTOR, FIXED, COMPOSITION: 150 Ω , 5%, 1/4W	1	RCR07G151JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 100 Ω , 5%, 1/8W	1	RCR05G101JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 68 Ω , 5%, 1/8W	1	RCR05G680JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 47 k, 5%, 1/4W	1	RCR07G473JS	81349	01121

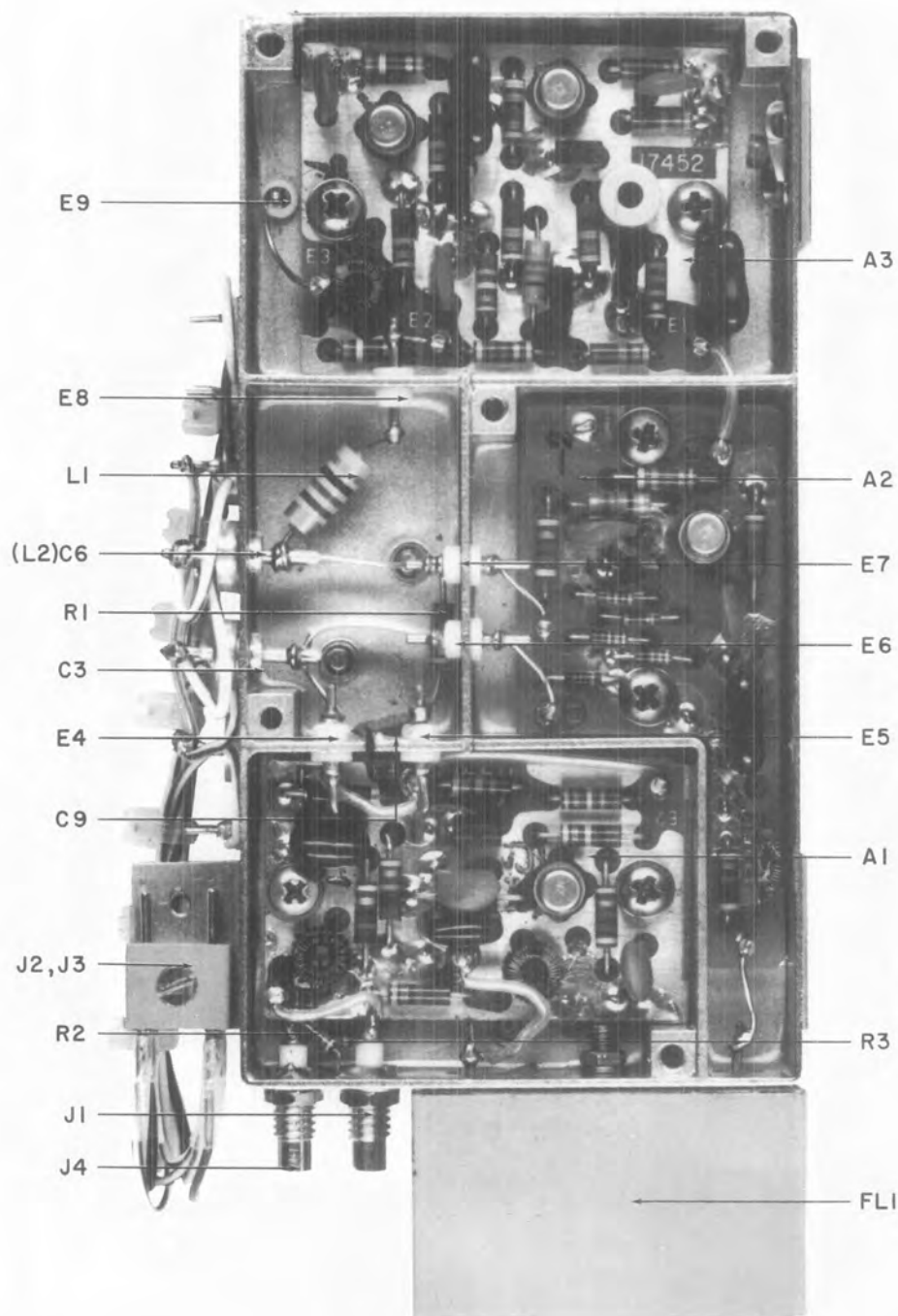


Figure 5-11. Type 72427-(X) IF Demodulator Assembly (A2), Right Side View, Location of Components

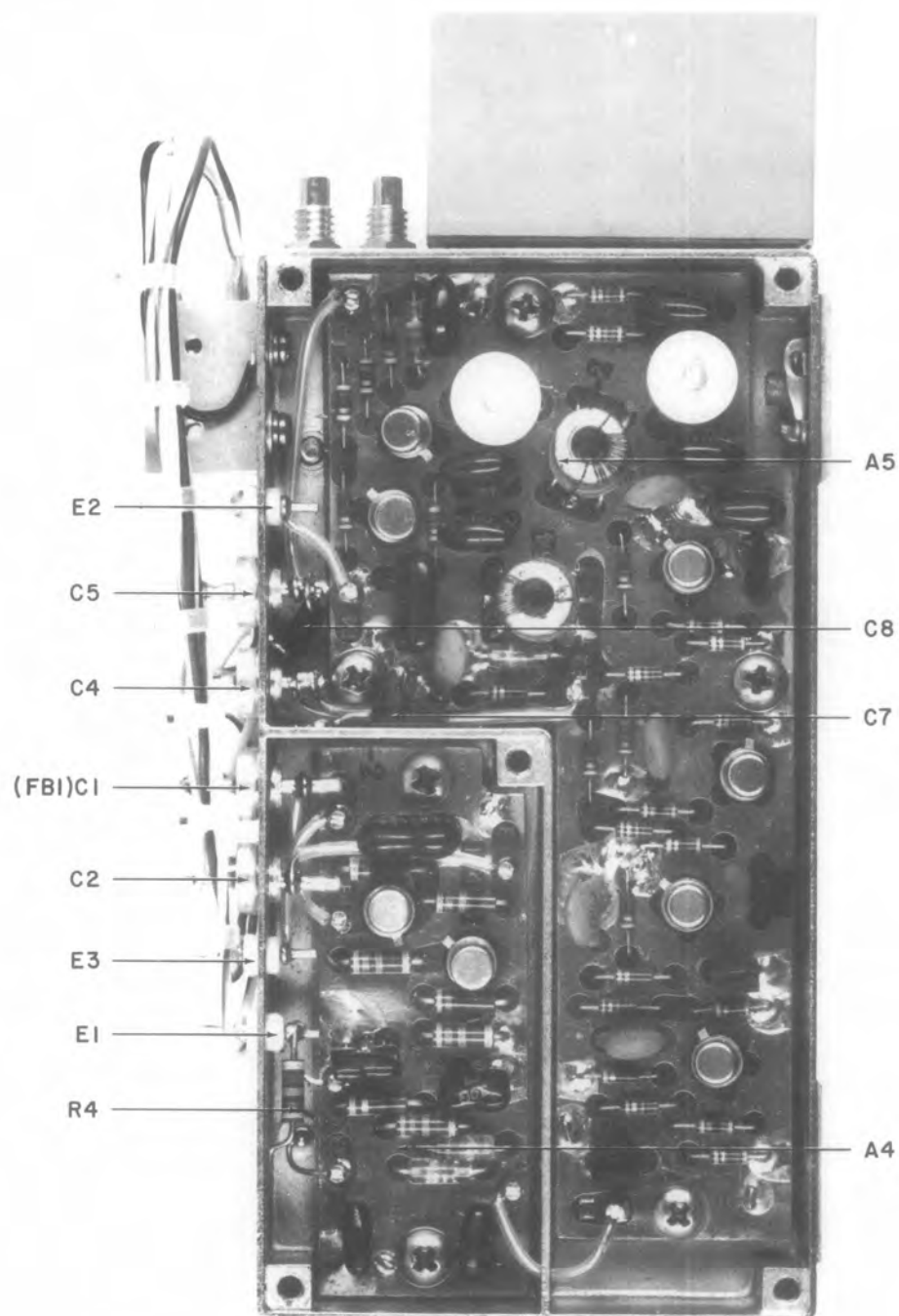


Figure 5-12. Type 72427-(X) IF Demodulator Assembly (A2), Left Side View, Location of Components

5.4.3.1 Part 17447-2 IF Input

REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	DIODE	1	1N462A	80131	93332
C1	CAPACITOR, MICA, DIPPED: 270 pF, 2%, 500 V	1	CM04FD271G03	81349	72136
C2	CAPACITOR, CERAMIC, DISC: 1000 pF, 10%, 200 V	1	CK05BX102K	81349	56289
C3	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	2	C023B101E502M	56289	
C4	Same as C3				
C5	CAPACITOR, MICA, DIPPED: 56 pF, 2%, 500 V	1	CM04ED560G03	81349	72136
Q1	TRANSISTOR	1	3N187	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 56 Ω , 5%, 1/4W	1	RCR07G560JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 56 k, 5%, 1/4W	1	RCR07G563JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 200 k, 5%, 1/4W	1	RCR07G204JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 15 k, 5%, 1/4W	1	RCR07G153JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 130 k, 5%, 1/4W	1	RCR07G134JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 270 Ω , 5%, 1/4W	1	RCR07G271JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4W	1	RCR07G471JS	81349	01121
R8	RESISTOR, FIXED, COMPOSITION: 220 Ω , 5%, 1/4W	1	RCR07G221JS	81349	01121
T1	TRANSFORMER, TOROIDAL	1	21092-17	14632	
T2	TRANSFORMER, TOROIDAL	1	20937-30	14632	

