



MOTOROLA INC.

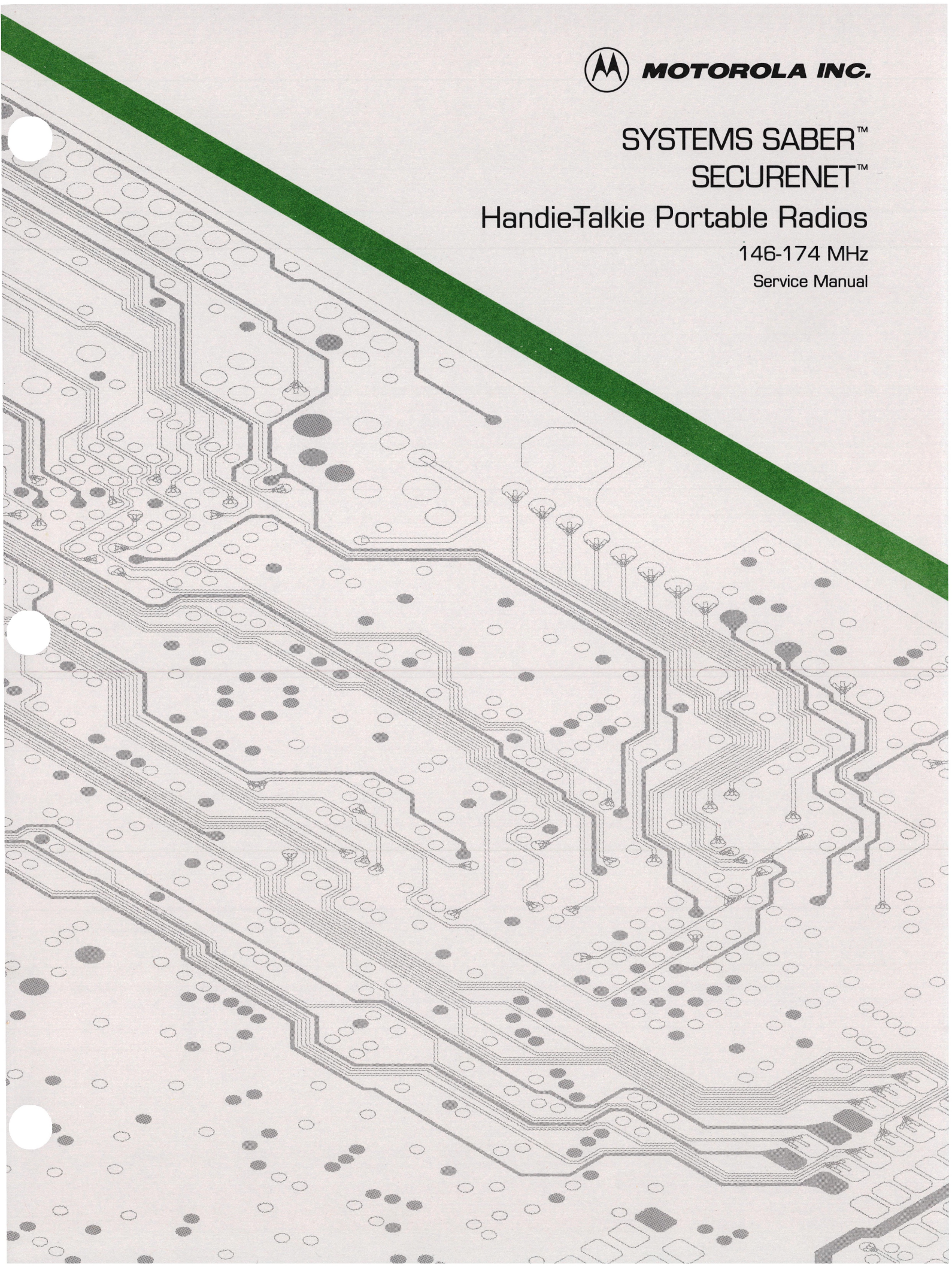
SYSTEMS SABER™

SECURENET™

Handie-Talkie Portable Radios

146-174 MHz

Service Manual



Manual Scan

I hope this service manual is of use to you. Motorola does not make this available as a PDF and all other available copies are of poor quality.

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This was captured on a Canon DR-G2140 scanner which is ~ 7500 USD unit circa 2021. You may note some artifacts and lines in on the scans, these are due to scratches on the sensor glass, and are minor. The replacement glass is about 250 USD if you're feeling generous :-)

If you have a hard to find/out of print manual and would like to make it available please reach out, I may be able to scan and return it to you.

Thank you,

Bryan Fields, W9CR
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MOTOROLA INC.

MANUAL REVISION

for
Service Manual No. 68P81067C10-0
SYSTEMS SABER™ SECURENET™
Handie-Talkie® Portable Radios (146-174 MHz)

This information outlines changes that have occurred since the printing of your manual. Use this information to supplement your manual.

REVISION DETAILS

NO.	CHANGE AFFECTS
1	Specifications
2	Specialized Tools and Test Equipment
3	Table 2. Modulation/Squelch Modes
4	Main Board Schematic Diagram

CHANGES NO.

- 1 On the front cover, **SPECIFICATIONS**, change the following as indicated:

TRANSMITTER
FREQUENCY STABILITY (-30° C TO +60°C; +25°C REF.):
change to: $\pm 0.0003\%$
RECEIVER
FREQUENCY STABILITY (-30°C TO +60°C; +25°C REF.):
change to: $\pm 0.0003\%$

AUDIO SPL (AT 30 cm WITH RATED AUDIO):
Weighted, 300-3000Hz
90 dB Nominal
87dB Nominal (-TUK models)
- 2 On page 2, **SPECIALIZED TOOLS AND TEST EQUIPMENT**, and on page 8, **TORQUE SPECIFICATIONS**, change the following as indicated:

<u>PART NO.</u>	<u>ACTION</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
6680370B90	changed to	6680371B34	Antenna Bushing Spanner Nut Rotatorq Bit

- 3 On page 10, change **Table 2. Modulation/Squelch Modes**

Mode	Audio Indication	Display Indication	Transmit Modulation Functions(s)	Receiver Squelch Function
1	1 bonk	Mode 1	Mic	RF Carrier Noise Squelch
2	2 bonks	Mode 2	Mic with PL	PL Squelched
3	3 bonks	Mode 3	Mic with DPL	DPL Squelch
4	4 bonks	Mode 4	Mic with Trunking connect Tone	PL Connect Tone 105.88 Hz
5	5 bonks	Mode 5	High-Speed Trunking Data; 900 Hz Square Wave	RF Carrier Noise Squelch
6	6 bonks	Mode 6	MDC Encode Data, 1500 Hz Tone	RF Carrier Noise Squelch

- 4 On page 15, **MAIN BOARD SCHEMATIC DIAGRAM**, show at pin 4 of U4 that intermediate frequency equals 53.55MHz

June 28, 1990



MOTOROLA INC.

MANUAL REVISION

for
Manuals No. 68P81067C10
SYSTEMS SABER™ and SABER ATS™ VHF
Portable Radios Service Manual

This revision details changes that have occurred since the printing of your manual. Use this information to supplement your manual. Installation of these changes in earlier equipment is not necessary except as recommended in Motorola Service and Repair Notes (SRN's).

REVISION DETAILS

<u>NO.</u>	<u>CHANGE AFFECTS</u>
1	SPECIFICATIONS
2	MODEL CONFIGURATION
3	CURRENT DRAIN
4	FOR USE IN HAZARDOUS ATMOSPHERES
5	Transmitter Performance Checks In Air Test Mode
6	Receiver Performance Checks In Air Test Mode
7	Alignment Setup and Specifications
8	SYSTEMS SABER VHF SECURENET Electrical Parts List TPLF-3925-O
9	SYSTEM SABER Controller Board Electrical Parts List TPLF-3926-O
10	SYSTEMS SABER I SECURENET VHF Exploded View Parts List TPLF-3923-O
11	SYSTEMS SABER III SECURENET VHF Exploded View Parts List TPLF-3924-O

CHANGES

NO.

