

LOWBAND Electrical Parts List, Transceiver Board

L = 30-36MHz

M = 36-42MHz

H = 42-50MHz

PL-11653

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF ±5%;50V 1/10W unless stated
C1	2113740A65	270 (L)
	or 2113740A62	200 (M)
	or 2113740A59	150 (H)
C2	2113740A67	330 (L)
	or 2113740A62	200 (M)
	or 2113740A58	130 (H)
C3	2113741A25	1500 (L)
	or 2113740A72	510 (M)
	or 2113740A66	300 (H)
C4	2113740A59	150(L)
	or 2113740A57	120 (M)
	or 2113740A54	91 (H)
C5	2113741A25	1500 (L)
	or 2113740A77	820 (M)
	or 2113740A70	430 (H)
C7	2113740A55	100 (L)
	or 2113740A56	110 (M)
	or 2113740A53	82 (H)
C8	2113740A52	75 (L)
	or 2113740A54	91 (M,H)
C10	2113740A62	200 (L)
	or 2113740A56	110 (M,H)
C11	2113740A66	300 (L)
	or 2113740A59	150 (M)
	or 2113740A64	240 (H)
C12	2113740A20	5.1 (L,M)
	or 2113740A19	4.7 (H)
C13	2113740A50	62 (L)
	or 2113740A33	15 (M)
	or 2113740A43	39 (H)
C14	2113740A57	120 (L,H)
	or 2113740A46	47 (M)
C15	2113740A69	390 (L)
	or 2113740A62	200 (M)
	or 2113741A31	2700 (H)
C16	2113740A50	60 (L)
	or 2113740A61	180 (M)
	or 2113740A54	91(H)
C18	2113740A59	150 (L)
	or 2113740A62	200 (M)
	or 2113740A63	220 (H)
C19	2113740A54	91 (L)
	or 2113740A59	150 (M)
	or 2113740A60	160 (H)
C20,21	2113741A45	.01uF
C22	2113740A23	6.2 (L)
	or 2113740A13	2.7 (M)
	or 2113740A20	5.1 (H)
C23	2113741A45	.01uF
C24	2311049J08	3.3uF; Tant.
C25	2113740A52	75 (L)
	or 2113740A56	110 (M,H)
C26	2113740A66	300 (L)
	or 2113740A69	390 (M,H)
C27	2113740A69	390
C28	2113741A45	.01uF
C29	2113741A45	.01uF
C30	2113740A29	10
C31	2113740A25	7.5 (L)
	or 2113740A21	5.6 (M)
	or 2113740A20	5.1 (H)
C32	2113741A45	.01uF (L)
	or 2113741A53	22000 (M)
	or 2113741A47	12000 (H)
C33	2113740A38	24 (L)
C34	2113740A38	24 (L)
	or 2113740A36	20 (M)
C35	2160521G37	0.1+80-20%;25V
C37	2113741A45	.01uF
C101	2113741A45	.01uF
C102	2113741A45	.01uF
C103	2113740A33	15 (L)
	or 2113740A36	20 (M)
	or 2113740A23	6.2 (H)
C104	2113740A32	13 (L,M)
	or 2113740A36	20 (H)
C105	2113740A42	36 (L)