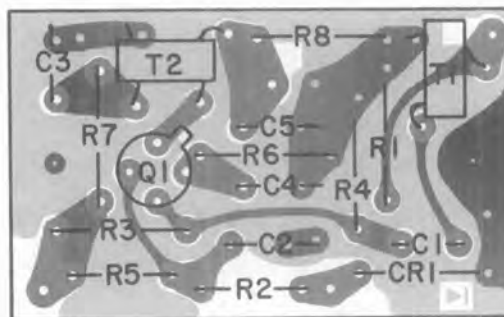


Figure 5-13. Part 17447-2 IF Input (A2A1), Location of Components

5.4.3.2 Part 17451-2 Filtered Output

REF DESIG PREFIX A2A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	DIODE	1	1N462A	80131	93332
C1	CAPACITOR, MICA, DIPPED: 270 pF, 2%, 500 V	1	CM04FD271G03	81349	72136
C2	CAPACITOR, CERAMIC, DISC: 1000 pF, 10%, 200 V	1	CK05BX102K	81349	56289
C3	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	2	C023B101E502M	56289	
C4	Same as C3				
L1	COIL, FIXED: 18 μ H, 10%	1	1025-50	99800	
Q1	TRANSISTOR	1	3N187	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 300 Ω , 5%, 1/4W	1	RCR07G301JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 47 k, 5%, 1/8W	1	RCR05G473JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 270 k, 5%, 1/8W	1	RCR05G274JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 20 k, 5%, 1/8W	1	RCR05G203JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 130 k, 5%, 1/8W	1	RCR05G134JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4W	1	RCR07G471JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 220 Ω , 5%, 1/4W	1	RCR07G221JS	81349	01121
R8	RESISTOR, FIXED, COMPOSITION: 620 Ω , 5%, 1/4W	1	RCR07G621JS	81349	01121
T1	XFMR, TOROIDAL	1	21428-42	14632	

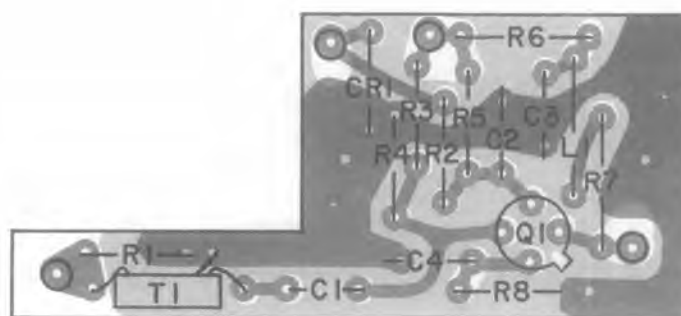


Figure 5-14. Part 17451-2 Filtered Output (A2A2), Location of Components

Figure 5-15

487A

5.4.3.3 Part 17452-2 IF Output

REF DESIG PREFIX A2A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	CAPACITOR, MICA, DIPPED: 270 pF, 2%, 500 V	2	CM04FD271G03	81349	72136
C2	CAPACITOR, CERAMIC, DISC: 1000 pF, 10%, 200 V	4	CK05BX102K	81349	56289
C3	Same as C2				
C4	Same as C2				
C5	CAPACITOR, CERAMIC, DISC: 500 pF, 20%, 100 V	3	C023B101E502M	56289	
C6	Same as C1				
C7	Same as C2				
C8	Same as C5				
C9	Same as C5				
L1	COIL, FIXED: 18 μ H, 10%	1	1025-50	99800	
Q1	TRANSISTOR	2	3N187	80131	02735
Q2	Same as Q1				
R1	RESISTOR, FIXED, COMPOSITION: 82 k, 5%, 1/4W	1	RCR07G823JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 68 k, 5%, 1/4W	1	RCR07G683JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 20 k, 5%, 1/4W	1	RCR07G203JS	81349	01121
R4	RESISTOR, VARIABLE, FILM: 50 k, 10%, 1/2W	1	62PR50K	73138	
R5	RESISTOR, FIXED, COMPOSITION: 15 k, 5%, 1/4W	1	RCR07G153JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 620 Ω , 5%, 1/4W	1	RCR07G621JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4W	1	RCR07G471JS	81349	01121
R8	RESISTOR, FIXED, COMPOSITION: 220 Ω , 5%, 1/4W	1	RCR07G221JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: 130 k, 5%, 1/4W	1	RCR07G134JS	81349	01121
R10	RESISTOR, FIXED, COMPOSITION: 51 k, 5%, 1/4W	1	RCR07G513JS	81349	01121
R11	RESISTOR, FIXED, COMPOSITION: 22 k, 5%, 1/4W	1	RCR07G223JS	81349	01121
R12	RESISTOR, FIXED, COMPOSITION: 390 Ω , 5%, 1/4W	2	RCR07G391JS	81349	01121
R13	Same as R12				
R14	RESISTOR, FIXED, COMPOSITION: 10 k, 5%, 1/4W	1	RCR07G103JS	81349	01121
T1	TRANSFORMER, TOROIDAL	1	20937-31	14632	



Figure 5-15. Part 17452-2 IF Output (A2A3), Location of Components

5.4.3.4 Part 17453-2 AM Detector and Output

REF DESIG PREFIX A2A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	DIODE	2	1N198A	80131	93332
CR2	Same as CR1				
C1	CAPACITOR, MICA, DIPPED: 12 pF, 5%, 500 V	1	CM04CD120J03	81349	72136
C2	CAPACITOR, MICA, DIPPED: 82 pF, 2%, 500 V	1	CM04ED820G03	81349	72136
C3	CAPACITOR, MICA, DIPPED: 39 pF, 2%, 500 V	2	CM04ED390G03	81349	72136
C4	CAPACITOR, MICA, DIPPED: 820 pF, 5%, 300 V	1	DM15-821J	72136	
C5	Same as C3				
Q1	TRANSISTOR	1	2N3251	80131	04713
Q2	TRANSISTOR	1	2N2222A	80131	04713
R1	RESISTOR, FIXED, COMPOSITION: 47 k, 5%, 1/4W	4	RCR07G473JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 2.2 M, 5%, 1/4W	1	RCR07G225JS	81349	01121
R3	Same as R1				
R4	RESISTOR, FIXED, COMPOSITION: 10 k, 5%, 1/4W	1	RCR07G103JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/4W	1	RCR07G222JS	81349	01121
R6	Same as R1				
R7	Same as R1				

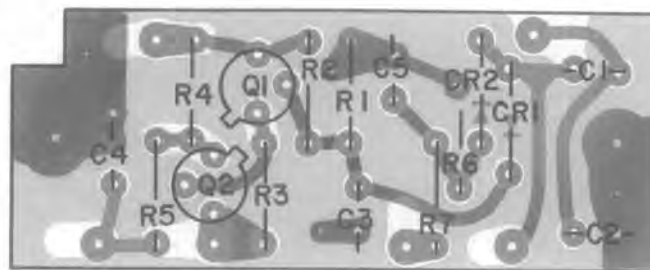


Figure 5-16. Part 17453-2 AM Detector and Output (A2A4), Location of Components

5.4.3.5 Part 17454-2 Limiter/Discriminator and FM Output

REF DESIG PREFIX A2A5

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	REC. VENDOR
CR1	DIODE	2	1N198A	80131	93332
CR2	Same as CR1				
C1	CAPACITOR, CERAMIC, DISC: 1000 pF, 10%, 200 V	4	CK05BX102K	81349	56289
C2	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100 V	5	C023B101E502M	56289	
C3	Same as C2				
C4	Same as C1				
C5	Same as C1				
C6	Same as C2				
C7	Same as C2				
C8	CAPACITOR, MICA, DIPPED: 130 pF, 2%, 500 V	1	CM04FD131G03	81349	72136
C9	CAPACITOR, MICA, DIPPED: 20 pF, 5%, 500 V	2	CM04ED200J03	81349	72136
C10	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350 V	2	538-011D9-35	72982	
C11	Same as C1				
C12	CAPACITOR, MICA, DIPPED: 10 pF, ± 0.5 pF, 500 V	1	CM04CD100D03	81349	72136
C13	CAPACITOR, MICA, DIPPED: 150 pF, 2%, 500 V	1	CM04FD151G03	81349	72136
C14	Same as C9				
C15	Same as C10				
C16	CAPACITOR, MICA, DIPPED: 33 pF, 2%, 500 V	1	CM04ED330G03	81349	72136
C17	Same as C2				
C18	CAPACITOR, MICA, DIPPED: 820 pF, 5%, 300 V	1	DM15-821J	72136	
L1	INDUCTOR	1	23545-1	14632	
Q1 thru Q4	TRANSISTOR	4	2N3478	80131	02735
Q5	TRANSISTOR	1	2N3251	80131	04713
Q6	TRANSISTOR	1	2N2222A	80131	04713
R1	RESISTOR, FIXED, COMPOSITION: 18 k, 5%, 1/8W	4	RCR05G183JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 4.7 k, 5%, 1/8W	5	RCR05G472JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 47 Ω , 5%, 1/8W	3	RCR05G470JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/8W	4	RCR05G222JS	81349	01121
R5	Same as R4				
R6	Same as R4				
R7	Same as R1				
R8	Same as R2				
R9	Same as R1				
R10	Same as R2				

