SECTION 17.
RF INPUT MODULE (A17)

17.1 DESCRIPTION

The RF Input module comprises four sections:

1) the Wattmeter board (A17A1),
2) the Wideband Amplifier board (A17A2),
3) the Duplex Generator board (A17A3), and
4) the mechanical assembly.

The chassis uses feed-through filters and capacitors to interconnect the three printed circuit boards. The mechanical assembly includes a 0 to 130-dB rotary step attenuator with associated co-axial cables, Antenna, RF In/Out and Duplex Generator ports, and the Duplex Generator On/Off switch.

Electrically, the RF Input module provides five primary RF functions:

1) High-level generate (GENERATE ANTENNA PORT) provides an RF-output signal (AM,FM, or CW; 10 kHz to 1 GHz) adjustable over a range of +13 dBm to −135 dBm;
2) Low-level generate (GENERATOR RF IN/OUT PORT) provides an RF-output signal (as above, for GENERATE ANTENNA PORT), adjustable over a range of −17 dBm to −165 dBm;
3) High-level power monitor (MONITOR RF IN/OUT PORT) provides a means of measuring RF power (1 MHz to 1 GHz; 1 to 125W at ±10 percent accuracy);
4) Sensitive monitor (MONITOR ANTENNA PORT) provides off-the-air reception;
5) Duplex Generator (DUPLEX GEN) provides an RF-output signal, offset in frequency (0 to 10 MHz or fixed 45 MHz) from the received signal.

A wirelist of the RF Input module is shown at the end of the section in Table 17-2, a block diagram in Figure 17-1, and an interconnect diagram in Figure 17-2. Following that, Figure 17-3 coordinates a parts list with the assembly of the RF Input module and with the printed wiring board assembly of the RF Input Flex Standard.

17.2 THEORY OF OPERATION

17.2.1 WATTMETER BOARD (A17A1)

17.2.1.1 General

RF power to and from the System Analyzer passes through the Wattmeter board to one of two ports, Antenna or RF In/Out. In the sensitive monitor mode (less than 100 milliwatts) or in high-level generate mode, the signal is either transmitted or received through the Antenna port. In the high-level RF-input mode, power enters the module through the RF In/Out port. This port is −30 dB below the Antenna port. This board also contains the circuitry for the wattmeter.

A block diagram of the Wattmeter board is shown at the end of the section in Figure 17-4, a schematic in Figure 17-5 and the printed wiring board assembly and parts list in Figure 17-6.

17.2.1.2 Wattmeter

In the monitor-RF-power mode, the signal applied to the RF In/Out port (J1) is first attenuated by a 14-dB, 125W attenuator (AT2). This reduced power level is applied to 50-ohm load AT3. Diode CR1 detects the peak of the voltage produced across the load, and the resulting dc level is applied to a three-stage, instrumentation-style amplifier (U1A, U1B, and U1C).

Thermistor RT2 compensates for changes in the internal temperature of the compartment. Diode CR3 and operational amplifier U1A provide temperature compensation for diode CR1. U1B amplifies the detected signal, and then U1C differentially sums U1B's output with the output of the reference amplifier, U1A. The signal at the output of U1C is connected to the Scope/DVM Control board (A7), where it is routed to the DVM. Because of diode detector CR1, this output is directly proportional to the square root of the power applied (Power in watts = $1.25*V^2$). Potentiometer R20 provides offset adjustment, while R7 provides gain adjustment. For 125W of input power, 50-ohm load AT3 dissipates only 5W, with the balance absorbed by the 14-dB, 125W attenuator, AT2.

17.2.1.3 Over-Temperature Protection

The 14-dB, 125W attenuator (AT2) can dissipate 125 watts for approximately 1.5 minutes, at which time the temperature of the device exceeds the temperature rating of 100°C. Thermistor RT1, recessed into the flange that AT2 is soldered to, decreases in resistance to 10K ohm, causing the output of comparator U2A to go high. This signal causes the processor to activate the System Analyzer's audible alarm and to flash a warning signal on the CRT until the applied RF power is removed and AT2 has had ample time to cool off.

17.2.1.4 Port Selection

The Antenna and RF In/Out port signal is routed to the Wideband Amplifier board (A17A2) by relay K1. The Antenna port is selected by turning on transistor Q1. This path starts at the connector, passes through fuse F1 and relay K1, connecting to the Wideband Amplifier via the rotary step attenuator, AT1. Following loads AT2 and AT3, the RF In/Out port is similarly connected to the Wideband Amplifier via rotary step attenuator AT1. Both the Antenna and RF In/Out port can receive and transmit signals from the Wideband Amplifier.

17.2.2 WIDEBAND AMPLIFIER BOARD (A17A2)

17.2.2.1 General

The Wideband Amplifier board performs three functions: 1) amplification and leveling of the RF Synthesizer's output; 2) RF-switching, which allows the RF Synthesizer's output to be used as the system's RF-generator output or as the local oscillator (L.O.) for the system's monitor function; and 3) frequency-translation, converting the RF input to 10.7 MHz when the system is in monitor mode.

A block diagram of the Wideband Amplifier board is shown at the end of the section in Figure 17-7, a schematic in Figure 17-8, and a printed wiring board assembly and parts list in Figure 17-9.

17.2.2.2 Generate Mode

When the system's FUNCTION control is set to Generate FM, Generate CW, Generate AM, or SWP, or when the DISPLAY control is set to Spect Analyzer, the MON + DSB/GEN input is low, putting the Wideband Amplifier in generate mode. In this mode, the Wideband Amplifier's output is directed through relay K1 and out the ATTENUATOR OUT/IN port. The RF-leveling loop allows control of the level of the RF output. Using the variable RF Level control on the front panel, the operator can vary the level at the Antenna port between −3 dBm and +13 dBm.

17.2.2.2.1 Voltage-Controlled Attenuator (VCA)

The RF Synthesizer's (A9) output drive to amplifier U4 is controlled by the VCA (Q2, CR1, CR2, CR3). As the voltage on the base of Q2 is varied, the currents through PIN diodes CR1, CR2, and CR3 are changed, thus varying the attenuation. Minimum attenuation occurs when the voltage on the base of Q2 is at its maximum (approximately 11 volts). Over the full range of dc control voltages, the VCA range is greater than 50 dB.

17.2.2.2.2 Wideband Amplifiers

The VCA is followed by three stages of amplification at U4, U5, and Q7. This cascade has a nominal gain of about 35 dB and can linearly deliver +16 dBm to a 50-ohm load. U4 and U5 are biased with constant current sources Q4 and Q5, respectively. Q7 is biased in a slightly different manner by Q6. Q6 samples the collector current of Q7 and adjusts the base bias accordingly, to achieve a collector current of 57 mA.

17.2.2.2.3 Detector and Detector Amplifier

The output voltage of the Wideband Amplifier is sampled by detector CR10. Accuracy at low output levels is improved by slightly forward-biasing CR10 with resistors R29-R31 and R33. Operational amplifier U7 amplifies the detector output and drives the CARRIER + MOD LVL output and one input of the summing amplifier. The CARRIER + MOD LVL output is used to measure the output level and percent AM of the signal at the generator output. Gain potentiometer R34 and offset potentiometer R38 are adjusted so that the CARRIER + MOD LVL is 8 times the rms voltage at the output of the front panel's Antenna port.

17.2.2.2.4 Summing Amplifier and ALC-Reference Selection

As mentioned in the previous paragraph, one input of the summing amplifier, U8, is driven by the detector amplifier. The other input is driven by the ALC-reference selector, U9. The summing amplifier compares the detector amplifier's output with the selected ALC reference and then adjusts the VCA's drive to correspond to the desired output level indicated by the ALC-reference voltage. In generate mode, the AM MOD + DC REF input is selected as the ALC reference. When AM is not the selected function, this signal is a dc voltage, controlled by the variable RF Level control on the front panel. The range of this voltage is sufficient to allow an output-power range of −3 dBm to +13 dBm at the front panel's Antenna port. When AM is the selected function, the AM MOD + DC REF input consists of ac and dc components. The ratio of the ac component to the dc component determines the percent AM at the generator output. This ratio and the type of modulation signal are controlled by the front panel's MODULATION controls.

17.2.2.2.5 HI/LO Band Switching

To operate over the full band of 10 kHz to 1 GHz, the Wideband Amplifier is operated in either HI-band mode or LO-band mode. The mode is controlled by the WB AMP HI/LO input. In HI-band mode, the VCA

on the Wideband Amplifier controls the level (1 MHz to 1 GHz), and diodes CR6 and CR7 are switched into amplifiers U4 and U5, respectively. These diodes, when switched on, reduce the low-frequency gain of U4 and U5, keeping the ALC loop stable. In LO-band mode, 0.01 to 1 MHz, the VCA on the Wideband Amplifier is set to minimum attenuation by U9, and the output level is controlled by a VCA in the RF Synthesizer. This VCA is controlled by the 0.01 to 1 AGC output of the Wideband Amplifier. Also, during LO-band mode, C30 is switched into the detector circuit. This increases the detector time constant so that the detector operates properly at lower frequencies.

Switching of CR6, CR7, CR9 is controlled by comparators on U6.

17.2.2.2.6 RF-Switching

In generate mode, the output of the Wideband Amplifier is switched by relay K1 to the ATTENUATOR OUT/IN port. This signal then goes through the step attenuator and to the Wattmeter board where it is switched to either the Antenna port or the RF In/Out port. The operator can select the Antenna or RF In/Out port by pulling out or pushing in the variable RF Level control on the front panel.

17.2.2.3 Monitor Mode

In monitor mode, the MON + DSB/GEN input is taken high. This switches a fixed reference into summing amplifier U8, which is set by R58, resulting in a fixed local-oscillator drive level out of Q7. This also energizes relay K1, causing mixer U10 to mix the monitor input from the ATTENUATOR OUT/IN port with the local-oscillator signal.

A portion of the local-oscillator output is sent to the Duplex Generator (A17A3) through the L.O. OFFSET OSC OUT port. The output of mixer U10 is sent through the 20-MHz low-pass filter and then to the Receiver through the 10.7 MHz IF OUT port.

17.2.2.4 Double Sideband-Suppressed Carrier (DSBSC) Mode

For DSBSC mode, the Wideband Amplifier is configured as in the monitor mode, except that modulation is applied to the DSBSC MOD input through the isolation network to mixer U10. The resulting DSBSC output is coupled through relay K1, to the ATTENUATOR OUT/IN port.

17.2.3 DUPLEX GENERATOR BOARD (A17A3)

17.2.3.1 General

The Duplex Generator board provides an RF output whose frequency is offset from the Receiver's center frequency by either a fixed 45 MHz or an adjustable 0 to 10 MHz in 5-kHz steps. The 45-MHz offset is obtained by mixing the local-oscillator signal from the Wideband Amplifier (L.O. OFFSET), which is offset by 10.7 MHz from the desired Receiver signal, with a 34.3-MHz signal generated by a phase-locked-loop (PLL). The 0 to 10-MHz adjustable offset is obtained by mixing the L.O. OFFSET signal with a 0.7 to 10.7-MHz signal. This signal is generated by mixing the 34.3-MHz PLL with a 35 to 45-MHz PLL.

A block diagram of the Duplex Generator board is shown at the end of the section in Figure 17-10, a schematic in Figure 17-11, and the printed wiring board assembly and parts list in Figure 17-12.

17.2.3.2 Phase-Locked-Loop (PLL) Control

The phase-locked-loops on the Duplex Generator board use a PLL integrated circuit (IC). This IC provides digital dividers, control functions, the phase detector, and a reference-frequency oscillator. The reference oscillator is divided-down by the reference divider to set the reference frequency of the PLL. This signal is applied to the phase detector, where it is compared to the output of the divider chain (divide-by-N and divide-by-A). The selection of the dividers (reference, divide-by-N, and divide-by-A) can be programmed by using either hard wiring or serial data lines. The serial-data-programmable IC provides two latched open-drain outputs that can be used for external switching.

17.2.3.3 35 to 45-MHz PLL

17.2.3.3.1 General

The 35 to 45-MHz PLL consists of a serial-input PLL IC, a loop filter, a voltage-controlled oscillator (VCO), an amplifier, and a two-modulus pre-scaler.

The reference oscillator on the PLL IC (U2) uses crystal Y1 to generate a 10.24-MHz source. The reference divider on U2 divides this signal by 2048, providing a reference frequency of 5 kHz. The phase detector then compares this signal to the divided-down VCO output coming from the divide-by-N. The PLL uses a divide-by-32/33, two-modulus pre-scaler (U4) which, in conjunction with dividers N and A, divides the VCO output of 35 to 45 MHz down to 5 kHz. The two-output phase detector is connected to the loop filter.

