APPENDIX MANUAL

FOR THE

WJ-8615 SERIES VHF/UHF RECEIVER

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878-1794

February 1990

WJ-8615 Receiver Option Configurations

Option	WJ-8615	WJ-8615(S1)	WJ-8615D	WJ-8615(S1)	WJ-8615P	WJ-8615TC
EM	S	S	S	S	X	
FE	S	S	S	S	S	
FSLO	S	NS	S	S	NS	
FEX-16	NS	S	NS	S	S	
WBO	S	S	S	S	S	
PRE	S	S	S	S	S	
SAO	S	S	S	S	S	
SSL	S	S	S	S	X	
FEX-12	S	S	S	S	S	
HFE	NS	NS	NS	NS	S	
BWS	3X/2S	3X/2S	3X/2S	3X/2S	3X/2S	3X/2S

NOTES:

X = STANDARD
S = SUPPORTED
NS = NOT SUPPORTED
3X/2S = 3 STANDARD, 2 ADDITIONAL OPTIONAL

* AN EXTERNAL FE,
WJ-9077 IS SUPPORTED

WJ-8615 SERIES OPTIONS

STANDARDIZATION

As of February 15, 1990 the following options are assigned the respective appendix letter, the associated title, and the corresponding header for use in all future publications.

Option Desig.	Appendix Desig.	Header Desig.	Option Title
EM	A	WJ-8615/EM OPTION	WJ-8615/EM EXTENDED MEMORY OPTION
FE	B	WJ-8615/FE OPTION	WJ-8615/FE FREQUENCY EXTENDER OPTION
FSLO	C	WJ-8615/FSLO OPTION	WJ-8615/FSLO FAST SECOND LO OPTION
FEX-16	D	WJ-8615/FEX-16 OPTION	WJ-8615/FEX-16 FREQUENCY EXTENDER OPTION
WBO	E	WJ-8615/WBO OPTION	WJ-8615/WBO WIDEBAND OUTPUT OPTION
PRE	F	WJ-8615/PRE OPTION	WJ-8615/PRE TRACKING PRESELECTOR OPTION
SAO	G	WJ-8615/ SAO OPTION	WJ-8615/SAO SELECTED AUDIO OUTPUT OPTION
SSL	H	WJ-8615/SSL OPTION	WJ-8615/SSL STEP/SCAN/LOCKOUT OPTION
FEX-12	I	WJ-8615/FEX-12 OPTION	WJ-8615/FEX-12 FREQUENCY EXTENDER OPTION
HFE	J	WJ-8615/HFE OPTION	WJ-8615/HFE HIGH FREQUENCY EXTENDER OPTION
BWS	K	WJ-8615/BWS OPTION	WJ-8615/BWS IF BANDWIDTH FILTER AND VIDEO FILTER SETS

WJ-8615 RECEIVER

APPENDIX A

EXTENDED MEMORY OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
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April 1988

WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

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WJ-8615/EM UHF/VHF RECEIVER OPTION

A.1 GENERAL

The Extended Memory (EM) option provides the WJ-8615 Receiver with additional memory. Extended Memory increases the previously available memory by 8K bytes. This additional memory allows for 150 additional memory storage channels and 300 lockouts. Partitioning of memory is software fixed at 150. This prevents the partition command mnemonic (PAR) from having any effect on the software memory partitioning. The response to the partition query (PAR?) is always 150.

Microprocessor A1A3, Type 796495-X contains three 28 pin sockets. These sockets are designed to accept several different memory devices. Jumperwires JW1-JW7 are positioned as described in **Table A-2** on the Microprocessor schematic (**Figure A-1**) to accept the different memory devices.

The number of jumperwires used varies, depending on the printed circuit (PC) board revision level. The revision level is silkscreened onto the PC board. The following list indicates the PC board revision level and the jumperwires installed.

Revision Level	Jumperwires
A	JW1-JW5
B	JW1-JW6
C	JW1-JFW7

NOTE

Refer to the printed circuit board Revision level to determine which version of the Microprocessor is installed in the receiver.

The standard 796495-X Microprocessor is jumperwired to accept 16K EPROMs in the U7 and U9 sockets. The U11 socket is jumperwired to accept an 8K RAM. Configuring the jumperwires as listed in **Table A-2,** on the Microprocessor schematic, allows the Real Time Clock (RTC) option to be installed in the U7 socket.

The operation of the Step/Scan/Lockout option (SSL) requires the additional memory space provided by the EM option. **Table A-1** lists the microprocessor memory address mapping.

A.2 CIRCUIT DESCRIPTION

A.2.1 TYPE 796495-X MICROPROCESSOR (A1A3)

The reference designation for the Microprocessor subassembly is A1A3. Refer to **Figure A-1** for the Type 796495-X Microprocessor schematic diagram.

Table A-1. Microprocessor Memory Mapping

Address	Function
0000-07FF	RAM U11 2K (6264) lower 2K of RAM
0800-17FF	Not Used 4K
1800-1FFF	I/O U15 2K divided into 4 I/O ports
2000-27FF	Not Used 2K
2800-3FFF	RAM U11 6K (6264) Upper 6K of RAM
4000-5FFF	Not Used 8K
6000-7FFF	Not Used 8K
8000-BFFF	EPROM U7 16K (27128)
C000-FFFF	EPROM U9 16K (27128)

The Microprocessor subassembly contains: the software operating program in EPROMs U7 and U9, temporary storage in RAM U11 and microprocessor U5. These devices are used to control the receiver operation. The Microprocessor subassembly is designed to allow a variety of different memory devices to be installed in the sockets of U7, U9, and U11. This allows for expansion and flexibility of the memory devices used in the different sockets. Thus the Microprocessor module can be configured to accept different devices in the same socket location via only changing the jumperwire. The device type numbers and the jumperwire configurations required to support the various devices are listed on the schematic diagram in **Table A-2.**

The crystal oscillator circuit, composed of capacitors C1 and C2 and the 4.9152 MHz crystal (Y1), is used to provide the microprocessor's internal clock frequency. The external oscillator frequency is divided by 4, providing the microprocessor with an internal clock frequency of 1.2288 MHz. This internal clock frequency is used to control timing functions and determines the rate at which instructions are performed.

The power fail circuit, composed of diodes CR1 through CR5, zener diode VR1, resistors R2 and R6 through R12, capacitors C3, C4, C5, and C14 through C16, transistors Q1 and Q2, and NAND gates U20A and U20B, provides a time delay allowing the supply voltage to settle before the microprocessor is enabled. It also provides a power detection, allowing the microprocessor to be turned off before power failure occurs. The RC time constant established by R2 and C3 provides an additional time delay, keeping the microprocessor circuit turned off until the +5 V supply line stabilizes. At power up, microprocessor operation does not begin until the supply voltage is at least +4.8 Vdc. At power down, microprocessor operation halts when the dc level is +4.7 V or less.

The power fail circuit samples the +5 V supply voltage. The sampled +5 V is applied through zener diode VR1 and variable resistor R8 to pin 2 of NAND gate U20A. R8 is adjusted to provide the power up condition at a level of +4.8 Vdc. When the supply voltage reaches +4.8 Vdc, the output of U20A (pin 3) is Low. The Low causes C16 to slowly discharge through R7, causing the output of U20B (pin 6) to go High. The discharge time of C16 through R7 is the time delay allowing the supply voltage to settle before the microprocessor is enabled. The output from U20B is applied directly to NAND gates U20C and U20D, to pin 5 of connector P2 and through R11 to the base of transistor Q1. The output of U20B is also applied through R10 as positive feedback to the input of NAND gate U20A, creating approximately 100 mV hysteresis on power up and power down. Applying a High to the base of transistor Q1 turns it on, which then turns on

Q2. These two transistors act as a switch, selecting either the +5 V supply line or the battery. When transistors Q1 and Q2 conduct, CR4 is reverse biased, keeping the battery (BT1) out of the circuit.

NOTE

BT1 is a primary lithium cell, which under normal operating conditions is expected to last 10 years. When the microprocessor board is removed, the battery is disconnected. DO NOT place this assembly on a metallic surface.

When the +5 V line falls below +4.7 Vdc, the output of U20A is High. This High forward biases CR2 and quickly charges C16 to +5 Vdc. With C16 completely charged, the output of NAND gate U20B goes Low. The Low at the output of U20B (pin 6) is directed to pin 5 of connector P2, to NAND gates U20C and U20D, through R10 to pin 2 of U20A and through R11 to the base of transistor Q1. Applying a Low to the base of Q1 turns it off and also turns off Q2. With both transistors turned off, the back-up battery (BT1) applies +2.8 Vdc from pin 14 to pin 10 of connector P2 and also to pins 1 and 4 of JW2 and to pins 26 and 28 of the RAM (U11). The back-up battery allows the information stored in RAM to be saved, allowing the receiver operating parameters to be maintained when power has been turned off.

When the PFAIL line goes Low, capacitor C3 discharges quickly through diode CR1 and the microprocessor RESET line (pin 37) is held Low. A Low on the RESET line causes the microprocessor to be held in a known quiescent state, keeping it from responding to any address or data information on the buses. When the RESET line returns High, the microprocessor resumes operation.

Integrated circuit U5 is a type MC68B09 microprocessor. The microprocessor controls the receiver operations, updating, changing and maintaining the operating parameters. The microprocessor controls the order in which internal operations are performed. Receiver data is transferred via the data and address buses. The bus lines, and other microprocessor lines are pulled High via pull-up resistors U3, U4, U6, U8, U10, U14 and U16. These pull-up resistors pull the associated line High when the line is not used.

Microprocessor communication is performed via the 16-bit, unidirectional address bus (A0-A15) and the 8-bit, bidirectional data bus (D0-D7). The address bus allows a selected device to be activated for control. Address information is valid on the rising edge of the Q clock. The data bus is used to transmit information to and from the selected device(s).

On U5, pin 2 Non-Maskable Interrupt (NMI), pin 36 Memory Ready (MRDY), pin 33 Bus Request (BREQ) and pin 40 Halt (HALT) are not used (under normal operating conditions) and are pulled High by pull-up resistor U4. The Non-Maskable Interrupt is utilized to start the signature analysis program, when pulled Low. The Fast Interrupt Request (FIRQ), pin 4, and the Interrupt Request (IRQ), pin 3, are also pulled High by U4. These two lines are held High, unless pulled Low by an interrupt request. FIRQ and IRQ provide an interrupt to halt the microprocessor main routine. Between these two interrupts, FIRQ has the higher priority.

Enable (E) and Quadrature (Q) clock outputs, pins 34 and 35 respectively, provide the Microprocessor subassembly timing reference. The frequency of both clocks is 1.2288 MHz. The quadrature clock leads the enable clock by a phase shift of approximately 90°. The leading edge of the enable pulse (E) indicates to the memory and peripheral devices that the data is stable and the write operation may begin. The leading edge of the quadrature clock (Q) indicates the address data is valid.

The quadrature clock (Q) is applied to OR gates U17C and U17A. U17C provides a buffered quadrature clock at pin 6 of connector P1. The enable clock (E) is applied to HEX Inverter U18E and to OR gates U17A and U17D. U18E inverts the enable clock and applies the output to pin 6 of connector P2 and to OR gate U17B. The other input to OR gate U17B is the read/write output from the microprocessor. The output from U17B is connected to pin 7 of connector P2, to write enable (WE) of U11 and to jumperwires JW2, JW3 and JW5.

E and Q clock outputs from U17A are inverted by U18B and applied to the enable input (pin 15) of PROM decoder U1. A Low at the enable input allows address data from the microprocessor to be decoded and applied to the peripheral devices.

Pull-up resistors U8 and U10 hold the address bus lines High, when the lines are not active. The microprocessor address bus interconnects the memory devices (U9, U7, and U11), the PROM address decoder (U1), the I/O decoder (U15), and the bus drivers (U12 ad U13) to the other receiver modules.

Input address lines A11-A15, from the microprocessor, are used to enable the output lines of decoder U1. Decoder U1 is used to select the device with which the microprocessor is to interact. A Low output from U1 allows the selected device to be enabled. With the device enabled, address or data information can be transferred. The following list indicates the address decoder (U1) output, and the device enabled.

Output	Device Addressed
00	EPROM U9
01	Not Used
02	RAM or EPROM U7
03	RAM U11
04	I/O Decoder U15A, Buffers U12, U13 and U19
05	Decoder U15B (SPARE)
06	P1 Pin 22 (SPARE)
07	P1 Pin 24 (SPARE)

Buffers U12 and U13 are used with the address bus lines (A0-A15). Buffer U9 is used with the data bus lines (D0-D7).

Output address enables, O2 and O3, from U1 are inverted through U18C and U18D, respectively before being applied to the input of NAND gates U20C and U20D. The other input to these NAND gates is from the PFAIL line. When the PFAIL line is Low, NAND gate U20C disables RAM U7 and NAND gate U20D disables RAM U11. When the PFAIL line is High and the O2 and O3 outputs from U1 are Low, RAMs U7 and U11 are enabled. With the RAM enabled, data can be entered in memory or removed from memory.

Decoder/demultiplexer U15 further decodes the address output from U1 (O4 and O5) by dividing the address data into four equal segments (I/O 1 to 4 and SP ADDR DEC 1 to 4). Demultiplexed address outputs from U15A are sent to other receiver modules connected to the address bus. This allows the microprocessor to address other devices in the receiver which are connected to the address bus. Using the address outputs from U15A, the microprocessor can read from or write to the other devices on the address bus. Outputs from U15B are spare address lines for future expansion.

Address information, at the input of line buffer/drivers U12 and U13, is coupled to the output when the enable line (pin 1 for U12A and U13A and pin 19 for U12B and U13B) is Low. When enabled, the buffer/driver places address information onto the address bus for the other modules in the receiver. The address bus output lines are pulled High by pull-up resistors U14 and U16 when they are not active.

The microprocessor data bus lines (D0-D7) are bidirectional, allowing data to be sent (written onto) or received (read from) using the same lines. The microprocessor read/write line (pin 32) determines whether the data is written onto or read from the bus. When the read/write line is High, the microprocessor reads data from the data bus. When the read/write line is Low, the microprocessor writes data onto the data bus. When the data bus lines are not active, pull-up resistor U6 pulls the data bus lines High.

Data bus outputs from the microprocessor (U5) are coupled through U2 to the memory devices (U7, U9, U11) and to the bus transceiver (U19). U2 allows for signature analysis of the Microprocessor module. Removing U2 allows access to the data bus and provides the means of testing the operation of the data bus and the microprocessor. Refer to **Section IV** in the WJ-8615 Instruction Manual for the signature analysis test procedures.

The read/write line also logic level controls the direction of data flow through bus transceiver U19. When the enable line (pin 19) and the read/write line (pin 1) are Low, data is transferred from the B data ports to the A data ports. Allowing the microprocessor to output data to other receiver modules. When the enable line is Low and the read/write line is High, data is transferred from the A data ports to the B data ports, allowing the microprocessor to receive data from other devices on the bus.

A.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address	Mfr. Code	Name and Address
00681	Catalyst Research Corporation 1421 Clarkview Road Baltimore, MD 21209	4W715	Linear Technology 1630 McCarthy Boulevard Milpitas, CA 95035
14674	Corning Glass Works Houghton Park Corning, NY 14830	51642	Centre Engineering 2820 East College Avenue State College, PA 16801

Mfr. Code	Name and Address	Mfr. Code	Name and Address
17217	Gore WL and Associates 555 Paper Mill Road P.O. Box 9206 Newark, DE 19711	62786	Hitachi America Ltd. 1800 Bering Drive San Jose, CA 95122

A.4 REPLACEMENT PARTS LIST

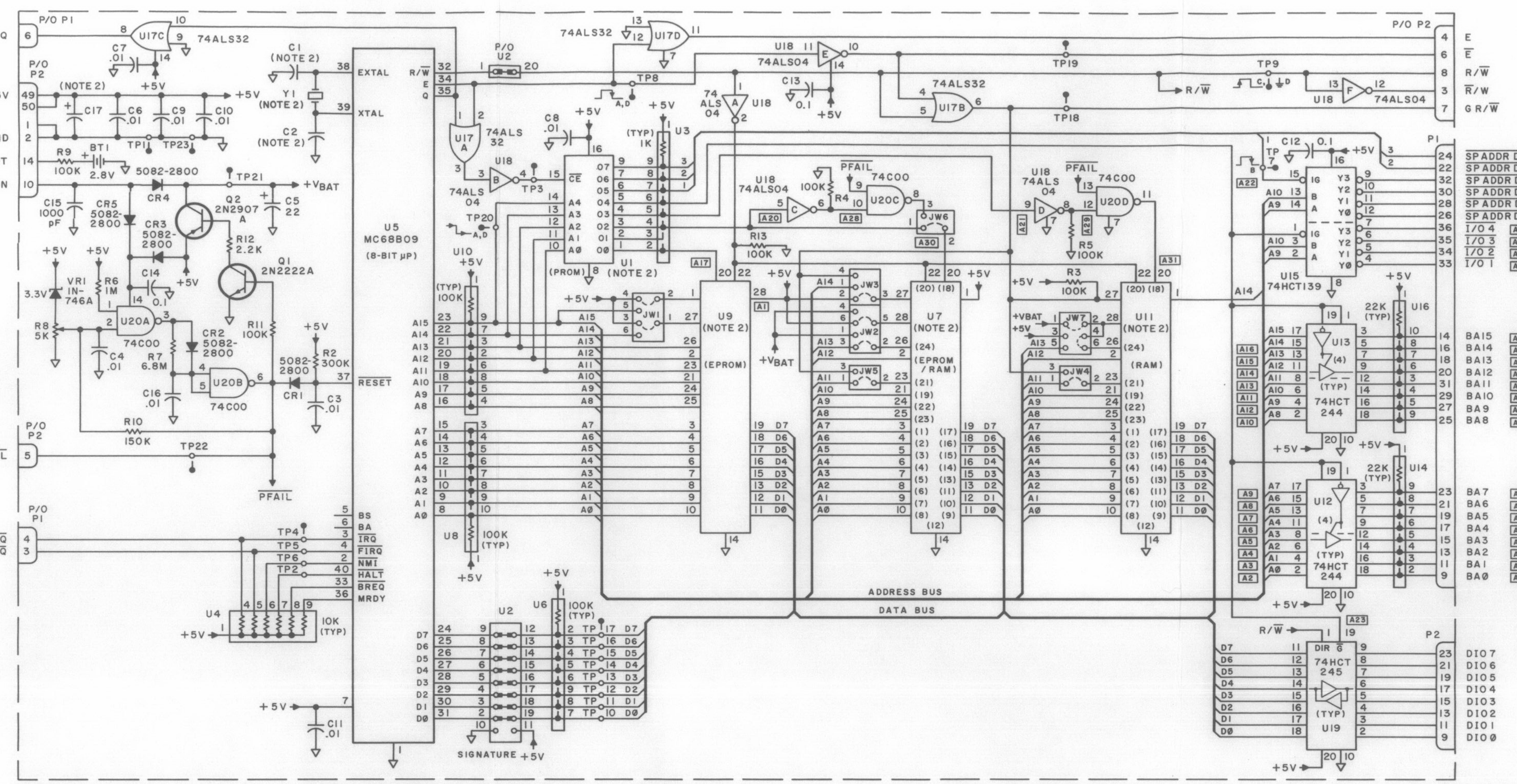
A.4.1 TYPE 796495-1, MICROPROCESSOR

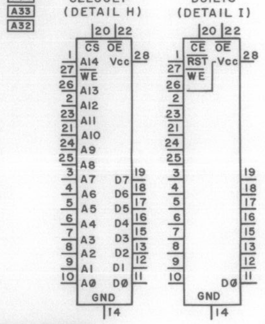
REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
BT1	Battery, Lithium Iodine Cell	1	1935	00681	
C1	Capacitor, Ceramic, Monolithic: 27 pF, ±2%, 100 V	2	150-100-NPO-270G	51642	
C2	Same as C1				
C3	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	9	34453-1	14632	
C4	Same as C3				
C5	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	2	196D226X010JE3	56289	
C6 Thru C11	Same as C3				
C12	Capacitor, Ceramic, Disc: .1 µF, 20%, 50 V	3	34475-1	14632	
C13	Same as C12				
C14	Same as C12				
C15	Capacitor, Ceramic, Monolithic: 1000 pF, ±2%, 100 V	1	150-100-NPO-102G	51642	
C16	Same as C3				
C17	Same as C5				
CR1	Diode	5	5082-2800	28480	
CR2 Thru CR5	Same as CR1				
P1	Receptacle Assembly	1	66527-018	22526	
P2	Receptacle Assembly	1	66527-025	22526	
Q1	Transistor	1	2N2222A	80131	
Q2	Transister	1	2N2907A	80131	
P1	Not Used				
R2	Resistor, Fixed, Film: 300 kΩ, 5%, 1/8 W	1	CF1/8-300K/J	09021	
R3	Resistor, Fixed, Film: 100 kΩ, 5%, 1/8 W	6	CF1/8-100K/J	09021	
R4	Same as R3				
R5	Same as R3				
R6	Resistor, Fixed, Film: 1.0 MΩ, 5%, 1/8 W	1	CF/8-1M/J	09021	
R7	Resistor, Fixed, Composition: 6.8 MΩ, 5%, 1/8 W	1	RCR05G685JS	81349	
R8	Resistor, Trimmer, Film: 5 kΩ, 10%, 1/2 W	1	62PAR5K	73138	
R9	Same as R3				
R10	Resistor, Fixed, Film: 150 kΩ, 5%, 1/8 W	1	CF1/8-150K/J	09021	
R11	Same as R3				
R12	Resistor, Fixed, Film: 2.2 kΩ, 5%, 1/8 W	1	CF1/8-2.2K/J	09021	
R13	Same as R3				
U1	See Table A-2 Parts List for Value				
U2	Programmed Shunt (DIP)	1	180246-1	14632	
U3	Resistor, Network: 1 kΩ, 2%	1	765-1-R1K	73138	
U4	Resistor, Network: 10 kΩ, 2%	1	765-1-R10K	73138	
U5	Integrated Circuit, Microprocessor	1	MC68B09P	04713	
U6	Resistor, Network: 100 kΩ, 2%	3	765-1-R100K	73138	

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
U7	See Table A-2 Parts List for value				
U8	Same as U6				
U9	See Table A-2 Parts List for value				
U10	Same as U6				
U11	See Table A-2 Parts List for value				
U12	Integrated Circuit, Buffer	2	MM74HCT244N	27014	
U13	Same as U12				
U14	Resistor, Network: 22 kΩ, 2%,	2	765-1-R22K	73138	
U15	Integrated Circuit, Decoder	1	MM74HCT139N	27014	
U16	Same as U14				
U17	Integrated Circuit	1	SN74ALS32N	01295	
U18	Integrated Circuit	1	SN74ALS04N	01295	
U19	Integrated Circuit	1	MM74HCT245N	27014	
U20	Integrated Circuit	1	MM74C00N	27014	
VR1	Diode, Zener: 3.3 V	1	1N746A	80131	
Y1	Crystal, Quartz: 4.91520 MHz	1	MP042	75378	

Table A-2. Integrated Circuit Parts List

Type	U1	U7	U9	U11
796495-1	Programmed Dip 841168 14632	IC/EPROM HN4827128G-25 62786	IC/EPROM HN4827128G-25 62786	IC/RAM HM6264LP-12 62786
796495-2	Programmed Dip 841190 14632	IC/EPROM HN4827128G-25 62786	IC/EPROM HN4827128G-25 62786	IC/RAM HM6264LP-12 62786
796495-3	Programmed Dip 841191 14632	IC/EPROM HN4827128G-25 62786	IC/EPROM HN4827128G-25 62786	IC/CMOS HM6116LP-4 62786
796495-4	Programmed Dip 841192 14632	IC/EPROM HN27C64G-20 62786	IC/EPROM HN27C64G-20 62786	IC/CMOS HM6116LP-4 62786
796495-5	Programmed Dip 841206 14632	IC/EPROM HN4827128G-25 62786	IC/EPROM HN4827128G-25 62786	IC/RAM HM6264LP-12 62786
796495-6	Programmed Dip 841225 14632	IC DS1216	IC/EPROM 27C256 34649	IC/RAM HM6264LP-12 62786
796495-7	Programmed Dip 841226 14632	IC/EPROM 27C256 34649	IC/EPROM 27C256 34649	IC/RAM HM6264LP-12 62786





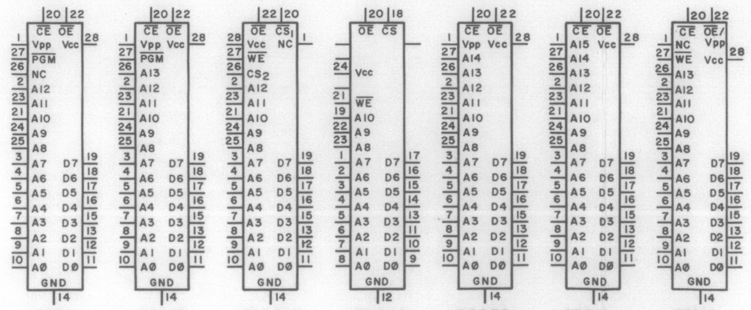


TABLE A

TYPE		U1	U7 (DETAIL)	U9 (DETAIL)	U11 (DETAIL)	JW1	JW2	JW3	JW4	JW5	JW6	JW7	Y1	C17	I/O BASE ADDRESS	C1,C2
796495-1	EM/SSL	841168	27128 (B)	27128 (B)	6264LP (C)	1-3 2-4	2-3 5-6	2-3	1-2	1-2	1-2	1-2 4-6	4.9152 MHz	22	1800	22pF
796495-2	SSL	841190	27128 (B)	27128 (B)	6264LP (C)	1-3 2-4	2-3 5-6	2-3	1-2	1-2	1-2	1-2 4-6	4.9152 MHz	22	1800	22pF
796495-3	STD-(NEW)	841191	27128 (B)	27128 (B)	6116LP (D)	1-3 2-4	2-3 5-6	2-3	2-3	1-2	1-2	1-2 4-6	4.9152 MHz	22	1800	22pF
796495-4	STD-(OLD)	841192	2764 (A)	2764 (A)	6116LP (D)	1-3 2-4	2-3 5-6	2-3	2-3	1-2	1-2	1-2 4-6	4.9152 MHz	22	1800	22pF
796495-5	(SI) STD	841206	27128 (B)	27128 (B)	6264LP (C)	1-3 2-4	2-3 5-6	2-3	1-2	1-2	1-2	1-2 4-6	4.9152 MHz	22	1800	22pF
796495-6	LOG/RTC	841225	DS1216 (I)	27256 (E)	6264LP (C)	1-6 2-4	— 5-6	3-4	1-2	1-2	1-2	1-2 4-6	4.9152 MHz	22	1800	22pF
796495-7	TC	841226	27C256(E)	27C256(E)	6264LP (C)	1-6 2-4	2-3 5-6	1-3	1-2	1-2	1-2	1-2 4-6	4.9152 MHz	220	1800	22pF
796495-8	STD	841247	27128 (B)	27128 (B)	6264LP (C)	1-3 2-4	2-3 5-6	2-3	1-2	1-2	1-2	1-2 4-6	8.0 MHz	22	—	18pF
796495-9	WJ-8942/CU	841249	27C513(G)	27C512 (F)	6264LP(C)	1-6 2-5	2-3 5-6	3-4	1-2	1-2	1-2	1-2 4-6	4.9152 MHz	22	0000	22pF
796495-10	P-1	841302	MK48T12B(D)	27C512 (F)	6264LP(C)	1-6 2-5	2-6	N/U	1-2	2-3	1-2	1-2 4-6	4.9152 MHz	22	0000	22pF
796495-11	P	841302	MK48T12B-15 (D)	27C512-20(F)	6264LP(C)	1-6 2-5	2-6	N/U	1-2	2-3	1-2	1-2 4-6	8.0MHz	22	0000	18pF

NOTES: 1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
b) CAPACITANCE IS IN μF.
2. DIFFERENCE BETWEEN TYPES (U1, U7, U9, U11, Y1, C17, C2, C1) ARE LISTED IN TABLE A.

Figure A-1. Type 796495-1, Microprocessor (A1A3), Schematic Diagram 580472 (G)

WJ-8615 RECEIVER

APPENDIX B

FREQUENCY EXTENDER OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878

April 1988

WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

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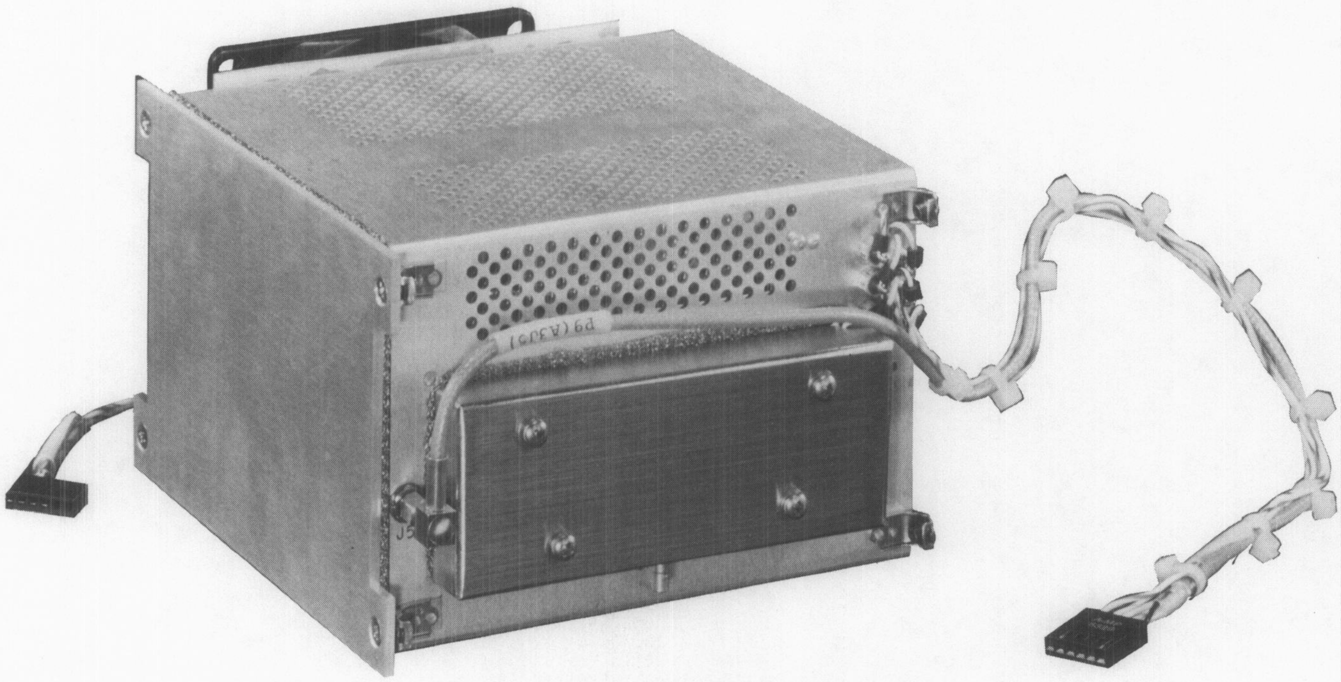


Figure B-1. WJ-8615 Frequency Extender

APPENDIX B

WJ-8615 FREQUENCY EXTENDER OPTION

B.1 GENERAL DESCRIPTION

This 500-1100 MHz Frequency Extender (FE) is composed of the UHF Preselector (A3A1A1) Type 796414-1, the UHF Preamplifier Mixer (A3A1A2) Type 796415-1, the UHF LO Synthesizer (A3A1A3) Type 798079-2 and the RF Switch (A3A2) Type 280899-1. All of these subassemblies install in the Motherboard Assembly (A3A1). These subassemblies provide an extension of the receiver tuning range from 500 MHz up to 1100 MHz. When the receiver is tuned to frequencies within the extended frequency range (500-1100 MHz) the received signal is mixed with one of four fixed LO frequencies. The difference frequency (the result of down conversion) is within the VHF tuning range of the receiver. The receiver is tuned to the difference frequency.

B.1.1 LIST OF PARTS SUPPLIED

The following items are included as part of the Frequency Extender Type 796456-1.

Item	Ref. Designation	Type	Qty.
A3	FE Option	796456-1	1
A3A1	Motherboard	380762-1	1
A3A1A1	UHF Preselector	796414-1	1
A3A1A2	UHF Preamp/Mixer	796415-1	1
A3A1A3	UHF LO Synthesizer	798079-2	1
A3A1A3A1	UHF Var. Divider	390421-1	1
A3A2	RF Switch	280899-1	1

These items are included with the Frequency Extender. Replacement parts for these subassemblies are listed in paragraph 1.7.

B.2 INSTALLATION

Installation of the Frequency Extender option can be performed by following the procedure below.

CAUTION

When installing the Frequency Extender (FE) Option, special precautions should be taken to prevent the possibility of damaging the UHF Preselector and UHF Preamp/Mixer subassemblies. Two different versions of the FE Option exist. Subassemblies from one version MUST NOT be mixed with the other version. Use only Type 794111-1 UHF Preselector (A3A1A1) with Type 798075-1 UHF Preamp/Mixer (A3A1A2) or Type 796414-1 UHF Preselector (A3A1A1) with Type 796415-1 Preamp/Mixer (A3A1A2). Interchanging the different version types could result in physical damage to the subassemblies.

Installation Procedure:

1) Remove the screws securing the rear panel and extend the rear panel.

2) Remove the fan, its mounting bracket and mount the fan onto the fan bracket supplied with the Frequency Extender (FE).

3) Remove the middle support bracket. Carefully move the cables near the bracket to allow its removal.

4) Install the supplied support bracket and put the spacer for Aux. Connector J13 behind the connector.

5) Unlace the cable bundle, on the bottom of the unit. Remove the cable to J6 and replace it with the supplied connector cable.

6) Unlace the cable to A1A14J1. Install the fan and FE subassembly. To secure the end plate to the FE subassembly put the screws through the side of the unit far enough to hold the plate in place. Then align the screw holes in the subassembly and secure with the remaining screws.

7) Connect P1 to J1 and P7 to J7. Existing cabling may have to be carefully moved. Connect A1A14 to the FE subassembly and connect the FE output cable to A1A14.

8) Relace the wire bundles and reconnect the rear panel to the unit.

B.3 CIRCUIT DESCRIPTION

B.3.1 FUNCTIONAL DESCRIPTION

With the FE Option installed, the 20-500 MHz output from the RF Switch (A3A2) is applied to a VHF/UHF select switch in the Type 796415-1 UHF Preamplifier/Mixer (A3A1A2), and the 500-1100 MHz RF Switch output is applied to the input of the UHF Preselector (A3A1A1) Type 796414-1. Refer to **Figure B-15** for the WJ-8615 Frequency Extender Main Chassis schematic diagram.

When the receiver is tuned to frequencies above 500 MHz, the incoming signals are applied from the 500-1100 MHz output of the RF Switch to the input of the UHF Preselector (A3A1A1). The UHF Preselector divides the 500 to 1100 MHz RF frequency range into 4 bands (500 to 599, 600 to 699, 700 to 899 and 900-1100 MHz). Switching between bands is accomplished via the PIN diode switching network, which applies the signal through the selected bandpass filter, determined by the tuned frequency of the receiver. The control signals from the UHF LO Synthesizer (A3A1A3) provide bias current to the PIN diode switching network to accomplish switching between the preselector bands as the UHF LO Synthesizer is tuned.

From the UHF Preselector, the RF signal is applied to the UHF Preamplifier/Mixer (A3A1A2), where the signal is amplified and mixed with the LO signal provided by the UHF LO Synthesizer (A3A1A3) producing an output frequency within the VHF frequency range. A voltage controlled attenuator (U2) within UHF Preamplifier/Mixer provides automatic gain control (AGC) for this subassembly. U2 receives a dc bias voltage from the AGC circuitry of the receiver which varies with respect to the strength of the received signal, thus controlling the overall gain of the FE Option. The amount of attenuation introduced by U2 varies directly with the strength of the tuned signal providing a relatively constant signal to the mixer (U3). From the mixer, the down converted signal is applied to the receiver via the UHF/VHF select switch in the output circuitry of the UHF Preamplifier/Mixer.

When the receiver is tuned to 500 MHz or less, the UHF/VHF switch, at the output of the UHF Preamplifier, switches to provide a signal path from the 20-500 MHz RF Switch output to the VHF section of the receiver. At this time, the output from the UHF section is cut off.

B.3.2 DETAILED CIRCUIT DESCRIPTION

B.3.2.1 Type 280899-1 Switch Assembly (A3A2)

The reference designation for this subassembly is A3A2. Refer to **Figure B-14** for the Type 280899-1 RF Switch schematic diagram.

RF Switch (A3A2) Type 280899-1 receives input RF signals from the Antenna Input (J1). Received RF signals are capacitive coupled through C7 and C9 to the two filter branches. One branch, consisting of L6 and L7, C10 through C15 and their associated components, forms the VHF (500-1100 MHz) bandpass filter. Filter branch selection is accomplished via voltages from the Motherboard (A3A1) applied to E1 and E2 of the RF Switch Assembly. When the receiver tuned frequencies are from 20 to 500 MHz a +15 Vdc is applied to E1 of the RF switch. At the same time a -10 Vdc is applied to E2. Applying a +15 Vdc to E1, of the RF Switch (A3A2), forward biases CR3 and allows the received RF signal to flow through the VHF filter branch and to J2 of the UHF Preamplifier/Mixer (A3A1A2). While the +15 Vdc is applied to E1 a -10 Vdc is applied to E2. This -10 Vdc reverse biases CR4 and prohibits signal flow through the UHF bandpass filter branch. Tuning the receiver to frequencies from 500-1100 MHz causes the voltages applied to E1 and E2 to be reversed. The -10 Vdc on E1 inhibits the flow of signals through the VHF branch by reverse biasing CR3. The +15 Vdc applied to E2 forward biases CR4 and permits UHF signals to be passed through the UHF bandpass filter branch.

B.3.2.2 Type 796414-1 UHF Preselector (A3A1A1)

The reference designation for this subassembly is A3A1A1. Refer to **Figure B-11** for the Type 796414-1 UHF Preselector schematic diagram.

The Type 796414-1 UHF Preselector (A3A1A1) provides the first stage of RF preselection for the 500-1100 MHz UHF signals. This subassembly utilizes three bandpass filters (FL1 through FL3) dividing the UHF spectrum into three bands: 500-700, 700-900 and 900-1100 MHz. Each bandpass filter is essentially flat over its specified frequency and passes these frequencies with minimum attenuation (0.5 dB). Frequencies out of the filter bandpass are attenuated, thus improving image frequency and IF rejection. The RF signal enters the UHF preselector via P1 of cable W1 and is coupled by C1 to the PIN diode switching network comprised of CR1 through CR14. This switching network applies the signal of interest through the appropriate bandpass filter, according to the tuned frequency of the receiver. From the filter, the RF signal is coupled through C12 to the output (P2 of W2).

Switching of the RF signal through the proper filter is controlled by the Band A*, B* and C* and select inputs. Dependent upon the tuned frequency, the Band A*, B*, or C* select is placed at -10 Vdc providing a current-sink through its respective series input and output PIN diodes. When conducting, the diodes provide a minimum impedance path for the RF signal through the filter within the selected branch. The remaining select inputs are held at +15 Vdc which provides a current source for the shunt diodes in their switch branch. The series diodes in these branches are cut off, thus blocking the RF signal path. The select inputs required to activate each filter branch are illustrated in the UHF Preselector Bandpass Selection Table (Table B-1). Each of the select inputs are provided by the Digital Control Section, automatically selecting the proper filter for the frequency tuned.

Table B-1. UHF Preselector Bandpass Selection Table

Select UHF/VHF	C*	B*	A*	Active Filter	Bandpass (MHz)
0	1	1	1	---	---
1	1	1	0	FL1	500 - 700
1	1	0	1	FL2	700 - 900
1	0	1	1	FL3	900 - 1100

0 = -10 Vdc
1 = +5 Vdc

Inductors L1 through L8, ferrite beads FB1 through FB12, resistors R1 through R13 and capacitors C2 through C11 and C13 through C18 function as decoupling components. These components prevent RF signals from exiting the UHF Preselector via the select inputs of the subassembly.

B.3.2.3 Type 796415-1 UHF Preamplifier/Mixer (A3A1A2)

The reference designation for this subassembly is A3A1A2. Refer to **Figure B-12** for the Type 796415-1 UHF Preamplifier/Mixer schematic diagram.

The RF signal from the Type 796414-1 UHF Preselector (A3A1A1) enters the UHF Preamplifier/Mixer (A3A1A2) via RF input connector J1 and is applied to the input of preamplifier U1. U1, a broadband amplifier, provides +15.5 dB of gain to the RF signal increasing the signal to a sufficient level to drive the mixer. Decoupling of the +15 Vdc input to U1 (pin 1) is accomplished by L3 and C5. The output of U1 (pin 4) is then applied to PIN diode attenuator U2 via FL1. FL1 is a 1100 MHz low-pass filter, installed in the signal path to attenuate frequencies above 1100 MHz, thus reducing image noise from U1. Voltage controlled attenuator U2, presents a constant impedance at the output of FL1 and provides a means of limiting the signal level to the mixer under strong signal conditions. The amount of attenuation presented by U2 is dependent on the AGC voltage provided by the AGC circuitry of the receiver applied to terminal 49 of the UHF Preamplifier/Mixer subassembly. This voltage varies from +10 Vdc, when weak signals are present to +2 Vdc under strong signal conditions. The attenuation presented by U2 varies between -20 dB, with an AGC voltage of +2 Vdc, to -1.75 dB, with an AGC voltage of +10 Vdc. Operating bias is supplied by +15 Vdc applied to pin 1 via the decoupling network comprised of L4 and C6. Control is supplied by the AGC voltage applied to pin 5. L9, C16 and C17 provide decoupling of the AGC input line.

Double balanced mixer U3 receives the RF signal from U2 and mixes it with an LO signal provided by the UHF LO Synthesizer (A3A1A3) providing a difference frequency within the VHF range. The UHF LO Synthesizer applies one of four different fixed frequencies to the mixer to divide the UHF frequency range into four frequency bands as illustrated in the UHF Tuning Table (Table B-2). The Digital Control Section then tunes the VHF section of the receiver to the mixer output frequency, thus permitting the signal of interest to be further processed. The mixer output from pin 1 of U3 is coupled across dc blocking capacitor C22 and is then applied through a low-pass filter comprised of L10, C26 and C27. This filter suppresses high order harmonics of the UHF LO preventing their radiation from the VHF input (J2). From the low-pass filter, the RF signal is applied to the UHF branch of the UHF/VHF switch.

Table B-2. UHF Tuning Table

RF Tuned Frequency (MHz)	LO Frequency (MHz)	Mixer Output Frequency (MHz)
500 - 599	848	348 - 249
600 - 699	944	344 - 245
700 - 899	1144	444 - 245
900 - 1100	1344	444 - 244

The UHF/VHF switch, comprised of CR3 through CR6, selects the converted UHF signal from the UHF mixer or the VHF signal from the RF Switch (A3A2), entering at J2. Switching is controlled by the UHF/VHF input (terminal 53) provided by the Digital Control Section. This switching input is at a logic "1" (+5 Vdc) when the receiver is tuned to 500 MHz or above and at a logic "0" (0 Vdc) when tuned below 500 MHz. The UHF/VHF select signal from terminal 53 is applied, via R11, to the inverting input of switch driver U8B and also to the U8A non-inverting input. These switch drivers switch between +15 Vdc and -10 Vdc providing bias current for the PIN diodes in the UHF/VHF switch. With a tuned frequency of 500 MHz or higher, the +5 Vdc level causes the output of U8A to switch to +15 Vdc. This provides a current source for CR4, causing it to conduct and provides a current path for the converted UHF signal to the output of the subassembly (J4). At this time the output of U8B is at -10 Vdc, providing a current-sink for CR6. This causes CR6 to conduct and series diode CR5 to be cut off, preventing the VHF signal from passing through the switch. With tuned frequencies below 500 MHz, the outputs of U8A and U8B are reversed, causing a signal path for the VHF signal through CR5 and blocking the UHF path by cutting off CR4. The voltage divider formed by R5 and R3 provides a switching reference level of approximately 1.5 Vdc.

Integrated circuits U6 and U7 function as switch drivers for the band select circuitry of the UHF Preselector (A3A1A1). These switch drivers receive the UHF/VHF and the 2^0 and 2^1 UHF select inputs from the Digital Control Section and decode these inputs to select the proper preselector filter as the UHF LO Synthesizer is tuned. The UHF select inputs are applied to the A, B and C inputs of decoder U4, which in turn provides a logic "1" level to the inverting input of appropriate switch driver (U7B, U6A or U6B). The UHF/VHF input is also applied directly to the non-inverting input of U7A causing the output of U7A to be held at +5 Vdc, whenever UHF is selected by the UHF/VHF select input. The remaining drivers switch according to the logic levels provided at the 2^0 and 2^1 UHF select inputs.

When the receiver is tuned between 500 and 599 MHz, 2^0 and 2^1 are both at a logic "0", causing the Q4 output of U4 to be placed at a logic "1." This level is applied at pin 6 of U6B, via CR2, causing the A* select output to be switched to -15 Vdc. At frequencies of from 500 to 699 MHz, 2^0 is at logic "1" and 2^1 is at logic "0." This condition causes the Q5 output of U4 to be placed at a logic "1" level. This level is applied at pin 6 of U6B, via CR1, causing the A* select output to be switched to -15 Vdc. At tuned frequencies of from 700 to 899 MHz, 2^0 is at a logic "0" and 2^1 is at a logic "1", causing the Q6 output of U4 to be placed at a logic "1." The Q6 output level is applied to the inverting input of U6A, causing the B* output to be switched to -15 Vdc. When frequencies between 900 and 1100 MHz are tuned, both the 2^0 and 2^1 select inputs are at a logic "1" state. This causes the Q7 output of U4 to be placed at a logic "1" state. The Q7 output is applied to the inverting input of U7B, causing the C* output to be switched to -15 Vdc.

The LO signal provided by the UHF LO Synthesizer is applied to the mixer (U3) via J3 and buffer amplifier U5. U5 receives the LO signal at a level of -3 dBm and provides amplification of +10 dB increasing the signal to a sufficient level to drive mixer U3. L5 and C7 function as decoupling components maintaining a signal ground potential on the +9 Vdc source.

B.3.2.4 Type 798079-2 UHF LO Synthesizer (A3A1A3)

The reference designation for this subassembly is A3A1A3. Refer to **Figure B-13** for the Type 798079-2 UHF LO Synthesizer schematic diagram.

This subassembly consists of the UHF Variable Divider (A3A1A3A1) and the UHF VCO (A3A1A3U1), which together comprise the phase locked loop of the UHF LO Synthesizer. The inputs consists of the 1 MHz reference, (provided by the Synthesizer Section at J2) the UHF and UHF SEL (2^1, 2^0) select inputs provided by the Digital Control Section. The output provided consists of a fixed LO frequency of 848, 944, 1144 or 1344 MHz at J1 of the 848-1344 MHz Oscillator (U1).

B.3.2.5 Part 390421-1 HF Variable Divider (A3A1A3A1)

The reference designation for this part is A3A1A3A1. Refer to **Figure B-13** for the Part 390421-1 schematic diagram.

The Part 390421-1 UHF Variable Divider (A3A1A3A1) provides the tuning control for the 848-1344 MHz Oscillator, (U1). This subassembly decodes the UHF, 2^0 and 2^1 select lines, provided by the Digital Control Section, and utilizes the decoded data to select the oscillator frequency band and to preset the divide-by-n counters in the phase-locked-loop circuitry.

Control inputs to the Part 390421-1 UHF Variable Divider consist of the UHF 2^0 and 2^1 select input, provided at terminals E1, E2 and E3. The UHF input line, which is set to a logic "1" whenever the receiver is tuned above 500 MHz, is applied to the G input of U8 and to the cathode of CR1 enabling the Variable Divider circuitry. The 2^0 and 2^1 inputs are applied to the A and B inputs of U8 and to gates A and B of U9. U8 and U9 then decode the select inputs selecting the oscillator frequency band and presetting binary counters U7 and U6. Comparator U5 monitors the output lines of U8 and compares the logic level at each line with a +2.5 Vdc reference, provided by the voltage divider formed by R1 and R2. Each comparator in U5 provides +15 Vdc to the appropriate band select input of oscillator U1 when its respective input (from U8) goes low, causing the desired oscillator band to be selected. The remaining outputs of U5 are held at -15 Vdc, due to the logic "1" at their inverting inputs.

A sample of the output frequency of A3A1A3U1 enters the Variable Divider at E9 and is applied to the input of amplifier U4 via the pad formed by R9, R10 and R11. U4 amplifies the oscillator frequency and applies the signal to the input of U3, via C12. Integrated circuits U3 and U2 provide divide factors of 4 and 2, respectively, providing a total prescaling factor of 8. The prescaled output is then applied to the input of a two modulus counter which further divides the signal by a factor of 10 or 11, as determine by the CRY output of counter U6. When the CRY output is at a logic "0," U1 divides by 11 and when the output is at a logic "1," U1 divides by 10. The output of U1 is then applied as a TTL clock to counters U7 and U6.

Presetable binary counters U7 and U6 function with the two modulus counter U1 providing division factors of 106, 118, 143 or 168. U7 and U6 are preset by the decoded outputs of U8 and U9 and count up from the preset until the maximum count is reached. When the maximum count is reached, a pulse is provided to the phase detector U10 and the CRY output of U7 reloads the counters, restarting the count sequence. U7 determines the total number of counts in each count sequence and U6 determines the number of times U1 divides by 11 or 10.

For example, when a LO frequency of 848 MHz is selected, U7 is preset to "6" and U6 is preset to "9." The total count sequence continues until U7 counts up from "6" to its maximum of "15" and then resets (10 counts). Simultaneous with the count of U7, U6 counts up from its preset of "9" to its maximum of "15" (6 counts). When U6 reaches "15" the CRY output is set to 1 and U6 counting halts until the preset is reloaded. During the first 6 counts (while U6 is counting) U1 divides by a factor of 11. For the remaining 4 counts (until U7 reaches its maximum count) U1 divides by a factor of 10. The total count sequence provides a divide factor of 106 (11x6) + (10x4) . This, combined with the division factor of 8 by the prescaler, divides the oscillator output frequency by a factor of 848.

The output of U7 is applied to the phase detector (U10), where the divided signal is compared with the 1 MHz reference signal, provided by the Synthesizer Section of the receiver. The phase detector compares the frequency and phase of the two signals and generates an output representing the difference between the signals. This output is integrated by the loop filter, comprised of Q1, Q2 and associated components, to produce a tuning voltage which retunes the oscillator until the divided signal and the reference signal are equal in both frequency and phase. R18 and C22 determine the bandwidth of the loop filter, and C21 and R19 permit bandwidth adjustment.

B.4 ALIGNMENT

Alignment of the Frequency Extender Option may be performed via the procedure that follows:

1. Using an RF analyzer, connect the RF analyzer reflection test port to the Antenna Input (J1) and the RF analyzer's transmission RF input to J3 of the RF Switch (A3A2). Tune the WJ-8615 to 600 MHz.

2. Observe the displayed response on the RF analyzer. Adjust the analyzer to display a 500 MHz response centered at 450 MHz.

3. Adjust L7 to notch out the frequency at 228 MHz and L6 to notch out the frequency at 337 MHz. (Coil adjustment is accomplished via compressing or spreading the coil turns.)

4. Verify that the roll off from 450 MHz to 350 MHz is a minimum of 30 dB and that the ripple from 200 MHz to 340 MHz is at least 30 dB below the level at 450 MHz.

5. Verify the insertion loss is not greater than 1.5 dB and that the bandpass ripple is not more than 1.75 dB overall.

6. With the RF analyzer transmission RF input connected to A3A2J2, connect the reflection test port to the Antenna Input (J1), tune the WJ-8615 to 400 MHz and observe the displayed response.

7. Adjust L8 and L9 to produce minimum insertion loss and maximum flatness (less than 0.5 dB loss from 400 MHz to 550 MHz).

B.5 PERFORMANCE TEST

After the Frequency Extender Option has been installed, verify proper operation of the frequency extender via the following procedure.

1. Connect a signal generator to the Antenna Input (J1) with a CW output at -20 dBm. Connect a spectrum analyzer to J4 of the Frequency Extender.

2. Tune the signal generator and the receiver to 500 MHz. Set the spectrum analyzer center frequency to 348 MHz. Note the output level displayed on the spectrum analyzer.

3. Tune the receiver and signal generator to the following frequencies and monitor the output frequency and level on the spectrum analyzer. Verify the frequency accuracy (]1 kHz) and the output level gain (+3 to +6 dB gain), compared to the level noted in step 2.

Tuned Frequency	S.A. Frequency
599 MHz	249 MHz
600 MHz	344 MHz
699 MHz	245 MHz
700 MHz	444 MHz
899 MHz	245 MHz
900 MHz	444 MHz
1100 MHz	244 MHz

B.6 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00779	Amp, Inc. P.O. Box 3608 Harrisburg, PA 17105
01295	Texas Instruments, Inc. Semiconductor-Components Div. 13500 North Central Expressway Dallas, TX 75231
02114	Ferroxcube Corp. P.O. Box 359 Mount Marion Road Saugerties, NY 12477
02735	RCA Corporation Solid State Division Route 202 Somerville, NJ 08876
05397	Union Carbide Corp. 11901 Madison Avenue Cleveland, OH 44101
07263	Fairchild Camera & Instr. Corp. Semiconductor Division 464 Ellis Street Mt. View, CA 94040
09021	Airco Electronics Bradford, PA 16701
14482	Watkins-Johnson Company 3333 Hillview Avenue Palo Alto, CA 94304
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20878
18736	Voltronics Corporation West Street Hanover, NJ 07936
19505	Applied Engineering Products 300 Seymour Avenue Derby, CT 06418
24539	Avantek, Incorporated 3175 Bowers Avenue Santa Clara, CA 95051
27014	National Semi-Conductor Corp. 2950 San Ysidro Way Santa Clara, CA 95051
27956	Relcom 3333 Hillview Avenue Palo Alto, CA 94304
28480	Hewlett-Packard Company 1501 Page Mill Road Palo Alto, CA 94304
29990	American Technical Ceramics 1 Norden Lane Huntington Station, NY 11746
31091	Alpha Industries, Incorporated Advance Lane Colmar, PA 18915
31433	Union Carbide Corporation P.O. Box 5928 Greenville, SC 29606
33095	Spectrum Control, Inc. 152 East Main Street Fairview, PA 16415
34731	Lakeside Bridge and Steel Co. 5303 North 33rd Street Milwaukee, WI 53209
50101	Frequency Sources, Inc. 16 Maple Road South Chelmsford, MA 01824
50140	K and L Microwave, Inc. 203 Newton Street Salisbury, MD 21801

Mfr. Code	Name and Address	Mfr. Code	Name and Address
52648	Plessey Semiconductors 1641 Kaiser Irvine, CA 92714	76055	Mallory Control Division P.O. Box 327 State Road 28W Frankfort, IN 46041
55969	Metuchen Capacitors, Inc. 420 Park Avenue Perth Amboy, NJ 08861	80131	Electronics Industries Assoc. 2001 Eye Street, N.W. Washington, D.C. 20006
56289	Sprague Electric Company Marshall Street North Adams, MA 01247	81312	Winchester Electronics Division Litton Industries Main Street and Hillside Avenue Oakville, CT 06779
57856	Aero American, Incorporated 7830 Balboa Boulevard Van Nuys, CA 91406	81349	Military Specifications
59660	Tusonix, Incorporated 2155 N. Forbes Blvd., Suite 107 Tucson, AZ 85745	91418	Radio Materials Company 4242 West Bryn Mauer Avenue Chicago, IL 60646
70903	Belden Corporation 415 South Kelpatrick Chicago, IL 60644	91506	Augat, Incorporated 33 Perry Avenue Attleboro, MA 02703
71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, MA 02138	96341	Microwave Assoc., Incorporated South Avenue Burlington, MA 01803
73138	Beckman Instruments, Inc. 2500 Harbor Boulevard Fullerton, CA 92634	98291	Sealectro Corporation 225 Hoyt Mamaroneck, NY 10544
75037	Minnesota Mining & Manuf. Co. 3 M Center St. Paul, MN 55101	99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, NY 14052

B.7 REPLACEMENT PARTS LIST

The following parts list contains all the electrical components and certain mechanical parts, subject to unusual wear or possible damage, used in the Frequency Extender Option. The List of Manufacturers provided in paragraph B.6, and the manufacturer's component part numbers are included as an aid for the equipment user in the field. The listed parts may not necessarily agree with the components installed; however, the listed parts can be used and will provide satisfactory equipment operation. Replacement parts may be obtained from any manufacturer, as long as the physical and electrical parameters of the replacement part agree with the original part.