REF DESIG PREFIX A2A5

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R11	Same as R3				
R12	RESISTOR, FIXED, COMPOSITION: 820 Ω , 5%, 1/8W	2	RCR05G821JS	81349	01121
R13	RESISTOR, FIXED, COMPOSITION: 220 Ω , 5%, 1/8W	3	RCR05G221JS	81349	01121
R14	Same as R13				
R15	Same as R12				
R16	Same as R1				
R17	Same as R2				
R18	Same as R3				
R19	Same as R13				
R20	RESISTOR, FIXED, COMPOSITION: 47 k, 5%, 1/8W	3	RCR05G473JS	81349	01121
R21	Same as R20				
R22	RESISTOR, FIXED, COMPOSITION: 1.0 k, 5%, 1/8W	1	RCR07G102JS	81349	01121
R23	RESISTOR, FIXED, COMPOSITION: 3.6 M, 5%, 1/8W	1	RCR05G365JS	81349	01121
R24	Same as R20				
R25	Same as R2				
R26	Same as R4				
T1	TRANSFORMER	1	23545-2	14632	

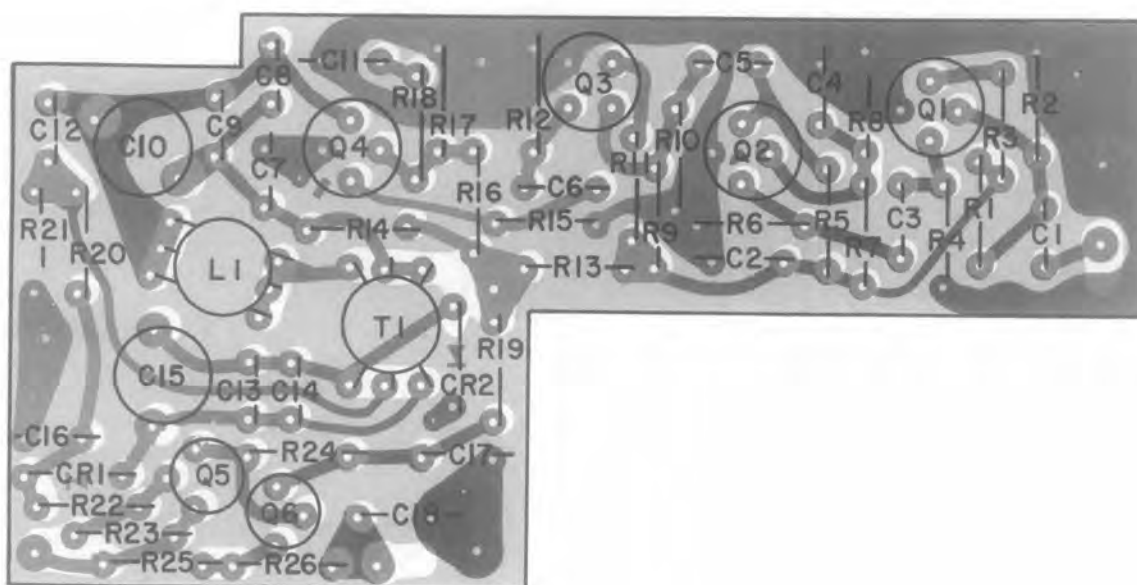


Figure 5-17. Part 17454-2 Limiter/Discriminator and FM Output (A2A5),
Location of Components

Figure 5-18

487A

5.4.4 Type 791296 FM Video Equalizer

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	CAPACITOR, CERAMIC, DISC: 0.47 μ F, 20%, 100 V	1	8131M100-651-474M	72982	
C2	Same as C1				
C3	CAPACITOR, MICA, DIPPED: 750 pF, 5%, 300 V	1	DM15-751J	72136	
Q1	TRANSISTOR	2	2N2222A	80131	04713
Q2	Same as Q1				
R1	RESISTOR, VARIABLE, FILM: 10 k, 10%, 1/2W	1	62PR10K	73138	
R2	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/8W	1	RCR05G104JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 68 k, 5%, 1/8W	1	RCR05G683JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 8.2 k, 5%, 1/8W	1	RCR05G822JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 1.5 k, 5%, 1/8W	1	RCR05G152JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 47 Ω , 5%, 1/8W	1	RCR05G470JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/8W	1	RCR05G222JS	81349	01121
R8	RESISTOR, FIXED, COMPOSITION: 4.7 k, 5%, 1/8W	1	RCR05G472JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: 1.0 k, 5%, 1/8W	1	RCR05G102JS	81349	01121

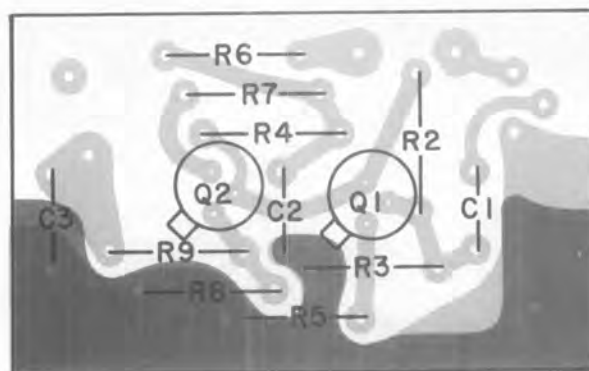


Figure 5-18. Type 791296 FM Video Equalizer (A3), Location of Components

5.4.5 Type 7898-1 AGC COS Squelch and Video Amplifier

REF DESIG PREFIX A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
CR1	DIODE	1	1N4446	80131	93332
CR2	DIODE	1	1N458A	80121	93332
CR3	DIODE	1	1N198A	80131	93332
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 3.3 μ F, 20%, 35 V	1	196D335X0035JE3	56289	
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μ F, 20%, 35 V	3	196D225X0035JE3	56289	
C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 15 μ F, 20%, 35 V	1	196D156X0015JE3	56289	
C4	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μ F, 20%, 35 V	1	196D105X0035JE3	56289	
C5	CAPACITOR, CERAMIC, DISC: 0.47 μ F, 20%, 100 V	4	8131M100-651-474M	72982	
C6	Same as C5				
C7	Same as C5				
C8	Same as C2				
C9	Same as C2				
C10	Same as C5				
Q1	TRANSISTOR	1	2N3251	80131	04713
Q2	TRANSISTOR	1	U1899E	15818	
Q3	TRANSISTOR	1	2N4416	80131	04713
Q4	TRANSISTOR	1	2N2222A	80131	04713
R1	RESISTOR, FIXED, COMPOSITION: 47 k, 5%, 1/8W	1	RCR05G473JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 10 k, 5%, 1/8W	2	RCR05G103JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 680 k, 5%, 1/8W	1	RCR05G684JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 6.8 M, 5%, 1/8W	1	RCR05G685JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 68 k, 5%, 1/8W	3	RCR05G683JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 22 k, 5%, 1/8W	2	RCR05G223JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 3.3 k, 5%, 1/8W	1	RCR05G332JS	81349	01121
R8	RESISTOR, FIXED, COMPOSITION: 33 Ω , 5%, 1/8W	2	RCR05G333JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/8W	2	RCR05G471JS	81349	01121
R10	RESISTOR, FIXED, COMPOSITION: 330 Ω , 5%, 1/8W	1	RCR05G331JS	81349	01121
R11	RESISTOR, FIXED, COMPOSITION: 100 k, 5%, 1/8W	3	RCR05G104JS	81349	01121
R12	RESISTOR, FIXED, COMPOSITION: 220 k, 5%, 1/8W	1	RCR05G224JS	81349	01121
R13	Same as R6				
R14	Same as R9				
R15	Same as R11				
R16	RESISTOR, FIXED, COMPOSITION: 2.2 M, 5%, 1/8W	1	RCR05G225JS	81349	01121