17.2.3.3.2 Loop Filter

Loop filter U6 sets the bandwidth and stability of the loop and attenuates the reference-frequency components coming from the phase detector. The 3-dB bandwidth of the 35 to 45-MHz loop is 22 Hz. The loop filter incorporates a lead-lag network (R29, R30, and C38) to reduce the resistor values of R21-R25. This allows for a faster loop-lock time. Diodes CR7 and CR8 help the operational amplifier (U6) slew the large-value capacitor (C38). The output of the loop filter tunes the

VCO frequency to the value needed to maintain phase lock.

17.2.3.3.3 VCO and Amplifier

The 35 to 45-MHz VCO (Q3 and Q4) is a series-tuned oscillator that resonates varactor diodes CR5 and CR6 with the inductance in the 26 turns of transformer T1. Transistor Q7 is the VCO ON/OFF switch which is controlled by the PLL IC (U1) via the SW1 output. The amplifier (Q5) following the VCO provides an output of +7 dBm. This signal is attenuated by R39 and R40 before going to the two-modulus prescaler, U4.

17.2.3.4 34.3-MHz PLL

17.2.3.4.1 General

The 34.3-MHz PLL has the same components as the 35 to 45-MHz PLL, except that the PLL IC (U1) is hard-wired to provide one frequency of operation, 34.3 MHz. The PLL IC (U1) uses the 10.24-MHz source from U2. The reference divider on U1 divides this 10.24-MHz signal by 512 to provide a reference frequency of 20 kHz. As with the 35 to 45-MHz PLL, the phase detector then compares this signal to the divided-down VCO output coming from the divide-by-N. The PLL uses a divide-by-32/33, two-modulus prescaler (U3) which, in conjunction with dividers N and A, divides the VCO output of 34.3 MHz down to 20 kHz. The two-output phase detector is connected to the loop filter.

17.2.3.4.2 Loop Filter

Loop filter U5 sets the bandwidth and stability of the loop and attenuates the reference-frequency component coming from the phase detector. The 3-dB bandwidth of the 34.3-MHz PLL is 5 Hz. The loop filter incorporates a lead-lag network (R8, R73, and C85) to reduce the resistor values of R1-R4. This allows for a faster loop-lock time. Diodes CR14 and CR15 help the operational amplifier (U5) slew the large-value capacitor (C85). The output of the loop filter tunes the VCO frequency to the value needed to maintain phase lock.

17.3.3.4.3 VCO and Amplifier

The 34.3-MHz VCO (Q1) is a Colpitts-type oscillator that resonates CR2, CR3, C10, C11, C47, and C68 with the inductance of transformer T1. Capacitor C68 is adjusted to provide a tuning voltage of 8 to 10V at TP1 when the loop is locked. Transistor Q8 is the VCO ON/OFF switch, which is controlled by PLL IC U1 via the SW2 output. The amplifier (Q2) following the VCO provides an output of +7 dB. This signal is attenuated by R37 and R38 before going to the two-modulus pre-scaler, U3.

17.2.3.5 Offset Selection

The 45-MHz offset is generated by routing the 34.3-MHz PLL through relay U7 (which is controlled by the SW1 output on U2), to the L.O. offset-mixer, U10. Here the 34.3-MHz signal is mixed with the L.O. OFFSET signal coming from the Wideband Amplifier board. Amplifier U14 provides a gain of 8 dBm to the −20 dBm L.O. OFFSET input signal. The output of the L.O. mixer (U10) is routed through relay U12 to the Duplex output port, J6. To generate the 0 to 10-MHz offset, mixer U9 mixes the 34.3-MHz PLL with the 35 to 45-MHz PLL. The output of mixer U9 is low-pass filtered by C54, C56, and L8 to obtain the difference product. This signal is amplified by amplifier Q6 from approximately 0 dBm to +7 dBm. The output of amplifier Q6 is applied to the L.O. offset mixer, U10, where it is mixed with the L.O. OFFSET signal and routed to the Duplex output port, J6.

17.2.3.6 Modulation

FM modulation of the Duplex Generator is accomplished by directly modulating the VCO in the 34.3-MHz PLL. The sensitivity of this input port is adjusted by R69 to 5 kHz/V. The frequency response of the modulation input is 1 Hz to 20 kHz.

17.2.3.7 Board Control

The Duplex Generator board is controlled by PLL IC U2, which uses the RF control bus coming from the Processor Interface board (A11). (See the A11 section, paragraph 13.2.1.3 for a description of this bus.) The PLL IC uses the last 19 bits of the RF data bus. The first two bits of these 19 bits control the two output switches (SW1 and SW2), as shown in Table 17-1. The next ten bits control the divide-by-N, and the last seven bits control the divide-by-A.

Table 17-1. Switch Control

Switch Position		Result
SW1	SW2	
0	0	0 to 10-MHz OFFSET
0	1	Not Allowed
1	0	45-MHz OFFSET
1	1	Duplex Generator OFF

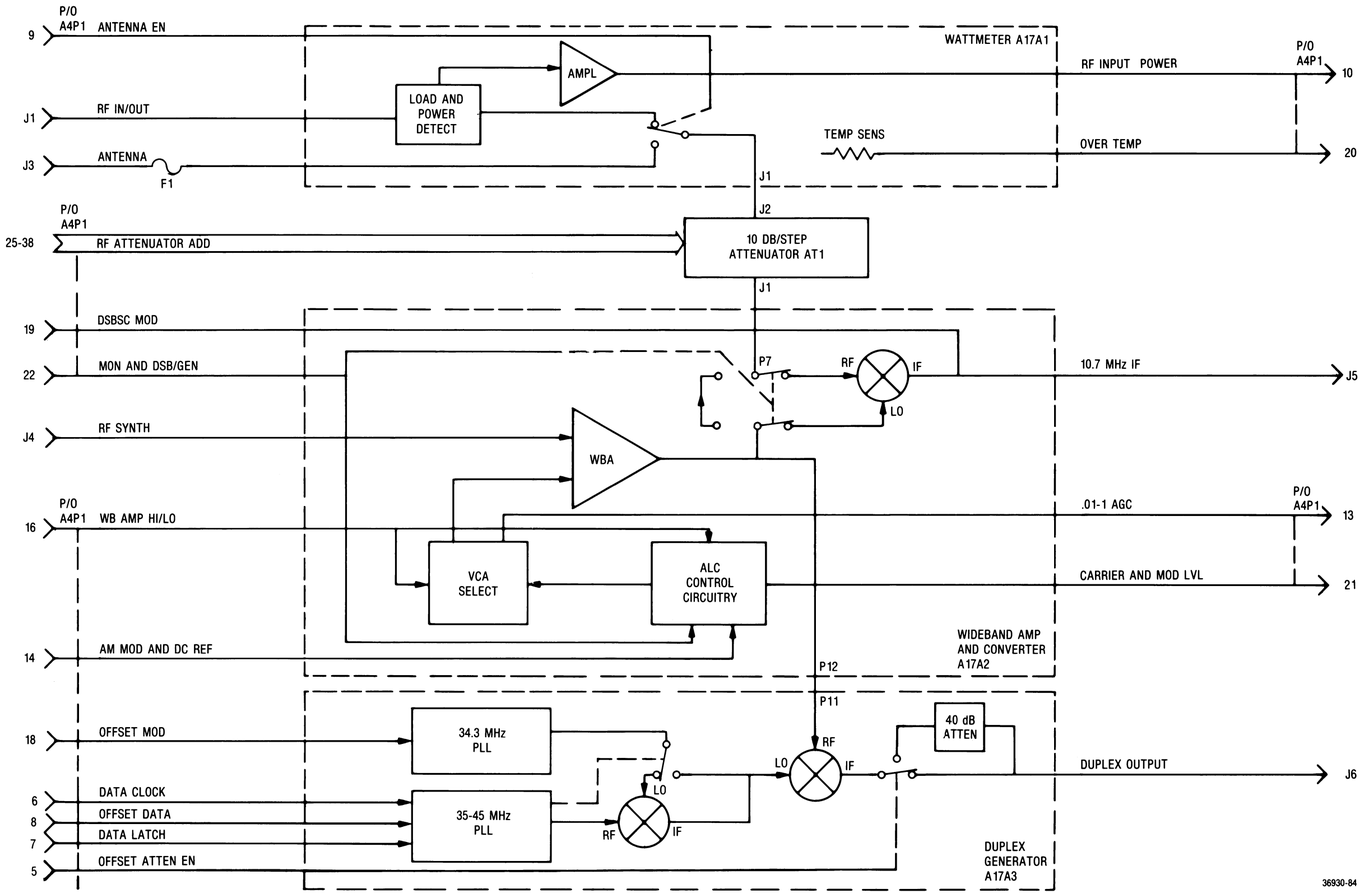
Table 17-2. RF Input Module-Wirelist

1	2	3	4	5	6	7	8	9
WIRE NO.	COLOR / SIZE AWG	WIRE RUNS FROM	NOTE OR VIEW	WIRE RUNS TO	NOTE OR VIEW	FUNCTION ROUTING REMARKS	APPROX LENGTH	USE FIND NO.
		A4-E1		C10		+5 Volts		
		A4-E2				SPARE		
		A4-E3		C11		+33 Volts		
		A4-E4		A4S1 Center Pin		OFFSET ON/OFF		
		A4-E5		C8		OFFSET ATTEN EN		
		A4-E6		W7		DATA CLOCK		
		A4-E7		W5		DATA LATCH		
		A4-E8		W6		OFFSET DATA		
		A4-E9		C5		ANT ENABLE		
		A4-E10		C2		RF INPUT PWR		
		A4-E11		E1		GND		
		A4-E12		E3		GND		
		A4-E13		FL4		.01-1 MHz AGC		
		A4-E14		FL5		AM MOD +DC REF.		
		A4-E15		C6		EXT FWD PWR		
		A4-E16		FL3		WB AMP HI/LO		
		A4-E17		C7		EXT RFL PWR		
		A4-E18		W8		OFFSET MOD		
		A4-E19		FL8		DSBSC MOD		
		A4-E-20		C4		OVERTEMP		
		A4-E21		FL6		CARRIER + MOD LVL		
		A4-E22		FL2		MON + DSB/GEN		
		A4-E23		FL1		+12V		
		A4-E24		FL7		-12V		
		A4-E25		S1-4		RF ATTEN 130		
		A4-E26		S1-5		RF ATTEN 120		
		A4-E27		S1-6		RF ATTEN 110		
		A4-E28		S1-7		RF ATTEN 100		
		A4-E29		S1-8		RF ATTEN 90		
		A4-E30		S1-9		RF ATTEN 80		
		A4-E31		S1-10		RF ATTEN 70		
		A4-E32		S1-11		RF ATTEN 60		
		A4-E33		S1-12		RF ATTEN 50		
		A4-E34		S1-13		RF ATTEN 40		
		A4-E35		S1-14		RF ATTEN 30		
		A4-E36		S1-1		RF ATTEN 20		
		A4-E37		S1-2		RF ATTEN 10		
		A4-E38		S1-3		RF ATTEN 0		
		A4-E39		E2		GND		
		A4-E40				SPARE		

Table 17-2. RF Input Module–Wirelist (Cont)

1	2	3	4	5	6	7	8	9
WIRE NO.	COLOR / SIZE AWG	WIRE RUNS FROM	NOTE OR VIEW	WIRE RUNS TO	NOTE OR VIEW	FUNCTION ROUTING REMARKS	APPROX LENGTH	USE FIND NO.
		C10		S1-15		+5 Volts		
		C9		FL1		+12		
		C9		C3		+12		
		FL7		C1		-12		
		E3		A4S1 TOP PIN		GND		

