MESSENGER 132 CB BASE STATION
SERVICE MANUAL ADDITION

GENERAL

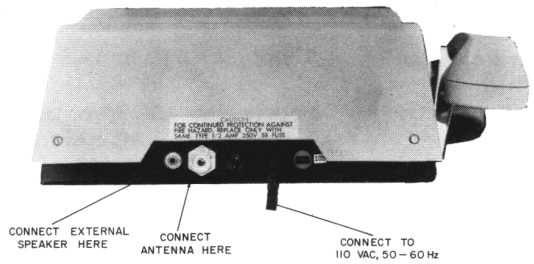
This service manual addition contains installation, service and alignment information for the Messenger®* 132 CB Base Station. Also included is a schematic diagram, a components layout with wiring terminations and a complete parts list. For complete transceiver service information and test setups, refer to the Messenger® 122-123A Service Manual, Part No. 001-0122-001.

DESCRIPTION

The Messenger 132 CB Base Station, Part No. 242-0132-001, is a fully solid state, 23 channel transceiver with a built-in power supply which operates from 117 VAC or 13.8 VDC. Also included in the Messenger 132 is an "S" meter which indicates receiver signal strength, modulation and relative RF power output. The Messenger 132 contains a 3 watt public address feature and a 14 crystal frequency synthesizer which generates all transmitter and receiver frequencies.

INSTALLATION

The Messenger 132 should be located in a position that will allow for the shortest possible antenna transmission line and operating convenience.



TYPICAL BASE STATION CONNECTIONS
FIGURE 1

a. Install the antenna, pay particular attention to FCC regulations concerning height above the ground.

b. Route the transmission line to the intended transceiver location and connect it to the antenna connector.

c. Connect the transceiver line cord to any 110 VAC, 50-60 Hz power source. Refer to the operating manual included with each transceiver for operating instructions.

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E. F. JOHNSON COMPANY
WASECA, MINNESOTA 56093
® 3-75EFJ 001-0132-001
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SPECIFICATIONS

(Measurements are made per EIA Standard RS-382 and are nominal unless otherwise stated.)

GENERAL

Channels	23
Frequency Range	26.965 to 27.255 MHz
Frequency Control	±0.005% crystal, -30°C to 60°C transmit and receive
Overall Dimensions	13.3 cm W x 34.9 cm H x 32.9 cm D (5.2 in W x 13.7 in H x 9 in D)
Weight -	
Unit	3.4 kg (8.5 lbs)
Shipping	4.0 kg (10 lbs)
Handset	High impedance ceramic microphone element, push to talk switch
Antenna Impedance	50 ohms
Compliance	FCC Type Acceptance Part 95 DOC Type Approved RSS-136
Circuitry	1 integrated circuit, 18 transistors, 25 diodes and 2 thermistors
Power Requirements	117 VAC, 50-60 Hz or 13.8 VDC
Circuit Protection	2 ampere fuse - DC operation 0.5 ampere fuse - AC operation

RECEIVER

Sensitivity	10 dB (S+N)/N at 0.5μV input
Selectivity	6 kHz min. bandwidth at -6 dB 30 kHz max. bandwidth at -60 dB
Spurious Rejection	50 dB except image of 10 dB and 1/2 IF of 35 dB
Tight Squelch	30 μV minimum to 2000 μV maximum
Squelch Sensitivity	1 dB or less signal change for 40 dB of quieting at 1 μV
Intermediate Frequency	455 kHz
AGC Characteristics	Flat within ±6 dB from 100,000 μV to 5 μV with 12 dB of rolloff from 5 to 0.5 μV
Noise Limiting	3 dB maximum
Speaker Impedance	3.2 ohms
Audio Frequency Response	+2 dB, -16 dB from 300 to 3000 Hz
Audio Output Power	3 watts

TRANSMITTER

Emission	6A3
RF Power Output	4 watts maximum at 13.8 VDC
RF Spurious and Harmonic Attenuation	50 dB minimum
Audio Frequency Response	1 dB, -16 dB from 300 to 3000 Hz
Modulation	80% minimum

MINIMUM PERFORMANCE SPECIFICATIONS

(The specifications listed in this section are absolute service minimums.)

RECEIVER

Sensitivity	7 dB (S+N)/N at 0.5 μV input
Spurious Rejection	40 dB except image of 5 dB and 1/2 IF of 30 dB
Audio Output Power	0.075 watt minimum at 0.5 μV, 2.5 watts with less than 10% distortion at 1000 μV input
Tight Squelch	30 μV minimum and 2000 μV maximum
AGC Characteristics	15 ±4 dB rolloff from 500 to 0.5 μV

TRANSMITTER

RF Power Output	2.8 watts minimum at 13.8 VDC
Modulation	80% minimum positive and negative

SERVICE

For transceiver servicing, refer to the Messenger 122-123A Service Manual Servicing Section. The Messenger 132 circuitry is similar to the Messenger 123A and the service information listed for the Messenger 123A applies to both transceivers. Only the unique functions of the Messenger 132 are discussed in this manual addition.

CRYSTAL REPLACEMENT

As a quick check of the transmit crystal activity, connect a frequency counter to the unmodulated transmitter output and count the carrier frequency on channels 1, 6, 11, 16, 20 and 23. Compare your readings with those listed in Table 1.

TABLE 1
Transmitter Channel Frequency Limits

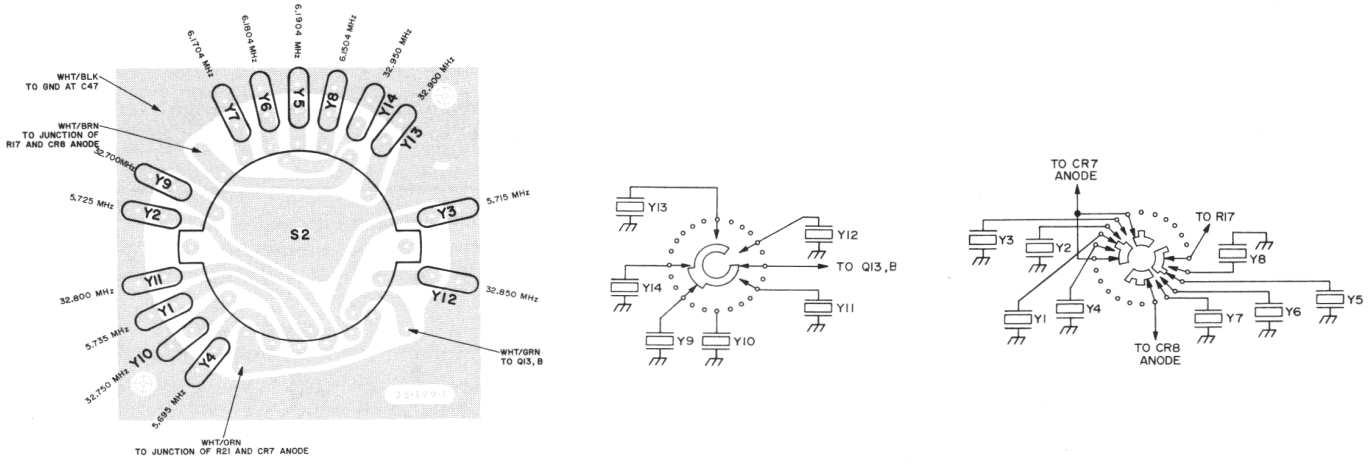
Channel No.	Crystal	High Limit, kHz	Low Limit, kHz
1	Y9	26,966.348	26,963.652
6	Y10	27,026.351	27,023.649
11	Y11	27,086.354	27,083.646
16	Y12	27,156.357	27,153.643
20	Y13	27,206.360	27,203.640
23	Y14	27,256.362	27,253.638