REF DESIG PREFIX A4

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R17	Same as R2				
R18	RESISTOR, FIXED, COMPOSITION: 15 k, 5%, 1/8W	1	RCR05G153JS	81349	01121
R19	RESISTOR, FIXED, COMPOSITION: 2.7 k, 5%, 1/8W	1	RCR05G272JS	81349	01121
R20	RESISTOR, FIXED, COMPOSITION: 18 k, 5%, 1/8W	1	RCR05G183JS	81349	01121
R21	RESISTOR, FIXED, COMPOSITION: 390 Ω , 5%, 1/8W	1	RCR05G391JS	81349	01121
R22	Same as R8				
R23	RESISTOR, FIXED, COMPOSITION: 82 k, 5%, 1/8W	1	RCR05G823JS	81349	01121
R24	RESISTOR, FIXED, COMPOSITION: 1.0 k, 5%, 1/8W	1	RCR05G102JS	81349	01121
R25	Same as R21				
R26	Same as R5				
R27	RESISTOR, FIXED, COMPOSITION: 150 k, 5%, 1/8W	1	RCR05G154JS	81349	01121
R28	NOT USED				
R29	NOT USED				
R30	Same as R5				
R31	Same as R11				
R32	RESISTOR, FIXED, COMPOSITION: 2.2 k, 5%, 1/8W	1	RCR05G222JS	81349	01121
R33	RESISTOR, FIXED, COMPOSITION: 8.2 k, 5%, 1/8W	1	RCR05G822JS	81349	01121
R34	RESISTOR, FIXED, COMPOSITION: 91 Ω , 5%, 1/8W	1	RCR05G910JS	81349	01121
R35	RESISTOR, FIXED, COMPOSITION: 10 Ω , 5%, 1/8W	1	RCR05G100JS	81349	01121
U1	INTEGRATED CIRCUIT	1	CA3018A	02735	
U2	INTEGRATED CIRCUIT	1	U5B7741393	07263	
U3	INTEGRATED CIRCUIT	1	LH0002CH	27014	

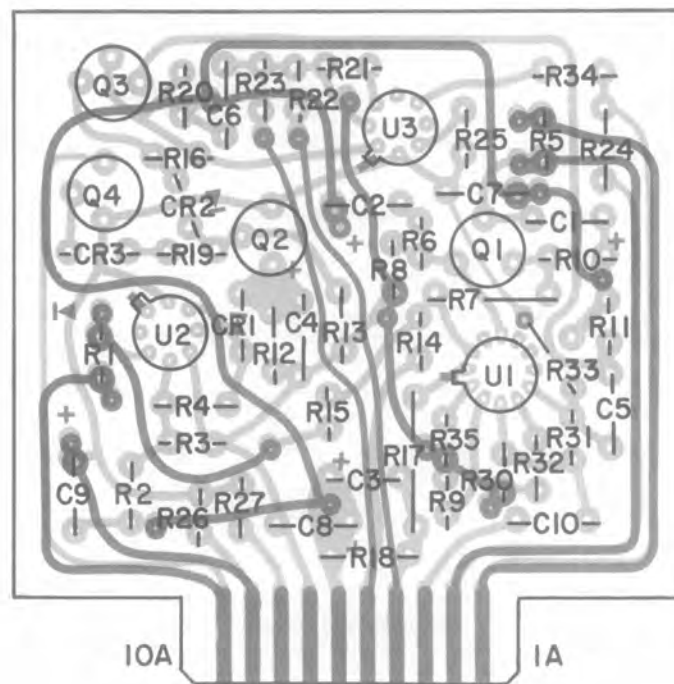


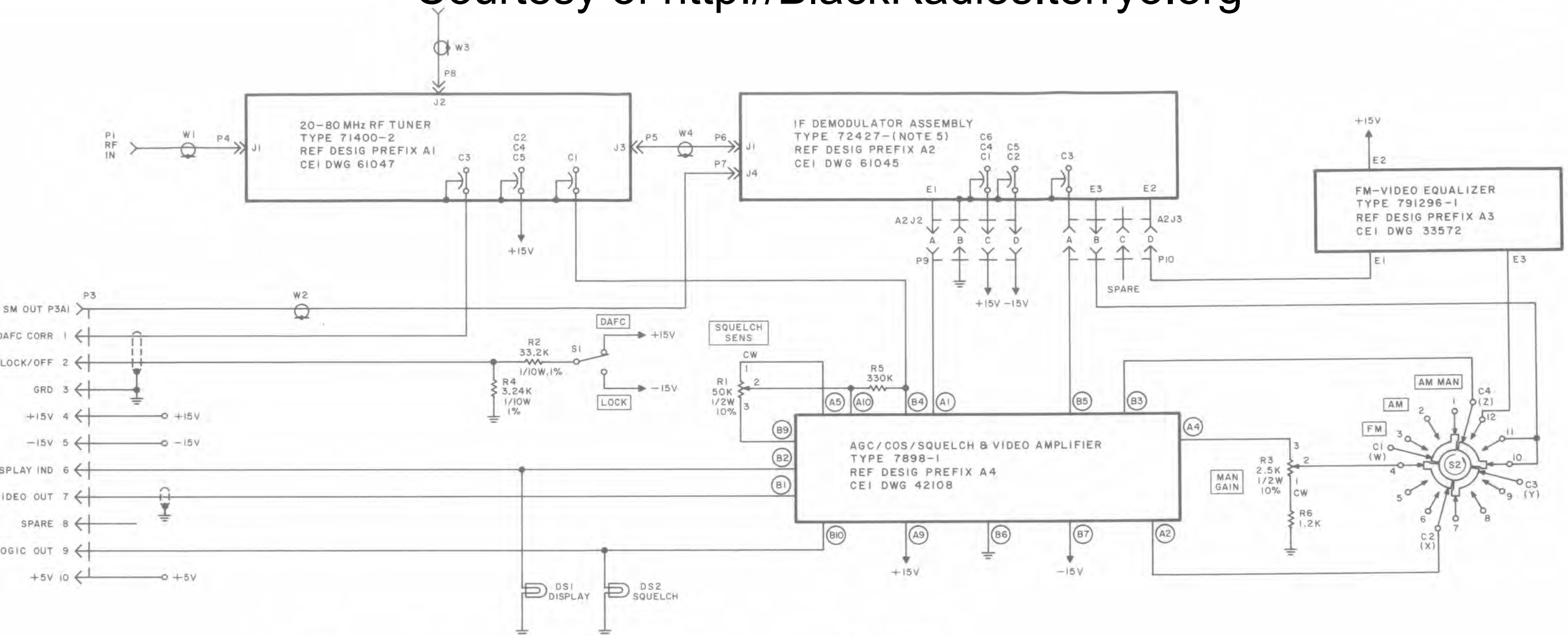
Figure 5-19. Type 7898-1 AGC, COS, Squelch and Video Amplifier (A4),
Location of Components