C106	2113741A45	.01uF	L11
C107	2113740A59	150 (L)	L12,13
	or 2113740A60	160 (M)	L14
	or 2113740A39	27 (H)	L15
C108	2113740A73	560 (L)	L16
	or 2113740A71	470 (M)	L100
	or 2113740A57	120 (H)	L101
C109	2113740A64	240 (L)	
	or 2113740A58	130 (M)	L102
	or 2113740A53	82 (H)	
C110	2113740A56	110	L103
C111	2113740A49	56 (L)	
	or 2113740A52	75 (M)	
C112	2113740A72	510 (L,M)	L104
	or 2113740A68	360 (H)	
C114	2113740A59	150 (L)	
	or 2113740A61	180 (M)	L105
	or 2113740A59	150 (H)	
C115	2005568P01	Trimmer,5.5-65pF	
C116	2113740A61	180 (L,M)	L106
	or 2113740A60	160 (H)	
C117	2113740A51	68 (L)	L107
	or 2113740A54	91 (M,H)	
C118	2113740A42	36 (L,M)	
	or 2113740A38	24 (H)	
C119	2113740A57	120 (L)	L108
	or 2113740A53	82 (M)	
	or 2113740A56	110 (H)	
C120	2113740A42	36 (L,M)	L109
	or 2113740A38	24 (H)	L112
C121	2113740A49	56 (L)	
	or 2113740A46	47 (M)	
	or 2113740A50	62 (H)	L113
C123	2113741A45	.01uF	
C124	2113740A53	82 (L,M)	L114
	or 2113740A51	68 (H)	
C125	2113740A53	82 (L,M)	L115
	or 2113740A51	68 (H)	
C126	2113740A51	68 (L)	L116
	or 2113740A53	82 (M)	
	or 2113740A38	24 (H)	L117
C127	2113740A51	68 (L,M)	
	or 2113740A44	43 (H)	
C128	2113741A45	.01uF	L119
C129	2113740A52	75 (L)	
	or 2113740A51	68 (M)	
	or 2113740A46	47 (H)	L120
C130	2113740A55	100 (L)	
	or 2113740A53	82 (M)	L121,122
	or 2113740A50	62 (H)	L123
C131	2113740A55	100 (L)	
	or 2113740A53	82 (M)	L124
	or 2113740A50	62 (H)	
C132	2113741A45	.01uF	
C134	2360562B01	.01uF;Tant.	
C135,136	2113741A45	.01uF	LS1
C137	2311049A37	1uF	
C138,152,155	2160521G37	0.1uF	MK1
C157	2113741A45	.01uF	
C158	2311049J08	3.3uF; 16V	
C159	2002407J01	Trimmer; 10-120pF	P1, 2
C160	2305499G20	10uF±20%; 20V Tant.	P3, 4
			P5
			P6
			P7
CR1	4805119G34	DIODE: See Note	
CR2	4805490G02	Silicon	
CR3,4	4805494Q04	Silicon	
CR5	4880236E16	Quad Ring Array	
CR101,102	0102712J05	Unitrode,9401and Heat Shrink	P8*
CR103	4805119G34	Silicon	
CR104	4805119G34	Silicon (M, H Only)	
CR301A, 301B	4805729G24	LED, Bicolor (Rotary Radios Only)	
FL1, 2	4805245J26	FILTER:	Q1,2
	or 4805245J27	Crystal,19.95MHz (L)	Q101
FL3	9105725Q02	Crystal,16.65MHz (M,H)	Q102
FL4	9105726Q01	Ceramic, 450kHz	Q103
		Ceramic, 450kHz	
L1	2402406J05	COIL, RF: unless stated	R1
L2	2402406J11	6- turns, spacewound	R2
L3 thru 6	2402406J05	11- turns, spacewound	R3
L7	2402406J10	6- turns, spacewound	R5
	or 2402406J09	Tunable, Choke (L,M)	R6
L8	2402406J05	Tunable, Choke (H)	R7
	or 2402406J10	6- turns, spacewound (L,H)	R9,10
L9	2411087B25	Tunable, Choke (M)	R11
L10	2411087B18	0.82uH Choke	
		0.220uH Choke	