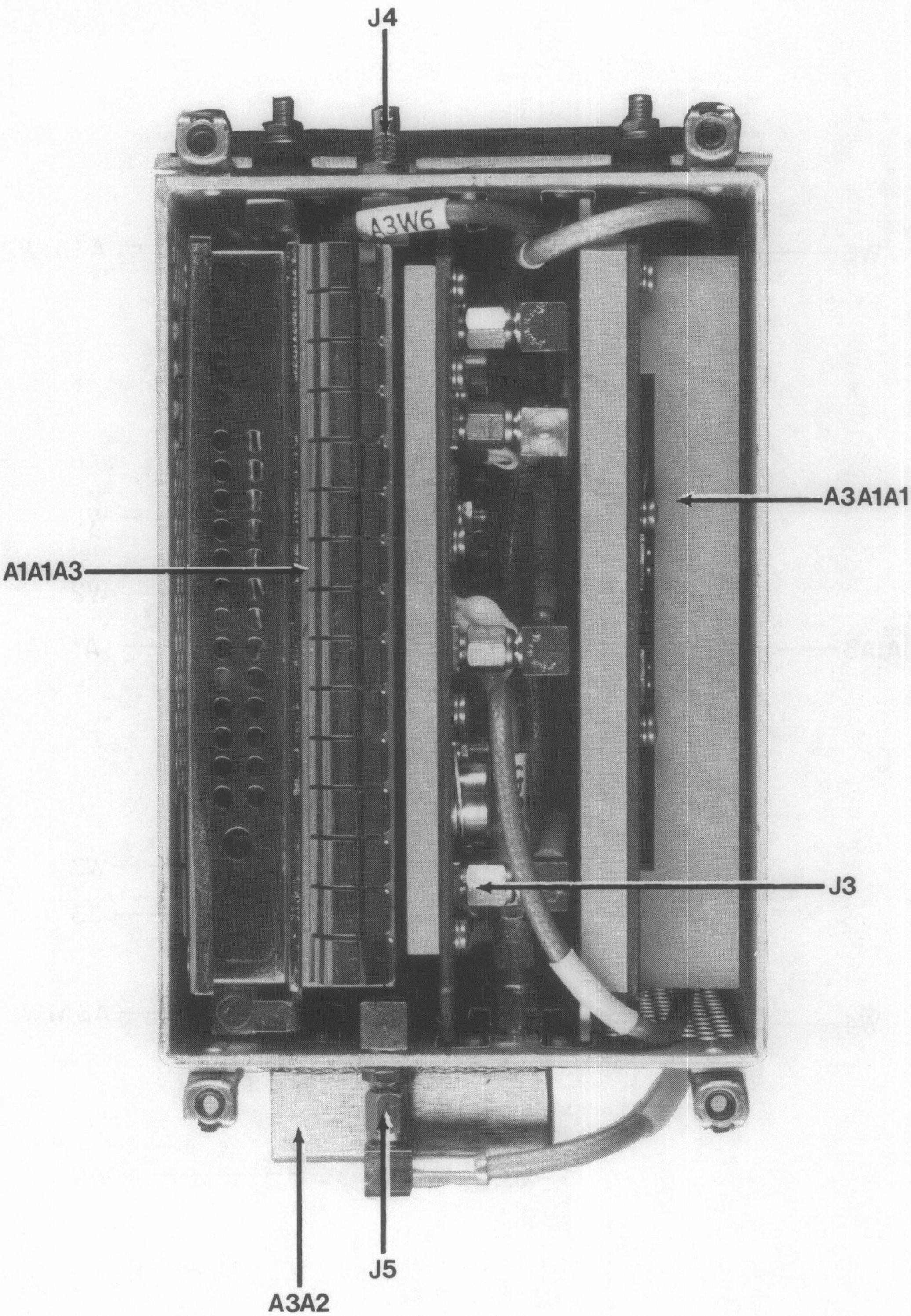


Figure B-2. WJ-8615/FE Left Side Component View

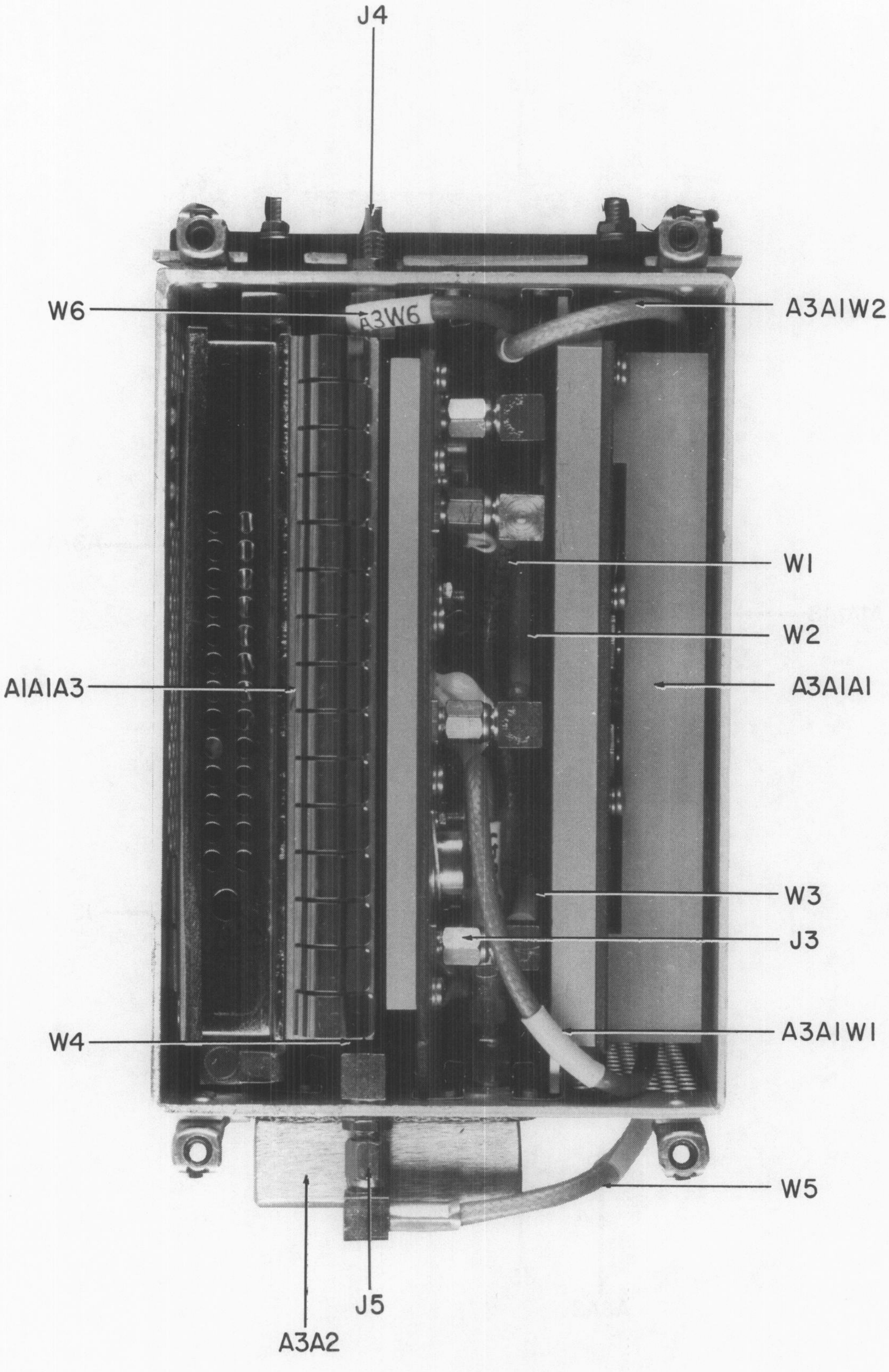


Figure B-3. WJ-8615/FE Right Side Component View

B.7.1 **TYPE 796456-1 FREQUENCY EXTENDER** REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A3A1	Motherboard	1	380762-1	14632	
A3A2	RF Switch	1	280899-1	14632	
A3A1A1	UHF Preselector Module Assembly	1	796414-1	14632	
A3A1A2	UHF Preamplifier/Mixer Module Assembly	1	796415-1	14632	
A3A1A3	UHF LO Synthesizer Module Assembly	1	798079-2	14632	
C1	Capacitor, Ceramic, Feedthru: 0.05 µF, 300 V	9	54-785-005-503P	33095	
C2 Thru C9	Same as C1				
FB1	Ferrite Bead	20	56-590-65-4A	02114	
FB2 Thru FB20	Same as FB1				
J1	Part of A3A2				
J2	Connector, Jack	1	8126-2521-008	19505	
J3	Part of A3A2				
J4	Connector, Plug	2	50-330-0039-91	98291	
J5	Same as J4				
P1	Connector, Plug	2	1-87499-1	00779	
P2	Same as P1				
P3	Connector, Plug	5	50-328-3875-91	98291	
P4	Same as P3				
P5	Same as P3				
P7	Connector, Plug	2	50-024-3875-91	98291	
P8	Same as P7				
P9	Same as P3				
P10	Same as P3				
P11	Connector, Plug	1	2105-7521-008	19505	
W1	Cable Assembly	1	380535-7	14632	
W2	Cable Assembly	1	380535-2	14632	
W3	Cable Assembly	1	380535-3	14632	
W4	Cable Assembly	1	380535-4	14632	
W5	Cable Assembly	1	380535-5	14632	
W6	Cable Assembly	1	380535-6	14632	

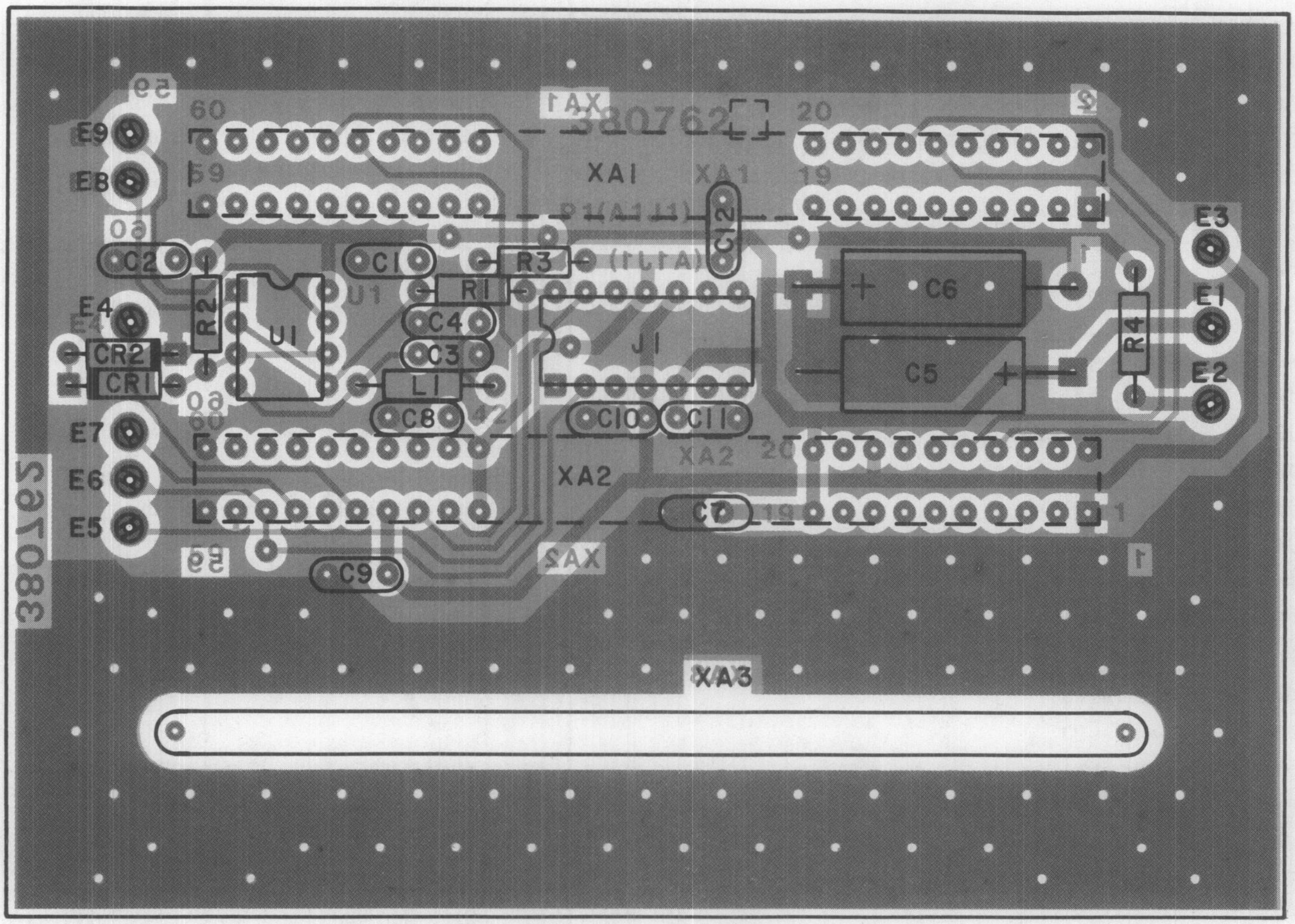


Figure B-4. Type 380762-1 Motherboard (A3A1), Location of Components

B.7.1.1 **Type 380762-1 Motherboard Assembly** REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A1	UHF Preselector	1	796414-1	14632	
A2	UHF Preamplifier, Mixer	1	796415-1	14632	
A3	UHF LO Synthesizer	1	798079-2	14632	
C1	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	3	34475-1	14632	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	1	34452-1	14632	
C5	Capacitor, Electrolytic, Tantalum: 100 µF, 20%, 35 V	2	MTP107M035P1C	76055	
C6	Same as C5				
C7	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	6	34453-1	14632	
C8 Thru C12	Same as C7				
CR1	Diode	2	1N4446	80131	
CR2	Same as CR1				
J1	Socket, Integrated Circuit	1	514-AG10D	91506	
L1	Coil, Fixed: 0.47 µH	1	1025-12	99800	
P1	Connector, Plug	1	3406-0002	75037	
R1	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	1	CF1/8-1.0K/J	09021	
R2	Resistor, Fixed, Film: 5.1 kΩ, 5%, 1/8 W	1	CF1/8-5.1K/J	09021	
R3	Resistor, Fixed, Film: 180Ω 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
R4	Resistor, Fixed, Film: 7.5Ω, 5%, 1/4W	1	CF1/4-7.5 OHMS/J	09021	
U1	Integrated Circuit	1	LM358N	27014	
W1	Cable Assembly	1	380532-1	14632	
XA1	Housing	2	MK30C-13-195-4381	81312	
XA2	Same as XA1				
XA3	Connector, Receptacle, Multipin	1	RF30-2801-5	57856	

B.7.1.1.1 **Type 796414-1 UHF Preselector** REF DESIG PREFIX A3A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	2	C1210E471K1GAH	31433	
C2 Thru C5	Not Used				
C6	Capacitor, Ceramic, Monolithic: 220 pF, 5%, 100 V	6	8121-100-C0G0-221J	59660	
C7 Thru C11	Same as C6				
C12	Same as C1				
C13	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	3	34475-1	14632	
C14	Capacitor, Ceramic, Disc: 1000 pF, 500 V	3	B-GP1000PFP	91418	
C15	Same as C13				
C16	Same as C14				
C17	Same as C13				
C18	Same as C14				
C19	Capacitor, Variable, Air: 1-4.5 pF, 250 V	2	9410-0	91293	
C20	Same as C19				
CR1	Diode Pin	6	GC4371-15	50101	
CR2	Diode Pin	6	GC4212-15	50101	
CR3	Same as CR2				
CR4	Same as CR1				
CR5	Same as CR1				
CR6	Same as CR2				
CR7	Same as CR2				
CR8	Same as CR1				
CR9	Same as CR1				
CR10	Diode	2	MA47201	96341	
CR11	Same as CR10				
CR12	Same as CR1				
CR13	Same as CR2				
CR14	Same as CR2				
FB1	Not Used				
FB2	Not Used				
FB3	Ferrite Bead	10	56-590-65-4A	02114	
FB4 Thru FB12	Same as FB3				
FL1	Filter, Bandpass: 600 MHz CF, 200 MHz Bandwidth	1	92222	50140	
FL2	Filter, Bandpass: 800 MHz CF, 200 MHz Bandwidth	1	92223	50140	
FL3	Filter, Bandpass: 1000 MHz CF, 200 MHz Bandwidth	1	92224	50140	
L1	Coil, Fixed	8	170134-1	14632	

Courtesy of www.BlackRadios.terryo.org

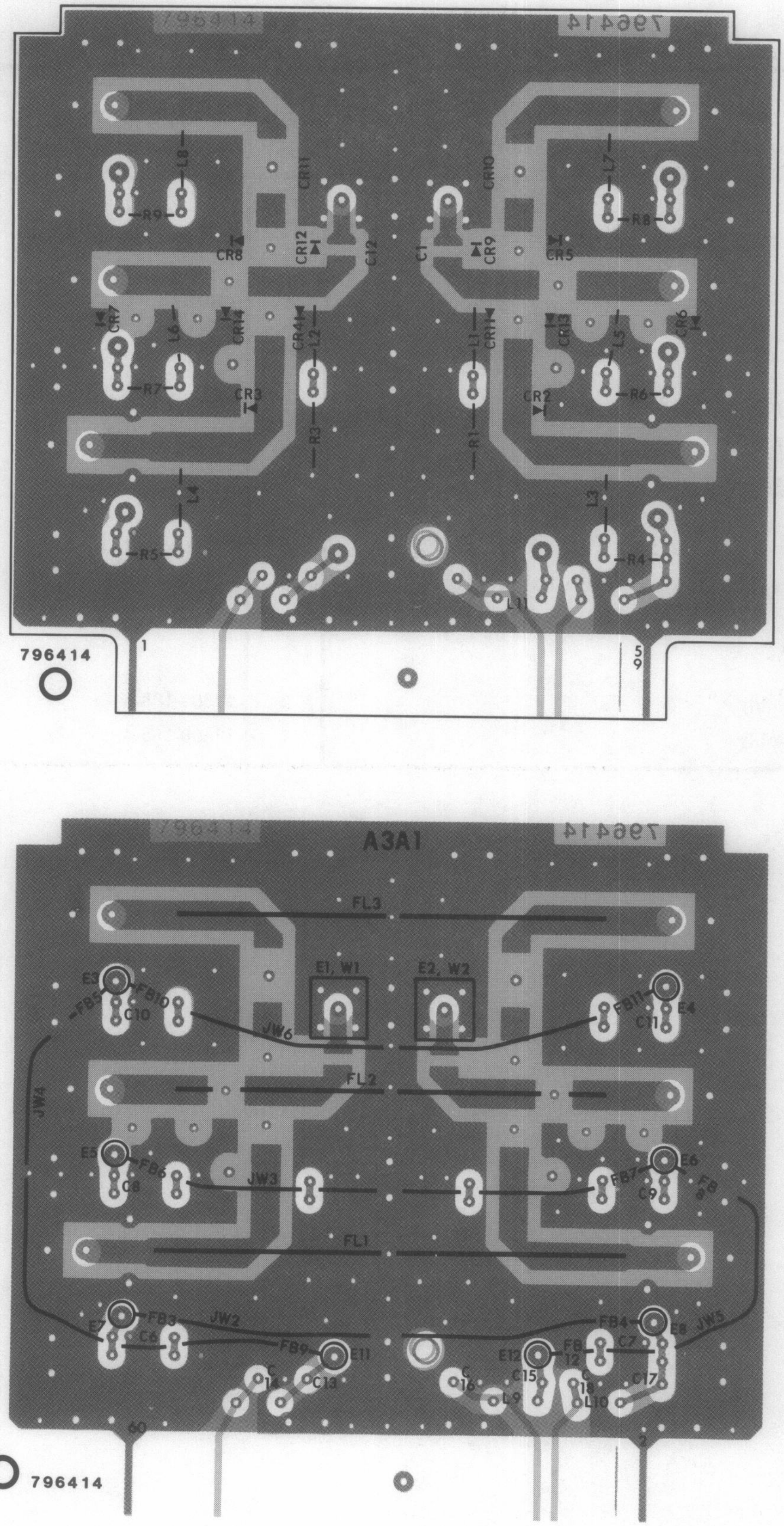


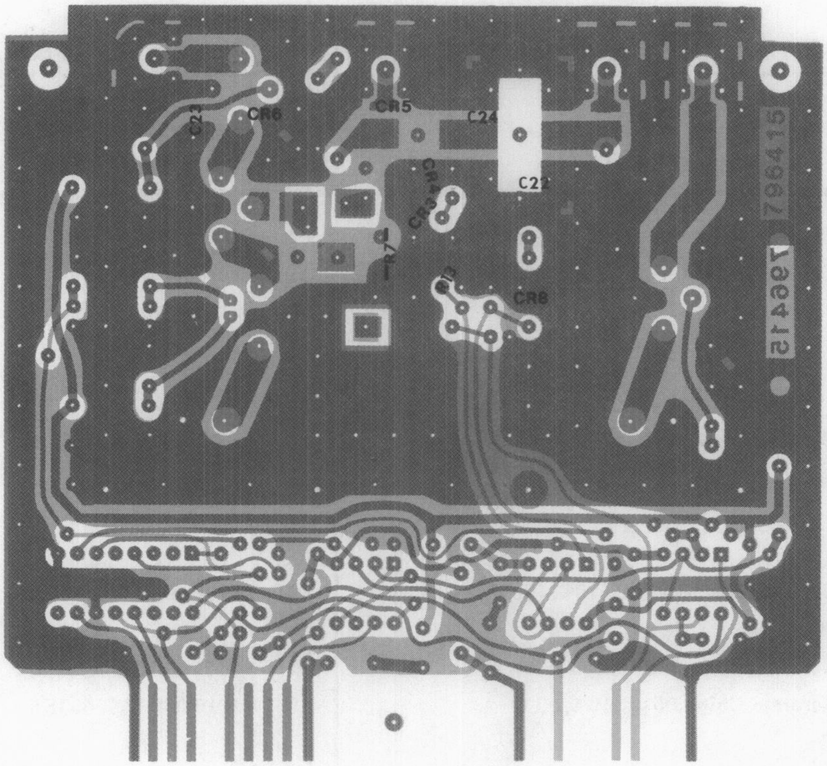
Figure B-5. Type 796414-1, UHF Preselector (A3A1A1), Location of Components

REF DESIG PREFIX A3A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L2 Thru L8	Same as L1				
L9	Coil, Fixed	3	190187-1	14632	
L10	Same as L9				
L11	Same as L9				
P1	Connector, Plug	1	50-024-3875-91	98291	
P2	Connector, Plug	1	50-328-3875-91	98291	
R1	Resistor, Fixed, Film: 1.2 kΩ, 5%, 1/4 W	2	CF1/4-1.2K/J	09021	
R2	Not Used				
R3	Same as R1				
R4	Resistor, Fixed, Composition: 470Ω, 5%, 1/8 W	6	RCR05G471JS	81349	
R5 Thru R9	Same as R4				
W1	Cable Assembly	1	17300-188-3	14632	
W2	Cable Assembly	1	17300-188-4	14632	

B.7.1.1.2 **Type 796415-1 UHF Preamplifier/Mixer** REF DESIG PREFIX A3A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	2	196D475X0035JE3	56289	
C2	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	15	34475-1	14632	
C3	Same as C1				
C4 Thru C15	Same as C2				
C16	Capacitor, Ceramic, Monolithic: 470 pF, 5%, 100 V	3	8121-100-C0G0-471J	59660	
C17	Same as C16				
C18	Same as C2				
C19	Same as C2				
C20	Capacitor, Ceramic, Disc: 1000 pF, 10%, 100 V	2	8121-100-X7R0-102K	59660	
C21	Same as C20				
C22	Capacitor, Ceramic, Chip: 220 pF, 10%, 50 V	1	C1210C221K5GAH	05397	
C23	Capacitor, Ceramic, Chip: .05 µF, 10%, 50 V	2	1210-050-X7R-503K5	55969	
C24	Same as C23				
C25	Same as C16				
C26	Capacitor, Ceramic, Chip: 4.3 pF, 0.5%, 500 V	2	ATC700B4R3DP500X	29990	
C27	Same as C26				
C28	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	1	C1210E471K1GAH	31433	
C29	Capacitor, Variable, Air: 0.6-4.5 pF, 500 V	1	M5F	18736	
CR1	Diode	2	1N4446	80131	
CR2	Same as CR1				
CR3	Diode, Pin	2	GC4212-15	50101	
CR4	Diode, Pin	2	GC4371-15	50101	
CR5	Same as CR4				
CR6	Diode	1	5082-3040	28480	
CR7	Not Used				
CR8	Same as CR3				
FL1	Filter Low-Pass: 1100 MHz	1	92225	50140	
J1	Connector, Receptacle	4	1009-7511-000	19505	
J2 Thru J4	Same as J1				
L1	Coil, Fixed	6	16209-12	14632	
L2 Thru L5	Same as L1				
L6	Coil, Fixed	2	170134-1	14632	
L7	Coil, Fixed	2	190187-1	14632	
L8	Same as L6				
L9	Same as L1				



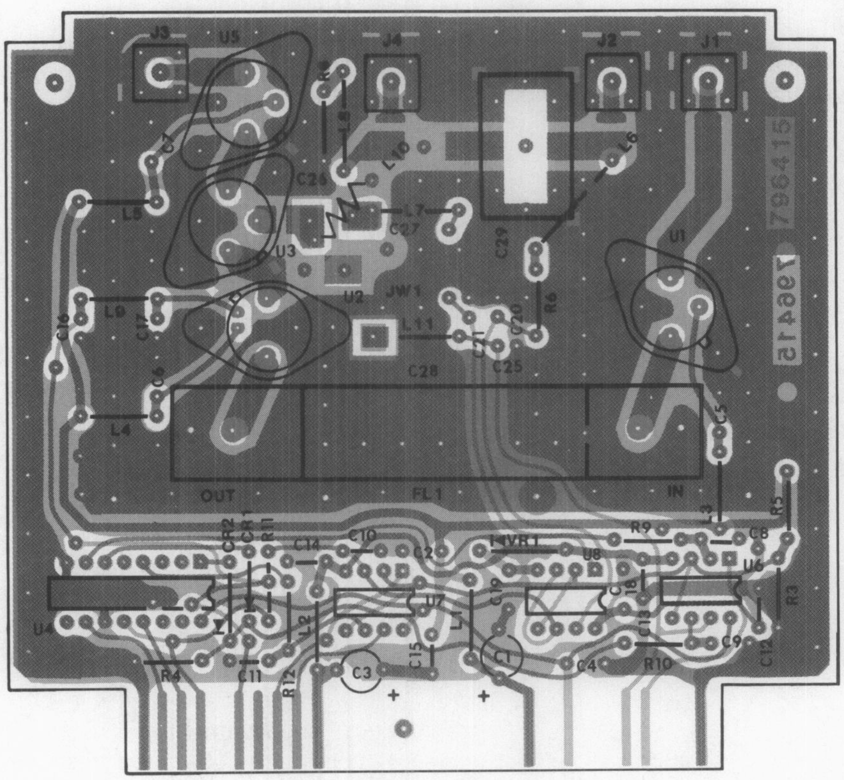
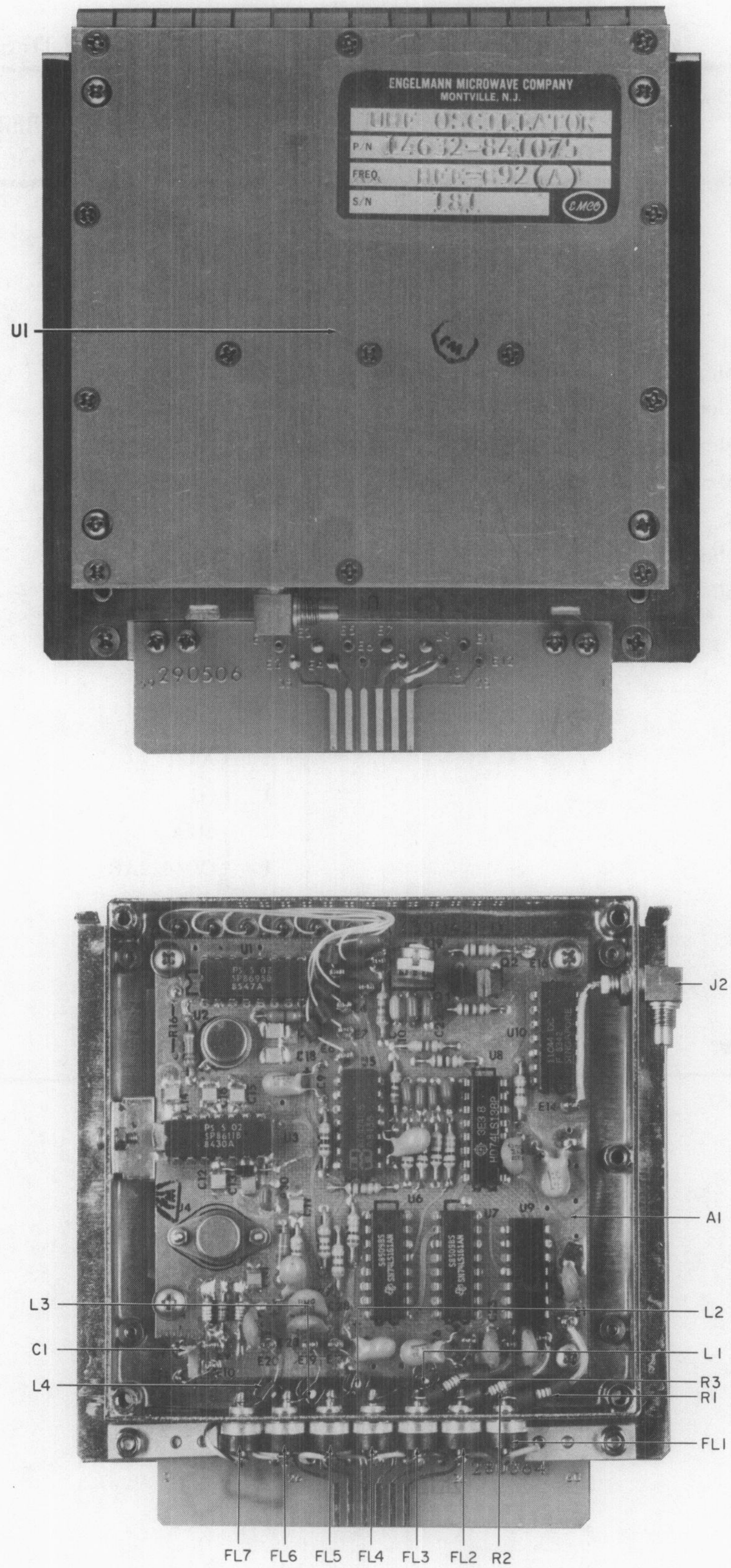


Figure B-6. Type 796415-1, Preamplifier/Mixer (A3A1A2), Location of Components

REF DESIG PREFIX A3A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L10	Coil, Fixed	1	170189-1	14632	
L11	Same as L7				
R1	Not Used				
R2	Not Used				
R3	Resistor, Fixed, Film: 1.8 kΩ, 5%, 1/8 W	2	CF1/8-1.8K/J	09021	
R4	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	1	CF1/8-47K/J	09021	
R5	Resistor, Fixed, Film: 12 kΩ, 5%, 1/8 W	1	CF1/8-12K/J	09021	
R6	Resistor, Fixed, Film: 680Ω, 5%, 1/8 W	2	CF1/8-680 OHMS/J	09021	
R7	Same as R6				
R8	Resistor, Fixed, Film: 1.2 kΩ, 5%, 1/8 W	1	CF1/8-1.2K/J	09021	
R9	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	4	CF1/8-18K/J	09021	
R10 Thru R12	Same as R9				
R13	Same as R3				
U1	Amplifier	1	A12	14482	
U2	Attenuator	1	G1	27956	
U3	Mixer, Balanced	1	M2A	27956	
U4	Integrated Circuit	1	CD4028AE	02735	
U5	Amplifier	1	A28	27956	
U6	Integrated Circuit	3	LM358N	27014	
U7	Same as U6				
U8	Same as U6				
VR1	Diode, Zener: 5.1 V	1	1N751A	80131	



B-7. Type 798079-2 UHF LO Synthesizer (A3A1A3), Location of Components

B.7.1.1.3 **Type 798079-2 UHF LO Synthesizer** REF DESIG PREFIX A3A1A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A1	UHF Variable Divider	1	390421-1	14632	
C1	Capacitor, Ceramic, Monolithic: 1.0 pF, 100 V	1	100-100-NPO-109B	51642	
FB1	Ferrite Bead	12	56-590-65-4A	02114	
FB2 Thru FB12	Same as FB1				
FL1	Filter, Modified	7	33728-18	14632	
FL2 Thru FL7	Same as FL1				
J1	Not Used				
J2	Connector, Receptacle	1	1012-1511-000	19505	
L1	Coil, Fixed	4	16209-4	14632	
L2 Thru L4	Same as L1				
R1	Resistor, Fixed, Film: 270Ω, 5%, 1/8 W	3	CF1/8-270 OHMS/J	09021	
R2	Same as R1				
R3	Same as R1				
R4	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	
U1	UHF VCO Oscillator	1	280217-1	14632	

B.7.1.1.3.1 Type 390421-1 UHF Variable Divider REF DESIG PREFIX A3A1A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	7	838IKYZ5U470	59660	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: 0.01 µF, 20%, 50 V	6	34453-1	14632	
C5 Thru C7	Same as C4				
C8	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	5	196D475X0035JE3	56289	
C9	Same as C8				
C10	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	1	34475-1	14632	
C11	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	9	C1210C471K1GAC	31433	
C12 Thru C18	Same as C11				
C19	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	2	34452-1	14632	
C20	Same as C8				
C21	Same as C19				
C22	Same as C4				
C23	Same as C1				
C24	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	1	196D226X0010JE3	56289	
C25	Same as C1				
C26	Same as C8				
C27	Same as C8				
C28	Same as C1				
C29	Same as C1				
C30	Same as C4				
C31	Same as C11				
CR1	Diode	1	GC4211-15	50101	
L1	Inductor, Air Core	1	22292-170	14632	
Q1	Transistor	2	2N3904	80131	
Q2	Same as Q1				
R1	Resistor, Fixed, Film: 10 kΩ, 5%, 1/4 W	7	CF1/4-10K/J	09021	
R2 Thru R6	Same as R1				
R7	Resistor, Fixed, Film: 27Ω, 5%, 1/4 W	1	CF1/4-27 OHMS/J	09021	
R8	Resistor, Fixed, Film: 100Ω, 5%, 1/4 W	2	CF1/4-100 OHMS/J	09021	
R9	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R10	Resistor, Fixed, Film: 47Ω, 5%, 1/8 W	2	CF1/8-47 OHMS/J	09021	
R11	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	
R12	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/4 W	2	CF1/4-1K/J	09021	
R13	Resistor, Fixed, Film: 15 kΩ, 5%, 1/4 W	1	CF1/4-15K/J	09021	

REF DESIG PREFIX A3A1A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R14	Resistor, Fixed, Film: 3.6 kΩ, 5%, 1/4 W	1	CF1/4-3.6K/J	09021	
R15	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/4 W	1	CF1/4-1.5K/J	09021	
R16	Not Used				
R17	Resistor, Fixed, Film: 330Ω, 5%, 1/4 W	1	CF1/4-330 OHMS/J	09021	
R18	Same as R12				
R19	Resistor, Trimmer, Film: 2 kΩ, 10%, 1/2 W	1	62PAR2K	73138	
R20	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/4 W	1	CF1/4-3.3K/J	09021	
R21	Same as R1				
R22	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/4 W	1	CF1/4-4.7K/J	09021	
R23	Same as R8				
R24	Resistor, Fixed, Film: 4.7 MΩ, 5%, 1/4 W	1	CF1/4-4.7M/J	09021	
R25	Resistor, Fixed, Film: 180Ω, 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
U1	Integrated Circuit	1	SP8695B	52648	
U2	Integrated Circuit	1	SP8602B	52648	
U3	Integrated Circuit	1	SP8611B/DG	52648	
U4	Amplifier	1	GPD-410	24539	
U5	Integrated Circuit	1	HA1-4741-5	34371	
U6	Integrated Circuit	2	SN74LS161AN	01295	
U7	Same as U6				
U8	Integrated Circuit	1	SN74LS138N	01295	
U9	Integrated Circuit	1	SN74LS04N	01295	
U10	Integrated Circuit	1	11C44DC	07263	

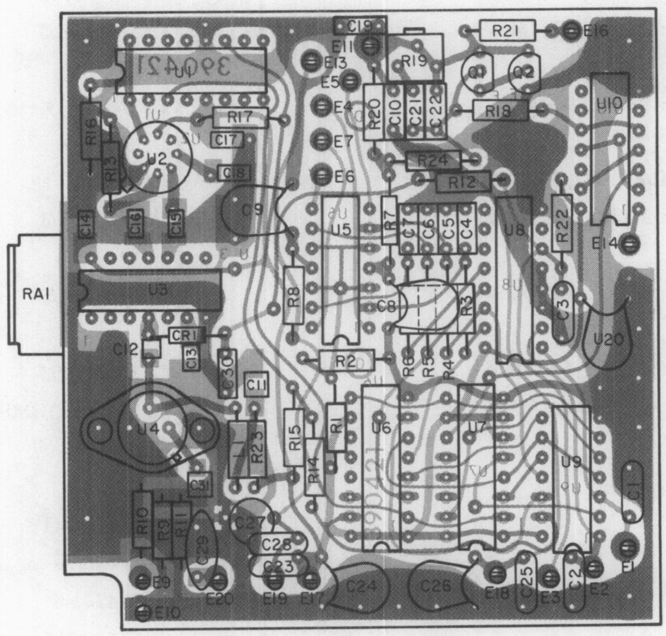


Figure B-8. Type 390421 UHF Variable Divider (A3A1A3A1), Location of Components

B.8.1.1.3.2 Type 796719-1 UHF Oscillator Assembly **REF DESIG PREFIX A3A1A3A2**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
A1	UHF Oscillator PC Assembly	1	381473-1	14632	
C1	Capacitor, Feedthru: 1000 pF, 100 V	6	54-790-018	33095	
C2 Thru C6	Same as C1				
J1	Connector, Receptacle	1	1012-1511-000	19505	
R1	Resistor, Fixed, Film: 22 kΩ, 5%, 1/8 W	4	CF1/8-22K/J	09021	
R2 Thru R4	Same as R1				

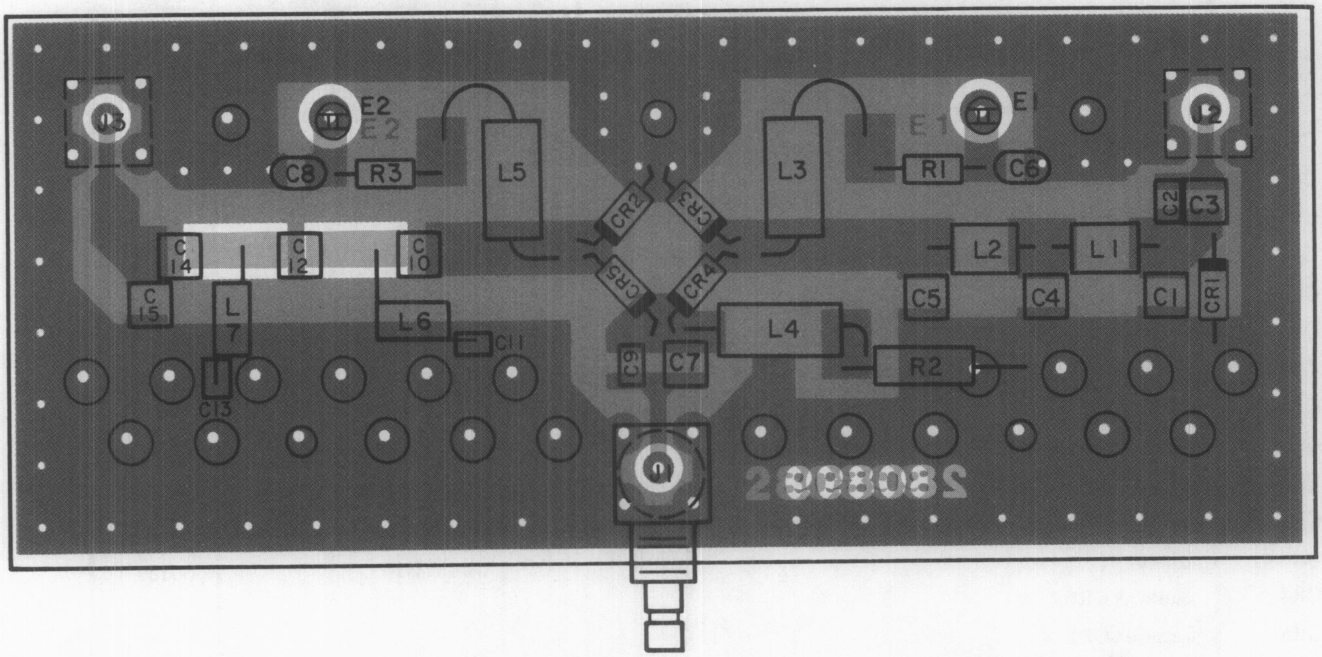
B.8.1.1.3.2.1 Type 381473-1 UHF Oscillator PC Assembly REF DESIG PREFIX A3A1A3A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
C1	P/O PC Board	4			
C2	Capacitor, Ceramic: 1.5 pF, ±.1 pF, 500 V	3	ATC175B1R5BP500X	29990	
C3	Capacitor, Variable, Air: .4-2.5 pF, 500 V	4	27283	91293	
C4	Capacitor, Ceramic: 5.6 pf, ±.1 pF, 500 V	2	ATC175B5R6BP500X	29990	
C5	Same as C1				
C6	Same as C2				
C7	Same as C3				
C8	Same as C4				
C9	Same as C1				
C10	Same as C2				
C11	Same as C3				
C12	Capacitor, Ceramic: 4.7 pF, ±.1 pF, 500 V	1	ATC175B4R7BP500X	29990	
C13	Same as C1				
C14	Capacitor Ceramic: 1.0 pF, ±.1 pF, 500 V	1	ATC175B1R0BP500X	29990	
C15	Same as C3				
C16	Capacitor, Ceramic: 3.9 pF, ±.1 pF, 500 V	1	ATC175B3R9BP500X	29990	
C17	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 15 V	1	TMM-S-226M-015R	04222	
C18	Capacitor, Ceramic, Monolithic: 2.0 pF, ±.1 pF, 100 V	2	100-100-NPO-209B	51642	
C19	Capacitor, Ceramic, Monolithic: 2.4 pF, ±.1 pF, 100 V	1	100-100-NPO-249B	51642	
C20	Capacitor, Ceramic, Monolithic: 1.0 pF, ±.1 pF, 100 V	2	100-100-NPO-109B	51642	
C21	Same as C20				
C22	Same as C18				
C23	Capacitor, Ceramic, Disk: .01 µF, 20%, 50 V	1	34453-1	14632	
CR1	Tuning Varactor	4	MA-45240-31	96341	
CR2 thru CR4	Same as CR1				
CR5	Diode	1	IN4449	80131	
FB1	Ferrite Bead	12	56-590-65-4A	02114	
FB2 thru FB12	Same as FB1				
L1	Coil, Fixed	9	190187-1	14632	
L2 Thru L9	Same as L1				
L10	Coil, Fixed	3	180683-1	14632	
L11	Same as L10				
L12	Same as L10				
Q1	Transistor	4	MMBT2222A	04713	
Q2	Transistor	4	841269	14632	
Q3	Same as Q2				
Q4	Same as Q1				

B.7.2 TYPE 280899-1 RF SWITCH

REF DESIG PREFIX A3A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Chip: 4.3 pF, ±0.5 pF, 500 V	2	ATC700B4R3DP500X	29990	
C2	Capacitor, Ceramic, Chip: 2200 pF, 5%, 50 V	2	C1005C222J5GPH	31433	
C3	Capacitor, Ceramic, Chip: 0.05 µF, 10%, 50 V	2	1210-050-X7R-503KS	55969	
C4	Capacitor, Ceramic, Chip: 8.2 pF, ±0.25 pF, 500 V	2	ATC700B8R2CP500X	29990	
C5	Same as C1				
C6	Capacitor, Ceramic, Disc: 1000 pF, 10%, 100 V	2	8121-100-X7R0-102K	59660	
C7	Same as C3				
C8	Same as C6				
C9	Same as C2				
C10	Capacitor, Ceramic, Chip: 13 pF, 2%, 500 V	1	ATC700B130GP500X	29990	
C11	Capacitor, Ceramic, Chip: 10 pF, 2%, 500 V	1	ATC700B100GP500X	29990	
C12	Capacitor, Ceramic, Chip: 4.7 pF, ±0.25 pF, 500 V	1	ATC700B4R7CP500X	29990	
C13	Capacitor, Ceramic, Chip: 33 pF, 2%, 500 V	1	ATC700B330GP500X	29990	
C14	Same as C4				
C15	Capacitor, Ceramic, Chip: 0.5 pF, ±0.1 pF, 500 V	1	ATC100B0R5BP500X	29990	
CR1	Diode	3	GC4212-15	50101	
CR2	Same as CR1				
CR3	Diode	2	GC4371-15	50101	
CR4	Same as CR3				
CR5	Same as CR1				
J1	Connector, Receptacle	1	2110-7511-000	19505	
J2	Not Used				
J3	Connector, Receptacle	1	1009-7511-000	19505	
L1	Coil, Fixed	2	170160-1	14632	
L2	Same as L1				
L3	Coil, Fixed	3	170134-1	14632	
L4	Same as L3				
L5	Same as L3				
L6	Coil, Fixed	1	170158-1	14632	
L7	Coil, Fixed	1	170159-1	14632	
R1	Resistor, Fixed, Composition: 560Ω, 5%, 1/8 W	2	RCR05G561JS	81349	
R2	Resistor, Fixed, Composition: 680Ω, 5%, 1/4 W	1	RCR07G681JS	81349	
R3	Same as R1				



B-9. Type 280899-1 RF Switch (A3A2),
Location of Components

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) CAPACITANCE IS IN µF.
b) INDUCTANCE IS IN µH.
c) RESISTANCE IS IN OHMS, ±5%, 1/8 W.

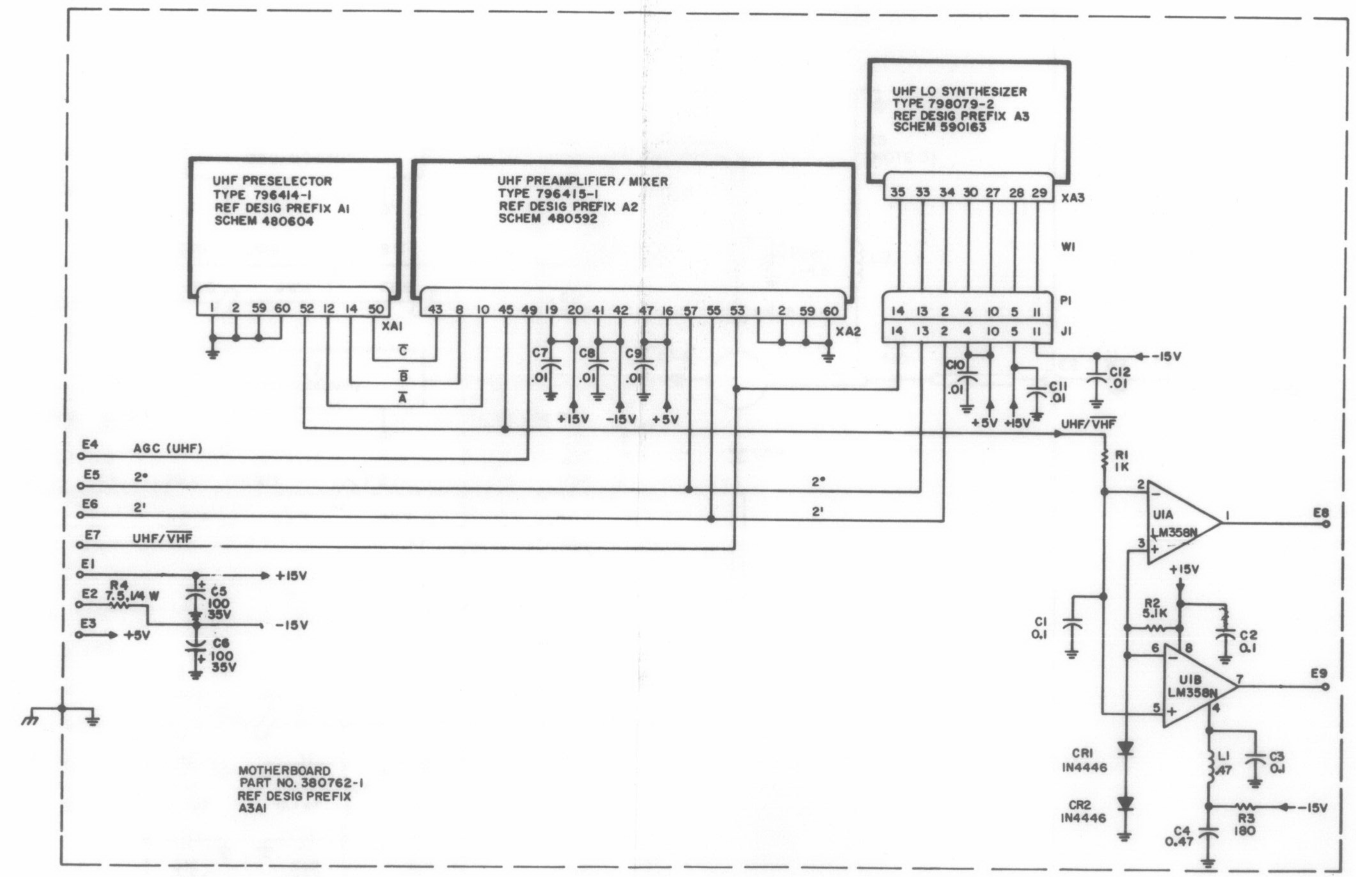


Figure B-10. Type 380762-1, Motherboard (A3A1), Schematic Diagram 480652 (B)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
   c) INDUCTANCE IS IN μH.
2. DIODES CR10, CR11 ARE MA-47201; CR1 THRU CR9, CR12 THRU CR14 ARE 841320.
3. FOR DIFFERENCES BETWEEN DASH NUMBERS, SEE TABLE A.
4. SWITCHING CODES SEE TABLE B

TABLE A

TYPE NO.	R1, R3	FL3
796414-1	1.2K	92224
796414-2	910	92224
796414-3	1.2K	92390

TABLE B

BAND	FILTERS	$\overline{A}$	$\overline{B}$	$\overline{C}$
900-1100	FL3	1	1	0
700-900	FL2	1	0	1
500-700	FL1	0	1	1
900-1200	FL3	1	1	0

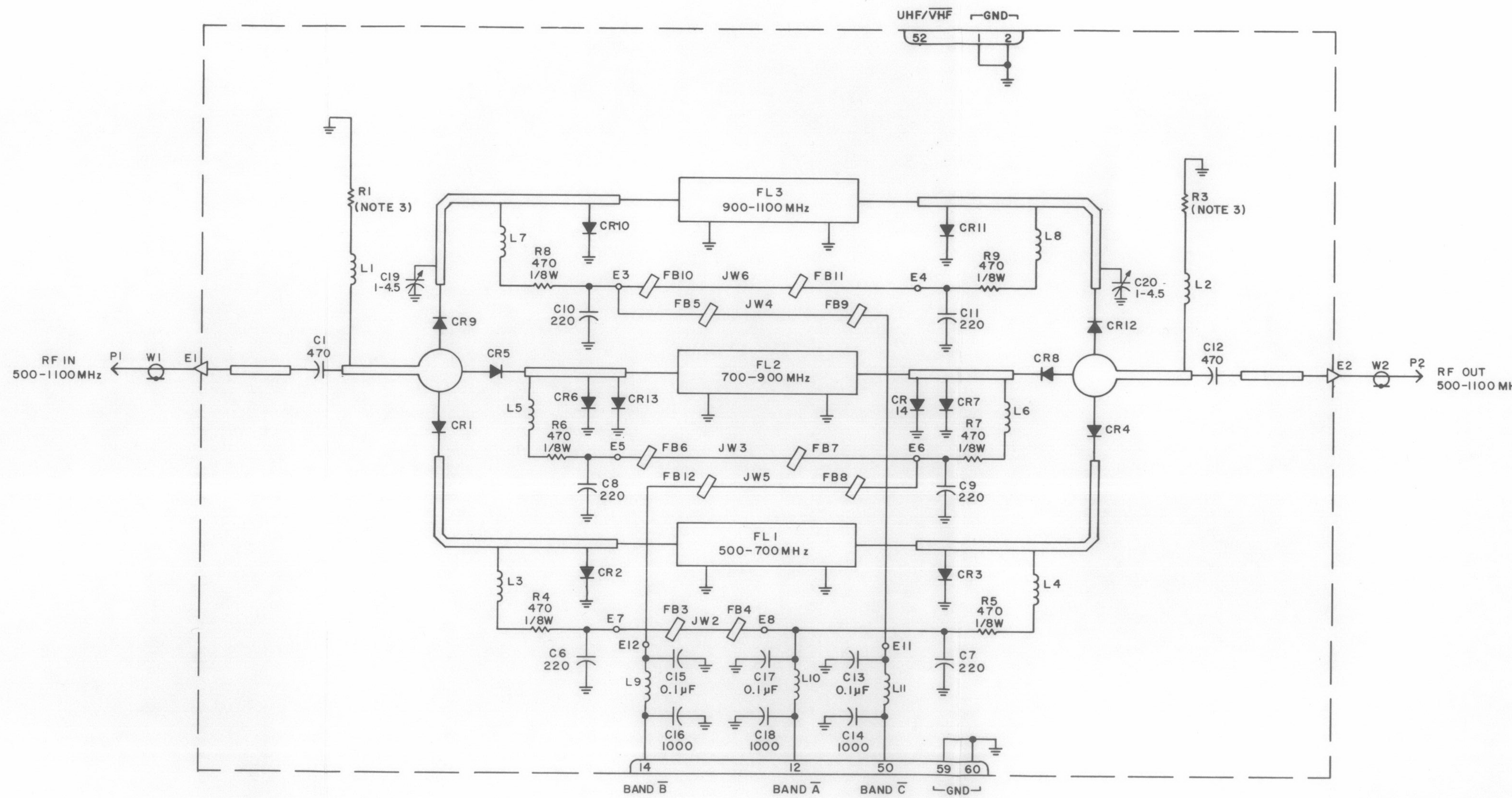


Figure B-11. Type 796414-1, HF Preselector (A3A1A1), Schematic Diagram 480604 (C)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS ±5%, 1/8W.
   b) CAPACITANCE IS IN μF.
2. DIFFERENCE BETWEEN TYPE NO'S IS SHOWN IN TABLE A.

TABLE A

TYPE NO.	JW2	R3	R5	R6	R7	R8	R13	U5	VR1	+V	−V	FL1
796415-1	1-2	1.8K	12K	680	680	1.2K	1.8K	A28	1N751A 5.1V	+15V	−15V	92225
796415-2	1-3	1.5K	10K	560	560	1K	1.2K	A28-2	1N746A 3.3V	+12V	−12V	92225
796415-3	1-2	1.8K	12K	680	680	1.2K	1.8K	A28	1N751A 5.1V	+15V	−15V	92389

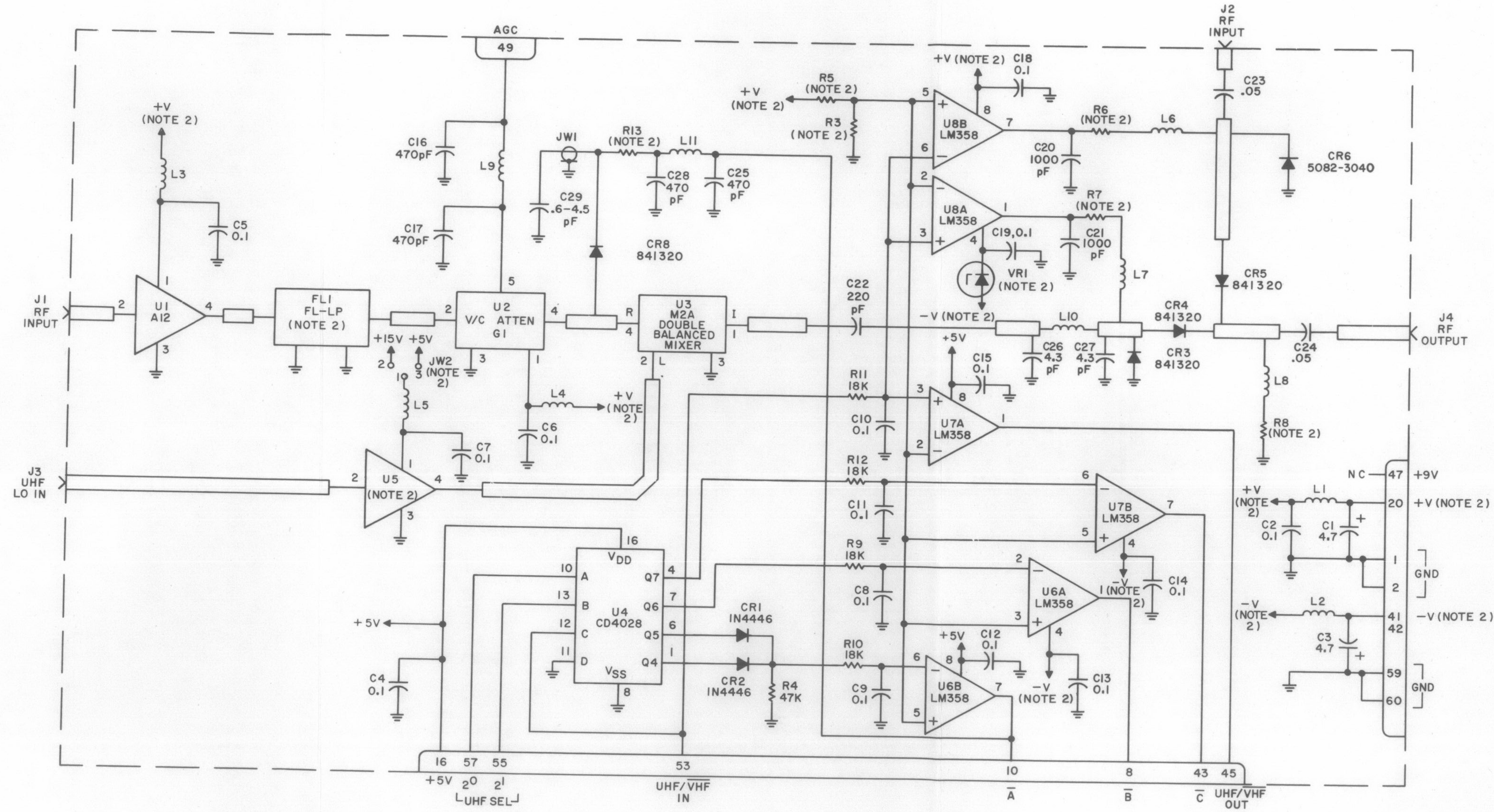
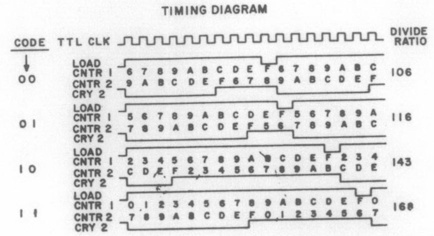


Figure B-12. Type 796415-1, UHF Preamplifier/Mixer (A3A1A2), Schematic Diagram 480592 (F)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
b) CAPACITANCE IS IN pF.
2. DIFFERENCE BETWEEN TYPES IS MECHANICAL ONLY.

TIMING DIAGRAM



DETAIL A
WIRING TO CONNECTOR

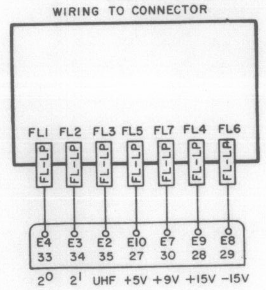


TABLE I

INPUTS UHF 2^1 2^0		CONTR 1 D C B A	CONTR 2 D C B A
1 0 0	→	0 1 1 0	1 0 0 1
1 0 1	→	0 1 0 1	0 1 1 1
1 1 0	→	0 0 1 0	1 1 0 0
1 1 1	→	0 0 0 0	0 1 1 1

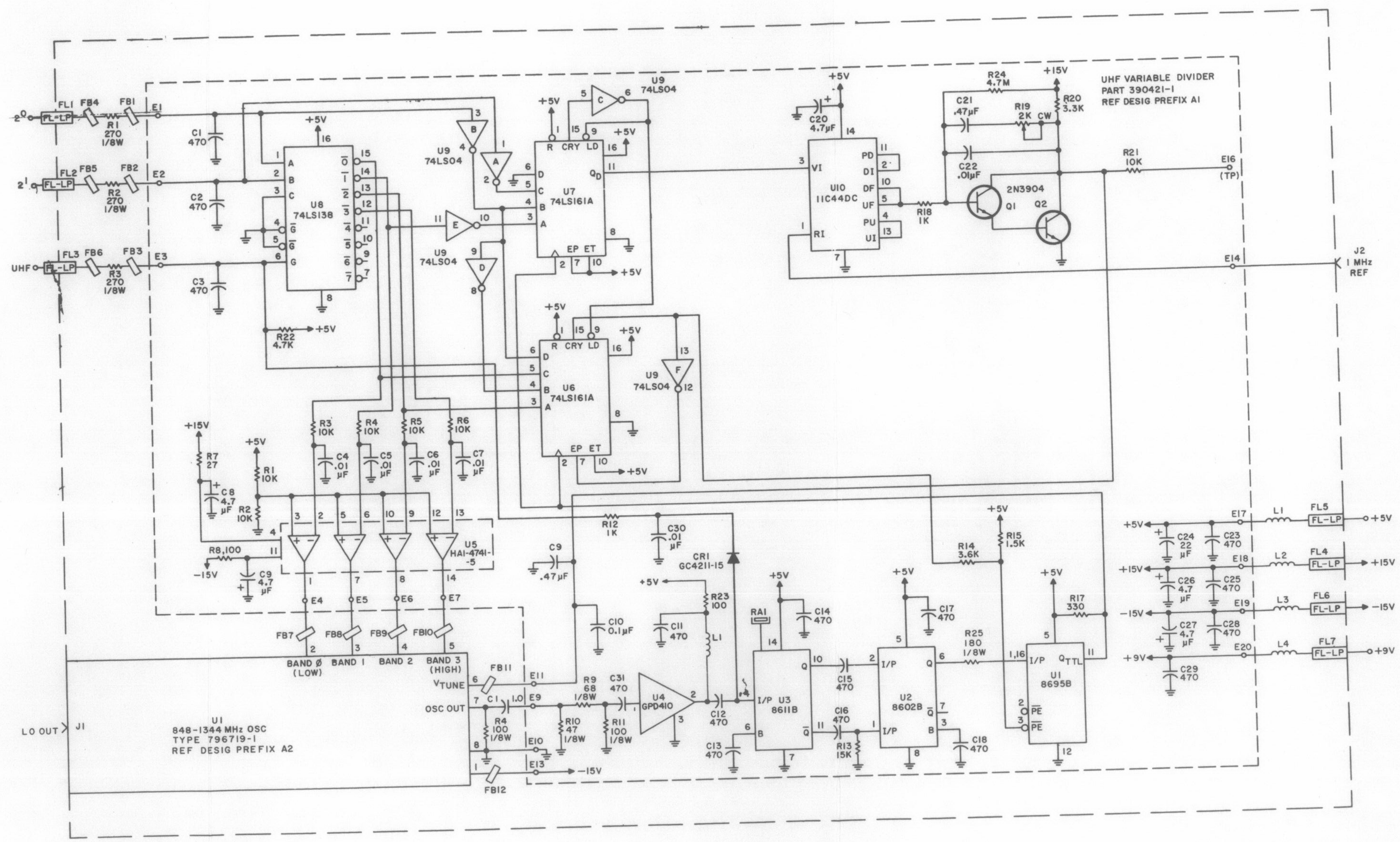


Figure B-13. Type 798079-2, UHF LO Synthesizer (A3A1A3), Schematic Diagram 590163 (M)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
c) CAPACITANCE IS IN pF.
d) INDUCTANCE IS IN nH.