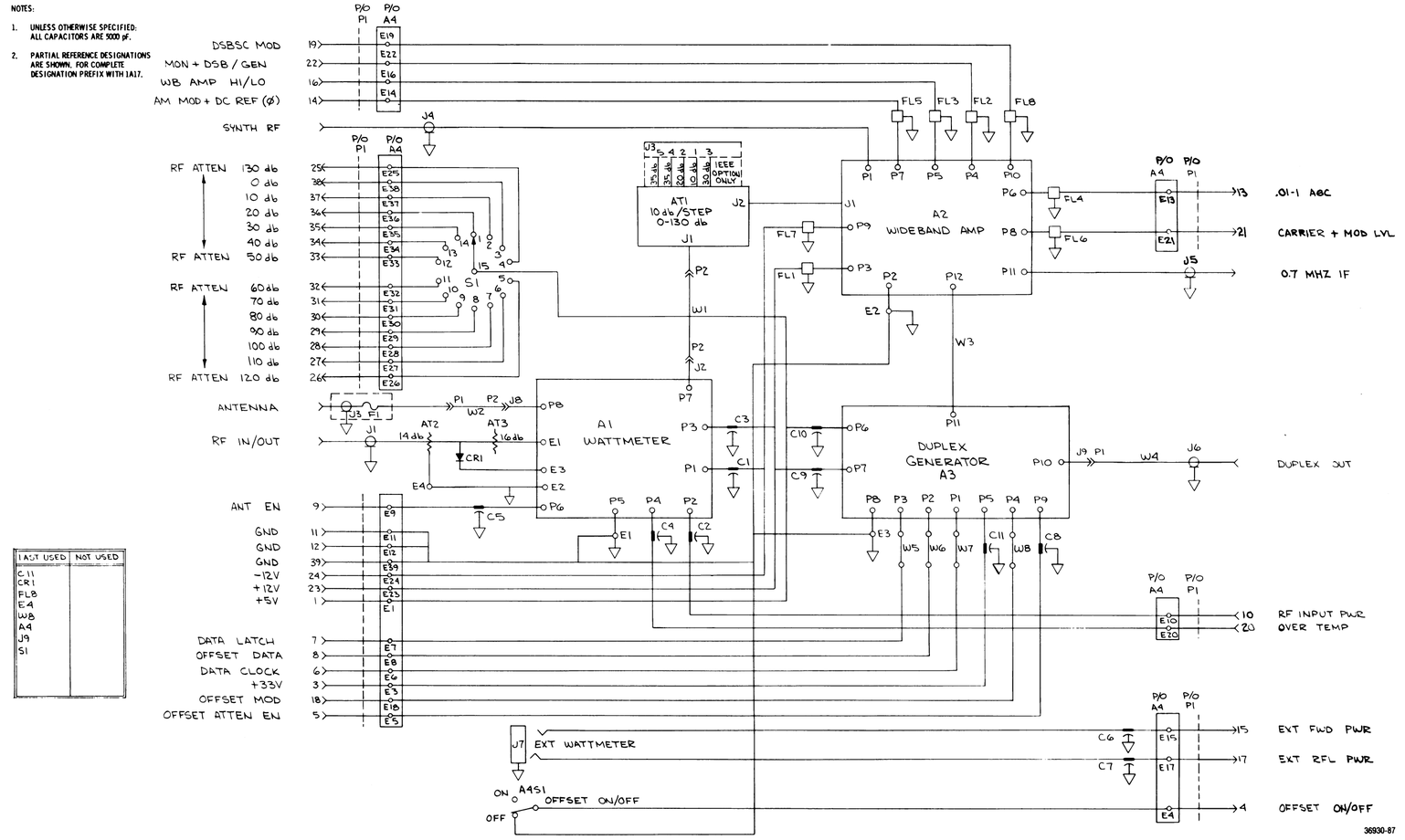
Figure 17-1. Block Diagram

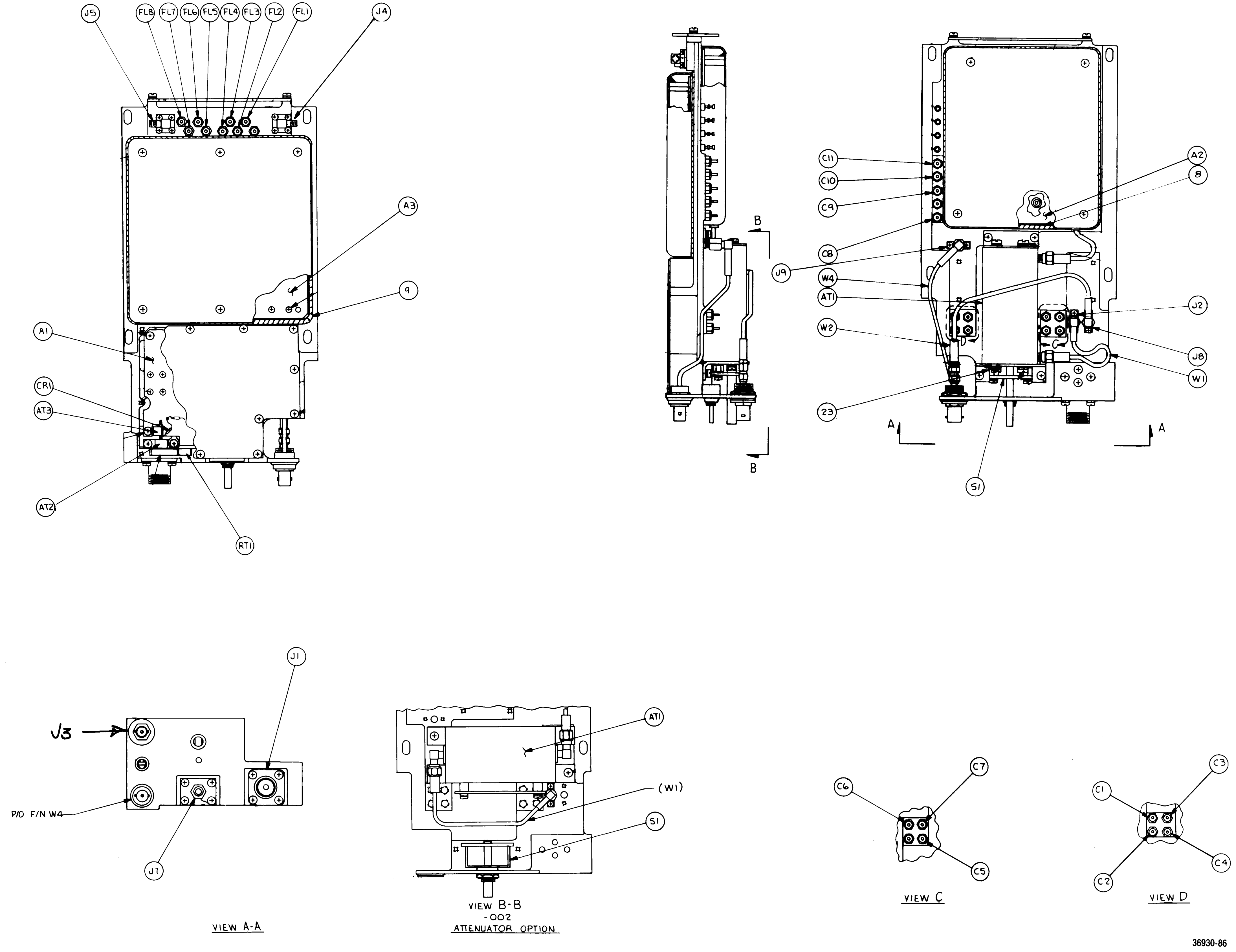


RF INPUT MODULE (A17)

(RTL-1021A)

Figure 17-2. Interconnect Diagram





RF INPUT MODULE (A17)

(RTL-1021A)

Figure 17-3a. Assembly and Parts List (Sheet 1 of 2)

RF INPUT MODULE (A17)
RTL-1021A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
008	1	32-80342B94	GASKET,EMI	
009	1	32-80342B95	GASKET,EMI	
023	2	43-80342B49	SPACER	
A 001	1	RTL-4158A	WATT METER ASSY(A17A1)	
A 002	1	RTL-4156A	WIDE BND AMPL.ASSY(A17A2)	
A 003	1	RTL-4157A	DUPLEX GEN.ASSY(A17A3)	
AT001	1	01-80343B83	ATTENUATOR	
AT002	1	17-80377A95	ATTENUATOR,POWER	
AT003	1	01-80343B81	ATTENUATOR,16DB	
C 001	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 002	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 003	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 004	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 005	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 006	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 007	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 008	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 009	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 010	1	21-80342B51	CAPACITOR	5000PF-6MV-500
C 011	1	21-80342B51	CAPACITOR	5000PF-6MV-500
CR001	1	48-87643C01	DIODE	
FL001	1	91-80342B25	FILTER	
FL002	1	91-80342B25	FILTER	
FL003	1	91-80342B25	FILTER	
FL004	1	91-80342B25	FILTER	
FL005	1	91-80342B25	FILTER	
FL006	1	91-80342B25	FILTER	
FL007	1	91-80342B25	FILTER	
FL008	1	91-80342B25	FILTER	
FL009	1	91-80342B25	FILTER	
FL010	1	91-80342B25	FILTER	
FL011	1	91-80342B25	FILTER	
FL012	1	91-80342B25	FILTER	
J 001	1	28-80342B87	CONNECTOR, MODIFIED	
J 002	1	28-80342B88	CONNECTOR	MODIFIED
J 004	1	28-80342B89	CONNECTOR	MODIFIED
J 005	1	28-80342B89	CONNECTOR	MODIFIED
J 007	1	09-80331A70	CONNECTOR	PHONE JACK
J 008	1	28-80342B88	CONNECTOR	MODIFIED
J 009	1	28-80342B88	CONNECTOR	MODIFIED
J 010	1	09-80340B39	CONNECTOR	
R 003	1	06-00185A19	RESISTOR	56-5-1/8
RT001	1	06-83600K05	THERMISTOR	
S 001	1	40-80335A74	SWITCH	WAFER
S 002	1	40-80335A80	SWITCH, TOGGLE	SPDT
W 001	1	30-80344B06	CABLE ASSEMBLY-W1	
W 002	1	30-80344B08	CABLE ASSEMBLY-W2	ANTENNA/A1
W 004	1	30-80344B09	CABLE ASSY-W4, DUPLEX/A3	
W 009	1	30-80344B17	CABLE ASSEMBLY, W9	
J003	1	9-80378A51	BNC FUSED	
F001	1	65-80377A44	P/O J003	

Cable Assembly (W1)
30-80344B06

W001 :A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
P 001	1	09-80331A75	CONNECTOR	
P 002	1	09-80343B86	CONNECTOR	

W002

Cable Assembly (W2)
30-80344B08

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
P 002	1	09-80331A75	CONNECTOR	

W004

Cable Assembly (W4, Duplex/A3)
30-80344B09

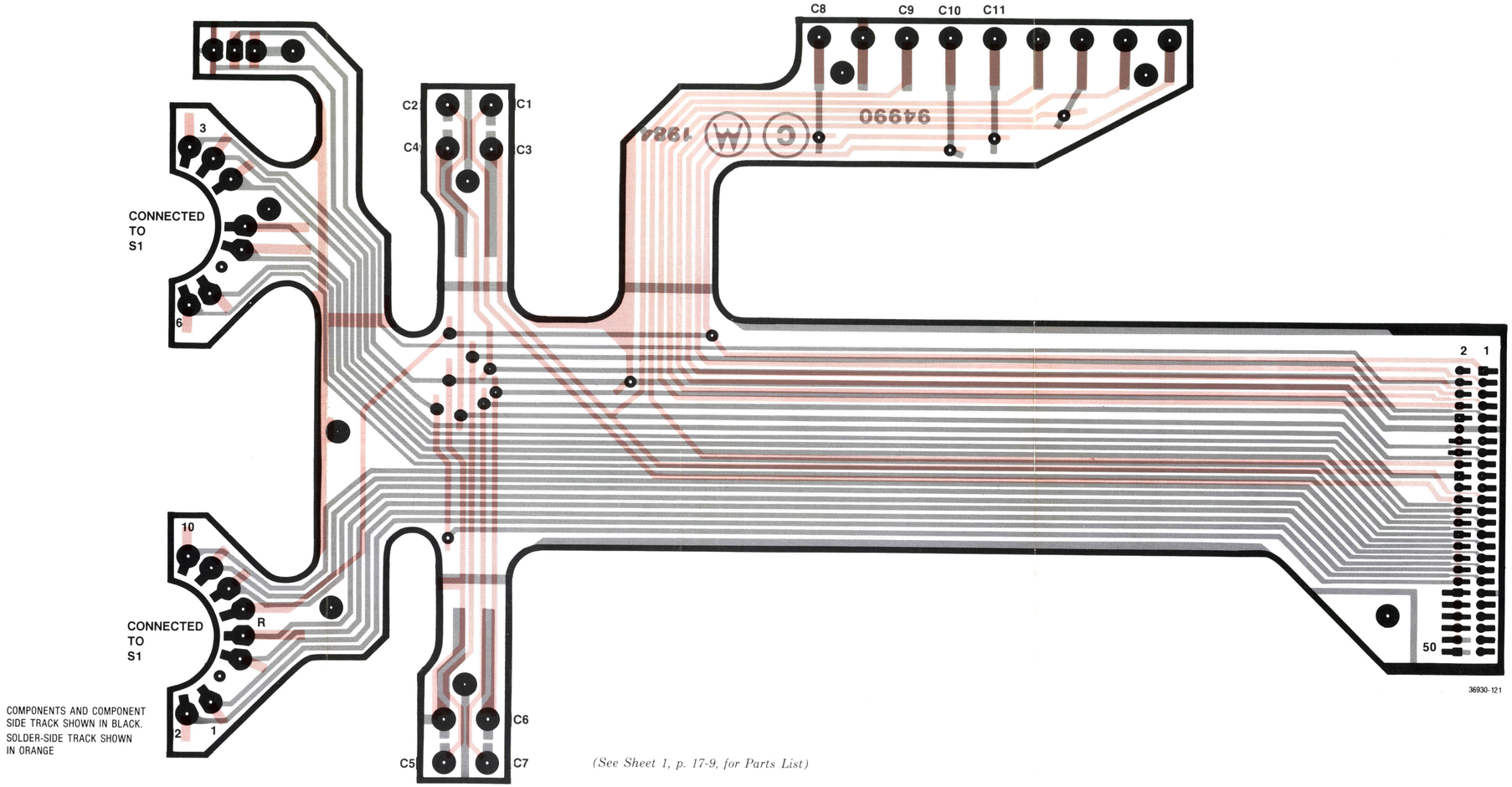
Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
J 006	1	28-80342B90	CONNECTOR, BNC	
P 001	1	09-80331A75	CONNECTOR	