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
84

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

SECTION VI

SCHEMATIC DIAGRAMS

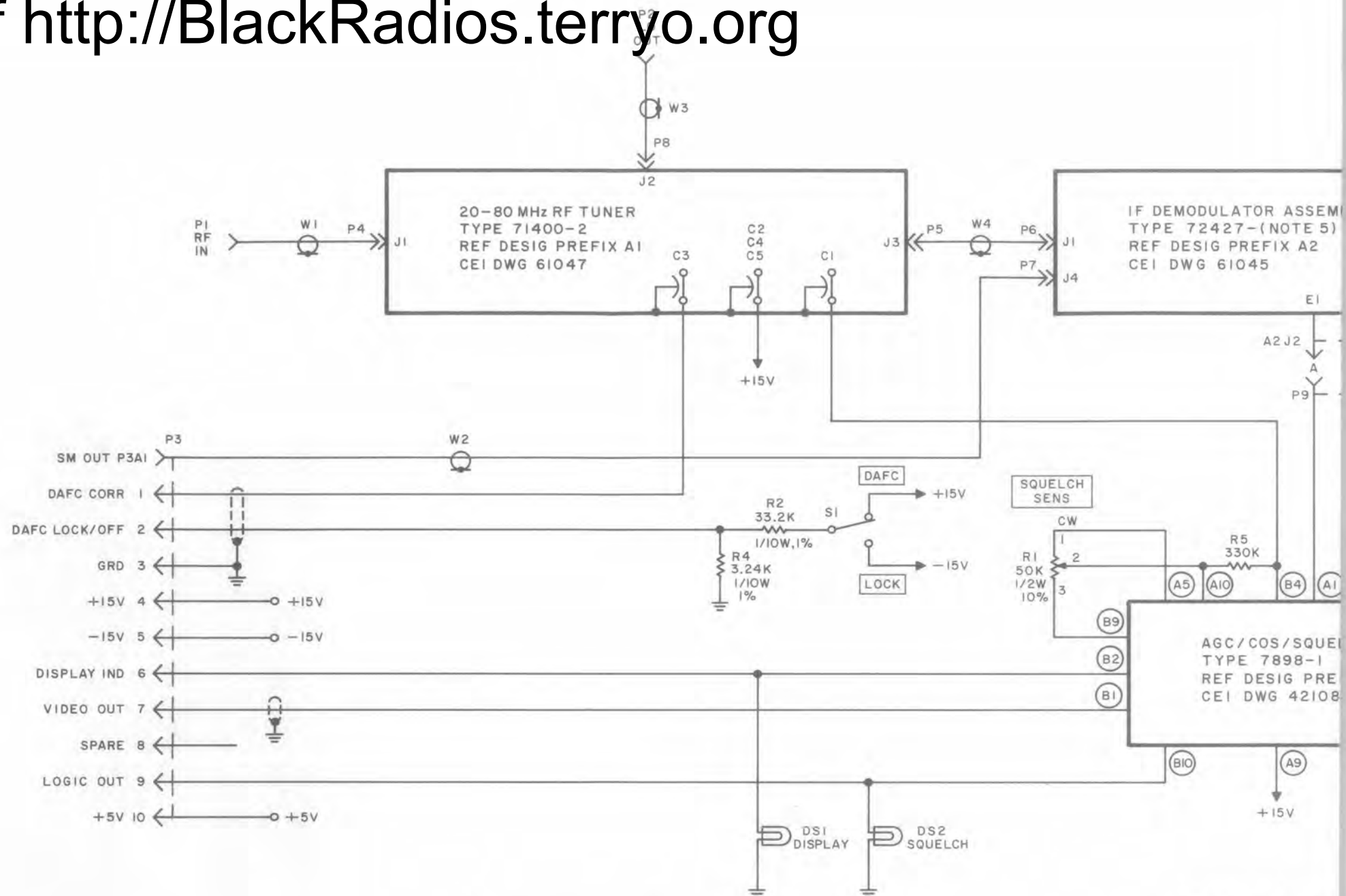


TABULATION BLOCK

TYPES	IF BW	IF DEMOD (A2)
487A-1	10kHz	72427-4
487A-2	20kHz	72427-5
487A-3	50kHz	72427-6
487A-8	40kHz	72427-7

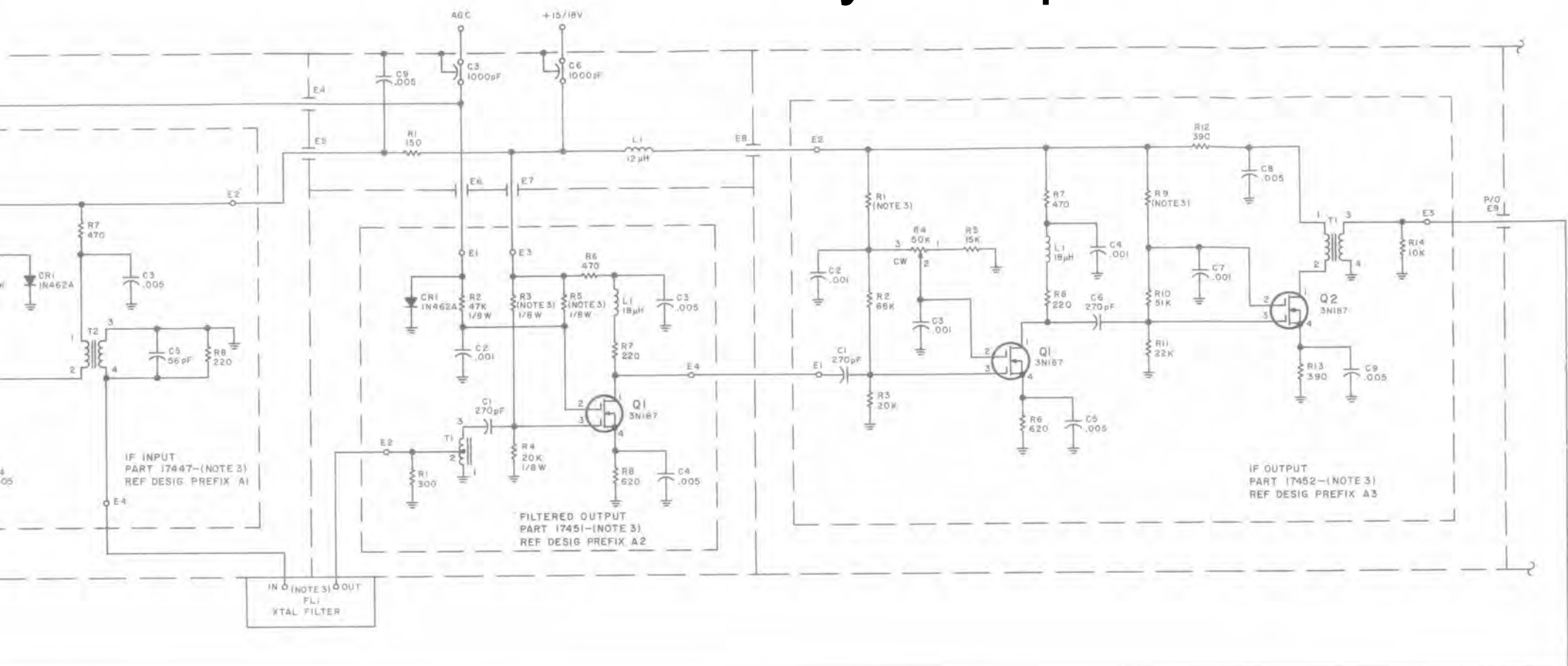
Figure 6-1. Type 71400-2 20-80 MHz Tuner (A1), Schematic Diagram

Courtesy of <http://BlackRadios.terry.org>

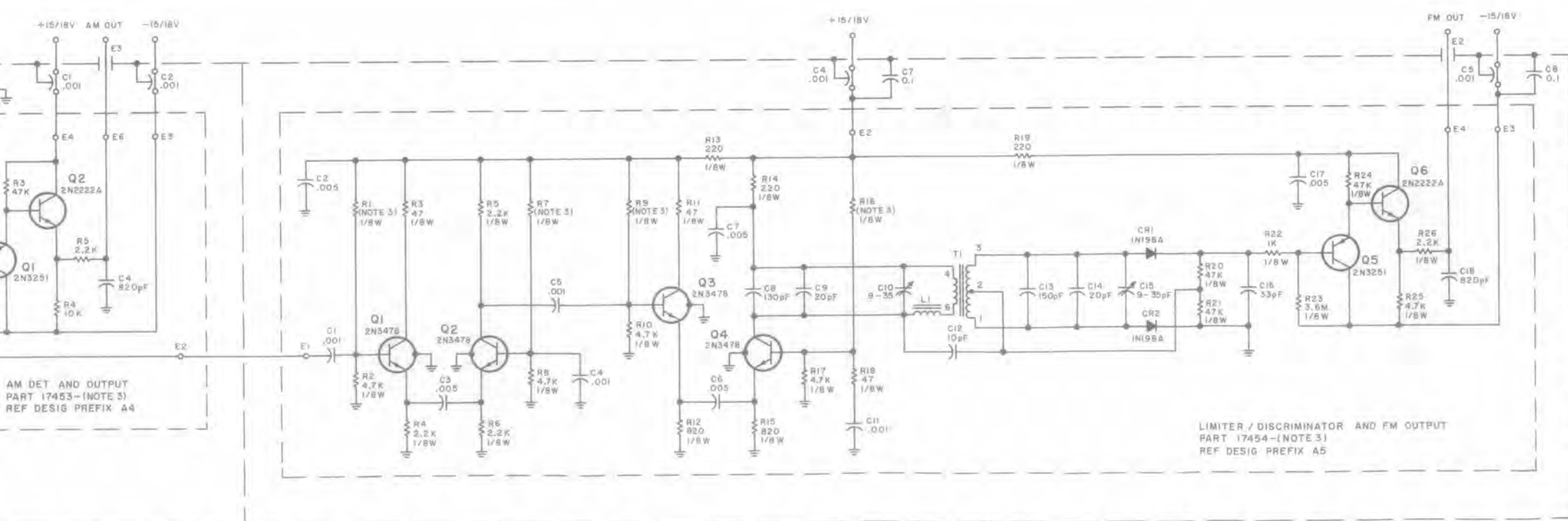


- NOTES:
- 1. UNLESS OTHERWISE SPECIFIED, RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4W.
 - 2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
 - 3. CW ON R1, R3 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
 - 4. INDICATES FRONT PANEL CONTROL.
 - 5. DIFFERENCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK.
 - 6. SWITCH S2 IS SHOWN IN EXTREME CCW POSITION AND IS VIEWED FROM END OPPOSITE CONTROL KNOB. LETTERS W, X, Y, Z DENOTE SEGMENTS OF WAFER. ARROW INDICATE CW ROTATION OF CONTROL KNOB.