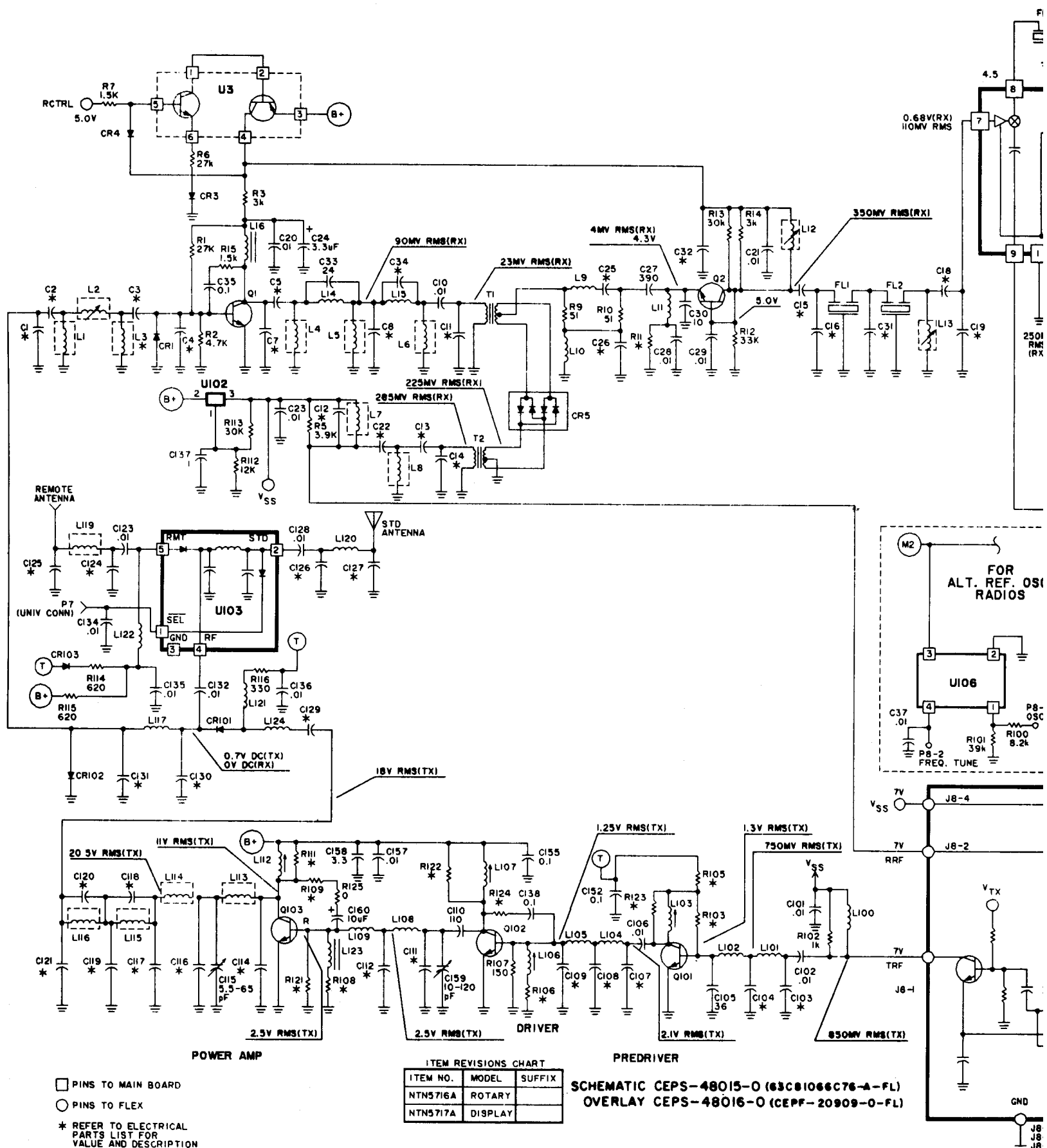
	L11	2411087B25	0.82uH Choke	R12	0660076A85	33k
	L12,13	2405063H13	1.2uH Choke	R13	0660076A84	30k
	L14	2411087B25	0.82uH Choke	R14	0660076A60	3k
	L15	2411087B25	0.85uH Choke (M, H Only)	R15	0660076A53	1.5k
	L16	2411087B37	8.2uH Choke	R100	0660076A71	8.2k
	L100	2411087B36	6.8uH Choke	R101	0660076A87	39k
	L101	2411087B27	1.2uH Choke (L,M)	R102	0660076A49	1k
		or 2411087B26	1uH Choke (H)	R103	0660076A73	10k (L,M)
	L102	2411087B27	1.2uH Choke (L)		or 0660076A76	13k (H)
		or 2411087B28	1.5uH Choke (M,H)	R105	0602432J27	120;1/2W (L,M)
	L103	0102710J48	1.2uH Choke and Heat Shrink(L)		or 0602432J29	150;1/2W (H)
		or 0102710J46	6.2uH Choke and Heat Shrink (M,H)	R106	0660076A01	10 (L,M)
					or 0660076A15	39 (H)
	L104	2411087B16	0.15uH Choke (L)	R107	0660076A29	150
		or 2411087B15	0.12uH Choke (M)	R108	0660076A01	10 (L)
		or 2411087B21	0.39uH Choke (H)		or 0660076A10	24 (M, H)
	L105	2411087B13	0.82uH Choke (L)	R109	0602433J29	150;1W (L)
		or 2411087B12	.068uH Choke (M)		or 0602433J28	130;1W (M,H)
		or 2411087B16	0.15uH Choke (H)	R111	0602433J28	130;1W (L)
	L106	2411087B37	8.2uH Choke (L,H)		or 0602433J29	150;1W (M)
		or 2411087B36	6.8uH Choke (M)		or 0602433J25	100;1W (H)
	L107	0102710J48	Assy., 1.2uH Choke and Heat Shrink (L)	R112	0660076E75	12k±1%
			Assy., 6.2uH Choke and Heat Shrink (M,H)	R113	0660076E84	30k±1%
		or 0102710J46	Assy., 6-1/2 turns, airwound (L,M)	R114,115	0660076A44	620
	L108	0102710J83	Assy., 5-1/2 turns, airwound (H)	R116	0660076A37	330
			Assy., 2-1/2 turns, airwound	R120	1805559S02	Pot., 50k
	L109	0102710J79	.085uH Choke (L,H)	R121	0660076A10	24 (M,H)
	L112	2482723H48	Assy.,.085uH Choke and Heat Shrink (M)		or 0660076A01	10 (L)
		or 0102712J04	4-1/2 turns, airwound (L)	R122	0611072A33	220; 1/4W (L)
	L113	0102710J69	3-1/2 turns, airwound (M,H)		or 0611072A32	200 (M)
		or 0102710J68	9-1/2 turns, airwound (L)		or 0611072A34	240 (H)
	L114	0102710J74	7-1/2 turns, airwound (M,H)	R123	0660076A49	1k (L)
		or 0102710J72	8-1/2 turns, airwound (L)		or 0660076A41	470 (M,H)
	L115	0102710J73	6-1/2 turns, airwound (M,H)	R124	0660076A41	470 (L,M)
		or 0102710J71	8-1/2 turns, airwound (L)		or 0660076A34	240 (H)
	L116	0102710J73	6-1/2 turns, airwound (M,H)	R125	0660076M01	0
		or 0102710J71	8-1/2 turns, airwound (L)	R140	1805100Q04	Pot., 25k
	L117	0102710J73	7-1/2 turns, airwound (M)			
		or 0102710J72	6-1/2 turns, airwound (H)	S1	-----	SWITCH:
	L119	0102710J75	10-1/2 turns, airwound (L)	S2	4005265Q02	On/Off, Part of R140
		or 0102710J74	9-1/2 turns, airwound (M)	S3	4005101Q02	16-position, Hexadecimal (Rotary Radios Only)
		or 0102710J72	7-1/2 turns, airwound (H)	S301	3905834K06	Toggle, PL Disable/Scan
	L120	0102710J75	10-1/2 turns, airwound (L,M)	S302	3905834K06	Snap Dome, Monitor
		or 0102710J74	9-1/2 turns, airwound (H)	S303	3905834K06	Snap Dome, PTT
	L121,122	2411087B36	6.8uH Choke			Snap Dome, Light/Scan
	L123	0102710J48	1.2uH Choke and Heat Shrink (M, H Only)	T1,2	2580163M02	TRANSFORMER:
			11-1/2 turns, airwound (L)			CIRCUIT MODULE: See Note
	L124	0102710J76	10-1/2 turns, airwound (M)	U1	5102001J12	I-F
		or 0102710J75	9-1/2 turns, airwound (H)	U3	4802245J01	Dual Transistor
		or 0102710J74		U102	5160880B01	Regulator (5V)
				U103	5102001J36	Antenna Switch (L)
	LS1	5005155Q03	TRANSDUCER		or 5102001J37	Antenna Switch (M)
	MK1	0105956P37	MICROPHONE ASSEMBLY		or 5102001J38	Antenna Switch (H)
			PLUG:	U106*	5105729E52	Ref. Oscillator, 16.8MHz
	P1, 2	2805466R01	Connector, Flex Top; 15-pin		or 5102463J01	Ref. Oscillator (alternate), 2.1MHz
	P3, 4	2805144Q01	Connector, FGU; 7-pin	U201*	5102001J47	Freq. Generator (L)
	P5	2805433R02	Connector, Front Cover		or 5102001J64	Freq. Generator (L); alternate
	P6	2805247Q01	Connector, I-F		or 5102001J48	Freq. Generator (M)
	P7	-----	Not field replaceable, order Top Control Panel Assembly		or 5102001J49	Freq. Generator (H)
			0102700J59 (Rotary Radios) or 0105958N64 (Display Radios)	NONREFERENCED ITEMS		
	P8*	2805507R01	Connector, 2-pin (replaces R120 in radios with alternate reference oscillator)		1402428J01	INSULATOR
					1405511R02	SHIELD
					2602240J01	HEATSINK (PA)
					2605296Q01	HEATSINK (Driver)
					2682671D21	CAN, for L113 thru 116 and L119
					2805507R01*	CONNECTOR, 2-Pin (used with alternate low split reference oscillator only)
	Q1,2	4802245J02	TRANSISTOR: See Note			PAD, for FL1, FL2
	Q101	4802233J11	NPN,Type MMBR941L		7505295B07	BOARD, Printed Circuit
	Q102	4800869859	NPN,Type MRF0211		8402214J01	
	Q103	4802245J03	Driver			
			NPN,Type MRF0233			
			RESISTOR, Fixed: $\Omega \pm 5\%$; 1/10W unless stated			
	R1	0660076A83	27k			
	R2	0660076A65	4.7k			
	R3	0660076A60	3k			
	R5	0660076A63	3.9k			
	R6	0660076A83	27k			
	R7	0660076A53	1.5k			
	R9,10	0660076A18	51			
	R11	0660076A57	2.2k (L,M)			
		or 0660076A60	3k (H)			
rink						
is Only)						