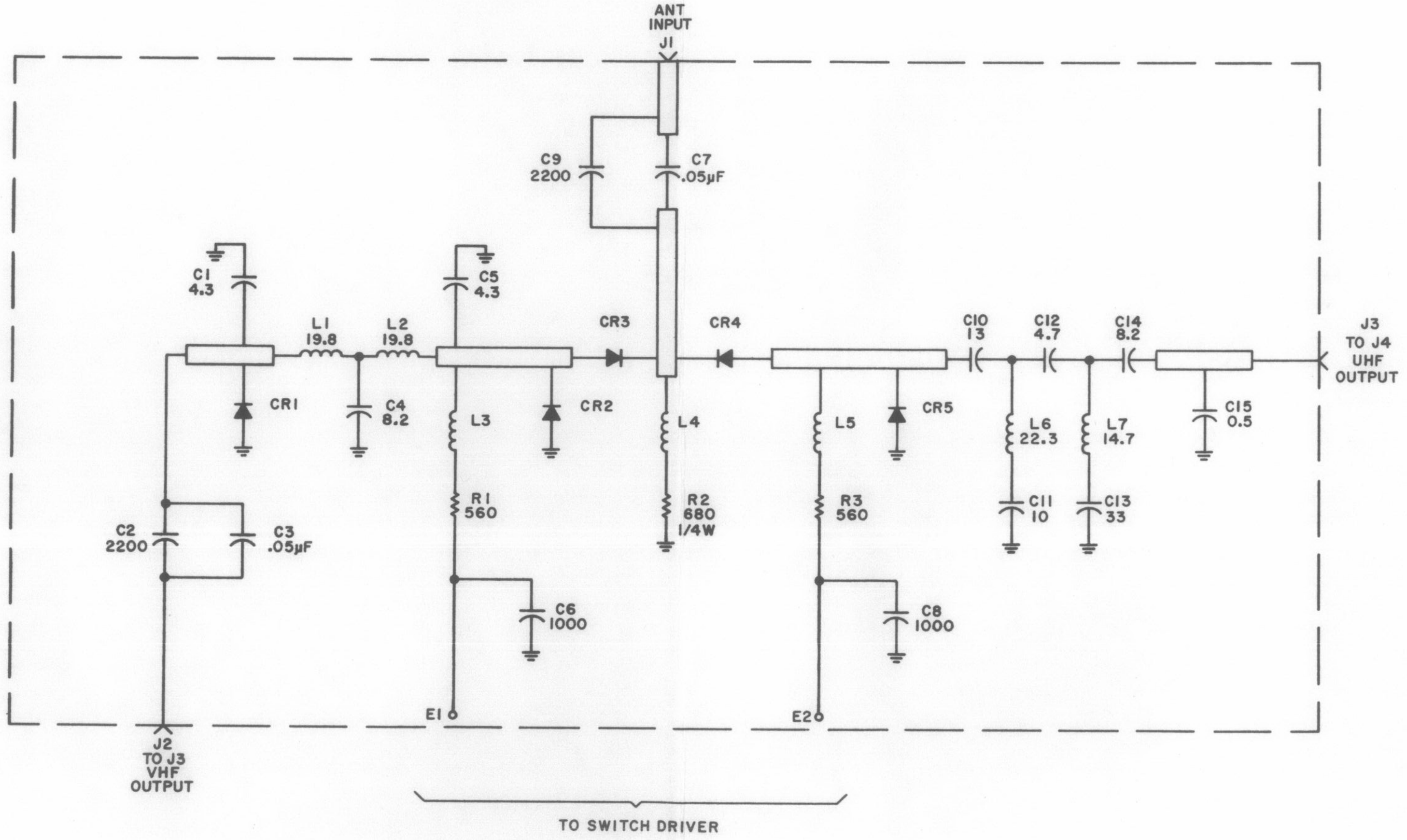


Figure B-14. Part 280899-1, RF Switch (A3A2), Schematic Diagram 480653 (A)

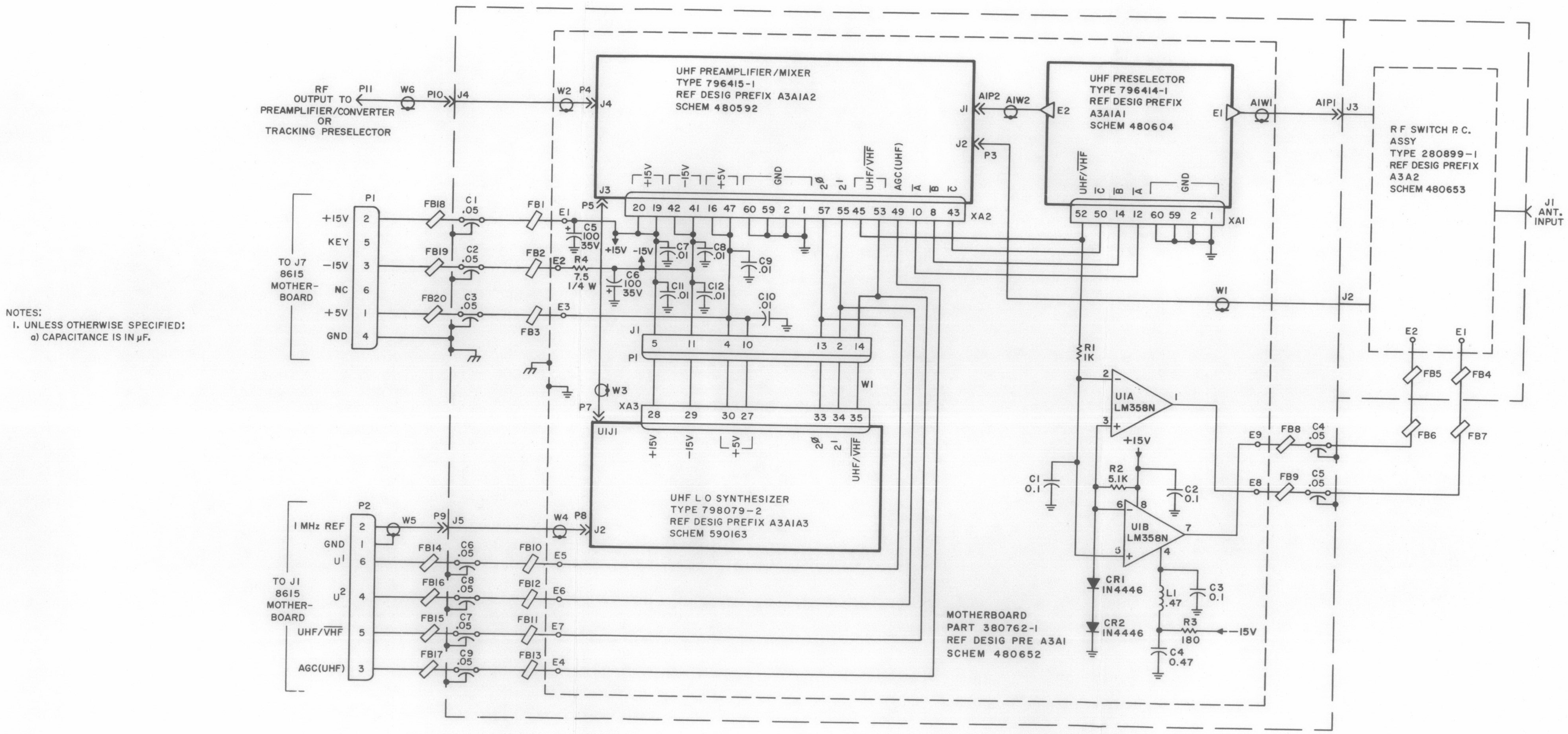


Figure B-15. Type 796456-1, Frequency Extender, Main Chassis Schematic Diagram 480651 (C)

WJ-8615 RECEIVER

APPENDIX C

FAST SWITCHING 2nd LO SYNTHESIZER OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878

April 1988

WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

PROPRIETARY STATEMENT

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FAST SWITCHING 2nd LO SYNTHESIZER OPTION

LIST OF ILLUSTRATIONS

APPENDIX C

FAST SWITCHING 2ND LO SYNTHESIZER OPTION

C.1 GENERAL

Fast Switching 2nd LO Synthesizer (A1A6) Type 776012-1 increases the 2nd LO tuning speed from 50 milliseconds to 15 milliseconds maximum (to within 10 kHz), and provides a 2nd LO output frequency, from 531.1600 MHz to 536.1500 MHz. The 2nd LO frequencies, from A1A6, are applied to connector J2 of the Preamplifier/Converter (A1A13). The 2nd LO output level is approximately +2 dBm. 2nd LO frequencies are used to provide the receiver with a tuning resolution of 10 kHz. Fast Switching 2nd LO Synthesizer Type 776012-1 provides the following features:

- Improved temperature stability when used with the SSL (Step/Scan/Lockout) option
- Fast Step/Scan/Lockout compatible
- Faster switching than the standard 2nd LO operation

C.2 SELECTION

Fast Switching 2nd LO operation is selected when position 6 of switch S1, on the A1A2 module, is in the OPEN position. Access to the IEEE-488/Interrupt module (A1A2) is provided by removing the receiver top protective cover. Use the decal located on the top cover, or refer to the A1A2 location of components in Section V to locate the A1A2 module. Locate position 6 on switch S1. Switch S1 is the same as OPT B. Switch S1 is the switch on the left, when facing the receiver, and position 6 is the third switch position from the left. Place S1 position 6 to the OPEN position to enable FSLO.

If switch S1 is not set to support the type of 2nd LO installed in the receiver, the receiver will not operate properly. At power up, incompatibility is indicated on the front panel significant digits. To correct the error, set switch S1 position 6 to the proper setting for the 2nd LO installed and turn the receiver power off and on again. The error indication should not be indicated on the front panel display.

C.3 CIRCUIT DESCRIPTION

Refer to Figure C-1 for Type 776012-1 Fast Switching 2nd LO Synthesizer schematic diagram. Operation of the 2nd LO remains essentially the same for small frequency steps (less than 100 kHz). 2nd LO operation changes when a large frequency step (equal or greater than 100 kHz), is taken.

When the receiver power is turned on, U15 is turned on. With U15 turned on, transistor Q5 causes the temperature of heater HR1 to begin increasing. As the temperature of heater HR1 increases toward 40°C, feedback from thermister RT2 reduces the output from U15. Reducing the output from U15 causes Q5 to conduct less. When the heater temperature reaches 40°C, Q5 is cutoff. The heater circuit brings the VCO temperature up to the receiver operating temperature more quickly, increasing synthesizer stability during Step/Scan/Lockout operation.

For a small frequency step, the level of the FINE TUNE DISABLE line (connector pin 9) is LOW. This LOW is applied to quad electronic switches U8 and U9, allowing normal 2nd LO operation. Assuming a small frequency step has been made, 2nd LO operation is as follows. The 2nd LO VCO, consisting of W1, Q2, CR3, CR4 and their associated components, produces the 2nd LO frequency. Biasing for the VCO circuit is provided through ripple reducer Q1. Reducing ripple on the supply voltage for the VCO is required for low noise operation.

Oscillator frequencies from the VCO are coupled from Q2 to the input of buffer amplifier U14. From U14, the VCO frequency is split into two paths. One signal path is through R14 to the 2nd LO Output (J1). The other path is to the input of buffer amplifier U1. Biasing for buffer amplifiers U1 and U14 is directed through Q3 and its associated circuitry for ripple reduction.

The output from buffer amplifier U1 is directed to divide by 80/81 prescaler U2. Prescaler U2 is biased by a separate +5 V regulator (U3) for the purpose of isolation. The output frequency from U2 is applied to controller U11. Controller U11 divides the 2nd LO VCO (the variable frequency) to produce a 10 kHz variable signal. U11 also divides a reference 250 kHz signal (the reference frequency) to produce a reference 10 kHz signal. U11's internal frequency/phase comparator determines if the two signals are synchronized. If both signals do not match in frequency and phase, U11 generates an error correction voltage. Correction voltages from U11 are directed through closed contacts of electronic switch U9 to voltage driver U10. Output error correction voltages from U10 are split. One path is to connector pin 10 (FINE TUNE OUT) and the other path is RC filtered by R47-R50 and C49-C52 to eliminate the 10 kHz component. After filtering the error correction voltages are applied through closed contacts of electronic switch U8 to the 2nd LO VCO circuit. Applying an error correction voltage to the varicap diodes (CR3 and CR4) tunes the VCO in the direction required to correct the error in frequency or phase.

Taking a frequency step of 100 kHz or greater causes several changes in the operation of the 2nd LO VCO. The following paragraphs describe the changes that occur within a 3 millisecond time span.

Tuning the receiver frequency from 200 MHz to 210 MHz causes the logic level of the FINE TUNE DISABLE at connector P1 pin 9 to be driven HIGH. This HIGH is directed to electronic switches U8 and U9, closing switch contacts S1 and S2, while opening S2 and S4. Closing U8 switches S1 and S2 causes the +2 to +10 Vdc COARSE TUNE IN voltage (from connector pin 11) to bypass resistor R43. Bypassing R43, through the closed contacts of switch S1, reduces the RC time constant of R43 and C19. Reducing the RC time constant allows the coarse tune VCO frequency to change more quickly. Closing switch S1 causes the VREF to be applied out D2 (U8 pin 11), through R42 to the keep the fine tune VCO at a constant voltage.

Opening U8 switch contact S4 causes the lock detect output from U11 (pin 13) to be interrupted. This forces the 2nd LO LOCK indication at connector pin 25 to float. The Microprocessor sees a HIGH because of the pull up resistor on the Motherboard. With U8 switch S3 open, the error correction voltage from U10 is prevented from reaching the VCO loop.

Closing U9 switch contacts S1 and S2 causes the VREF at U9 pin 5 to be applied to U10 pin 3. Closing switch S2 electrically removes R5 and C57, shorting U10 pin 2 to pin 3. This makes into a voltage follower. As a voltage follower, any voltage at pin 3 is the same voltage at pin 6. The output voltage from U6 is directed to U9 (pin 2) as feedback and also through R59 to connector pin 10, the FINE TUNE OUT. This voltage is applied to the DAC (digital-to-analog converter) on the Analog/Digital (A1A4) module.

Opening U9 switch contacts S3 and S4 keeps U11's phase detector error correction voltages from being applied through U9 to U10. This prevents the error correction voltages from being directed through U8 and tuning the VCO.

After 3 milliseconds, the time provided for fast switching operation, the VCO frequency is almost on frequency. At this time the FINE TUNE DISABLE line again goes LOW, allowing the VCO loop to operate as described for small frequency steps.

The 3rd LO VCO is also contained on the Fast Switching 2nd LO VCO Synthesizer. Transistor Q4, varicap diodes CR6 and CR7, along with their associated components, make up the 3rd LO VCO. From oscillator Q4, 3rd LO VCO frequencies are directed to the input of buffer amplifier U4. LO frequencies from U4 are then split. One signal path leads to two divide-by-10 devices (U6 and U7) that reduce the VCO frequency by a factor of 100. This divided VCO frequency is then applied to connector pin 34 (2.5 MHz OUT). The other signal path is to U5, a divide-by-80/81 device. The output from U5 is applied to controller U13. Controller U13 divides the input frequency (divide by N and divide by A) to produce a 10 kHz variable frequency. Controller U13 divides the input 250 kHz (connector pin 27) to produce a 10 kHz reference frequency. U13's internal frequency/phase comparator determines the relationship of the reference and variable frequencies. Any variation in frequency or phase produces an error correction voltage that is output to U12. Output error correction voltages from U12 are filtered, to eliminate the 10 kHz component, before the tuning voltage is applied to the VCO circuit to tune the 3rd LO VCO. The 3rd LO VCO 10 kHz steps are divided by 100 to provide 100 Hz tuning resolution for the receiver.

C.4 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00681	Catalyst Research Corp. 1421 Clarkview Rd. Baltimore, MD 21209
09359	Minco Products Inc. 7300 Commerce Lane Minneapolis, MI 55432
14674	Corning Glass Works Houghton Park Corning, NY 14830
17217	Gore WL and Associates 555 Paper Mill Rd. P.O. Box 9206 Newark, DE 19711
4W715	Linear Technology 1630 McCarthy Blvd. Milpitas, CA 95035
50157	Mid West Components Inc. 1981 Port City Blvd. Muskegan, MI 49443
51642	Centre Eng. 2820 E. College Ave. State College, PA 16801
62786	Hitachi America Ltd 1800 Bering Drive San Jose, CA 95122

C.5 REPLACEMENT PARTS LIST

C.5.1 TYPE 776012-1 FAST SWITCHING 2nd LO SYNTHESIZER

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Chip: 4700 pF, 10%, 50 V	1	C121CC472K5XAH	31433	
C2	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 35 V	1	MMJ-035-226R-20	14674	
C3	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	18	C1210E471K1GAH	31433	
C4	Same as C3				
C5	Capacitor, Electrolytic, Tantalum: 22 µF, ±20%, 10 V	1	MML-010-226R-20	14674	
C6	Capacitor, Ceramic Disc: .1µF, 20%, 50 V	11	34475-1	14632	
C7 Thru C11	Same as C3				
C12	Capacitor, Ceramic, Monolithic: 470 pF, ±2%, 100 V	1	150-100-NPO-471G	51642	
C13	Same as C3				
C14	Capacitor, Ceramic, Chip: 3.9 pF, 0.25 pF, 500 V	1	ATC700B3R9CP500X	29990	
C15	Capacitor, Ceramic, Disc: 200 pF, ±20%, -0, 500 V	2	603P201	91984	
C16	Capacitor, Ceramic, Chip: 4.7 pF, ±0.25 pF, 500 V	3	ATC100B4R7CP500X	29990	
C17	Same as C15				
C18	Same as C3				
C19	Same as C6				
C20	Same as C3				
C21	Same as C6				
C22	Same as C3				
C23	Same as C3				
C24	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	11	34453-1	14632	
C25	Capacitor, Ceramic, Disc: .47 µF, 20%, 50 V	9	34452-1	14632	
C26	Capacitor, Ceramic, Chip: 18 pF, 5%, 500 V	1	ATC100B180JP500X	29990	
C27	Capacitor, Electrolytic, Tantalum: 2.2 µF, 20%, 25 V	1	MMM-025-225R-20	14674	
C28	Same as C3				
C29	Same as C16				
C30	Same as C29				
C31	Same as C24				
C32	Capacitor, Ceramic, Chip: 100 pF, 5%, 500 V	1	ATC700B101JP500X	29990	
C33 Thru C37	Same as C3				
C38	Same as C6				
C39	Same as C24				
C40 Thru C44	Same as C24				
C45	Same as C25				
C48	Same as C24				
C47	Same as C6				
C48	Same as C6				
C49	Capacitor, Ceramic, Monolithic: 2200 pF, ±2%, 100 V	1	200-100-NPO-222G	51642	

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C50	Same as C24				
C51	Capacitor, Ceramic, Disc: .068 µF, 10%, 100 V	1	CK06BX683K	81349	
C52	Same as C25				
C53 Thru C55	Same as C6				
C56	Capacitor, Electrolytic, Tantalum: 1.0 µF, 20%, 20 V	2	MMF-020-105R-20	14674	
C57	Capacitor, Ceramic, Monolithic: 3300 pF ±2%, 100 V	2	200-100-NPO-332G	51642	
C58	Same as C56				
C59	Same as C57				
C60	Same as C24				
C61 Thru C63	Same as C25				
C64	Capacitor, Ceramic, Disc: .047 µF, 10%, 100 V	2	CK06BX473K	81349	
C65	Same as C64				
C66	Capacitor, Electrolytic, Tanatlum: 100 µF, 10 Vdc, 20%	2	MMJ-010-107R-20	14674	
C67	Not Used				
C68	Capacitor, Ceramic, Disc: 2200 pF, 10%, 200 V	1	CK06BX222K	81349	
C69	Capacitor, Ceramic, Disc: .01 µF, 10%, 200 V	1	CK06BX103K	81349	
C70	Capacitor, Ceramic, Monolithic: 4300 pF, ±2%, 100 V	2	300-100-NPO-432G	51642	
C71	Same as C70				
C72	Capacitor, Ceramic, Disc: .022 pF, 10%, 100 V	2	CK06BX223K	81349	
C73	Same as C72				
C74	Same as C66				
C75	Same as C25				
C76	Same as C25				
C77	Same as C6				
C78	Same as C6				
C79	Same as C25				
C80	Capacitor, Ceramic, Monolithic: 30 pF, ±2%, 100 V	1	150-100-NPO-300G	51642	
C81	Capacitor, Ceramic, Monolithic: 1.5 pF, ±.170, 100 V	1	100-100-NPO-159B	51642	
CR1	Diode	4	1N4449	80131	
CR2	Same as CR1				
CR3	Diode Tuning	4	U11-3102	52673	
CR4	Same as CR3				
CR5	Same as CR1				
CR6	Same as CR3				
CR7	Same as CR3				
CR8	Same as CR1				
HR1	Heater	1	HK913C	09359	
J1	Connector, Receptacle, SMB	1	2012-1511-000	19505	
J2	Connector, Receptacle	1	65624-106	22526	

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L1	Coil, Fixed, Molded: 1.0 µH, 10%	1	1025-20 (75083-13)	99800	
L2	Coil, Fixed: 30 µH, 5%	2	1537-50 (4465-1J)	99800	
L3	Coil, Fixed, Molded: .22 µH, 10%	10	1025-04 (75083-5)	99800	
L4	Same as L3				
L5	Inductor, Air Core	1	22292-159	14632	
L6 Thru L13	Same as L3				
L14	Same as L2				
P1	Receptacle, Assembly	1	66527-018	22526	
P2	Connector, Plug	1	65043-034	22566	
Q1	Transistor	1	2N3906	80131	
Q2	Transistor	2	180565	14632	
Q3	Transistor	1	2N2222A	80131	
Q4	Same as Q2				
Q5	Transistor	1	T1P29	01295	
R1	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	1	CF1/8-18K/J	09021	
R2	Resistor, Fixed, Film: 2.7 kΩ, 5%, 1/8 W	3	CF1/8-2.7K/J	09021	
R3	Resistor, Fixed, Film: 180Ω, 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
R4	Resistor, Fixed, Film: 5.1 kΩ, 5%, 1/8 W	1	CF1/8-5.1K/J	09021	
R5	Resistor, Fixed, Film: 8.2 kΩ, 5%, 1/8 W	1	CF1/8-8.2K/J	09021	
R6	Resistor, Fixed, Film: 560Ω, 5%, 1/8 W	6	CF1/8-560 OHMS/J	09021	
R7	Resistor, Fixed, Film: 3.9 kΩ, 5%, 1/8 W	1	CF1/8-3.9K/J	09021	
R8	Resistor, Fixed, Film: 150Ω, 5%, 1/8 W	2	CF1/8-150 OHMS/J	09021	
R9	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R10	Resistor, Fixed, Film: 15Ω, 5%, 1/8 W	7	CF1/8-15 OHMS/J	09021	
R11	Same as R10				
R12	Resistor, Fixed, Film: 56Ω, 5%, 1/8 W	5	CF1/8-56 OHMS/J	09021	
R13	Same as R12				
R14	Same as R10				
R15	Same as R10				
R16	Same as R6				
R17	Same as R12				
R18	Resistor, Fixed, Film: 5.6 kΩ, 5%, 1/8 W	4	CF1/8-5.6K/J	09021	
R19	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/8 W	7	CF1/8-4.7K/J	09021	
R20	Resistor, Fixed, Film: 47Ω, 5%, 1/8 W	4	CF1/8-47 OHMS/J	09021	
R21	Same as R20				
R22	Same as R19				
R23	Resistor, Variable, Film: 500Ω	2	3262W1-501	80294	
R24	Resistor, Fixed, Film: 10 kΩ, 5%, 1/8 W	3	CF1/8-10K/J	09021	
R25	Same as R24				
R26	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	9	CF1/8-100 OHMS/J	09021	

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R27	Resistor, Fixed, Film: 15 kΩ, 5%, 1/8 W	2	CF1/8-15K/J	09021	
R28	Same as R19				
R29	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/8 W	1	CF1/8-3.3K/J	09021	
R30	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	1	CF1/8-1.0K/J	09021	
R31	Same as R26				
R32	Resistor, Fixed, Film: 120Ω, 5%, 1/8 W	2	CF1/8-120 OHMS/J	09021	
R33	Same as R20				
R34	Same as R32				
R35	Same as R12				
R36 Thru R38	Same as R10				
R39	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/8 W	1	CF1/8-1.5K/J	09021	
R40	Same as R6				
R41	Same as R20				
R42	Resistor, Fixed, Film: 68 kΩ, 5%, 1/8 W	1	CF1/8-68K/J	09021	
R43	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	2	CF1/8-47K/J	09021	
R44	Same as R19				
R45	Same as R26				
R46	Same as R26				
R47	Resistor, Fixed, Film: 12 kΩ, 5%, 1/8 W	1	CF1/8-12K/J	09021	
R48	Same as R2				
R49	Same as R6				
R50	Same as R8				
R51 Thru R53	Same as R26				
R54	Resistor, Fixed, Film: 390 kΩ, 5%, 1/8 W	2	CF1/8-390K/J	09021	
R55	Resistor, Fixed, Film: 3.32 kΩ, 1%, 1/10 W	2	RN55C3321F	81349	
R56	Same as R55				
R57	Same as R26				
R58	Same as R54				
R59	Same as R43				
R60	Same as R19				
R61	Resistor, Fixed, Film: 2.74 kΩ, 1%, 1/10 W	1	RN55C2741F	81349	
R62	Same as R23				
R63	Resistor, Fixed, Film: 3.0 kΩ, 5%, 1/8 W	1	CF1/8-3.0K/J	09021	
R64	Same as R18				
R65	Resistor, Variable, Film: 1 kΩ, 10%, 1/4 W	2	326W1-102	80294	
R66	Same as R27				
R67	Same as R6				
R68	Same as R19				
R69	Resistor, Fixed, Film: 33 kΩ, 5%, 1/8 W	1	CF1/8-33K/J	09021	

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R70	Same as R24				
R71	Same as R2				
R72	Resistor, Fixed, Film: 82 kΩ, 5%, 1/8 W	2	CF1/8-82K/J	09021	
R73	Same as R18				
R74	Same as R18				
R75	Same as R72				
R76	Resistor, Fixed, Film: 4.3 kΩ, 5%, 1/8 W	1	CF1/8-4.3K/J	09021	
R77	Same as R19				
R78	Same as R65				
R79	Same as R6				
R80	Resistor, Fixed, Film: 2.43 kΩ, 1%, 1/10 W	1	RN55C2431F	81349	
R81	Same as R12				
R82	Resistor, Fixed, Film: 56.2 kΩ, 1%, 1/10 W	2	RN55C5622F	81349	
R83	Resistor, Fixed, Film: 100 kΩ, 1%, 1/10 W	1	RN55C1003F	81349	
R84	Resistor, Fixed, Film: 1.0 kΩ, 1%, 1/10 W	1	RN55C1001F	81349	
R85	Same as R26				
R86	Same as R82				
RT1	Thermistor	1	4D103	50157	
RT2	Thermistor	1	4D101	50157	
TP1	Connector, Pin	6	460-3241-02-0400	71279	
TP2 Thru TP6	Same as TP1				
U1	Amplifier	3	GPD-321	24539	
U2	Integrated/Divider	2	SP8719B	52648	
U3	Voltage Regulator	1	LM78L05ACZ	27014	
U4	Same as U1				
U5	Same as U2				
U6	Integrated Circuit	1	SP8685B	52648	
U7	Integrated Circuit	1	SP8690B	52648	
U8	Integrated Circuit	2	DG303CJ	17856	
U9	Same as U8				
U10	Integrated Circuit	2	LT1007CN8	4W715	
U11	Integrated Circuit	2	MC145146P	04713	
U12	Same as U10				
U13	Same as U11				
U14	Same as U1				
U15	Integrated Circuit	1	MC34001P	04713	
VR1	Diode Zener	1	LM329CZ	27014	
W1	Cable Assembly, Coaxial	1	280565-1	14632	

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) CAPACITANCE IS IN μF.
   b) INDUCTANCE IS IN μH.
   c) RESISTANCE IS IN OHMS, ± 5%, 1/8W.
2. FOR DIFFERENCES BETWEEN DASH NUMBERS, SEE TABLE A.

TABLE A

DASH NO.	+V	$+V_1$	$+V_2$	−V	$-V_1$	R2	R82
−1	+15V	$+15V_1$	$+15V_2$	−15V	$-15V_1$	2.7K	56.2K
−2	+12V	$+12V_1$	$+12V_2$	−12V	$-12V_1$	1.2K	68.1K

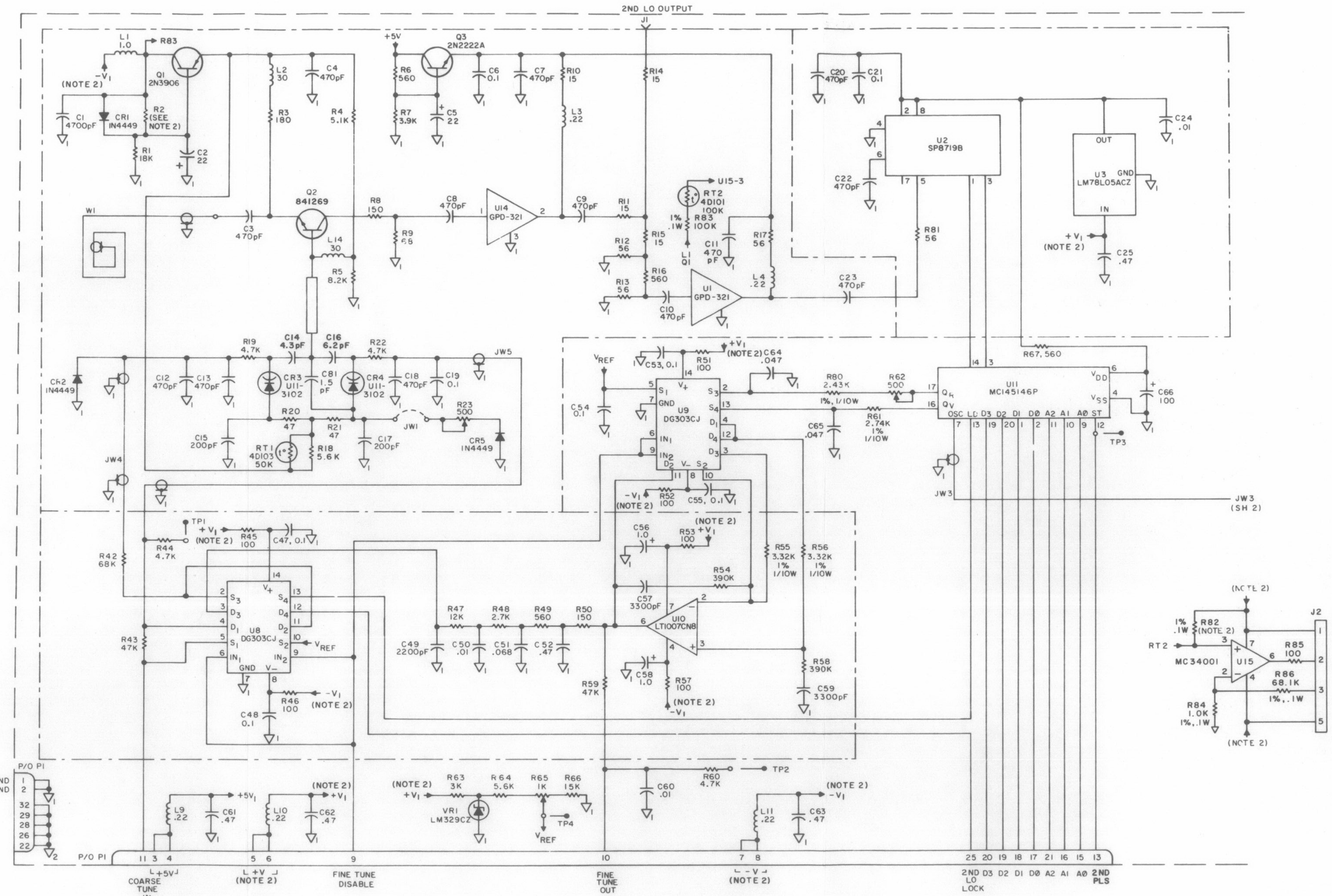

Figure C-11. Type 776012-1, Fast Switching 2nd LO Synthesizer (A1A1A3), Schematic Diagram 580478 (Sheet 1 of 2) (K)

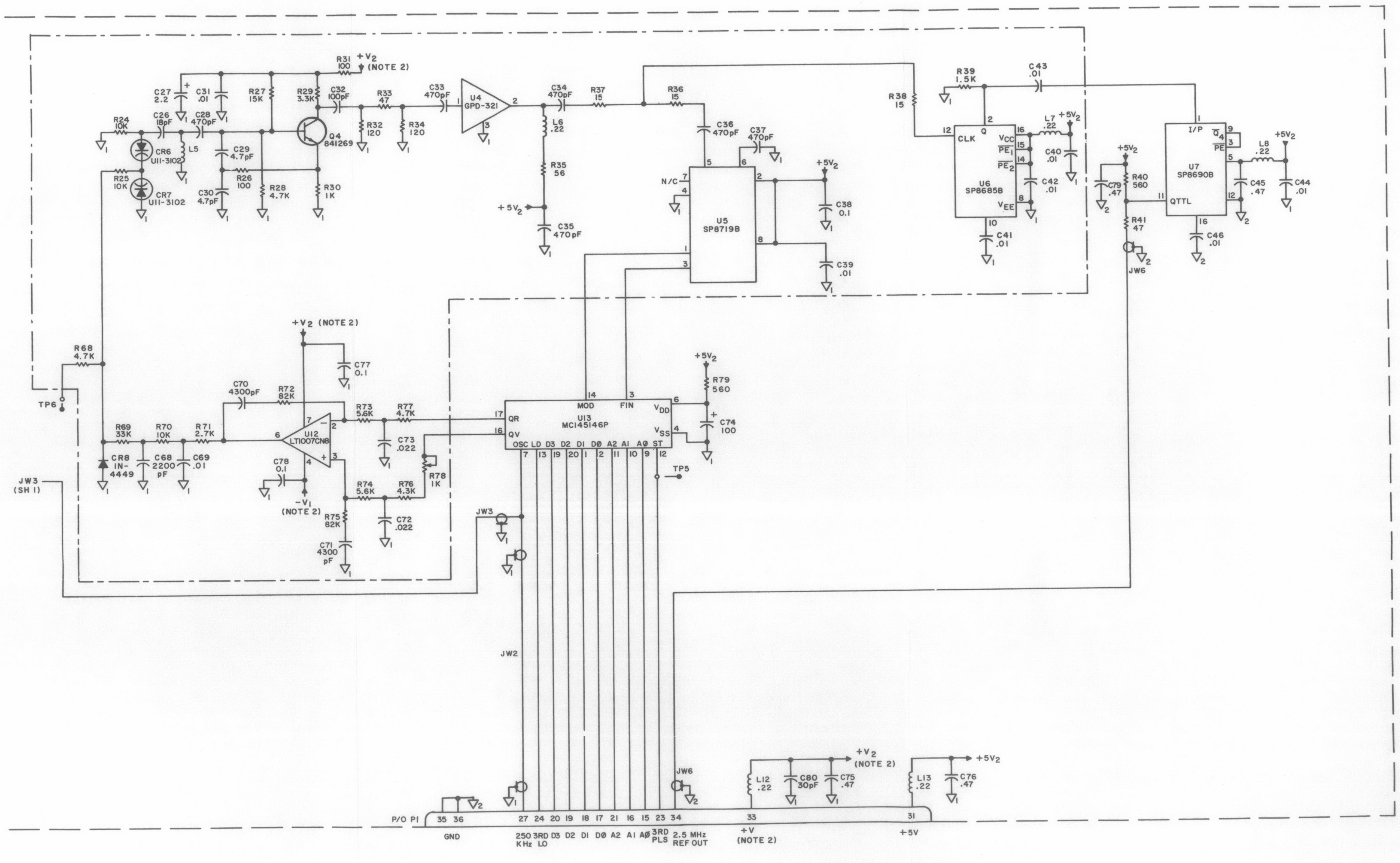

Figure C-11. Type 776012-1, Fast Switching 2nd LO Synthesizer (A1A1A3), Schematic Diagram 580478 (Sheet 2 of 2) (K)

WJ-8615 RECEIVER

APPENDIX D

FEX-16 500-1600 MHz FREQUENCY EXTENDER OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878

August 1988

WARNING

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

PROPRIETARY STATEMENT

This document and subject matter disclosed herein are proprietary items to which Watkins-Johnson Company retains the exclusive right of dissemination, reproduction, manufacture and sale.

This document is provided to the individual or using organization, for their use alone in the direct support of the associated equipment, unless permission for further disclosure is expressly granted in writing.

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LIST OF ILLUSTRATIONS (Continued)

WJ-8615 RECEIVER
FEX-16 500-1600 MHz FREQUENCY EXTENDER OPTION

D.1 ELECTRICAL CHARACTERISTICS

The WJ-8615/FEX-16 Frequency Extender option extends the upper tuning range of the WJ-8615(S1), WJ-8615D(S1), and WJ-8615P Receivers from 500 MHz to 1600 MHz. Six frequency bands are used to cover the 500 MHz to 1600 MHz extended frequency range.

Power for the WJ-8615/FEX-16 Frequency Extender option is provided by the WJ-8615 Receiver. Supply voltages (+15 Vdc, -15 Vdc and +5 Vdc) are applied to connector P1. Motherboard A3A1 (Part 381888-1) distributes these supply voltages to the subassemblies that make up the Frequency Extender option.

Connector P2 receives the control signals and the 1 MHz reference signal from the WJ-8615 Receiver. The control lines are used to select one of the six frequency extender frequency bands. These frequency bands are listed in Table D-1.

Table D-1. WJ-8615/FEX-16 Frequency Bands

Band	Tuned Frequency
1	500 - 600 MHz
2	600 - 700 MHz
3	700 - 900 MHz
4	900 - 1150 MHz
5	1150 - 1350 MHz
6	1350 - 1600 MHz

D.2 MECHANICAL CHARACTERISTICS

The WJ-8615/FEX-16 Frequency Extender assembly (A3) consists of a 5.05 inch x 3.25 inch x 4.5 inch enclosed aluminum chassis with an internal motherboard (A3A1). Three sub-assemblies A3A1A1, A3A1A2, A3A1A3 are plugged into this motherboard. An additional sub-assembly the RF Switch (A3A2) is mounted to the outside of the aluminum chassis.

D.3 EQUIPMENT SUPPLIED

The following list describes the components that are part of this option:

- Type 796781-1 WJ-8615/FEX-16 Frequency Extender
- Part 281990-1 Cable Assembly W7
- EPROMs U9 and U7 for Type 796495-X Microprocessor (A1A3)
- Part 380535-6 Cable Assembly W6

When the FEX-16 option is to be field installed in a WJ-8615P, it is not necessary to replace U7. Therefore, only U9 is provided.

D.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

- WJ-8615(S1) Receiver
  or
- WJ-8615D(S1) Receiver
  or
- WJ-8615P Receiver

D.5 INSTALLATION

The following steps outline the procedures for performing a field installation of the FEX-16 Option in the WJ-8615 Receiver.

1. Remove the screws securing the WJ-8615 Receiver top protective cover and remove the top cover.

2. Remove the hex nut securing connector J10 (ANTENNA) to the rear panel and push the connector inside the receiver.

3. Disconnect P10 of cable W4 (Part 280573-1) from the assembly to which it is connected. This may be another Frequency Extender version, a Tracking Preselector, or a RF Input Filter.

4. Install the new W7 cable assembly (Part 281990-1) (supplied) in the main chassis by extending the N-type connector through the rear panel cutout for connector J10. Secure the connector to the rear panel with the hex nut.

5. If another frequency extender version is currently installed in the receiver then this entire assembly (A3) must first be removed. Removal of any existing FE version can be accomplished by reversing the operations associated with steps 6 through 10 starting with step 10 and working backwards.

NOTE

Retain cable W4 (Part 280573-1), in the event the FEX-16 option is desired to be removed. Reinstalling this cable will allow receiver operation between 20 and 500 MHz.

6. Connect P1 from the FEX-16 option to connector J7 on the receiver Motherboard (A1).

7. Connect P2 from the FEX-16 option to connector J1 on the receiver Motherboard (A1).

8. Connect cable W6 from J4 of the FEX-16 option to J1 of the Tracking Preselector or to the RF Input Attenuator.

9. Loosely thread the four counter-sunk screws through the receiver side panel into the FEX-16 option bottom plate.

10. Ensure the FEX-16 option is properly aligned before securing the FEX-16 bucket to the receiver side panel.

11. Secure P2 (of cable W7) to connector J1 of the Frequency Extender input.

NOTE

When installing the FEX-16 option in a WJ-8615P, only U9 has to be replaced. Therefore, U7 is not provided for field installation of the FEX-16 option in a WJ-8615P.

12. Remove the Microprocessor subassembly (A1A3) from the receiver Motherboard (A1) and replace U9 and U7 with the replacement ICs supplied.

13. Reinstall the Microprocessor into the Motherboard.

14. Set switch S1 on the IEEE-488/Interrupt (A1A2) to the open position to enable the FEX-16 option.

15. Replace and secure the top protective cover.

16. Turn the receiver power on while simultaneously holding the CONTROL key pressed in. This places the receiver in the definitions operation.

17. Rotate the tuning wheel to display dEF On.

18. Press either CHANGE key (Δ or ∇) until FE is displayed.

19. Verify that the FE selection displays On.

D.6 FUNCTIONAL DESCRIPTION

The WJ-8615/FEX-16 Frequency Extender option is a 500 MHz to 1600 MHz frequency extender for use with the WJ-8615 Receiver. This frequency extender consists of: Motherboard (A3A1), RF Switch (A3A2), UHF Preselector (A3A1A1), UHF Preamplifier/Mixer (A3A1A2), and UHF LO Synthesizer (A3A1A3). The Motherboard (A3A1) routes the supply voltages for all of the modules within the frequency extender, with the exception of the RF Switch.

All signals present at the receiver rear panel connector J10 (Antenna) are applied to the RF Switch (A3A2). From the RF Switch signals are routed to either the UHF Preselector (A3A1A1) or to the UHF Preamplifier/Mixer (A3A1A2). Signals routed directly to A3A1A2 by the RF Switch bypass the down-converter circuitry of the FEX-16 and are directed to the main receiver. Routing of the signals is determined by the three control lines (U1, U2, and U3). The logic levels of these control lines determine the signal path through the RF Switch. For tuned frequencies of 499 MHz or less, the RF signal path is directed to the UHF Preamplifier/Mixer and for tuned frequencies greater than 501 MHz, RF signals are directed to the UHF Preselector. For frequencies between 499 MHz and 501 MHz, the RF signal path is determined by the direction the receiver frequency is tuned.

Tuned frequencies between 501 MHz and 1600 MHz are processed through the frequency extender. This frequency range is divided into six frequency bands listed in **Table D-1**. Within the extended tuning range there are two reversals of the final 21.4 MHz IF output spectrum. These spectrum reversals occur due to changes in the overall conversion scheme of the radio (i.e., VHF receiver plus UHF down-converter). One reversal occurs at 500 MHz (nominal) where the upper frequency limit of the main VHF receiver stops and the UHF frequency extender takes over. The other reversal occurs at 1150 MHz (nominal) which is approximately midway through the tuning range of the FEX-16 down-converter. This is the point where the conversion scheme of the extender switches from high-side local oscillator injection to low-side injection.

Due to these reversals in the final IF spectrum a tuning hysteresis of ±1 MHz around the nominal frequency of the two affected band breaks is required for the proper operation of several receiver functions, such as AFC. This tuning hysteresis at the two affected band breaks results in the exact frequency at which the band change occurs to be different depending upon the direction in which the receiver is being tuned. **Table D-2** lists the actual band break frequencies for those which are dependent upon direction of tuning.

Table D-2. Band Breaks for Direction of Tuning

Band #	Tuning Direction	Tuning Range	FEX-16 Status
0	Up	20.0000 - 500.9999 MHz	"Off"
0	Down	498.9999 - 20.0000 MHz	"Off"
1	Up	501.0000 - 599.9999 MHz	"On"
1	Down	599.9999 - 499.0000 MHz	"On"
4	Up	900.0000 - 1150.9999 MHz	"On"
4	Down	1148.9999 - 900.0000 MHz	"On"
5	Up	1151.0000 - 1349.9999 MHz	"On"
5	Down	1349.9999 - 1149.0000 MHz	"On"

RF signals directed to the UHF Preselector are divided into six bands. Frequencies within these bands are directed to the UHF Preamplifier/Mixer. The UHF Preamplifier/Mixer amplifies the RF signal before being mixed with one of the following four LO frequencies:

848 MHz,
944 MHz,
1144 MHz, or
1344 MHz

These four LO signals, produced by the UHF LO Synthesizer, are mixed with the RF signal to produce a difference frequency falling within the VHF tuning range of the receiver. This down-converted signal is then directed out the FEX-16 option to the receiver for signal processing as an ordinary VHF signal. **Table D-3** lists the equations used to determine the receiver operating frequency.

Table D-3. Receiver Operating Frequency Equations

Band #	Formula
1	Receiver Frequency = 848 MHz - Tuned Frequency
2	Receiver Frequency = 944 MHz - Tuned Frequency
3	Receiver Frequency = 1144 MHz - Tuned Frequency
4	Receiver Frequency = 1344 MHz - Tuned Frequency
5	Receiver Frequency = Tuned Frequency - 944 MHz
6	Receiver Frequency = Tuned Frequency - 1144 MHz

As an aid to the operator, **Table D-4** provides examples of the WJ-8615/FEX-16 Frequency Extender tuning scheme.

Table D-4. WJ-8615/FEX-16 Tuning Scheme Examples

Band #	Tuned Frequency	Tuning Direction	Operating Frequency	IF Spectrum
1	499.0000	Down	349.0000	Upright
1	499.0001	Down	348.9999	Upright
1	500.9999	Down	347.0010	Upright
1	501.0000	Up or Down	347.0000	Upright
1	501.0001	Up or Down	346.9999	Upright
1	599.9998	Up or Down	248.0002	Upright
1	599.9999	Up or Down	248.0001	Upright
2	600.0000	Up or Down	344.0000	Upright
2	600.0001	Up or Down	343.9999	Upright
2	699.9998	Up or Down	244.0002	Upright
2	699.9999	Up or Down	244.0001	Upright

Table D-4. WJ-8615/FEX-16 Tuning Scheme Examples (Continued)

Band #	Tuned Frequency	Tuning Direction	Operating Frequency	IF Spectrum
3	700.0000	Up or Down	444.0000	Upright
3	700.0001	Up or Down	443.9999	Upright
3	899.9998	Up or Down	244.0002	Upright
3	899.9999	Up or Down	244.0001	Upright
4	900.0000	Up or Down	444.0000	Upright
4	900.0001	Up or Down	443.9999	Upright
4	1099.9999	Up or Down	244.0001	Upright
4	1100.0000	Up or Down	244.0000	Upright
4	1100.0001	Up or Down	243.9999	Upright
4	1148.9998	Up or Down	195.0002	Upright
4	1148.9999	Up or Down	195.0001	Upright
4	1149.0000	Up	195.0000	Upright
4	1149.0001	Up	194.9999	Upright
4	1150.9998	Up	193.0002	Upright
4	1150.9999	Up	193.0001	Upright
5	1149.0000	Down	195.0000	Inverted
5	1149.0001	Down	194.9999	Inverted
5	1150.9998	Down	193.0002	Inverted
5	1150.9999	Down	193.0001	Inverted
5	1151.0000	Up or Down	207.0000	Inverted
5	1151.0001	Up or Down	207.0001	Inverted
5	1349.9998	Up or Down	405.9998	Inverted
5	1349.9999	Up or Down	405.9999	Inverted
6	1350.0000	Up or Down	206.0000	Inverted
6	1350.0001	Up or Down	206.0001	Inverted
6	1599.9998	Up or Down	455.9998	Inverted
6	1599.9999	Up or Down	455.9999	Inverted

D.7 REPLACEMENT PARTS LIST

D.7.1 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 numbering method follows:

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

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

D.7.2 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 parentheses within the figure titles.

D.7.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00779	AMP, Inc. P. O. Box 3608 Harrisburg, PA 17105
01295	Texas Instruments, Inc. 13500 N. Central Expressway Dallas, TX 75231
02113	Coilcraft, Inc. 1102 Silver Lake Road Cary, IL 60013
02114	Amperex Electronic Corp. 5083 Kings Highway Saugerties, NY 12477
04713	Motorola Semiconductors 5005 East McDowell Road Phoenix, AZ 85008
07263	Fairchild Semiconductors 464 Ellis Street Mountain View, CA 94042
09021	Airco, Incorporated Airco Electronics Bradford, PA 16701
12515	Teledyne Thermatics Hwy 301 South P. O. Box 909 Elm City, NC 27822

Mfr. Code	Name and Address
12969	Unitrode Corp. 5 Forbes Road Lexington, MA 02173
14482	Watkins-Johnson Company 3333 Hillview Avenue Palo Alto, CA 94304
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20878
14674	Corning Glass Works Houghton Park Corning, NY 14830
16179	Omni-Spectra, Inc. 21 Continental Blvd. Merrimack, NH 03054
19505	Applied Engineering Products 300 Seymour Avenue Derby, CT 06418
24539	Avantek, Inc. 3175 Bowers Avenue Santa Clara, CA 95051
24546	Corning Glass Works 550 High Street Bradford, PA 16701
25088	Siemens America, Inc. 186 Wood Avenue S. Iselin, NJ 08830
27014	National Semiconductor Corp. 2950 San Ysidro Way Santa Clara, CA 95051
27956	Relcom 3333 Hillview Palo Alto, CA 94304

Mfr. Code	Name and Address
29990	American Technical Ceramics 1 Norden Lane Huntington Station, NY 11746
31433	Union Carbide Corp. Hwy. 276 S.E. P. O. Box 5928 Greenville, SC 29606
33095	Spectrum Control, Inc. 152 E. Main Street Fairview, PA 16415
34371	Harris Semiconductor Division P. O. Box 883 Melbourne, FL 32901
50101	Frequency Sources, Inc. 16 Maple Road South Chelmsford, MA 01824
51642	Centre Engineering 2830 E. College Avenue State College, PA 16801
52648	Plessey Memories, Inc. DBA Plessey Semiconductors 1674 McGraw Avenue Irvine, CA 92714
54583	TDK Electronics Corporation 755 Eastgate Blvd. Garden City, NY 11530
56289	Sprague Electric Company 87 Marshall Street North Adams, MA 01247
57856	Aero American, Inc. 7830 Balboa Blvd. Van Nuys, CA 91406
59660	Tusonix, Inc. 2155 N. Forbes Blvd. Suite 107 Tuscon, AZ 85745

Mfr. Code	Name and Address	Mfr. Code	Name and Address
70903	Belden Corporation 2000 S. Batavia Avenue Geneva, IL 60134	91293	Johanson Manufacturing Co. P.O. Box 329 Boonton, NJ 07005
71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, MA 02138	91506	Augat, Inc. 33 Perry Avenue P.O. Box 779 Attleboro, MA 02703
73138	Beckman Instruments, Inc. 2500 Harbor Blvd. Fullerton, CA 92634	94902	Coilcraft, Inc. 222 Avenue East Hawarden, IA 51023
75037	Electro Products Division 3M Center St. Paul, MN 55101	96341	Microwave Associates, Inc. South Avenue Burlington, MA 01803
76055	Mallory Controls Division P. O. Box 327 State Road 2820 Frankfort, IN 46041	98291	Sealectro Corporation 225 Hoyt Marmaroneck, NY 10544
80131	Electronic Industries Ass. 2001 Eye Street, N.W. Washington, DC 20006	99800	American Precision Ind., Inc. 270 Quaker Road East Aurora, NY 14052
81312	Winchester Electronics Mainstreet & Hillside Avenue Oakville, CT 06779		

D.7.4 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 maufacturers provided in **paragraph D.7.3** 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.