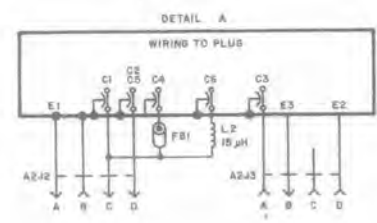
TABULATION BLOCK		
TYPES	IF BW	IF DEMOD(A
487A-1	10kHz	72427-4
487A-2	20kHz	72427-5
487A-3	50kHz	72427-6
487A-8	40kHz	72427-7



- NOTES:
- 1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4 W.
b) CAPACITANCE IS IN μ F.
 - 2. CW ON POTENTIOMETERS INDICATES CLOCKWISE ROTATION OF ACTUATOR.
 - 3. DIFFERENCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK.
 - 4. FOR WIRING TO PLUG, SEE DETAIL A.



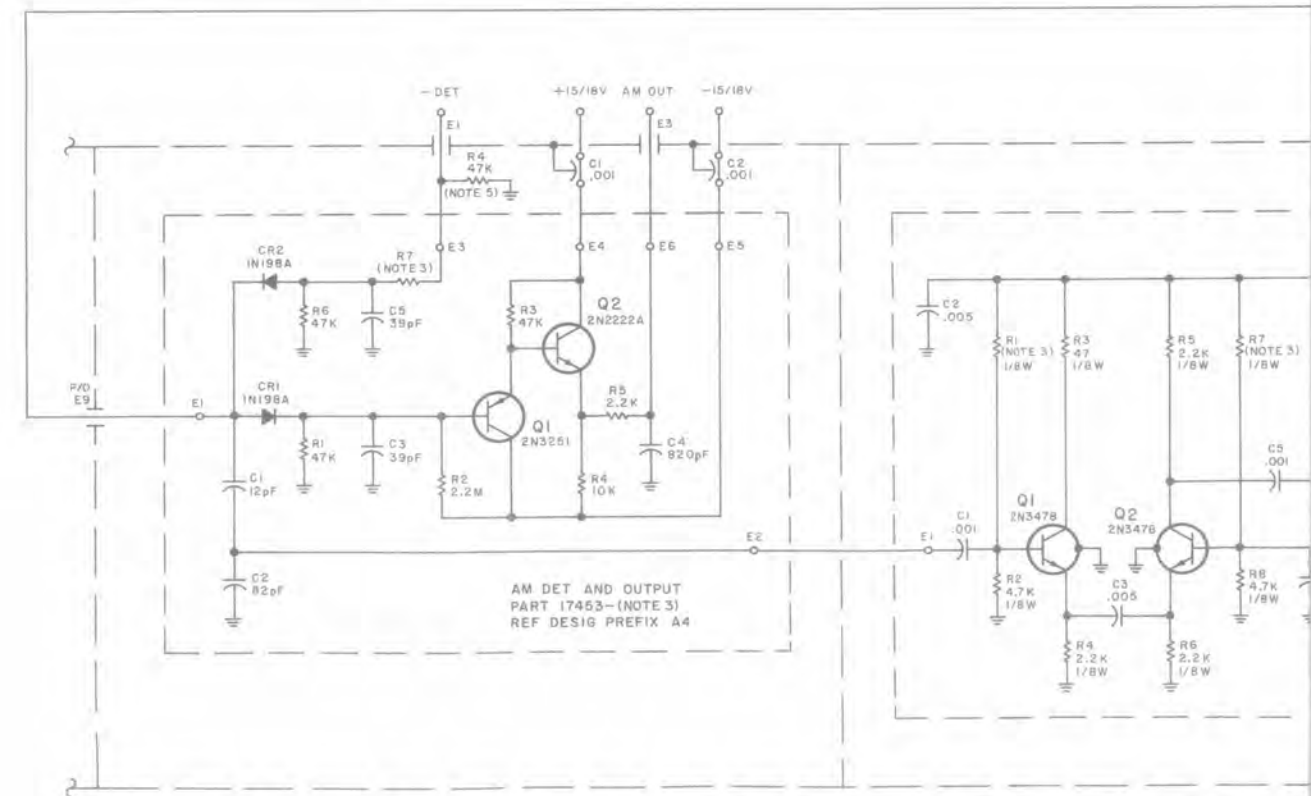
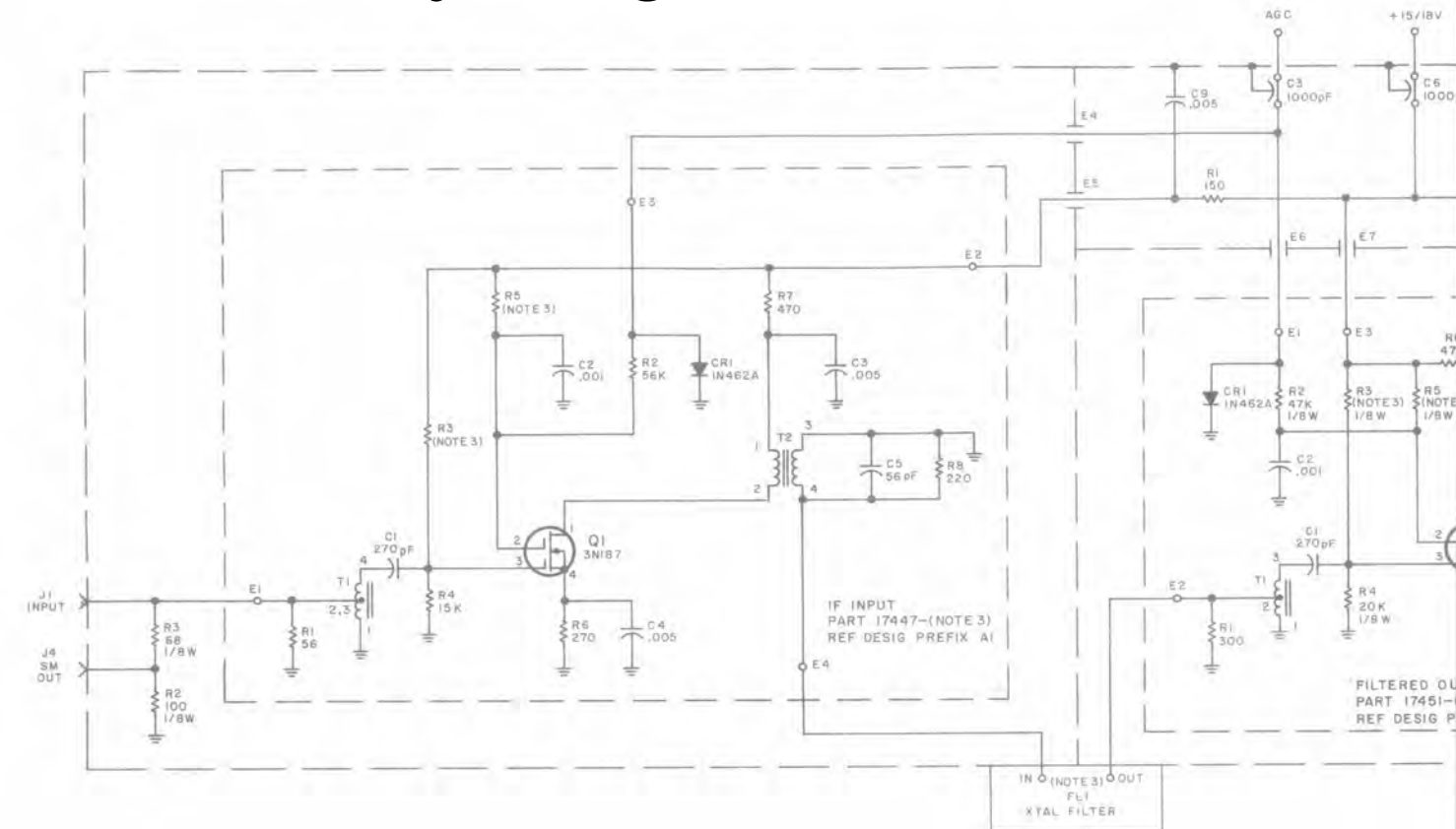
HIGHEST REF DESIG USED	REF DESIG NOT USED	HIGHEST REF DESIG USED	REF DESIG NOT USED
A5 C9 E9 FL) J1 L1 R1		A3C9 A3E3 A3L1 A3Q2 A3R14 A3T1	
A4C5 A4CR2 A4E6 A4Q2 A4R6 A4T1		A4C5 A4CR2 A4E6 A4Q2 A4R6 A4T1	
A2C4 A2CR1 A2E4 A2L1 A2Q6 A2R2 A2T1		A5C9 A5CR2 A5E4 A5L1 A5Q6 A5R2 A5T1	