If channels 1, 6, 11, 16, 20 or 23 are either off frequency or completely inoperative, other channels may be affected. Refer to Table 2 for a more complete analysis of the frequency synthesizer crystal scheme.

TABLE 2
Frequency Synthesizer Analysis

Channel No.	Faulty Receive	Faulty Transmit	Faulty Crystal
1,2,3 and 4	X	X	Y9
5,6,7 and 8	X	X	Y10
9,10,11 and 12	X	X	Y11
13,14,15 and 16	X	X	Y12
17,18,19 and 20	X	X	Y13
21,22 and 23	X	X	Y14
1,5,9,13,17 and 21	X		Y5
2,6,10,14,18 and 22	X		Y6
3,7,11,15 and 19	X		Y7
4,8,12,16,20 and 23	X		Y8
1,5,9,13,17 and 21		X	Y1
2,6,10,14,18 and 22		X	Y2
3,7,11,15 and 19		X	Y3
4,8,12,16,20 and 23		X	Y4

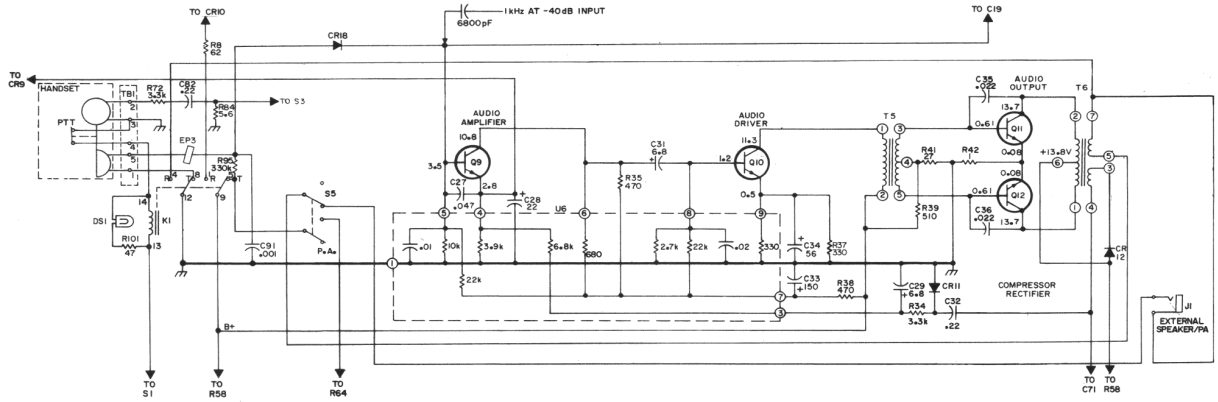
To replace a defective crystal, remove the two screws from the crystal circuit board and gently pull the board away from the switch detent. Figure 2 shows the crystal circuit board layout and switch wiring. The switch is shown in the channel 1 position as viewed from the knob end of the shaft. Channel numbers increase with clockwise rotation.



CRYSTAL SWITCH
(SOLDER SIDE VIEW)
FIGURE 2

PUBLIC ADDRESS (PA)

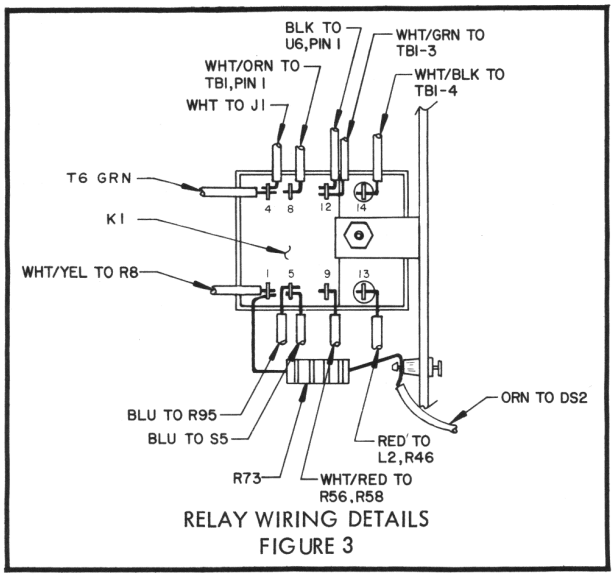
The PA circuit utilizes the audio amplifier section of the transceiver for public address without activating the transmitter. When using the PA function, an external speaker must be connected to the external speaker jack. Refer to E. F. Johnson booklet 004-2000-001 which gives details on speaker installation. When S5, the Off/PA switch, is in the PA position, the external speaker jack is connected across the audio output at terminals 5 and 7 of T6 and the transmit B+ line is opened. Therefore, when the handset push to talk switch is depressed, CR18 is forward biased through contacts 5 and 9 of K1, which allows audio from the microphone to be applied to the base of Q9.



SIMPLIFIED SCHEMATIC
PUBLIC ADDRESS

RELAY

Because of the switching requirements of the Messenger 132 handset, relay K1 is included to provide increased switching capability. Basically, the relay is used in conjunction with the handset push to talk (PTT) switch to switch between receive and transmit functions. In the receive mode, the receive B+ is supplied through contacts 1 and 9 of the relay. When the PTT switch is closed, the relay coil is activated and B+ is applied through contacts 5 and 9 of K1 to the transmit circuits. Contacts 8 and 12 provide the ground connections for the microphone portion of the handset. Figure 3 shows a bottom view of the relay and lists the wiring terminations.