D.7.5 WJ-8615/FEX-16 FREQUENCY EXTENDER OPTION MAIN CHASSIS

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision 02				
A3	Frequency Extender	1	796781-1	14632	
J10	Connector, Jack: N-Type, Part of W7	1	3004-7388-10	16179	
P10	Connector, Plug, Part of W6	2	50-328-3875-91	98291	
P11	Connector, Plug, Part of W6	1	2150-7521-008	19505	
P12	Same as P10, Part of W7				
W6	Cable Assembly	1	380535-6	14632	
W7	Cable Assembly	1	281990-1	14632	

D.7.5.1 **Type 796781-1 Frequency Extender Assembly** REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision 03				
A1	Motherboard Assembly	1	381888-1	14632	
A2	RF Switch Assembly	1	381812-1	14632	
C1	Capacitor, Ceramic, Feedthru: .05 µF, 300 V	9	54-785-005-503P	33095	
C2 Thru C9	Same as C1				
FB1	Ferrite Bead	20	56-590-65-4A	02114	
FB2 Thru FB20	Same as FB1				
J1	P/O A2				
J2	Not Used				
J3	Not Used				
J4	Connector, Plug, Part of W2	2	50-330-0039-91	98291	
J5	Same as J4, Part of W4				
P1	Connector, Plug	2	1-87499-1	00779	
P2	Same as P1, Part of W2				
P3	Not Used				
P4	Connector, Plug, Part of W2	3	50-328-3875-91	98291	
P5	Same as P4, Part of W3				
P6	Not Used				
P7	Connector, Plug, Part of W3	2	50-024-3875-91	98291	
P8	Same as P7, Part of W4				
P9	Same as P4, Part of W5				
W1	Not Used				
W2	Cable Assembly	1	380535-2	14632	
W3	Cable Assembly	1	380535-3	14632	
W4	Cable Assembly	1	380535-4	14632	
W5	Cable Assembly	1	380535-5	14632	

D.7.5.1.1 **Type 381888-1 Motherboard** REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision 01				
A1	UHF Preselector	1	796769-1	14632	
A2	UHF Preamplifier, Mixer	1	796768-1	14632	
A3	UHF LO Synthesizer	1	798079-2	14632	
C1	Capacitor, Ceramic, Disc: .1 µF, 20%, 50 V	3	34475-1	14632	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: .47 µF, 20%, 50 V	1	34452-1	14632	
C5	Capacitor, Electrolytic, Tantalum: 100 µF, 20%, 35 V	2	MTP107M035P1C	76055	
C6	Same as C5				
C7	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	6	34453-1	14632	
C8 Thru C12	Same as C7				
CR1	Diode	2	1N4446	80131	
CR2	Same as CR1				
E1	Terminal, Forked	9	140-1941-03-01	71279	
E2 Thru E9	Same as E1				
J1	Connector, Receptacle	1	514-AG10D	91506	
L1	Coil, Fixed: .47 µH	1	1025-12	99800	
P1	Connector, Plug, Part of W1	1	3406-0002	75037	
R1	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	1	CF1/8-1.0K/J	09021	
R2	Resistor, Fixed, Film: 2.7 kΩ, 5%, 1/8 W	1	CF1/8-2.7K/J	09021	
R3	Resistor, Fixed, Film: 10Ω, 5%, 1/8 W	1	CF1/8-10 OHMS/J	09021	
R4	Resistor, Fixed, Film: 2.7Ω, 5%, 1/4 W	1	CF1/4-2.7 OHMS/J	09021	
U1	Integrated Circuit	1	LM358N	27014	
W1	Cable Assembly	1	380532-1	14632	
XA1	Connector	2	MK30C-13-195-4381	81312	
XA2	Same as XA1				
XA3	Connector, Receptacle, Part of W1	1	RF30-2852-5	57856	

D.7.5.1.1.1 **Type 796769-1 UHF Preselector** REF DESIG PREFIX A3A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision 04	10	841250-09	14632	
C1	Chip, Capacitor: 220 pF, ±5%, 50 V	10	841250-09	14632	
C2 Thru C6	Same as C1				
C7	Not Used				
C8	Capacitor, Ceramic, Chip: 47 pF, 5%, 500 V	3	ATC100B470JP500X	29990	
C9	Chip, Capacitor: .10 µF, ±20%, 50 V	5	841250-24	14632	
C10	Chip, Capacitor: 1000 pF, ±5%, 50 V	5	841250-13	14632	
C11	Same as C9				
C12	Same as C10				
C13	Same as C9				
C14	Same as C10				
C15	Same as C8				
C16 Thru C19	Same as C1				
C20	Same as C9				
C21	Same as C9				
C22	Same as C10				
C23	Same as C10				
C24	Same as C8				
C25	Chip, Capacitor: 100 pF, ±5%, 50 Vdc	13	841250-07	14632	
C26 Thru C37	Same as C25				
CR1	PIN Diode	12	841320	14632	
CR2	Same as CR1				
CR3	Same as CR1				
CR4	Diode	8	UM9601	12969	
CR5	Same as CR4				
CR6	Same as CR1				
CR7	Same as CR1				
CR8	Same as CR4				
CR9	Same as CR4				
CR10 Thru CR14	Same as CR1				
CR15 Thru CR18	Same as CR4				
CR19	Same as CR1				
CR20	Same as CR1				
E1	Connector, Terminal, Part of W1	3	55-039-3875-91	98291	
E2	Same as E1, Part of W2				

REF DESIG PREFIX A3A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
E3	Same as E1, Part of W3	13	140-1941-02-01	71279	
E4	Terminal, Forked	13	140-1941-02-01	71279	
E5 Thru E16	Same as E4				
FB1	Ferrite, Chip: 120Ω, ±25%, 100 MHz	5	CB30-453215B	54583	
FB2 Thru FB5	Same as FB1				
FB6	Ferrite, Chip: 31Ω, ±25%, 100 MHz	10	CB70-322513B	54583	
FB7 Thru FB15	Same as FB6				
FL1	Filter, Bandpass: 600 MHz = CF, 210 MHz = BW	1	92506	14632	
FL2	Filter, Bandpass: 800 MHz = CF, 210 MHz = BW	1	92507	14632	
FL3	Filter, Bandpass: 1025 MHz = CF, 260 MHz = BW	1	92508	14632	
FL4	Filter, Bandpass: 1250 MHz = CF, 210 MHz = BW	1	92509	14632	
FL5	Filter, Bandpass: 1475 MHz = CF, 260 MHz = BW	1	92510	14632	
JW1	Wire, Electrical, Busswire	AR	8021 22AWG	70903	
JW2 Thru JW8	Same as JW1				
L1	Inductor, Chip: 0.1 μH, ±20%	11	B82422-A3101-M	25088	
L2	Same as L1				
L3	Same as L1				
L4	Inductor, Chip: 0.47 μH, ±20%	2	B82422-A3471-M	25088	
L5	Same as L4				
L6 Thru L13	Same as L1				
P1	Connector, Plug, Part of W1	3	50-328-3875-91	98291	
P2	Same as P1, Part of W2				
P3	Same as P1, Part of W3				
R1	Resistor, Fixed, Chip: 470Ω, 5%, 1/8 W	10	841296-57	14632	
R2 Thru R4	Same as R1				
R5	Resistor, Fixed, Chip: 1.2 kΩ, 5%, 1/8 W	3	841296-67	14632	
R6	Same as R1				
R7	Same as R1				
R8	Same as R5				
R9 Thru R12	Same as R1				
R13	Same as R5				

REF DESIG PREFIX A3A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
W1	Cable Assembly	1	17300-439-1	14632	
W2	Cable Assembly	1	17300-439-2	14632	
W3	Cable Assembly	1	17300-439-3	14632	

D.7.5.1.1.2 **Type 796768-1 500-1600 MHz UHF Preamplifier/Mixer**

REF DESIG PREFIX A3A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision 04				
C1	Chip, Capacitor: .01 μF, ±10%, 50 Vdc	6	841250-19	14632	
C2	Same as C1				
C3	Chip, Capacitor: 1000 pF, ±5%, 50 V	14	841250-13	14632	
C4	Same as C1				
C5	Same as C3				
C6	Same as C3				
C7	Same as C1				
C8	Same as C1				
C9	Same as C3				
C10	Same as C3				
C11	Chip, Capacitor: .047 μF, ±10%, 50 Vdc	2	841250-23	14632	
C12	Chip, Capacitor: 220 pF, ±5%, 50 V	1	841250-09	14632	
C13	Capacitor, Ceramic, Chip: 4.3 pF, ±0.5 pF, 500 V	2	ATC700B4R3DP500X	29990	
C14	Same as C13				
C15	Same as C3				
C16	Same as C3				
C17	Chip, Capacitor: .10 μF, ±20%, 50 V	12	841250-24	14632	
C18 Thru C20	Same as C17				
C21 Thru C23	Same as C3				
C24 Thru C29	Same as C17				
C30	Capacitor, Electrolytic, Chip: 10 μF, 20%, 16 V	1	841293-16	14632	
C31	Same as C17				
C32	Capacitor, Electrolytic, Chip: 4.7 μF, 20%, 25 V	2	841293-13	14632	
C33	Same as C17				
C34	Same as C32				
C35	Same as C11				
C36	Capacitor, Ceramic, Chip: 47 pF, 5%, 500 V	2	ATC100B470JP500X	29990	
C37	Same as C36				
C38	Same as C1				
C39	Same as C3				
C40	Chip, Capacitor: 100 pF, ±5%, 50 Vdc	3	841250-07	14632	
C41	Same as C40				
C42	Same as C3				
C43	Same as C3				
C44	Same as C40				
C45	Same as C3				
CR1	Diode	4	UM9601	12969	

REF DESIG PREFIX A3A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
CR2	Same as CR1				
CR3	PIN Diode	5	841320	14632	
CR4	Same as CR3				
CR5	Same as CR1				
CR6	Same as CR3				
CR7	Same as CR3				
CR8	Same as CR1				
CR9	Same as CR3				
E1	Connector, Pin	14	460-3241-02-0400	71279	
E2 Thru E14	Same as E1				
FB1	Ferrite, Chip: 120Ω, ±25%, 100 MHz	3	CB30-453215B	54583	
FB2	Same as FB1				
FB3	Same as FB1				
FB4	Ferrite, Chip: 31Ω, ±25%, 100 MHz	6	CB70-322513B	54583	
FB5 Thru FB9	Same as FB4				
FL1	Filter, Low Pass: 495-1155 MHz	1	92519	14632	
FL2	Filter, Highpass: 1145-1810 MHz	1	92520	14632	
J1	Connector, Receptacle	5	1009-7511-000	19505	
J2 Thru J5	Same as J1				
JW1	Wire, Teflon	7	26-SOLID WHT	12515	
JW2 Thru JW7	Same as JW1				
L1	Inductor, Chip: 0.47 μH, ±20%	2	B82422-A3471-M	25088	
L2	Inductor, Chip: 0.1 μH, ±20%	2	B82422-A3101-M	25088	
L3	Same as L2				
L4	Inductor: 47 μH, 10%	1	1611LS-473	02113	
L5	Same as L1				
L6	Inductor, Chip: 15 mH, ±20%	1	1008CT-150	94902	
L7	Inductor, Chip: 4.7 μH, ±20%	1	B82422-A1472-M	25088	
Q1	Transistor	2	MMBT-4403	04713	
Q2	Transistor	2	MMBT2222A	04713	
Q3	Same as Q1				
Q4	Same as Q2				
R1	Resistor, Fixed, Chip: 470Ω, 5%, 1/8 W	4	841296-57	14632	
R2	Resistor, Fixed, Chip: 1.2 kΩ, 5%, 1/8 W	2	841296-67	14632	
R3	Same as R1				
R4	Resistor, Fixed, Chip: 2.7 kΩ, 5%, 1/8 W	1	841296-75	14632	

REF DESIG PREFIX A3A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R5	Resistor, Fixed, Chip: 2.2 kΩ, 5%, 1/8 W	1	841296-73	14632	
R6	Resistor, Fixed, Chip: 2.4 kΩ, 5%, 1/8 W	1	841296-74	14632	
R7	Same as R2				
R8	Same as R1				
R9	Same as R1				
R10	Resistor, Fixed, Chip: 20 kΩ, 5%, 1/8 W	4	841296-96	14632	
R11	Resistor, Fixed, Chip: 4.7 kΩ, 5%, 1/8 W	2	841296-81	14632	
R12	Same as R10				
R13	Same as R10				
R14	Same as R11				
R15	Same as R10				
R16	Resistor, Fixed, Chip: 270Ω, 5%, 1/8 W	3	841296-51	14632	
R17	Same as R16				
R18	Same as R16				
U1	Amplifier	1	A12	14482	
U2	Amplifier	1	UTO-2024	24539	
U3	Amplifier	1	A28	27956	
U4	Attenuator	1	G1	27956	
U5	Mixer, Balanced	1	WJ-M8T	14482	
U6	Integrated Circuit	3	LM324M	27014	
U7	Integrated Circuit	1	8674HC32S014N	14632	
U8	Integrated Circuit	1	8674HC237S016N	14632	
U9	Integrated Circuit	1	8674HC04S014N	14632	
U10	Same as U6				
U11	Same as U6				

D.7.5.1.1.3 **Type 798079-2 UHF LO Synthesizer** REF DESIG PREFIX A3A1A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision E1				
A1	UHF Variable Divider	1	390421-1	14632	
A2	UHF Oscillator	1	796719-1	14632	
C1	Capacitor, Ceramic, Monolithic: 1.0 pF, ±.1 pF, 100 V	1	100-100-NPO-109B	51642	
FB1	Ferrite Bead	12	56-590-65-4A	02114	
FB2 Thru FB12	Same as FB1				
FL1	Filter	7	33728-18	14632	
FL2 Thru FL7	Same as FL1				
J1	Not Used				
J2	Connector, Receptacle	1	1012-1511-000	19505	
L1	Coil, Fixed	4	16209-4	14632	
L2 Thru L4	Same as L1				
R1	Resistor, Fixed, Film: 270Ω, 5%, 1/8 W	3	CF1/8-270 OHMS/J	09021	
R2	Same as R1				
R3	Same as R1				
R4	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	

D.7.5.1.1.3.1 **Part 390421-1 UHF Variable Divider** REF DESIG PREFIX A3A1A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision P1				
C1	Capacitor, Ceramic, Disc: 470 pF, ±20%, 1000 V	7	8381KVZ5U470	59660	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	6	34453-1	14632	
C5 Thru C7	Same as C4				
C8	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	5	196D475X0035JE3	56289	
C9	Same as C8				
C10	Capacitor, Ceramic, Disc: .1 µF, 20%, 50 V	1	34475-1	14632	
C11	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	9	C1210C471K1GAC	31433	
C12 Thru C18	Same as C11				
C19	Capacitor, Ceramic, Disc: .47 µF, 20%, 50 V	2	34452-1	14632	
C20	Same as C8				
C21	Same as C19				
C22	Same as C4				
C23	Same as C1				
C24	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	1	196D226X0010JE3	56289	
C25	Same as C1				
C26	Same as C8				
C27	Same as C8				
C28	Same as C1				
C29	Same as C1				
C30	Same as C4				
C31	Same as C11				
CR1	Diode, PIN	1	GC4211-15	50101	
E1	Terminal, Forked	17	140-1941-02-01	71279	
E2 Thru E7	Same as E1				
E8	Not Used				
E9 Thru E11	Same as E1				
E12	Not Used				
E13	Same as E1				
E14	Same as E1				
E15	Not Used				
E16 Thru E20	Same as E1				
L1	Inductor	1	22292-170	14632	

REF DESIG PREFIX A3A1A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
Q1	Transistor	2	2N3904	80131	
Q2	Same as Q1				
R1	Resistor, Fixed, Film: 10 kΩ, 5%, 1/4 W	7	CF1/4-10K/J	09021	
R2 Thru R6	Same as R1				
R7	Resistor, Fixed, Film: 27Ω, 5%, 1/4 W	1	CF1/4-27 OHMS/J	09021	
R8	Resistor, Fixed, Film: 100Ω, 5%, 1/4 W	2	CF1/4-100 OHMS.J	09021	
R9	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R10	Resistor, Fixed, Film: 47Ω, 5%, 1/8 W	1	CF1/8-47 OHMS/J	09021	
R11	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	
R12	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/4 W	2	CF1/4-1K/J	09021	
R13	Resistor, Fixed, Film: 15 kΩ, 5%, 1/4 W	1	CF1/4-15K/J	09021	
R14	Resistor, Fixed, Film: 3.6 kΩ, 5%, 1/4 W	1	CF1/4-3.6K/J	09021	
R15	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/4 W	1	CF1/4-1.5K/J	09021	
R16	Not Used				
R17	Resistor, Fixed, Film: 330Ω, 5%, 1/4 W	1	CF1/4-330 OHMS/J	09021	
R18	Same as R12				
R19	Resistor, Trimmer, Film: 2 kΩ, 10%, 1/2 W	1	62PAR2K	73138	
R20	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/4 W	1	CF1/4-3.3K/J	09021	
R21	Same as R1				
R22	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/4 W	1	CF1/4-4.7K/J	09021	
R23	Same as R8				
R24	Resistor, Fixed, Film: 4.7 MΩ, 5%, 1/4 W	1	CF1/4-4.7M/J	09021	
R25	Resistor, Fixed, Film: 180Ω, 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
RA1	Heatsink, Integrated Circuit	1	290509-1	14632	
U1	Integrated Circuit	1	SP8695B/DG	52648	
U2	Integrated Circuit	1	SP8602B/CM	52648	
U3	Integrated Circuit	1	SP8611B/DG	52648	
U4	Amplifier	1	GPD-410	24539	
U5	Integrated Circuit	1	HA1-4741-5	34371	
U6	Integrated Circuit	2	SN74LS161AN	01295	
U7	Same as U6				
U8	Integrated Circuit	1	SN74LS138N	01295	
U9	Integrated Circuit	1	SN74LS04N	01295	
U10	Integrated Circuit	1	MC4044P	04713	

D.7.5.1.1.3.2 **Type 796719-1 UHF Oscillator Assembly** REF DESIG PREFIX A3A1A3A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
A1	UHF Oscillator PC Assembly	1	381473-1	14632	
C1	Capacitor, Feedthru, EMI: 1000 pF, 100 V	6	54-790-018	33095	
C2 Thru C6	Same as C1				
E1	Terminal, Feedthru, Insulated	1	001-1007	98291	
J1	Connector, Receptacle	1	1012-1511-000	19505	
R1	Resistor, Fixed, Film: 22 kΩ, 5%, 1/8 W	4	CF1/8-11K/J	09021	
R2 Thru R4	Same as R1				

D.7.5.1.1.3.2.1 **Part 381473-1 UHF Oscillator** REF DESIG PREFIX A3A1A3A2A1

REF DESIGC	DESCRIPTION9	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
C1	CAP PAD IPF P/O PC Artwork				
C2	Capacitor, Ceramic, Chip: 1.5 pF, ±.1 pF, 500 V	3	ATC175B1R5BP500X	29990	
C3	Capacitor, Variable, Air: .4-2.5 pF, 500 V	4	27283	91293	
C4	Capacitor, Ceramic, Chip: 5.6 pF, ±.1 pF, 500 V	2	ATC175B5R6BP500X	29990	
C5	Same as C1				
C6	Same as C2				
C7	Same as C3				
C8	Same as C4				
C9	Same as C1				
C10	Same as C2				
C11	Same as C3				
C12	Capacitor, Ceramic, Chip: 4.7 pF, ±.1 pF, 500 V	1	ATC175B4R7BP500X	29990	
C13	Same as C1				
C14	Capacitor, Ceramic, Chip: 1.0 pF, ±.1 pF, 500 V	1	ATC175B1R0BP500X	29990	
C15	Same as C3				
C16	Capacitor, Ceramic, Chip: 3.9 pF, ±.1 pF, 500 V	1	ATC175B3R9BP500X	29990	
C17	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 15 V	1	MMS-015-226R-20	14674	
C18	Capacitor, Ceramic, Monolithic: 1.5 pF, ±.1 pF, 100 V	1	100-100-NPO-209B	51642	
C19	Capacitor, Ceramic, Monolithic: 2.0 pF, ±.1 pF, 100 V	2	100-100-NPO-249B	51642	
C20	Capacitor, Ceramic, Monolithic: 2.0 pF, ±.1 pF, 100 V	2	100-100-NPO-109B	51642	
C21	Same as C20				
C22	Same as C18				
C23	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	1	34453-1	14632	
CR1	Tuning Varactor	4	MA-45240-31	96341	
CR2 Thru CR4	Same as CR1				
CR5	Diode	1	1N4449	80131	
JW1	Wire, Elec, Buss, AWG, Bus Wire	AR	8021 22AWG	70903	
JW2 Thru JW4	Same as JW1				
L1	Coil, Fixed	9	190187-1	14632	
L2 Thru L9	Same as L1				
L10	Coil, Fixed	3	180683-1	14632	
L11	Same as L10				
L12	Same as L10				
Q1	Transistor	4	MMBT2222A	04713	
Q2	Transistor	4	841269	14632	
Q3	Same as Q2				
Q4	Same as Q1				

REF DESIG PREFIX A3A1A3A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
Q5	Same as Q2				
Q6	Same as Q1				
Q7	Same as Q2				
Q8	Same as Q1				
Q9	Transistor	1	MMBT-3906	04713	
R1	Resistor, Fixed, Film: 1.8 kΩ, 5%, 1/8 W	6	C3-1.8K-5PCT	24546	
R2	Resistor, Fixed, Film: 130Ω, 5%, 1/4 W	1	CF1/4-130 OHMS/J	09021	
R3	Same as R1				
R4	Resistor, Fixed, Film: 150Ω, 5%, 1/4 W	1	CF1/4-150 OHMS/J	09021	
R5	Same as R1				
R6	Resistor, Fixed, Film: 180Ω, 5%, 1/4 W	1	CF1/4-180 OHMS/J	09021	
R7	Same as R1				
R8	Resistor, Fixed, Film: 110Ω, 5%, 1/4 W	1	CF1/4-110 OHMS/J	09021	
R9	Same as R1				
R10	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/8 W	1	C3-3.3K-5 PCT	24546	
R11	Same as R1				
R12	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	1	C3-18K-5PCT	24546	
R13	Not Used				
R14	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	2	C3-100R-5PCT	24546	
R15	Same as R14				
T1	Power Divider	2	281926-1	14632	
T2	Same as T1				

D.7.5.1.2 **Part 381812-1 RF Switch** REF DESIG PREFIX A3A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision 05				
C1	Capacitor, Ceramic, Chip: 4.3 pF, ±0.5 pF, 500 V	2	ATC700B4R3DP500X	29990	
C2	Chip, Capacitor: .047 µF, ±10%, 50 Vdc	2	841250-23	14632	
C3	Capacitor, Ceramic, Chip: 47 pF, ±5%, 500 V	1	ATC100B470JP500X	29990	
C4	Capacitor, Ceramic, Chip: 8.2 pF, ±0.25 pF, 500 V	1	ATC700B8R2CP500X	29990	
C5	Same as C1				
C6	Chip, Capacitor: 1000 pF, ±5%, 50 V	2	841250-13	14632	
C7	Same as C2				
C8	Same as C6				
C9	Chip, Capacitor: 100 pF, ±5%, 50 Vdc	1	841250-07	14632	
C10	Chip, Capacitor: .01 µF, ±10%, 50 Vdc	1	841250-19	14632	
CR1	Not Used				
CR2	Diode	1	UM9601	12969	
CR3	Pin Diode	3	841320	14632	
CR4	Same as CR3				
CR5	Same as CR3				
E1	Terminal, Forked	2	140-1941-02-01	71279	
E2	Same as E1				
E3	Cable, Terminal, PC Mount, Part of W1	1	8146-7521-008	19505	
J1	Connector, Receptacle: SMC	2	1110-1511-000	19505	
J2	Not Used				
J3	Same as J1				
L1	Coil, Fixed	2	170160-1	14632	
L2	Same as L1				
L3	Inductor, Chip: 8.2 µH, ±20%	1	B82412-A1822-M	25088	
L4	Coil, Fixed	1	281992-1	14632	
L5	Inductor, Chip: 0.068 µH, ±20%	1	B82412-A3680-M	25088	
P1	Connector, Plug, Part of W1	1	50-328-3875-91	98291	
R1	Resistor, Fixed, Chip: 470Ω, 5%, 1/8 W	2	841296-57	14632	
R2	Resistor, Fixed, Chip: 1.0 kΩ, 5%, 1/8 W	1	841296-65	14632	
R3	Same as R1				
R4	Resistor, Fixed, Chip: 10 kΩ, 5%, 1/8 W	1	841296-89	14632	
W1	Cable Assembly	1	380535-8	14632	

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

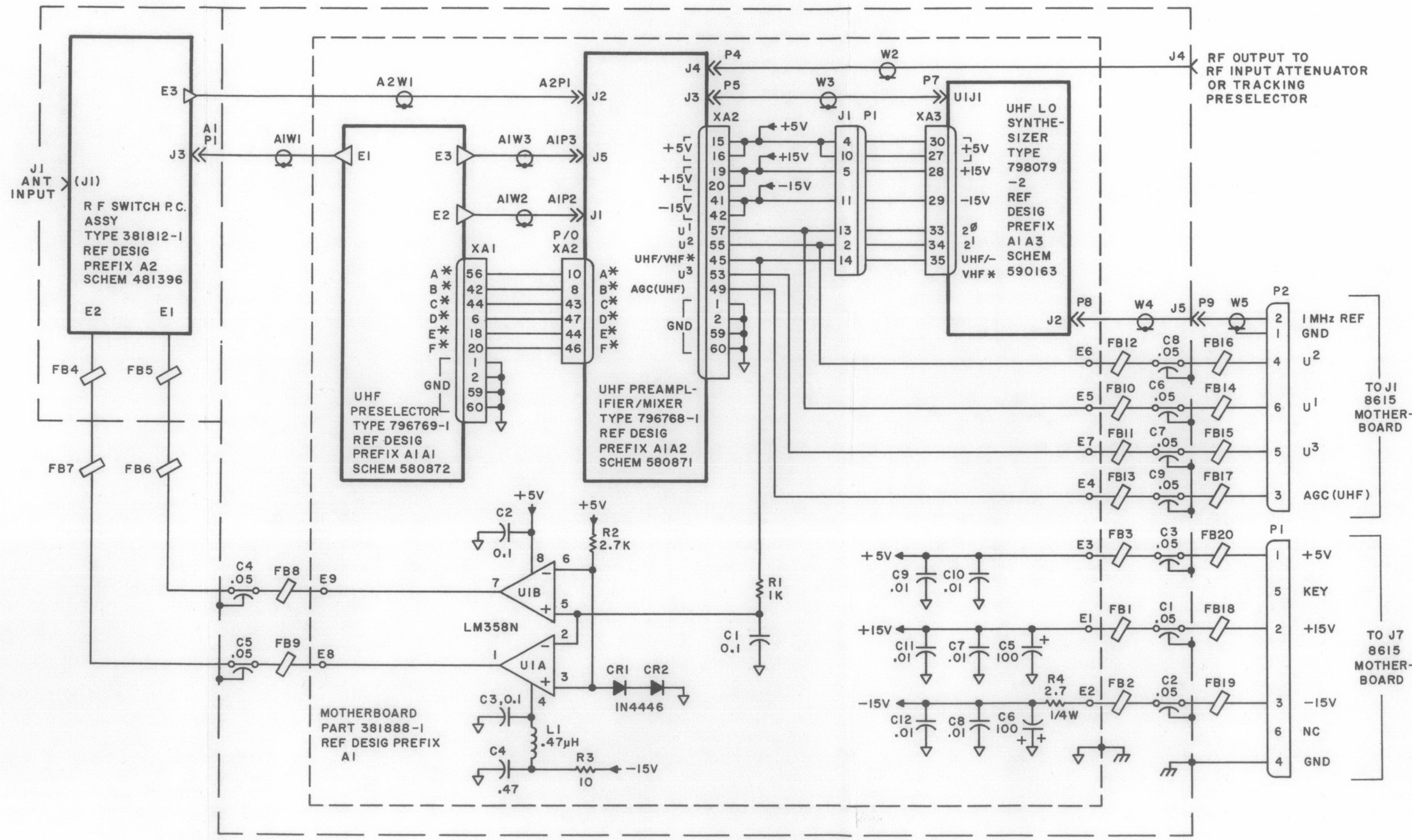


Figure D-1. Type 796781-1, Frequency Extender (A3), Schematic Diagram 481439 (02)

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

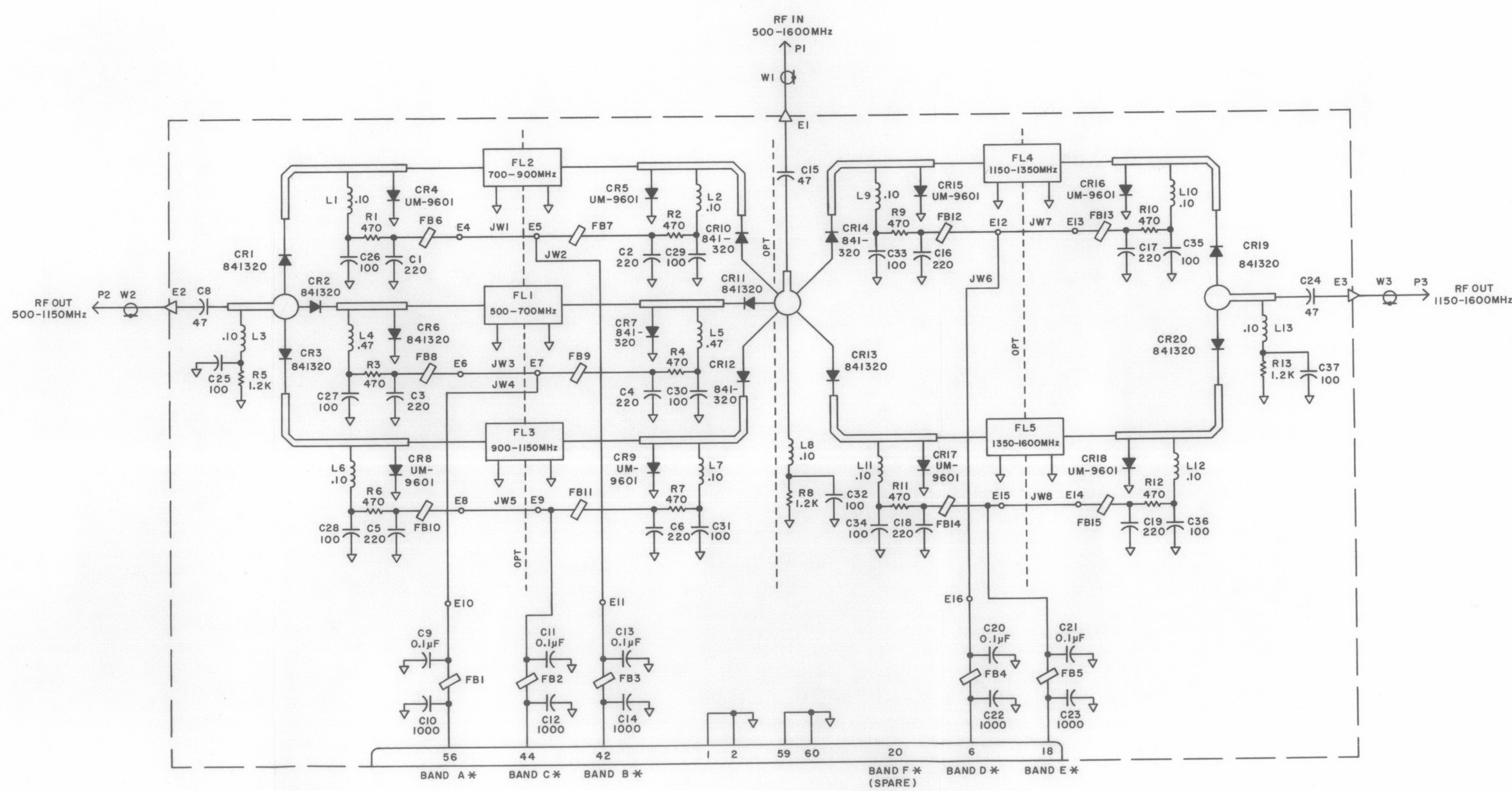
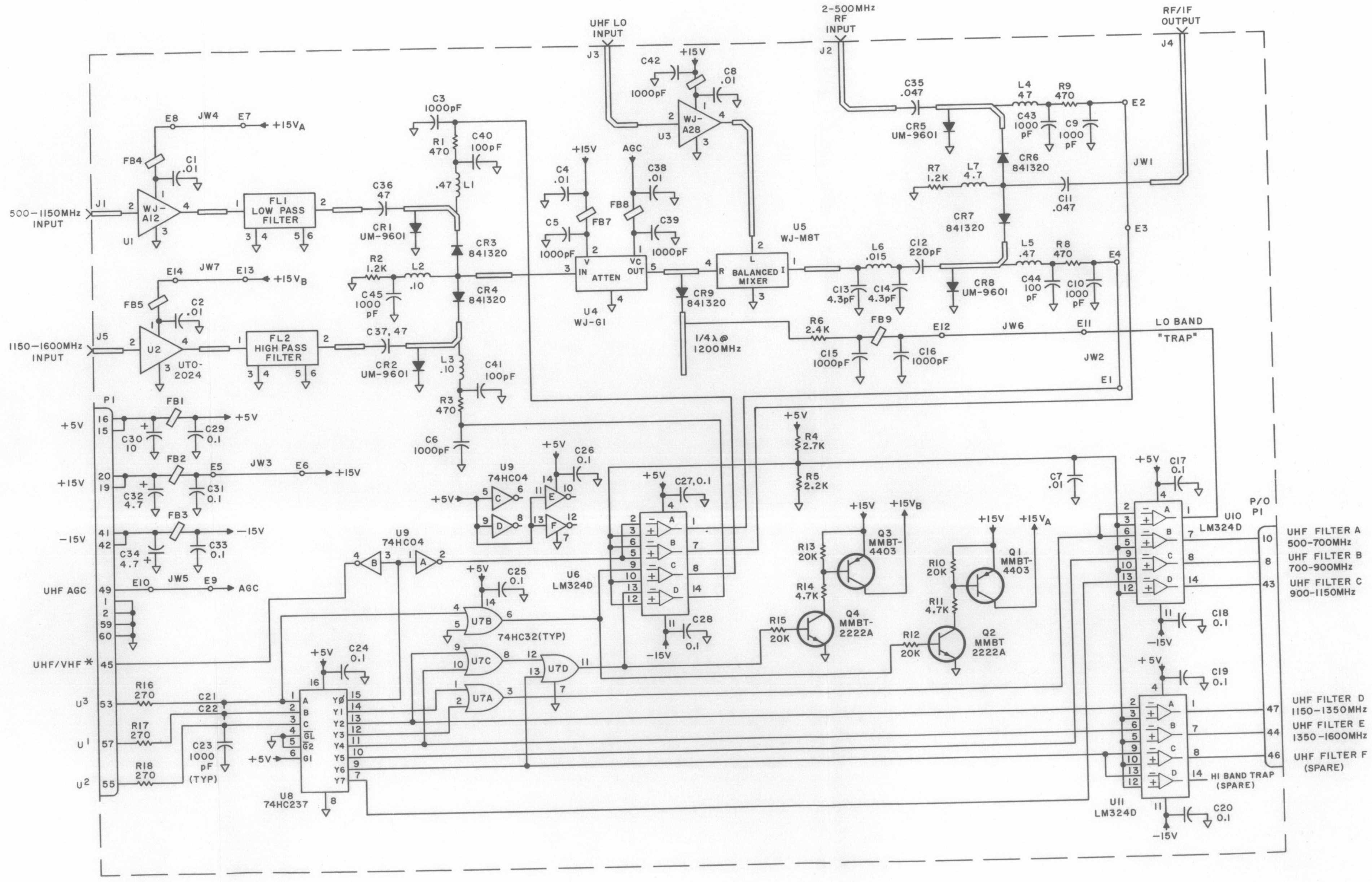


Figure D-2. Type 796769-1, HF Preselector 500-1600 MHz (A3A1A1), Schematic Diagram 580872 (02)



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
   b) CAPACITANCE IS IN µF.
   c) INDUCTANCE IS IN µH.

Figure D-3. Type 796768-1, UHF Amplifier/Mixer 500-1600 MHz (A3A1A2), Schematic Diagram 580871 (03)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
2. DIFFERENCE BETWEEN TYPES IS MECHANICAL ONLY.

TIMING DIAGRAM

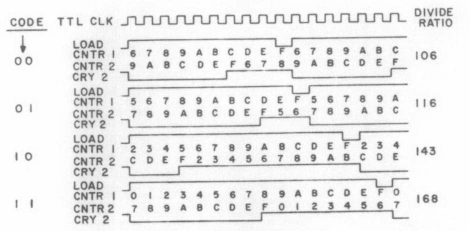
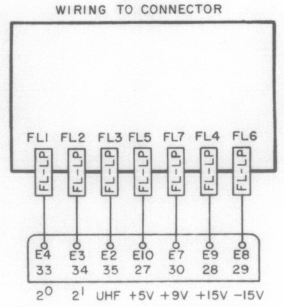


TABLE 1

INPUTS UHF 2^1 2^0		CONTR 1 D C B A	CONTR 2 D C B A
1 0 0	→	0 1 1 0	1 0 0 1
1 0 1	→	0 1 0 1	0 1 1 1
1 1 0	→	0 0 1 0	1 1 0 0
1 1 1	→	0 0 0 0	0 1 1 1

DETAIL A
WIRING TO CONNECTOR



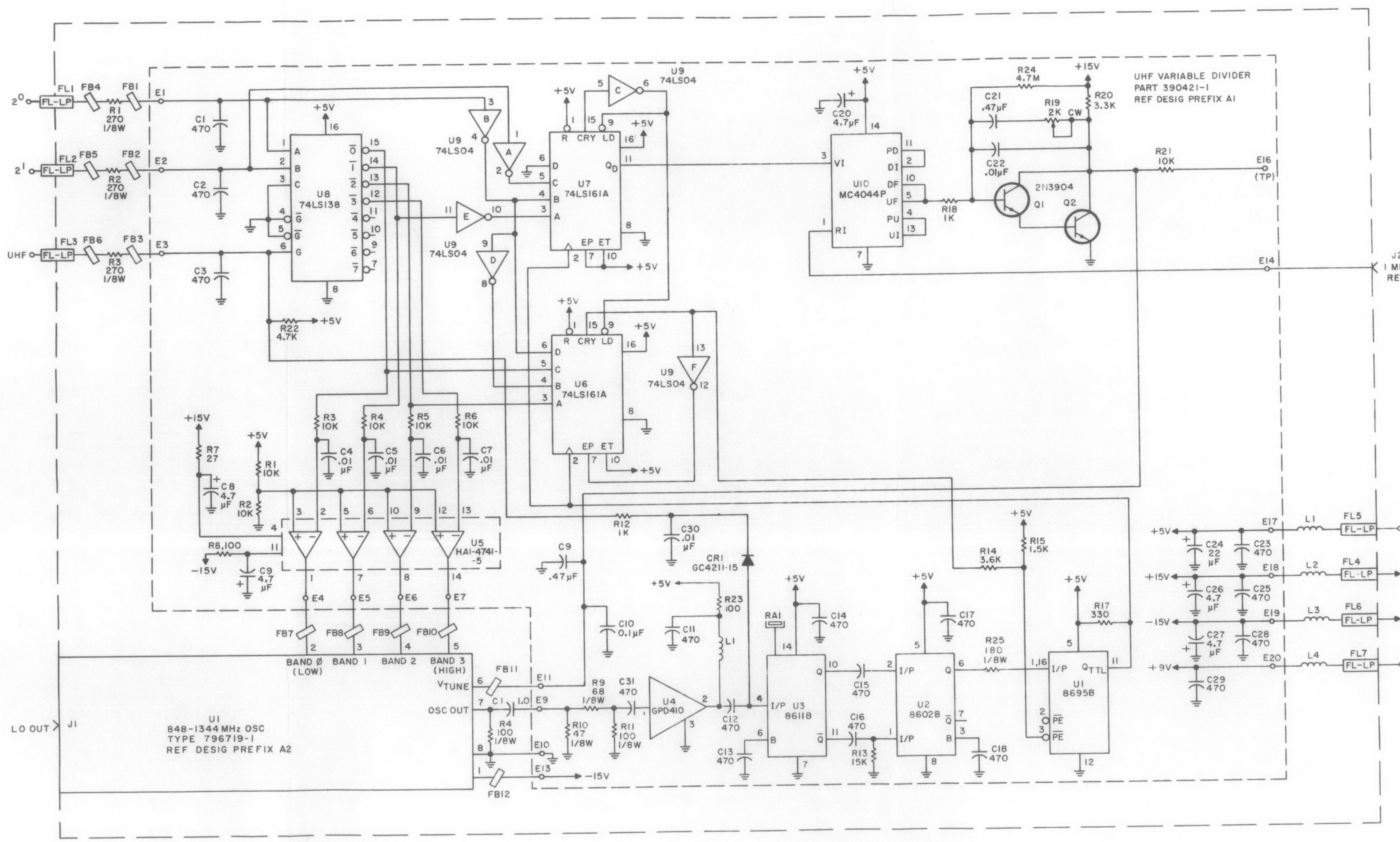


Figure D-4. Type 798079-2, UHF LO Synthesizer (A3A1A3), Schematic Diagram 590163 (N)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
b) CAPACITANCE IS IN pF.
c) INDUCTANCE IS IN μH.
2. CR1 THRU CR4 ARE TYPE MA-45240-31.

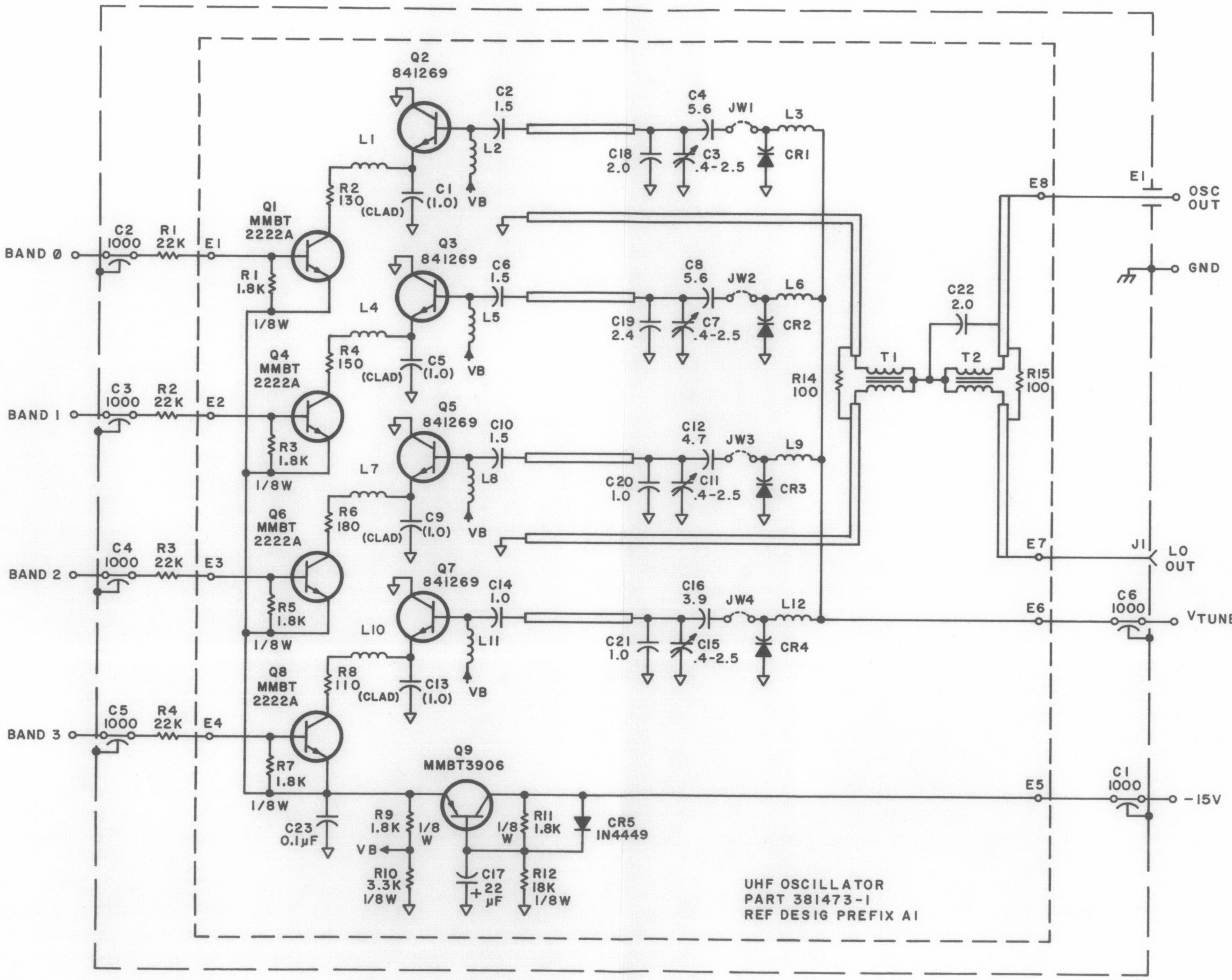


Figure D-5. Type 796719-1, UHF Oscillator (A3A1A3A2), Schematic Diagram 481200 (A)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
c) CAPACITANCE IS IN pF.
d) INDUCTANCE IS IN nH.

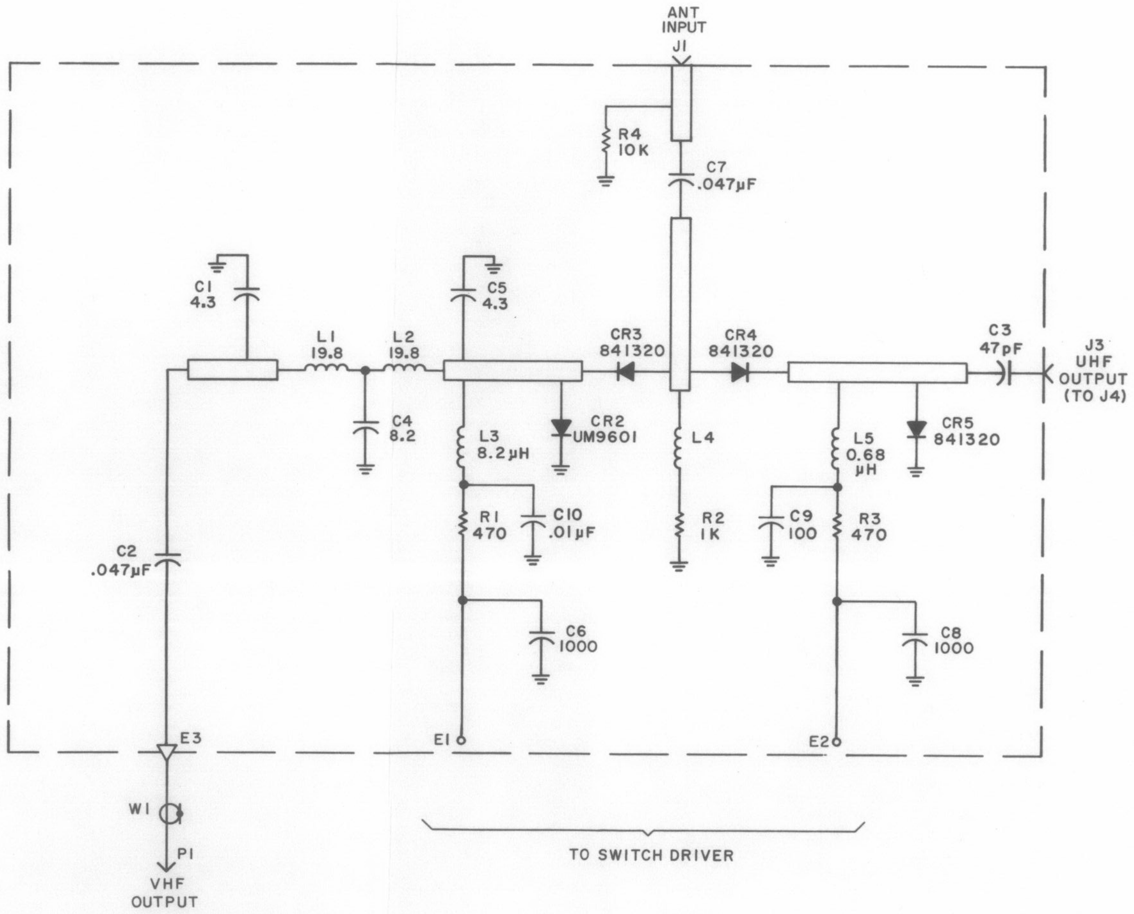


Figure D-6. Part 381812-1, R.F. Switch (A3A2), Schematic Diagram 481396 (03)

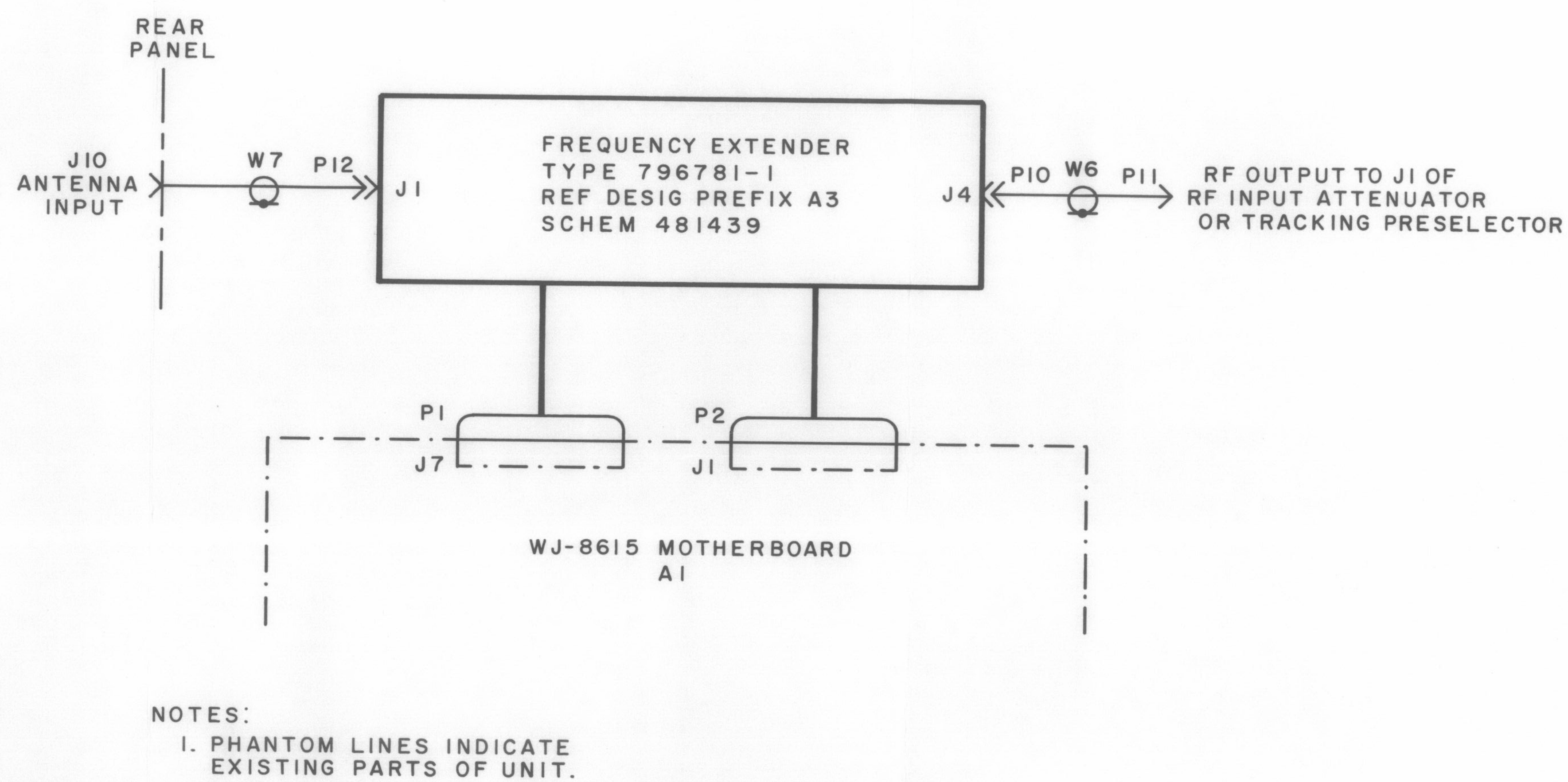


Figure D-7. Type WJ-8615 FEX 16 Frequency Extender Option, Main Chassis Schematic Diagram 381918 (01)

WJ-8615 RECEIVER

APPENDIX E

WIDEBAND OUTPUT OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878

May 1988

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TYPE 796318-1 WIDEBAND OUTPUT OPTION (A2)

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TYPE 796318-1 WIDEBAND OUTPUT OPTION (A2)

E.1 GENERAL DESCRIPTION

The Type 796318-1 Wideband Output option (A2) provides an 8-MHz wide IF signal, centered about 21.4 MHz, to rear panel connector J9 (SM OUT). The wideband output (WBO) is a gain leveled IF signal with a nominal output impedance of 50 ohms.

E.2 ELECTRICAL DESCRIPTION

The Type 796318-1 WBO option assembly is enclosed in a metal chassis. The supply voltage (+15 Vdc) is supplied via WJ-8615 Motherboard connector, A1J5. Input signals are applied to connector J1 and output signals are present at connector J2.

E.3 MECHANICAL DESCRIPTION

WBO option Type 796318-1 measures 3.4 inches in length, 0.9 inches in width, and 0.65 inches in height. This assembly contains printed circuit board Part 280515-1 (A2A1), which mounts to the inside of the WBO assembly. The internal components of the WBO assembly may be accessed by removal of a press-on cover. BNC connector J2, SMB connector J1, capacitor C1, and forked terminal E1 are all mounted to the outside of the WBO assembly.

Two cross-head screws secure the WBO assembly to the inside of WJ-8615, Receiver's rear panel. Connector J2 protrudes through a cutout in the receiver rear panel. On the rear panel J2 is given the reference designation of J9.

E.4 EQUIPMENT SUPPLIED

- Type 796318-1 WBO assembly

E.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED

- WJ-8615 Receiver

E.6 CONNECTOR SIGNALS

E.6.1 J1 - This SMB connector, which has a 50-ohm input impedance, accepts the 21.4 MHz IF signal from the Preamplifier/Converter assembly (A1A13) via Motherboard connection A1P7.

E.6.2 J2 - This BNC connector provides a wideband output at rear panel connector J9. The wideband output has a 50-ohm output impedance and produces an 8-MHz wide signal, centered about 21.4 MHz, at a nominal output level of -30 dBm.

E.7 OPERATION

With the Wideband Option installed and the receiver operating, a wideband output is present at rear panel connector J9. With a -85 dBm signal level at the Antenna connector (J10), the wideband output will provide a nominal output level of -30 dBm.

E.8 CIRCUIT DESCRIPTION

Refer to **Figure E-2** for the Wideband Output schematic diagram. The IF signal from the Preamplifier/Converter (A1A13) is input at connector J1 of the Wideband Output option (A2). Connector P5 provides the +15 Vdc supply voltage for the WBO circuitry. WBO signals from the Wideband Output assembly are output at connector J2. From J2, the wideband IF signal is directed to receiver rear panel connector J9.

IF signals present at J1 of the Type 796318-1 Wideband Output assembly (A2) are transformer coupled across T2 from E4 to the input of gain controlled amplifier U1. Amplifiers U1, U2, and their associated circuitry form a gain-controlled amplifier that provides approximately 50 dB of gain control range. Gain controlled IF signals are coupled across transformer T1 to a 6 dB attenuator pad before being routed from E2 to connector J2. IF signals at J2 are approximately 8 MHz wide, centered at 21.4 MHz, and have a 50-ohm, nominal, output impedance. The WBO signal level at rear panel connector J9 is typically between -30 dBm and -25 dBm.

E.9 TYPE 796318-1 WBO (A2) ALIGNMENT PROCEDURES

1. Connect the test equipment as illustrated in **Figure E-1**.

2. Set the signal generator to produce a -40 dBm CW signal at a frequency of 21.4 MHz.

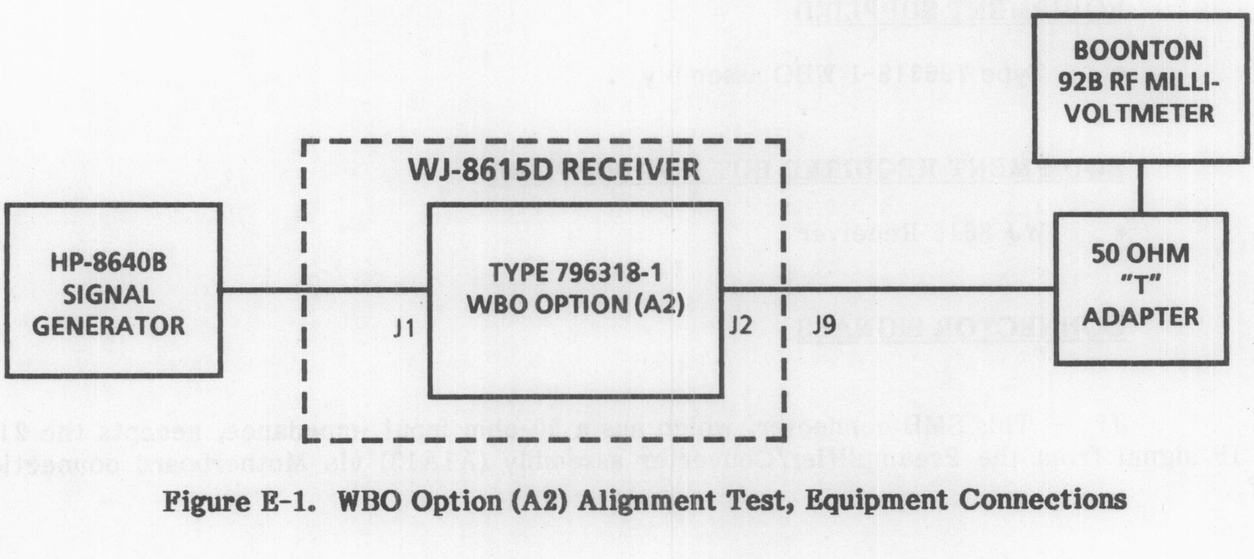

Figure E-1. WBO Option (A2) Alignment Test, Equipment Connections

3. Verify the signal level indicated on the RF millivoltmeter is between -30 dBm and -25 dBm. If it is not, adjust R10 to produce a level of -27 dBm. Note this level.

4. While observing the level displayed on the RF millivoltmeter, slowly tune the signal generator to 17.4 MHz and verify that the output level does not vary more than ±1 dB from the level noted in **step 3**.

5. Reset the signal generator frequency to 21.4 MHz and again note the level on the RF millivoltmeter.

6. Slowly tune the signal generator to 25.4 MHz and verify that the level on the RF millivoltmeter does not vary more than ±1 dB from the level noted in **step 5**.

7. Reset the signal generator frequency to 21.4 MHz with an output level of -60 dBm.

8. Verify the level on the RF millivoltmeter is between -30 dBm and -25 dBm.

9. Increase the signal generator output level from -60 dBm to -10 dBm, in 10 dB steps, while observing the level on the RF millivoltmeter.

10. Verify the displayed level remains between -30 dBm and -25 dBm.

11. If step 10 is not able to be met over the 50 dB range, readjust R10 and repeat **step 7** through **step 10**.

12. Disconnect the test equipment and reinstall the receiver connectors to their corresponding mating connectors.

E.10 TYPE 796318-1 WBO (A2) PERFORMANCE TEST

1. Connect the test equipment as illustrated in **Figure E-1**.

2. Set the signal generator to produce a -40 dBm CW signal at a frequency of 21.4 MHz.

3. Verify that the signal level indicated on the RF millivoltmeter is between -30 dBm and -25 dBm. Note this level.

4. While observing the level displayed on the RF millivoltmeter, slowly tune the signal generator to 17.4 MHz and verify that the output level does not vary more than ±1 dB from the level noted in **step 3**.

5. Reset the signal generator frequency to 21.4 MHz and again note the level on the RF millivoltmeter.

6. Slowly tune the signal generator to 25.4 MHz and verify that the level on the RF millivoltmeter does not vary more than ±1 dB from the level noted in **step 5**.

7. Reset the signal generator frequency to 21.4 MHz with an output level of -60 dBm.

8. Verify the level on the RF millivoltmeter is between -30 dBm and -25 dBm.

9. Increase the signal generator output level from -60 dBm to -10 dBm, in 10 dB steps, while observing the level on the RF millivoltmeter.

10. Verify the displayed level remains between -30 dBm and -25 dBm.

11. If **step 10** is not able to be met over the 50 dB range, perform the alignment procedure described in **paragraph E.2**.

12. Disconnect the test equipment and reinstall the receiver connectors to their corresponding mating connectors.

E.11 REPLACEMENT PARTS LIST

E.11.1 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 numbering method follows:

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

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

E.11.2 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 parentheses within the figure titles.

E.11.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address	Mfr. Code	Name and Address
02114	Feroxcube Corp. P.O. Box 359 Mt. Marion Road Saugerties, NY 12477	56289	Sprague Electric Company 87 Marshall Street North Adams, MA 01247
09021	Airco, Inc. Airco Electronics Bradford, PA 17055	59660	Tusonix, Inc. 2155 North Forbes Blvd. Tuscon, AZ 85745
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20878	71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, MA 02138
16179	M/A-COM OMNI Spectra, Inc. Microwave Component Div. 21 Continental Blvd. Merrimack, NH 03054-4303	73138	Beckman Instruments, Inc. Helipot Div. 2500 Harbor Boulevard Fullerton, CA 92634
19505	Applied Eng. Products, Co. Division of Samarious, Inc. 300 Seymour Avenue Derby, CT 06418	80131	Electronic Industries Assoc. 2001 Eye Street, N.W. Washington, D.C. 20006
33095	Spectrum Control, Inc. 152 E. Main Street Fairview, PA 16415	94375	Plessey Connector Division, Inc. 400 Moreland Road Commack, NY 11725
52648	Plessey Semiconductors 1641 Kaiser Avenue Irvine, CA 92714		

E.11.4 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 E.11.3** 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.

E.12 TYPE 796318-1 WIDEBAND OUTPUT ASSEMBLY REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A1	WBO 21.4 MHz Amplifier	1	280515-1	14632	
C1	Capacitor, Ceramic, Feedthru: 1000 pF, GMV 150 V	1	54-809-002-FC102P	33095	
E1	Terminal, Forked	1	140-1941-02-01	71279	
J1	Connector, Receptacle: SMB	1	2012-7511-000	19505	
J2	Connector, Jack: BNC	1	3252-0000-10	16179	
VR1	Diode, Zener: 3.3 V	1	1N746A	80131	

E.12.1 PART 280515-1 WIDEBAND OUTPUT 21.4 MHZ AMPLIFIER REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Disc: 4700 pF, 20%, 50 V	7	8121-050-651-472M	59660	
C2 Thru C5	Same as C1				
C6	Capacitor, Electrolytic, Tantalum: 15 µF, 20%, 15 V	1	196D156X0015JE3	56289	
C7	Same as C1				
C8	Capacitor, Ceramic, Monolithic: 220 pF, 5%, 100	1	8121-100-COGO-221J	59660	
C9	Same as C1				
FB1	Ferrite Bead	4	56-590-65-4A	02114	
FB2 Thru FB4	Same as FB1				
R1	Not Used				
R2	Resistor, Fixed, Film: 220Ω, 5%, 1/8 W	1	CF1/8-220 OHMS/J	09021	
R3	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	
R4	Resistor, Fixed, Film: 820Ω, 5%, 1/8 W	1	CF1/8-820 OHMS/J	09021	
R5	Resistor, Fixed, Film: 10Ω, 5%, 1/4 W	1	CF1/4-10 OHMS/J	09021	
R6	Resistor, Fixed, Film: 300Ω, 5%, 1/8 W	1	CF1/8-300 OHMS/J	09021	
R7	Not Used				
R8	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	1	CF1/8-47K/J	09021	
R9	Resistor, Fixed, Film: 470Ω, 5%, 1/8 W	2	CF1/8-470 OHMS/J	09021	
R10	Resistor, Trimmer, Film: 5 kΩ, 10%, 1/2 W	1	62PAR5K	73138	
R11	Same as R9				
R12	Resistor, Fixed, Film: 200Ω, 5%, 1/8 W	1	CF1/8-200 OHMS/J	09021	
R13	Resistor, Fixed, Film: 150Ω, 5%, 1/8 W	2	CF1/8-150 OHMS/J	09021	
R14	Resistor, Fixed, Film: 39Ω, 5%, 1/8 W	1	CF1/8-39 OHMS/J	09021	
R15	Same as R13				
T1	Transformer	2	180204-1	14632	
T2	Same as T1				
U1	Integrated Circuit	1	SL1611C/DP	52648	
U2	Integrated Circuit	1	SL1432/DP	94375	
VR1	Diode, Zener: 3.3V	1	1N746A	80131	

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

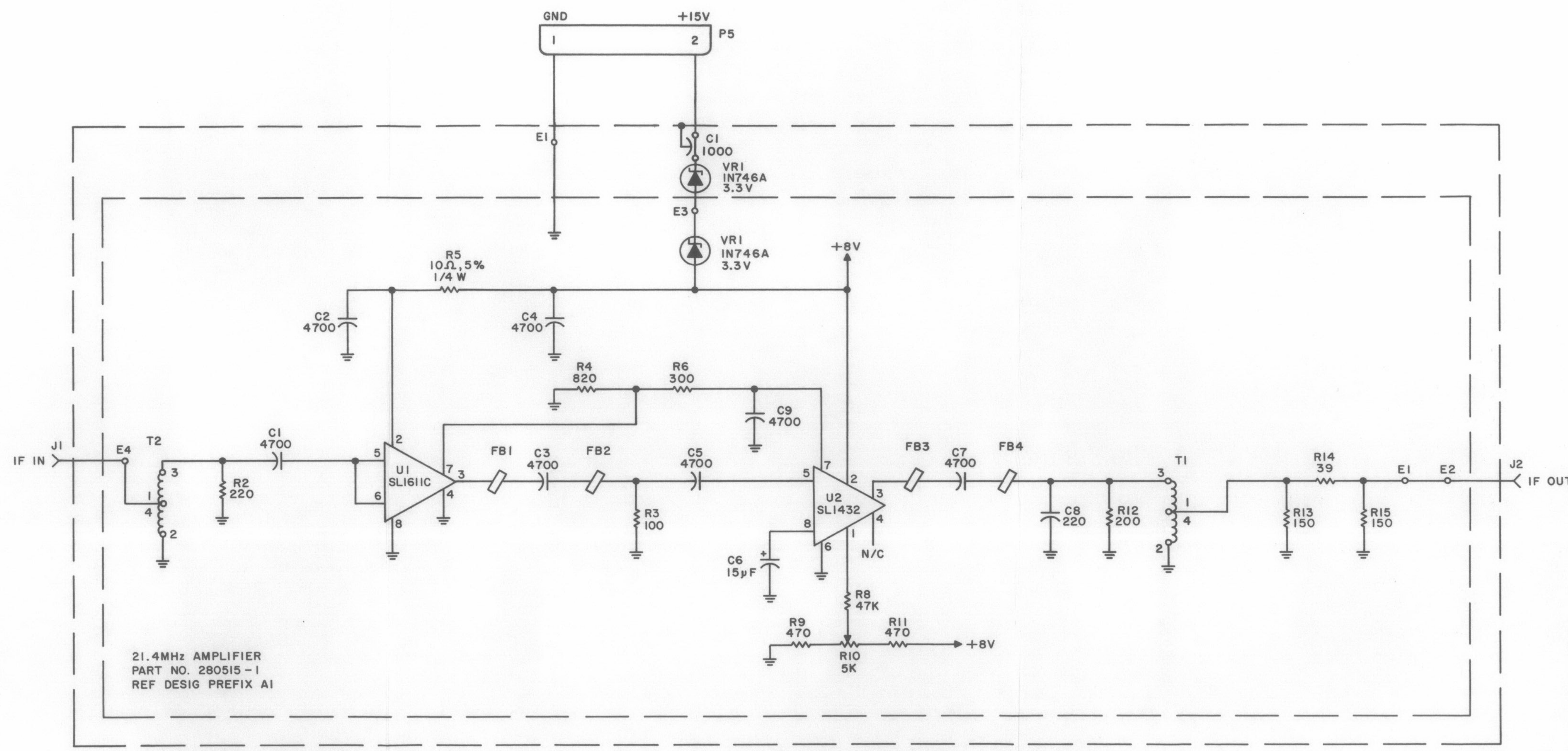

Figure E-2. Type 796318-1, Wideband Output 21.4 MHz Amplifier (A2), Schematic Diagram 480466 (C)

WJ-8615 RECEIVER

APPENDIX F

TRACKING PRESELECTOR OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878-1794

July 1989

WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

PROPRIETARY STATEMENT

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This document is provided to the individual or using organization for their use alone in the direct support of the associated equipment unless permission for further disclosure is expressly granted in writing.