NOTE: For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

* In the (L) frequency split, radios operating on 33.6 MHz will be equipped with three alternate parts:

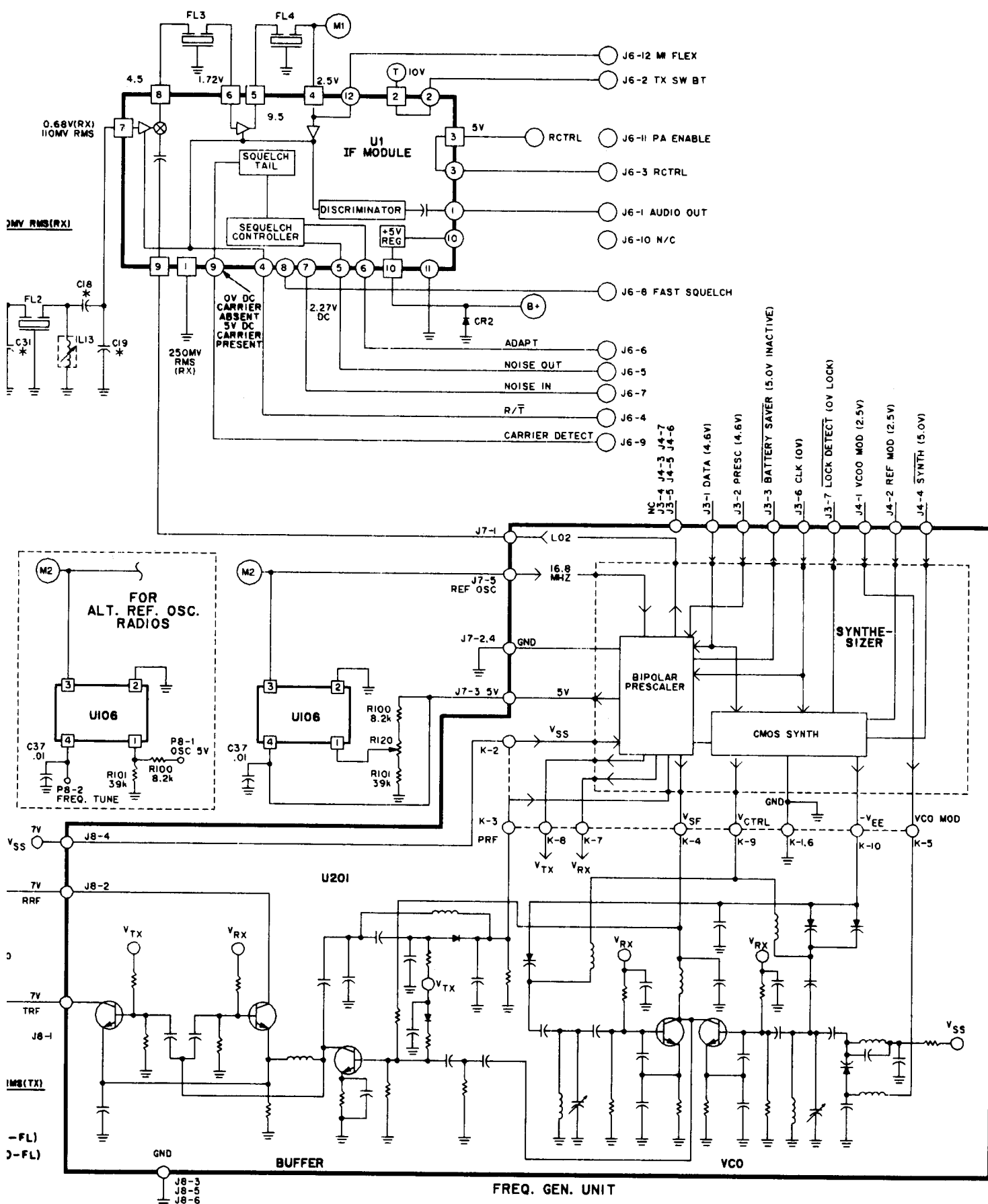
- U106
- U201
- P8 a 2-pin connector that replaces resistor R120

If the radio is not equipped with the alternate parts, it will not perform properly on 33.6 MHz.