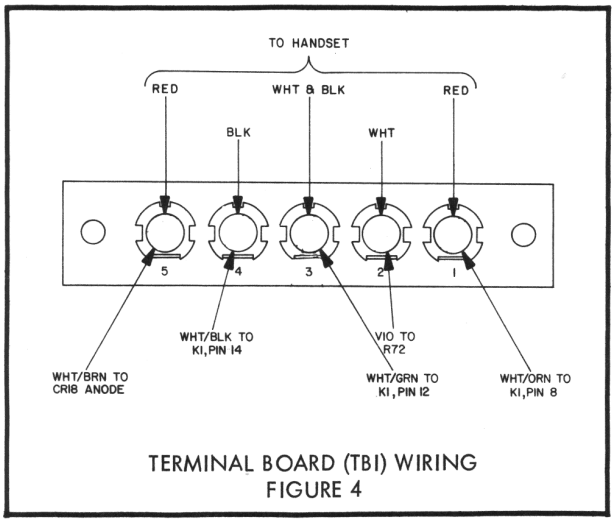
RELAY WIRING DETAILS
FIGURE 3

HANDSET

The telephone type handset contains a speaker element and a ceramic microphone cartridge. In the handle of the handset is the PTT switch which switches the transmit and receive functions through relay K1. The audio level to the earpiece is set by R72 to provide a comfortable listening level.

With the handset in the cradle, the audio is coupled to the speaker through S3. The audio can be switched to the handset earpiece, the speaker or both by S3 and S4.

The handset is wired to the transceiver through a terminal board, TB1. Refer to Figure 4 for TB1 wiring terminations.



TERMINAL BOARD (TB1) WIRING
FIGURE 4

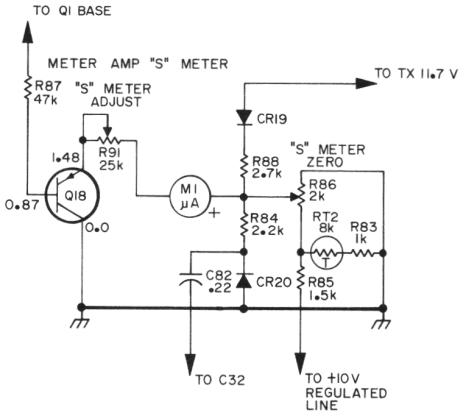
METER CIRCUITRY

The front panel meter on the Messenger 132 serves as an "S" meter in the receive condition and indicates relative power output in the transmit condition.

In the receive condition with no signal input, Q18 is biased off which results in no meter indication. When a signal is received, AGC-1 voltage is applied to Q18 base causing the base to become more negative with respect to the emitter and Q18 conducts. The Q18 conduction path is from ground through Q18, R91, M1 and R86 to receive B+. Therefore the meter indication is directly proportional to the conduction of Q18 which is determined by the receive signal strength. CR19 is used as a DC blocking diode to isolate the receive B+ from the transmit circuitry.

In the transmit condition, transmit B+ voltage is applied from the PTT switch through CR19 to the meter circuit. When the transmitter is keyed, RF leakage through CR16 is coupled through T1 to Q1. The base-emitter junction of Q1 rectifies the RF and applies a negative going bias voltage to the base of Q18. With the base more negative then the emitter, Q18 conducts from ground through Q18, R91, M1, R88 and CR19 to transmit B+, causing the meter to deflect upscale indicating the transmit RF carrier. When the operator speaks into the microphone, a modulation sample is coupled through C82 and rectified by CR20. The resultant positive DC voltage, which varies with the modulation, aids Q18 conduction and causes the meter to vary with the modulation.

Thermistor RT2 provides for a constant rate of conduction through Q18 over various ambient temperatures.

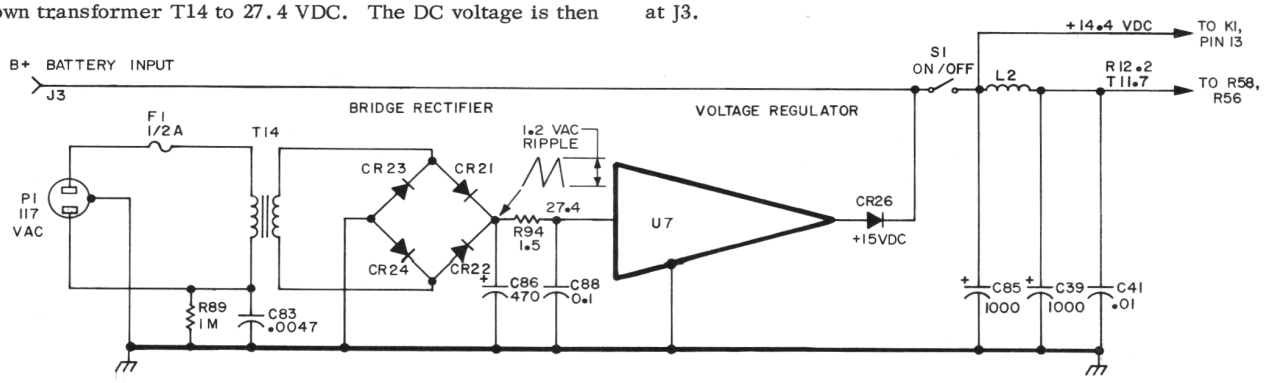


SIMPLIFIED SCHEMATIC
"S" METER CIRCUIT

POWER SUPPLY

The Messenger 132 contains an integrated circuit (IC) regulated power supply. When connected to a 110-120 VAC 50-60 Hz source, the voltage regulator provides a constant 14.4 VDC to the transceiver circuits.

The bridge rectifier, consisting of CR21-CR24, rectifies approximately 21 VAC from the secondary of the step down transformer T14 to 27.4 VDC. The DC voltage is then filtered by C86 and C88 and then regulated by the integrated circuit voltage regulator U7. Resistor R94 is a protection device which dissipates a sufficient amount of power to prevent damage to U7 when the transmitter is keyed. The output of U7 is approximately 15 volts, therefore CR26 is added in series to provide an additional 0.5 VDC voltage drop to ensure a constant 14.4 VDC output. CR26 also provides isolation between U7 and the DC voltage input jack to prevent any possible damage that might occur with a 13.8 VDC input at J3.



SIMPLIFIED SCHEMATIC
POWER SUPPLY CIRCUIT

RECEIVER ALIGNMENT

Before aligning the Messenger 132, refer to the alignment section of the Messenger 122-123A Service Manual for a list of alignment tools and test setups. Refer to Figure 5 on the foldout page in this manual for alignment points locations.