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TRACKING PRESELECTOR OPTION

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TRACKING PRESELECTOR OPTION

F.1 GENERAL DESCRIPTION

The WJ-8615/PRE Tracking Preselector is a field installable option for the WJ-8615 Receiver. The primary function of this Preselector is to provide extremely narrow bandpass filtering of the RF spectrum between 20 and 500 MHz. Four separate, tunable filter bands are used in the Preselector, each covering a segment of the overall range, plus a 'BYPASS' band. Selection of the appropriate band and filter tuning, is controlled automatically using a 'Tuning Word' provided by the receiver. Should preselector filtering not be desired, the Preselector can be disabled from the front panel, or through the Remote Bus using the mnemonic "BYP". When "PRE OFF" is utilized, the "BYPASS" band of the Preselector is automatically selected. This bypass band provides the added advantage of extending the receiver's lower tuning limit to 2 MHz. However, narrow bandpass filtering does not occur in the extended 2 to 20 MHz frequency range. A 30V dc-dc converter is furnished with the Tracking Preselector to provide the necessary voltage for biasing of the varactor diodes used in the tunable filters.

F.2 INSTALLATION

Installation of the Tracking Preselector option consists of removing one printed circuit board, installing the Preselector board in the same slot and installing a dc-dc converter on an existing printed circuit board. Two cables are disconnected and two are reconnected.

To install the Preselector option, proceed as follows:

1. Remove the top cover of the WJ-8615 by; removing nine (9) flathead screws. (Captive nuts are used to secure these screws.)

   Lift the rear of the cover about a half-inch and slide the cover several inches to the rear. The cover may now be lifted from the unit.

2. Using **Figure F-1** as a guide, find the location of the RF filter board, Reference Designator A1A14.

3. Disconnect the RF Input coaxial connector at the top rear of the RF filter board.

4. Disconnect the RF filter output coaxial cable from the RF preamplifier/converter input, (A1A14).

5. Remove the RF filter board and its output coaxial cable.

6. Install the Tracking Preselector board in the same card slot which the RF filter was removed. Position the board so that the component side is facing the left side of the cabinet, board connectors down. Press the board connectors firmly into place.

7. Install the output coaxial cable from the Preselector, into the preamplifier/converter RF input jack, to which the RF filter output coaxial was connected.

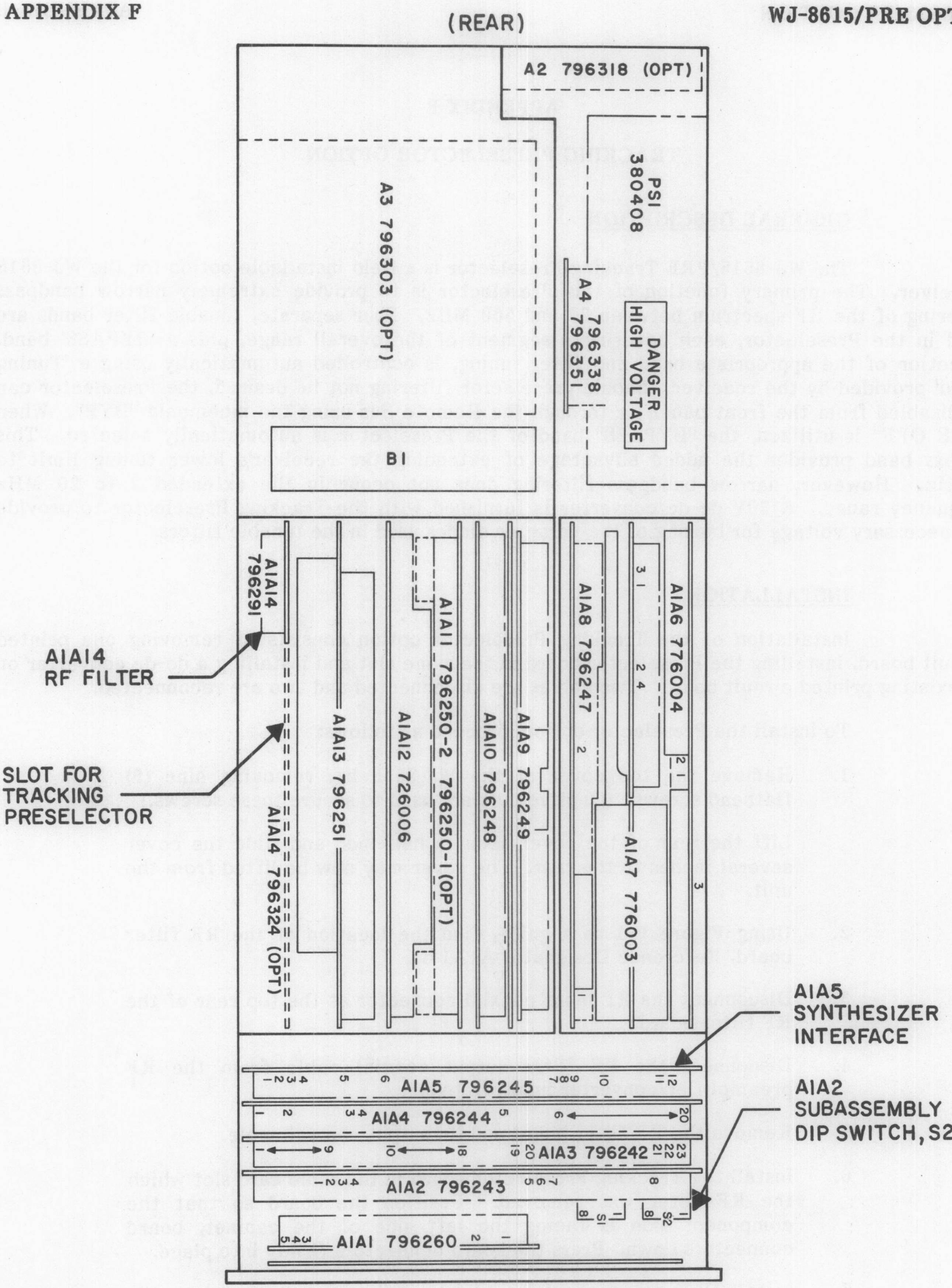


Figure F-1. Location of Printed Circuit Boards, WJ-8615 Receiver, (Top View)

8. Connect the incoming RF coaxial cable and connector to input jack J1, at the top rear of the Preselector board.

NOTE

THE FOLLOWING STEPS ARE NOT REQUIRED WHEN THE TRACKING PRESELECTOR WAS ORDERED AT THE SAME TIME AS THE WJ-8615 RECEIVER.

9. Refer to **Figure F-1** and determine the board location of the Synthesizer Interface board, Reference Designator A1A5, (fourth plug-in circuit board from the front panel).

10. Remove the A1A5 printed circuit card from the unit.

11. On the component side of the board, notice that in the upper right-hand corner is located an area with designator U15. (Refer to **Figure F-2,** which is a partial illustration of the board.)

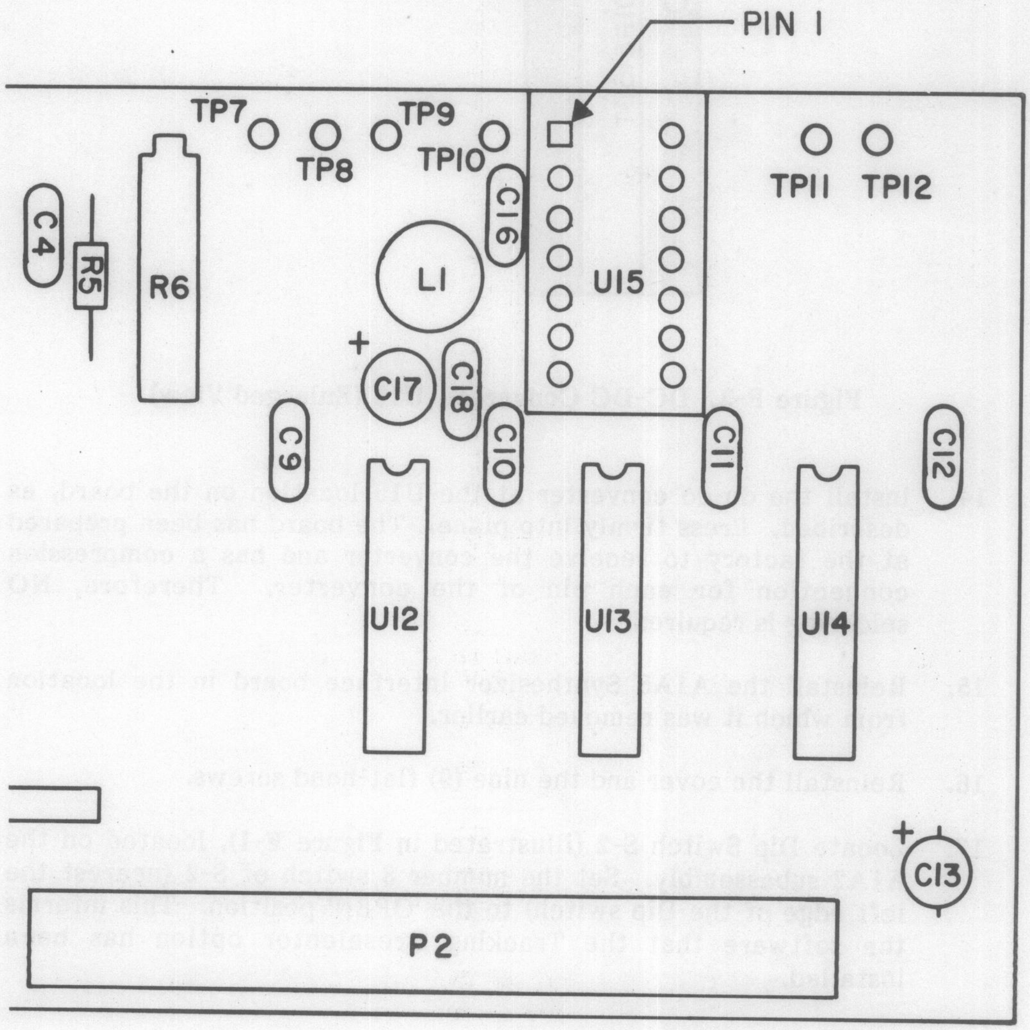


Figure F-2. Partial Component Side View of the Synthesizer Interface Showing U15

12. The dc-dc converter (Part Number DIP515DT), is illustrated in **Figure F-3.** Note that the number 1 pin of the converter is located with a large white dot.

13. The number 1 pin locator (on the parts mounted side of board), is shown with a square at the U15 location, as shown in **Figure F-2.**

NOTE

CARE SHOULD BE TAKEN, AS THE CONVERTER CAN BE INSTALLED BACKWARDS!

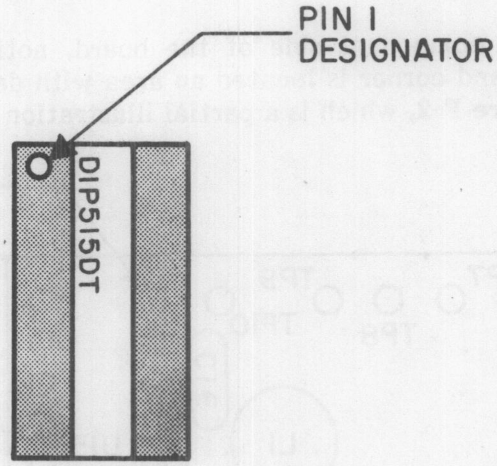


Figure F-3. DC-DC Converter, U15 (Enlarged View)

14. Install the dc-dc converter at the U15 location on the board, as described. Press firmly into place. The board has been prepared at the factory to receive the converter and has a compression connection for each pin of the converter. Therefore, NO soldering is required.

15. Reinstall the A1A5 Synthesizer Interface board in the location from which it was removed earlier.

16. Reinstall the cover and the nine (9) flat-head screws.

17. Locate Dip Switch S-2 (illustrated in **Figure F-1**), located on the A1A2 subassembly. Set the number 8 switch of S-2 (nearest the left edge of the Dip switch) to the 'OPEN' position. This informs the software that the Tracking Preselector option has been installed.

NOTE

IF A NEW RECEIVER TOP COVER HAS BEEN SUPPLIED WITH THE TRACKING PRESELECTOR, THE OLD COVER SHOULD BE DISCARDED AND THE NEW COVER USED.

18. Install the cover and the nine (9) flat-head screws.

F.2.1 EQUIPMENT MALFUNCTIONS

The Tracking Preselector was thoroughly inspected and factory aligned for performance prior to shipment. If a malfunction is encountered, verify the voltages at the Test Points discussed in paragraph F.3. If there appears to be a problem, contact your Watkins-Johnson representative or the Watkins-Johnson Company, CET Division, Gaithersburg, Maryland, to prevent possible warranty voiding prior to undertaking any corrective maintenance action.

F.3 OPERATIONAL TEST

The following tests may be performed in order to check for proper operation of the control sections of the Tracking Preselector. The four (4) Test Points are located on the upper righthand corner of the component side of the Preselector circuit board. (PRE1, PRE2, PRE3, and PRE4.) (Reference Table F-1.)

Table F-1. Normal Test Point Indications

Test Point	Normal Indication	Remarks
PRE1	STROBE - Negative going pulse	Pulse duration 50 to 100 nSEC occurs only when receiver frequency is being changed.
PRE2	1 Volt to 26.5 Volts dc	PRE2 and PRE4 voltages should not differ more than 1%.
PRE3	0 Volts to 2.55 Volts dc	256 10 mVolt steps.
PRE4	1 Volt to 26.5 Volts dc	PRE4 and PRE2 voltages should not differ by more than 1%.

F.4 OPERATION

Once installed in the receiver, the filters in the Tracking Preselector may be activated or bypassed at will, as required for the intended application of the receiver. This operation is accomplished either from the receiver front panel or via the remote interface of the receiver. Additionally, in either LOCAL or REMOTE mode, the status of this option is available to determine if the filters are active or bypassed.

F.4.1 REMOTE OPERATION

When the receiver is operated in the REMOTE mode, via the IEEE-488 interface, Preselector status and control is accomplished using the BYP, BYP/, and BYP?, remote commands. Descriptions of these commands are as follows:

Mnemonic	Hex	Dec	Description
BYP	3F	63	The "BYP" command selects the "BYPASS" mode of operation, disabling the Preselector filters.
BYP/	40	64	The "BYP/" command selects the Preselector mode. Once active, all control over Preselector tuning and band switching is automatic, requiring no further action by the operator.
BYP?	41	65	This query requests the operational status of the Tracking Preselector. As a response to this command, the receiver will return a "BYP" if the Preselector is in the "BYPASS" mode, or "BYP/ " if the Preselector mode is active.

F.4.2 LOCAL OPERATION

When the receiver is under local front panel control, the Preselector status can be read or changed by placing the receiver front panel into the definitions mode and selecting the Preselector display, "PrE". This is accomplished by using the following procedure:

a. Starting with the receiver powered "OFF", press in and hold the CONTROL pushbutton, while activating the receiver Power Switch. Continue to hold the CONTROL button in, until the definitions mode is activated, as indicated by a dEF "ON" or dEF "OFF" display in the Frequency Window. Release the CONTROL button when activated.

b. Rotate the front panel tuning knob as required to obtain a dEF "ON" display.

c. Using the UP/DOWN CHANGE buttons, step through the definition functions until the Preselector display is present in the Frequency Window (PrE "ON" or PrE "OFF"). PrE ON indicates that the Preselector mode is active, while PrE OFF indicates that the BYPASS mode is active.

d. Select the desired Preselector status by rotating the tuning knob until the desired status is obtained.

e. To exit the Definitions mode and restore normal front panel operation, press the CONTROL pushbutton. The Preselector status will remain as selected, unless it is changed using the above procedure or by the definitions mode being turned off (dEF OFF), prior to exiting.

F.5 CIRCUIT DESCRIPTION

F.5.1 FUNCTIONAL DESCRIPTION

The Tracking Preselector is characterized by the special ability to automatically tune the bandpass filter center frequency so that it tracks with the WJ-8615 receiver 'front end', through the use of a digital 'Tuning Word'. As an aid to describing the Tuning Preselector circuit, the unit may be functionally divided into two basic sections, the RF Section and the Control Section.

F.5.1.1 RF Section

The RF section of the Tracking Preselector consists of four electronically tunable bandpass filters, each dedicated to a specific band of frequencies within the 20-500 MHz frequency spectrum, which may be remotely tuned. Each of these filters has a 3 dB bandwidth that is approximately 11% of its center frequency. As the center frequency of a filter is varied over its specified range, (tracking the receiver tuned frequency changes), the percentage bandwidth remains relatively constant.

The Band "A" filter covers 20-49 MHz; Band "B" 49-118 MHz; Band "C" 118-264 MHz; and Band "D" 264-500 MHz. An additional band called "BYPASS" provides a straight-through signal path with no filtering, which permits operation of the receiver from 20 MHz down to 2 MHz. If desired, the "BYPASS" mode may be selected by the operator at any time, from either the front panel or by remote control, should Preselection in the 20-500 MHz range not be desired.

F.5.1.2 Control Section

The other part of the Tracking Preselector is the control circuitry. A "Tuning Word" from the WJ-8615 receiver is used to select the proper Preselector Band. The circuits also provide the proper control voltage for the voltage controlled tuning diodes, which are used in the RF section to resonate the various tuned circuits.

F.5.2 DETAILED CIRCUIT DESCRIPTION

The Tracking Preselector is a WJ-8615 option. Refer to Block Diagram **Figure F-4**, Parts Location **Figure F-5**, and Schematic Diagram **Figure F-6**.

Control for the Tracking Preselector RF circuits is through the use of a "Tuning Word", provided to the Preselector from the WJ-8615 receiver. The Tuning Word is a 12 bit word, made up of DATA 0 - DATA 9 and CODE 0 and CODE 1, which are the most significant bits (MSB). The 12 bit word is connected to an Erasable Programmable-Read-Only-Memory (EPROM) U1, address lines. The EPROM is programmed to provide certain proper data, for each "Tuning Word" on its address lines from the receiver.

The data out of the EPROM (as selected by the data on its address lines), is connected to a Digital-To-Analog Converter (D-A), U3. The D-A converter produces a step voltage output dependent upon data received from the EPROM. The information stored in the EPROM is such that the D-A converter will output the proper voltage for the Voltage Controlled Tuning Diodes (VARICAPS), discussed later in these paragraphs. This permits the Tracking Preselector to accurately track the receiver tuning.

A strobe is used to trigger the EPROM and D-A Converter, after the address has been received by the PROM. The CE pin of the D-A Converter is grounded, so the received signal is latched after the completion of the strobe. This keeps the control voltage output of the converter at the proper level for the receiver "tuning word" connected to the EPROM address lines. For every "tuning word" from the receiver, there is a corresponding voltage requirement by the VARICAPS of the selected band. It is the data required by the D-A converter in order to produce this voltage, which is stored in the PROM.

The step voltage output of the D-A converter is connected to the + input of two OP Amps, U4B and U4A. The OP Amps have outputs which have sufficient swing to furnish the voltage required by the VARICAPS. A +30 volt dc-dc converter is used (off card), to produce the required OP Amp potential.

In providing the required potential swing for the varicaps, two OP Amps are used instead of one. The VARICAPS are divided into two groups; group 1 consists of Band "B" and Band "D", connected to the U4B output called "TV 1", and the other group, made up of Band "A" and Band "C" VARICAPS, which are connected to the U4A output called "TV 2". Using the two OP Amps prevents OP Amp loading and provides some isolation between the two preselector groups.

The CODE 0 and CODE 1 bits of the "tuning word" connected to the PROM address lines, are also connected to U2, which is used as a Decoder and Latch. In addition, the decoder uses a third bit, CODE 2 from the receiver tuning word. These three bits provide the decoder input that allows the selection of the proper preselector band. Note that the Decoder CE (Chip Enable) pin is connected to the same strobe line input as the PROM and D-A converter. Thus the decoder band select and D-A converter are timed together. The strobe trigger pulse is LOW, so at the end of the trigger pulse the decoder chip latches the data on the CBA input from the CODE 0, 1 and 2 bits. This keeps the selected preselector band connected until a different preselector band is chosen by the tuning word as received at the U2 decoder input.

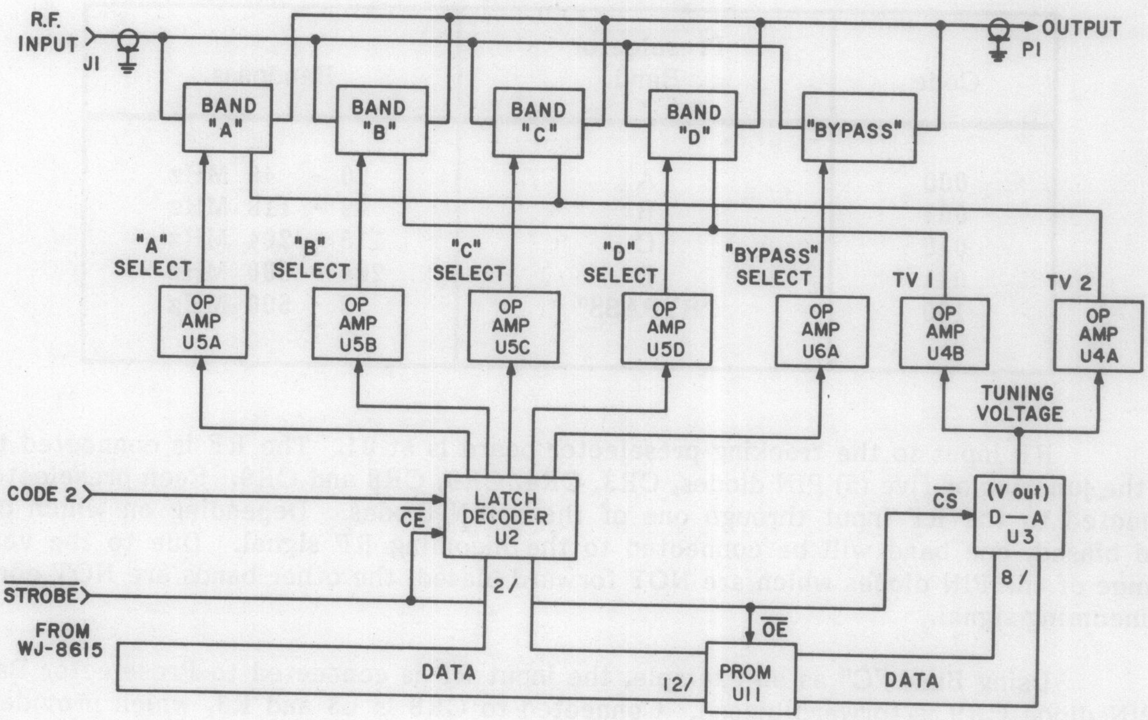


Figure F-4. Tracking Preselector Block Diagram

Five decoder outputs are used, one for each preselector band. Also, a separate OP Amp is used for each of the decoder outputs. The OP Amps provide the forward current necessary to connect one of the preselector bands. The non-inverting + input of the amps is used. When the decoder input goes LOW (at the selected output), the OP Amp output goes LOW, selecting the proper preselector band, as described later in these paragraphs. **Table F-2** illustrates the relationship of the decoder input (CODE 0, 1 and 2), verses the selected preselector band and its bandwidth.

Table F-2. CODE 0, 1, 2 Versus Band Select and Frequency Coverage

Code	Preselector Band	Bandpass
000	A	20 - 49 MHz
001	B	49 - 118 MHz
010	C	118 - 264 MHz
011	D	264 - 500 MHz
100	"BYPASS"	2 - 500 MHz

RF input to the tracking preselector board is at J1. The RF is connected through C1, to the junction of five (5) PIN diodes, CR3, CR4, CR6, CR8 and CR9. Each preselector band is connected to the RF input through one of these PIN diodes. Depending on which diode is forward biased, one band will be connected to the incoming RF signal. Due to the very high impedance of the PIN diodes which are NOT forward biased, the other bands are NOT connected to the incoming signal.

Using Band "C" as an example, the input RF is connected to Preselector Band "C" when PIN diode CR9 is forward biased. Connected to CR9 is L3 and R3, which provide a high impedance for the incoming signal, but a low impedance path for the forward biasing current. Band "C"* select from the U5C OP Amp, furnishes the voltage required to forward bias the CR9 PIN diode. The forward biasing presents a low impedance path for the RF signal from J1 through CR9, to the Band "C" preselector. All other PIN diode inputs are reversed biased under these conditions, keeping the other preselector band inputs DISCONNECTED from the incoming RF signals.

The preselector output circuits operate in a similar manner. Note that each preselector output is connected a PIN diode, CR32, CR33, CR35, CR38 or CR39 through an inductor and capacitor in series. The other end of each of the PIN diodes go to a junction of the other preselector outputs. This junction connects to the output cable (and P1), through C16. Each PIN diode is also connected (through its own inductor and resistor), to the band select input used for that band's RF input PIN diode.

Using Band "C" as an example, the preselector output is coupled through L11 and C14, to PIN diode CR35. When Preselector Band "C" is selected, the Band "C"* select signal is connected to PIN diode CR35 through R15 and L15. This forward biases CR35 and provides a low impedance path to the output of Preselector Band "C", to the output coaxial cable (through C16). All other preselector output PIN diodes have a high impedance path to the coaxial, because all PIN diodes (except CR35), are reversed biased when Preselector Band "C" is selected.

Each of the Preselector Bands share similar circuitry. The primary difference is in part values required to tune the different frequencies. Each of the preselectors use ten (10) VARICAPS to tune the preselector circuits, with the voltage from either the Tune Voltage 1 (TV 1), or Tune Voltage 2 (TV 2), which is controlled by the D-A Converter output. In the case of Band "A" Preselector, THREE VARICAPS connected in parallel are used for each of the 10 VARICAP locations shown on the parts layout and the schematic. They are required in order to provide the relatively large capacitance values necessary for the lower frequencies of 20 to 49 MHz, covered by the "A" Band Preselector. In the case of the Band "B" Preselector, two (2) VARICAPS are used in parallel for each of the 10 VARICAP locations, required to resonate the frequencies of the "B" Band (49 to 118 MHz).

The "BYPASS"* select signal from the decoder (and associated U6A OP Amp), is used to select the "BYPASS" function provided by the Tracking Preselector. This function is provided primarily so that RF input signals below 20 MHz, (which are too low for the Preselector), can bypass the four Preselector Bands and connect directly to the output coaxial(through C16), and P1. When the decoder (and associated OP Amp U6A), present BYPASS* select, it is connected through R13 to the CR6 PIN diode. This forward biases the diode, allowing the RF signal to pass through it, to PIN diode CR33. Note that the CR33 PIN diode is also connected to BYPASS* select through R14, and therefore it too is forward biased. Thus, the incoming signal is connected from J1 through CR6, CR33 and C16, to the output coaxial and P1. There is NO filtering of any signals which pass through the "Bypass" part of the tracking preselector.

In addition to selecting the "Bypass" function of the preselector for frequencies below 20 MHz, the function may also be used for "A-typical" purposes. The "tuning word" can legitimately select the Bypass function. An example of A-typical use is when a 4 MHz or 2 MHz IF bandwidth is being used. In this case, the Preselector should not be used and the Bypass mode selected.

F.5.3 ALIGNMENT

Alignment of the WJ-8615/PRE Tracking Preselector is determined by the programming of the EPROM U1. Should alignment be required, the complete Preselector should be returned to the factory for reprogramming.

F.6 REPLACEMENT PARTS LIST

F.6.1 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 numbering method follows:

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

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

F.6.2 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 parentheses within the figure titles.

F.6.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address	Mfr. Code	Name and Address
09021	Airco Electronics Bradford, PA 16701	29990	American Technical Ceramics 1 Norden Lane Huntington Station, NY 11746
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20878	50101	Frequency Sources Inc. 16 Maple Road South Chelmsford, MA 01824
19505	Applied Engineering Prod. Co. Division of Samarius Inc. 300 Seymour Avenue Derby, CT 06418	51642	Centre Engineering Inc. 2820 E. College Avenue State College, PA 16801
22526	Berg Electronics Route 83 New Cumberland, PA 17070	52673	KSW Electronics Corp. South Bedford Street Burlington, MA 01803
24355	Analog Devices Inc. P.O. Box 280 Norwood, MA 02062	56289	Sprague Electric Company Marshall Street North Adams, MA 01247
24546	Corning Glass Works 2155 N. Forbes Blvd. Bradford, PA 16701	59660	Tusonix Inc. 550 High Street Suite 107 Tuscon, AZ 85745
27014	National Semi-Conductor Corp. 2950 San Ysidro Way Santa Clara, CA 95051	7W259	Tel-Cal Corp. 9108 Mayflower Avenue El Paso, TX 79925
28480	Hewlett-Packard Company Corporate Headquarters 1501 Page Mill Road Palo Alto, CA 94304	70903	Belden Corp. 415 South Kilpatrick Chicago, IL 60644

Mfr. Code	Name and Address
71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, MA 02138
72982	Erie Technological Prod., Inc. 2155 North Forbes Suite 10718 Tuscon, AZ 85705
80031	Electra-Midland Corp. 22 Columbia Road Morristown, NJ 07960
81349	Military Specifications
91506	Augat, Inc. 3 Perry Ave. Attleboro, MA 02703
93306	Uniform Tubes Inc. 200 W. 7th Avenue Collegeville, PA 19426

F.6.4 REPLACEMENT 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 F.6.3** 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

The component U15, listed on the following parts list, is required by the tracking preselector option, but is not mounted on the preselector circuit board. This component is mounted on the Type 796245 Synthesizer Interface (A1A5).

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.

F.6.4.1 Type 796324-1 Tracking Preselector

REF DESIG PREFIX A1A14

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Chip: 5100 pF, 20%, 50 V	7	ATC700B512MP50X	29990	
C2	Capacitor, Ceramic, Monolithic: 1000 pF, ±2%, 100 V	15	150-100-NPC-102G	51642	
C3	Capacitor, Ceramic, Chip: 470 pF, 10%, 200 V	4	ATC700B471KP200X	29990	
C4	Same as C3				
C5	Same as C2				
C6	Same as C2				
C7	Capacitor, Ceramic, Chip: 1.5 pF, ±0.1 pF, 500 V	2	ATC700B1R5BP500X	29990	
C8	Capacitor, Ceramic, Chip: 1.3 pF, ±0.1 pF, 500 V	1	ATC700B1R3BP500X	29990	
C9	Same as C2				
C10	Same as C2				
C11	Same as C3				
C12	Same as C1				
C13	Capacitor, Ceramic, Disc: 4700 pF, 20%, 50 V	5	8121-050-651-472M	59660	
C14	Same as C3				
C15	Same as C2				
C16	Same as C1				
C17	Same as C13				
C18	Same as C1				
C19	Same as C1				
C20	Same as C13				
C21	Same as C2				
C22	Same as C7				
C23	Capacitor, Ceramic, Chip: 1.0 pF, ±0.1 pF, 500 V	1	ATC100B1R0BP500X	29990	
C24	Same as C2				
C25	Same as C13				
C26	Same as C1				
C27	Same as C1				
C28	Same as C13				
C29	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	9	34475-1	14632	
C30	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	2	34453-1	14632	
C31	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	1	196D226X0010JE3	56289	
C32 Thru C35	Same as C29				
C36	Not Used				
C37	Same as C29				
C38	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	1	196D475X0035JE3	56289	
C39	Same as C30				
C40	Capacitor, Ceramic, Monolithic: 300 pF, ±2%, 100 V	2	150-100-NPO-301G	51642	
C41	Same as C40				
C42	Same as C29				
C43	Same as C2				

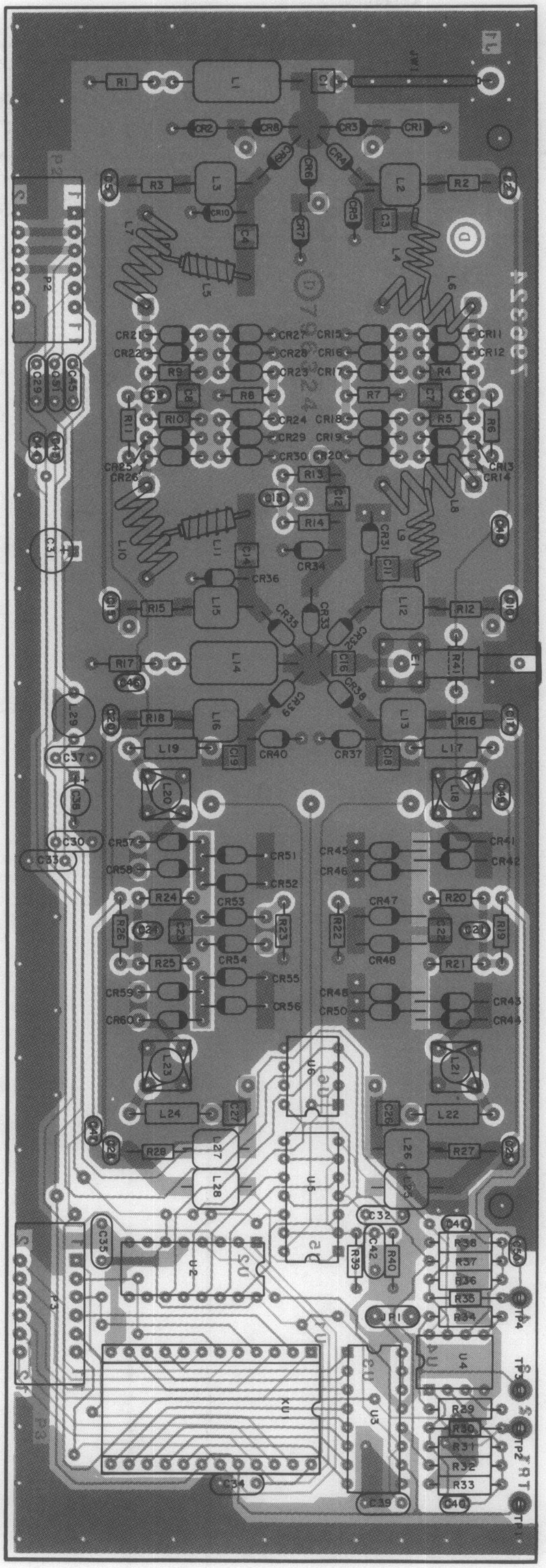


Figure F-5. Type 796324-1 Tracking Preselector, Location of Components

REF DESIG PREFIX A1A4

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C44	Same as C2				
C45	Same as C29				
C46 Thru C50	Same as C2				
C51	Same as C29				
CR1	Diode	10	5082-3039	28480	
CR2	Same as CR1				
CR3	Diode	10	841320	14632	
CR4	Same as CR3				
CR5	Same as CR1				
CR6	Same as CR3				
CR7	Same as CR1				
CR8	Same as CR3				
CR9	Same as CR3				
CR10	Same as CR1				
CR11	Diode	10	U11-3102	52673	
CR12 Thru CR20	Same as CR11				
CR21	Diode	60	KV3901	52673	
CR22 Thru CR30	Same as CR21				
CR31	Same as CR1				
CR32	Same as CR3				
CR33	Same as CR3				
CR34	Same as CR1				
CR35	Same as CR3				
CR36	Same as CR1				
CR37	Same as CR1				
CR38	Same as CR3				
CR39	Same as CR3				
CR40	Same as CR1				
CR41	Diode Assembly	10	280711-1	14632	
CR42 Thru CR50	Same as CR41				
CR52 Thru CR60	Same as CR51				
CR51	Diode Assembly	10	280711-2	14632	
CR52 Thru CR60	Same as CR51				
J1	Connector, Receptacle	1	2009-7511-000	19505	
L1	Coil, Fixed	2	170134-1	14632	

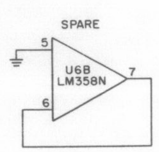
REF DESIG PREFIX A1A14

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L2	Coil, Fixed	10	190187-1	14632	
L3	Same as L2				
L4	Coil	1	180343-2	14632	
L5	Coil, Fixed: .040 µH, ±1%	2	L8-0R-040	7W259	
L6	Coil	1	180342-2	14632	
L7	Coil	1	180341-1	14632	
L8	Coil	1	180342-1	14632	
L9	Coil	1	180343-1	14632	
L10	Coil	1	180341-2	14632	
L11	Same as L5				
L12	Same as L2				
L13	Same as L2				
L14	Same as L1				
L15	Same as L2				
L16	Same as L2				
L17	Coil, Fixed: .121 µH, ±1%	2	L10-0R121	7W259	
L18	Coil Assembly	2	280519-1	14632	
L19	Coil, Fixed: .261 µH, ±1%	2	L10-0R261	7W259	
L20	Coil Assembly	2	280693-1	14632	
L21	Same as L18				
L22	Same as L17				
L23	Same as L20				
L24	Same as L19				
L25 Thru L28	Same as L2				
L29	Coil, Fixed: 1.0 mH, 10%	1	553-3635-37	71279	
P1	Connector Plug	1	2105-7521-005	19505	
P2	Receptacle Assembly	2	66527-006	22526	
P3	Same as P2				
R1	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/8 W	3	CF1/8-1.5K/J	09021	
R2	Resistor, Fixed, Film: 470Ω, 5%, 1/8 W	10	CF1/8-470 OHMS/J	09021	
R3	Same as R2				
R4	Resistor, Fixed, Film: 27 kΩ, 5%, 1/8 W	12	C3-27K-5PCT	24546	
R5	Same as R4				
R6	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	7	CF1/8-1.0K/J	09021	
R7 Thru R10	Same as R4				
R11	Same as R6				
R12 Thru R16	Same as R2				
R17	Same as R1				

REF DESIG PREFIX A1A14

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R18	Same as R2				
R19	Same as R6				
R20 Thru R25	Same as R4				
R26	Same as R6				
R27	Same as R2				
R28	Same as R2				
R29	Resistor, Fixed, Film: 10 kΩ, 1%, 1/10 W	2	RN55C1002F	81349	
R30	Same as R6				
R31	Resistor, Fixed, Film: 16.2 kΩ, 1%, 1/10 W	2	RN55C1622F	81349	
R32	Resistor, Fixed, Film: 121 kΩ, 1%, 1/4 W	2	MF4C/121K/F	80031	
R33	Resistor, Fixed, Film: 1.82 kΩ, 1%, 1/10 W	2	RN55C1821F	81349	
R34	Same as R29				
R35	Same as R6				
R36	Same as R31				
R37	Same as R32				
R38	Same as R33				
R39	Same as R1				
R40	Same as R6				
R41	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	
U1	Integrated Circuit (EPROM)	1	TBA	14632	
U2	Integrated Circuit	1	MM74HC137N	27014	
U3	Integrated Circuit	1	AD558KN	24355	
U4	Integrated Circuit	2	LM358N	27014	
U5	Integrated Circuit	1	LM324N	27014	
U6	Same as U4				
W1	Cable Assembly	1	280570-2	14632	

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) CAPACITANCE IS IN pF.
   b) INDUCTANCE IS IN μH.
   c) RESISTANCE IS IN OHMS, ±5 %, 1/8W.
2. 280711-1 VARICAP ASSEMBLY CONSISTING OF TWO KV-3901'S IN PARALLEL.
3. 280711-2 VARICAP ASSEMBLY CONSISTING OF THREE KV-3901'S IN PARALLEL.
4. ADD Q-DOPE TO ADJUSTMENT AFTER FINAL ALIGNMENT.



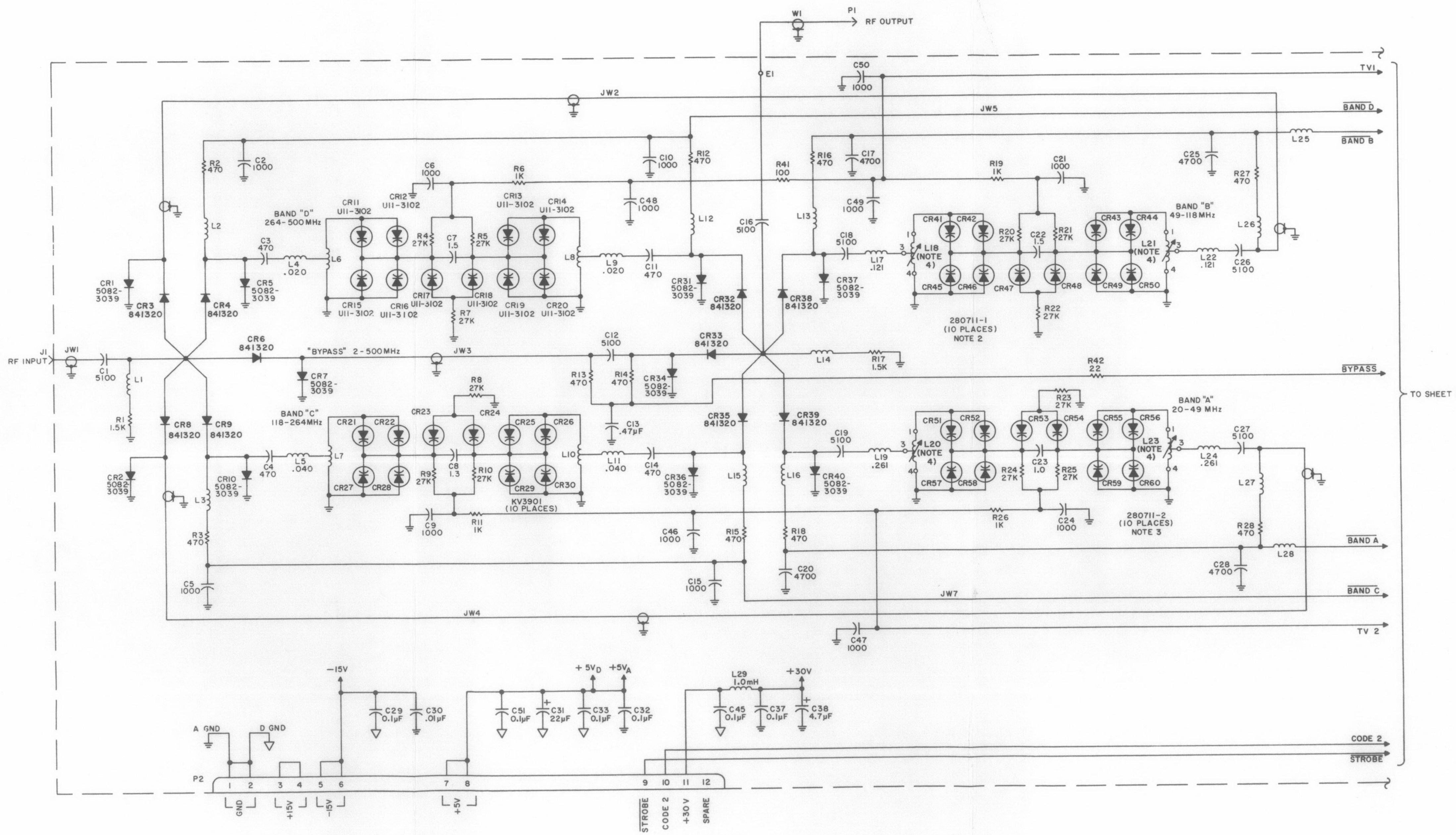


Figure F-6. Type 796324-1, Tracking Preselector/Control (A1A14), Schematic Diagram 580296 (Sheet 1 of 2) (G)

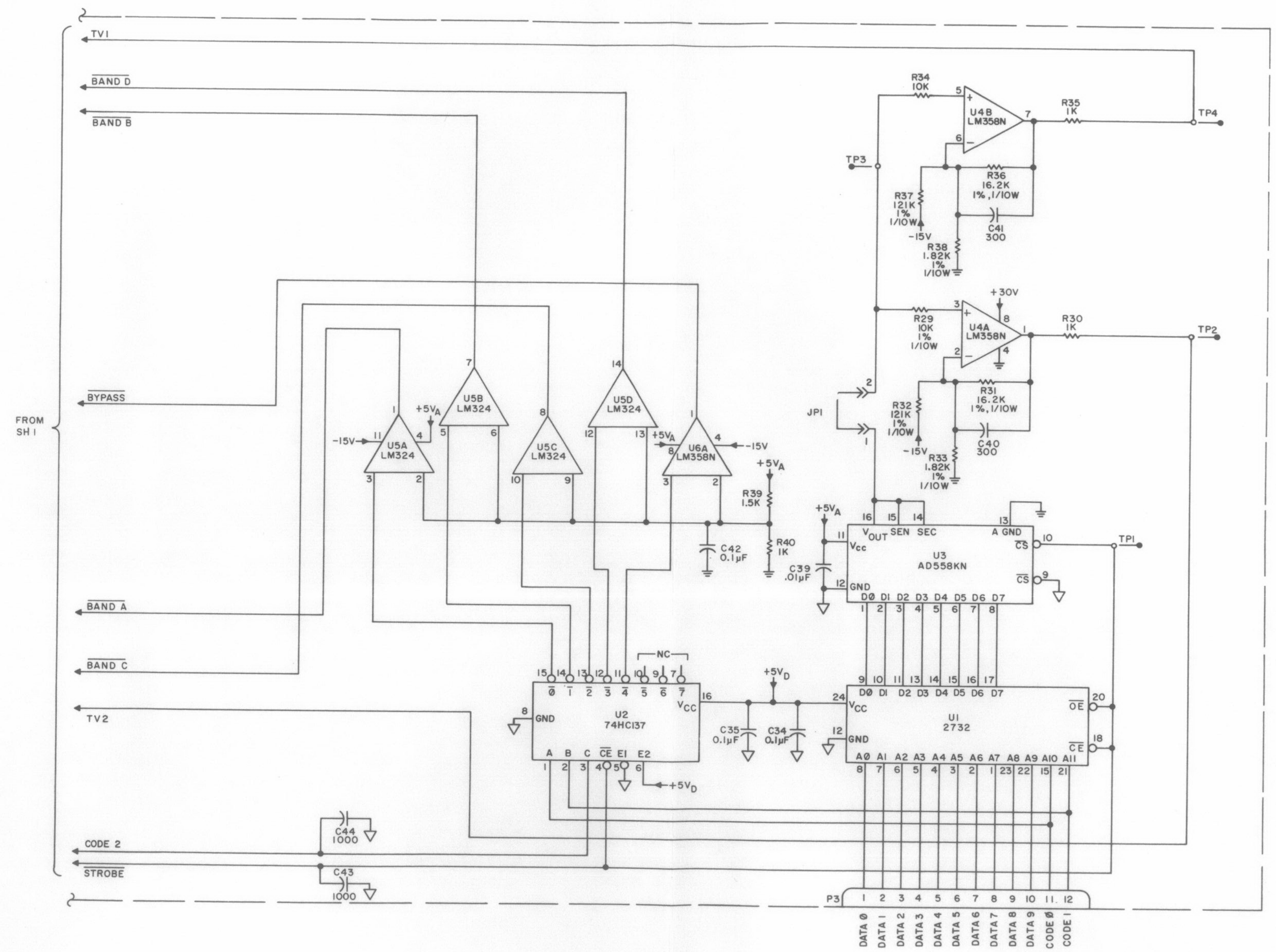


Figure F-6. Type 796324-1, Tracking Preselector/Control (A1A14), Schematic Diagram 580296 (Sheet 2 of 2) (G)

WJ-8615 RECEIVER

APPENDIX G

SELECTED AUDIO OUTPUT OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878

April 1988

WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

PROPRIETARY STATEMENT

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WJ-8615 SELECTED AUDIO OUTPUT OPTION

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APPENDIX G

WJ-8615 SELECTED AUDIO OUTPUT OPTION

G.1 GENERAL DESCRIPTION

The WJ-8615 Selected Audio Output (SAO) feature is a field option. The primary purpose of the option is to provide a means for the WJ-8610A Receiver Controller to select the audio output from any receiver in the Controller's System. When selected, the receivers audio will be available to the operator at the Controller. Audio output from all receivers in the System OTHER than the selected one, will be inhibited from the Controller receiver audio input line.

G.2 INSTALLATION

Installation of the Selected Audio Output consists of installing one PC card, connecting one cable plug and setting one switch.

To install the Selected Audio Output Option, proceed as follows:

1. Remove the top cover of the WJ-8615 receiver by: removing nine (9) flathead screws. (Captive nuts are used to secure these screws.)

   Lift the rear of the cover about a half-inch and slide the cover several inches to the rear. The cover may then be removed from the receiver.

2. Use **Figure G-1** to locate the press-in plug used to cover the option hole marked "J14", on the rear panel of the receiver.

   Remove this cover by pressing it out from the inside of the receiver.

3. Look at the Selected Audio Output (SAO) unit and notice that the printed circuit card of the unit is attached with a bracket to a female, panel mount BNC connector.

4. Remove the nut on the connector, and install the BNC connector and circuit board in hole "F14", from inside of the receiver. Secure the connector and circuit board to the hole labeled "J14" on the rear panel using the nut removed earlier from the BNC connector. Tighten the nut securely.

5. Look for plug P21 on the end of a six wire cable, which will be located near the BNC connector installed at J14. P21 is installed on the SAO board at the matching connector.

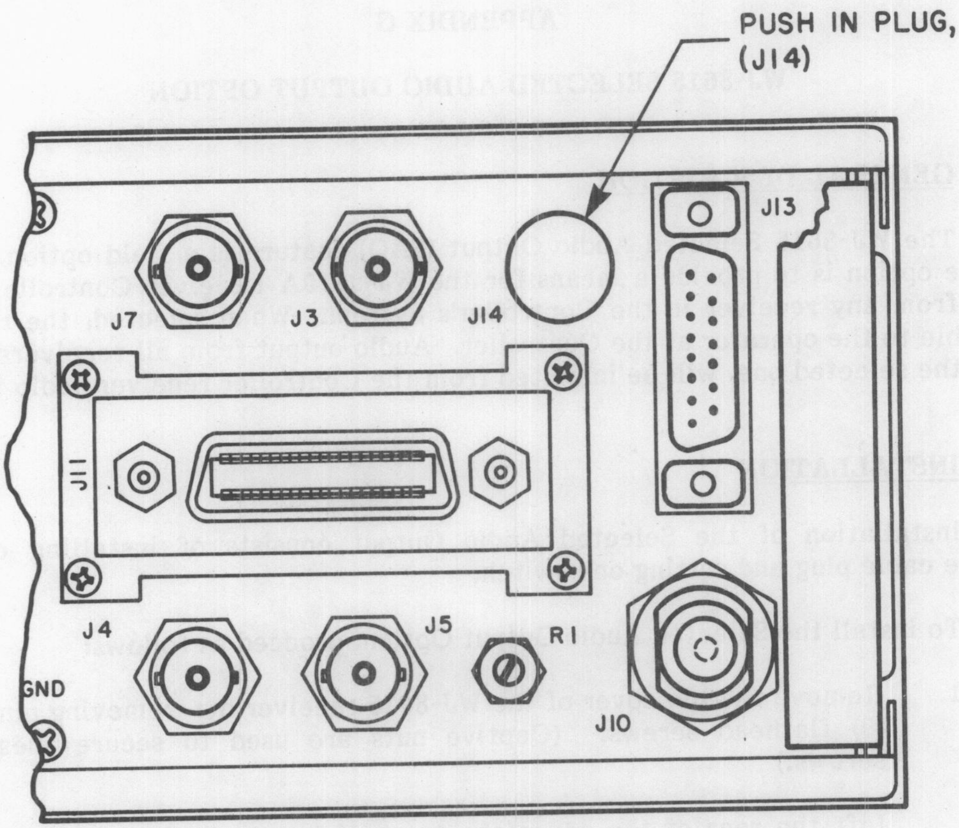

Figure G-1. Rear Panel Illustrating J14

6. Locate the Option Dip Switch "92", which is at the top of receiver, near the front panel. Locate position number "7" of this switch and set the switch position to "OPEN". This will inform the software that the option has been installed and is available to the WJ-8610A Controller.

7. Reinstall the top cover of the receiver and the nine (9) flat-head screws.

8. This completes installation of the Selected Audio Output Option.

G.2.1 UNPACKING AND INSPECTION

Examine the shipping carton for damage before unpacking equipment. If the carton exterior appears to be damaged, try to have the carrier's agent present during unpacking of the equipment. If for some reason this is impossible, retain all packing material and shipping containers for the carrier's inspection, if damage to the equipment is evident after unpacking. Also, verify that the equipment supplied is as listed on the shipment slip. Contact the Watkins-Johnson Company or your Watkins-Johnson representative if there is a discrepancy or shortage.

G.3 OPERATIONAL TEST

The Selected Audio Output Option was designed to be used with the WJ-8610A Receiver Controller. In order to give the option an operational test, a Controller is required. If a Controller is available, connect the Controller to the receiver(s), at connector jack J14. (Follow instructions in the WJ-861A-2 Supplement Manual for connection of the Controller and receivers in the system.)

Note that there is no 'LOCAL' operation of the SAO. It is operated only by Remote control of the WJ-8610 Receiver Controller. To check out the SAO option, a WJ-8610A Receiver Controller, HP-85, or other device is required. Using one of these devices, proceed as follows:

1. Tune the receiver to an incoming signal.
2. Set the COR to "ZERO".
3. Make sure that the signal audio is available at the Audio Jack of the Receiver.
4. With the Receiver Controller (or other device), issue an "SAO" command.
5. The received signal audio should now ALSO be available at the SAO output, J14.
6. With the Receiver Controller (or other device), issue an "SAO/" command (Selected Audio OFF).
7. The audio signal should no longer be available.

G.4 OPERATION

Once installed in the receiver, no other adjustments or controls are required to use the Selected Audio Output Option. The Receiver Controller will select or deselect the receiver audio output as required.

G.5 CIRCUIT DESCRIPTION

G.5.1 FUNCTIONAL DESCRIPTION

The Selected Audio Output Option is a miniature printed circuit board, containing parts required to switch the audio output of the receiver to a common receiver audio line, either on or off. Operation is such that only one receiver audio output will be on the 'audio line' at any given time.

G.5.1.1 **Block Diagram**

A Block Diagram of the Switched Audio Output Option is shown in **Figure G-2.** The audio output from the receiver is connected to the SAO option as the "Audio In". This is at connector J1 on the Option card. (The connections for each pin of this connector is given in **Table G-1.**) The audio is connected to the output of the receiver (at J14) only if instructed by the software at the WJ-8610A Receiver Controller.

When a command is sent to the receiver by the Controller to connect the receiver audio to the common receiver 'Audio Line', the command arrives at the SAO card, which causes the solid state switch on the card to switch, connecting the audio from the receiver, through the solid state switch, to jack J14 at the rear panel of the receiver.

The audio will remain connected to the 'Audio Line', until the Receiver Controller sends a 'deselect' command to the receiver, instructing it to disconnect the audio. Note that connection of the audio output to the 'audio line' does NOT affect the receiver's 'local' audio, at the Line Audio or Headphone Jack.

G.5.2 **DETAILED CIRCUIT DESCRIPTION**

The Watkins-Johnson Selected Audio Output Option Parts List is given in **Section G.6.4** and the Schematic is shown in **Section G.6.5.**

Power for the Solid State switch enters the SAO card at the connector, J1. Plus 15 Vdc at pin 6, minus 15 Vdc at pin 1 and ground on pin 3. The Solid State Switch (SSS), used is a single pole-single-through type, controlled by a high/low input control signal on pin 1 of the SSS. This signal (from software) enters the SAO card on pin 2 of J1.

The audio output of the receiver is connected to the SAO card at pins 4 and 5 of connector J1. The 'hot' audio lead is pin 5, while the ground lead for the audio line is pin 4. When the software receives a command (SAO) from the Receiver Controller to connect this receivers audio on the 'audio line' (J14), the Solid State Switch connects the 'hot' audio lead at pin 5 of U1, to J14 from the switch output at pin 6 of U1.

Resistor R1 provides a load for the incoming control signal for U1, while capacitors C1, C2, C3, and C4 are used as bypassing. R2 presents a 620 ohm load for the audio, should there be an inadvertent short at the output jack J14 or in the audio line which it is connected to. Essentially, the 'audio line' is a high impedance line to the Controller. Coaxial with BNC connectors is used for this 'line'.

G.5.3 **ALIGNMENT**

There is NO alignment or adjustments to the Selected Audio Output Option required.

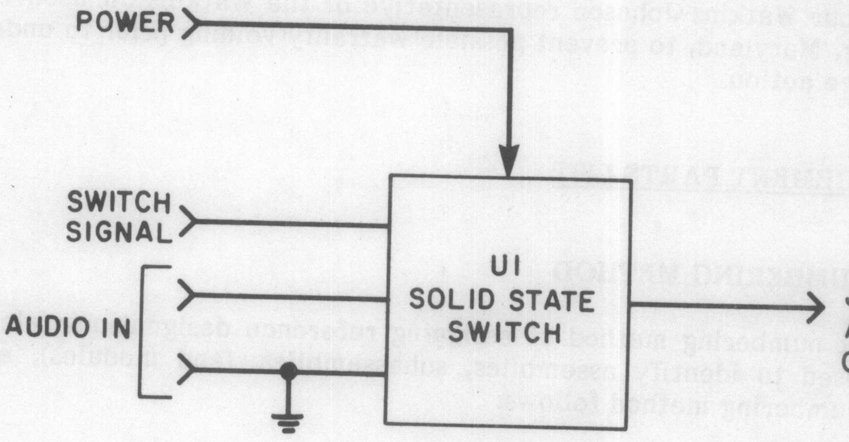

Figure G-2 Selected Audio Output Block Diagram

Table G-1. Connector J1 (Mates with P21) Pin Connections

Pin No.	Connection
1	-15 Vdc for Solid State Switch
2	Serial Output (Software Signal)
3	Ground
4	Audio In (Hot)
5	Audio In (Ground)
6	+15 Vdc for Solid State Switch

G.5.4 EQUIPMENT MALFUNCTIONS

The WJ-8615-SAO Option was thoroughly inspected and tested prior to shipment. If malfunctions are encountered after following the recommended installation procedures, verify that the inter-unit cables are installed properly. If there still appears to be a problem with the equipment, contact your Watkins-Johnson representative or the Watkins-Johnson Company, CET Division, Gaithersburg, Maryland, to prevent possible warranty voiding prior to understanding any corrective maintenance action.