- 1 On page 1, add the following information to the **SPECIFICATIONS** table:

TRANSMITTER		RECEIVER	
CURRENT DRAIN (with 7.5V Supply)		CURRENT DRAIN (with 7.5V Supply)	
Low Power (2.5 Watts)	1900 ma	Receive (500mW Audio)	225 mA
High Power (6 Watts)	3300 ma	Standby	95 mA
CHANNEL			
SPACING:	DEVIATION	PL DEVIATION	
25 kHz	±5 kHz	±1.0 kHz	
12.5 kHz	±2.5 kHz	±0.5 kHz	

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technical publications

Radio Products Group
8000 W. Sunrise Blvd., Ft Lauderdale, FL 33322



FMR1482-5

On page 1, change existing information in the **SPECIFICATIONS** table to read as follows:

TRANSMITTER		RECEIVER	
FREQUENCY STABILITY (-25°C to +55°C; +25°C REF.):		SENSITIVITY	<u>12.5 kHz</u> <u>25 kHz</u>
25 kHz	±.0005%	20dBS:	0.5µV 0.45µV
	(±.0002% optional)	12dBS:	0.4µV 0.35µV
		Squelch (Programmable):	0.5µV
Max.			
12.5 kHz	±.0002%		
MODULATION (±5kHz for 100% modulation @1000Hz) (±2.5kHz for 100% modulation @1000Hz [12.5kHz only])		SELECTIVITY	
	Types 20K0F3E	Adjacent Channel	25 kHz -70dB
	20K0F1D		12.5 kHz -60dB
	20K0F2D	Fourth Channel	-90dB
		FREQUENCY STABILITY (-25°C to +55°C; +25°C REF.):	
		25 kHz	
±.0002%			
		12.5 kHz	
±.0002%			
		CHANNEL SPACING:	25,
12.5kHz			

On page 1, change the existing information below the **SPECIFICATIONS** table to read as follows:

All specifications are per EIA RS316B, unless noted.
All radio parameters for 12.5kHz channel spacing models are measured per CEPT 84 methods.
Specifications are subject to change without notice.

2 On page 2, change the **MODEL CONFIGURATION** table to read as follows:

FACTORY ID	RADIO TYPE	POWER LEVEL	FREQUENCY	SUB-	MERSIBLE	KEYPAD	DISPLAY
H33TUN5170CN	SYS. SABER I	2.5W	146-174MHz	No	No	No	No
H43TUN5170CN	SYS. SABER I	6W	136-174MHz	No	No	No	No
H43TUN5570CN	SYS. SABER I	6W	146-174MHz	No	No	No	Yes
H33YUN5170CN	SYS. SABER I	2.5W	146-174MHz	Yes	No	No	No
H43YUN5170CN	SYS. SABER I	6W	136-174MHz	Yes	No	No	No
H43YUN5570CN	SYS. SABER I	6W	146-174MHz	Yes	No	No	Yes
H33TUK5170CN	SYS. SABER III	2.5W	146-174MHz	No	3x5	Yes	No
H43TUK5170CN	SYS. SABER III	6W	136-174MHz	No	3x5	Yes	No
H43TUK5570CN	SYS. SABER III	6W	146-174MHz	No	3x5	Yes	Yes
H43TUB5170CN	SABER ATS	6W	136-174MHz	No	No	No	No
H43YUB5170CN	SABER ATS	6W	136-174MHz	Yes	No	No	No
H43TUB5570CN	SABER ATS	6W	146-174MHz	No	No	No	Yes
H43YUB5570CN	SABER ATS	6W	146-174MHz	Yes	No	No	Yes

3 On page 3, delete the **CURRENT DRAINS** chart and related note.

- 4 On page 3, add the following:

FOR USE IN HAZARDOUS ATMOSPHERES

Factory Mutual Non-Incendive and Intrinsically Safe Approved Models

The SYSTEMS SABER I and III, and SABER ATS portable radios must be properly equipped with a Factory Mutual (FM) Corporation approved battery to be considered "intrinsically safe."

The FM options for the radio provide a label which lists the Class/Division/Group, verifies the radio as being FM approved, and states the type of battery to be used with the radio.

The intrinsically safe rating by Factory Mutual states that electrical equipment is incapable of releasing sufficient electrical or thermal energy, under normal or abnormal operating conditions, to cause ignition of specific hazardous atmospheres designated on the radio label.

WARNING

Substitution of components may impair the intrinsic safety of the radio.

Note

Radios must be shipped from the Motorola factory equipped with the hazardous atmosphere option; they *cannot* be modified in the field.

Failure to use the radio with an approved battery will negate the FM approval. Factory Mutual approved radios can be used in those applications requiring reliable, two-way hand-held radios in the listed specific hazardous atmospheres. Motorola approved equipment and accessories are listed in the approval guide published yearly by Factory Mutual Corporation.

- 5 On page 11, change existing information in **Table 3. Transmitter Performance Checks in Air Test Mode** to read as follows:

Test Name	Instructions	Specifications
Tx Modulator Limiting		5 kHz maximum deviation (25 kHz channel spacing) 2.5 kHz maximum deviation (12.5 kHz channel spacing)
Tx Modulator Sensitivity	Apply 1 kHz tone (25 kHz channel spacing) or 1.5 kHz tone (12.5 kHz channel spacing). Adjust audio input level for 3.0 kHz deviation.	
Tx PL Deviation		0.5-1.0 kHz deviation (25 kHz channel spacing) 0.2-0.5 kHz deviation (12.5 kHz channel spacing)
Tx Modulator Limiting with PL and Voice		5 kHz maximum deviation (25 kHz channel spacing) 2.5 kHz maximum deviation (12.5 kHz channel spacing)
Tx Connect Tone Deviation		0.8-1.2 kHz deviation (25 kHz channel spacing) 0.4-0.6 kHz deviation (12.5 kHz channel spacing)
Tx Modulator Limiting with DPL and Voice		5 kHz maximum deviation (25 kHz channel spacing) 2.5 kHz maximum deviation (12.5 kHz channel spacing)
Tx DPL Deviation		0.5-1.0 kHz deviation (25 kHz channel spacing) 0.2-0.5 kHz deviation (12.5 kHz channel spacing)
Tx Modulator Limiting with DPL and Voice		5 kHz maximum deviation (25 kHz channel spacing) 2.5 kHz maximum deviation (12.5 kHz channel spacing)
Tx High Speed Data Deviation		2.4-3.6 kHz deviation (25 kHz channel spacing) 1.2-1.8 kHz deviation (12.5 kHz channel spacing)

- 6 On page 12, change existing information in **Table 4. Receiver Performance Checks in Air Test Mode** to read as follows:

Test Name	Specifications
Rx Sensitivity	0.35µV maximum (-116dBm)(25 kHz channel spacing) 0.5µV maximum (-113dBm)(12.5 kHz channel spacing)

- 7 On page 13, change existing information in **Table 5. Alignment Setup and Specifications** to read as follows:

Test Name	Tune Target	Test Limits
Deviation Limit		3.9-4.8 kHz (25 kHz channel spacing) 2.0-2.4 kHz (12.5 kHz channel spacing)
Signalling Deviations Channel	<div>25 kHz Channel</div> <div>12.5 kHz Channel</div> <div>Spacing</div>	<div>25 kHz Channel</div> <div>12.5 kHz</div> <div>Spacing</div> <div>Spacing</div>
DTMF with Connect Tone:	4.0 kHz Nominal	2.0 kHz Nominal
DTMF Only:	3.0 kHz Nominal	1.5 kHz Nominal
DTMF with PL:	3.75 kHz Nominal	1.8 kHz Nominal
ISW Only:	3.0 kHz Nominal	1.5 kHz Nominal
DVP Only:	4.0 kHz Nominal	Not Applicable
		3.3-4.7 kHz
		1.8-2.2 kHz
		2.5-3.5 kHz
		1.2-1.8 kHz
		3.0-4.5 kHz
		1.5-2.3 kHz
		2.4-3.6 kHz
		1.2-1.8 kHz
		3.5-4.5 kHz
		Not Applicable

- 8 On page 16, **SYSTEMS SABER VHF SECURENET Electrical Parts List**, change the following.

REF. SYM.	MOTOROLA PART No.	ACTION	MOTOROLA PART No.	DESCRIPTION
C66		add	2113471A17	680pF (See Note 2)
C583	2113740B49	changed to	2113740A55	100pF ± 30%
P5	3905446Q03	change to	REX-4166A	Contact, Antenna
E202		add	2484657R01	Ferrite Bead
FL2	9105685Q05	changed to	9105685Q05	Ceramic; 450kHz; 20kHz BW (25kHz channel spacing only)
			or 9105685Q06	Ceramic; 450kHz; 15kHz BW (12.5kHz channel spacing only)
R401	0660076N65	changed to	0660076A65	4.7k
U4	NLD8180A	changed to	NLD8180A	Receiver Front End (136-174MHz)(25kHz channel spacing only)
			or NLD8220A	Receiver Front End (148-174MHz)(12.5kHz channel spacing only)
		add		

NOTE 2: 12.5kHz channel spacing models only

- 9 On page 16, **SYSTEMS SABER Controller Board Electrical Parts List**, change the following.