NOTE

The low pass filter adjustments, L6 and L7, should be adjusted for 3.8 watts output power before the receiver is aligned. Refer to the transmitter tuneup section for details.

FREQUENCY SYNTHESIZER

a. High Frequency Oscillator Adjustment

1. Set the channel selector switch to channel 23 and connect the RF voltmeter to the CR14-CR15 junction.

2. Adjust T7 to the peak RF voltmeter reading point. A typical reading of approximately 0.4 VRF should be measured.

b. Synthesizer Mixer Adjustment

1. Set the channel selector switch to channel 12 and connect the RF voltmeter probe to the case of Q15.

2. Key the transmitter into an RF load and adjust T8, T9, T10 and T11 for a maximum meter reading. A typical reading of approximately 0.28 VRF should be measured.

RF AND IF SECTION (CHANNEL PEAKING METHOD)

a. RF Adjustment

1. Set the channel selector switch to channel 12 and connect a 1 kHz, 30% modulated RF signal to the antenna connector.

2. Adjust T1 and T2 for a maximum audio output while keeping the RF signal generator output to a minimum.

b. IF Adjustment

1. Test setup same as a.1.

2. Adjust Z1A, Z1B, T3 and T4 for a maximum audio output while keeping the RF signal generator output to a minimum.

3. Set the RF signal generator output level to 0.5 μV, modulated 30% at 1 kHz.

4. Readjust T1, T2, Z1A, Z1B, T3 and T4 for a maximum audio output and make final adjustment of T1 for best signal to noise ratio.

RF AND IF SECTION (455 kHz GENERATOR METHOD)

a. IF Adjustment

1. Connect a 455 kHz signal generator through a 0.02 μF coupling capacitor to the base of Q2.

2. Adjust Z1A, Z1B, T3 and T4 for a maximum audio voltmeter indication while reducing the generator output level (an excessive generator output level will cause improper IF amplifier alignment).

b. RF Adjustment

1. Remove the 455 kHz signal generator and connect the RF signal generator to the antenna connector. Set the generator level to 0.5 μV, modulated 30% at 1 kHz on channel 12 (27.105 MHz).

2. Adjust T1 and T2 for a maximum audio output and make final adjustment of T1 for best signal to noise ratio.

AUTOMATIC GAIN CONTROL (AGC) ROLLOFF

a. Refer to the receiver test setup in the alignment section of the Messenger 122-123A Service Manual.

b. Set the RF signal generator output for 500 μV on channel 11 frequency (27.085 MHz) modulated with 1 kHz at 30%.

c. Set the transceiver channel selector to channel 11 and adjust the volume control for a 0 dB indication on the VTVM.

d. Reduce the RF signal generator output to a 0.5 μV. The VTVM reading should decrease 15 ±4 dB. Adjust R7 and repeat steps 3 and 4 if unable to obtain the 15 ±4 dB reading.

METER

a. S-Meter Zero

1. Set the RF signal generator to channel 12 frequency (27.105 MHz) and set the output level to 0.5 μV, modulated 30% at 1 kHz.

2. Connect the RF signal generator to the transceiver antenna connector and set the channel selector switch on the transceiver to channel 12.

3. Adjust R86 for an S1 indication on the meter.

b. S-Meter Adjust

1. Set the RF signal generator to channel 12 frequency (27.105 MHz) and set the output level to 50 μV, modulated 30% at 1 kHz.

2. Connect the RF signal generator to the transceiver antenna connector and set the channel selector switch on the transceiver to channel 12.

3. Adjust the S-meter adjust control, R91, for an S9 meter indication.

TRANSMITTER TUNEUP

PREDRIVER AND POWER AMPLIFIER

Connect a 5 watt wattmeter (Bird Model 43 or equivalent) and a dummy load to the antenna connector. Key the microphone and proceed as follows:

a. Predriver

1. Adjust T12 and T13 for maximum power output.

2. Adjust T10 and T11 for maximum power output.

b. Power Amplifier

1. Adjust L6 and L7 for a power output between 2.8 and 3.8 watts.

2. Adjust L6 for minimum transmitter current while maintaining a power output between 2.8 and 3.8 watts.

TRANSMITTER FREQUENCY CHECK

To check the transmitter frequency, proceed as follows:

a. Loop couple a frequency counter or meter to L7.

b. Refer to Table 3 for channel frequencies. Replace crystals as necessary to maintain a channel frequency tolerance of ±0.005%.

TABLE 3
CHANNEL FREQUENCIES

Channel	Minimum Limit (kHz)	Center Frequency (MHz)	Maximum Limit (kHz)	Channel	Minimum Limit (kHz)	Center Frequency (MHz)	Maximum Limit (kHz)
1	26,963.652	26.965	26,966.348	13	27,113.645	27.115	27,116.355
2	26,973.652	26.975	26,976.348	14	27,123.644	27.125	27,126.356
3	26,983.651	26.985	26,986.349	15	27,133.644	27.135	27,136.356
4	27,003.651	27.005	27,006.350	16	27,153.643	27.155	27,156.357
5	27,013.650	27.015	27,016.350	17	27,163.642	27.165	27,166.358
6	27,023.649	27.025	27,026.351	18	27,173.642	27.175	27,176.358
7	27,033.649	27.035	27,036.351	19	27,183.641	27.185	27,186.359
8	27,053.648	27.055	27,056.352	20	27,203.640	27.205	27,206.360
9	27,063.647	27.065	27,066.353	21	27,213.640	27.215	27,216.360
10	27,073.647	27.075	27,076.353	22	27,223.638	27.225	27,226.361
11	27,083.646	27.085	27,086.354	23	27,253.638	27.255	27,256.362
12	27,103.645	27.105	27,106.355				

NOTE:

FCC regulations require all transmitter frequencies to be within ±0.005% as listed.

CRYSTAL STARTING AND MODULATION CHECK

a. Switch between channels 1 and 23 and check for normal crystal starting.

b. Check for normal waveform and percent of modulation.

1. Loop couple the oscilloscope to L7. Refer to Figure 5-4 in the Messenger 122-123A Service Manual for fabrication details.
2. Set the audio generator frequency to 1 kHz and couple a 35 mV (-27 dB) audio input through a 6800 pF series capacitor to the base of Q9. The oscilloscope should indicate at least 50% modulation.
3. Increase the audio generator level to 220 mV (-11 dB). The oscilloscope should indicate not less than 80% nor more than 100% modulation on both negative and positive peaks.

c. Check each channel for clean modulation and absence of oscillations. Adjust T12 and T13 as necessary to eliminate modulation distortion.

d. Check for normal modulation by speaking into the handset microphone.