Standard RF Input Kit

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
001	1	RTL-1021A	RF INPUT MODULE ASSY(A17)	
005	1	36-80335A88	KNOB, SKIRTED	
007	2	04-80335A99	WASHER	.156

RF INPUT FLEX STANDARD

Figure 17-3b. Printed Wiring Board Assembly and Parts List (Sheet 2 of 2)

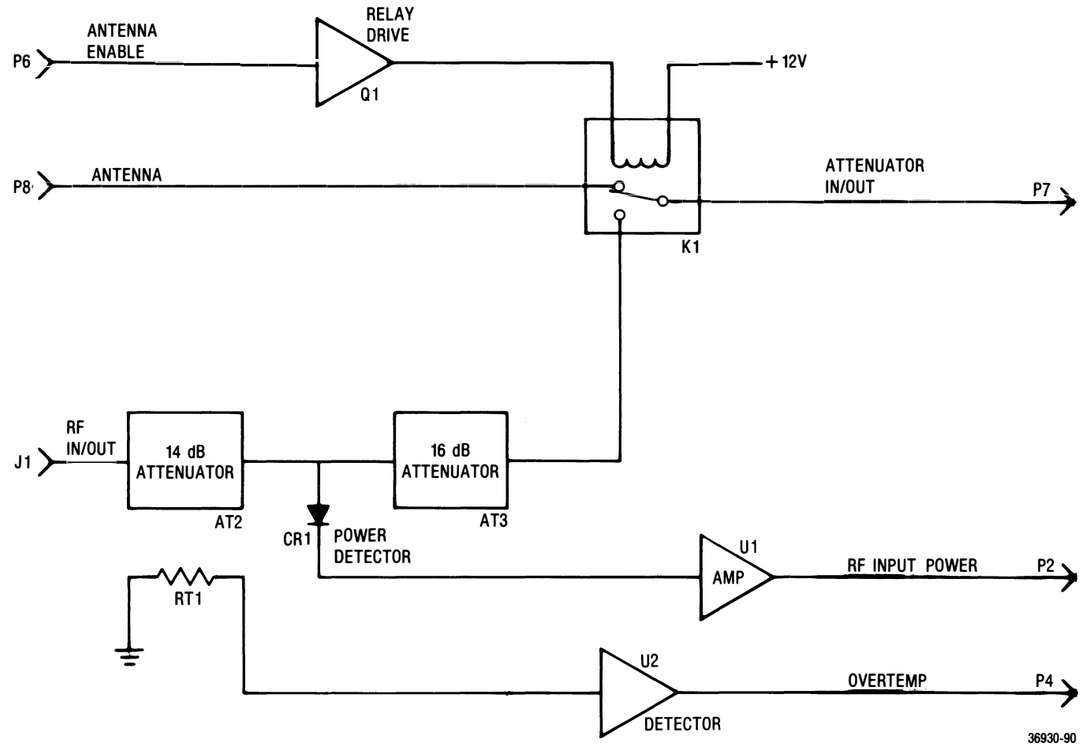


(See Sheet 1, p. 17-9, for Parts List)

RF WATTMETER BOARD (A17A1)

(RTL-4158A)

Figure 17-4. Block Diagram



RF WATTMETER BOARD (A17A1)

(RTL-4158A)

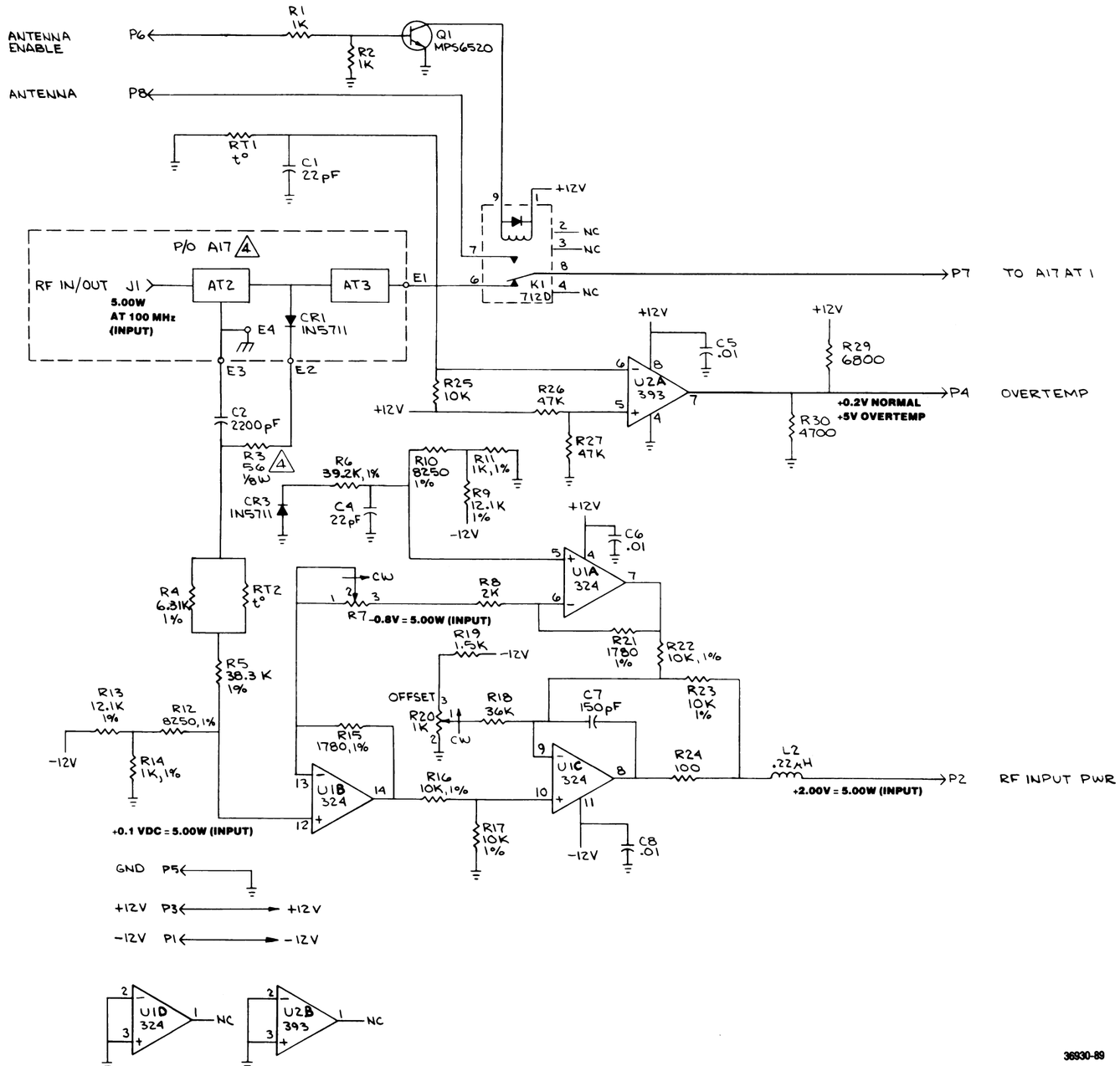
Figure 17-5. Schematic

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS PREFIX WITH 1A17A1. EXCEPT AS NOTED.
2. UNLESS OTHERWISE SPECIFIED
   ALL RESISTORS ARE IN OHMS ± 5 PCT, 1/4 WATT.
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN MH.
   ALL VOLTAGES ARE IN DC.
3. FOR REFERENCE DRAWINGS REFER TO :
   01-P22170E ASSEMBLY DRAWING
   01-P22280E PRINTED WIRING BOARD ASSEMBLY
   12-P22283E TEST PROCEDURE.
4. ⚠ PARTS SHOWN TO BE ASSEMBLED AT TEST.

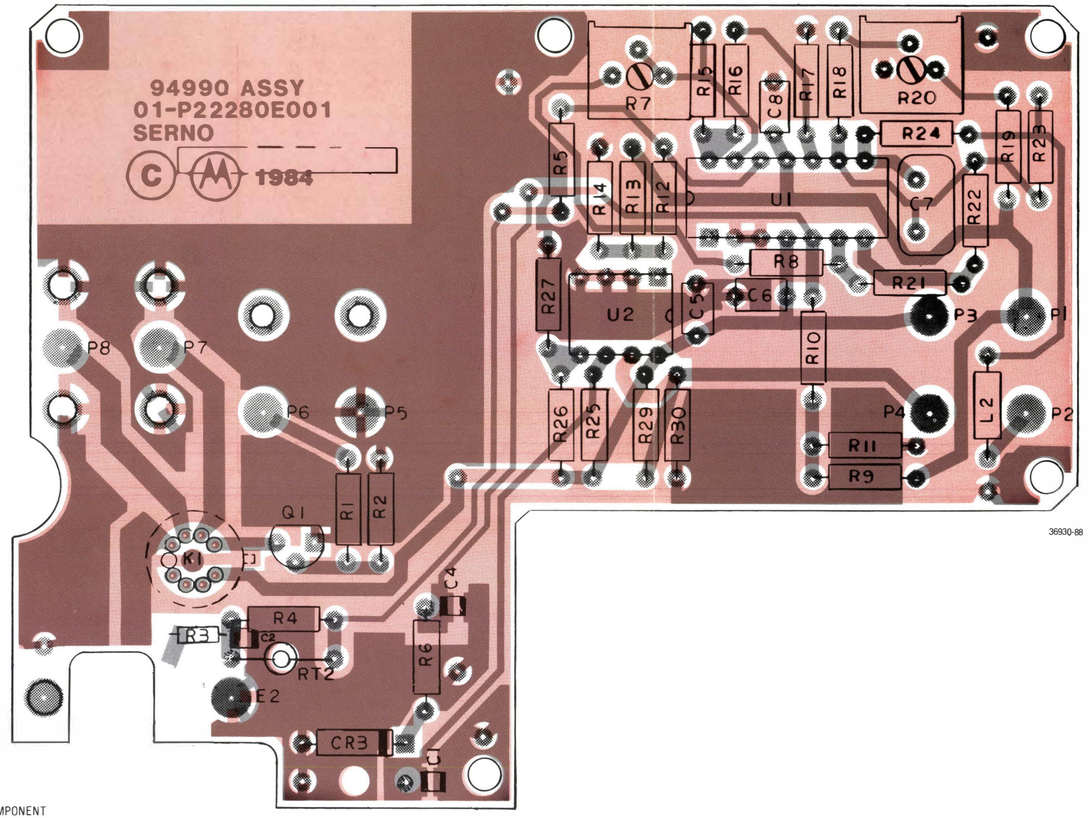
REF DES	DEVICE	GND	+12	-12	NO CONNECT
U1	LM324 N		4	11	1,2,3
U2	LM393 N	4	8		1,2,3