REF. SYM.	MOTOROLA PART No.	ACTION	MOTOROLA PART No.	DESCRIPTION
U503	5105226P39	changed to	0105951R14	RAM; 8K X8
U505	5195007D01	changed to	5195007D05	EPROM; 128k x 8
	6105534T01	changed to	6105520U01	LIGHTPIPE

- 10 On page 18, **SYSTEMS SABER I SECURENET VHF Exploded View Parts List**, change the following.

December 05, 1991

ing.

<u>ITEM NO.</u>	<u>MOTOROLA PART No.</u>	<u>ACTION</u>	<u>MOTOROLA PART No.</u>	<u>DESCRIPTION</u>
25		add	or NLD8880A	for option H879AD
33	NTN4595B	changed to	NTN4595C	BATTERY, 1500mAh
60	0105953R65	changed to	0105950S84	ASSEMBLY, Controller PC Board (SYSTEMS SABER I)

11 On page 18, **SYSTEMS SABER III SECURENET VHF Exploded View Parts List**, change the following.

<u>ITEM NO.</u>	<u>MOTOROLA PART No.</u>	<u>ACTION</u>	<u>MOTOROLA PART No.</u>	<u>DESCRIPTION</u>
17	NAE6432A	changed to	NAD6471A	ANTENNA, VHF Helical (136-150.8 MHz)
	NAE6440A	changed to	or NAD6472A	ANTENNA, VHF Helical (146-162 MHz)
		add	or NAD6473A	ANTENNA, VHF Helical (157-174 MHz)
25	NLE9911A	changed to	NLD8880A	ASSEMBLY, VHF Main PC Board (25kHz Channel Spacing)
			or NLD8891A	ASSEMBLY, VHF Main PC Board (12.5kHz Channel Spacing)
33	NTN4595B	changed to	NTN4595C	BATTERY, 1500 mAh
49	0105953R66	changed to	0105950S85	ASSEMBLY, Controller PC Board (SYSTEMS SABER III)(Includes Item 48)



SYSTEMS SABER™
SECURENET™
Handie-Talkie® Portable Radio
146 - 174 MHz

SPECIFICATIONS

GENERAL	TRANSMITTER	RECEIVER
FREQUENCY RANGE: 146-174MHz BANDSPLITS: 136-150.8MHz 146-162MHz 146-174MHz (Low-Power Only) 148-174MHz (H366 Option) 157-174MHz POWER SUPPLY: Rechargeable Nickel-Cadmium Battery or Primary Battery BATTERY VOLTAGE: Nominal: 7.5Vdc Range: 6 to 9Vdc TEMPERATURE RANGE Operating: -30°C to +60°C Storage: -40°C to +85°C DIMENSIONS (HXWXD) Less Battery: 4.42"x2.94"x1.18" (112.27x74.67x29.97 mm) With Medium-Capacity Battery: 7.56"x2.94"x1.18" (192.02x74.67x29.97 mm) With Ultra-High-Capacity Battery: 8.32"x2.94"x1.18" (211.33x74.67x29.97 mm) WEIGHT Non-Keypad Less Battery: 12.22 oz. (347 g) With Medium-Capacity Battery: 23.87 oz. (678 g) With Ultra-High-Capacity Battery: 25.49 oz. (724 g) Keypad Less Battery: 12.57 oz. (357 g) With Medium-Capacity Battery: 24.23 oz. (688 g) With Ultra-High-Capacity Battery: 25.85 oz. (734 g)	RF POWER OUTPUT Low-Power Models: 1 - 2.5 Watts High-Power Models: 2.5 - 6 Watts High-Power Models with H366 Option: 2 - 5 Watts FREQUENCY STABILITY (-30°C to +60°C; +25°C REF): ±.0002% MODULATION: Types 20K0F3E (±5kHz for 100% 20K0F1D modulation @ 1000Hz) 20K0F2D FM HUM AND NOISE (COMPANION RECEIVER): -45dB SPURIOUS EMISSION (CONDUCTED AND RADIATED) 2.5W: -71dBc 6.0W: -75dBc AUDIO DISTORTION: 3% Maximum AUDIO FREQUENCY RESPONSE: +1, -3dB (6dB/OCTAVE PRE-EMPHASIS; 300-3000Hz) MAXIMUM FREQUENCY SEPARATION: Full Bandsplit (NO DEGRADATION)	SENSITIVITY 20dBQ: 0.45uV Max. 12dBS: 0.35uV Max. Squelch (Programmable): 0.30uV Max. USEABLE BANDWIDTH: 5kHz Minimum SELECTIVITY: Adjacent channel: -80dB Fourth channel: -90dB INTERMODULATION: -78dB FM HUM AND NOISE: -45dB FREQUENCY STABILITY (-30°C to +60°C; +25°C REF): ±.0002% AUDIO SPL (AT 30 cm WITH RATED AUDIO): Weighted, 300-3000Hz 90dB Nominal RATED AUDIO OUTPUT: 500mW (At less than 5% distortion) CHANNEL SPACING: 30kHz MAXIMUM FREQUENCY SEPARATION: Full Bandsplit (NO DEGRADATION)
SECURENET		
SCRAMBLE TYPE: Digital ENCRYPTION METHOD: Multi-Register, Non-Linear Combiner ENCRYPTION KEY INITIALIZATION: Random ENCRYPTION KEY GENERATION: External, Hand-Held Microprocessor-Controlled Key loader Volatile Electronic Memory KEY STORAGE: One NUMBER OF KEYS PER RADIO: Continuously-Variable Slope Delta ANALOG-TO-DIGITAL CONVERSION: (CVSD) Modulation VOICE SAMPLE RATE: 12 Kilobits/Second		

All specifications are per EIA RS316B, unless noted
Specifications are subject to change without notice

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MODEL CONFIGURATION

FACTORY ID	POWER LEVEL	FREQ.	SUBMERSIBLE	KEYPAD	DISPLAY
H33TUN5170CN	2.5W	146-174MHz	NO	None	None
H43TUN5170CN	6W	136-174MHz	NO	None	None
H33YUN5170CN	2.5W	146-174MHz	YES	None	None
H43YUN5170CN	6W	136-174MHz	YES	None	None
H33TUK5170CN	2.5W	146-174MHz	NO	3x5	LCD
H43TUK5170CN	6W	136-174MHz	NO	3x5	LCD

SPECIALIZED TOOLS AND TEST EQUIPMENT

SERVICE AIDS

NTN4720A	SECURENET Bypass Module
REN-4001A	Housing Eliminator (Allows key loading through the cable)
RPX-4665A	Field Modification Kit/RTX-4005A
RSX-4043A	Rotatorq Tool
RTK-4203A	Program/Test Cable
RTK-4208A	RF Coaxial Probe
RTL-4224A	Battery Eliminator
RTL-4238A	RF Cable
RTX-4005B	Portable Products Test Set
TKN8506A	Keyload Cable (Hand-held key loader to radio)
0180370B85 thru B86	Ungar Table Fixtures
0180386A81	Micro-Tip Soldering Iron
0180386A82	Static Protection Kit
5880348B33	SMA-BNC Adapter for RTL-4208A Probe
6680321B79	Phillips-Head Rotatorq Bit
6680334B48 thru B52	Ungar Service Heads
6680370B88	Frequency and On/Off Switch Spanner Nut Rotatorq Bit
6680370B89	Baseplate Spanner Nut Rotatorq Bit
6680370B90	Antenna Bushing Spanner Nut Rotatorq Bit
6680385A11	Module Extractor
6680387A59	Leadless Component Extractor
6680387A64	Heat Controller With Safety Stand
8407264N02	SYSTEMS SABER Controller Extender Cable (10-pin)

TEST EQUIPMENT

R-1053A	Dual-Trace Oscilloscope
R-2045D	Communications Systems Analyzer with Secure Voice Option
S-1339A	RF Millivoltmeter
S-1347D	Power Supply
RTK-4237A	Battery Tester
RTL-4223A	Charger Tester

FIELD PROGRAMMING EQUIPMENT

RVN-4051A	SYSTEMS SABER Field Programmer Software on 5 1/4-inch 360k Double-Density Disk
RVN-4052A	SYSTEMS SABER Field Programmer Software on 3 1/2-inch Disk
0180353A74	Radio Interface Box (RIB)
0180357A57	RIB Wall-Mounted Power Supply
3080369B71	Computer Interface Cable (PC-AT), 25-pin
3080369B72	Computer Interface Cable (PC-XT), 9-pin
68P81060C25	SYSTEMS SABER Field Programmer User's Guide

CURRENT DRAINS (SEE NOTE)

	SYSTEMS SABER I	SYSTEMS SABER III
STANDBY	85	88
RECEIVE	215	218
H33 MODELS: 2.5-WATT	1500	1500
H43 MODELS: 6-WATT	3100	3100

NOTE: Drain specifications are in milliamperes at 7.5Vdc. These *typical* current drains apply to test mode, with the radio operating through the external antenna port. Current drains decrease in normal operation due to antenna switch drains and antenna loading.