G.6 REPLACEMENT PARTS LIST

G.6.1 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 numbering method follows:

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

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

G.6.2 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 parentheses within the figure titles.

G.6.3 REFERENCE PARTS LIST

The Parts List which follows contains all electrical parts used in the equipment (which are in addition to the parts already in the WJ-8615 Manual), 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 the main manual and the manufacturers 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 Replacement Parts List will prove 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 vender 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 this manual may be substituted in every case with satisfactory results.

G.6.4 LIST OF MANUFACTURERS

Mfr. Code	Name and Address	Mfr. Code	Name and Address
17856	Siliconix, Inc. 2201 Laurel Wood Rd. Santa Clara, CA 95054		

G.6.5 **TYPE 796464-1 SELECTED AUDIO OUTPUT ASSEMBLY** **REF DESIG PREFIX A1**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Disc: .1 µF, 20%, 50 V	2	34475-1	14632	
C2	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	2	196D475X0035JE3	56289	
C3	Same As C1				
C4	Same As C2				
J1	Header Assembly	1	87220-6	00779	
J14	Connector Modified	1	180428-1	14632	
R1	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/4 W	1	CF1/4-1K/J	09021	
R2	Resistor, Fixed, Composition: 620Ω, 5%, 1/2 W	1	RCR20G621JS	81349	
U1	Integrated Circuit, SW	1	DG200BP	17856	

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

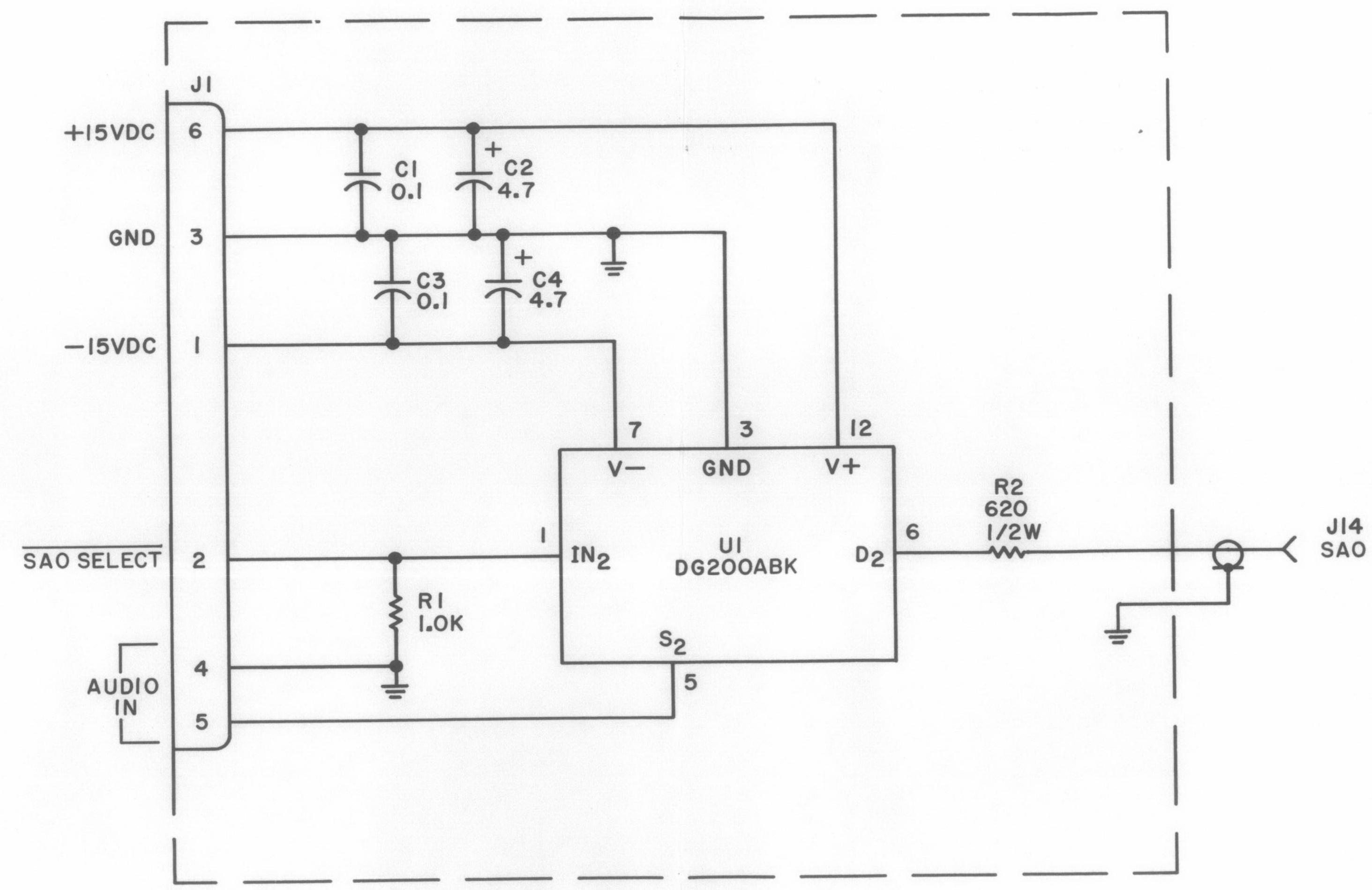

Figure G-3. Type 796464-1, Selected Audio Output (A1), Schematic Diagram 380779 (C)

WJ-8615 RECEIVER

APPENDIX H

STEP/SCAN/LOCKOUT OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878

May 1988

WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

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APPENDIX H

STEP/SCAN LOCKOUT

H.1 GENERAL DESCRIPTION

Step/Scan Lockout (SSL) provides the WJ-8615 Receiver the capability of stepping through pre-programmed, discrete frequencies, (Step mode) or scanning across predetermined frequency segments (Scan mode). Scan mode has the capability of not responding to certain frequencies within the scanned segment (Lockout). In either the Step or Scan mode, the selected COR level determines the signal threshold level that must be exceeded before the receiver will lock onto a frequency. When a Step frequency or a frequency within a frequency segment being scanned exceeds the set COR threshold level, the receiver takes action which is determined by the selected scan or step parameter settings.

The type of action taken in Step or Scan mode when the COR level is exceeded, is based on the configuration register. The controller determines the action the receiver will take by the setting of the configuration register. The following configuration register options are available:

Halt step or Scan and remain halted as long as the set COR level is exceeded.

Halt step or Scan and remain halted until the controller commands the receiver to continue.

Halt step or Scan and remain halted only long enough to queue the signal.

The lockout feature is used to prevent the receiver from stopping at known or undesired signals during the Scan mode. This allows the receiver to scan through frequency segments in search of signals that have not been identified.

Set-up and control of Step/Scan Lockout (SSL), is only provided via the WJ-8615 remote interface connector, J11. Using a suitable controller and the remote commands listed in the **Table H-8**, SSL functions may be set, changed or queried.

Scan mode allows the receiver to tune across a predetermined segment of the RF spectrum. During a scan, the receiver tunes from a start frequency (the lower frequency), to a stop frequency (the higher frequency), in predetermined increments between 10 kHz and 5 MHz. The scan start and stop frequency and the increment size are set by the operator. The start and stop frequencies are selectable between 20 and 500 MHz (2 - 4500 MHz with appropriate options). Selection of the increment step is from 10 kHz to 5 MHz, in 5 kHz increments. For example, 10 kHz, 15 kHz, 20 kHz, etc.

NOTE

When entering start and stop frequencies for a scan, the start frequency must be lower in frequency than the stop frequency.

When a scan is started the receiver begins tuning from the start frequency through to the stop frequency. Using the selected frequency step size, the receiver tunes up in frequency until signal activity exceeding the COR level, is encountered or until the stop frequency is reached. When either of these occur action is taken based on the configuration register.

Step mode allows the operator to select discrete frequencies within the receiver tuning range to be monitored. Step mode provides the operator the capability of selecting specific frequency patterns. Step frequencies can be placed in any order, independent of the frequency. This allows the operator to select a specific series of frequencies, in any order, that have unique characteristics. Each step frequency set has specific characteristics, such as COR level, bandwidth, detection mode, etc. The COR level can be set to a different level for each frequency. Once the COR level threshold has been exceeded, action taken by the receiver is determined by the configuration register setting.

Lockout capabilities provide the operator with the ability to eliminate specific frequencies within a scan. This allows a known signal within a scan to be ignored, allowing the scan to be repeated without being interrupted by a known signal.

H.2 FUNCTIONAL DESCRIPTION

The Step/Scan Lockout function (without Extended Memory option), uses 2k bytes of random access memory (RAM) dedicated to the SSL option. This space in RAM contains all the receiver parameters required for SSL operation. Allotted SSL memory allows up to seventy-one (71) memory channels for step or scan parameters or up to 142 memory channels for Lockout data.

Each Step or Scan channel contains a complete set of receiver operating parameters. Receiver operating parameters include:

Tuned Frequency
IF Bandwidth Position
COR Level
Detection Mode
AGC Status
AFC Status
RF Gain Level
BFO Frequency

Memory channels designated to store Lockout data contain the center frequency and the width of each segment to be locked out during the Scan operation.

With the Extended Memory option (EM) installed, there are 150 storage channels available for step or scan parameters and 300 storage channels for Lockout. The partitioning of Extended Memory is permanently fixed and cannot be changed by the operator.

Without the EM option installed, partitioning is recommended before entering SSL data into memory. Partitioning of memory allows the operator to designate the number of channels allocated as stored channels. Without partitioning memory, 50 channels (150 with extended memory option installed), are allocated for storage data. This leaves 42 channels available for lockout information. Partitioning the memory designates storage channels from zero to the designated partition number. Storage channels maintain the data for scans, steps or manual setups.

When partitioning memory, the remaining number of channels multiplied by two, produces the number of Lockout channels. For each increase of one storage channel, the number of Lockout channels available decreases by two. For example, with the partition set to 60, there are 22 channels allocated for Lockout channels. Changing the partitioning to 61 changes the number of Lockout channels to 20. Once the partioning has been accomplished (no EM installed), partitioning will remain fixed. However, non-Extended Memory may be re-partioned if necessary.

NOTE

When memory is partitioned, any data previously stored in SSL memory will be lost.

To determine the SSL partitioning, use the partition query command "PAR?," listed in **Table H-1**. The receiver will respond by returning the present partitioning configuration default number, where that number = 0 to 70 (or 150 with EM). If SSL memory has not been partitioned, the default value is 50. This provides 50 memory channels and 42 lockout channels.

H.2.1 STEP/SCAN SYNCHRONIZATION SIGNAL

Step and scan provide a series of synchronization pulses at pin 8 of rear panel connector J13 (AUX). At the initialization of each scan operation and each time that the scan or step is started, an active LOW pulse ranging from 500 µsec to 2 µsec in duration is available at J13, pin 8. At each frequency increment within the scan the receiver will again provide an active low pulse for use as a sync pulse for external devices. If the frequency of the scan increment is at a locked out frequency or step channel disabled, the output pulse will have a duration of 16 to 64 µsec. For normal frequency increments (frequencies that are not locked out or steps), the output at J13 pin 8 will be active LOW for a duration of 80 to 140 µsec.

The output synchronization pulse is typically used as a trigger by external devices to synchronize the reading of the receiver Log Video Output (connector J13, pin 9) with the Scan operation. At each scan increment the Log Video Output provides a dc voltage (between 0 V and +5 V) that reflects the signal strength at the receiver tuned frequency. The dc voltage is proportional to the signal strength. No signal activity produces 0 Vdc and a signal level of 55 dB or greater (above the noise floor of the selected IF bandwidth) produces a voltage of +5 Vdc.

While the receiver is operating in the Step or Scan operating mode, the Log Video Output voltage will be constantly changing to reflect the signal activity at the tuned frequency. During the time the sync pulse is LOW (J13 pin 8), indicating a scan or step increment, the Log Video Output represents the RF signal activity for the currently tuned frequency. The Log Video Output is also valid during scan lockout sync pulses. However, the Log Video Output is not valid during Step or Scan operation restart pulses.

An external device may use the synchronization pulses and Log Video Output to capture Step/Scan data for evaluation. After the restart frequency pulse, each successive normal pulse (between 80 and 140 µsec) represents a signal. The counting of pulses will relate to the frequency of the data they represent. **Figure H-1** illustrates typical examples of the synchronization pulses as they occur at the output of the receiver. Note that the start of the sequence is represented by a 1.0 millisecond pulse. Normal step or scan increments and locked out or disabled increments are represented by 100 µsec and 32 µsec pulses respectively.

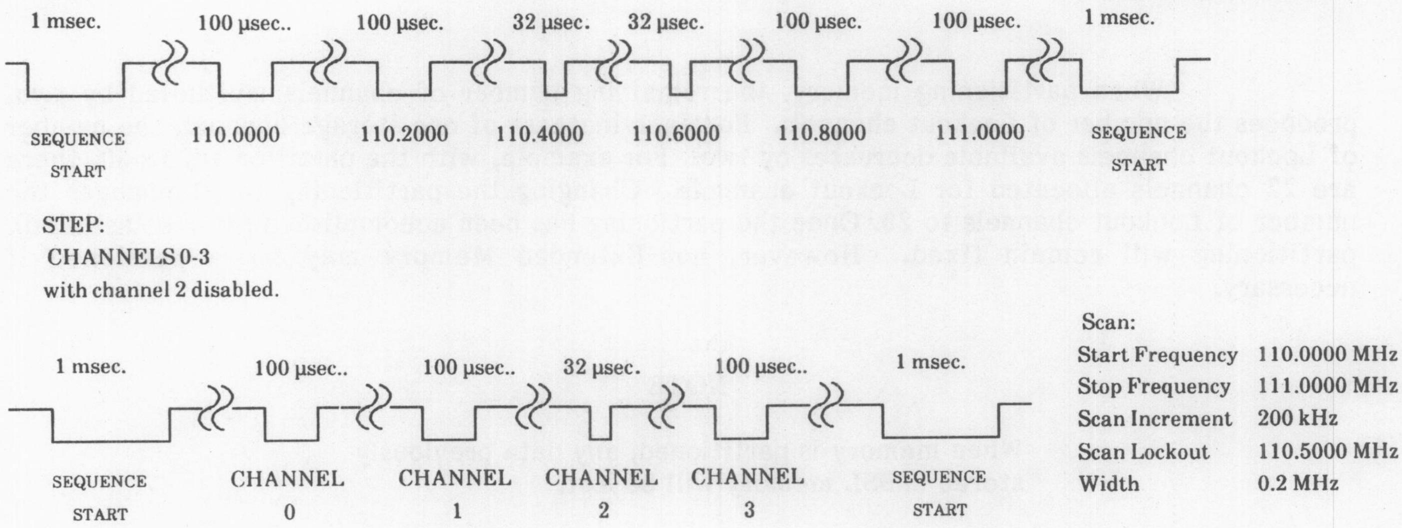

Figure H-1. Step/Scan Synchronization Pulses

H.2.2 STORAGE MEMORY

Once memory has been partitioned, set-up data may then be stored. For storage of fixed tuned operation, all the set-up data can be stored in one channel.

Storing Scan set-up data requires two memory channels. The first channel Scan Set-up Parameters include:

- Start Frequency
- IF Bandwidth
- COR Level
- Detection Mode
- AFC Status
- AGC Status
- RF Gain
- BFO Frequency

The second channel is a stop channel. The only data needed by the scan operation of this channel, is the frequency which is interpreted as a stop frequency.

Memory channels allow universal use for scan, step or manual storage. Data may be entered into or retrieved from storage memory using one of two methods. One method is to tune the receiver to the desired frequency with the desired parameters, then use a "STO" n command, where "n" is the specified channel number. This method may be used only if the receiver is in one of the manual modes of operation: manual; scan manual; or step manual.

Associated with this storage method is a recall and execute command, that allows data to be transferred from storage memory to current receiver operational parameters. This function is performed by sending the recall and execute command, (RCE n), where n is the specified channel. This command is only valid in one of the manual modes of operation.

The other method of memory access is direct. This method allows stored parameter data to be read from memory without affecting the current receiver parameters or operation. The store channel command is followed by the channel number and channel parameters. The command may be used in any of the manual receiver modes of operation or in step mode, to dynamically turn channels ON or OFF. Other parameters may not be changed while in Scan or Step operation. The recall channel command (RCH n) is valid in all modes of receiver operation. It returns the data from the requested channel (n) in the form of the store channel command. When the channel command is used, any blank fields retain their previous value. Table H-1 lists memory commands with short descriptions.

Table H-1. Memory Commands and Descriptions

Commands		Response		Description
ASCII	HEX	ASCII	HEX	
CLM	6C			Clear receiver memory. Both lockout and storage memory are cleared. The receiver returns to the default conditions.
PAR a	21 b			Partition memory for the number of storage channels, (0-71). This command has no effect with the EM option.
PAR?	23	PAR a	21 b	Request the number of storage channels partitioned. Will always respond 150 with the EM option.
RCE a	27 b			Recall and execute data from the specified memory channel. The data from the channel is used for the current operating parameters.
RCH a?	2C b	(See SCH)		Request data in the specified channel. Responds with an SCH command.
SCH 1,2, 3,4,5,6,7, 8,9,0	30 bbpppp bbbbbbpppp			Store the designated data into the specified memory channel, where: 1 = memory channel number where the data is to be stored (0-partitioned channel or 149 with EM) 2 = channel off/on flag (CHN/ CHN) 3 = frequency (in MHz) 4 = bandwidth slot (1 to 5) 5 = COR level (0 to 80, 99 for OFF) 6 = detection mode (AM, FM, CW, PLS, USB, LSB, or ISB) 7 = AFC status (AFC, AFC/) 8 = AGC status (AGC, AGC/) 9 = RF gain setting (0 to 255) 0 = BFO frequency (-4 kHz to +4 kHz)
STO a	8A b			Store current active parameters to the specified memory channel. The channel number must be 0 through 149.

LEGEND:

chr	Used in Command	Used in Response
b	Is a single byte of data.	Is a single byte of data.
p	Is a packed BCD data byte.	Is a packed BCD data byte.
a	Is 1-3 ASCII digits used as a number.	Is a space and 3 ASCII digits.

H.2.3 CALIBRATION

The receiver requires the 2nd LO to be calibrated in order to operate. Two types of calibrations must be performed.

1. The first is called 2nd LO Calibration. This is the calibration performed at the factory and should not be required again, unless the 2nd LO is replaced or the data in the battery back-up memory is lost or defaulted. If any of the above conditions have occurred, the 2nd LO should be re-calibrated.

2. The 2nd LO may be calibrated by three methods. These are:

   a. The receiver will automatically perform the calibration 15 minutes after turn-on, if left in local mode of operation.

   b. The calibration may be initiated from the front panel, definitions operation.

   c. Remotely, a CAP command will cause the receiver to calibrate if it is required.

While the receiver is performing the 2nd LO calibration, the front panel of the receiver displays "CAL 2nd." This calibration should not need to be performed by the user unless the receiver has had service performed on it. In the event that a scan or step is attempted without performing a 2nd LO calibration, the receiver will generate an error "815" and ignore the Scan or Step command.

The other calibration required for Scan or Step operation is continuous in nature. Upon entering Scan or Step, the receiver performs a Scan Calibration operation. During this operation the receiver learns the frequency to voltage relationship of the 2nd LO. While the receiver is in Scan or Step, the 2nd LO is not phase locked. As the receiver scans or steps, it periodically checks calibration. If it detects a small error it will mathematically correct the calibration data. When a large error is detected, the receiver will need to re-calibrate itself. Depending on mode of Auto Calibration, it will either stop and calibrate when necessary, or request the host controllers permission to calibrate. The calibration routine holds the scan or step frequency accuracy to within ±10 kHz of the requested scan or step frequency.

Calibration checks and corrections are done by stealing time from the Scan or Step operation. Calibration checks take approximately 100 milliseconds to be performed. Mathematical corrections take approximately 150 milliseconds to complete. Major calibrations require up to 120 seconds. A typical receiver will require a major calibration every 5 to 10 minutes during the first two hours of operation. After warm up, major calibration occurs every 30 to 60 minutes.

During the first two hours of operation after turn-on, the receiver will perform calibration checks every 1 minute if Scan or Step mode of operation is selected. If Scan or Step is activated during the 2 hour warm-up interval, an error "817" will be generated. This error is a warning only, indicating that the receiver will be doing frequent calibrations during the warm-up time. After 2 hours of operation, calibration checks occur every 10 minutes. Calibration commands are listed in **Table H-2**.

The automatic calibration mode has been included to provide greater flexibility and allow control over the automatic re-calibration function. While in the ACL mode the receiver automatically re-calibrates when the LO frequency drifts. When the ACL mode is not selected (ACL/), the receiver performs the major mathematical calibrations as required. However, before the receiver performs the calibrations, permission of the controller is first requested. The receiver request is initiated by setting the SRQ bit 6 and the ERROR bit (5) in the receiver status register. This causes an error "470" to be generated. The controller does not receive the most significant digit, so an error "70" is observed by the controller. The controller may permit the calibration by returning the calibration approval response, which is CAP. Refer to the mnemonics listed in **Table H-2** for the calibration commands.

NOTE

When the controller receives error "70", the receiver LO frequency has drifted significantly and any Step or Scan operations performed are inaccurate (ERROR exceeds 10 kHz).

Table H-2. Calibration Commands and Descriptions

Commands		Response		Description
ASCII	HEX	ASCII	HEX	
ACL	09			Select auto calibration ON. In this mode the receiver will self calibrate when required.
ACL/	0A			Auto calibration OFF. The receiver will generate error "470" when it needs to calibrate. The controller should send a "CAP" to allow the calibration to occur. Ignoring the calibration request will cause improper receiver operation.
ACL?	0B	ACL ACL/	09 0A	Request the status of auto calibration.
CAP	0F			Calibration approved. This will cause the receiver to perform a calibration if in Scan or Step mode of operation.

H.2.4 CONFIGURATION REGISTER

WJ-8615 Receivers equipped with Step/Scan Lockout provide three modes of SSL operation. These modes are described in the following paragraphs. Selection of the desired SSL mode must be performed before initiating a Step or Scan operation. Selection of the Scan/Step mode determines the receiver response during a Scan or Step operation when a signal greater than the COR level is encountered.

H.2.5 MODE 1 (SIGNAL ACTIVATED STEP/SCAN)

Mode one is the default for Scan or Step Operations. When Mode 1 operation is selected, the Step or Scan operation halts whenever a signal is encountered that exceeds the set COR level. The selected operations will continue when one of two conditions occur. The selected operation will continue when:

1. The signal drops below the set COR level, or

2. A Scan (SCN) or a Step (STP) command is received.

When either of these condition are met, the receiver resumes its previous Scan or Step operation.

When the receiver stops on a signal in Scan or Step, it sets the SRQ line and bit 6 of the status byte, if enabled. Bit 0 of the status byte indicates the current COR status. Reading the COR status will indicate if the receiver is currently scanning, stepping or stopped on a signal.

H.2.6 MODE 2 (STOP ON SIGNAL)

Operation of Mode 2 is identical to Mode 1, until a signal is encountered that exceeds the COR level. When this occurs, the receiver is placed in the Step manual or Scan manual mode and the SRQ bit (6), is set in the status byte, (as is the SRQ line), provided that SRQ has been previously enabled.

H.2.7 MODE 3 (QUEUE SIGNALS ONLY)

Mode 3 operates the same as Modes 1 and 2 until a signal greater than the COR level is encountered. Such a signal is encountered, the receiver operations halts long enough to store the signal frequency in a queue before continuing its Step or Scan operation.

When the receiver is in Mode 3 (queue signals only), the queue is filled using a first in, first out, technique (FIFO). When Variation 3 is disabled, the first data in the queue (the oldest data), is written over first. This allows the last data entered (the most recent) to be stored for the longest time. Sending the "QUE?" command, results in the receiver sending the current data entered in the queue. This represents the 16 most recent signals that were entered in the queue. The queue is filled with signals independent of the selected configuration mode. If no signals have been found since the last "QUE?" command, no frequencies are returned.

The three Step/Scan modes of operation may be varied three ways. The variation selected affects the operation of the selected Step or Scan mode differently. Refer to Table H-3 for the Step/Scan Configuration Register and Variations.

Table H-3. Step/Scan Configuration Register and Variations

Command	Bit Value	Description
CFG	1	Set SRQ on a COR status change
CFG	2	Cause AGC to re-attack signals upon receipt of new frequency command.
CFG	4	Mode 2 (Stop on Signal)
CFG	8	Variation 1 (Single Sequence)
CFG	16	Mode 3 (Queue Signals Only)
CFG	32	Variation 3 (Stop on Full Queue)
CFG	64	Variation 2 (All Signals Scan Log)
CFG	128	For Future Expansion

NOTES

1. Mode 1 is enabled by disabling both Mode 2 and Mode 3.
2. Mode 2 and Mode 3 cannot be enabled simultaneously.
3. The last CFG command set determines all the modes.
4. Step operation in bandwidths less than 20 kHz is not recommended since the calibration accuracy (±10 kHz) reduces the reliability.

Variation 1: (Single Sequence) - The receiver scans or steps, depending on the mode selected. When the Scan reaches the stop frequency or the step frequency reaches the last channel in the group, the receiver stops and enters Scan/Step Manual mode. When this happens, bit 3 (Scan or Step sequence complete) and bit 6 (SRQ), are set in the status byte along with SRQ line.

Variation 2: (All Signals Scan Log) - During normal receiver operation, the receiver only detects the leading edge of signals that are greater than the set COR level. This avoids repetitive logging of single signals that occupy more than one adjacent scan increment. Enabling this variation allows the receiver to log each frequency where signal energy is detected. This variation is valid in all three modes but has no affect during Manual or Step operations.

Variation 3: (Stop on Full Queue) - The receiver operation halts and enters the Step Manual or Scan Manual mode when the queue is full and sets bit 2 and bit 6 of the status byte, along with the SRQ line.

H.2.8 QUEUE OPERATION

While the receiver is in Scan or Step, the queue is filled using a first in, first out, approach. If Variation 3 is disabled (Stop on Full Queue), the oldest data in the queue is overwritten first. The queue may be queried (emptied) at any time using the "QUE?" command. The receiver responds with the 16 most recent signals it has found. Table H-4 lists and describes Queue commands and queries.

Table H-4. Que Commands/Descriptions

Commands		Response		Description
ASCII	HEX	ASCII	HEX	
QUE?	26	QUE f,f,f,	24pp . .	Return all frequencies which have been queried, if queue is empty, no frequencies are returned. Returns frequencies in queue up to a maximum of 16 frequencies.

LEGEND:

chr	Used in Command	Used in Response
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits.	Is a space, 4 digits, a decimal, and 4 more ASCII digits.
p	Is a packed BCD data byte.	Is a packed BCD data byte.

H.3 OPERATION

The following paragraphs describe the operation of three different SSL operating modes.

H.3.1 STEP OPERATION

During Step operation, the receiver steps through the programmed memory channels 0-71 (or 0-150 with EM), that have been partitioned for Step or Scan channel data. Data entered into each memory channel contains the receiver operating parameters for that specific frequency. Step memory channels do not have to be entered in ascending frequency order. The Step frequency order is determined by the memory channel order.

Before Step operations are initiated, the configuration register mode (Modes 1 through 3) and the variation (Modes 1 through 3) must be selected. Refer to the preceding paragraphs for an explanation of the modes and variations available. There are three forms of Step operation available. The three forms are:

1. Sequential
2. Sequential Sector
3. Random

Sequential Step operation begins its operation at memory channel zero and continues to the operator determined stop memory channel. Thus, only the stop memory channel must be defined. The Step command is sent in the following form: "STP a," (where a = the desired stop memory channel). The frequency data stored in the memory channels between 0 and the value of "a" are stepped through in numerical sequence, regardless of the frequency entered in the memory channel location. When memory channel "a" is stepped to, the receiver action is determined by the configuration register mode selected. If single sequence is on, the receiver will stop and enter Step Manual. If OFF, the sequence is repeated.

Sequential Sector Step operation begins at an operator defined memory channel and ends at another operator defined memory channel. Thus the operator defines both the start and stop memory channels. The stop memory channel number must be higher than the start memory channel. Sending the sequential sector command takes the form: "STP a-a" (where the first "a" is start, the second "a" is the stop channel). All memory channels between the first and second "a" are stepped in numerical sequence order. When the stop memory channel is reached the operation of the receiver is determined by the configuration register mode selected, the same as in the Sequential Step operation.

Random Step operation is a series of up to 25 discrete memory channels, stepped through in the order in which they have been entered in the Step command. This allows the operator the flexibility to custom create a series of frequencies for the receiver to tune through in a specified order. The form for entering the series of step memory channels is: "STP a,a,a,a,a,a,...", up to a maximum of 25 channels. Thus, the receiver steps through each of the discrete memory channel frequencies in the order in which they are listed in the Step command. Once the final random step memory channel is reached, the receiver operation is determined by the selection of the configuration register mode, as in Sequential Step.

Step operation may change from Step continue to Step Manual, as determined by the configuration register mode selected and by the variation selected. Step continue mode allows the receiver to halt at a frequency with a signal level that exceeds the COR level, until the signal is lost or the controller sends a resume Step command (STP). The Step Manual operation is similar to the Step Manual operation by allowing the receiver to accept new commands for optimization of the signal encountered. If the Step operation is continued, the Step operation resumes with the next memory channel in the programmed sequence. However, if the Step operation is halted, placing the receiver in the Step Manual mode, and the Manual command (MAN) is sent, the Step operation is terminated and the receiver is placed in the Manual operating mode. Refer to **Table H-5** for a list of the Step commands.

Since lockouts are not supportable in the Step operating mode, memory channels must be enabled or disabled. Enabling or disabling memory channels is accomplished by a combination of two commands. The commands are store memory channel, (SCH) and channel enable, (CHN) or, channel disable (CHN/). The form used to disable a memory channel is as follows: "SCHa,CHN/." Using this form memory channel "a" has been disabled. For memory channels to be enabled or disabled, they must first have been included in the Step sequence being performed. Thus, if a sequential sector Step of memory channels 5 to 10 is being performed, memory channel 12 cannot be disabled. Only memory channels between 5 and 10 (in this case), can be disabled. Likewise, in a random Step operation, a memory channel must be included in the start Step command (STP a,a,a,a) before it can be enabled or disabled.

Table H-5. Step Commands

Commands		Response		
ASCII	HEX	ASCII	HEX	Description
MAN	75			Stop the Step and enter Step Manual. If in Step Manual, enter the Manual mode.
STM	B1			Enter Step Manual mode if the receiver is currently in Step. Otherwise the command is ignored.
STP	8d			Resume Step from Step continue or Step Manual.
STP a	8D b			Start Step using stop channel "a." Step from 0 to memory channel "a."
STPa-a	8D bb			Start Step sequentially using the first memory channel "a" as the start and the second "a" as the stop.
STP a,a,a	8E b,b,b			Start Step using channel "a", then step to channel "a", then step to "a", in the order entered.
STM	B1			Enter Step Manual mode if the receiver is currently in Step, otherwise ignore the command.
SCHa,CHN/	30 b 0C			Disable memory channel "a" from a Step sequence.
SCHa,CHN	30 b 0D			Enable memory channel "a" to a Step sequence.
SSC	10			Resume Step operation if in Step Continue or Step Manual.

LEGEND:

chr	Used in Command	Used in Response
b	Is a single byte of data.	Is a single byte of data.
a	Is 1-3 ASCII digits used as a number.	Is a space and 3 ASCII digits.

H.3.2 SCAN OPERATION

Scan operation in the WJ-8615 Receiver allows the receiver to tune between two operator determined frequencies. The start frequency and setup parameters are loaded into one memory channel and the stop frequency is loaded into another memory channel. The start frequency must always be lower in frequency than the stop frequency. Both frequencies must be entered into memory before a scan is initiated. In addition to the parameters entered in the memory channel, the scan increment size must also be entered. The scan size is determined by the scan increment size command or the bandwidth increment commands. The scan increment command (SCI), is used to set the desired scan increment (between 10 kHz and 5 MHz in 5 kHz increments). When sending the scan increment size, the frequency is always represented as MHz. Thus, selecting a scan increment of 500 kHz would require the following format: "SCI 0.5." This would produce a 500 kHz scan increment.

If no scan increment is specified (SCI 0), the scan increment is determined by the bandwidth stored in the memory channel and the bandwidth increment status. If a scan increment is specified, the Bandwidth commands (FBW or FBW/) have no affect. When SCI is set for a Scan increment of zero, full bandwidth is selected by sending the full Bandwidth command, FBW. The Scan increment is equal to the size of the bandwidth stored in the memory channel.

However, if half bandwidth is selected (FBW/), the scan increment is one-half of the bandwidth stored in the memory channel. If no scan increment is set, the default scan increment is "SCI 0" and the bandwidth is set to half bandwidth.

When entering parameters into the memory channels, the lower numbered memory channel contains the start frequency and the receiver setup parameters. The next higher numbered memory channel contains the stop frequency. (The other parameters are not used for Scan.) The start frequency must always be lower than the stop frequency. Initiating the Scan operation causes the receiver to scan from the start frequency to the stop frequency. The Scan operation is halted when a signal greater than the COR level is encountered or if the controller sends the Manual command, MAN. When this occurs, the receiver is placed in the Scan Manual mode. The Scan operation can be resumed by sending the Scan continue command, SCN or the receiver can be placed in the Manual mode by sending the Manual command, MAN.

Initiating a Scan sequence can be done in two ways. The Scan operation may be set to Scan from the start frequency contained in memory channel "a" and the stop frequency contained in the next memory channel, by using the form "SCN a." Or a scan can be initiated using the start frequency in one memory channel and end using the stop frequency in another specified memory channel by using the form: "SCN a-a." When specifying two memory channels in a scan command, the first channel number is the start frequency and start parameters. The second channel number contains the stop frequency.

Scan operation may change to Scan Continue or to Scan Manual, based on configuration register and the variation selections. While in the Scan Manual mode, the receiver can accept new commands and operating parameters may be varied. This allows an active signal to be more closely observed before resuming the Scan or before entering into the Manual mode. Sending the Scan command "SCN" allows the receiver to exit the Scan Manual mode command and resume the scan.

The action taken by the receiver when a signal is encountered that exceeds the set COR level, is determined by the configuration mode and the variation selected. If the SRQ bit is enabled for signal activity, the receiver sets the SRQ bit as signals are found in the scan. **Table H-6** lists the Scan commands.

Table H-6. Scan Commands

Commands		Response		
ASCII	HEX	ASCII	HEX	Description
SCN	85			Resume scan from Scan continue or Scan Manual.
SCN a	84 b			Start scan from frequency stored in memory channel "a" and frequency in channel a + 1.
SCNa-a	84 b b			Start scan using frequency in memory channel "a" as the start frequency and in the second memory channel as the stop frequency.

LEGEND:

chr	Used in Command	Used in Response
b	Is a single byte of data.	Is a single byte of data.
a	Is 1-3 ASCII digits used as a number.	Is a space and 3 ASCII digits.

Table H-6. Scan Commands (Continued)

Commands		Response		Description
ASCII	HEX	ASCII	HEX	
SCM	B2			Enters Scan Manual if in Scan mode, otherwise it is ignored.
SCI f	06 pppp			Scan increment frequency (in MHz). Selectable from 10 kHz to 5 MHz in 5 kHz increments. SCI of 0 causes increment to be controlled by FBW command.
SCI?	08	SCI f	06 pppp	Requests selected scan increment.
FBW	D8			Selects the full bandwidth scan increment mode.
FBW/	D9			Selects the half bandwidth scan increment mode.
FBW?	DA	FBW	D8	Requests the selected bandwidth scan increment mode.
		FBW/	D9	Scan continue. If in Scan continue already, enters the Manual mode.
MAN	75			Stops scan and enters Scan Manual. If in Scan Manual, enters Manual mode.

LEGEND:

chr	Used in Command	Used in Response
p	Is a packed BCD data byte.	Is a packed BCD data byte.
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits.	Is a space, 4 digits, a decimal, and 4 more ASCII digits.

H.3.3 SCAN LOCKOUT

Lockout allows specific segments of the frequency spectrum to be ignored during the Scan operating mode. This allows previously identified signals to appear invisible to the Scan operation. The lockout frequency entered into the memory channel is the center frequency of the undesired signal. In addition to entering the center frequency, the operator must determine the width of the RF spectrum to lockout. The lockout bandwidth is selectable from 10 kHz to 99.99 MHz in 10 kHz increments. By overlapping the Lockout frequency and bandwidth, one Lockout may extend into another Lockout, thus eliminating an entire segment of the RF spectrum.

The receiver must be in either the Manual operating mode or the Scan Manual mode before a frequency can be entered into a Lockout memory channel. If the receiver is in the Scan Manual mode when the Lockout is sent, the Lockout is stored in memory but is not used until the Scan command with a memory channel (SCN n), is sent. Sending the Scan command without a memory channel (SCN) does not use any of the Lockout frequencies that were sent while in Scan Manual.

When storing Lockout frequencies in memory channels, each Lockout is given a separate memory channel, starting with Lockout 1. Lockout frequencies may be entered into memory in any order, but are arranged in memory in descending frequency order by the processor. This places the highest Lockout frequency in memory Lockout 1.

Two methods may be used to enter a Lockout into partitioned memory. One method is by sending the Lockout command "LCK." This command locks out the current tuned frequency and uses the selected IF bandwidth as the lockout width. If the selected IF bandwidth is not an even 10 kHz increment, the bandwidth is truncated to the nearest 10 kHz multiple. The other method is by using the lock frequency command "LKF", followed by the Lockout center frequency and the Lockout bandwidth.

Once a frequency has been locked out, there are two methods to re-enable (or "de-select"), a Lockout frequency. To re-enable a Lockout frequency the receiver must be in Manual or Scan Manual mode. If the receiver is in Scan Manual, the Lockout is not re-enabled until the Scan is resumed by sending the Scan Command and the associated memory channel number with SCN a.

One method to re-enable a Lockout frequency is by using the center frequency. The unlock frequency command, ULF must be accompanied by the center frequency to be unlocked (re-enabled). If an unlock frequency command is sent and there is no lockout at the specified frequency, an "816" error will be generated.

The other method for re-enabling a locked out frequency is to use the unlock command, ULK and the associated memory channel number. The Lockout memory channels may be searched by the controller in a non-destructive manner, by using the recall lockout command and the lockout channel number (RLK n). Once the desired Lockout is found, the unlock command may be used to re-enable the locked out frequency and the associated bandwidth. To determine the number of Lockout channels in use, the Lockout channel query," LCH?" may be used. The Lockout query requests the number of Lockout memory channels that are being used. The receiver responds by returning "LCH" followed by the number of locked-out channels. Refer to **Table H-7** for a list of the Scan Lockout commands.

Table H-7. Scan Lockout Commands

Commands		Response		
ASCII	HEX	ASCII	HEX	Description
CLC	15			Clears all Lockout memory channels.
LKF ff	1E pppppp			Locks center frequency width in Lockout memory. In binary, the first 4 bytes are center frequency and the last 2 bytes are width (10's MHz, 1's MHz, 100's kHz and 10's kHz.
LCK	94			Locks out the current tuned frequency and uses the IF bandwidth as the width.
LCH?	1D	LCK	94	Requests the number of Lockouts being used.

LEGEND:

chr	Used in Command	Used in Response
p	Is a packed BCD data byte.	Is a packed BCD data byte.
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits.	Is a space, 4 digits, a decimal, and 4 more ASCII digits.

Table H-7. Scan Lockout Commands (Continued)

Commands		Response		Description
ASCII	HEX	ASCII	HEX	
RLK a?	2D bb	LKF ff	1E pppppp	Requests the center frequency and width of Lockout channel a.
ULC a	22 bb			Unlocks frequency and width in memory channel a.
ULF f	36 ppp			Unlocks channel with center frequency f.

LEGEND:

chr	Used in Command	Used in Response
b	Is a single byte of data.	Is a single byte of data.
p	Is a packed BCD data byte.	Is a packed BCD data byte.
a	Is 1-3 ASCII digits used as a number.	Is a space and 3 ASCII digits.
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits.	Is a space, 4 digits, a decimal, and 4 more ASCII digits.

Refer to **Table H-8** for a complete list of the Step/Scan Lockout commands supported by the WJ-8615 Receiver. **Table H-9** provides a list of the Error messages and the cause associated with their generation.

Table H-8. Step/Scan Lockout Commands

Commands		Response		Description
ASCII	HEX	ASCII	HEX	
ACL	09			Select auto calibration.
ACL/	0A			Only calibrate on controller approval.
ACL?	0B	ACL	09	Return auto calibration status.
CAP	0F			Calibration approved.
CFG a	12 b			Sets configuration mode and variation.
CFG?	14	CFG a	12b	Returns current configuration.
CHN	0C			Enables the channel on status flag for storage.
CHN/	0D			Disable channel on flag.
CHN?	0E	CHN CHN/	0C 0D	Returns status of the channel flag.
CLC	15			Clears all Lockout channels.
FBW	D8			Selects full bandwidth scan increment.
FBW/	D9			Selects half bandwidth scan increment.
FBW?	DA	FBW FBW/		Returns bandwidth Scan increment status.

LEGEND:

chr	Used in Command	Used in Response
b	Is a single byte of data.	Is a single byte of data.
a	Is 1-3 ASCII digits used as a number.	Is a space and 3 ASCII digits.

Table H-8. Step/Scan Lockout Commands (Continued)

Commands		Response		
ASCII	HEX	ASCII	HEX	Description
LCH?	1D	LCH n	AB bb	Returns number of last Lockout used.
LCK	94			Locks out current frequency and uses current bandwidth as frequency width of Lockout.
LKF f,f	1E			Lockout center frequency in first argument, width in second argument. In binary, first four bytes are center frequency, last two are width. (Width range 10 kHz - 10 MHz.)
MAN	75			Stops scan. Enters Scan, Step Manual mode if in Scan continue mode if in Scan, Step. Enters Manual mode if in Scan, Step Manual.
MOD?	B3			Returns the current receiver mode:
		MAN	75	Manual
		SCN	84	Scan
		SCM	B2	Scan Manual
		STP	8D	Step
		STM	B1	Step Manual
PAR a	21 B			Partition memory to number of storage channels in memory (a=0 to 71).
PAR?	23	PAR n	21 b	Returns the number of storage channels partitioned.
QUE?	26	QUE	24	Returns no variable when no frequencies in queue.
		QUEf,f..	24pppppp pp..	Returns a maximum of sixteen frequency variables from queue.
RCE a	27 b			Recalls and executes memory channel in statement.
RCH a?	2C b	(See SCH)		Request data in the specified channel. Responds with an SCH command.

LEGEND:

chr	Used in Command	Used in Response
b	Is a single byte of data.	Is a single byte of data.
p	Is a packed BCD data byte.	Is a packed BCD data byte.
a	Is 1-3 ASCII digits used as a number.	Is a space and 3 ASCII digits.
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits.	Is a space, 4 digits, a decimal, and 4 more ASCII digits.

Table H-8. Step/Scan Lockout Commands (Continued)

Commands		Response		Description
ASCII	HEX	ASCII	HEX	
SCH 1,2,3, 4,5, 6,7,8,9,0	30 bb ppppbbbbbb pppp			Store the designated data into the specified memory channel, where: 1 - memory channel number where the data is to be stored (0 to partitioned channel or (149 with EM) 2 - channel off/on flag(CHN/ CHN) 3 - frequency (in MHz) 4 - bandwidth slot (1 to 5) 5 - COR level(0 to 80, 99 for OFF) 6 - detection mode (AM, FM, CW, PLS, USB, LSB, or ISB) 7 - AFC status (AFC, AFC/) 8 - AGC status (AGC, AGC/) 9 - RF gain setting: (0 to 255) 0 - FO frequency (-4 kHz to +4 kHz)
SCI f	06 pppp			Selects the Scan increment frequency.
SCI?	08	SCI f	06 pppp	Returns the current scan increment.
SCN	84			Continues Scan from Scan Continue or Scan Manual mode.
SCN a	84 b			Starts Scan using channel specified by a.
SCN a-a	84 bb			Scan beginning with first a, continuing to the second "a" memory channel.
SCM	B2			Stop scan if in Scan mode. Enters Scan Manual mode.
STM	B1			Stops step, if in Step mode. Enters Step Manual mode.
STO a	8A b			Stores current active receiver parameters in specified channel.
STP	8B			Continues step from Step Continue or Step Manual mode.
STP a	8D b			Starts step using channel specified as the LAST in the sequence. Steps from 0 to channel a.
STP a-a	8D bb			Starts step with first user defined a and ends with second specified a.
STP a,a,a	8Ebbbb...			Starts step with user defined (a) sequences. Maximum of 25 entries.
SSC	10			Continue scan or step from Scan Manual or Step Manual.
ULC a	33 bb			Unlock channel number specified in command.
ULF	36 pppp			Unlock center frequency specified in command.

LEGEND:

chr	Used in Command	Used in Response
b	Is a single byte of data.	Is a single byte of data.
p	Is a packed BCD data byte.	Is a packed BCD data byte.
a	Is 1-3 ASCII digits used as a number.	Is a space and 3 ASCII digits.
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits.	Is a space, 4 digits, a decimal, and 4 more ASCII digits.

Table H-9. Error Messages

Error		Cause	Result
Local	Remote		
	00	No Error	
221	21	1st LO Unlocked >75 msec	Hardware Failure
222	22	2nd LO Unlocked for >75 msec OR 3rd LO Unlocked for >75 msec	Hardware Failure
230	30	Protected RAM error detected	Receiver returns to error detected all defaults including reading of configuration switches.
233	33	Fine tune reference out of tolerance.	Hardware failure, 2nd LO is unable to calibrate or operate properly.
234	34	Unable to calibrate 2nd LO	Hardware failure, Improper 2nd LO operation.
401	01	488 input buffer overflow. 80 char. received without a terminator.	Buffer is dumped, input pointer reset to beginning.
402	02	Illegal message format, 2 characters in ASCII.	Message from error to terminator is ignored.
404	04	Number is out of range for this command.	Message from error to terminator is ignored.
405	05	"/" or "?" is not valid for this command.	Message from error to terminator is ignored.
407	07	Invalid mnemonic or binary command.	Message from error to terminator is ignored.
416	16	This message not valid for WJ-8615.	Message ignored.
470	70	Permission to calibrate request.	Remote controller must send CAP command.
471	71	Calibration in progress.	Receiver calibrating.
472	72	Calibration complete.	Receiver is returned to previous state.
473	73	Calibration aborted.	Receiver returns to Manual mode without completing calibration.
551	51	No more lockout space in lockout memory.	Lockout ignored. Repartition memory.
552	52	Attempt to store memory channel beyond partition.	Store channel ignored. Repartition memory.
810	10	Attempt to scan/step undefined channel.	Command ignored.
813	13	Attempt to scan with start frequency stop frequency.	Command ignored.
814	14	Attempt to select an illegal bandwidth slot. (No bandwidth slot.)	Command ignored.

Table H-9. Error Messages (Continued)

Error		Cause	Result
Local	Remote		
815	15	Attempt to scan/step without a valid calibration.	Scan/Step command ignored. Send CAP if no hardware failure.
818	18	Attempt to unlock a non-existent lockout frequency.	Command Ignored.
817	17	Attempt to scan or step when the receiver on for less than 2 hours.	Scan/Step allowed. Be aware of calibration check required each minute.

Remote Errors for WJ-8615/SSL returned by sending ERR? command.

H.4 SERIAL POLL STATUS BYTE

The following table indicates the bit functions for the Status Byte returned as a result of a serial poll. The list of values associated with each status byte and functions, are given in **Table H-10.**

Table H-10. Serial Poll Status Byte

"Bit	Value	Function
0	1	Indicates a signal greater than the set COR level is present.
1	2	Unit power-up.
2	4	Queue is full.
3	8	Selected Step or Scan operation is complete (must be in the single sequence mode).
4	16	Receiver is busy. The output buffer has data to be sent.
5	32	Error is detected.
6	64	SRQ (service request) set.
7	128	Reserved for future use.

H.5 SCAN AND STEP TIMES

The time duration required for the receiver to perform a Step or Scan operation is determined by the type of filter used and several other factors. The following paragraphs describe the factors that affect the time required to perform operations.

H.5.1 SCAN TIME

The time required to perform a Scan operation is determined by the following factors:

1. Distance between the start and stop frequencies.
2. Number of scan increments between the start and stop frequencies.
3. Size of the frequency increment.
4. Where the Scan occurs within the receiver tuning range.

The following is a list of times which provide the basis for making calculations of specific scan times.

1. Scan points that do not cross 5 MHz boundaries or the optional Frequency Extender band breaks. These times assume no narrow band compensation for non-Gaussian filters.

   a. Time per Scan frequency increment without optional Preselector.

1)	Base time per point	330	µsec
2)	With Preselector on: (add per point)	45	µsec
3)	With non-Gaussian filters:		
	10 kHz filter selected	200	µsec
	15 kHz filter selected	200	µsec
	20 kHz filter selected	100	µsec
	30 kHz filter selected	100	µsec
	50 kHz filter selected	50	µsec
	100 kHz filter selected	0	µsec

   b. Total time per point = (Aa) + (Ab) + (Ac), (if required because of non-Gaussian filters).

2. Scan points that cross 5 MHz boundaries.

   a. Lock time for 1st LO, 7 msec typical.

3. Scan points that cross Frequency Extender bands (500, 600, 700, 800 or 900).

   a. Frequency Extender turned on or band changes add 30 msec.

To calculate the total Scan time:

Multiply the number of points not crossing a 5 MHz boundary by the time in "1." Add the product of the number of 5 MHz boundaries crossed and multiply with the value of "2." Add the number of Frequency Extender band breaks crossed and multiply by value of "3." The sum of these three values provide the total start to stop time, of a scan.

In order to minimize the Scan and Step speed, special IF bandwidth filters are included as part of the Step/Scan Lockout option whenever 10 kHz, 20 kHz, 25 kHz or 50 kHz filters are chosen. These filters are transitional Gaussian to -6 dB and provide faster transient response. However, the filter shape factor is specified at 3:1, 60 dB to 6 dB instead of 3:1, 60 dB to 3 dB. When an improved IF shape factor is required, standard filters can be specified with some sacrifice of slower Scan and Step times.

The following is an example of a typical Scan using a Gaussian filter.

Example

1.	Start Frequency	120 MHz
2.	Stop Frequency	140 MHz
3.	Bandwidth	20 kHz
4.	Scan increment	20 Hz
5.	Preselector	OFF
	Scan time per point	330 µsec
	Total number of points	1000
	Number of 5 MHz boundaries crossed	4
	Number of Frequency Extender band breaks crossed	0

Total Scan Time = 0.33 msec x 1000 + (4 x 7 msec) = 358 msec

H.5.2 STEP TIME

Step time is also affected by factors similar to those of Scan operation. The Step time factors include:

1. Number of Steps taken without crossing a 5 MHz boundary.
2. Number of Steps taken that DO cross a 5 MHz boundary.
3. Number of Steps taken that cross a Frequency Extender band.

The following times are for each Step taken and the condition associated with each step.

1. Step time without crossing a 5 MHz boundary = 1.5 msec (typical)
2. Step time crossing a 5 MHz boundary = 7.0 msec (typical)
3. Step time crossing Frequency Extender bands = 30.0 msec (typical)

H.5.3 IF FILTER SELECTIONS SWITCH

When the SSL option is installed in a WJ-8615 Receiver, two operating speeds are available. The SSL rate selection is determined by S1 on the IEEE/Interrupt module (A1A2). When S1, position 4 is OPEN, the standard SSL operation speed is selected. When S1, position 4 is changed to the CLOSED position, the fast SSL operating mode is selected.

When standard IF filters are installed in the WJ-8615 Receiver, the standard SSL operating rate should be selected. When the receiver is equipped with Gaussian filters, the faster Step/Scan position of S1, position 4 may be used.

H.6 STEP/SCAN LOCKOUT RETROFIT

The following modules and components are required to install the SSL option in a WJ-8615 Receiver.

Type 796244-3 Analog/Digital module (A1A4)
Type 796242-4 Microprocessor module (A1A3)*
Type 776004-3 2nd LO Synthesizer module (A1A6)
Version E.0.3 or higher software

*Or Type 796495-5 Microprocessor, with Version E.1.0 or higher software

H.7 PARTS LIST

The following parts list reflects module changes used in the WJ-8615 Receiver.

H.7.1 TYPE 776004-3 2ND LO SYNTHESIZER REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	4	196D226X0010JE3	56289	
C2	Capacitor, Ceramic, Chip: 4700 pF, 10%, 50 V	3	C1210C472K5XAH	31433	
C3	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	25	34453-1	14632	
C4	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	13	C1210E471K1GAH	31433	
C5 Thru C8	Same as C4				
C9	Capacitor, Electrolytic, Tantalum: 100 µF, 20%, 10 V	1	MMJ-010-107R-20	14674	
C10	Same as C2				
C11 Thru C13	Same as C4				
C14	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	8	34475-1	14632	
C15	Same as C4				
C16	Capacitor, Ceramic, Chip: 4.3 pF, ±0.55 pF, 500 V	1	ATC700B4R3CP500X	29990	
C17	Capacitor, Ceramic, Chip: 6.2 pF, 500 V	1	ATC100B6R2BP500X	29990	
C18	Capacitor, Ceramic, Chip: 200 pF, 50%, 500 V	2	32-257578-40	91984	
C19	Same as C4				
C20	Same as C18				
C21	Capacitor, Ceramic, Disc: .1 pF, 20%, 50V 2.2 µF, 20%, 35 V	6	34575	14632	
C22	Same as C2				
C23 Thru C28	Same as C3				
C29	Not Used				
C30	Not Used				
C31	Same as C3				
C32	Same as C14				
C33	Same as C32				
C34	Same as C32				
C35	Same as C21				
C36	Same as C21				
C37	Same as C32				
C38	Same as C1				
C39	Not Used				
C40	Same as C3				
C41	Capacitor, Electrolytic, Tantalum: 150 µF, 20%, 6 V	2	MMJ-606-157R-20	17554	
C42	Same as C1				
C43	Same as C1				
C44	Capacitor, Ceramic, Disc: .47 µF, 20%, 50 V	3	34452-1	14632	
C45	Capacitor, Ceramic, Chip: 470 pF, 20%, 200 V	1	ATC100B471MP	29990	
C46	Same as C3				
C47	Capacitor, Ceramic, Chip: 47 pF, 5%, 500 V	1	ATC100B470JP500	29990	

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C48	Capacitor, Ceramic, Chip: 6.2 pF, ±0.25 pF, 500 V	1	ATC700B6R2CP500X	29990	
C49	Not Used				
C50	Capacitor, Ceramic, Chip: 4.7 pF, ±0.1 pF, TOL, 500 V	1	ATC100B4R7BP500X	29990	
C51	Same as C4				
C52 Thru C61	Same as C3				
C62	Same as C21				
C63	Same as C21				
C64	Capacitor, Electrolytic, Tantalum: 4.7 μF, 20%, 35 V	1	196D475X0035JE3	56289	
C65	Same as C21				
C66 Thru C69	Same as C3				
C70	Same as C44				
C71	Capacitor, Electrolytic, Tantalum: 47 μF, 20%, 20 V	1	196D476X0020PE4	56289	
C72	Capacitor, Electrolytic, Tantalum: 100 μF, 20%, 20 V	1	196D107X0020TE4	56289	
C73	Same as C41				
C74	Same as C44				
C75	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	2	BHD470-20PCT	91418	
C76	Same as C75				
C77	Same as C3				
C78	Capacitor, Ceramic, Monolithic: 30 pF, ±2%, 100V	1	150-100-NPO-3006	51642	
CR1	Diode	4	U11-3102	52673	
CR2	Same as CR1				
CR3	Diode	3	1N4449	80131	
CR4	Same as CR3				
CR5	Diode	2	1N4446	80131	
CR6	Diode	2	1N754A	80131	
CR7	Same as CR1				
CR8	Same as CR1				
CR9	Same as CR5				
CR10	Same as CR3				
J1	Connector, Receptacle: SMB	1	212	19505	
L1	Coil, Fixed: 1.0 μF, 10%	1	1537-12	99800	
L2	Coil, Fixed: 30 μH, 5%	2	1537-50	99800	
L3	Same as L2				
L4	Coil, Fixed, Molded: 0.1 μH	1	1025-94	99800	
L5	Coil, Fixed, Molded: .22 μH, 10%	3	1025-04	99800	
L6	Same as L5				
L7	Coil, Fixed: 10 μH, 10%	2	1537-36	99800	
L8	Not Used				

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L9	Not Used				
L10	Coil	1	1129-52	14632	
L11	Same as L5				
L12	Inductor	4	170134-1	14632	
L13 Thru L15	Same as L12				
L16	Inductor	1	21209-38	14632	
P1	Receptable Assembly	1	102585-8	00779	
Q1	Transistor	1	2N3906	80131	
Q2	Transistor	1	BFR96	73445	
Q3	Transistor	1	2N2222A	80131	
Q4	Transistor	1	2N2270	80131	
Q5	Transistor	1	U310	17856	
R1	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1.8 W	10	CF1/8-4.7K/J	09021	
R2	Resistor, Fixed, Film: 180Ω, 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
R3	Resistor, Fixed, Film: 5.1 kΩ, 5%, 1/8 W	1	CF1/8-5.1K/J	09021	
R4	Resistor, Fixed, Film: 8.2 kΩ, 5%, 1/8 W	1	CF1/8-8.2K/J	09021	
R5	Resistor, Fixed, Film: 150Ω, 5%, 1/8 W	1	CF1/8-150 OHMS/J	09021	
R6	Resistor, Fixed, Film: 36Ω, 5%, 1/8 W	1	CF1/8-36 OHMS/J	09021	
R7	Resistor, Fixed, Film: 15Ω, 5%, 1/8 W	5	CF1/8-15 OHMS/J	09021	
R8	Resistor, Fixed, Film: 27Ω, 5%, 1/8 W	3	CF1/8-27 OHMS/J	09021	
R9	Same as R7				
R10	Same as R7				
R11	Resistor, Fixed, Film: 130Ω, 5%, 1/8 W	2	CF1/8-130 OHMS/J	09021	
R12	Resistor, Fixed, Film: 120Ω, 5%, 1/8 W	3	CF1/8-120 OHMS/J	09021	
R13	Same as R11				
R14	Resistor Fixed, Film: 56Ω, 5%, 1/8 W	2	CF1/8-56 OHMS/J	09021	
R15	Same as R1				
R16	Resistor, Fixed, Film: 47Ω, 5%, 1/8 W	3	CF1/8-47 OHMS/J	09021	
R17	Same as R1				
R18	Same as R1				
R19	Same as R16				
R20	Resistor, Fixed, Film: 10Ω, 5%, 1/4 W	1	CF1/4-10 OHMS/J	09021	
R21	Same as R1				
R22	Same as R7				
R23	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R24	Resistor, Fixed, Film: 91Ω, 5%, 1/8 W	2	CF1/8-91 OHMS/J	09021	
R25	Same as R7				
R26	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/8 W	4	CF1/8-1.5K/J	09021	
R27	Resistor, Fixed, Film: 2.7Ω, 5%, 1/8 W	1	CF1/8-2.7 OHMS/J	09021	

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R28	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	6	CF1/8-1.0K/J	09021	
R29	Same as R28				
R30	Resistor, Fixed, Film: 3 kΩ, 5%, 1/8 W	3	CF1/8-3K/J	09021	
R31	Same as R30				
R32	Resistor, Fixed, Film: 6.8 kΩ, 5%, 1/8 W	2	CF1/8-6.8K/J	09021	
R33	Same as R30				
R34	Resistor, Variable, Film: 100 kΩ, 10%, 1/4 W	1	3262W1-104	80294	
R35	Resistor, Variable, Film: 5 kΩ, 10%, 1/4 W	1	3262X-1-502	80294	
R36	Resistor, Fixed, Film: 10 kΩ, 5%, 1/8 W	6	CF1/8-10K/J	09021	
R37	Resistor, Variable, Film: 500Ω	1	3262W1-501	80294	
R38	Same as R36				
R39	Same as R36				
R40	Same as R40				
R41 Thru R44	Not Used				
R45	Same as R1				
R46	Resistor, Fixed, Film: 330 kΩ, 5%, 1/8 W	2	CF1/8-330K/J	09021	
R47	Same as R46				
R48	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/8 W	1	C3-4.7K-5PCT	24546	
R49	Resistor, Fixed, Film: 6.8 kΩ, 5%, 1/8 W	1	CF1/8-6.8K/J	09021	
R50	Not Used				
R51	Not Used				
R52	Same as R1				
R53	Resistor, Fixed, Film: 2.7 kΩ, 5%, 1/8 W	4	CF1/8-2.7K/J	09021	
R54	Not Used				
R55	Same as R36				
R56	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	3	CF1/8-100 OHMS/J	09021	
R57	Resistor, Fixed, Film: 330Ω, 5%, 1/8 W	1	CF1/8-330 OHMS/J	09021	
R58	Same as R28				
R59	Resistor, Fixed, Film: 22Ω, 5%, 1/8 W	1	CF1/8-22 OHMS/J	09021	
R60	Same as R36				
R61	Same as R36				
R62	Resistor, Fixed, Film: 680Ω, 5%, 1/8 W	1	CF1/8-680 OHMS/J	09021	
R63	Resistor, Fixed, Film: 820Ω, 5%, 1/8 W	1	CF1/8-820 OHMS/J	09021	
R64	Same as R14				
R65	Not Used				
R66	Same as R12				
R67	Same as R12				
R68	Same as R28				
R69	Same as R53				
R70	Same as R1				

REF DESIG PREFIX A1A6

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R71	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	1	CF1/8-47K/J	09021	
R72	Same as R1				
R73	Same as R53				
R74	Same as R28				
R75	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/8 W	1	CF1/8-3.3K/J	09021	
R76	Same as R32				
R77	Same as R26				
R78	Same as R53				
R79	Same as R24				
R80	Same as R26				
R81	Same as R26				
R82	Not Used				
R83	Same as R28				
R84	Resistor, Fixed, Film: 470Ω, 5%, 1/8 W	1	CF1/8-470 OHMS/J	09021	
R85	Same as R56				
R86	Same as R16				
R87	Resistor, Fixed, Film: 270Ω, 5%, 1/8 W	1	CF1/8-270 OHMS/J	09021	
U1	Amplifier	3	GPD-321	24539	
U2	Same as U1				
U3	Program Divider by 10/11	1	SP8680B	52648	
U4	Divide by 10/11	3	SP8690B	52648	
U5	ECL Dual Flip-Flop, Type D	2	MC10131L	04713	
U6	Single Low Noise Operational Amplifier	1	NE5534N	18324	
U7	4-Bit Data Bus Input PLL Frequency Synthesizer	2	MC145146P	04713	
U8	Same as U1				
U9	Two Modulus Prescaler	2	SP8685B	52648	
U10	Same as U9				
U11	Same as U5				
U12	Same as U4				
U13	Same as U4				
U14	Same as U7				
U15	Analog Switch	1	DG303CJ	17856	
VR1	Diode	1	LM329CZ	27014	
VR2	Diode	1	1N754A	80131	
W1	Cable Assembly Coaxial	1	280565-1	14632	

NOTES:
1. UNLESS OTHERWISE SPECIFIED
a) RESISTANCE IS IN OHMS, ± 5%, 1/8 W.
b) CAPACITANCE IS IN µF.
c) INDUCTANCE IS IN µH.
2. — — — INDICATES SHIELDING COVER.