HIGHEST USED	NOT USED
C8	
CR3	CR2,CR1
K1	
L2	L1
P8	
R30	R28
RT2	
U2	
VR1	



WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

36930-89



36930-88

COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK.
SOLDER-SIDE TRACK SHOWN IN ORANGE

WATTMETER BOARD (A17A1)
RTL-4158A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
C 001	1	21-80370A14	CAPACITOR	22PF-5-100
C 002	1	21-80370A24	CAPACITOR	2200PF-20-100
C 004	1	21-80370A14	CAPACITOR	22PF-5-100
C 005	1	21-80342B09	CAPACITOR	.01UF-20-50
C 006	1	21-80342B09	CAPACITOR	.01UF-20-50
C 007	1	21-80369A94	CAPACITOR	150PF-5-500
C 008	1	21-80342B09	CAPACITOR	.01UF-20-50
CR003	1	48-87643C01	DIODE	
K 001	1	80-80343B61	RELAY	
L 002	1	24-80369A25	COIL	.22UH
P 001	1	09-80344B25	RECEPTACLE	
P 002	1	09-80344B25	RECEPTACLE	
P 003	1	09-80344B25	RECEPTACLE	
P 004	1	09-80344B25	RECEPTACLE	
P 005	1	09-80344B25	RECEPTACLE	
P 006	1	09-80344B25	RECEPTACLE	
P 007	1	09-80344B25	RECEPTACLE	
P 008	1	09-80344B25	RECEPTACLE	
Q 001	1	48-80340B86	TRANSISTOR	MPS6520
R 001	1	06-11009C49	RESISTOR	1K-5-1/4
R 002	1	06-11009C49	RESISTOR	1K-5-1/4
R 004	1	06-10621C75	RESISTOR	6.81K-1-1/4
R 005	1	06-10621D48	RESISTOR	38.3K-1-1/4
R 006	1	06-10621D49	RESISTOR	39.2K-1-1/4
R 007	1	18-83452F10	RESISTOR,VARIABLE	1K
R 008	1	06-11009C56	RESISTOR	2.0K-5-1/4
R 009	1	06-10621C99	RESISTOR	12.1K-1-1/4
R 010	1	06-10621C83	RESISTOR	8.25K-1-1/4
R 011	1	06-10621B94	RESISTOR	1K-1-1/4
R 012	1	06-10621C83	RESISTOR	8.25K-1-1/4
R 013	1	06-10621C99	RESISTOR	12.1K-1-1/4
R 014	1	06-10621B94	RESISTOR	1K-1-1/4
R 015	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 016	1	06-10621C91	RESISTOR	10K-1-1/4
R 017	1	06-10621C91	RESISTOR	10K-1-1/4
R 018	1	06-11009C86	RESISTOR	36K-5-1/4
R 019	1	06-11009C53	RESISTOR	1.5K-5-1/4
R 020	1	18-83452F10	RESISTOR,VARIABLE	1K
R 021	1	06-10621C19	RESISTOR	1.78K-1-1/4
R 022	1	06-10621C91	RESISTOR	10K-1-1/4
R 023	1	06-10621C91	RESISTOR	10K-1-1/4
R 024	1	06-11009C25	RESISTOR	100-5-1/4
R 025	1	06-11009C73	RESISTOR	10K-5-1/4
R 026	1	06-11009C89	RESISTOR	47K-5-1/4
R 027	1	06-11009C89	RESISTOR	47K-5-1/4
R 029	1	06-11009C69	RESISTOR	6.8K-5-1/4
R 030	1	06-11009C65	RESISTOR	4.7K-5-1/4
RT002	1	06-83600K05	THERMISTOR	
U 001	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U 002	1	51-80345A10	INTEGRATED CIRCUIT	LM393N SCREENED

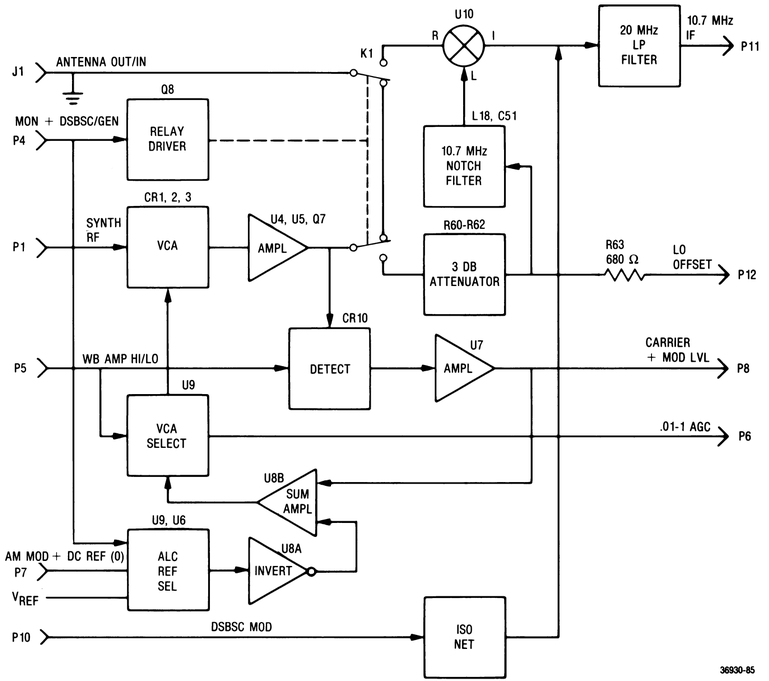
RF WATTMETER BOARD (A17A1)
(RTL-4158A)

Figure 17-6. Printed Wiring Board Assembly and Parts List

WIDEBAND AMPLIFIER BOARD (A17A2)

(RTL-4156A)

Figure 17-7. Block Diagram



WIDEBAND AMPLIFIER BOARD (A17A2)

(RTL-4156A)

Figure 17-8. Schematic

NOTES:

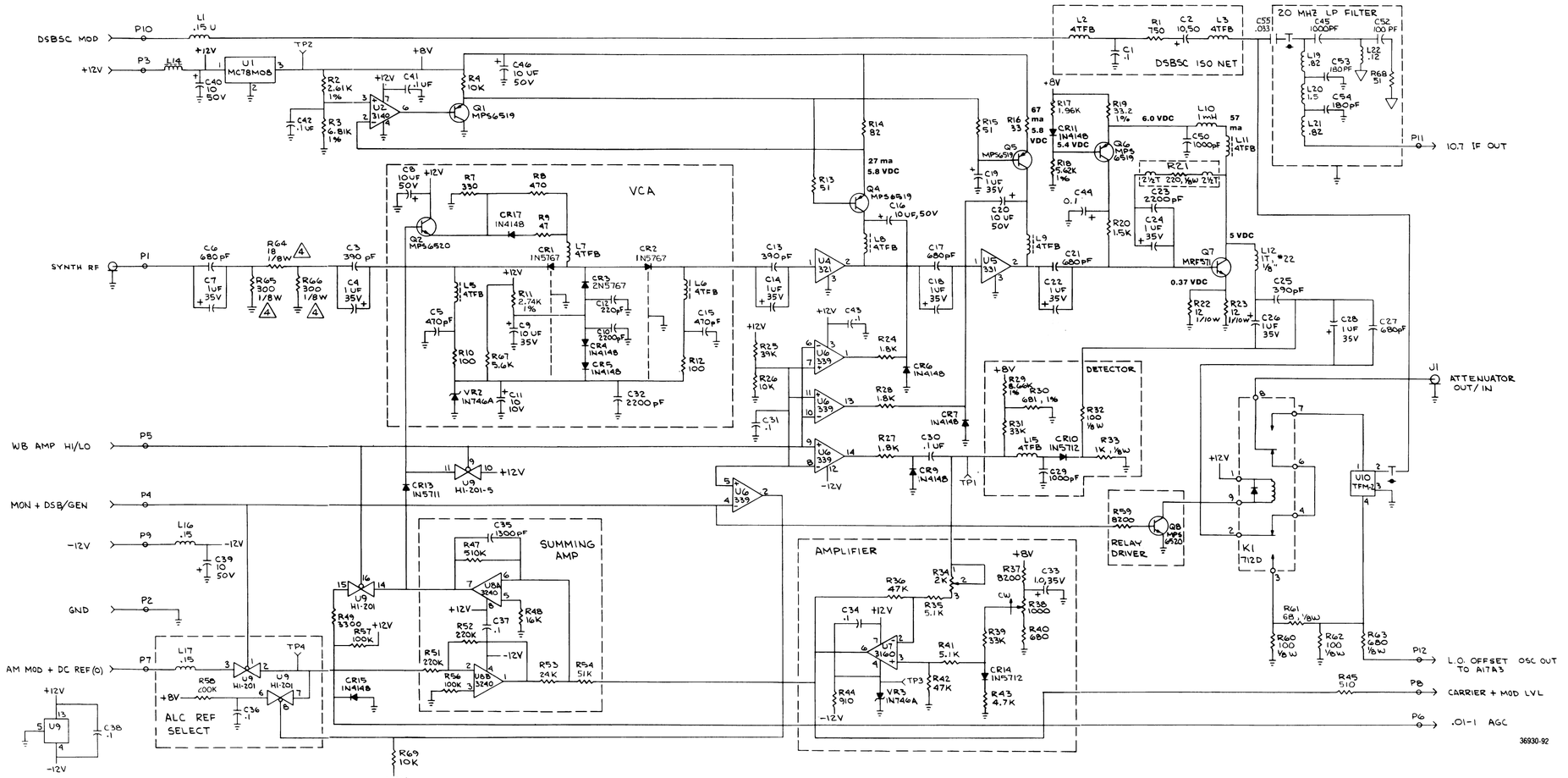
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS PREFIX WITH A7A2.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS ± 5 PCT, 1/4 WATT.
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN UH.
   ALL VOLTAGES ARE IN DC.
3. DEVICE TYPE NUMBER AND CONNECTION NOT SHOWN ON SYMBOL ARE LISTED IN TABLE 1. UNDERLINED PORTION OF TYPE NUMBER IS USED AS A CODE TO IDENTIFY DEVICES ON DIAGRAM.
4. SELECT IN TEST. NOMINAL VALUE SHOWN.
5. FOR REFERENCE DRAWINGS REFER TO:

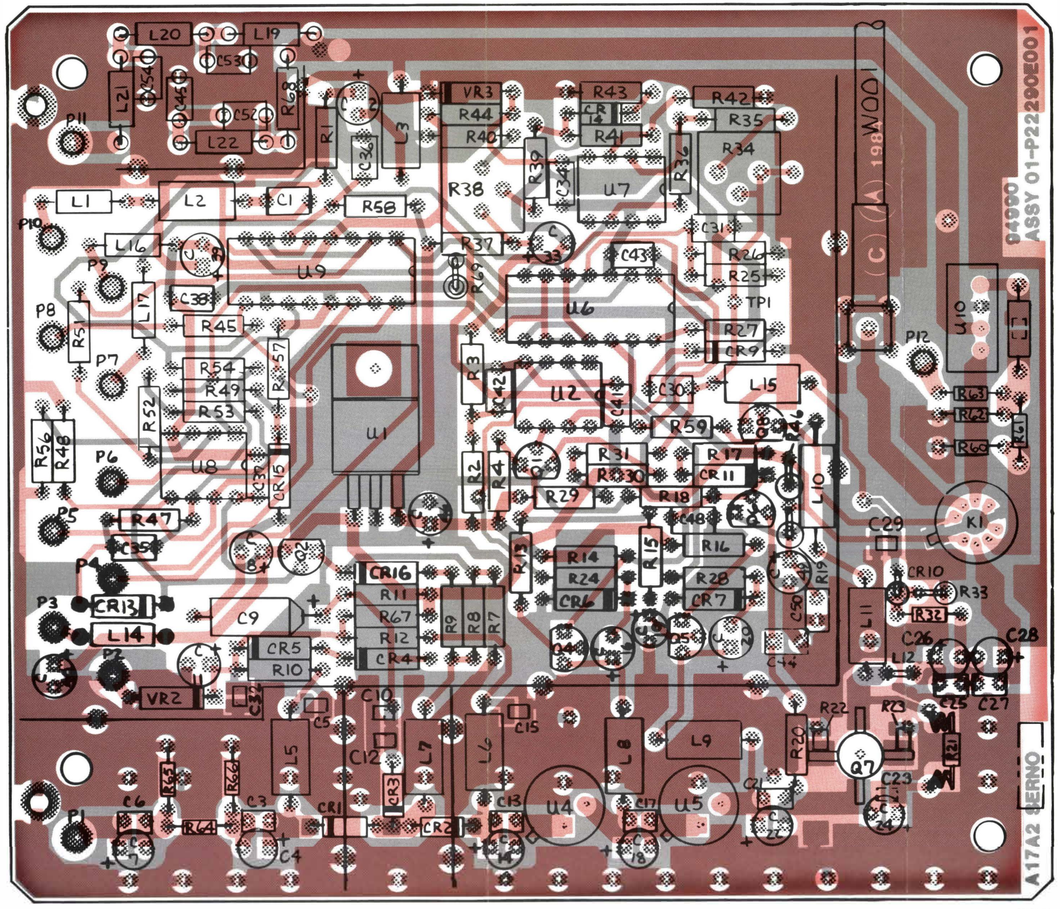
01-P22290E	ASSEMBLY DRAWING
12-P22293E	TEST PROCEDURE