CLEANING

- Clean all external radio surfaces with a 0.5% solution of a mild dishwashing detergent in water (one teaspoon of detergent per gallon of water).
- Stronger cleaning agents may only be used to remove soldering flux from circuit boards after making repairs.
- Clean internal surfaces with water-activated optical wipes.

CAUTION

Never allow any alcohol- or solvent-based product to contact any plastic or rubber radio part.

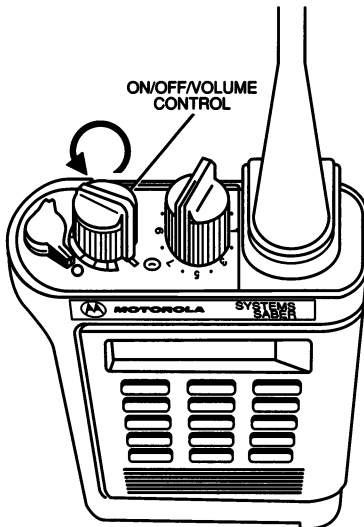
RELATED PUBLICATIONS AVAILABLE SEPARATELY

SYSTEMS SABER I/III SECURENET OPERATING INSTRUCTIONS.....	68P81060C10
SYSTEMS SABER SECURENET THEORY/ MAINTENANCE MANUAL.....	68P81060C20
SYSTEMS SABER FIELD PROGRAMMER USER'S GUIDE.....	68P81060C25
SYSTEMS SABER SECURENET SERVICE MANUAL (UHF)	68P81066C95

DISASSEMBLY/REASSEMBLY PROCEDURES

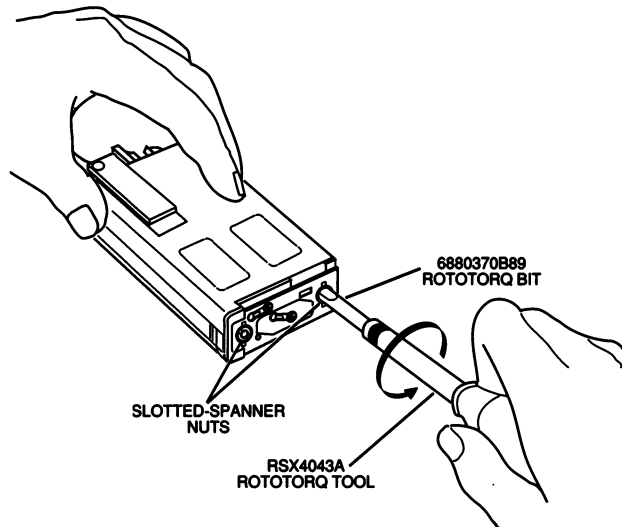
1. DISASSEMBLY

- a. **Turn off the radio** by rotating the on/off/volume control knob fully counterclockwise until you hear a click. Remove the universal connector cover or any accessory connected to the radio before beginning disassembly.



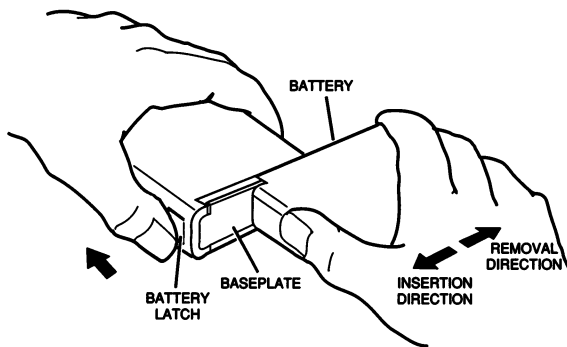
MAEPF-20609-O

- c. **Loosen the two slotted-spanner nuts** on the bottom of the radio using Rotatorq tool bit No. 6680370B89. When loosened, the slotted-spanner nuts are captive and will spin freely without separating from the baseplate.



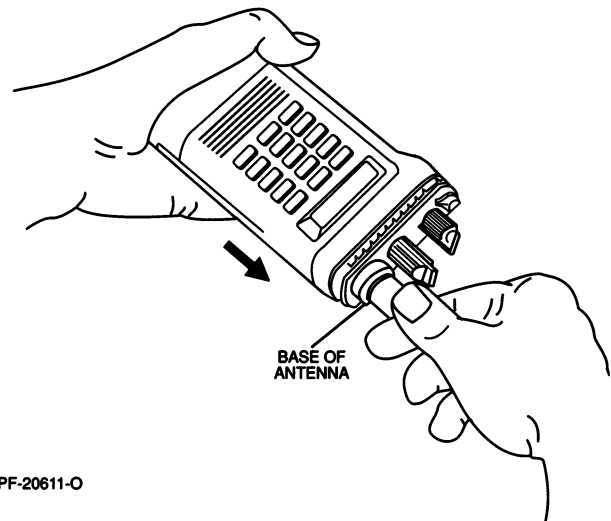
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- b. **Remove the battery** from the baseplate on the bottom of the radio housing by pushing the spring-loaded battery latch toward the top of the radio, and sliding the battery away from the latch until it clears the baseplate.



MAEPF-20185-O

- d. **Remove the frame assembly** from the radio housing by grasping the antenna at its base and pulling it gently upward. *Do not depress the PTT switch during removal and do not push on the slotted-spanner nuts to lift the frame assembly.*

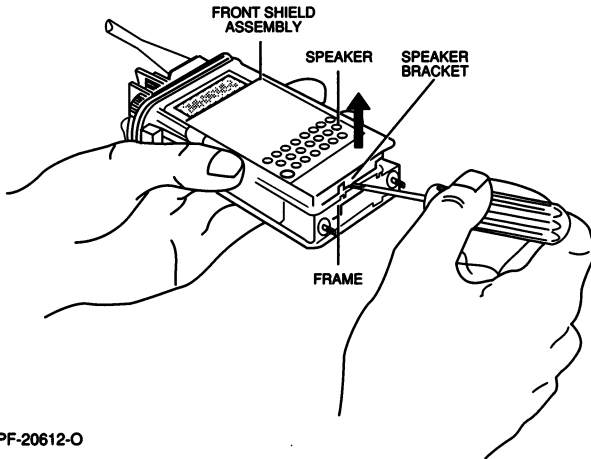


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CAUTION

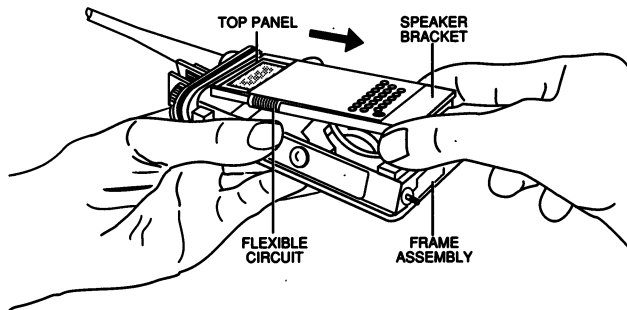
Ensure that all static electricity safeguards are in place.

- e. With the speaker facing upward, **remove the speaker bracket assembly** by inserting a thin screwdriver blade between the frame and the bottom of the speaker bracket, and prying gently upward on the speaker bracket until it is disengaged from the frame.



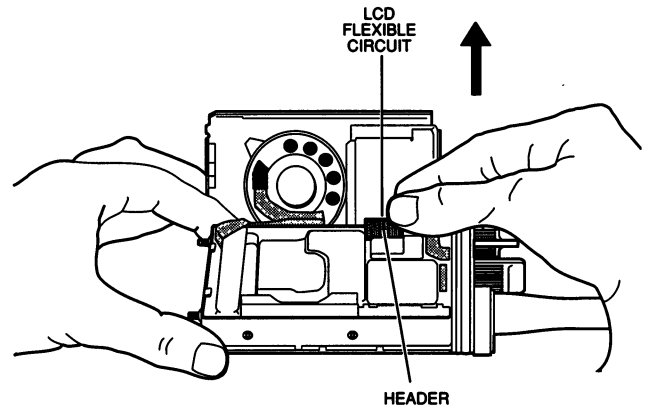
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- f. **Lift the speaker bracket assembly** away from the bottom of the frame assembly, then pull it out from under the plastic top panel. Be careful not to pull against the flexible circuits connecting the speaker bracket to the frame assembly.