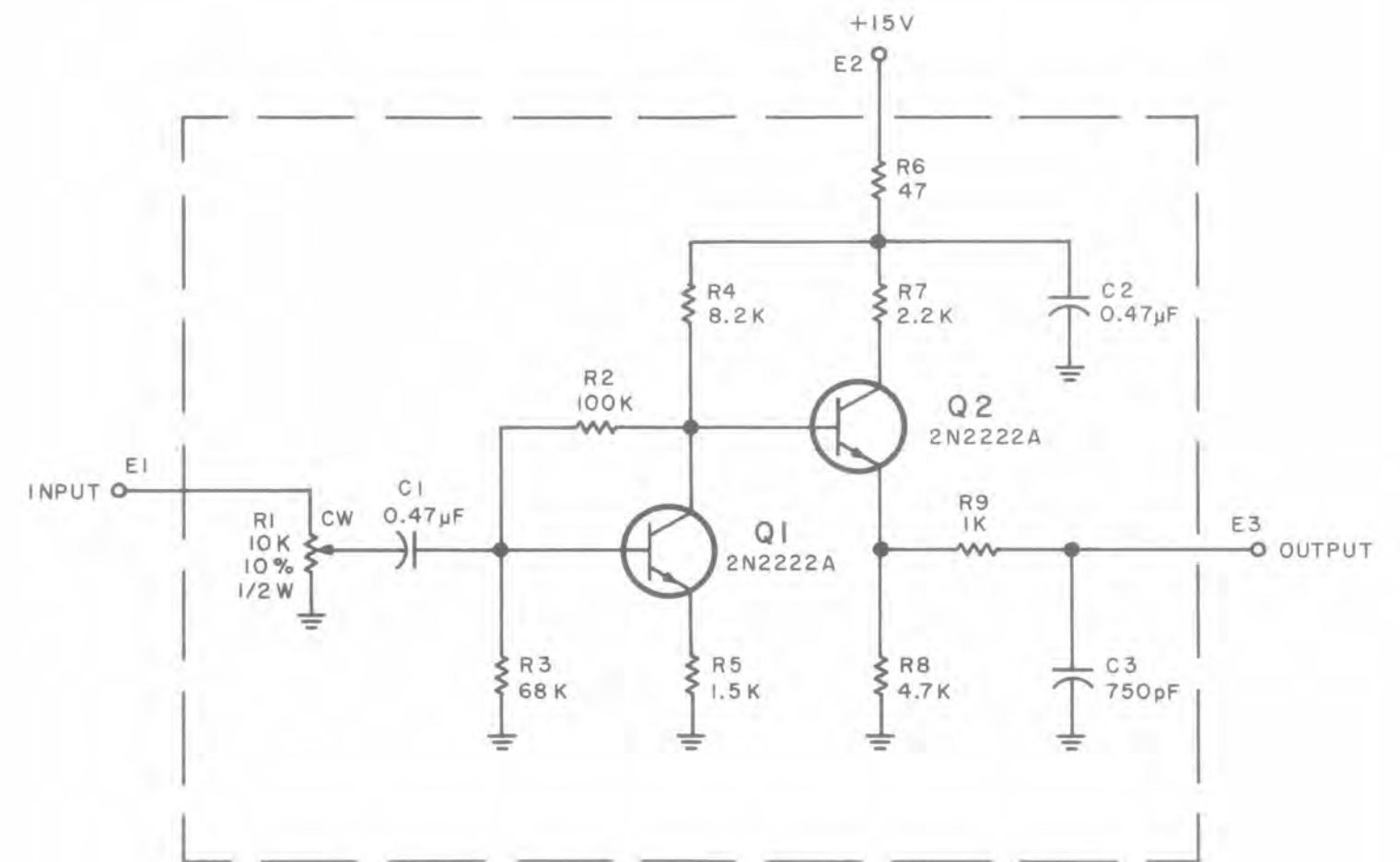


TYPE		A1		A2		A3		A4		A5		FL1		FL2	
TYPE	BW	PART NO.	REF DESIG.	PART NO.	REF DESIG.	PART NO.	REF DESIG.	PART NO.	REF DESIG.	PART NO.	REF DESIG.	PART NO.	REF DESIG.	PART NO.	REF DESIG.
72427-1	50kHz	17447-1	240K	150K	17451-1	330K	150K	17452-1	100K	150K	17453-1	390K	17454-1	22K	22K
72427-2	10kHz	17447-1	240K	150K	17451-1	330K	150K	17452-1	100K	150K	17453-1	390K	17454-1	22K	22K
72427-3	20kHz	17447-1	240K	150K	17451-1	330K	150K	17452-1	100K	150K	17453-1	390K	17454-1	22K	22K
72427-4	10kHz	17447-2	200K	130K	17451-2	270K	130K	17452-2	82K	130K	17453-2	47K	17454-2	18K	18K
72427-5	20kHz	17447-2	200K	130K	17451-2	270K	130K	17452-2	82K	130K	17453-2	47K	17454-2	18K	18K
72427-6	50kHz	17447-2	200K	130K	17451-2	270K	130K	17452-2	82K	130K	17453-2	47K	17454-2	18K	18K
72427-7	40kHz	17447-2	200K	130K	17451-2	270K	130K	17452-2	82K	130K	17453-2	47K	17454-2	18K	18K

Figure 6-2. Type 72427-(X) IF Demodulator Assembly (A2), Schematic Diagram

Courtesy of <http://BlackRadios.terryo.org>





NOTE:
UNLESS OTHERWISE SPECIFIED, RESISTANCE
IS IN OHMS, $\pm 5\%$, 1/8 W.

Figure 6-3. Type 791296-1 FM Video
Equalizer (A3), Schematic
Diagram

Figure 6-4

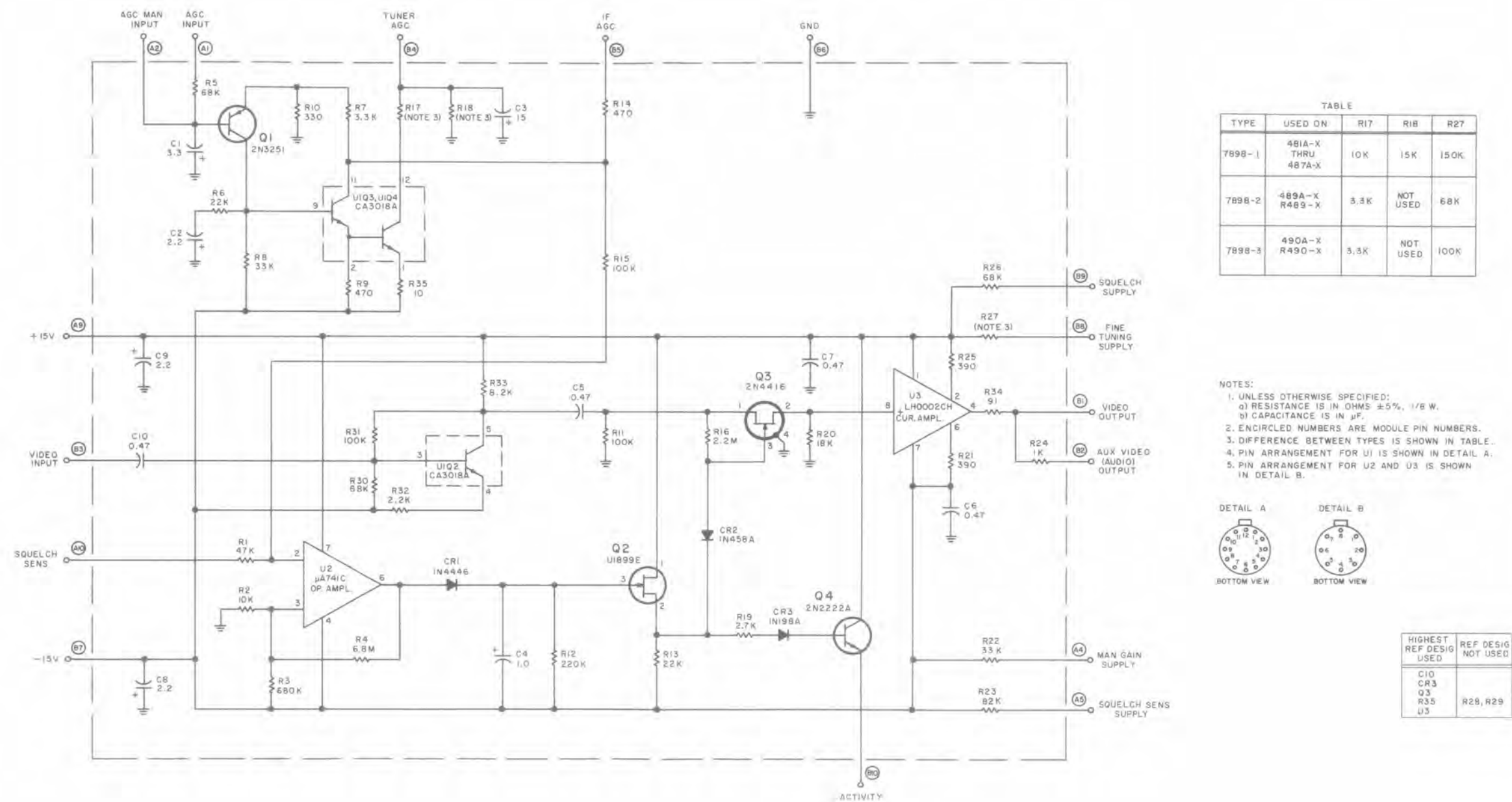
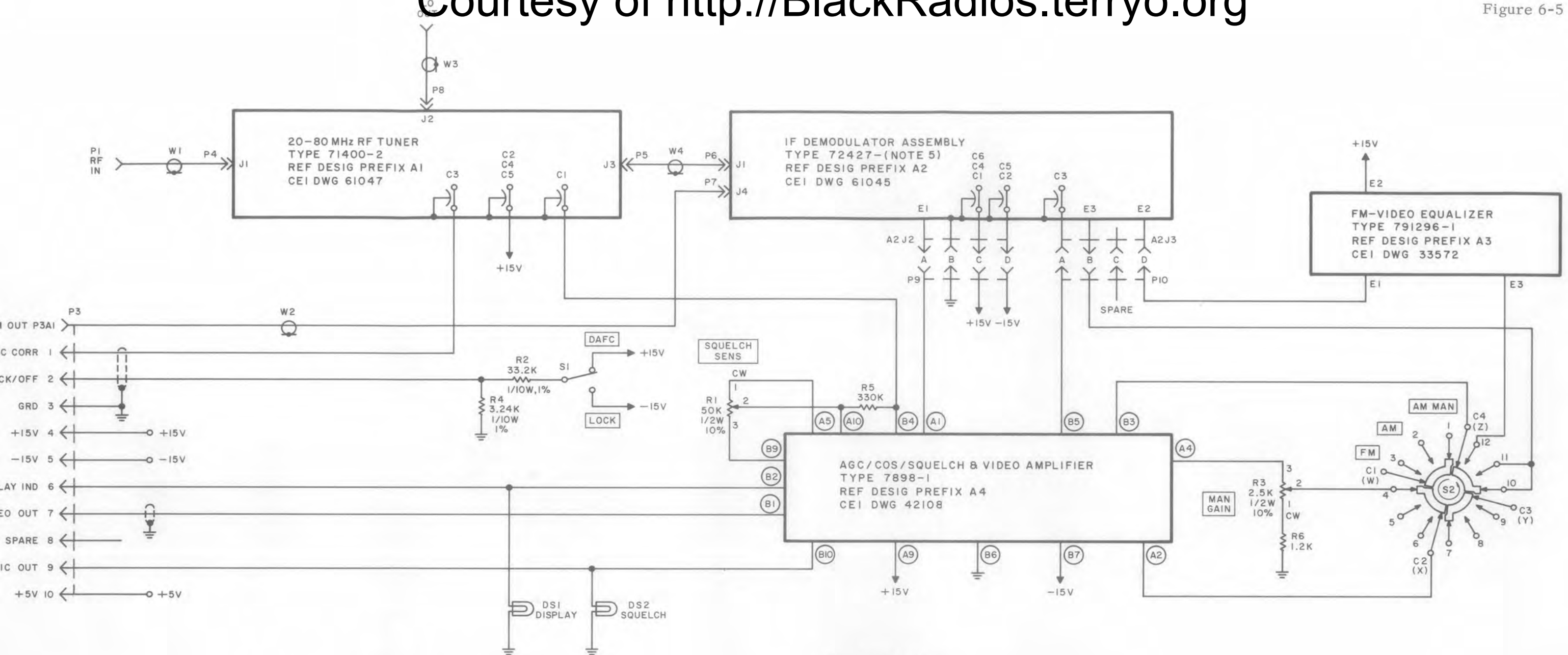