REF DES	DEVICE	GND	+V	-V	NO CONNECT
U1	MC78M08CTDS	2	1		
U2	CA3140E	4	7		1,5,8
U3					
U4	GPD321	3			
U5	GPD321	3			
U6	LM339NDS		3	12	
U7	CA3160E		7		1,5,8
U8	CA3240E		8	4	
U9	HI-201-5	5	10,13	4	12
U10	TFM-2	3			

LAST USED	NOT USED
C54	C47
CR15	CR8,CR12
J1	
K1	
L22	L4,L13
P12	
Q8	Q3
R69	R5,6,50,55
U10	U3
VR3	

WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY





36930-91

COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK.
SOLDER-SIDE TRACK SHOWN IN ORANGE

WIDEBAND AMPLIFIER BOARD (A17A2)
RTL-4156A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
C 001	1	21-80342B10	CAPACITOR	.1UF-20-50
C 002	1	23-80341B15	CAPACITOR	10UF-20-50
C 003	1	21-80339B66	CAPACITOR	390PF-5-100
C 004	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 005	1	21-80342B50	CAPACITOR	470PF-5-50
C 006	1	21-80339B69	CAPACITOR	680PF-10-100
C 007	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 008	1	23-80341B15	CAPACITOR	10UF-20-50
C 009	1	23-80341B03	CAPACITOR	10UF-10-35
C 010	1	21-80370A24	CAPACITOR	2200PF-20-50
C 011	1	23-80341B05	CAPACITOR	10UF-20-10
C 012	1	21-80370A23	CAPACITOR	220PF-20-50
C 013	1	21-80339B66	CAPACITOR	390PF-5-100
C 014	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 015	1	21-80342B50	CAPACITOR	470PF-5-50
C 016	1	23-80341B15	CAPACITOR	10UF-20-50
C 017	1	21-80339B69	CAPACITOR	680PF-10-100
C 018	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 019	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 020	1	23-80341B15	CAPACITOR	10UF-20-50
C 021	1	21-80339B69	CAPACITOR	680PF-10-100
C 022	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 023	1	21-80370A24	CAPACITOR	2200PF-20-50
C 024	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 025	1	21-80339B66	CAPACITOR	390PF-5-100
C 026	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 027	1	21-80339B69	CAPACITOR	680PF-10-100
C 028	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 029	1	21-80370A22	CAPACITOR	1000PF-20-50
C 030	1	21-80342B10	CAPACITOR	.1UF-20-50
C 031	1	21-80342B10	CAPACITOR	.1UF-20-50
C 032	1	21-80370A24	CAPACITOR	2200PF-20-50
C 033	1	23-83441B15	CAPACITOR	1.0UF-20-35
C 034	1	21-80342B10	CAPACITOR	.1UF-20-50
C 035	1	21-80341B52	CAPACITOR	1300PF-5-50
C 036	1	21-80342B10	CAPACITOR	.1UF-20-50
C 037	1	21-80342B10	CAPACITOR	.1UF-20-50
C 038	1	21-80342B10	CAPACITOR	.1UF-20-50
C 039	1	23-80341B15	CAPACITOR	10UF-20-50
C 040	1	23-80341B15	CAPACITOR	10UF-20-50
C 041	1	21-80342B10	CAPACITOR	.1UF-20-50
C 042	1	21-80342B10	CAPACITOR	.1UF-20-50
C 043	1	21-80342B10	CAPACITOR	.1UF-20-50
C 044	1	21-80342B10	CAPACITOR	.1UF-20-50
C 045	1	21-00850118	CAPACITOR	100PF-5-500
C 046	1	23-80341B15	CAPACITOR	10UF-20-50
C 050	1	21-80339B72	CAPACITOR	.001UF-10-200
C 052	1	21-00850118	CAPACITOR	100PF-5-500
C 053	1	21-80341B57	CAPACITOR	180PF-5-50
C 054	1	21-80341B57	CAPACITOR	180PF-5-50
C 055	1	21-80344B37	CAPACITOR, CHIP	.033UF-10-50
CR001	1	48-80342B19	DIODE	
CR002	1	48-80342B19	DIODE	
CR003	1	48-80342B19	DIODE	
CR004	1	48-84463K02	DIODE	
CR005	1	48-84463K02	DIODE	
CR006	1	48-84463K02	DIODE	
CR007	1	48-84463K02	DIODE	
CR009	1	48-84463K02	DIODE	
CR010	1	48-80396A27	DIODE	
CR011	1	48-84463K02	DIODE	
CR013	1	48-87643C01	DIODE	
CR014	1	48-80396A27	DIODE	
CR015	1	48-84463K02	DIODE	
CR016	1	48-84463K02	DIODE	
K 001	1	80-80343B61	RELAY	
L 001	1	24-80369A23	COIL	.15UH
L 002	1	24-83961B01	CHOKE	
L 003	1	24-83961B01	CHOKE	
L 005	1	24-83961B01	CHOKE	
L 006	1	24-83961B01	CHOKE	
L 007	1	24-83961B01	CHOKE	
L 008	1	24-83961B01	CHOKE	
L 009	1	24-83961B01	CHOKE	
L 010	1	24-80369A42	COIL	1000UH
L 011	1	24-83961B01	CHOKE	
L 012	1	24-80342B70	COIL	
L 014	1	25-80342B79	COIL,TOROID	
L 015	1	24-83961B01	CHOKE	
L 016	1	24-80369A23	COIL	.15UH
L 017	1	24-80369A23	COIL	.15UH
L 019	1	24-80340B53	COIL	.82UH

WIDEBAND AMPLIFIER BOARD (A17A2)
(RTL-4156A)

Figure 17-9. Printed Wiring Board Assembly and Parts List

WIDEBAND AMPLIFIER BOARD (A17A2) (Cont)
RTL-4156A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
L 020	1	24-80340B57	COIL	1.5UH
L 021	1	24-80340B53	COIL	.82UH
L 022	1	24-80340B50	COIL	.12UH
P 001	1	09-80344B25	RECEPTACLE	
P 002	1	09-80344B25	RECEPTACLE	
P 003	1	09-80344B25	RECEPTACLE	
P 004	1	09-80344B25	RECEPTACLE	
P 005	1	09-80344B25	RECEPTACLE	
P 006	1	09-80344B25	RECEPTACLE	
P 007	1	09-80344B25	RECEPTACLE	
P 008	1	09-80344B25	RECEPTACLE	
P 009	1	09-80344B25	RECEPTACLE	
P 010	1	09-80344B25	RECEPTACLE	
P 011	1	09-80344B25	RECEPTACLE	
P 012	1	09-80344B25	RECEPTACLE	
Q 001	1	48-80340B85	TRANSISTOR	MPS6519
Q 002	1	48-80340B86	TRANSISTOR	MPS6520
Q 004	1	48-80340B85	TRANSISTOR	MPS6519
Q 005	1	48-80340B85	TRANSISTOR	MPS6519
Q 006	1	48-80340B85	TRANSISTOR	MPS6519
Q 007	1	48-80340B48	TRANSISTOR	
Q 008	1	48-80340B86	TRANSISTOR	MPS6520
R 001	1	06-11009C46	RESISTOR	750-5-1/4
R 002	1	06-10621C35	RESISTOR	2.61K-1-1/4
R 003	1	06-10621C75	RESISTOR	6.81K-1-1/4
R 004	1	06-11009C73	RESISTOR	10K-5-1/4
R 007	1	06-11009C37	RESISTOR	330-5-1/4
R 008	1	06-11009C41	RESISTOR	470-5-1/4
R 009	1	06-11009C17	RESISTOR	47-5-1/4
R 010	1	06-11009C25	RESISTOR	100-5-1/4
R 011	1	06-10621C37	RESISTOR	2.74K-1-1/4
R 012	1	06-11009C25	RESISTOR	100-5-1/4
R 013	1	06-11009C18	RESISTOR	51-5-1/4
R 014	1	06-11009C23	RESISTOR	82-5-1/4
R 015	1	06-11009C18	RESISTOR	51-5-1/4
R 016	1	06-11009C13	RESISTOR	33-5-1/4
R 017	1	06-10621C23	RESISTOR	1.96K-1-1/4
R 018	1	06-10621C67	RESISTOR	5.62K-1-1/4
R 020	1	06-11009C53	RESISTOR	1.5K-5-1/4
R 021	1	06-11041C49	RESISTOR	220-5-1/8
R 022	1	06-80340B14	RESISTOR	12-5-.1
R 023	1	06-80340B14	RESISTOR	12-5-.1
R 024	1	06-11009C55	RESISTOR	1.8K-5-1/4
R 025	1	06-11009C87	RESISTOR	39K-5-1/4
R 026	1	06-11009C73	RESISTOR	10K-5-1/4
R 027	1	06-11009C55	RESISTOR	1.8K-5-1/4
R 028	1	06-11009C55	RESISTOR	1.8K-5-1/4
R 029	1	06-10621C85	RESISTOR	8.66K-1-1/4
R 030	1	06-10621B78	RESISTOR	681-1-1/4
R 031	1	06-11009C85	RESISTOR	33K-5-1/4
R 032	1	06-11041C41	RESISTOR	100-5-1/8
R 033	1	06-11041C65	RESISTOR	1K-5-1/8
R 034	1	18-83452F12	RESISTOR,VARIABLE	5K
R 035	1	06-11009C66	RESISTOR	5.1K-5-1/4
R 036	1	06-11009C89	RESISTOR	47K-5-1/4
R 037	1	06-11009C71	RESISTOR	8.2K-5-1/4
R 038	1	18-83452F10	RESISTOR,VARIABLE	1K
R 039	1	06-11009C85	RESISTOR	33K-5-1/4
R 040	1	06-11009C45	RESISTOR	680-5-1/4
R 041	1	06-11009C66	RESISTOR	5.1K-5-1/4
R 042	1	06-11009C89	RESISTOR	47K-5-1/4
R 043	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 044	1	06-11009C48	RESISTOR	910-5-1/4
R 045	1	06-11009C42	RESISTOR	510-5-1/4
R 046	1	06-10621D42	RESISTOR	33.2-1-1/4
R 047	1	06-11009D15	RESISTOR	510K-5-1/4
R 048	1	06-11009C78	RESISTOR	16K-5-1/4
R 049	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 051	1	06-11009D06	RESISTOR	220K-5-1/4
R 052	1	06-11009D06	RESISTOR	220K-5-1/4
R 053	1	06-11009C82	RESISTOR	24K-5-1/4
R 054	1	06-11009C90	RESISTOR	51K-5-1/4
R 056	1	06-11009C97	RESISTOR	100K-5-1/4
R 057	1	06-11009C97	RESISTOR	100K-5-1/4
R 058	1	06-11009B05	RESISTOR	200K-5-1/4
R 059	1	06-11009C71	RESISTOR	8.2K-5-1/4
R 060	1	06-11041C41	RESISTOR	100-5-1/8
R 061	1	06-11041C37	RESISTOR	68-5-1/8
R 062	1	06-11041C41	RESISTOR	100-5-1/8
R 063	1	06-00185A45	RESISTOR	680-5-1/8
R 064	1	06-11041A23	RESISTOR	18-5-1/8
R 065	1	06-11041C52	RESISTOR	300-5-1/8
R 066	1	06-11041C52	RESISTOR	300-5-1/8