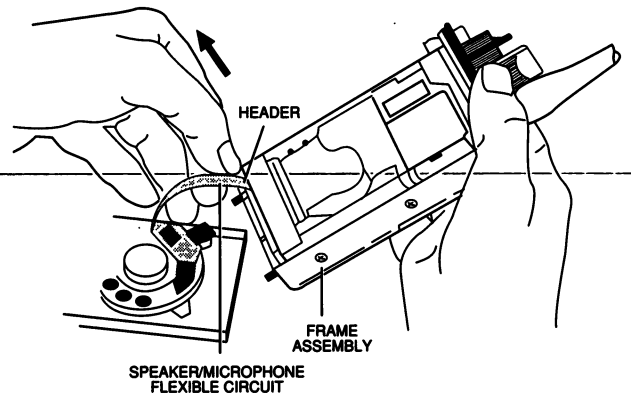
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- g. **Disconnect the interconnect flexible circuit** from the frame assembly by pulling the header straight out and away from the main printed circuit board.



MAEPF-20959-O

- h. **Disconnect the speaker/microphone flexible circuit** from the frame assembly by pulling the connector straight out and away from the main printed circuit board.



MAEPF-20615-A

CAUTION

Refer to "SERVICING MAJOR SUBASSEMBLIES" (Section 2) and the appropriate exploded view diagrams at the back of this manual before attempting further disassembly or repair.

2. SERVICING MAJOR SUBASSEMBLIES

a. Baseplate

- All repairs to the baseplate assembly can, and should, be made with the radio chassis inside the radio.
- After the slotted-spanner nuts are loosened, the baseplate is held in place by the power contact screw.
- The retainers holding the slotted-spanner nuts in place are not reusable. Replacement of the retainers requires special insertion procedures; refer to the instruction sheet provided with the slotted-spanner nut kit.
- The "o-ring" portion of the elastomer seal must be fully seated on the threaded bushing before the baseplate is reassembled (the bushing is part of the housing assembly).

b. Housing Assembly

- The housing assembly includes many parts that are not replaceable or repairable.
- The insulator on the universal connector can, and should, be replaced if the old insulator has been torn. When replacing the insulator take care to keep it out of the main seal o-ring's seating area.
- The PTT lever can be replaced by prying out the old part with a soft plastic tool. The plastic housing around the lever may be damaged if a harder tool is used.

c. Control Top Panel

- The control top panel is fastened to the frame by the on/off/volume and frequency switches, and two self-tapping screws; it should be removed from the frame only if absolutely necessary. If repair is required, always start the screws into the control top panel by hand before tightening them with a torque wrench; this will help avoid cross-threading and stripping of the plastic panel.
- The on/off/volume and frequency knobs are 2-part kits; each kit consists of a knob and an insert. Once an insert is removed, it cannot be used again; therefore, remove an insert only if the on/off/volume control or frequency switch must be replaced, or if the control top must be removed from the frame.

d. LCD/Speaker Bracket Assembly

The SYSTEMS SABER radio's LCD assembly and/or controller board can be replaced, but the comments and cautions in this manual must be strictly followed.

(1) Removing the LCD Assembly and Controller Board:

- (a) Carefully unplug the interconnect and speaker/microphone flexible circuits from the radio.
- (b) (SYSTEMS SABER III only) After ensuring that all static safeguards are in effect, turn the LCD/speaker bracket assembly over (display facing up), insert a thin plastic blade (such as a tuning wand) between the top edge of the keypad membrane switch and the LCD bezel, and break the adhesive bond between the bezel and the membrane switch.
- (c) Turn the assembly over (front shield facing down) and, using a thin-bladed screwdriver, gently pry the controller board away from the two speaker bracket tabs (the tabs next to the speaker).
- (d) Place your middle finger on the top center tab and your thumb on the bottom left tab of the controller board, and gently pry the shield/controller board assembly away from the front shield.
- (e) Gently lift the shield/controller board assembly away from the front shield, rotating it around the front shield until the keypad flexible circuit lies flat and the display is facing upward.
- (f) Insert a thin-bladed screwdriver between the plug on the keypad flexible circuit and the controller board, and gently pry upward on the plug until it is free from the board.
- (g) With the controller board facing upward, locate the retaining tab on the top edge of the controller board and deflect the shield near the tab while lifting the board up and away from the shield. The circuit board and interconnect flexible circuit can then be pulled forward and out.
- (g) Unplug the interconnect flexible circuit from the controller board.

(2) Replacing the LCD Assembly (SYSTEMS SABER III Only):

- (a) With the display facing downward, locate and carefully straighten the six bent-over metal tabs holding the LCD assembly to the controller board, then separate the LCD assembly from the board.
- (b) Inspect the two rows of LCD contacts on the controller board for damage and/or foreign material, and clean if necessary.
- (c) Using finger cots, inspect the new LCD assembly for fingerprints or other foreign material. Clean, if necessary, only with water-activated optical wipes.
- (d) After first making sure that the lens shipping protection has been removed, insert the new LCD assembly so that the viewing side of the display shows through the window in the bezel, and the seal on the display fits into the corresponding recess in the bezel.
- (e) Insert the LCD lightpipe into the bezel with the clear side facing the back of the display.
- (f) Position the elastomers along the top and bottom edges of the LCD lightpipe so that the conductive black dots on the elastomers connect the LCD to the contacts on the controller board.
- (g) Place the controller board over the metal tabs on the LCD bezel and, while applying firm, even pressure to fully seat the LCD assembly into the controller board, bend all the tabs inward.

e. Backshield Assembly

- Before removing the backshield, ensure that all static electricity safeguards are in place.
- For best results, loosen/tighten all four screws lightly before loosening/tightening any single screw completely.
- The backshield screws are held captive in the shield after being loosened.

f. Circuit Boards and Modules

- All modules plug into sockets on the main circuit board.

- Some modules are fastened to the main board and frame with screws; remove these screws before attempting to unplug a module. **Never** substitute any screw.
- Several of the modules are designed to be removed with a standard DIP extractor tool (OK-1 or equivalent). Always use the extractor tool when removing these modules to avoid damaging their leads.
- Some modules have guide pins to assist in insertion or removal. Pressure may be applied to these guide pins to aid removal of a module if, and only if, it is distributed evenly over all guide pins on the module. *Applying all the force to a single guide pin will cause severe damage to the module.*
- The secure module (U900) is not serviceable.
- Before reinserting any module, always check its leads for damage. Gently straighten any leads that may be bent; replace any modules with severely damaged leads.
- Before reinserting reference oscillator module U301 into the main circuit board, be certain that its squared (pin 1) corner is correctly oriented per the main circuit board component layout diagram.
- When electrically testing and/or probing the main circuit board with the back shield removed, always use the three finger screws on the SYSTEMS SABER housing eliminator service aid to provide grounding to VCO synthesizer module U300 (two places), and the rf ground clip (one place).
- When removing the main circuit board from the frame assembly, do the following:
 1. Remove the back shield assembly.
 2. Unplug the PTT/controls flexible circuit.
 3. Remove the two power amplifier module (U202) screws from the frame.
 4. Remove secure module U900.
 5. Remove the two main compression connector screws.
 6. Lift the board at the bottom and pull out from under the control top panel.
- The rf and ground contacts at the top of the main circuit board are exposed when the board is removed from the frame. Special care must be taken to avoid accidental damage to these contacts.

g. Frame Assembly

- The tapped tabs on the frame can be stripped if excessive screw tightening torques are used (see Torque Specifications table). The frame is not repairable.
- If you must lift or remove the PTT/controls flex circuit for any reason, do not readhere it to the frame; the flex must be replaced.

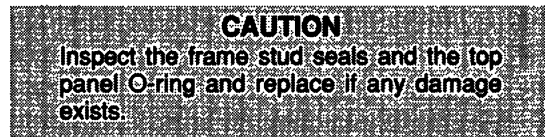
h. Dual-Function Switch (S801) and Actuator Assembly

- Before removing the switch, remove the knob by gently separating the two arms of the switch bracket (located between the switch and the main O-ring seal) and pulling upward on the knob.
- Before reinserting the knob, ensure that the slot in the switch is properly aligned with the blade on the knob's shaft.
- When the knob is properly inserted, the arms of the switch bracket will snap into position (approximately 0.2 inches apart), the knob will not be loose in the switch bracket, and the bracket will hold the switch firmly against the inside of the top control panel. If this is not the case, replace the switch bracket.