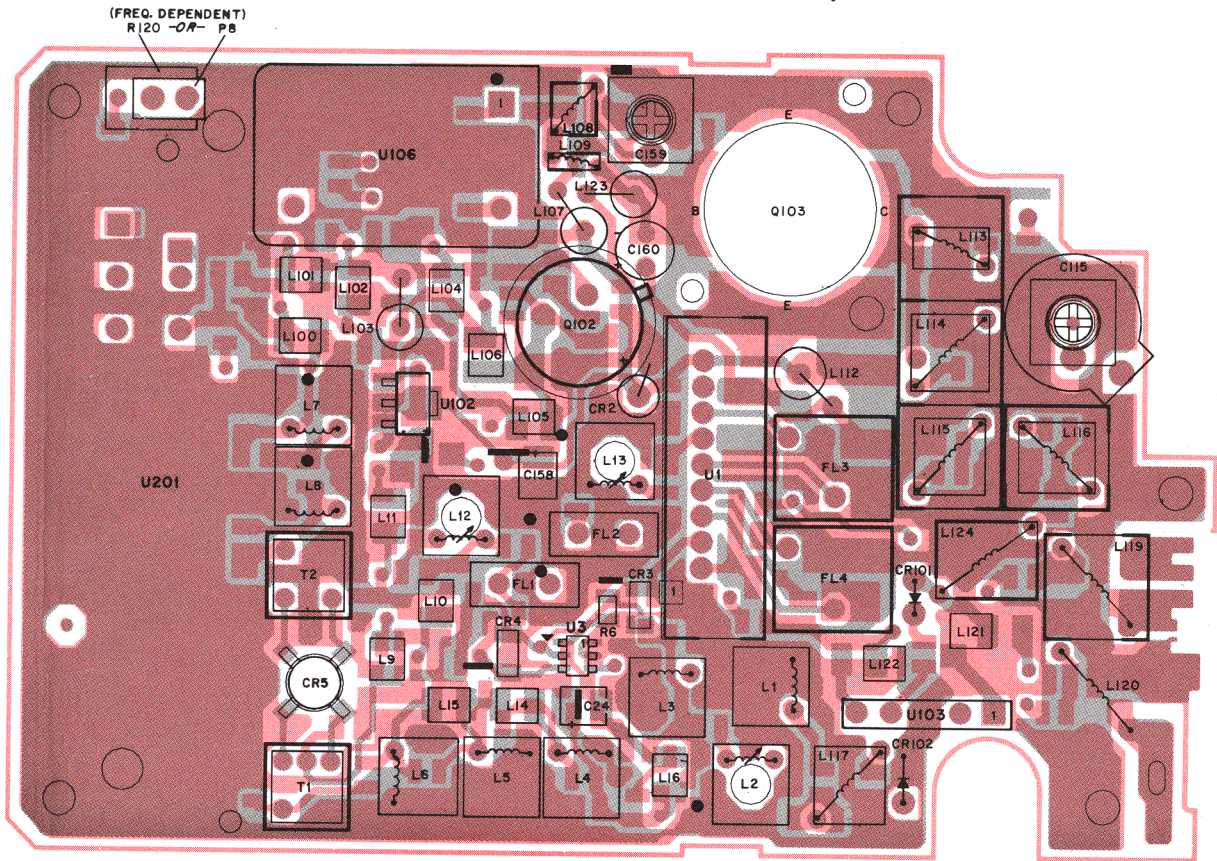


○ PINS TO FLEX

* REFER TO ELECTRICAL
PARTS LIST FOR
VALUE AND DESCRIPTION



VIEWED FROM SIDE 1 (COMPONENT SIDE)

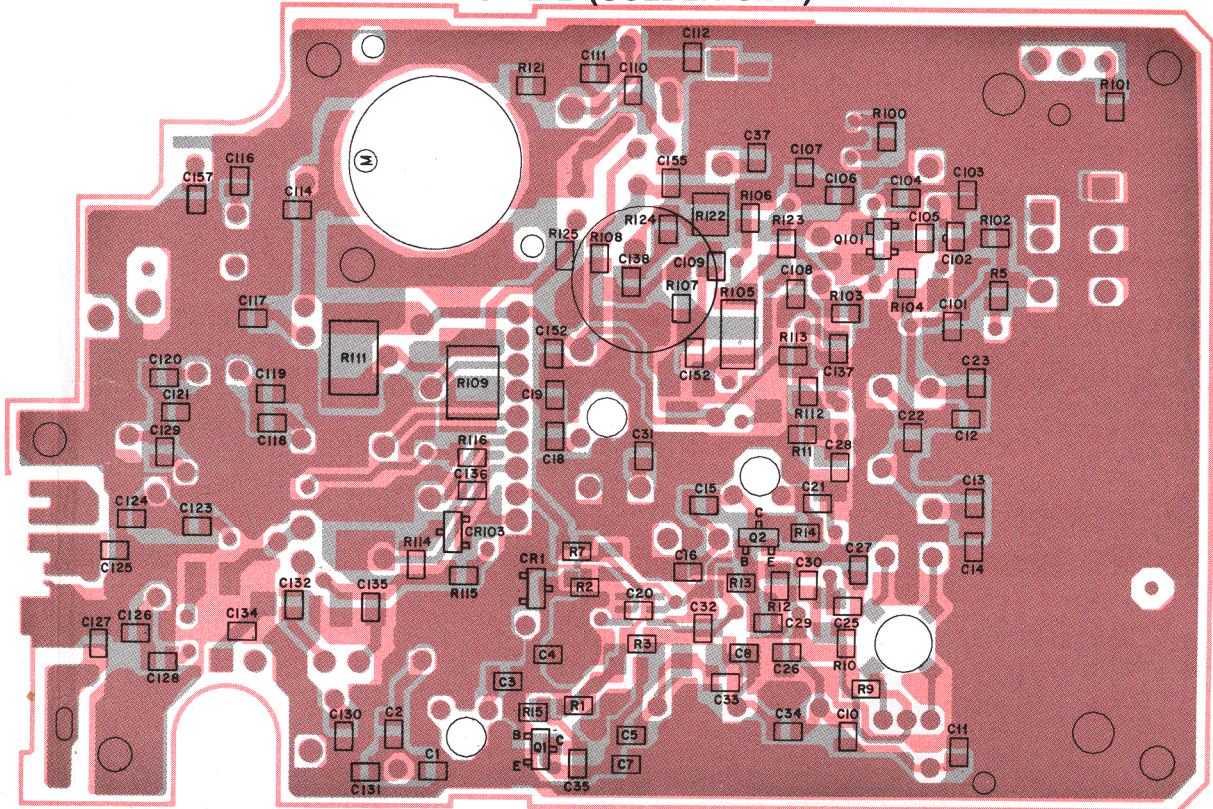


COMPONENT SIDE ● BD-CEPS-48043-O (LI-CEPF-20756-A-FL)

SOLDER SIDE ● BD-CEPS-48042-O (L4-CEPF-20757-A-FL)

OVERLAY OL-CEPS-48044-O (OL-CEPF-20758-A-FL)

VIEWED FROM SIDE 2 (SOLDER SIDE)



COMPONENT SIDE ● BD-CEPS-48045-O (LI-CEPF-20759-A-FL)

SOLDER SIDE ● BD-CEPS-48046-O (L4-CEPF-20760-A-FL)

OVERLAY DL-CEPS-48047-O (OL-CEPF-20761-A-FL)

b. Frequency Generation and Distribution

(1) Frequency Generation Unit, FGU

The VCO, buffer, and synthesizer functions are performed by a single module, the Frequency Generation Unit (FGU), U201 (Figure 5). The FGU, in conjunction with the reference oscillator (U106), generates rf in both modes of operation (receive and transmit). In the FGU, two sections (a synthesizer section and a VCO/Buffer section) interact with each other to produce the necessary voltages and signals for rf generation. The FGU receives its power (VSS) from a 7.0-volt regulator at U102 pin 3, via interconnect point J8-4.