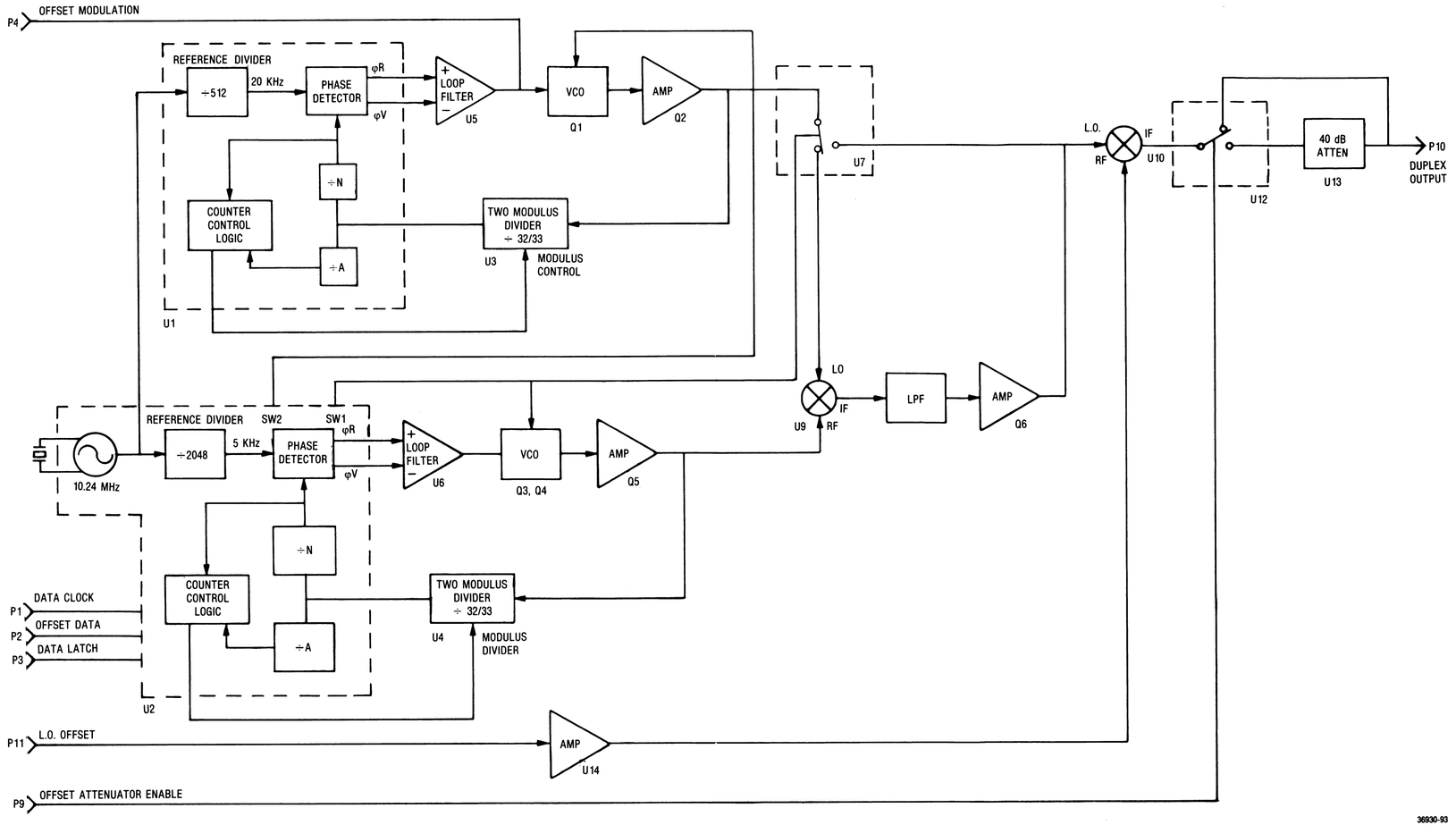
WIDEBAND AMPLIFIER BOARD (A17A2) (Cont)
RTL-4156A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
R 067	1	06-11009C67	RESISTOR	5.6K-5-1/4
R 068	1	06-11009C18	RESISTOR	51-5-1/4
R 069	1	06-11009C73	RESISTOR	10K-5-1/4
U 001	1	51-05292H02	INTEGRATED CIRCUIT	
U 002	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
U 004	1	51-80343B29	INTEGRATED CIRCUIT	SM83-2653
U 005	1	51-80343B28	INTEGRATED CIRCUIT	SM83-2654
U 006	1	51-83629M71	INTEGRATED CIRCUIT	
U 007	1	51-80345A02	INTEGRATED CIRCUIT	CA3160E SCREENED
U 008	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U 009	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U 010	1	51-80346A05	MIXER	
VR002	1	48-83461E03	DIODE,ZENER	3.3V-5-.5
VR003	1	48-83461E03	DIODE,ZENER	3.3V-5-.5
W 001	1	30-80344B16	CABLE ASSEMBLY	30-P22372E001

DUPLEX GENERATOR BOARD (A17A3)

(RTL-4157A)

Figure 17-10. Block Diagram



DUPLEX GENERATOR BOARD (A17A3)

(RTL-4157A)

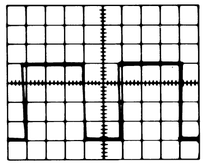
Figure 17-11. Schematic

NOTES:

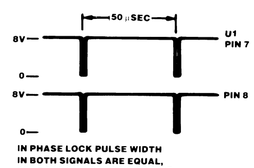
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS PREFIX WITH A17A3.
2. UNLESS OTHERWISE SPECIFIED
   ALL RESISTORS ARE IN OHMS ± 5 PCT, 1/4 WATTS.
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN MH.
   ALL VOLTAGES ARE IN DC.

LAST USED	NOT USED
CR4	C69-72
CR13	
L15	
Q11	
R71	R20
T2	
U14	
VR3	
Y1	

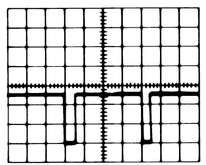
REF DES	DEVICE	GND	+V	-V	NO CONNECT
U1	MC1451152				26,28
U2	MC1451156				6,9,16
U3	MC12015				8
U4	MC12015				8
U5	LM308A				1,5
U6	LM308A				1,5
U7	LJ118DIP-T				6,7
U8	MC78M08				
U9	SBL-1				
U10	TFM-Z				
U11	MC78L05				
U12	G4V-152P				
U13	AT-40				
U14	MWA310				



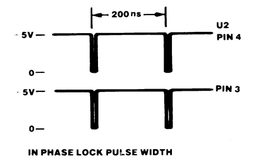
VOLTAGE U1 PIN 9
2V/DIV 10 µSEC/DID



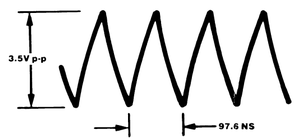
IN PHASE LOCK PULSE WIDTH IN BOTH SIGNALS ARE EQUAL, 100 nSEC OUT OF LOCK. ONE OF THE SIGNALS PULSE WIDTH WILL INCREASE DEPENDING ON PHASE POLARITY.

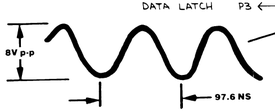


VOLTAGE U2 PIN 8
2V/DIV 50 µSEC/DIV
PULSE WIDTH DEPENDS ON VALUE OF DIVIDERS N AND A.



IN PHASE LOCK PULSE WIDTH IN BOTH SIGNALS ARE EQUAL, 100 nSEC OUT OF LOCK. ONE OF THE SIGNALS PULSE WIDTH WILL INCREASE DEPENDING ON PHASE POLARITY.





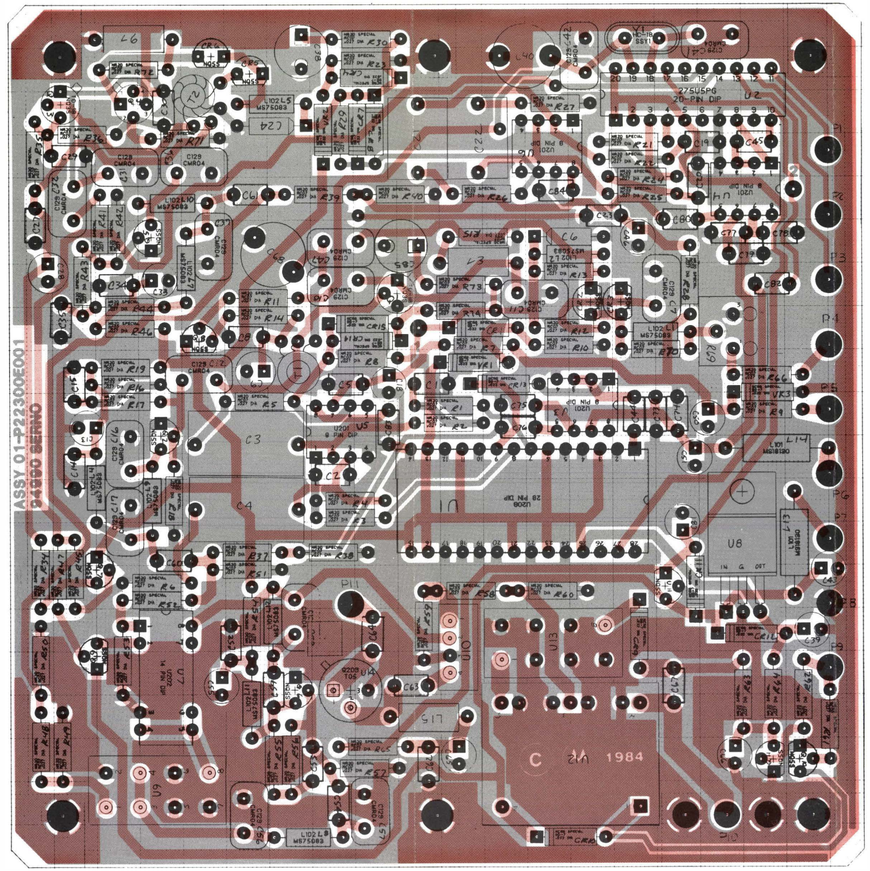
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

36930-95

DUPLEX GENERATOR BOARD (A17A3)

(RTL-4157A)

Figure 17-12. Printed Wiring Board Assembly and Parts List



36930-94

COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER-SIDE TRACK SHOWN IN ORANGE