3. REASSEMBLY

Reassemble the radio in the reverse order of disassembly, referring to "SERVICING MAJOR SUB-ASSEMBLIES" (Section 2) and making certain:

- that the speaker/microphone connector and the LCD interconnect header are correctly aligned to the main circuit board so that no twisting or pinching of the flexible circuit occurs when the speaker bracket is reattached to the frame assembly.
- that all pads are correctly aligned.
- that the two extended tabs at the top of the speaker bracket are properly inserted into the slots between the frame and the control top panel.
- to tighten all hardware loosened or removed during disassembly per the torque specifications listed in the Torque Specifications table. Use recommended torque driver (Motorola RSX4043A Rotatorq Tool or equivalent).
- that there is no foreign material on the main O-ring or stud seals.



- to properly orient the completed frame assembly before inserting it into the radio housing.
- *that the PTT switch and monitor button are not depressed while the frame is being inserted into the housing.*

TORQUE SPECIFICATIONS

APPLICATION	TORQUE (IN. LBS.)	TORQUE (N·m)	TORQUE BIT NO.
Antenna Bushing Spanner Nut	20	2.27	6680370B90
Back Shield to Frame Screws	2.5	0.28	6680321B79
Bottom Connector to Frame Screws	2.5	0.28	6680321B79
Frequency Switch Spanner Nut	8	0.91	6680370B88
All Module Screws	2.5	0.28	6680321B79
Power Contact Screws	2.5 ⁺	0.28	6680321B79
Slotted-Spanner Nut (Baseplate)	6	0.68	6680370B89
Top Panel to Frame Screws	2	0.23	6680321B79
Volume Pot Spanner Nut	8	0.91	6680370B88

PERFORMANCE TESTS

1. TEST MODE

When the SYSTEMS SABER radio is operating in a trunking environment, it operates with a specific identity within an assigned system. Given commands from that system, the radio's internal microcomputer controls such functions as rf channel selection, transmitter key-up, and receiver muting.

However, when the unit is on the bench for testing, it is removed from this trunking environment. It cannot receive commands from its system and, therefore, the internal microcomputer will not key the transmitter or unmute the receiver. This prevents testing the radio in the normal manner unless it has been programmed on one or more conventional (non-trunked) channels. On one of these channels the unit may be tested in the normal mode allowed by the channel's programmed modes; for example, tone Private-Line® (TPL), Digital Private-Line™ (DPL), etc.

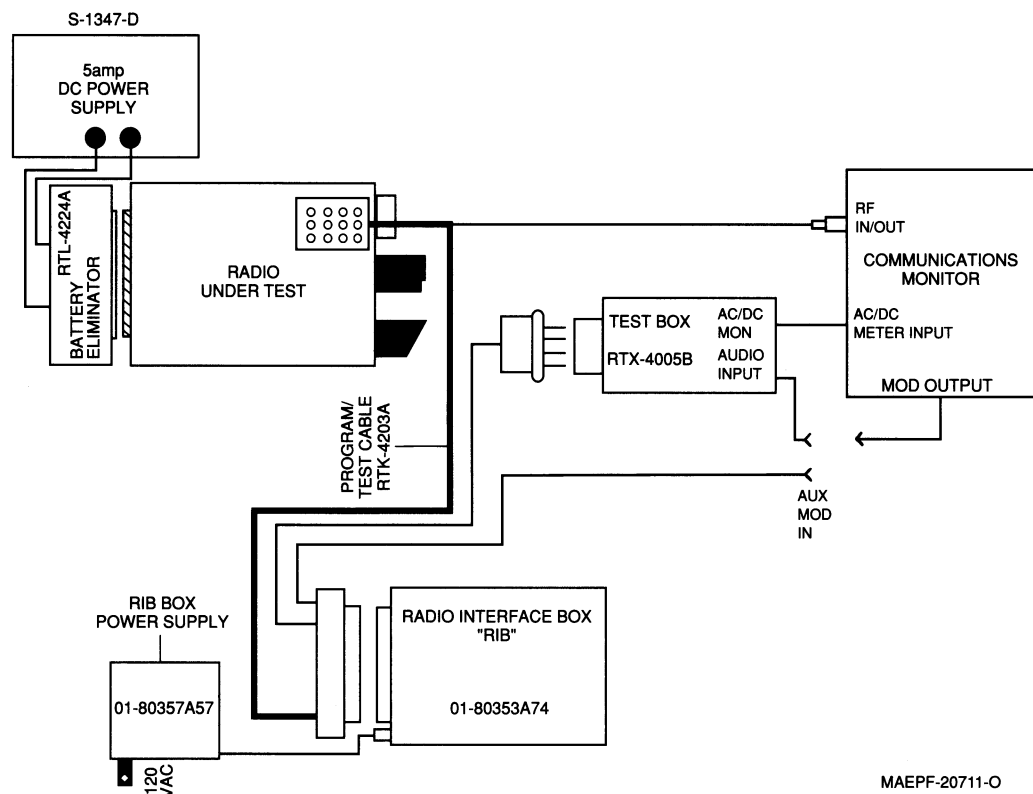
To allow for testing the radio in a more generic fashion, special test routines that allow manual control of the various modes of the unit have been provided for in the test mode called Air Test, which allows one to test various parameters without having to disassemble the radio. If adjustments are needed, the use of the field programmer, described in the SYSTEMS SABER Radio Service Software User's Guide, will be required.

To enter the Air Test mode, connect the equipment as shown in Figure 1, then do the following:

- Turn the radio off.
- Apply 7.5 volts to the radio battery contacts.
- Connect the radio to the RTX4005B portable test set via the test cable.
- Place the transmit mode switch on the test set in the **CONT** (transmit) position.
- Press and hold down the monitor button on the side of the radio.
- Turn the radio on and continue to hold down the monitor button for two seconds.
- Turn the transmit mode switch on the test set to the **OFF** position.

NOTE

- The unit will not transmit until the transmit mode switch has been turned off and then back to one of the transit positions.
- Do not change modes or channels during Air Test while in the transmit mode.
- To exit Air Test turn the radio off.



MAEPF-20711-O

Figure 1. Air Test Setup

Air Test allows the testing of any combination of ten frequency pairs, two transmitter power levels, six modulation modes, and three receiver squelch modes. Selection of a frequency pair is done by rotating the rotary selector switch on top of the radio. See Table 1 for a listing of the Air Test transmit and receiver frequencies, and transmitter power output levels associated with the rotary selector switch.

To change modulation/squelch modes, press one of the "side button" switches on the side of the radio: pressing the button closest to the *front* of the radio (SB1) will *increment* the mode; pressing the button closest to the *back* of the radio (SB2) will *decrement* the mode. See Table 2 for a listing on the various modulation/squelch modes.

As the modulation/squelch mode is changed, a one- to six-"bonk" audio tone will be heard, and the display will indicate the mode by displaying the squelch mode number from one to six.

Table 1. Air Test

Rotary Selector Switch Position	136-150.8 Model Freqs. (MHz)		146-162 Model Freqs. (MHz)		146-174 Model Freqs. (MHz)		148-174 Model Freqs. (MHz)		157-174 Model Freqs. (MHz)	
	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
1	136.05	143.55	146.05	152.25	146.05	160.25	148.05	160.25	157.05	163.25
2	139.05	136.25	149.05	146.25	149.05	146.25	149.05	146.25	160.05	157.25
3	142.05	150.75	152.05	161.85	152.05	173.85	152.05	173.85	163.05	173.85
4	145.05	145.05	155.15	155.15	155.15	155.15	155.15	155.15	166.15	166.15
5	148.05	148.05	158.05	158.05	158.05	158.05	158.05	158.05	169.05	169.05
6	150.75	150.75	161.95	161.85	161.05	173.85	161.05	173.85	171.05	173.85
7	150.75	150.75	161.95	161.85	164.05	173.85	164.05	173.85	173.95	173.85
8	150.75	150.75	161.95	161.85	168.05	173.85	168.05	173.85	173.95	173.85
9	150.75	150.75	161.95	161.85	171.05	173.85	171.05	173.85	173.95	173.85
10 thru 16	150.75	150.75	161.95	161.85	173.95	173.85	173.95	173.85	173.95	173.85

Note: The actual frequencies of the transmitter or receiver, and power-out setting of your unit may vary from the above table. If in doubt, please contact Motorola Portable Products Services at (305) 475-6170 during business hours EST.