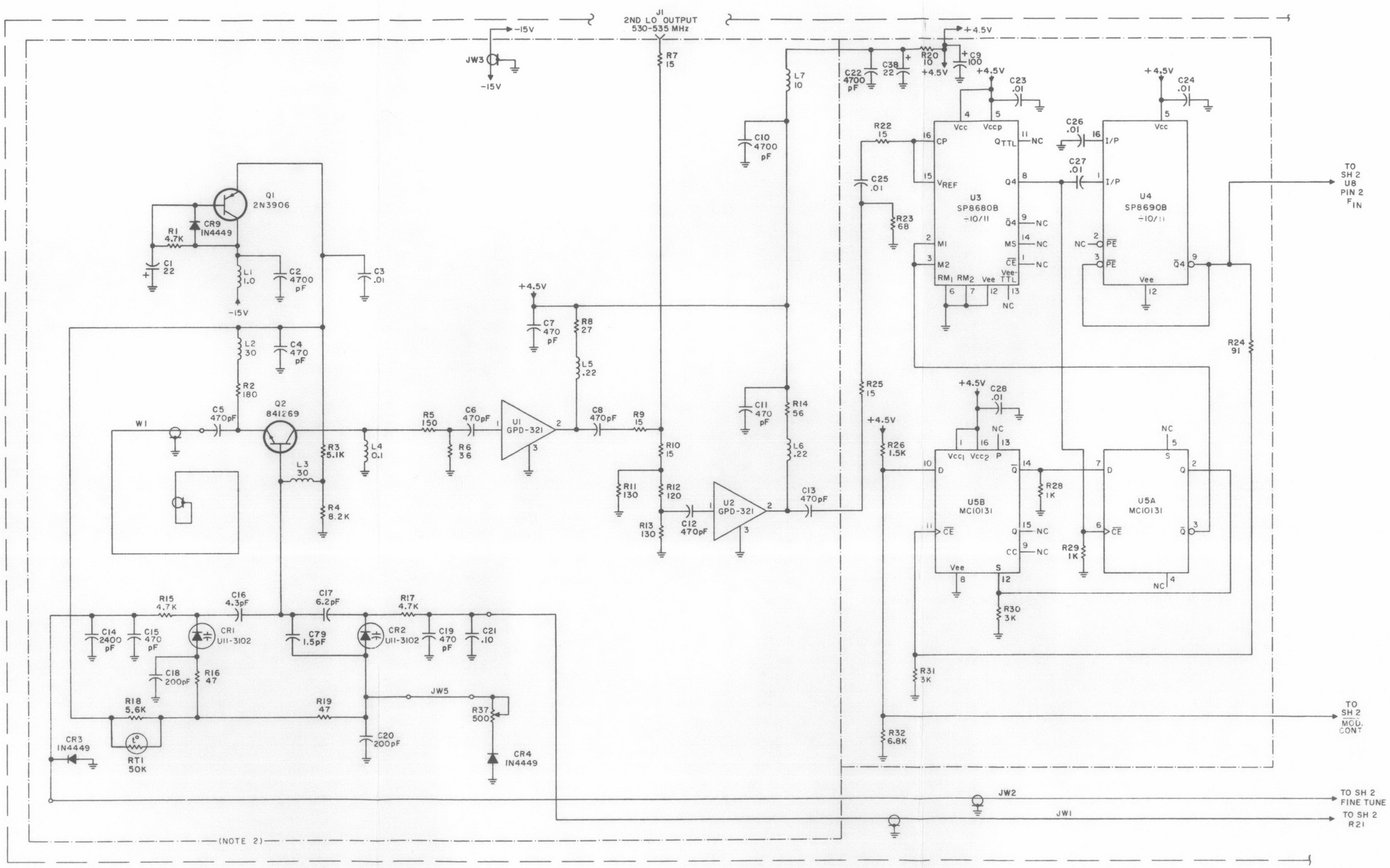

Figure H-1. Type 776004-3, 2nd LO Synthesizer (A1A6), Schematic Diagram 580408 (Sheet 1 of 2) (G)

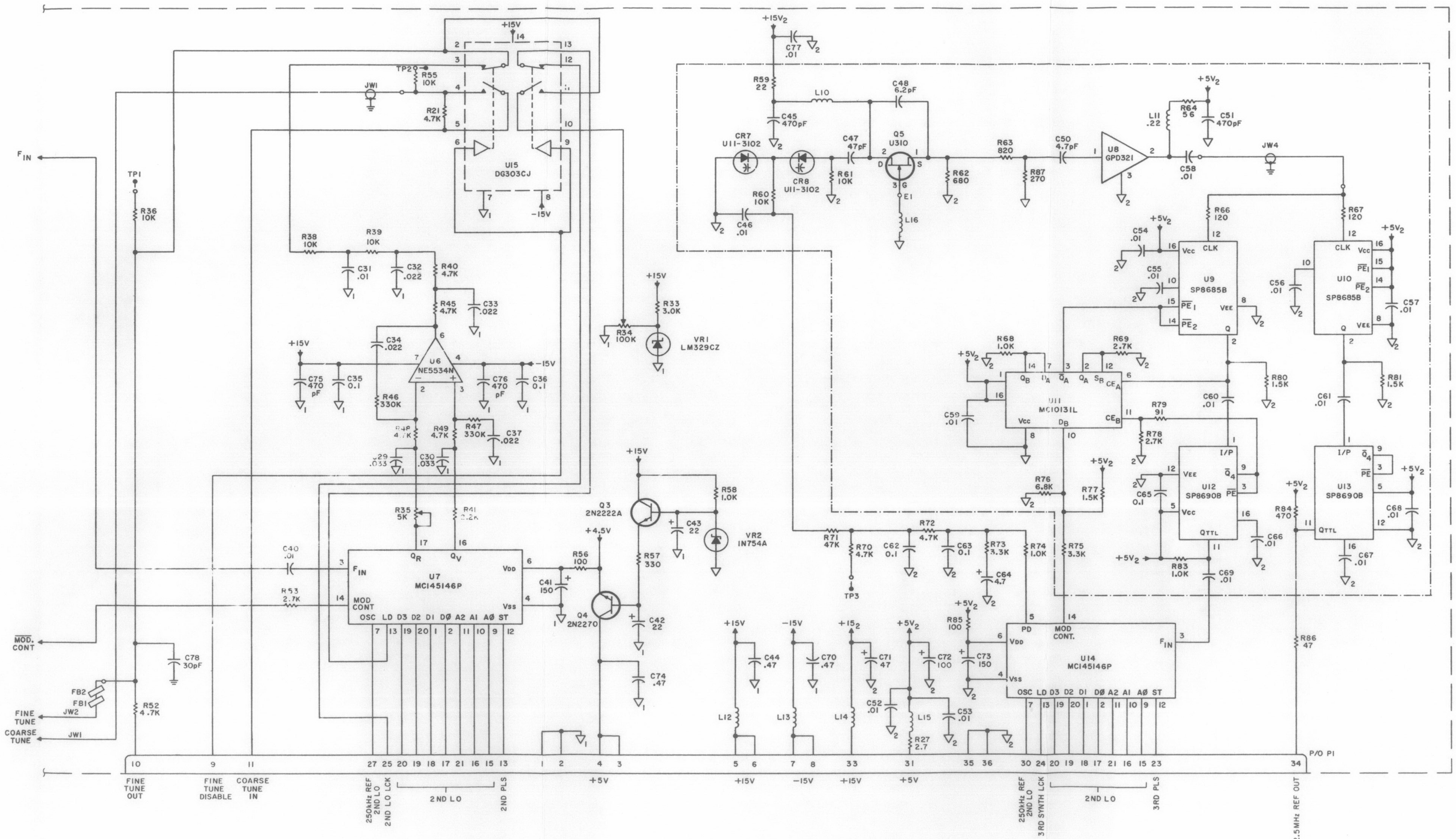

Figure H-1. Type 776004-3, 2nd LO Synthesizer (A1A6), Schematic Diagram 580408 (Sheet 2 of 2) (G)

WJ-8615/FEX-12 RECEIVER

APPENDIX I

FREQUENCY EXTENDER OPTION

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878-1794

July 1989

WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

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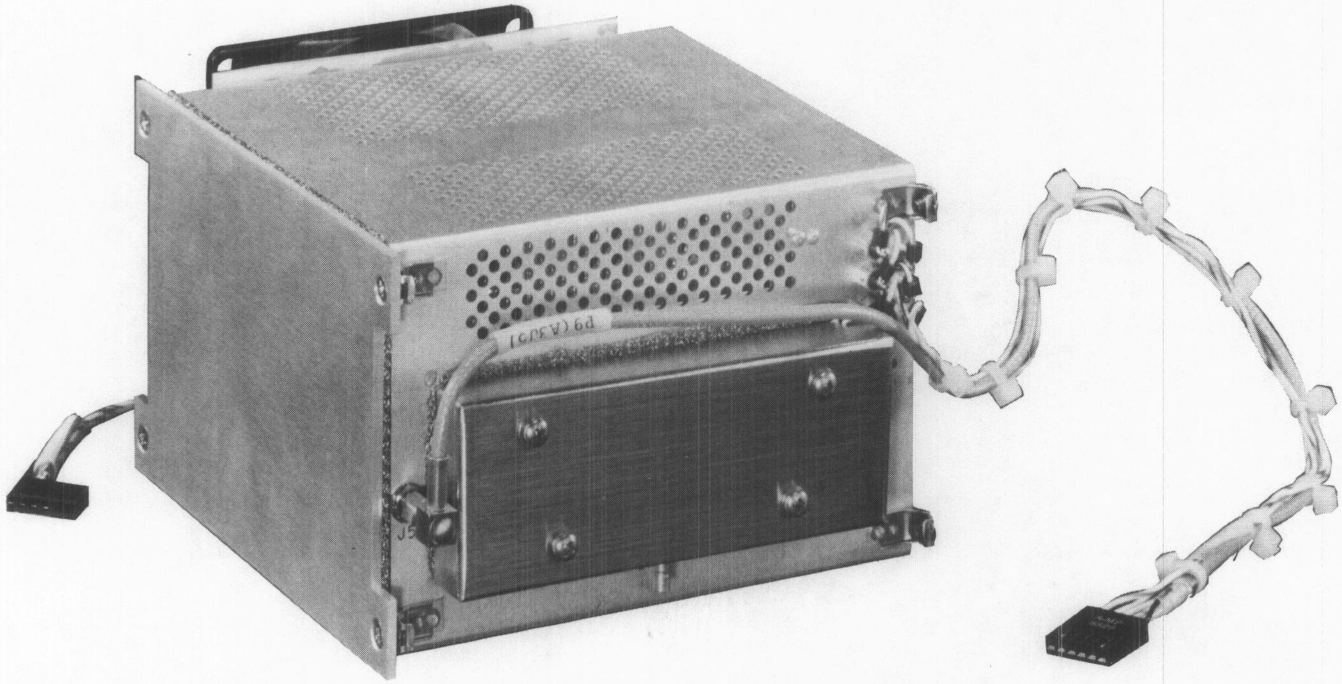


Figure I-1. WJ-8615/FEX-12 Frequency Extender

APPENDIX I

WJ-8615/FEX-12 FREQUENCY EXTENDER OPTION

I.1 GENERAL DESCRIPTION

The WJ-8615/FEX-12 Option extends the upper tuning range of receivers in the WJ-8615 family from 500 MHz to 1200 MHz. The FEX-12 is composed of the UHF Preselector (A3A1A1) Type 796414-3, the UHF Preamplifier Mixer (A3A1A2) Type 796415-3, the UHF LO Synthesizer (A3A1A3) Type 798079-2, and the RF Switch (A3A2) Type 280899-1. When the receiver is tuned to frequencies within the extended frequency range (500-1200 MHz), the received signal is mixed with one of four fixed LO frequencies. The difference frequency (the result of down conversion) is within the VHF tuning range of the receiver.

I.1.1 LIST OF PARTS SUPPLIED

The following items are included as part of the Frequency Extender Type 796456-2.

Item	Ref. Designation	Type	Qty.
A3	FE Option	796456-2	1
A3A1	Motherboard	380762-1	1
A3A1A1	UHF Preselector	796414-3	1
A3A1A2	UHF Preamp/Mixer	796415-3	1
A3A1A3	UHF LO Synthesizer	798079-2	1
A3A1A3A1	UHF Var. Divider	390421-1	1
A3A1A3A2	UHF Oscillator Assembly	796719-1	1
A3A2	RF Switch	280899-1	1

These items are included with the Frequency Extender. Replacement parts for these subassemblies are listed in **paragraph I.8.**

I.2 INSTALLATION

Installation of the Frequency Extender option can be performed by following the procedure below.

CAUTION

When installing the Frequency Extender (FEX-12) Option, special precautions should be taken to prevent the possibility of damaging the UHF Preselector and UHF Preamp/Mixer subassemblies. Older frequency extender versions exist. Subassemblies from one version MUST NOT be mixed with the other version. Use only Type 796414-3 UHF Preselector (A3A1A1) with Type 796415-3 Preamp/Mixer (A3A1A2). Interchanging the different version types could result in physical damage to the subassemblies or cause the unit to operate out of specification.

Installation Procedure:

1) Remove the screws securing the rear panel and extend the rear panel.

2) Remove the fan, its mounting bracket and mount the fan onto the fan bracket supplied with the Frequency Extender (FE).

3) Remove the middle support bracket. Carefully move the cables near the bracket to allow its removal.

4) Install the supplied support bracket and put the spacer for Aux. Connector J13 behind the connector.

5) Unlace the cable bundle, on the bottom of the unit. Remove the cable to J6 and replace it with the supplied connector cable.

6) Unlace the cable to A1A14J1. Install the fan and FE subassembly. To secure the end plate to the FE subassembly put the screws through the side of the unit far enough to hold the plate in place. Then align the screw holes in the subassembly and secure with the remaining screws.

7) Connect P1 to J1 and P7 to J7. Existing cabling may have to be carefully moved. Connect A1A14 to the FE subassembly and connect the FE output cable to A1A14.

8) Relace the wire bundles and reconnect the rear panel to the unit.

I.3 OPERATION

Operation of the WJ-8615 receiver configured with the FEX-12 option is very similar to standard WJ-8615 operation. Installation of the option allows the extended frequency range to be tuned directly from the front panel or remotely via the FRQ mnemonic.

I.4 CIRCUIT DESCRIPTION

I.4.1 FUNCTIONAL DESCRIPTION

With the FEX-12 Option installed, the 20-500 MHz output from the RF Switch (A3A2) is applied to a VHF/UHF select switch in the Type 796415-3 UHF Preamplifier/Mixer (A3A1A2), and the 500-1200 MHz RF Switch output is applied to the input of the UHF Preselector (A3A1A1) Type 796414-3. Refer to **Figure I-16** for the WJ-8615 Frequency Extender Main Chassis schematic diagram.

When the receiver is tuned to frequencies above 500 MHz, the incoming signals are applied from the 500-1200 MHz output of the RF Switch to the input of the UHF Preselector (A3A1A1). The UHF Preselector divides the 500 to 1200 MHz RF frequency range into 4 bands (500 to 599, 600 to 699, 700 to 899 and 900-1200 MHz). Switching between bands is accomplished via the PIN diode switching network, which applies the signal through the selected bandpass filter, determined by the tuned frequency of the receiver. The control signals from the UHF LO Synthesizer (A3A1A3) provide bias current to the PIN diode switching network to accomplish switching between the preselector bands as the UHF LO Synthesizer is tuned.

From the UHF Preselector, the RF signal is applied to the UHF Preamplifier/ Mixer (A3A1A2), where the signal is amplified and mixed with the LO signal provided by the UHF LO Synthesizer (A3A1A3) producing an output frequency within the VHF frequency range. A voltage controlled attenuator (U2) within UHF Preamplifier/Mixer provides automatic gain control (AGC) for this subassembly. U2 receives a dc bias voltage from the AGC circuitry of the receiver which varies with respect to the strength of the received signal, thus controlling the overall gain of the FEX-12 Option. The amount of attenuation introduced by U2 varies directly with the strength of the tuned signal providing a relatively constant signal to the mixer (U3). From the mixer, the down converted signal is applied to the receiver via the UHF/VHF select switch in the output circuitry of the UHF Preamplifier/Mixer.

When the receiver is tuned to 500 MHz or less, the UHF/VHF switch, at the output of the UHF Preamplifier, switches to provide a signal path from the 20-500 MHz RF Switch output to the VHF section of the receiver. At this time, the output from the UHF section is cut off.

I.4.2 DETAILED CIRCUIT DESCRIPTION

I.4.2.1 Type 280899-1 Switch Assembly (A3A2)

The reference designation for this subassembly is A3A2. Refer to **Figure I-15** for the Type 280899-1 RF Switch schematic diagram.

RF Switch (A3A2) Type 280899-1 receives input RF signals from the Antenna Input (J1). Received RF signals are capacitively coupled through C7 and C9 to the two filter branches. One branch, consisting of L6 and L7, C10 through C15 and their associated components, forms the VHF (500-1200 MHz) bandpass filter. Filter branch selection is accomplished via voltages from the Motherboard (A3A1) applied to E1 and E2 of the RF Switch Assembly. When the receiver tuned frequencies are from 20 to 500 MHz, a +15 Vdc is applied to E1 of the RF switch. At the same time a -10 Vdc is applied to E2. Applying a +15 Vdc to E1, of the RF Switch (A3A2), forward biases CR3 and allows the received RF signal to flow through the VHF filter branch and to J2 of the UHF Preamplifier/Mixer (A3A1A2). While the +15 Vdc is applied to E1 a -10 Vdc is applied to E2. This -10 Vdc reverse biases CR4 and prohibits signal flow through the UHF bandpass filter branch. Tuning the receiver to frequencies from 500-1200 MHz causes the voltages applied to E1 and E2 to be reversed. The -10 Vdc on E1 inhibits the flow of signals through the VHF branch by reverse biasing CR3. The +15 Vdc applied to E2 forward biases CR4 and permits UHF signals to be passed through the UHF bandpass filter branch.

I.4.2.2 Type 796414-3 UHF Preselector (A3A1A1)

The reference designation for this subassembly is A3A1A1. Refer to **Figure I-11** for the Type 796414-3 UHF Preselector schematic diagram.

The Type 796414-3 UHF Preselector (A3A1A1) provides the first stage of RF preselection for the 500-1200 MHz UHF signals. This subassembly utilizes three bandpass filters (FL1 through FL3) dividing the UHF spectrum into three bands: 500-700, 700-900 and

900-1200 MHz. Each bandpass filter is essentially flat over its specified frequency and passes these frequencies with minimum attenuation (0.5 dB). Frequencies out of the filter bandpass are attenuated, thus improving image frequency and IF rejection. The RF signal enters the UHF preselector via P1 of cable W1 and is coupled by C1 to the PIN diode switching network comprised of CR1 through CR14. This switching network applies the signal of interest through the appropriate bandpass filter, according to the tuned frequency of the receiver. From the filter, the RF signal is coupled through C12 to the output (P2 of W2).

Switching of the RF signal through the proper filter is controlled by the Band A*, B* and C* select inputs. Dependent upon the tuned frequency, the Band A*, B*, or C* select is placed at -10 Vdc providing a current-sink through its respective series input and output PIN diodes. When conducting, the diodes provide a minimum impedance path for the RF signal through the filter within the selected branch. The remaining select inputs are held at +15 Vdc which provides a current source for the shunt diodes in their switch branch. The series diodes in these branches are cut off, thus blocking the RF signal path. The select inputs required to activate each filter branch are illustrated in the UHF Preselector Bandpass Selection Table (Table I-1). Each of the select inputs are provided by the Digital Control Section, automatically selecting the proper filter for the frequency tuned.

Table I-1. UHF Preselector Bandpass Selection Table

Select UHF/VHF	C*	B*	A*	Active Filter	Bandpass (MHz)
0	1	1	1	---	---
1	1	1	0	FL1	500 - 700
1	1	0	1	FL2	700 - 900
1	0	1	1	FL3	900 - 1200

0 = -10 Vdc
1 = +5 Vdc

Inductors L1 through L8, ferrite beads FB3 through FB12, resistors R1, R3 through R9 and capacitors C6 through C11 and C13 through C18 function as decoupling components. These components prevent RF signals from exiting the UHF Preselector via the select inputs of the subassembly.

I.4.2.3 Type 796415-3 UHF Preamplifier/Mixer (A3A1A2)

The reference designation for this subassembly is A3A1A2. Refer to **Figure I-12** for the Type 796415-3 UHF Preamplifier/Mixer schematic diagram.

The RF signal from the Type 796414-3 UHF Preselector (A3A1A1) enters the UHF Preamplifier/Mixer (A3A1A2) via RF input connector J1 and is applied to the input of preamplifier U1. U1, a broadband amplifier, provides +15.5 dB of gain to the RF signal increasing the signal to a sufficient level to drive the mixer. Decoupling of the +15 Vdc input to U1 (pin 1) is accomplished by L3 and C5. The output of U1 (pin 4) is then applied to PIN diode attenuator U2 via FL1. FL1 is a 1200 MHz low-pass filter, installed in the signal path to attenuate frequencies

* Indicates active low.

above 1200 MHz, thus reducing image noise from U1. Voltage controlled attenuator U2, presents a constant impedance at the output of FL1 and provides a means of limiting the signal level to the mixer under strong signal conditions. The amount of attenuation presented by U2 is dependent on the AGC voltage provided by the AGC circuitry of the receiver applied to terminal 49 of the UHF Preamplifier/Mixer subassembly. This voltage varies from +10 Vdc, when weak signals are present to +2 Vdc under strong signal conditions. The attenuation presented by U2 varies between -20 dB, with an AGC voltage of +2 Vdc, to -1.75 dB, with an AGC voltage of +10 Vdc. Operating bias is supplied by +15 Vdc applied to pin 1 via the decoupling network comprised of L4 and C6. Control is supplied by the AGC voltage applied to pin 5. L9, C16 and C17 provide decoupling of the AGC input line.

Double balanced mixer U3 receives the RF signal from U2 and mixes it with an LO signal provided by the UHF LO Synthesizer (A3A1A3) providing a difference frequency within the VHF range. The UHF LO Synthesizer applies one of four different fixed frequencies to the mixer to divide the UHF frequency range into four frequency bands as illustrated in the UHF Tuning Table (Table I-2). The Digital Control Section then tunes the VHF section of the receiver to the mixer output frequency, thus permitting the signal of interest to be further processed. The mixer output from pin 1 of U3 is coupled across dc blocking capacitor C22 and is then applied through a low-pass filter comprised of L10, C26 and C27. This filter suppresses high order harmonics of the UHF LO preventing their radiation from the VHF input (J2). From the low-pass filter, the RF signal is applied to the UHF branch of the UHF/VHF switch.

Table I-2. UHF Tuning Table

RF Tuned Frequency (MHz)	LO Frequency (MHz)	Mixer Output Frequency (MHz)
500 - 599	848	348 - 249
600 - 699	944	344 - 245
700 - 899	1144	444 - 245
900 - 1200	1344	444 - 144

The UHF/VHF switch, comprised of CR3 through CR6, selects the converted UHF signal from the UHF mixer or the VHF signal from the RF Switch (A3A2), entering at J2. Switching is controlled by the UHF/VHF input (terminal 53) provided by the Digital Control Section. This switching input is at a logic "1" (+5 Vdc) when the receiver is tuned to 500 MHz or above and at a logic "0" (0 Vdc) when tuned below 500 MHz. The UHF/VHF select signal from terminal 53 is applied, via R11, to the inverting input of switch driver U8B and also to the U8A non-inverting input. These switch drivers switch between +15 Vdc and -10 Vdc providing bias current for the PIN diodes in the UHF/VHF switch. With a tuned frequency of 500 MHz or higher, the +5 Vdc level causes the output of U8A to switch to +15 Vdc. This provides a current source for CR4, causing it to conduct and provides a current path for the converted UHF signal to the output of the subassembly (J4). At this time the output of U8B is at -10 Vdc, providing a current-sink for CR6. This causes CR6 to conduct and series diode CR5 to be cut off, preventing the VHF signal from passing through the switch. With tuned frequencies below 500 MHz, the outputs of U8A and U8B are reversed, causing a signal path for the VHF signal through CR5 and blocking the UHF path by cutting off CR4. The voltage divider formed by R5 and R3 provides a switching reference level of approximately 1.5 Vdc.

Integrated circuits U6 and U7 function as switch drivers for the band select circuitry of the UHF Preselector (A3A1A1). These switch drivers receive the UHF/VHF and the 2^0 and 2^1 UHF select inputs from the Digital Control Section and decode these inputs to select the proper preselector filter as the UHF LO Synthesizer is tuned. The UHF select inputs are applied to the A, B and C inputs of decoder U4, which in turn provides a logic "1" level to the inverting input of appropriate switch driver (U7B, U6A or U6B). The UHF/VHF input is also applied directly to the non-inverting input of U7A causing the output of U7A to be held at +5 Vdc, whenever UHF is selected by the UHF/VHF select input. The remaining drivers switch according to the logic levels provided at the 2^0 and 2^1 UHF select inputs.

When the receiver is tuned between 500 and 599 MHz, 2^0 and 2^1 are both at a logic "0", causing the Q4 output of U4 to be placed at a logic "1." This level is applied at pin 6 of U6B, via CR2, causing the A* select output to be switched to -15 Vdc. At frequencies of 500 to 699 MHz, 2^0 is at logic "1" and 2^1 is at logic "0." This condition causes the Q5 output of U4 to be placed at a logic "1" level. This level is applied at pin 6 of U6B, via CR1, causing the A* select output to be switched to -15 Vdc. At tuned frequencies of 700 to 899 MHz, 2^0 is at a logic "0" and 2^1 is at a logic "1", causing the Q6 output of U4 to be placed at a logic "1." The Q6 output level is applied to the inverting input of U6A, causing the B* output to be switched to -15 Vdc. When frequencies between 900 and 1200 MHz are tuned, both the 2^0 and 2^1 select inputs are at a logic "1" state. This causes the Q7 output of U4 to be placed at a logic "1" state. The Q7 output is applied to the inverting input of U7B, causing the C* output to be switched to -15 Vdc.

The LO signal provided by the UHF LO Synthesizer is applied to the mixer (U3) via J3 and buffer amplifier U5. U5 receives the LO signal at a level of -3 dBm and provides amplification of +10 dB increasing the signal to a sufficient level to drive mixer U3. L5 and C7 function as decoupling components maintaining a signal ground potential on the +9 Vdc source.

I.4.2.4 Type 798079-2 UHF LO Synthesizer (A3A1A3)

The reference designation for this subassembly is A3A1A3. Refer to **Figure I-13** for the Type 798079-2 UHF LO Synthesizer schematic diagram.

This subassembly consists of the UHF Variable Divider (A3A1A3A1) and the UHF Oscillator Assembly (A3A1A3A2), which together comprise the phase locked loop of the UHF LO Synthesizer. The inputs consists of the 1 MHz reference, (provided by the Synthesizer Section at J2) the UHF and UHF SEL (2^1, 2^0) select inputs provided by the Digital Control Section. The output provided consists of a fixed LO frequency of 848, 944, 1144 or 1344 MHz at J1 of the 848-1344 MHz Oscillator.

I.4.2.5 Part 390421-1 HF Variable Divider (A3A1A3A1)

The reference designation for this part is A3A1A3A1. Refer to **Figure I-13** for the Part 390421-1 schematic diagram.

The Part 390421-1 UHF Variable Divider (A3A1A3A1) provides the tuning control for the 848-1344 MHz Oscillator, A3A1A3A2. This subassembly decodes the UHF, 2^0 and 2^1 select lines, provided by the Digital Control Section, and utilizes the decoded data to select the oscillator frequency band and to preset the divide-by-n counters in the phase-locked-loop circuitry.

Control inputs to the Part 390421-1 UHF Variable Divider consist of the UHF, 2^0, and 2^1 select inputs, provided at terminals E1, E2 and E3. The UHF input line, which is set to a logic "1" whenever the receiver is tuned above 500 MHz, is applied to the G input of U8 and to the cathode of CR1 enabling the Variable Divider circuitry. The 2^0 and 2^1 inputs are applied to the A and B inputs of U8 and to gates A and B of U9. U8 and U9 then decode the select inputs selecting the oscillator frequency band and presetting binary counters U7 and U6. Comparator U5 monitors the output lines of U8 and compares the logic level at each line with a +2.5 Vdc reference, provided by the voltage divider formed by R1 and R2. Each comparator in U5 provides +15 Vdc to the appropriate band select input of the oscillator assembly when its respective input (from U8) goes low, causing the desired oscillator band to be selected. The remaining outputs of U5 are held at -15 Vdc, due to the logic "1" at their inverting inputs.

A sample of the output frequency of A3A1A3U1 enters the Variable Divider at E9 and is applied to the input of amplifier U4 via the pad formed by R9, R10 and R11. U4 amplifies the oscillator frequency and applies the signal to the input of U3, via C12. Integrated circuits U3 and U2 provide divide factors of 4 and 2, respectively, providing a total prescaling factor of 8. The prescaled output is then applied to the input of a two modulus counter which further divides the signal by a factor of 10 or 11, as determined by the CRY output of counter U6. When the CRY output is at a logic "0," U1 divides by 11 and when the output is at a logic "1," U1 divides by 10. The output of U1 is then applied as a TTL clock to counters U7 and U6.

Presetable binary counters U7 and U6 function with the two modulus counter U1 providing division factors of 106, 118, 143 or 168. U7 and U6 are preset by the decoded outputs of U8 and U9 and count up from the preset until the maximum count is reached. When the maximum count is reached, a pulse is provided to the phase detector U10 and the CRY output of U7 reloads the counters, restarting the count sequence. U7 determines the total number of counts in each count sequence and U6 determines the number of times U1 divides by 11 or 10.

For example, when a LO frequency of 848 MHz is selected, U7 is preset to "6" and U6 is preset to "9." The total count sequence continues until U7 counts up from "6" to its maximum of "15" and then resets (10 counts). Simultaneous with the count of U7, U6 counts up from its preset of "9" to its maximum of "15" (6 counts). When U6 reaches "15" the CRY output is set to 1 and U6 counting halts until the preset is reloaded. During the first 6 counts (while U6 is counting) U1 divides by a factor of 11. For the remaining 4 counts (until U7 reaches its maximum count) U1 divides by a factor of 10. The total count sequence provides a divide factor of 106 $(11 \times 6) + (10 \times 4)$. This, combined with the division factor of 8 by the prescaler, divides the oscillator output frequency by a factor of 848.

The output of U7 is applied to the phase detector (U10), where the divided signal is compared with the 1 MHz reference signal, provided by the Synthesizer Section of the receiver. The phase detector compares the frequency and phase of the two signals and generates an output representing the difference between the signals. This output is integrated by the loop filter, comprised of Q1, Q2 and associated components, to produce a tuning voltage which retunes the oscillator until the divided signal and the reference signal are equal in both frequency and phase. R18 and C22 determine the bandwidth of the loop filter, and C21 and R19 permit bandwidth adjustment.

I.5 PERFORMANCE TEST

After the Frequency Extender Option has been installed, verify proper operation of the frequency extender via the following procedure.

1. Connect a signal generator to the Antenna Input (J1) with a CW output at -20 dBm. Connect a spectrum analyzer to J4 of the Frequency Extender.

2. Tune the signal generator and the receiver to 500 MHz. Set the spectrum analyzer center frequency to 348 MHz. Note the output level displayed on the spectrum analyzer.

3. Tune the receiver and signal generator to the following frequencies and monitor the output frequency and level on the spectrum analyzer. Verify the frequency accuracy (1 kHz) and the output level gain (+3 to +6 dB gain), compared to the level noted in step 2.

Tuned Frequency	S.A. Frequency
599 MHz	249 MHz
600 MHz	344 MHz
699 MHz	245 MHz
700 MHz	444 MHz
899 MHz	245 MHz
900 MHz	444 MHz
1200 MHz	144 MHz

I.6 ALIGNMENT

Alignment of the Frequency Extender Option may be performed via the procedure that follows:

1. Using an RF analyzer, connect the RF analyzer reflection test port to the Antenna Input (J1) and the RF analyzer's transmission RF input to J3 of the RF Switch (A3A2). Tune the WJ-8615 to 600 MHz.

2. Observe the displayed response on the RF analyzer. Adjust the analyzer to display a 500 MHz response centered at 450 MHz.

3. Adjust L7 to notch out the frequency at 228 MHz and L6 to notch out the frequency at 337 MHz. (Coil adjustment is accomplished via compressing or spreading the coil turns.)

4. Verify that the roll off from 450 MHz to 350 MHz is a minimum of 30 dB and that the ripple from 200 MHz to 340 MHz is at least 30 dB below the level at 450 MHz.

5. Verify the insertion loss is not greater than 1.5 dB and that the bandpass ripple is not more than 1.75 dB overall.

6. With the RF analyzer transmission RF input connected to A3A2J2, connect the reflection test port to the Antenna Input (J1), tune the WJ-8615 to 400 MHz and observe the displayed response.

7. Adjust L8 and L9 to produce minimum insertion loss and maximum flatness (less than 0.5 dB loss from 400 MHz to 550 MHz).

I.7 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00779	Amp, Inc. P.O. Box 3608 Harrisburg, PA 17105
01295	Texas Instruments, Inc. Semiconductor-Components Div. 13500 North Central Expressway Dallas, TX 75231
02114	Ferroxcube Corp. P.O. Box 359 Mount Marion Road Saugerties, NY 12477
02735	RCA Corporation Solid State Division Route 202 Somerville, NJ 08876
04222	AVX Ceramics Division of AVX Corp. Myrtle Beach, SC 29577
04713	Motorola, Inc. Semiconductor Products Div. Phoenix, AZ 85008
05397	Union Carbide Corp. 11901 Madison Avenue Cleveland, OH 44101
09021	Airco Electronics Bradford, PA 16701
14482	Watkins-Johnson Company 3333 Hillview Avenue Palo Alto, CA 94304
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20878
18736	Voltronics Corporation West Street Hanover, NJ 07936
19505	Applied Engineering Products 300 Seymour Avenue Derby, CT 06418
24539	Avantek, Incorporated 3175 Bowers Avenue Santa Clara, CA 95051
24546	Corning Glassworks Bradford, PA 16701

I.8.1.1 **Type 380762-1 Motherboard Assembly** REF DESIG PREFIX A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision B1				
A1	UHF Preselector	1	796414-1	14632	
A2	UHF Preamplifier, Mixer	1	796415-1	14632	
A3	UHF LO Synthesizer	1	798079-2	14632	
C1	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	3	34475-1	14632	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	1	34452-1	14632	
C5	Capacitor, Electrolytic, Tantalum: 100 µF, 20%, 35 V	2	MTP107M035P1C	76055	
C6	Same as C5				
C7	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	6	34453-1	14632	
C8 Thru C12	Same as C7				
CR1	Diode	2	1N4446	80131	
CR2	Same as CR1				
J1	Socket, Integrated Circuit	1	514-AG10D	91506	
L1	Coil, Fixed: 0.47 µH	1	1025-12	99800	
P1	Connector, Plug	1	3406-0002	75037	
R1	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	1	CF1/8-1.0K/J	09021	
R2	Resistor, Fixed, Film: 5.1 kΩ, 5%, 1/8 W	1	CF1/8-5.1K/J	09021	
R3	Resistor, Fixed, Film: 180Ω 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
R4	Resistor, Fixed, Film: 7.5Ω, 5%, 1/4W	1	CF1/4-7.5 OHMS/J	09021	
U1	Integrated Circuit	1	LM358N	27014	
W1	Cable Assembly	1	380532-1	14632	
XA1	Housing	2	MK30C-13-195-4381	81312	
XA2	Same as XA1				
XA3	Connector, Receptacle, Multipin	1	RF30-2852-5	57856	

I.8.1.1.1 **Type 796414-3 UHF Preselector** REF DESIG PREFIX A3A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision C1				
C1	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	2	C1210C471K1GAC	31433	
C2 Thru C5	Not Used				
C6	Capacitor, Ceramic, Monolithic: 220 pF, 5%, 100 V	6	8121-100-C0G0-221J	59660	
C7 Thru C11	Same as C6				
C12	Same as C1				
C13	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	3	34475-1	14632	
C14	Capacitor, Ceramic, Disc: 1000 pF, 500 V	3	59Z5U102P	91984	
C15	Same as C13				
C16	Same as C14				
C17	Same as C13				
C18	Same as C14				
C19	Capacitor, Variable, Air: 1-4.5 pF, 250 V	2	9410-0	91293	
C20	Same as C19				
CR1	Diode Pin	12	841320	14632	
CR2 Thru CR9	Same as CR1				
CR10	Diode	2	MA47201	96341	
CR11	Same as CR10				
CR12 Thru CR14	Same as CR1				
CR13	Same as CR2				
CR14	Same as CR2				
FB1	Not Used				
FB2	Not Used				
FB3	Ferrite Bead	10	56-590-65-4A	02114	
FB4 Thru FB12	Same as FB3				
FL1	Filter, Bandpass: 600 MHz CF, 200 MHz Bandwidth	1	92222	14632	
FL2	Filter, Bandpass: 800 MHz CF, 200 MHz Bandwidth	1	92223	14632	
FL3	Filter, Bandpass: 1050 MHz CF	1	92390	14632	
L1	Coil, Fixed	8	170134-1	14632	
L2 Thru L8	Same as L1				
L9	Coil, Fixed	3	190187-1	14632	

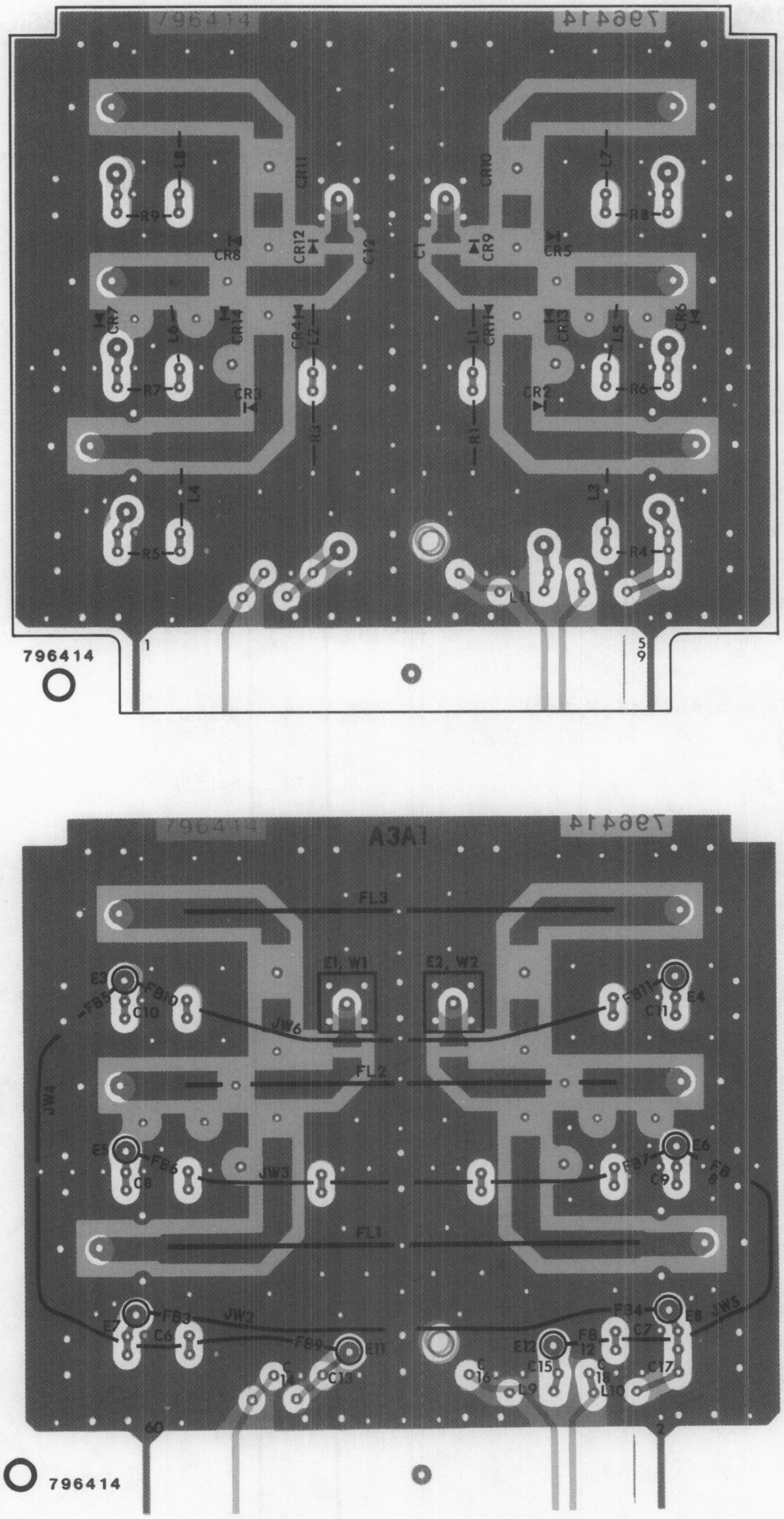


Figure I-5. Type 796414-3, UHF Preselector (A3A1A1), Location of Components

REF DESIG PREFIX A3A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L10	Same as L9				
L11	Same as L9				
P1	Connector, Plug	1	50-024-3875-91	98291	
P2	Connector, Plug	1	50-328-3875-91	98291	
R1	Resistor, Fixed, Film: 1.2 kΩ, 5%, 1/4 W	2	CF1/4-1.2K/J	09021	
R2	Not Used				
R3	Same as R1				
R4	Resistor, Fixed, Composition: 470Ω, 5%, 1/8 W	6	RCR05G471JS	81349	
R5 Thru R9	Same as R4				
W1	Cable Assembly	1	17300-188-3	14632	
W2	Cable Assembly	1	17300-188-4	14632	

I.8.1.1.2 Type 796415-3 UHF Preamplifier/Mixer

REF DESIG PREFIX A3A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
C1	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	2	196D475X0035JE3	56289	
C2	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	15	34475-1	14632	
C3	Same as C1				
C4 Thru C15	Same as C2				
C16	Capacitor, Ceramic, Monolithic: 470 pF, 5%, 100 V	3	8121-100-C0G0-471J	59660	
C17	Same as C16				
C18	Same as C2				
C19	Same as C2				
C20	Capacitor, Ceramic, Disc: 1000 pF, 10%, 100 V	2	8121-100-X7R0-102K	59660	
C21	Same as C20				
C22	Capacitor, Ceramic, Chip: 220 pF, 10%, 50 V	1	C1210C221K5GAH	05397	
C23	Capacitor, Ceramic, Chip: .05 µF, 10%, 50 V	2	1210-050-X7R-503K5	55969	
C24	Same as C23				
C25	Same as C16				
C26	Capacitor, Ceramic, Chip: 4.3 pF, 0.5%, 500 V	2	ATC700B4R3DP500X	29990	
C27	Same as C26				
C28	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	1	C1210E471K1GAH	31433	
C29	Capacitor, Variable, Air: 0.6-4.5 pF, 500 V	1	M5F	18736	
CR1	Diode	2	1N4446	80131	
CR2	Same as CR1				
CR3	Diode, Pin	2	GC4212-15	50101	
CR4	Diode, Pin	2	GC4371-15	50101	
CR5	Same as CR4				
CR6	Diode	1	5082-3040	28480	
CR7	Not Used				
CR8	Same as CR3				
FL1	Filter Low-Pass: 1100 MHz	1	92225	50140	
J1	Connector, Receptacle	4	1009-7511-000	19505	
J2 Thru J4	Same as J1				
L1	Coil, Fixed	6	16209-12	14632	
L2 Thru L5	Same as L1				
L6	Coil, Fixed	2	170134-1	14632	
L7	Coil, Fixed	2	190187-1	14632	
L8	Same as L6				
L9	Same as L1				

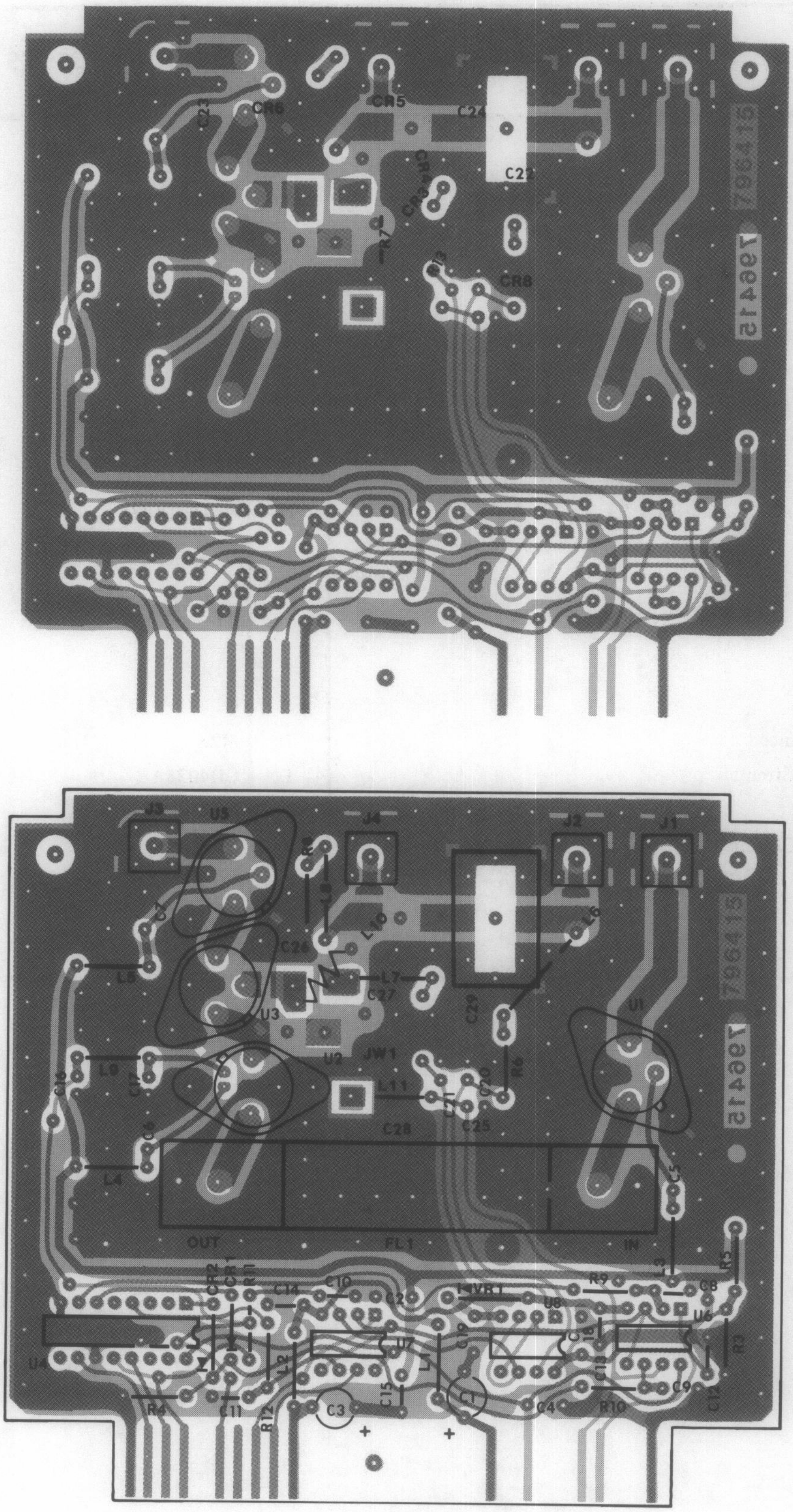


Figure I-6. Type 796415-3, Preamplifier/Mixer (A3A1A2), Location of Components

REF DESIG PREFIX A3A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L10	Coil, Fixed	1	170189-1	14632	
L11	Same as L7				
R1	Not Used				
R2	Not Used				
R3	Resistor, Fixed, Film: 1.8 kΩ, 5%, 1/8 W	2	CF1/8-1.8K/J	09021	
R4	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	1	CF1/8-47K/J	09021	
R5	Resistor, Fixed, Film: 12 kΩ, 5%, 1/8 W	1	CF1/8-12K/J	09021	
R6	Resistor, Fixed, Film: 680Ω, 5%, 1/8 W	2	CF1/8-680 OHMS/J	09021	
R7	Same as R6				
R8	Resistor, Fixed, Film: 1.2 kΩ, 5%, 1/8 W	1	CF1/8-1.2K/J	09021	
R9	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	4	CF1/8-18K/J	09021	
R10 Thru R12	Same as R9				
R13	Same as R3				
U1	Amplifier	1	A12	14482	
U2	Attenuator	1	G1	27956	
U3	Mixer, Balanced	1	M2A	27956	
U4	Integrated Circuit	1	CD4028AE	02735	
U5	Amplifier	1	A28	27956	
U6	Integrated Circuit	3	LM358N	27014	
U7	Same as U6				
U8	Same as U6				
VR1	Diode, Zener: 5.1 V	1	1N751A	80131	

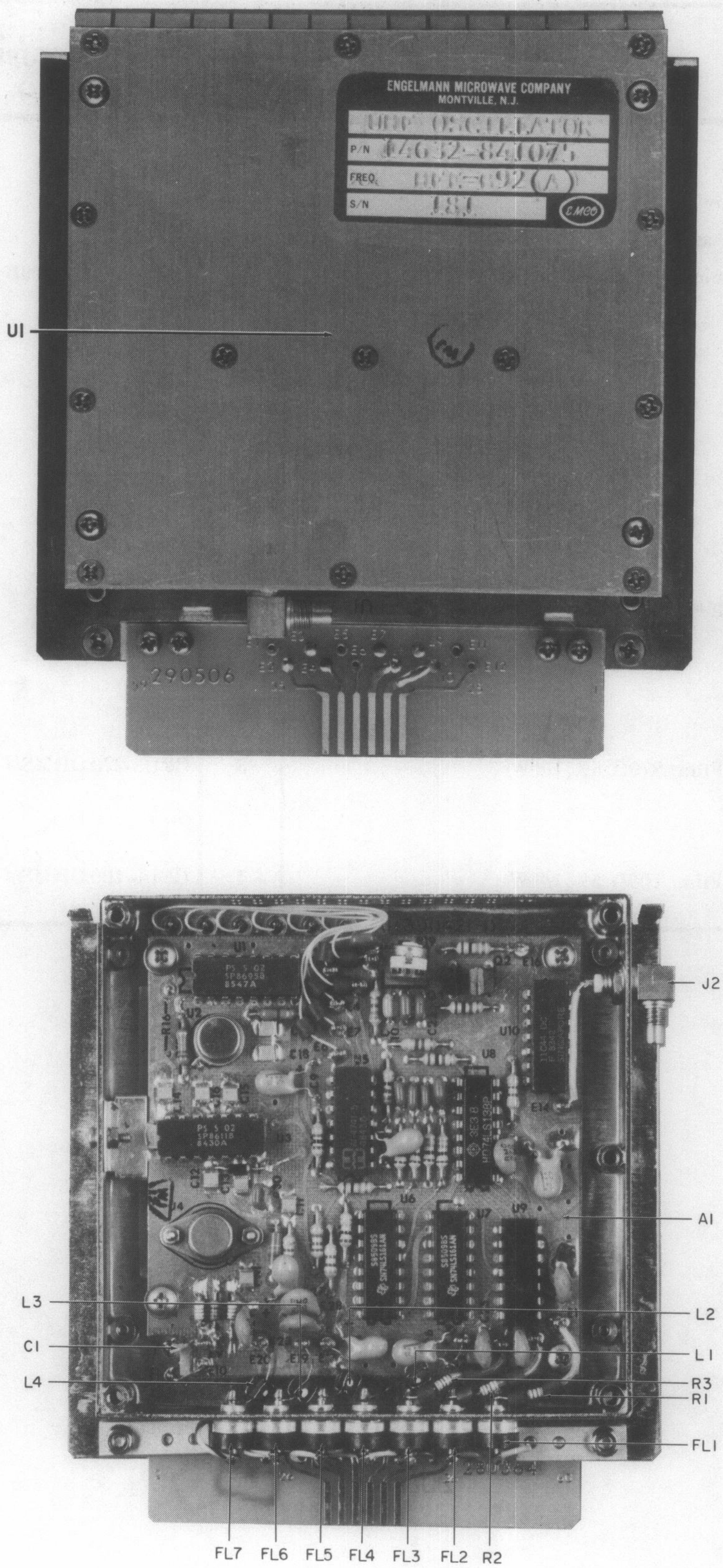


Figure I-7. Type 798079-2 UHF LO Synthesizer (A3A1A3), Location of Components

I.8.1.1.3 **Type 798079-2 UHF LO Synthesizer** REF DESIG PREFIX A3A1A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision E1				
A1	UHF Variable Divider	1	390421-1	14632	
A2	UHF Oscillator Assembly	1	796719-1	14632	
C1	Capacitor, Ceramic, Monolithic: 1.0 pF, 100 V	1	100-100-NPO-109B	51642	
FB1	Ferrite Bead	12	56-590-65-4A	02114	
FB2 Thru FB12	Same as FB1				
FL1	Filter, Modified	7	33728-18	14632	
FL2 Thru FL7	Same as FL1				
J1	Not Used				
J2	Connector, Receptacle	1	1012-1511-000	19505	
L1	Coil, Fixed	4	16209-4	14632	
L2 Thru L4	Same as L1				
R1	Resistor, Fixed, Film: 270Ω, 5%, 1/8 W	3	CF1/8-270 OHMS/J	09021	
R2	Same as R1				
R3	Same as R1				
R4	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	

I.8.1.1.3.1 Type 390421-1 UHF Variable Divider

REF DESIG PREFIX A3A1A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision R1				
C1	Capacitor, Ceramic, Disc: 470 pF, 10%, 1000 V	7	CK05BX471K	81349	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: 0.01 µF, 20%, 50 V	6	34453-1	14632	
C5 Thru C7	Same as C4				
C8	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	5	196D475X0035JE3	56289	
C9	Same as C8				
C10	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	1	34475-1	14632	
C11	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	9	C1210C471K1GAC	31433	
C12 Thru C18	Same as C11				
C19	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	2	34452-1	14632	
C20	Same as C8				
C21	Same as C19				
C22	Same as C4				
C23	Same as C1				
C24	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	1	196D226X0010JE3	56289	
C25	Same as C1				
C26	Same as C8				
C27	Same as C8				
C28	Same as C1				
C29	Same as C1				
C30	Same as C4				
C31	Same as C11				
CR1	Diode	1	GC4211-15	50101	
L1	Inductor, Air Core	1	22292-170	14632	
Q1	Transistor	2	2N3904	80131	
Q2	Same as Q1				
R1	Resistor, Fixed, Film: 10 kΩ, 5%, 1/4 W	7	CF1/4-10K/J	09021	
R2 Thru R6	Same as R1				
R7	Resistor, Fixed, Film: 27Ω, 5%, 1/4 W	1	CF1/4-27 OHMS/J	09021	
R8	Resistor, Fixed, Film: 100Ω, 5%, 1/4 W	2	CF1/4-100 OHMS/J	09021	
R9	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R10	Resistor, Fixed, Film: 47Ω, 5%, 1/8 W	1	CF1/8-47 OHMS/J	09021	
R11	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	
R12	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/4 W	2	CF1/4-1K/J	09021	
R13	Resistor, Fixed, Film: 15 kΩ, 5%, 1/4 W	1	CF1/4-15K/J	09021	