FINAL CHECKOUT PROCEDURE

a. Connect a Bird Model 43 with a 10A element or equivalent wattmeter into the transmission line.

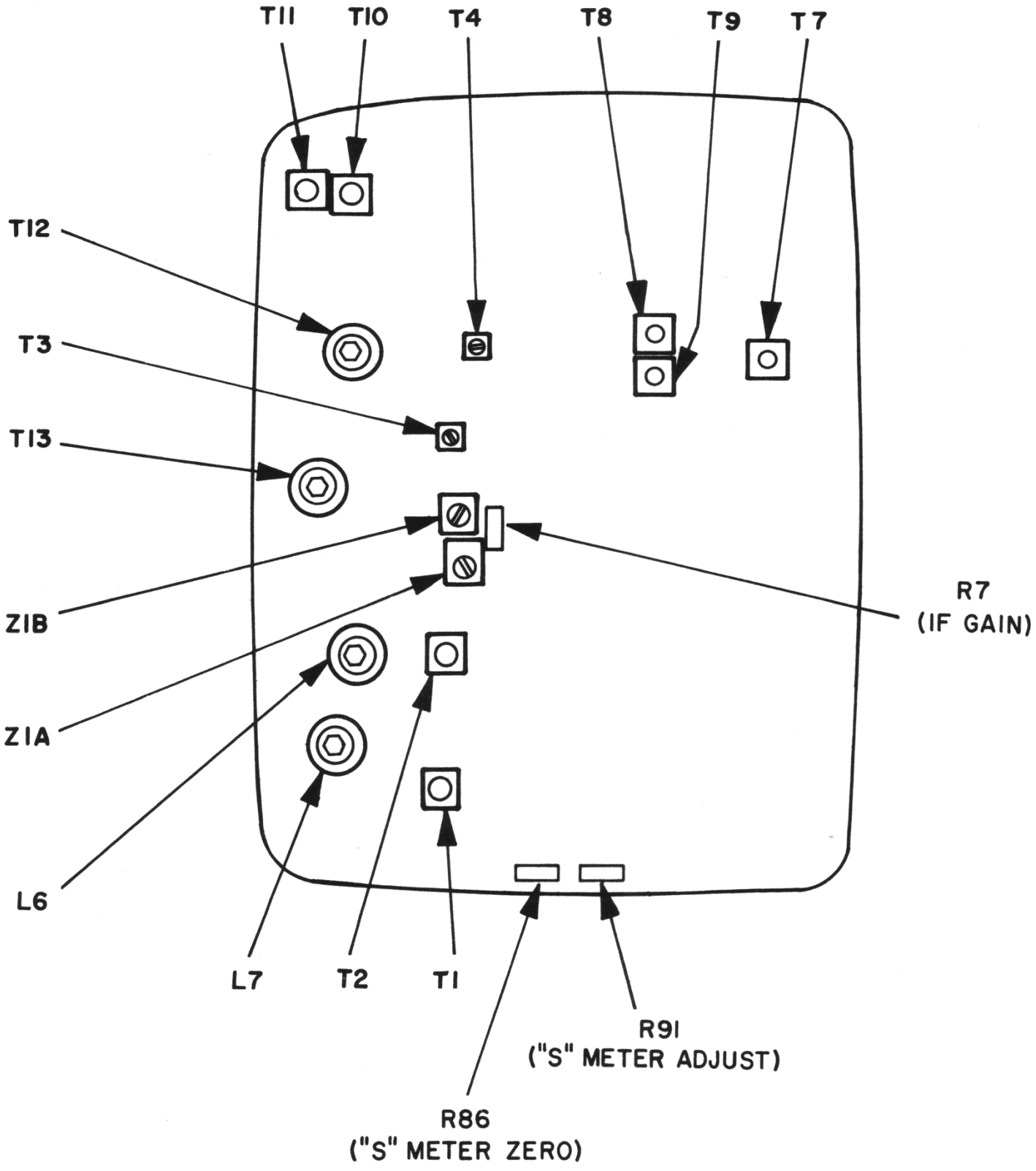
b. Adjust the antenna for best VSWR following the manufacturer's instructions. The transceiver has been aligned at the factory and the output network will not normally require realignment to match it to the antenna. The measured VSWR should be 1.5 to 1 or less.

c. Check the transmitter power output. The typical power output is 3.5 watts.