Table 2. Modulation/Squelch Modes

Mode	Audio Indication	Display Indication	Transmit Modulation Functions(s)	Receiver Squelch Function
1	1 bonk	Mode 1	Mic	RF Carrier Noise Squelch
2	2 bonks	Mode 2	Mic with PL	PL Squelched
3	3 bonks	Mode 3	Mic with Trunking Connect Tone	RF Carrier Squelch
4	4 bonks	Mode 4	Mic with DPL	DPL Squelch
5	5 bonks	Mode 5	High-Speed Trunking Data; 900 Hz Square Wave	RF Carrier Noise Squelch
6	6 bonks	Mode 6	MDC Encode Data, 1500 Hz Tone	RF Carrier Noise Squelch

PL frequency = 192.8 Hz; DPL code = 131 non inverted; Connect tone = 105.88 Hz

2. PERFORMANCE CHECKS IN AIR TEST MODE

Tables 3 and 4 outline a series of performance checks that can be done without any disassembly of the radio. If there is an indication of a malfunction, these checks should be the first step in the fault isolation process. The FCC requires that the frequency and deviation of the transmitting device be checked before the device is placed in service and once annually thereafter.

When making measurements using field test equipment, allow for $\pm 10\%$ measurement error. The SYSTEMS SABER radio is factory tuned using equipment of greater accuracy.

Table 3. Transmitter Performance Checks in Air Test Mode

Transmitter Test:

All tests below are done with the test box PTT switch on; however, the switch *must be turned off when changing modes or channels*. All of the following tests can be performed on any frequency/channel. Set power supply to 7.5V at the radio battery terminals.

Set test box **METER SELECTOR** switch to the **MIC** position. Connect ac voltmeter to **AC/DC MONITOR** jack on test box. Connect audio generator output to audio input on test box.

Test Name	Mode	Instructions	Specifications
Tx Power	1	Connect remote antenna port to power meter.	6W or 2.5W
Tx Current	1	Connect remote antenna port to 50 ohm load.	3.3 or 2.1 Amps
Tx Frequency Error	1	Measure Tx frequency at remote port.	$\pm 500\text{Hz}$ maximum
Tx Modulator Limiting	1	Audio input level = 80 mV rms; 1 kHz tone.	5 kHz maximum deviation
Tx Modulator Sensitivity	1	Apply 1 kHz tone. Adjust audio input level for 3.0 kHz deviation.	2-15 mV rms
Tx PL Deviation	2	Connect remote antenna port to deviation meter. Remove audio input.	0.5-1.0 kHz deviation
Tx Modulator Limiting with PL and Voice	2	Audio input level = 80 mV rms; 1 kHz tone.	5 kHz maximum deviation
Tx Connect Tone Deviation	3	Connect remote antenna port to deviation meter. Remove audio input.	0.8-1.2 kHz deviation
Tx Modulator Limiting with DPL and Voice	3	Audio input level = 80 mV rms; 1 kHz tone.	5 kHz maximum deviation
Tx DPL Deviation	4	Connect remote antenna port to deviation meter. Remove audio input.	0.5-1.0 kHz deviation
Tx Modulator Limiting with DPL and Voice	4	Audio input level = 80 mV rms 1 kHz tone.	5 kHz maximum deviation
Tx High Speed Data Deviation	5	Connect remote antenna port to deviation meter.	2.4-3.6 kHz deviation
Tx Binary Path	6	Special path not used at this time.	Not Applicable

Table 4. Receiver Performance Checks in Air Test Mode

Receiver Test:

1. In all of the following tests, the remote antenna port is connected to the rf signal generator.
2. The test box meter selector switch is set to **"AUDIO PA"**.
3. The test box speaker selector switch is set to **"A"**.
4. Connect the audio analyzer to the **"AC/DC MTR"** jack on the test box.
5. Set the power supply to 7.5 V at the radio battery terminals.
6. All of the following tests can be done on any frequency/channel.

Test Name	Mode	Instructions	Specifications
Rated Audio	1	Set rf generator output level to 1000 μ V (-47dBm). Set modulation to 1kHz tone @3kHz deviation. Set volume control for rated audio. Set audio analyzer to ac level.	3.7V rms audio out
Rx Audio Distortion	1	Set radio to rated audio. Set audio analyzer to check distortion.	5% maximum
Rx Current at Rated Audio	1	Set radio at rated audio.	235 mA maximum
Rx Sensitivity	1	Set radio to rated audio. Set audio analyzer to check SINAD. Decrease rf output of signal generator until 12dB SINAD is achieved. Note: In some cases it may be necessary to hold monitor button depressed to unsquelch radio.	0.35 μ V maximum (-116 dBm)
Rx Standby Current	2	Set rf signal generator output level to <-140dBm. Check that radio is squelched. Measure current.	105 mA maximum
Rx PL Squelch Sensitivity	2	Set rf signal generator level to <-140dBm. Modulate rf signal with 192.8 Hz tone at 750 Hz deviation. Check that the radio is squelched. Slowly increase rf signal level until radio becomes unsquelched.	0.5 μ V maximum (-113 dBm)
Rx DPL Squelch Sensitivity	4	Set rf signal generator output level to <-140dBm. Modulate rf signal with DPL code 131 at 750 Hz deviation. Check that the radio is squelched. Slowly increase rf signal level until radio becomes unsquelched.	0.5 μ V maximum (-113dBm)

3. ALIGNMENT SETUP AND SPECIFICATIONS

To align the radio using the Radio Service Software, do the following:

- a. Turn the radio off.
- b. Connect the radio to be aligned to the test equipment as shown in Figure 2.
- c. Connect the output of the RIB box (0180353A74) to the serial port of an IBM PC computer or 100% IBM PC compatible computer.
- d. Connect the 0180357A57 RIB box power supply to the RIB box, and plug the RIB box power supply into an ac outlet.
- e. Set the radio power supply to 7.5 volts dc.
- f. Connect the radio remote antenna cable (part of the RTK-4203 programming/test cable) to the rf power input of the communications monitor.
- g. Turn on the radio to be aligned.
- h. Refer to the Radio Service Software (RSS) manual, 68P81060C25, for the alignment procedure.
- i. Refer to Table 5, Alignment Setup and Specifications, while performing the RSS alignment procedure.