Within the VCO/buffer stage, an rf output is routed from the VCO to the buffer. A sample of this signal, PRESCALER OUT, is passed from the VCO/buffer to a prescaler circuit in the synthesizer section. After a frequency comparison in the synthesizer, a resultant control voltage is routed, via a loop filter in the synthesizer, back to the VCO/buffer. The voltage is between 0 and 5 volts when the PLL is locked on frequency. At the same time, a negative voltage from the synthesizer is applied to the VCO. The negative voltage and control voltage are applied at

opposing ends of a varactor diode, which tunes the VCO to the correct frequency. These signals and voltages are not accessible on the main circuit board. The frequencies for respective -VEEs are shown in Table 1.

In the receive mode, 5 volts (VRX) from a dc switch in the synthesizer is applied to and enables the VCO buffer. The weak signal from the VCO is amplified by the buffer, and the resulting signal (RFF) is applied to the first injection filter via interconnect point J8-2.

During the transmit condition (PTT depressed), 5 volts (VTX) from a dc switch in the synthesizer is applied to and enables the transmit buffer. The resulting signal (TRF) is routed to the transmitter via interconnect point J8-1. Also in the transmit mode, the audio signal to be modulated onto the carrier (VCO MOD) is received in the synthesizer at interconnect point J4-1 and routed to a varactor in the VCO.

Synthesizer- The microcomputer (U401) reads the code-plug (U402) and sends setup signals, which are received by the synthesizer latch circuit. These setup signals determine the correct negative voltage and the A/B counter divide ratios needed to generate the proper rf frequencies.