REF DESIG PREFIX A3A1A3A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R14	Resistor, Fixed, Film: 3.6 kΩ, 5%, 1/4 W	1	CF1/4-3.6K/J	09021	
R15	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/4 W	1	CF1/4-1.5K/J	09021	
R16	Not Used				
R17	Resistor, Fixed, Film: 330Ω, 5%, 1/4 W	1	CF1/4-330 OHMS/J	09021	
R18	Same as R12				
R19	Resistor, Trimmer, Film: 2 kΩ, 10%, 1/2 W	1	62PAR2K	73138	
R20	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/4 W	1	CF1/4-3.3K/J	09021	
R21	Same as R1				
R22	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/4 W	1	CF1/4-4.7K/J	09021	
R23	Same as R8				
R24	Resistor, Fixed, Film: 4.7 MΩ, 5%, 1/4 W	1	CF1/4-4.7M/J	09021	
R25	Resistor, Fixed, Film: 180Ω, 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
RA1	Heatsink, Integrated Circuit	1	290509-1	14632	
U1	Integrated Circuit	1	SP8695B/DG	52648	
U2	Integrated Circuit	1	SP8602B/CM	52648	
U3	Integrated Circuit	1	SP8611B/DG	52648	
U4	Amplifier	1	GPD-410	24539	
U5	Integrated Circuit	1	HA1-4741-5	34371	
U6	Integrated Circuit	2	SN74LS161AN	01295	
U7	Same as U6				
U8	Integrated Circuit	1	SN74LS138N	01295	
U9	Integrated Circuit	1	SN74LS04N	01295	
U10	Integrated Circuit	1	MC4044P	04713	

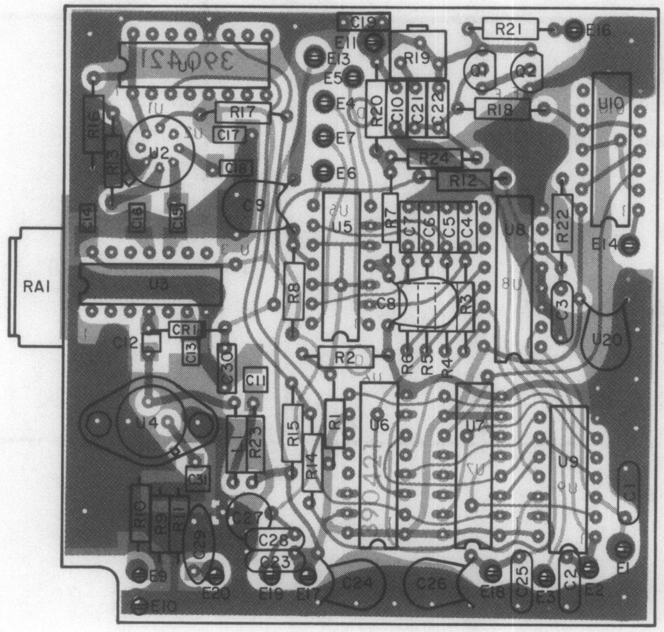


Figure I-8. Type 390421-1 UHF Variable Divider (A3A1A3A1), Location of Components

I.8.1.1.3.2 **Type 796719-1 UHF Oscillator Assembly** REF DESIG PREFIX A3A1A3A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
A1	UHF Oscillator PC Assembly	1	381473-1	14632	
C1	Capacitor, Feedthru: 1000 pF, 100 V	6	54-790-018	33095	
C2 Thru C6	Same as C1				
J1	Connector, Receptacle	1	1012-1511-000	19505	
R1	Resistor, Fixed, Film: 22 kΩ, 5%, 1/8 W	4	CF1/8-22K/J	09021	
R2 Thru R4	Same as R1				

I.8.1.1.3.2.1 **Type 381473-1 UHF Oscillator PC Assembly** REF DESIG PREFIX A3A1A3A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
C1	P/O PC Board	4			
C2	Capacitor, Ceramic: 1.5 pF, ±.1 pF, 500 V	3	ATC175B1R5BP500X	29990	
C3	Capacitor, Variable, Air: .4-2.5 pF, 500 V	4	27283	91293	
C4	Capacitor, Ceramic: 5.6 pf, ±.1 pF, 500 V	2	ATC175B5R6BP500X	29990	
C5	Same as C1				
C6	Same as C2				
C7	Same as C3				
C8	Same as C4				
C9	Same as C1				
C10	Same as C2				
C11	Same as C3				
C12	Capacitor, Ceramic: 4.7 pF, ±.1 pF, 500 V	1	ATC175B4R7BP500X	29990	
C13	Same as C1				
C14	Capacitor Ceramic: 1.0 pF, ±.1 pF, 500 V	1	ATC175B1R0BP500X	29990	
C15	Same as C3				
C16	Capacitor, Ceramic: 3.9 pF, ±.1 pF, 500 V	1	ATC175B3R9BP500X	29990	
C17	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 15 V	1	TMM-S-226M-015R	04222	
C18	Capacitor, Ceramic, Monolithic: 2.0 pF, ±.1 pF, 100 V	2	100-100-NPO-209B	51642	
C19	Capacitor, Ceramic, Monolithic: 2.4 pF, ±.1 pF, 100 V	1	100-100-NPO-249B	51642	
C20	Capacitor, Ceramic, Monolithic: 1.0 pF, ±.1 pF, 100 V	2	100-100-NPO-109B	51642	
C21	Same as C20				
C22	Same as C18				
C23	Capacitor, Ceramic, Disk: .01 µF, 20%, 50 V	1	34453-1	14632	
CR1	Tuning Varactor	4	MA-45240-31	96341	
CR2 thru CR4	Same as CR1				
CR5	Diode	1	IN4449	80131	
FB1	Ferrite Bead	12	56-590-65-4A	02114	
FB2 thru FB12	Same as FB1				
L1	Coil, Fixed	9	190187-1	14632	
L2 Thru L9	Same as L1				
L10	Coil, Fixed	3	180683-1	14632	
L11	Same as L10				
L12	Same as L10				
Q1	Transistor	4	MMBT2222A	04713	
Q2	Transistor	4	841269	14632	
Q3	Same as Q2				
Q4	Same as Q1				

REF DESIG PREFIX A3A1A3A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
Q5	Same as Q2				
Q6	Same as Q1				
Q7	Same as Q2				
Q8	Same as Q1				
Q9	Transistor	1	MMBT3906	04713	
R1	Resistor, Fixed, Film: 1.8 kΩ, 5%, 1/8 W	6	C3-1.8K-5PCT	24546	
R2	Resistor, Fixed, Film: 130Ω, 5%, 1/4 W	1	CF1/4-130 OHMS/J	09021	
R3	Same as R1				
R4	Resistor, Fixed, Film: 150Ω, 5%, 1/4 W	1	CF1/4-150 OHMS/J	09021	
R5	Same as R1				
R6	Resistor, Fixed, Film: 180Ω, 5%, 1/4 W	1	CF1/4-180 OHMS/J	09021	
R7	Same as R1				
R8	Resistor, Fixed, Film: 110Ω, 5%, 1/8 W	1	CF1/4-110 OHMS/J	09021	
R9	Same as R1				
R10	Resistor, Fixed, Film: 3.3K, 5%, 1/8 W	1	C3-3.3K-5PCT	24546	
R11	Same as R1				
R12	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	1	C3-18K-5PCT	24546	
R13	Not Used				
R14	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	2	C3-100R-5PCT	24546	
R15	Same as R14				
T1	Power Divider	2	281926-1	14632	
T2	Same as T1				

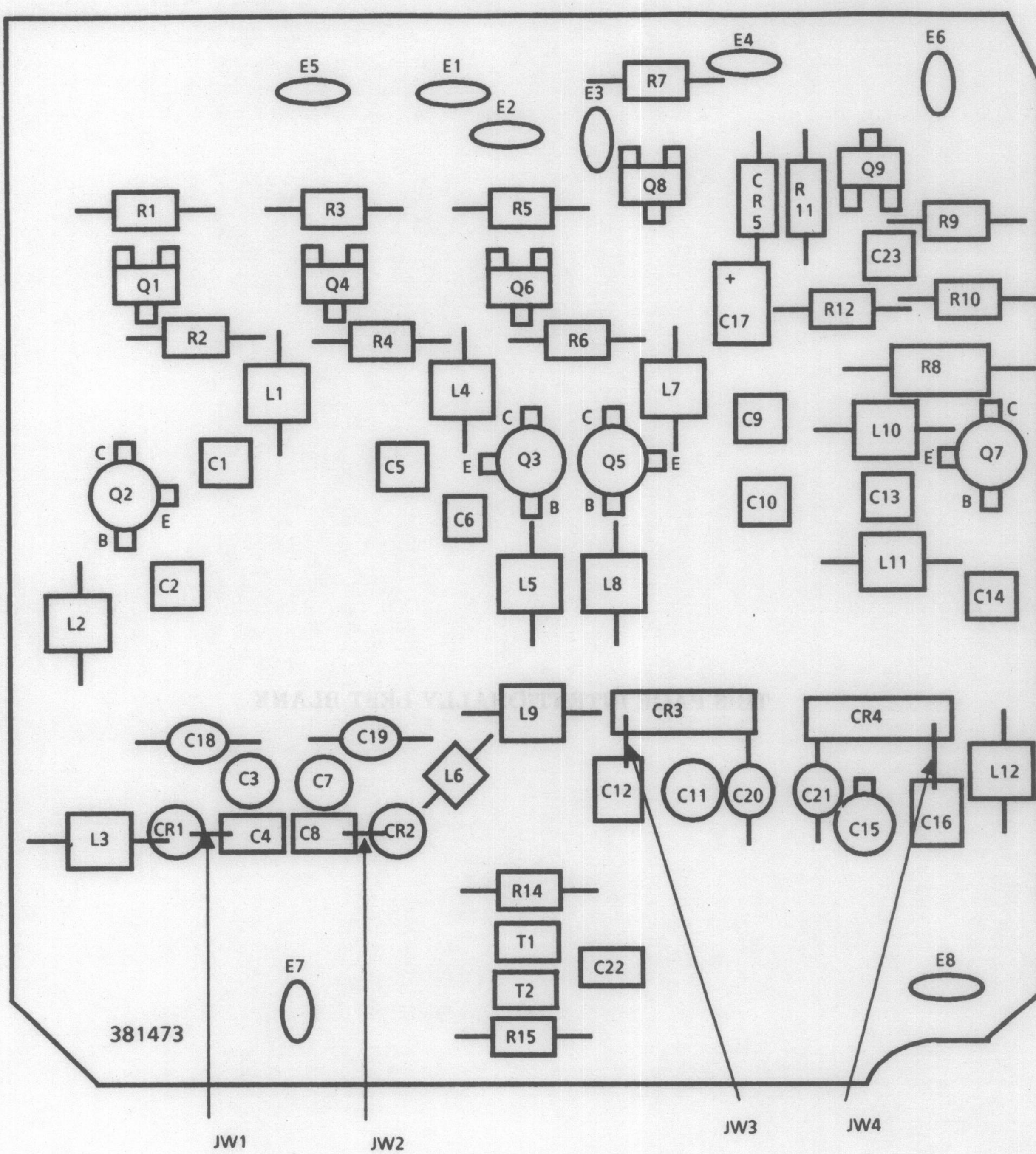


Figure I-8A. Type 381473-1 UHF Oscillator PC Assembly (A3A1A3A2A1), Location of Components

I.8.2 **TYPE 280899-1 RF SWITCH** REF DESIG PREFIX **A3A2**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision D1				
C1	Capacitor, Ceramic, Chip: 4.3 pF, ±0.5 pF, 500 V	2	ATC700B4R3DP500X	29990	
C2	Capacitor, Ceramic, Chip: 2200 pF, 5%, 50 V	2	C1005C222J5GAC	31433	
C3	Capacitor, Ceramic, Chip: 0.05 µF, 10%, 50 V	2	1210-050-X7R-503KS	55969	
C4	Capacitor, Ceramic, Chip: 8.2 pF, ±0.25 pF, 500 V	2	ATC700B8R2CP500X	29990	
C5	Same as C1				
C6	Capacitor, Ceramic, Disc: 1000 pF, 10%, 100 V	2	8121-100-X7R0-102K	59660	
C7	Same as C3				
C8	Same as C6				
C9	Same as C2				
C10	Capacitor, Ceramic, Chip: 13 pF, 2%, 500 V	1	ATC700B130GP500X	29990	
C11	Capacitor, Ceramic, Chip: 10 pF, 2%, 500 V	1	ATC700B100GP500X	29990	
C12	Capacitor, Ceramic, Chip: 4.7 pF, ±0.25 pF, 500 V	1	ATC700B4R7CP500X	29990	
C13	Capacitor, Ceramic, Chip: 33 pF, 2%, 500 V	1	ATC700B330GP500X	29990	
C14	Same as C4				
C15	Capacitor, Ceramic, Chip: 0.5 pF, ±0.1 pF, 500 V	1	ATC100B0R5BP500X	29990	
CR1	Diode	5	841320	14632	
CR2 Thru CR5	Same as CR1				
FB1	Ferrite Bead	6	56-590-65-HA	02114	
FB2 Thru FB6	Same as FB1				
J1	Connector, Receptacle	1	2110-7511-000	19505	
J2	Not Used				
J3	Connector, Receptacle	1	1009-7511-000	19505	
L1	Coil, Fixed	2	170160-1	14632	
L2	Same as L1				
L3	Coil, Fixed	3	170134-1	14632	
L4	Same as L3				
L5	Same as L3				
L6	Coil, Fixed	1	170158-1	14632	
L7	Coil, Fixed	1	170159-1	14632	
R1	Resistor, Fixed, Composition: 560Ω, 5%, 1/8 W	2	RCR05G561JS	81349	
R2	Resistor, Fixed, Composition: 680Ω, 5%, 1/4 W	1	RCR07G681JS	81349	
R3	Same as R1				

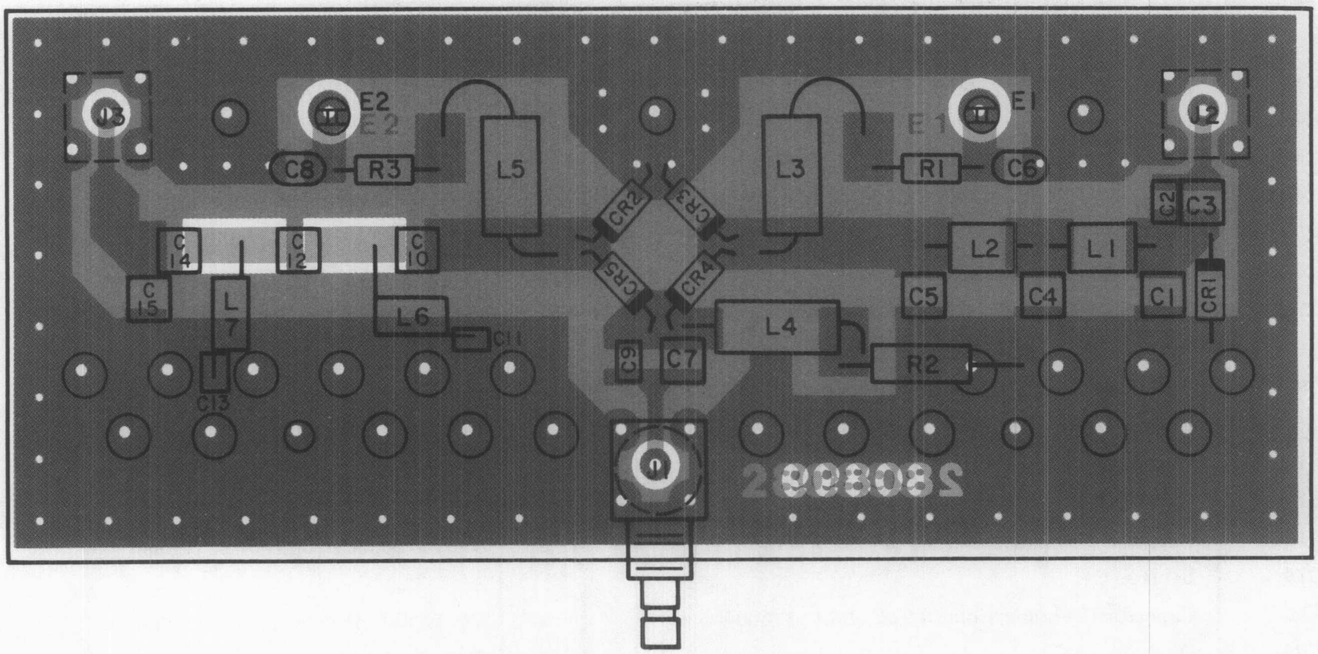


Figure I-9. Type 280899-1 RF Switch (A3A2), Location of Components

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) CAPACITANCE IS IN μF.
b) INDUCTANCE IS IN μH.
c) RESISTANCE IS IN OHMS, ±5%, 1/8 W.

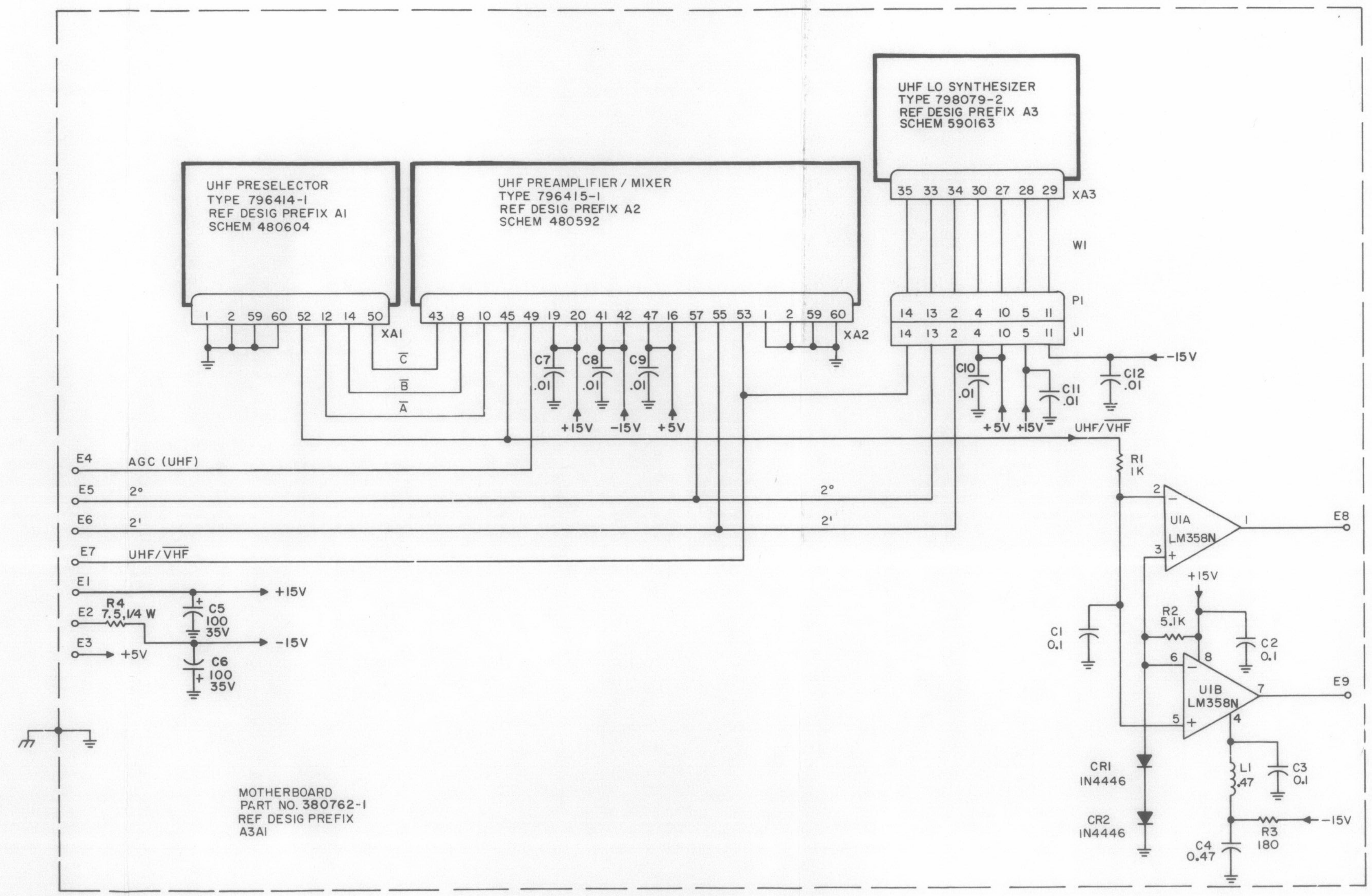


Figure I-10. Type 380762-1, Motherboard (A3A1), Schematic Diagram 480652 (B)

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4 W.
   b) CAPACITANCE IS IN pF.
   c) INDUCTANCE IS IN μH.
2. DIODES CR10, CR11 ARE MA-47201; CR1 THRU CR9, CR12 THRU CR14 ARE 841320.
3. FOR DIFFERENCES BETWEEN DASH NUMBERS, SEE TABLE A. DASH 1 & 4 MECH ONLY.
4. SWITCHING CODES SEE TABLE B

TABLE A

TYPE NO.	R1, R3	FL3
796414-1	1.2K	92224
796414-2	910	92224
796414-3	1.2K	92390
796414-4	1.2K	92224

TABLE B

BAND	FILTERS	$\overline{A}$	$\overline{B}$	$\overline{C}$
900-1100	FL3	1	1	0
700-900	FL2	1	0	1
500-700	FL1	0	1	1
900-1200	FL3	1	1	0

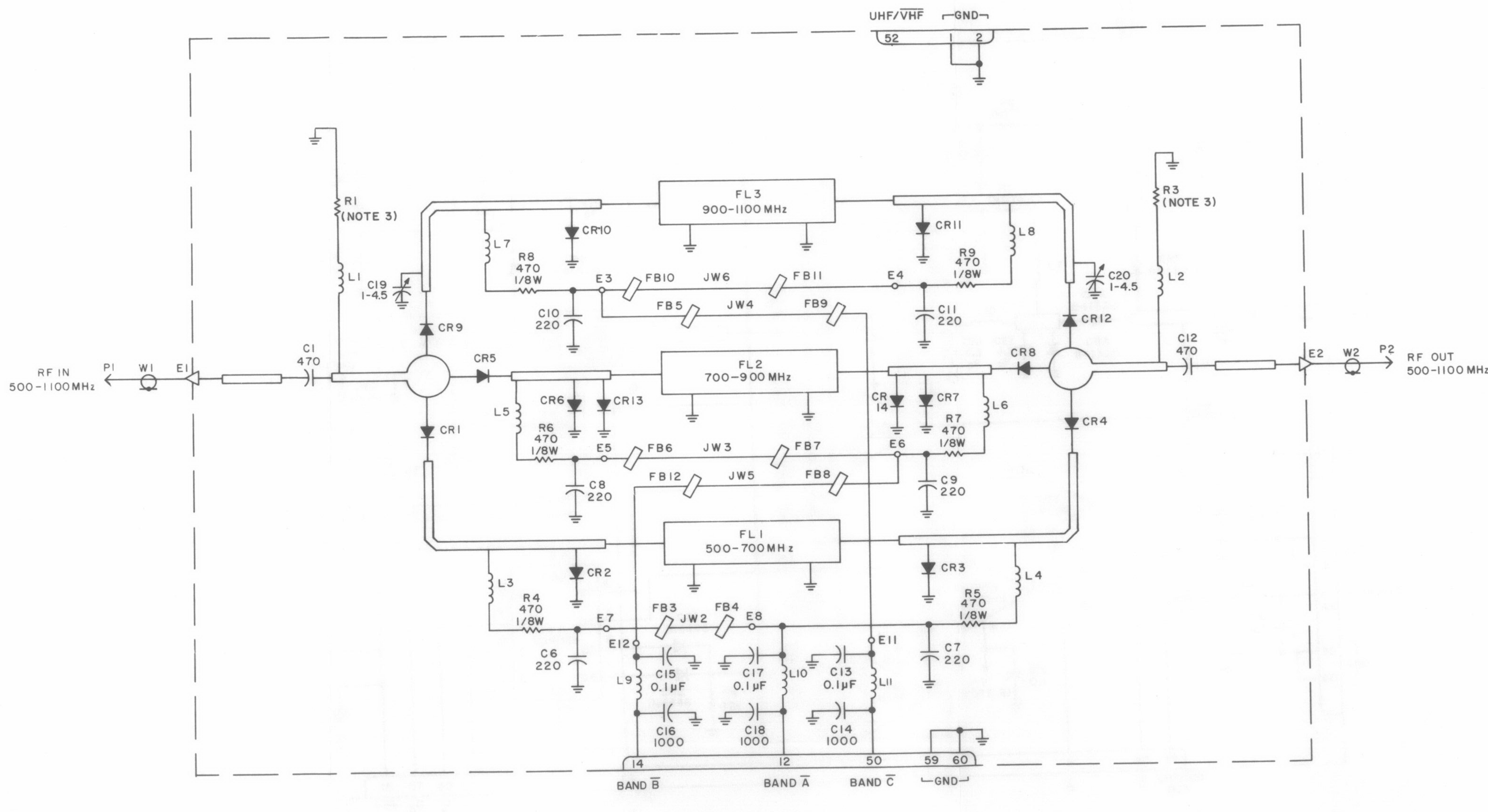


Figure I-11. Type 796414-3, UHF Preselector (A3A1A1), Schematic Diagram 480604 (D)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS ±5%, 1/8W.
   b) CAPACITANCE IS IN μF.
2. DIFFERENCE BETWEEN TYPE NO'S IS SHOWN IN TABLE A.

TABLE A

TYPE NO.	JW2	R3	R5	R6	R7	R8	R13	U5	VR1	+V	−V	FL1
796415-1	1-2	1.8K	12K	680	680	1.2K	1.8K	A28	IN751A 5.1V	+15V	−15V	92225
796415-2	1-3	1.5K	10K	560	560	1K	1.2K	A28-2	IN746A 3.3V	+12V	−12V	92225
796415-3	1-2	1.8K	12K	680	680	1.2K	1.8K	A28	IN751A 5.1V	+15V	−15V	92389

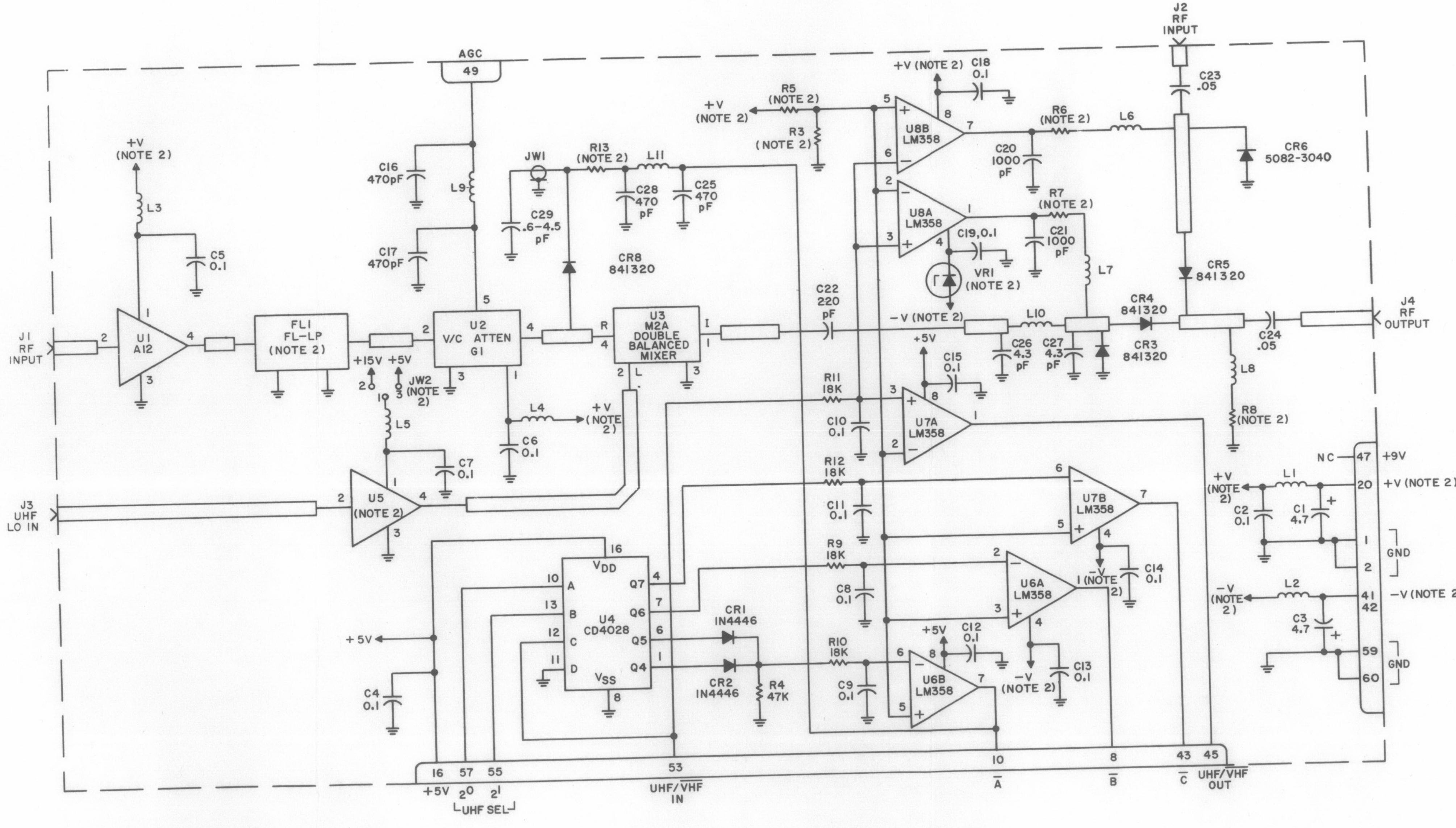
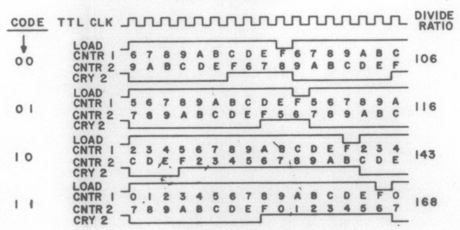


Figure I-12. Type 796415-3, UHF Preamp/Mixer (A3A1A2), Schematic Diagram 480592 (F)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
b) CAPACITANCE IS IN pF.
2. DIFFERENCE BETWEEN TYPES IS MECHANICAL ONLY.

TIMING DIAGRAM



DETAIL A
WIRING TO CONNECTOR

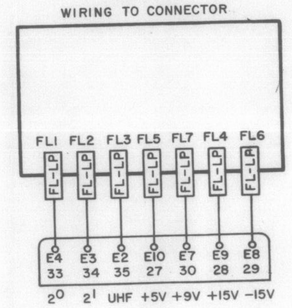


TABLE 1

INPUTS UHF 2^1 2^0		CONTR 1 D C B A	CONTR 2 D C B A
1 0 0	→	0 1 1 0	1 0 0 1
1 0 1	→	0 1 0 1	0 1 1 1
1 1 0	→	0 0 1 0	1 1 0 0
1 1 1	→	0 0 0 0	0 1 1 1

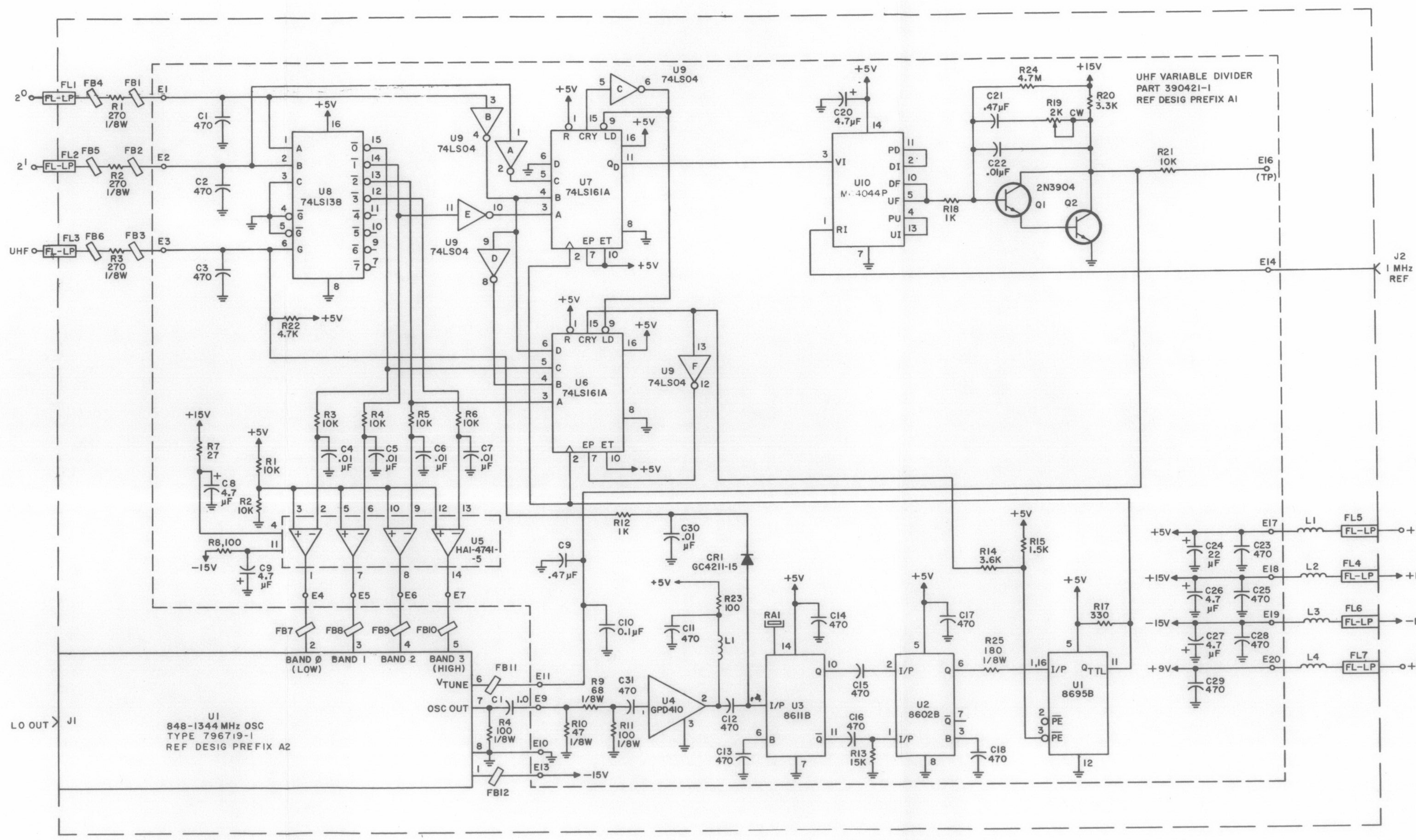


Figure I-13. Type 798079-2, UHF LO Synthesizer (A3A1A3), Schematic Diagram 590163 (N)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
b) CAPACITANCE IS IN pF.
c) INDUCTANCE IS IN μH.
2. CR1 THRU CR4 ARE TYPE MA-45240-31.

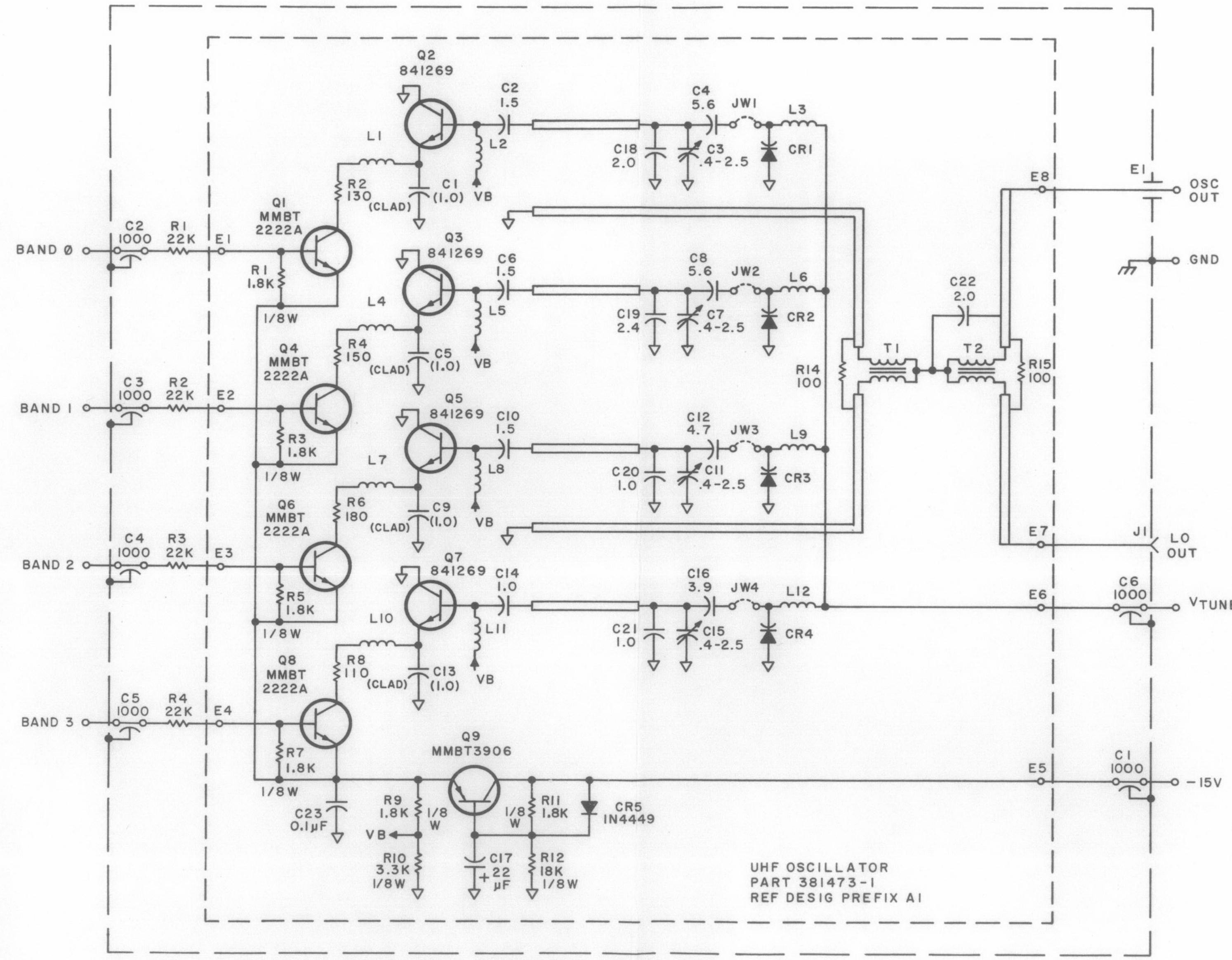


Figure I-14. Type 796719-1, UHF Oscillator (A3A1A3A2), Schematic Diagram 481200 (A)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
   c) CAPACITANCE IS IN pF.
   d) INDUCTANCE IS IN nH.

2. FOR DIFFERENCES BETWEEN DASH NUMBERS, SEE TABLE A. DASH NO.S 1 & 3 ARE MECHANICALLY DIFFERENT ONLY.

TABLE A

TYPE NO.	R1	R2	R3
280899-1	560	680 1/4W	560
280899-2	470	560 1/4W	470
280899-3	560	680 1/4W	560

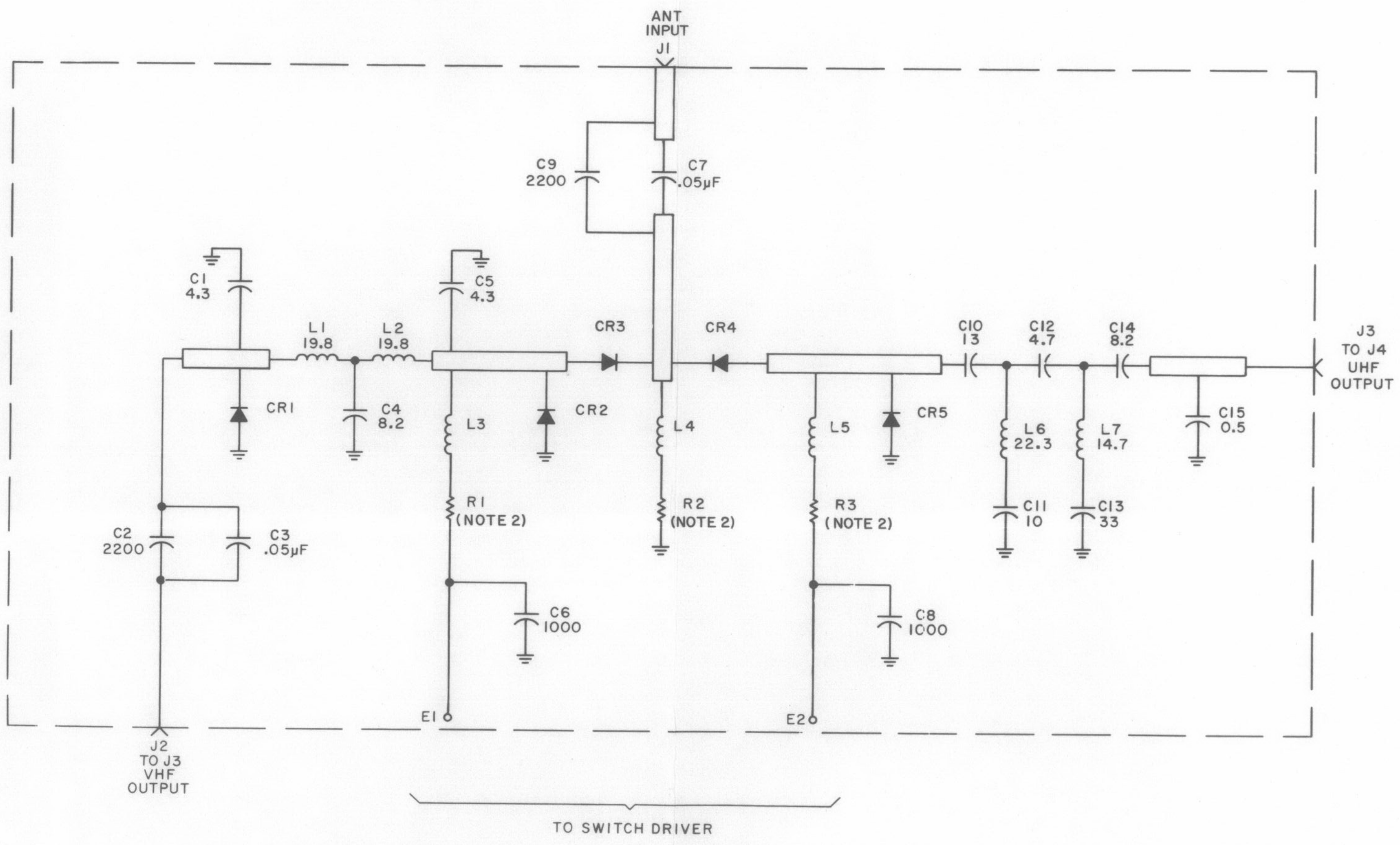


Figure I-15. Type 280899-1, RF Switch (A3A2), Schematic Diagram 480653 (B)

APPENDIX J

WJ-8615 VHF/UHF COMPACT RECEIVER

HIGH FREQUENCY EXTENDER

WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20878-1794

July 1989

WARNING

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

PROPRIETARY STATEMENT

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APPENDIX J

WJ-8615 HIGH FREQUENCY EXTENDER OPTION

J.1 GENERAL DESCRIPTION

The WJ-8615/HFE High Frequency Extender Option extends the low end of the tuning range of the WJ-8615 Receiver to 2 MHz. This allows the WJ-8615 Receiver to tune over a range of 2 to 500 MHz.

J.2 ELECTRICAL CHARACTERISTICS

Refer to **Figure J-1** for a block diagram of the Type 796291-2 RF Input Filter.

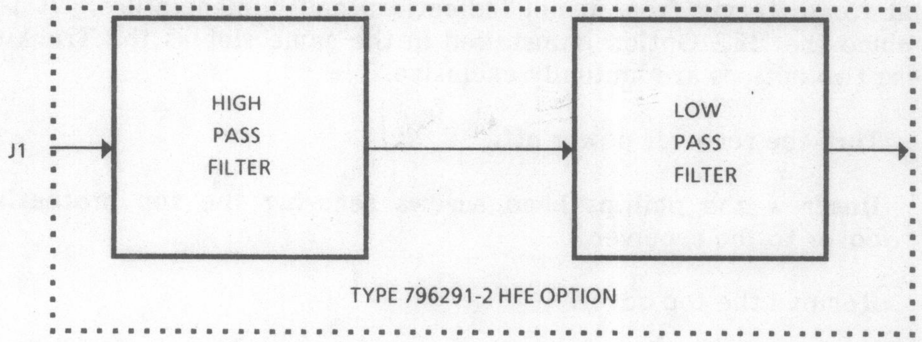

Figure J-1. Type 796291-2 RF Input Filter Block Diagram

RF Input Filter Type 796291-2 is a passive, LC-type, band-pass filter, containing two filters. The first of the two filters is a high-pass filter and the second filter is a low-pass filter. Together, these two filters pass frequencies between 2 and 500 MHz.

Refer to **Table J-1** for WJ-8615 Receiver specifications that change due to the installation of the HFE Option.

Table J-1. WJ-8615 Specification Changes for the HFE Option

Noise Figure	15 dB
2nd Order Intercept Point	+5 dBm
3rd Order Intercept Point	-5 dBm

J.3 MECHANICAL CHARACTERISTICS

The WJ-8615/HFE consists of a Type 796291-2 RF Input Filter. It is 2.93 inches long and 2 inches wide. The actual filter components are located under a 2.25 inch long by 1 inch wide metal cover. This cover is attached to the RF Input Filter Assembly by two phillips head screws. A 12-pin connector attached to the RF Input Filter Assembly is used to secure the filter to the WJ-8615 Receiver Motherboard (A1). This connector attaches to XA14A of the Motherboard.

J.4 INSTALLATION AND OPERATION

J.4.1 INSTALLATION

Installation of the WJ-8615/HFE Option consists of installing a Type 796291-2 RF Input Filter (A1A14). The following steps generically describe the procedure for installing the 8615/HFE Option into a receiver belonging to the WJ-8615 family. Refer to the receiver instruction manual for differing front panel indications and nomenclature. It is important to understand that, since the HFE Option is installed in the same slot as the Tracking Preselector Option (PRE), these two options are mutually exclusive.

1. Turn the receiver power off.
2. Unscrew the phillips head screws securing the top protective cover to the receiver.
3. Remove the top cover.
4. Disconnect the RF Input coaxial antenna connector at the top rear of the RF Filter board (Type 796291-1). Refer to Figures in **Section V** of the WJ-8615 Instruction Manual for the component locations.
5. Disconnect the RF Filter output coaxial cable W1 from E1 of the RF Input Filter (Type 796291-1).
6. Remove the RF Input Filter board.
7. Locate cable W4 from rear panel antenna connector and disconnect the SMB connector end of cable W4.
8. Connect the SMB connector of cable W4 to J1 of the RF Input Filter Assembly (Type 796291-2).
9. Connect cable assembly W1 to E1 of RF Input Filter assembly (Type 796291-2).
10. Connect P1 of cable W1 to connector J3 of the Preamplifier/Converter Assembly (A1A13).

11. Gently insert the RF Input Filter Assembly (Type 796291-2) into the mating connector (XA14A) on the receiver motherboard.

12. Set position 5 of switch S1 (located on the IEEE-488/Interrupt Assembly A1A2) to the open position. This enables the HFE Option.

13. Replace the top protective cover and secure the cover to the receiver with the phillips head screws removed in step 2.

14. Turn the receiver power "ON", while holding the MENU key pressed in. This places the receiver in the definitions mode.

15. Press the INC key until "DEF" is displayed. If "NO" is displayed to the right of "DEF", the receiver takes its configuration from DIP switches S1 and S2 on the IEEE-488/Interrupt Assembly.

16. Rotate the tuning wheel until "YES" is displayed to the right of "DEF". This allows the receiver configuration to be controlled from the front panel.

17. Press the INC key until "HF" is visible.

18. Verify "YES" is displayed to the right of "HF". This indicates that the HFE Option is enabled.

19. If "YES" is not displayed to the right of "HF", select "YES" with the tuning wheel. This enables the HFE Option.

20. Press the ENTER key to terminate the definitions mode of operation.

This completes the installation of the HFE Option in the WJ-8615 Receiver. The receiver is now capable of tuning down to 2 MHz.

J.4.2 OPERATION

The only difference in the operation of the WJ-8615 receiver with and without the WJ-8615/HFE Option is that the receiver can be tuned down to 2 MHz with the WJ-8615/HFE Option installed. For a detailed description of receiver operation refer to the appropriate section of the WJ-8615 Receiver Instruction Manual.

J.5 DETAILED CIRCUIT DESCRIPTION

The reference designation for the RF Input Filter Assembly is A1A14. Refer to **Figure J-3** for the Type 796291-2 RF Input Filter schematic diagram.

RF signals present at the rear panel antenna connector J10 (J9 in the WJ-8615TC) are routed through cable W4 to connector J1 of the RF Input Filter Assembly. These RF signals are first high pass filtered and then low pass filtered. The output of the RF Input Filter is passed to the Preamplifier/Converter (A1A13).

The high pass filter is made up of C1, L1, and L2. After being high pass filtered, the RF signal is then low pass filtered. The low pass filter is made up of C2, C3, C4, L3, and L4. The overall attenuation of the Type 796291-2 RF Input Filter is 0.5 dB. RF signals at E1 are routed through cable W1 to the Preamplifier/Converter Assembly (A1A13).

J.6 MAINTENANCE

J.6.1 PERFORMANCE TEST

1. Connect the test equipment as illustrated in **Figure J-2.**
2. Set the test equipment to view frequencies between 2-500 MHz.
3. Verify the displayed response is flat (less than 0.5 dB of ripple) and has less than 0.5 dB of insertion loss.
4. Disconnect the test equipment and reconnect the cables to their proper mating connectors.

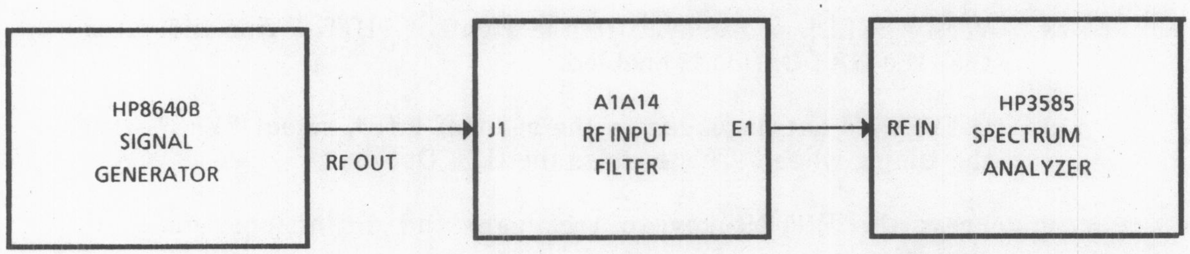

Figure J-2. HFE Option Performance Test, Equipment Connections

J.7 LIST OF MANUFACTURERS

Mfr. Code	Name and Address	Mfr. Code	Name and Address
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20878	51642	Centre Engineering, Inc. State College, PA 16801
19505	Applied Engineering Products 300 Seymour Avenue Derby, CT 06418	99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, NY 14052
29990	American Technical Ceramics 1 Norden Lane Huntington Station, NY 11746		

J.8 REPLACEMENT PARTS LIST

The following parts list is for the WJ-8615/HFE Option only. For parts lists for other options or WJ-8615 Receivers refer to the appropriate WJ-8615 VHF/UHF Compact Receiver Instruction Manual or the appropriate appendix.

J.9 TYPE 796291-2 RF INPUT FILTER ASSEMBLY REF DESIG PREFIX A1A14

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision C1				
C1	Capacitor, Ceramic, Monolithic: 16000 pF, 2%, 100 V	1	200-100-NPO-162G	51642	
C2	Capacitor, Ceramic: 4.3 pF, .5 pF, 500 V	2	ATC700B4R3DP500X	29990	
C3	Capacitor, Ceramic: 8.2 pF, .25 pF, 500 V	1	ATC700B8R2CP500X	29990	
C4	Same as C2				
J1	Connector, Receptacle	1	2009-7511-000	19505	
L1	Coil, Fixed: 4.7 μH, 10%	2	1537-28	99800	
L2	Same as L1				
L3	Coil, Fixed	2	170160-1	14632	
L4	Same as L3				
P1	Connector, Plug	1	2105-7521-005	19505	
W1	Cable Assembly	1	280570-1	14632	

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
a) CAPACITANCE IS IN pF.
b) INDUCTANCE IS IN μH.

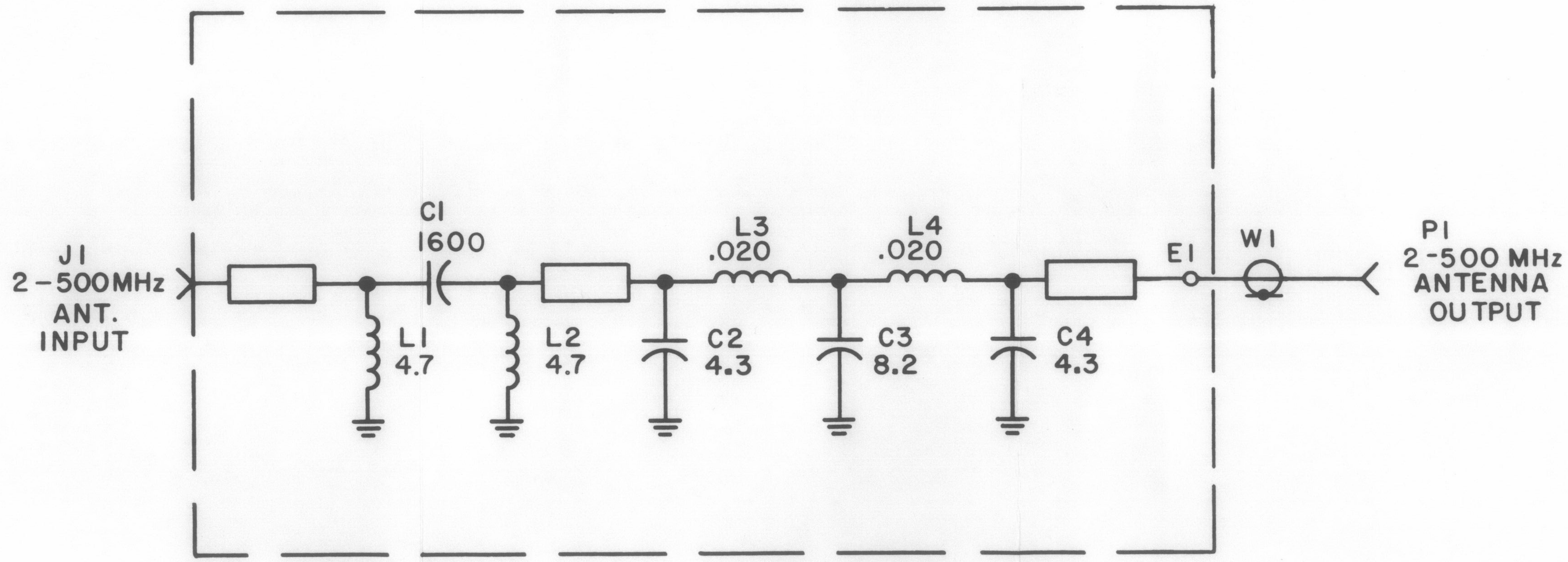

Figure J-3. Type 796291-2, RF Input Filter (A1A4), Schematic Diagram 380852 (A)

WJ-8615 RECEIVER

APPENDIX K

IF BANDWIDTH FILTER AND VIDEO FILTER SETS

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APPENDIX K

WJ-8615/BWS IF BANDWIDTH FILTER AND VIDEO FILTER SETS

K.1 GENERAL DESCRIPTION

The WJ-8615 Series Receiver may contain up to five user selectable IF bandwidths which are factory configured prior to delivery. Three IF bandwidths are installed in the standard receiver. As an option, two additional IF bandwidths may be installed.

Table 1-1 provides a list of the available IF bandwidths for the WJ-8615 Receiver and the part numbers of the components associated with each selection. The IF bandwidth filter and Bandwidth/Video Response Assembly components for each receiver are unique to the IF bandwidth configuration of that receiver. The actual IF bandwidth is determined by the crystal filter (FL1-FL5) installed on the Type 726016-X IF Bandwidth Filter Amplifier Assembly (A1A12). Video bandwidth is determined by the appropriate Bandwidth/Video Response Assembly (A1-A5), installed on the Type 796622-X Audio/Video Assembly (A1A10).

Table K-1. Available IF Bandwidth Sets and Associated Components

IF Bandwidth Set	Description	IF Bandwidth Filter Part Number	Bandwidth/Video Response Assembly Part Number
8615/3.2K	3.2 kHz Individual Bandwidth	92289 (Alt. 92272)	281516-15
8615/6.4K	6.4 kHz Individual Bandwidth	92299 (Alt. 92271)	281516-1
8615/10K	10 kHz Individual Bandwidth	92293 (Alt. 92001)	281516-2
8615/15K	15 kHz Individual Bandwidth	92300 (Alt. 92296)	281516-3
8615/20K	20 kHz Individual Bandwidth	92294 (Alt. 92002)	281516-4
8615/25K	25 kHz Individual Bandwidth	92340 (Alt. 92165)	281516-17
8615/30K	30 kHz Individual Bandwidth	92301 (Alt. 92245)	281516-16
8615/40K	40 kHz Individual Bandwidth	92302 (Alt. 92198)	281516-5
8615/50K	50 kHz Individual Bandwidth	92291 (Alt. 92000)	281516-6
8615/75K	75 kHz Individual Bandwidth	92303 (Alt. 92230)	281516-7
8615/100K	100 kHz Individual Bandwidth	92292 (Alt. 92024)	281516-8
8615/150K	150 kHz Individual Bandwidth	92304 (Alt. 92307)	281516-18
8615/250K	250 kHz Individual Bandwidth	92317 (Alt. 92186)	281516-9
8615/300K	300 kHz Individual Bandwidth	92290 (Alt. 92232)	281516-10
8615/500K	500 kHz Individual Bandwidth	92288 (Alt. 92277)	281516-11

Table K-1. Available IF Bandwidth Sets And Associated Components

IF Bandwidth Set	Description	IF Bandwidth Filter Part Number	Bandwidth/Video Response Assembly Parts Number
8615/1M	1 MHz Individual Bandwidth	92287 (Alt. 92278)	281516-12
8615/2M	2 MHz Individual Bandwidth	92286 (Alt. 92279)	281516-13
8615/3.2M	3.2 MHz Individual Bandwidth	92491	281516-24
8615/4M	4 MHz Individual Bandwidth	92285 (Alt. 92280)	281516-14
8615P/500K*	500 kHz Individual Bandwidth	92288	281516-19
8615P/1M*	1 MHz Individual Bandwidth	92287	281516-20
8615P/2M*	2 MHz Individual Bandwidth	92286	281516-21
8615P/4M*	4 MHz Individual Bandwidth	92285	281516-22
8615P/6M*	6 MHz Individual Bandwidth	92305	281516-26
8615P/8M*	8 MHz Individual Bandwidth	92373	281516-25
8615P/10M*	10 MHz Individual Bandwidth	92485	281516-23
8615P/1MG*	1 MHz Individual Bandwidth with Group Delay	92470	281516-20
8615P/2MG*	2 MHz Individual Bandwidth with Group Delay	92469	281516-21
8615P/4MG*	4 MHz Individual Bandwidth with Group Delay	92468	281516-22

* WJ-8615P Receivers only

Table K-1. Available IF Bandwidth Sets And Associated Components

IF Bandwidth Set	Description	IF Bandwidth Filter Parts Number	Bandwidth/Video Response Assembly Parts Number
8615P/8MG*	8 MHz Individual Bandwidth with Group Delay	92466	281516-25
8615SSL/10K**	10 kHz Individual Bandwidth	92331	281516-2
8615SSL/20K**	20 kHz Individual Bandwidth	92332	281516-4
8615SSL/25K**	25 kHz Individual Bandwidth	92327	281516-17
8615SSL/30K**	30 kHz Individual Bandwidth	92372	281516-16
8615SSL/50K**	50 kHz Individual Bandwidth	92333	281516-6

* WJ-8615P Receivers only
** Only for receivers equipped with WJ-8615/SSL Option