Figure 6-4. Type 7898-1 AGC, COS, Squelch and Video Amplifier (A4), Schematic Diagram

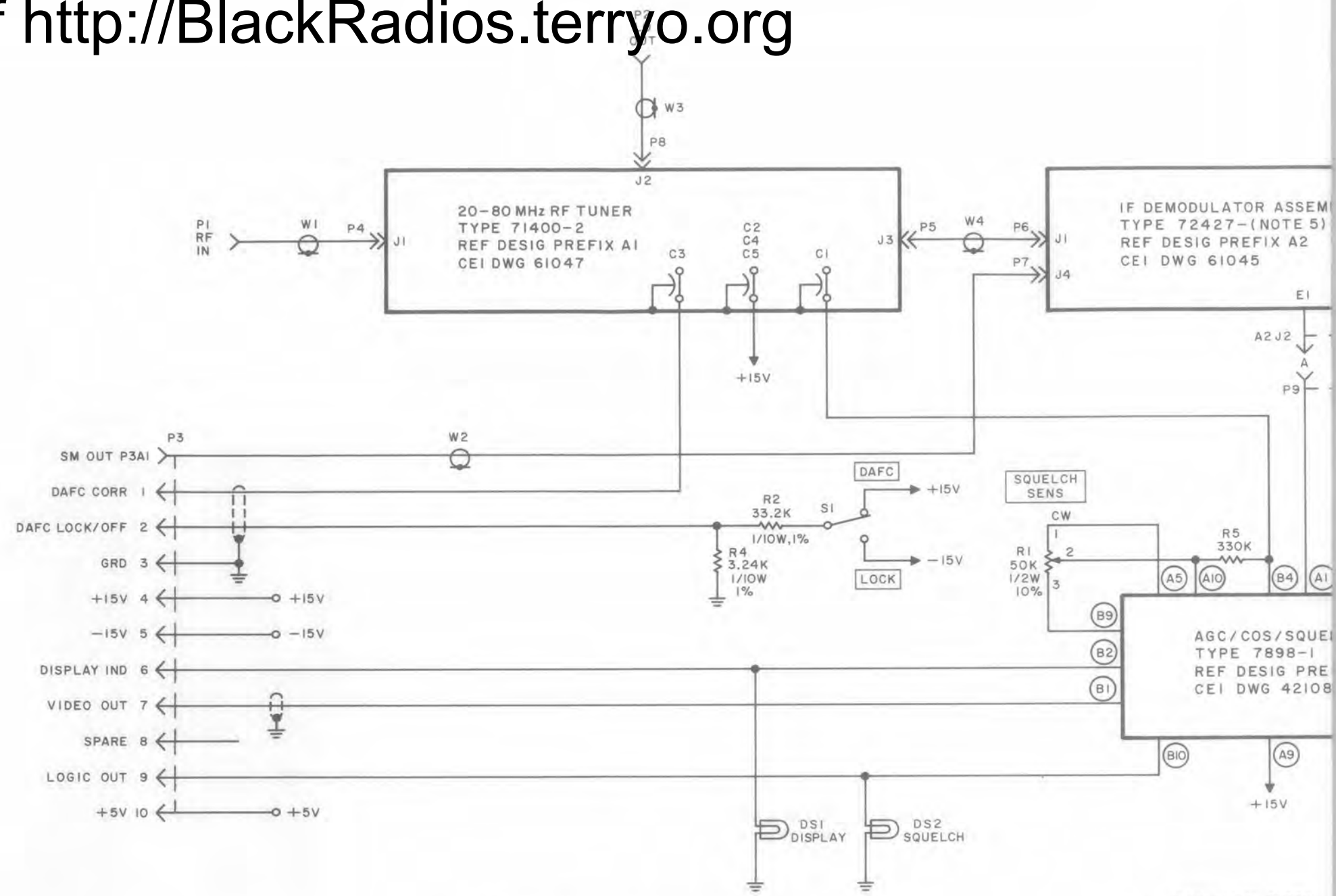


- NOTES:
1. UNLESS OTHERWISE SPECIFIED, RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4W.
 2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
 3. CW ON R1, R3 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
 4. INDICATES FRONT PANEL CONTROL.
 5. DIFFERENCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK.
 6. SWITCH S2 IS SHOWN IN EXTREME CCW POSITION AND IS VIEWED FROM END OPPOSITE CONTROL KNOB. LETTERS W,X,Y,Z DENOTE SEGMENTS OF WAFER. ARROW INDICATE CW ROTATION OF CONTROL KNOB.

TABULATION BLOCK		
TYPES	IF BW	IF DEMOD (A2)
487A-1	10 kHz	72427-4
487A-2	20 kHz	72427-5
487A-3	50 kHz	72427-6
487A-8	40 kHz	72427-7

Figure 6-5. Type 487A-(X) Receiver, Main Chassis Schematic Diagram

Courtesy of <http://BlackRadios.terry.org>



- NOTES:
- 1. UNLESS OTHERWISE SPECIFIED, RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4 W.
 - 2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
 - 3. CW ON R1, R3 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
 - 4.  INDICATES FRONT PANEL CONTROL.
 - 5. DIFFERENCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK.
 - 6. SWITCH S2 IS SHOWN IN EXTREME CCW POSITION AND IS VIEWED FROM END OPPOSITE CONTROL KNOB. LETTERS W, X, Y, Z DENOTE SEGMENTS OF WAFER. ARROW INDICATE CW ROTATION OF CONTROL KNOB.

TABULATION BLOCK		
TYPES	IF BW	IF DEMOD(A
487A-1	10kHz	72427-4
487A-2	20kHz	72427-5
487A-3	50kHz	72427-6
487A-8	40kHz	72427-7