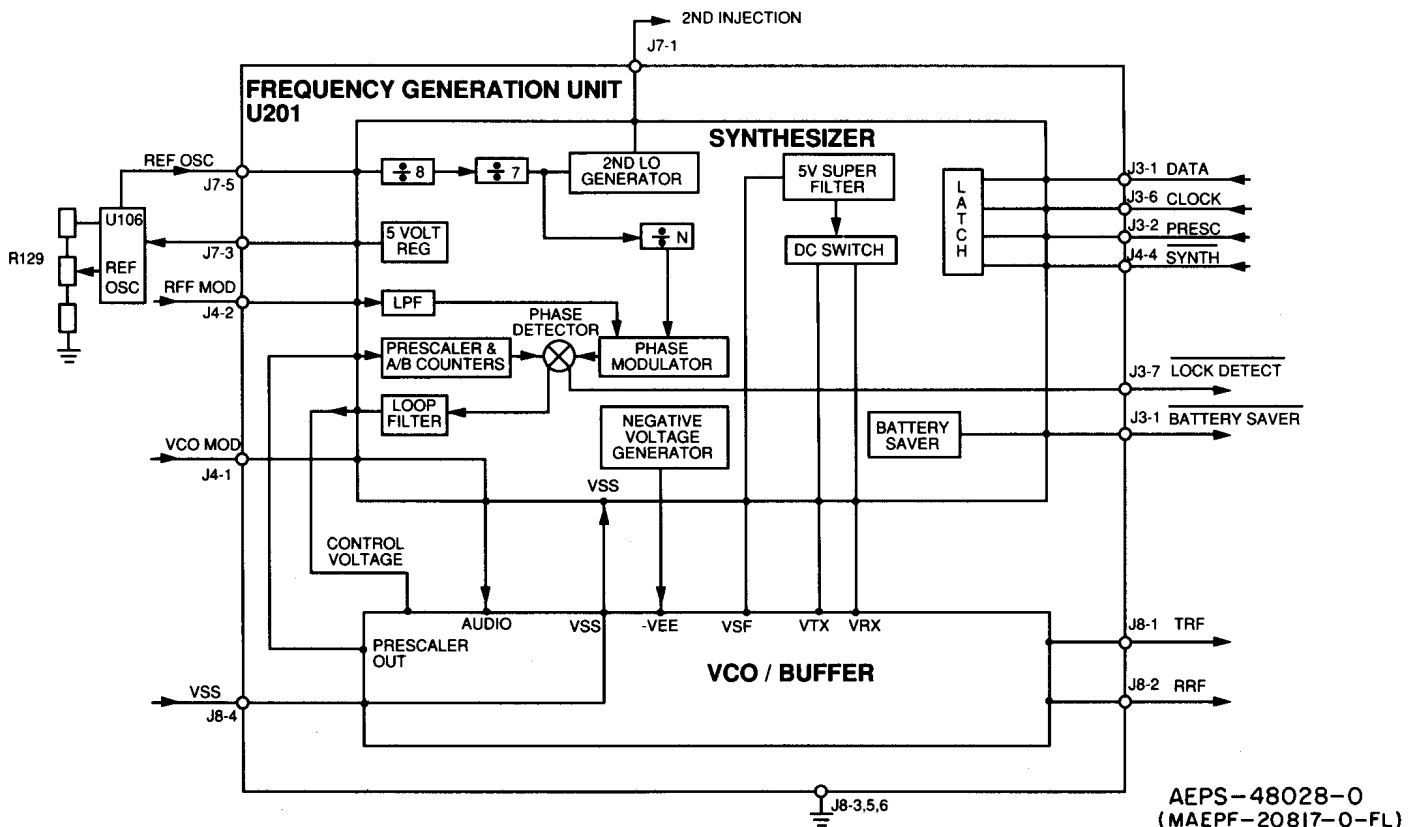


Figure 5. Frequency Generation Unit

Table 1. Negative Voltage vs User Rx and Tx Frequencies

BANDSPLIT	-VEE	Receive (MHz)	Transmit (MHz)
(LOWBAND) 30.0-36.0(MHz)	-2 -4 -6	30.00000-33.64900 33.65000-36.00000	30.00000-32.29900 32.30000-34.49900 34.50000-36.00000
36.0-42.0(MHz)	-2 -4 -6	36.00000-39.64900 39.65000-42.00000	36.00000-38.29900 38.30000-40.59900 40.60000-42.00000
42.0-50.0(MHz)	-2 -4 -6	42.00000-46.64900 46.65000-50.00000	42.00000-44.64900 44.70000-47.69900 47.70000-50.00000

The reference frequency for the synthesizer/VCO phase-locked loop is provided by a 16.8-MHz crystal oscillator (U106), which is fine tuned by resistor R120. The 16.8-MHz crystal oscillator frequency is divided first to 2.1 MHz (divide by 8) and then to 300 kHz. The 300-kHz signal is used for two different applications in the synthesizer. Lowsplit (30-36 MHz) radios may use a 2.1-MHz reference oscillator, which is fine tuned by an external fixture.

First, the 300kHz reference frequency is applied to an internal PLL circuit (within the synthesizer), which generates the receiver's second LO injection signal. The second LO is 19.5 MHz (for low-side injection) or 20.4 MHz (for high-side injection) for low-split radios and 16.2 MHz (LSI) or 17.1 (HSI) for mid- and high-split radios. This signal is routed to the i-f module U1 via interconnect point J7-1.

Second, the 300-kHz frequency is further divided to produce a VCO/synthesizer PLL reference frequency of 5.0 kHz (or 6.25 kHz), which is applied to a phase modulator. In the transmit mode, the phase modulator modulates audio below 60 Hz (PL/DPL tones) onto this reference signal. The reference signal is then fed, as one of the two inputs, to a phase detector. The second input to the phase detector comes from the VCO. This second signal is received by the synthesizer, divided by a prescaler circuit, divided again by an A/B counter circuit, and then applied to the phase detector. The phase detector circuit compares the two input signals. If the frequencies are not the same, a control voltage (error voltage) is generated and sent to the VCO, ultimately pulling the PLL on frequency. When the two frequencies are the same, the phase detector outputs a low on the LOCK DETECT line. This LOCK DETECT low is routed to the microcomputer, which in turn sets the radio transmit and receive voltages. Refer to the "DC Switch" section for a more detailed explanation.

c. Controller (See Figure 6)

Module U401 is a single chip, 8-bit microcomputer that performs control and processing functions. It works in conjunction with the code plug, which stores the radio personality in its non-volatile memory. The microcom-

puter controls three data buses: the code plug bus, the FGU/audio filter IC bus, and the radio programming bus..

The code plug data bus is bi-directional, meaning that data can be sent to or received from the code plug. When the microcomputer wants to access the code plug, it pulls CODE PLUG POWER (U401, pin 7) low, turning on the supply to the code plug(s) through Q402. The microcomputer then transmits the address of the data to the code plug on the data bus by toggling CODE PLUG CLOCK (U401, pin 4). The data then becomes available on CODE PLUG DATA (U401, pin 5). During a read instruction, data is input to the microcomputer from the code plug. During a write instruction, data is output from the microcomputer to the code plug(s).

The FGU/audio filter IC programming bus is uni-directional, meaning that data is sent from the microcomputer to the FGU (U201)/audio filter IC (U405). The bus is synchronous, and the flow of data is controlled by SPI CLOCK (U401, pin 23). The data appears on SPI DATA (U401, pins 21 and 22).

The FGU has two separate programming latch circuits, which are controlled by PRESC (U401, pin 17) and SYNTH (U401, pin 16). When programming the synthesizer module, the microcomputer first pulls PRESC low and sends data using SIP CLOCK and SIP DATA. PRESC is then pulled high and SYNTH is pulled low. The microcomputer again sends data using SIP CLOCK and SIP DATA. When data transfer is complete, SYNTH is pulled high. The synthesizer module is now programmed for the new operating frequency. To program the audio filter IC, AF SELECT (U401, pin 18) is pulled low. The data is transferred using SIP CLOCK and SIP DATA. When the data transfer is complete, AF SELECT goes high.

The radio programming bus is bi-directional, meaning that data can be sent to or received from the microcomputer. The bus is asynchronous and data is sent or received on SCI DATA (pins 20 and 19). The flow of data is controlled by BUSY (U401, pin 15). A low on the BUSY line indicates that a message exists on the DATA line.