DUPLEX GENERATOR BOARD (A17A3)
RTL-4157A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
C 001	1	21-80341B94	CAPACITOR	.01UF-10-100
C 002	1	21-80341B94	CAPACITOR	.01UF-10-100
C 003	1	08-80343B16	CAPACITOR	2.2UF-5-100
C 004	1	08-80343B16	CAPACITOR	2.2UF-5-100
C 005	1	21-80341B93	CAPACITOR	1000PF-20-100
C 006	1	23-80344B36	CAPACITOR	1.5UF-10-35
C 007	1	21-80339B21	CAPACITOR	390PF-5-100
C 008	1	21-80341B93	CAPACITOR	1000PF-20-100
C 009	1	23-80341B07	CAPACITOR	100UF-20-10
C 010	1	21 00840811	CAPACITOR	10PF-N470
C 011	1	21 80369A94	CAPACITOR	150PF-5-500
C 012	1	21-80369A85	CAPACITOR	5PF-.5PF-500
C 013	1	23-80341B15	CAPACITOR	10UF-20-50
C 014	1	21-80341B93	CAPACITOR	1000PF-20-100
C 015	1	21-80341B93	CAPACITOR	1000PF-20-100
C 016	1	21-00850118	CAPACITOR	100PF-5-500
C 017	1	21-80339B26	CAPACITOR	220PF-5-500
C 018	1	23-80341B15	CAPACITOR	10UF-20-50
C 019	1	21-80342B07	CAPACITOR	.056UF-10-100
C 020	1	21-80342B07	CAPACITOR	.056UF-10-100
C 021	1	08-80343B13	CAPACITOR	1.0UF-10-100
C 022	1	08-80343B13	CAPACITOR	1.0UF-10-100
C 023	1	21-80341B93	CAPACITOR	1000PF-20-100
C 024	1	23-80340B99	CAPACITOR	.39UF-10-35
C 027	1	21 80341B93	CAPACITOR	1000PF-20-100
C 028	1	23-80341B07	CAPACITOR	100UF-20-10
C 029	1	21-80339B72	CAPACITOR	.001UF-10-200
C 030	1	21-80339B72	CAPACITOR	.001UF-10-200
C 031	1	21 00859S34	CAPACITOR	10PF-.5PF 500
C 032	1	21-80339B26	CAPACITOR	220PF-5-500
C 033	1	21-80341B93	CAPACITOR	1000PF-20-100
C 034	1	23-80341B15	CAPACITOR	10UF-20-50
C 035	1	21-80341B93	CAPACITOR	1000PF-20-100
C 036	1	21-80339B18	CAPACITOR	82PF-5-500
C 037	1	21-80369A94	CAPACITOR	150PF-5-500
C 038	1	23-84665F03	CAPACITOR	100UF-20-25
C 039	1	23-80341B15	CAPACITOR	10UF-20-50
C 040	1	20-80396A57	CAPACITOR	9 TO 35PF-200
C 041	1	21-80339B18	CAPACITOR	82PF-5-500
C 042	1	21-80339B13	CAPACITOR	18PF-5-500
C 043	1	23-80341B15	CAPACITOR	10UF-20-50
C 044	1	21-80341B93	CAPACITOR	1000PF-20-100
C 045	1	21-80341B93	CAPACITOR	1000PF-20-100
C 046	1	23-80341B15	CAPACITOR	10UF-20-50
C 047	1	21-80339B11	CAPACITOR	7PF-.5PF-500
C 050	1	23-80341B15	CAPACITOR	10UF-20-50
C 051	1	23-80341B15	CAPACITOR	10UF-20-50
C 052	1	21-80341B93	CAPACITOR	1000PF-20-100
C 053	1	21-80342B09	CAPACITOR	.01UF-20-50
C 054	1	21-80342B09	CAPACITOR	.01UF-20-50
C 055	1	23-80341B15	CAPACITOR	10UF-20-50
C 056	1	21 80339B26	CAPACITOR	220PF-5-500
C 057	1	21-80339B26	CAPACITOR	220PF-5-500
C 058	1	21-80339B26	CAPACITOR	220PF-5-500
C 059	1	21-80342B09	CAPACITOR	.01UF-20-50
C 060	1	21-80342B09	CAPACITOR	.01UF-20-50
C 061	1	21-80342B09	CAPACITOR	.01UF-20-50
C 062	1	21 80341B93	CAPACITOR	1000PF-20-100
C 063	1	21-80339B72	CAPACITOR	.001UF-10-200
C 064	1	21-80339B72	CAPACITOR	.001UF-10-200
C 065	1	23-80341B15	CAPACITOR	10UF-20-50
C 066	1	23-80341B15	CAPACITOR	10UF-20-50
C 067	1	21-80339B72	CAPACITOR	.001UF-10-200
C 068	1	20-80343B36	CAPACITOR, VARIABLE	2.5 TO 11PF
C 073	1	21-80342B10	CAPACITOR	.1UF-20-50
C 074	1	21-80341B93	CAPACITOR	1000PF-20-100
C 075	1	21-80341B93	CAPACITOR	1000PF-20-100
C 076	1	21-80341B93	CAPACITOR	1000PF-20-100
C 077	1	21-80342B10	CAPACITOR	.1UF-20-50
C 078	1	21-80341B93	CAPACITOR	1000PF-20-100
C 079	1	21-80341B93	CAPACITOR	1000PF-20-100
C 080	1	21-80341B93	CAPACITOR	1000PF-20-100
C 081	1	23-80341B15	CAPACITOR	10UF-20-50
C 082	1	21-80341B93	CAPACITOR	1000PF-20-100
C 083	1	21-80341B93	CAPACITOR	1000PF-20-100
C 084	1	21-80341B93	CAPACITOR	1000PF-20-100
C 085	1	23-84665F03	CAPACITOR	100UF-20-25
CR001	1	48-84463K02	DIODE	
CR 002	1	48-80340B60	VARACTOR	
CR 003	1	48-80340B60	VARACTOR	
CR004	1	48-84463K02	DIODE	
CR 005	1	48-80340B60	VARACTOR	
CR006	1	48-80340B60	VARACTOR	

DUPLEX GENERATOR BOARD (A17A3) (Cont)

RTL-4157A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
CR007	1	48-84463K02	DIODE	
CR008	1	48-84463K02	DIODE	
CR009	1	48-80339B87	DIODE	
CR010	1	48-84463K02	DIODE	
CR011	1	48-82466H13	DIODE	
CR012	1	48-82466H13	DIODE	
CR013	1	48-87643C01	DIODE	
CR014	1	48-84463K02	DIODE	
CR015	1	48-84463K02	DIODE	
L 001	1	24-80369A31	COIL	22UH
L 002	1	24-80369A31	COIL	22UH
L 003	1	24-83961B01	CHOKE	
L 004	1	24-80340B52	COIL	.39UH
L 005	1	24-80369A29	COIL	10UH
L 006	1	24-83961B01	CHOKE	
L 007	1	24-80340B51	COIL	.27UH
L 008	1	24-80369A22	COIL	1UH
L 009	1	24-80369A26	COIL	.33UH
L 010	1	24-80369A25	COIL	.22UH
L 011	1	24-80369A31	COIL	22UH
L 012	1	24-80369A19	COIL	.1UH
L 013	1	24-80369A37	COIL	100UH
L 014	1	24-80369A38	COIL	220UH
L 015	1	24-83961B01	CHOKE	
P 001	1	09-80344B25	RECEPTACLE	
P 002	1	09-80344B25	RECEPTACLE	
P 003	1	09-80344B25	RECEPTACLE	
P 004	1	09-80344B25	RECEPTACLE	
P 005	1	09-80344B25	RECEPTACLE	
P 006	1	09-80344B25	RECEPTACLE	
P 007	1	09-80344B25	RECEPTACLE	
P 008	1	09-80344B25	RECEPTACLE	
P 009	1	09-80344B25	RECEPTACLE	
P 010	1	09-80344B25	RECEPTACLE	
P 011	1	09-80344B25	RECEPTACLE	
Q 001	1	48-00869933	TRANSISTOR	J-FET
Q 002	1	48-80340B86	TRANSISTOR	MPS6520
Q 003	1	48-00869933	TRANSISTOR	J-FET
Q 004	1	48-00869776	TRANSISTOR	
Q 005	1	48-80340B86	TRANSISTOR	MPS6520
Q 006	1	48-80340B86	TRANSISTOR	MPS6520
Q 007	1	48-80340B47	TRANSISTOR	
Q 008	1	48-80340B47	TRANSISTOR	
Q 009	1	48-00869849	TRANSISTOR	
Q 010	1	48-80340B45	TRANSISTOR	
Q 011	1	48-80340B86	TRANSISTOR	MPS6520
R 001	1	06-10621D70	RESISTOR	64.9K-1-1/4
R 002	1	06-10621D70	RESISTOR	64.9K-1-1/4
R 003	1	06-10621D70	RESISTOR	64.9K-1-1/4
R 004	1	06-10621D70	RESISTOR	64.9K-1-1/4
R 005	1	06-10621D88	RESISTOR	100K-1-1/4
R 006	1	06-10621D88	RESISTOR	100K-1-1/4
R 007	1	06-11009C49	RESISTOR	1K-5-1/4
R 008	1	06-10621D84	RESISTOR	90.9K-1-1/4
R 009	1	06-11009C60	RESISTOR	3K-5-1/4
R 010	1	06-11009C97	RESISTOR	100K-5-1/4
R 011	1	06-11009C80	RESISTOR	20K-5-1/4
R 012	1	06-11009C53	RESISTOR	1.5K-5-1/4
R 013	1	06-11009C80	RESISTOR	20K-5-1/4
R 014	1	06-11009C25	RESISTOR	100-5-1/4
R 015	1	06-11009C25	RESISTOR	100-5-1/4
R 016	1	06-11009C66	RESISTOR	5.1K-5-1/4
R 017	1	06-11009C73	RESISTOR	10K-5-1/4
R 018	1	06-11009C64	RESISTOR	4.3K-5-1/4
R 019	1	06-11009C33	RESISTOR	220-5-1/4
R 021	1	06-10621C99	RESISTOR	12.1K-1-1/4
R 022	1	06-10621C99	RESISTOR	12.1K-1-1/4
R 023	1	06-11009C97	RESISTOR	100K-5-1/4
R 024	1	06-10621C99	RESISTOR	12.1K-1-1/4
R 025	1	06-10621C99	RESISTOR	12.1K-1-1/4
R 026	1	06-10621D56	RESISTOR	46.4K-1-1/4
R 027	1	06-10621D56	RESISTOR	46.4K-1-1/4
R 028	1	06-11009C49	RESISTOR	1K-5-1/4
R 029	1	06-10621D84	RESISTOR	90.9K-1-1/4
R 030	1	06-10621C71	RESISTOR	6.19K-1-1/4
R 034	1	06-11009C29	RESISTOR	150-5-1/4
R 035	1	06-11009C63	RESISTOR	3.9K-5-1/4
R 036	1	06-11009C39	RESISTORS	390-5-1/4
R 037	1	06-11009C40	RESISTOR	430-5-1/4
R 038	1	06-11009C49	RESISTOR	1K-5-1/4
R 039	1	06-11009C40	RESISTOR	430-5-1/4
R 040	1	06-11009C49	RESISTOR	1K-5-1/4
R 041	1	06-11009C03	RESISTOR	12-5-1/4
R 042	1	06-11009C64	RESISTOR	4.3K-5-1/4
R 043	1	06-11009C73	RESISTOR	10K-5-1/4
R 044	1	06-11009C66	RESISTOR	5.1K-5-1/4
R 045	1	06-11009C80	RESISTOR	20K-5-1/4
R 046	1	06-11009C33	RESISTOR	220-5-1/4
R 047	1	06-11009C96	RESISTOR	91K-5-1/4
R 048	1	06-11009C18	RESISTOR	51-5-1/4
R 049	1	06-11009C26	RESISTOR	110-5-1/4
R 050	1	06-11009C26	RESISTOR	110-5-1/4
R 051	1	06-11009C40	RESISTOR	430-5-1/4
R 052	1	06-11009C03	RESISTOR	12-5-1/4
R 053	1	06-11009C40	RESISTOR	430-5-1/4
R 054	1	06-11009C34	RESISTOR	240-5-1/4
R 055	1	06-11009C34	RESISTOR	240-5-1/4
R 056	1	06-11009C58	RESISTOR	2.4K-5-1/4
R 057	1	06-11009C49	RESISTOR	1K-5-1/4
R 058	1	06-11009C07	RESISTOR	18-5-1/4
R 059	1	06-11009C36	RESISTOR	300-5-1/4
R 060	1	06-11009C36	RESISTOR	300-5-1/4
R 061	1	06-11009C91	RESISTOR	56K-5-1/4
R 062	1	06-11009C95	RESISTOR	82K-5-1/4
R 063	1	06-00124A11	RESISTOR	2K-5-1/4
R 064	1	06-11009C56	RESISTOR	2K-5-1/4
R 065	1	06-11009C37	RESISTOR	330-5-1/4
R 066	1	06-11009C66	RESISTOR	5.1K-5-1/4
R 069	1	18-83452F10	RESISTOR, VARIABLE	1K
R 070	1	06-11009C80	RESISTOR	20K-5-1/4
R 071	1	06-11009C49	RESISTOR	1K-5-1/4
R 072	1	06-11009C15	RESISTOR	39-5-1/4
R 073	1	06-10621C71	RESISTOR	6.19K-1-1/4
R 074	1	06-11009C80	RESISTOR	20K-5-1/4
T 001	1	25-80342B74	TRANSFORMER	
T 002	1	25-80342B82	TRANSFORMER	
U 001	1	51-80340B19	INTEGRATED CIRCUIT	
U 002	1	51-83625M62	INTEGRATED CIRCUIT	
U 003	1	51-80340B16	INTEGRATED CIRCUIT	
U 004	1	51-80340B16	INTEGRATED CIRCUIT	
U 005	1	51-80365A27	INTEGRATED CIRCUIT	
U 006	1	51-80365A27	INTEGRATED CIRCUIT	
U 007	1	80-80341B25	RELAY	
U 008	1	51-05292H02	INTEGRATED CIRCUIT	
U 009	1	01-80340B75	MIXER	
U 010	1	51-80346A05	MIXER	DOUBLE BALANCED
U 011	1	51-05469E01	INTEGRATED CIRCUIT	
U 012	1	80-80339B85	RELAY	
U 013	1	01-80339B01	ATTNEUATOR	40DB
U 014	1	51-80340B63	INTEGRATED CIRCUIT	
VR001	1	48-82256C51	DIODE, ZENER	5.1V-5-.5
VR002	1	48-82256C51	DIODE, ZENER	5.1V-5-.5
VR003	1	48-83461E18	DIODE, ZENER	18V-10-.5
Y 001	1	48-80343B32	CRYSTAL	10.24 MHZ