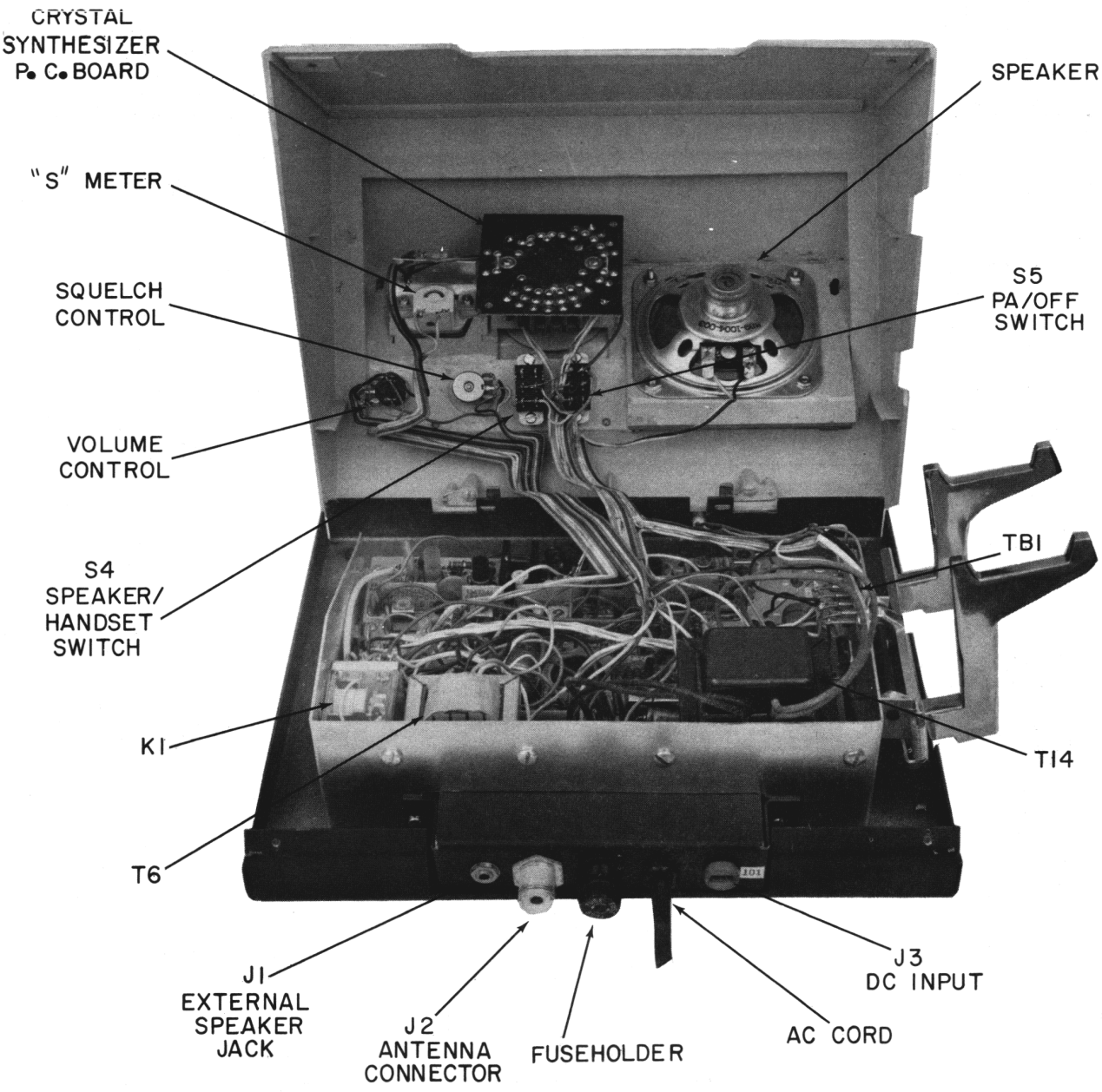
d. Check the transmitter frequency, the maximum allowable tolerance from the center frequency is ±0.005%. Refer to Table 3 for frequency limits.

e. Check the modulation, minimum acceptable is 80% upward and downward, it should not exceed 100%.

f. Give the transceiver a complete operational checkout. Make several contacts with other units in the system and correct any problems that may affect transceiver performance.



ALIGNMENT POINTS
FIGURE 5



PARTS NOT SHOWN ON PC BOARD

PARTS LIST

SYMBOL NO.	DESCRIPTION	PART NO.
	COMPONENTS CODES	
	J = ±5%	
	K = ±10%	
	M = ±20%	
	1DM15 = 1 coat dipped mica, size 15	
	HANDSET	
A1	Handset Assembly	023-3267-001
	Includes:	
	Resonator assembly	023-2858-002
	Handset	589-9002-010
	Machined cup	589-9002-012
	Mouthpiece	589-9002-013
	CABINET PARTS	
BK1	Bracket AC cover	017-1831-001
BK2	Bracket cradle stop	017-1834-001
BK3	Bracket cradle mounting	017-1835-002
BK4	Bracket meter lights	017-1838-001
BK5	Bracket dial light	017-1839-001
CH1	Mounting tray	017-1832-002
CH2	Chassis rail	017-1833-002
CH3	Plastic cabinet	032-0386-001
CH6	Cover bottom AC pwrsup	017-1860-001
CH13	Bracket AC cover	017-1831-001
EP1	Red rib loc feedthru	260-0202-901
MP6	Mounting clip, cabinet right	017-1841-002
MP9	Cradle, handset	537-9026-001
MP12	Spring, handset cradle	580-0001-031
MP13	Mounting clip, cabinet left	017-1841-001
MP14	Grill cloth	018-0827-016
NP1	Overlay	032-0384-001
	CAPACITORS	
C1	1000 pF M 1KV Y5S disc	510-3261-102
C2	6.8 μF M 35V dipped	510-2045-689
C4	27 pF J 200V N150 cera	510-3216-270
C5	5.1 pF J 200V NPO cera	510-3213-519
C6	0.010 μF M 50V Y5U	510-3202-103
C7	Same as C6	
C8	470 μF 40V aluminum	510-4009-001
C9	Same as C8	
C10	4700 pF M 50V Y5U disc	510-3204-472
C11	150 pF J 100V 1DM15	510-0001-151
C12	6.8 μF M 35V dipped	510-2045-689
C13	0.010 μF M 50V Y5U	510-3202-103
C14	Same as C13	
C15	0.047 μF K 250V flatfoil	510-1003-473
C16	0.010 μF K 250V flatfoil	510-1003-103
C17	1.0 μF M 35V dipped	510-2045-109
C18	Same as C17	
C19	Same as C17	
C21	820 pF J 100V 1DM15	510-0001-821
C22	390 pF J 100V 1DM15	510-0001-391
C23	0.010 μF M 50V Y5U	510-3202-103
C24	Same as C23	
C25	100 μF 10V aluminum	510-4003-005
C26	47 μF 25V aluminum	510-4006-012
C27	0.047 μF M 16V Y5S	510-3210-473
C28	22 μF M 15V tubular	510-2003-220
C29	6.8 μF M 35V dipped	510-2045-689
C30	4700 pF M 50V Y5U disc	510-3204-472
C31	6.8 μF M 35V dipped	510-2045-689
C32	1.0 μF M 35V	510-2005-109
C33	150 μF 25V aluminum	510-4006-006
C34	56 μF M 6V tubular	510-2001-560
C35	0.022 μF M 50V Y5U	510-3202-223
C36	Same as C35	
C37	0.010 μF M 50V Y5U	510-3202-103
C39	1000 μF 16V aluminum	510-4006-005
C41	0.010 μF M 50V Y5U	510-3202-103
C42	6.8 pF J 200V N750 ceramic	510-3220-689
C43	27 pF J 200V N150 ceramic	510-3216-270
C44	100 pF J 200V N150 ceramic	510-3216-101
C45	0.010 μF M 50V Y5U	510-3202-103
C46	Same as C45	
C47	0.010 μF M 16V Y5S disc	510-3010-103
C48	180 pF J 200V N750 ceramic	510-3220-181
C49	0.010 μF M 50V Y5U	510-3202-103
C51	1 pF J 500V composition	510-9002-109
C52	33 pF J 200V N150 ceramic	510-3216-330
C53	Same as C52	
C54	0.010 μF M 50V Y5U	510-3202-103
C55	220 μF 16V aluminum	510-4006-004
C56	0.010 μF M 50V Y5U	510-3202-103
C57	Same as C56	
C58	1 pF J 500V composition	510-9002-109
C59	33 pF J 200V N150 ceramic	510-3216-330
C60	0.047 μF M 16V Y5S	510-3210-473
C61	33 pF J 200V N150 ceramic	510-3216-330
C62	1000 pF J 100V 1DM15	510-0001-102
C64	22 pF J 200V NPO ceramic	510-3213-220
C65	0.010 μF M 50V Y5U disc	510-3002-103
C66	12 pF J 200V N750 ceramic	510-3220-120
C67	1000 pF M 1KV Y5S disc	510-3261-102
C68	47 pF J 200V N150 ceramic	510-3216-470
C69	4700 pF M 50V Y5U disc	510-3204-472
C70	0.047 μF M 16V Y5S	510-3210-473
C71	0.047 μF M 50V Y5U	510-3202-473
C72	1000 pF J 100V 1DM15	510-0001-102
C73	27 pF J 200V NPO ceramic	510-3213-270
C74	1000 pF M 1KV Y5S disc	510-3261-102
C75	1000 pF J 200V N150 ceramic	510-3216-101
C76	300 pF J 100V 1DM15	510-0001-301
C77	330 pF J 100V 1DM15	510-0001-331
C78	4700 pF M 1.4 KV Z5U	510-3001-472
C82	0.22 μF M 250V flatfoil	510-1004-224
C83	4700 pF M 1.4 KV Z5U	510-3001-472
C85	1000 μF 16V aluminum	510-4006-005
C86	470 μF 40V aluminum	510-4009-001
C88	0.10 μF M 250V flatfoil	510-1004-104
C90	470 pF J 100V 1DM15	510-0001-471
C91	1000 pF M 1KV Y5S disc	510-3261-102
C92	0.22 μF M 250V flatfoil	510-1004-224
C93	0.1 μF ±20% 16V Y5S disc	510-3010-104
C94	1000 pF ±20% 500V Y5U disc	510-3004-102
C101	1000 pF M 1KV Y5S disc	510-3061-102
C121	0.010 μF M 50V Y5U	510-3202-103
	DIODES	
CR1	1N67A germ diode	523-1500-067
CR2	1N4148 SI diode	523-1500-883
CR3	1N67A germ diode	523-1500-067
CR4	Same as CR3	
CR5	1N4148 SI diode	523-1500-883

PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.
CR6	1N881 SIL diode	523-1500-881
CR7	Same as CR6	
CR8	Same as CR6	
CR9	1N67A germ diode	523-1500-067
CR10	10V J 1W zener	523-2503-100
CR11	1N4148 SI diode	523-1500-883
CR12	1N4003 200V 1A rect	523-0001-002
CR13	10V J 1W zener	523-2503-100
CR14	1N4148 SI diode	523-1500-883
CR15	Same as CR14	
CR16	1N881 SIL diode	523-1500-881
CR17	1N4148 SI diode	523-1500-883
CR18	1N881 SIL diode	523-1500-881
CR19	Same as CR18	
CR20	Same as CR18	
CR21	1N4818 200V 1.5A rect	523-0013-201
CR22	Same as CR21	
CR23	Same as CR21	
CR24	Same as CR21	
CR26	Same as CR21	
	LAMPS	
DS1	21930 14.4V 0.12A clear on/off indicator	549-3001-003
DS2	1705D 14.0V 0.08A clear Receive indicator	549-3001-011
DS3	1705D 14.0V 0.08A red Transmit indicator	549-3001-013
	FUSE	
F1	Fuse 0.5A 125V SB MDL	534-0002-014
FH1	HKP fuseholder	534-1002-001
	FERRITE BEADS	
EP2	0.14 x 0.13 ferrite bead	517-2002-001
EP3	0.14 x 0.24 ferrite bead	517-2002-002
	TERMINAL STRIPS	
EP4	2103-4 terminal lug	586-0005-004
TB1	Terminal strip (Handset)	586-1007-005
TB2	Terminal strip 2 ins 1 gnd	586-1001-120
	AC CORD	
HW4	Strain relief AC cord	574-0003-002
W57	8 ft. AC cord 3-18 black	597-1001-002
	CONNECTORS	
J1	External speaker jack	515-2001-002
J2	Antenna connector	142-0101-002
J3	DC Power Connector	
	Includes:	
	Terminal tab	515-4101-001
	Red terminal bushing	515-4101-002
	RELAY	
K1	Relay DPDT 12V coil	567-0020-001
	INDUCTORS	
L2	20 mH audio choke	542-8001-011
L3	20 μH choke	542-3002-002
L4	13 μH choke	542-3003-001
L5	Same as L4	
L6	10 1/2 T ind. 0.75-1.0 μH	542-1005-010
L7	4 1/2 T ind. 0.24-0.32 μH	542-1005-004
L8	6.8 μH RF choke	542-3004-689
	SPEAKER	
LS1	3 in. 3.2 ohm speaker	589-1013-001
	METER	
M1	Meter	554-0017-001
	KNOBS	
MP10	Volume knob, squelch knob	547-0008-001
MP11	Channel selector switch knob	547-0008-005
	TRANSISTORS	
Q1	SI NPN 50 MHz amp TO92	576-0003-018
Q2	SI NPN gen. purp. TO92	576-0003-011
Q3	Same as Q2	
Q4	Same as Q2	
Q5	Same as Q2	
Q6	Same as Q2	
Q7	Same as Q2	
Q8	Same as Q2	
Q9	Same as Q2	
Q10	Same as Q2	
Q11	MJE2480 SI NPN pwr aud	576-0002-026
Q12	Same as Q11	
Q13	SI NPN 50 MHz amp TO92	576-0003-018
Q14	SI NPN gen. purp. TO92	576-0003-011
Q15	0.4W 27 MHz amp TO39	576-0004-004
Q16	Same as Q15	
Q17	3.4W 27 MHz amp	576-0004-005
Q18	SI PNP 50 MHz amp TO92	576-0003-017
	RESISTORS	
R2	10K ohm K 1/2 W	569-1504-103
R3	47 ohm K 1/2 W	569-1504-470
R4	1.0K ohm K 1/2 W	569-1504-102
R7	1.0K trim pot. (IF Gain)	562-0019-102
R8	62 ohm J 1/2 W	569-1503-620
R9	4.7K ohm K 1/2 W	569-1504-472
R12	10K ohm K 1/2 W	569-1504-103
R13	10K 1/8 W A 5/8 (Volume)	562-0016-004
R14	150K ohm K 1/2 W	569-1504-154
R15	68K ohm K 1/2 W	569-1504-683
R16	100K ohm K 1/2 W	569-1504-104
R17	2.2K ohm K 1/2 W	569-1504-222
R19	1.5K ohm ±10% 1/2 W	569-1504-152
R21	Same as R17	
R22	680 ohm K 1/2 W	569-1004-681
R23	330 ohm K 1/2 W	569-1504-331
R24	22K ohm K 1/2 W	569-1504-223
R25	330 ohm K 1/2 W	569-1504-331
R26	680 ohm K 1/2 W	569-1504-681
R27	5K 1/8 W BD 5/8 (Squelch)	562-0002-011
R29	1.0K ohm K 1/2 W	569-1504-102
R31	3.3K ohm K 1/2 W	569-1504-332
R32	120 ohm K 1/2 W	569-1504-121
R34	3.3K ohm K 1/2 W	569-1504-332

PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.
R37	330 ohm K 1/2 W	569-1504-331
R38	470 ohm K 1/2 W	569-1504-471
R39	510 ohm J 1/2 W	569-1503-511
R41	27 ohm K 1/2 W	569-1504-270
R42	1.0 ohm K 1/2 W	569-2503-109
R43	2.2K ohm K 1/2 W	569-1504-222
R45	470 ohm K 1/2 W	569-1504-471
R46	15 ohm K 1/2 W	569-1504-150
R47	2.7K ohm K 1/2 W	569-1504-272
R48	120 ohm K 1/2 W	569-1504-121
R49	390 ohm K 1/2 W	569-1504-391
R50	22 ohm K 1/4 W	569-1002-220
R51	120 ohm K 1/2 W	569-1504-121
R52	390 ohm K 1/2 W	569-1504-391
R53	39K ohm K 1/2 W	569-1504-393
R54	6.8K ohm K 1/2 W	569-1504-682
R55	120 ohm K 1/2 W	569-1504-121
R56	220 ohm K 1/2 W	569-1504-221
R57	120 ohm K 1/2 W	569-1504-121
R58	62 ohm J 1/2 W	569-1503-620
R59	2.2K ohm K 1/2 W	569-1504-222
R60	22 ohm K 1/4 W	569-1002-220
R61	3.3K ohm K 1/2 W	569-1504-332
R62	470 ohm K 1/2 W	569-1504-471
R63	27 ohm K 1/2 W	569-1504-270
R64	470 ohm K 1/2 W	569-1504-471
R65	120 ohm K 1/2 W	569-1504-121
R66	47 ohm K 1/2 W	569-1504-470
R67	1.2K ohm K 1/2 W	569-1504-122
R68	47K ohm K 1/2 W	569-1004-473
R70	1.0K ohm K 1/2 W	569-1504-102
R71	5.6 ohm K 2 W	569-2004-569
R72	3.3K ohm K 1/2 W	569-1004-332
R73	22 ohm K 1/2 W	569-1004-220
R82	27 ohm K 1/2 W	569-1504-270
R83	1.0K ohm K 1/2 W	569-1504-102
R84	2.2K ohm K 1/2 W	569-1504-222
R85	1.5K ohm K 1/2 W	569-1504-152
R86	2K 1/8 W ("S" Meter zero)	562-0004-202
R87	47K ohm K 1/2 W	569-1004-473
R88	3.9K ohm K 1/2 W	569-1504-392
R89	1.0M ohm K 1/2 W	569-1004-105
R91	25K 1/8 W ("S" Meter adjust)	562-0004-253
R94	1.5 ohm K 2 W	569-2004-159
R95	330K ohm K 1/2 W	569-1504-334
	THERMISTORS	
RT1	Thermistor	569-3001-001
RT2	Same as RT1	
	SWITCHES	
S1	ON/OFF, SPST (Volume Control)	562-0016-004
S2	Crystal Switch Assembly	023-3266-001
	Includes:	
	Switch indicator dial	032-0154-102
	Switch knob	547-0008-005
	Detent plate	018-1009-001
	24 position detent	583-9004-012
	Switch spacers	013-1422-001
	PC board	035-0199-001
	Switch wafer	583-2009-211
	Dial light bracket	017-1839-001
Y1	5.735 MHz HC-18/U	519-0023-104
Y2	5.725 MHz HC-18/U	519-0023-103
Y3	5.715 MHz HC-18/U	519-0023-102
Y4	5.695 MHz HC-18/U	519-0023-101
Y5	6.1904 MHz HC-18/U	519-0023-108
Y6	6.1804 MHz HC-18/U	519-0023-107
Y7	6.1704 MHz HC-18/U	519-0023-106
Y8	6.1504 MHz HC-18/U	519-0023-105
Y9	32.700 MHz 3 OT HC-18/U	519-0024-001
Y10	32.750 MHz 3 OT HC-18/U	519-0024-002
Y11	32.800 MHz 3 OT HC-18/U	519-0024-003
Y12	32.850 MHz 3 OT HC-18/U	519-0024-004
Y13	32.900 MHz 3 OT HC-18/U	519-0024-005
Y14	32.950 MHz 3 OT HC-18/U	519-0024-006
S3	SPDT stack switch	583-1002-001
S4	DPDT rocker switch	583-3004-003
S5	Same as S4	
	TRANSFORMERS	
T1	10MM 27 MHz ant. transformer	592-5015-001
T2	10MM 27 MHz mix. transformer	592-5015-002
T3	7MM 455 kHz IF transformer	592-5020-004
T4	Same as T3	
T5	Input/driver transformer	592-1007-004
T6	Out/mod transformer	592-1013-001
T7	10MM 27 MHz osc. transformer	592-5015-006
T8	10MM 27 MHz auto-transformer	592-5015-005
T9	Same as T8	
T10	Same as T8	
T11	Same as T8	
T12	25-40 MHz osc transformer	592-5014-001
T13	25-50 MHz driver transformer	592-5014-002
T14	115 AC-23 DC 1A FWB trans.	592-3001-001
	PACKAGED ELECTRONIC CIRCUITS	
U1	PEC RF amp. silicon	544-0003-011
U2	PEC 1st mixer silicon	544-0002-011
U3	PEC 1st IF 120 silicon	544-0003-043
U4	PEC 2nd IF silicon	544-0002-014
U5	PEC noise limit. germ.	544-0002-015
U6	PEC audio silicon	544-0002-026
	INTEGRATED CIRCUIT	
U7	IC MC7815CP volt. reg.	544-2003-005
	PC BOARD	
U8	PC board	035-0181-003
	FILTER	
Z1	Mech. filter 455-7	532-1004-001

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