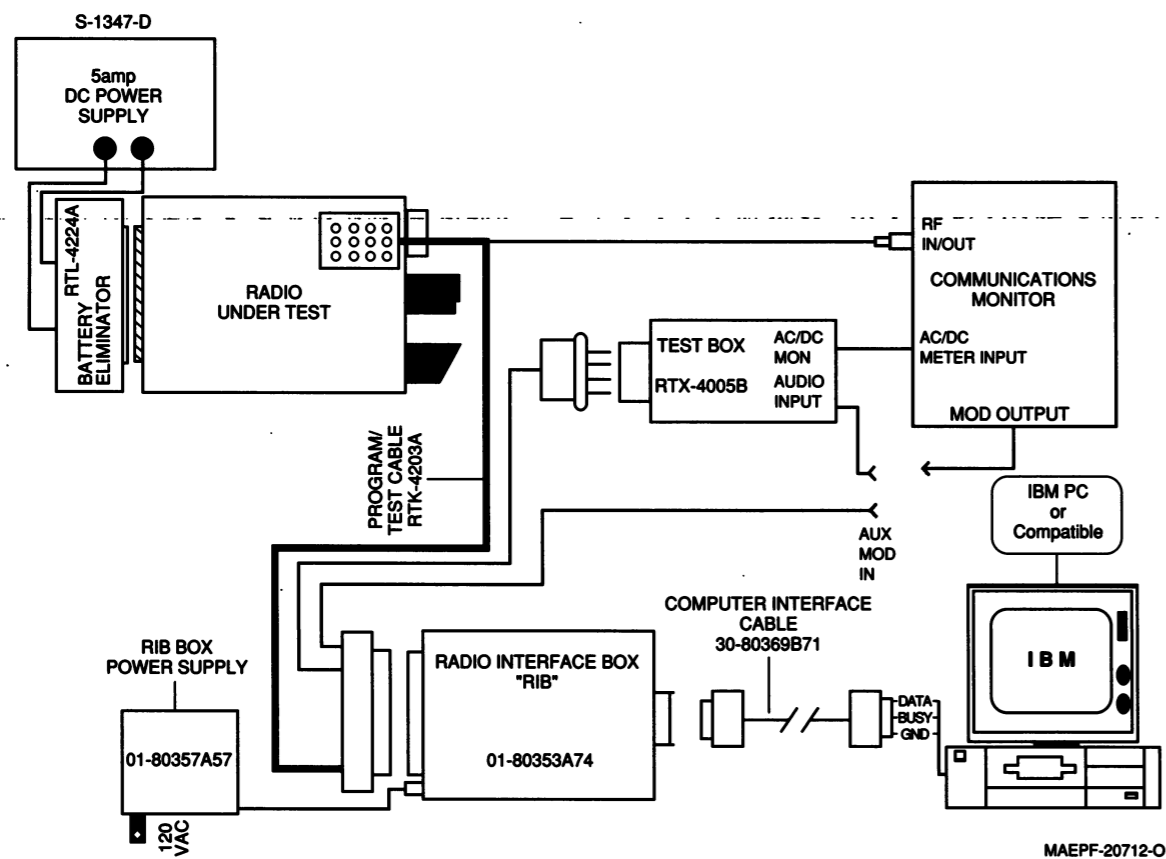


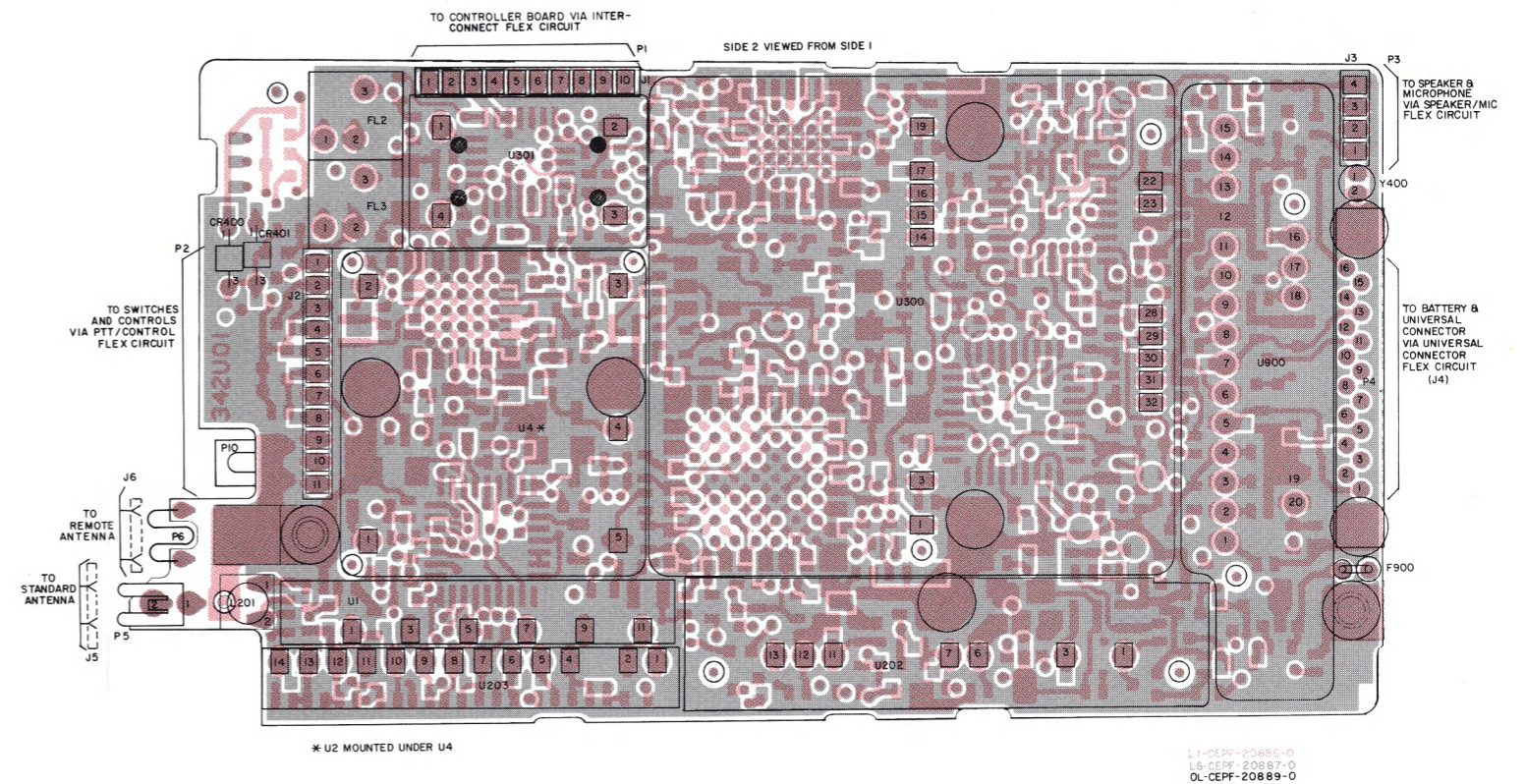
Figure 2. Alignment Setup

Table 5. Alignment Setup and Specifications

Refer to the Radio Service Software manual, 68P81060C25, for detailed alignment procedure.

Note: During alignment, the radio is controlled by the Radio Service Software. *Do not operate the radio's controls during alignment*, since this may result in improper tuning.

Test Name	Test Setup	Tune Target	Test Limits
Tx RF Power	Set communications monitor to measure rf power		
H33 Models Low output level: High output level:		1.28 Watts 2.8 Watts	1.0 - 2.0 Watts 2.5 - 3.5 Watts
H43 Models Low output level: High output level:		2.8 Watts 6.25 Watts	2.5 - 3.5 Watts 5.8 - 7.0 Watts
H43 Model with H366 Option:		5.3 Watts	4.9 - 6.0 Watts
Oscillator Adjust	Set communications monitor to measure rf frequency	Error <120Hz	Error <500 Hz
Deviation Limit	Connect audio generator to AUDIO INPUT on test set. Set frequency to 1000Hz. Set input level to 2 Volts rms.	4.4 kHz Nominal	3.9 - 4.8 kHz
Deviation Balance	Connect audio generator to AUX MODULATION connector on RTK-4203A test cable. Set audio output level for 350 mV. Set audio generator frequency to 1000 Hz or 20 Hz as specified in the alignment procedure.	Within 0.35 dB (4.1%)	Within 1.0 dB (12.2%)
Signalling Deviations	Deviation limits and deviation balance must be aligned before tuning signalling deviations. External modulation inputs are <i>not used</i> during these alignments. <i>Disconnect</i> any external modulation inputs. Set communications monitor to measure deviation.		
DTMF with Connect Tone: DTMF Only: DTMF with PL: ISW Only: DVP Only:		4.0 kHz Nominal 3.0 kHz Nominal 3.75 kHz Nominal 3.0 kHz Nominal 4.0 kHz Nominal	3.3 - 4.7 kHz 2.5 - 3.5 kHz 3.0 - 4.5 kHz 2.4 - 3.6 kHz 3.5 - 4.5 kHz
Threshold Squelch (Air Test Mode or Conventional Channels)	Set communications monitor rf output frequency to the receive frequency. Set rf output level to < -140 dBm or no output while adjusting squelch setting per RSS manual alignment procedure. Once squelch value has been set, increase communications monitor rf output level until squelch opens. This level is called "threshold squelch."	Per RSS Manual	0.5 µV Maximum



1. Unless otherwise stated, resistances are in ohms ($k = 1000$), capacitances less than 1 are in microfarads, and capacitances 1 or greater are in picofarads.

SYSTEMS SABER VHF SECURENET
Electrical Parts List

TPLF-3907-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	-----	CAPACITOR, Fixed: uF±20%; 25V
C2	2113741A25	unless stated
C3	2311049A07	Not Used
C4,5	2160521G37	1500pF±5%
C6	2311049J12	1±10%; 16V
C7	-----	0.1+80-20%
C8	2160521G37	4.7; 16V
C9	2311049J26	Not Used
C10	2311049A02	0.1+80-20%
C11	2311049J04	10; 16V
C12	2113741A21	.15±10%; 35V
C13	2113741A45	2.2; 20V
C14	2160521G37	1000pF ±5%
C15	-----	.01
C16	2113740A48	0.1+80-20%
C17	2160521G37	Not Used
C18	2160521H41	51pF±5%
C19	2311049J07	0.1+80-20%
C20	2311049A37	.22+80-20%
C21	2113741A21	3.3±10%; 20V
C22	2160521G37	1
C23	2113741A33	1000pF ±5%
C24	2311049J14	0.1+80-20%
C25	-----	3300pF±5%
C26	2113741A37	4.7; 20V
C27	2113741A59	Not Used
C28 thru 30	2311049A37	Not Used
C31	2113741A59	4700pF±5%
C32	2160521G37	.039±5%
C33	-----	0.1+80-20%
C34	2160521G37	Not Used
C35 thru 37	2113740A55	0.1+80-20%
C38	2113740A55	100pF ±30%
C39,40	-----	Not Used
C41	2113740A55	100pF ±30%
C42,43	-----	Not Used
C44	2160521G37	0.1+80-20%
C45	-----	Not Used
C46	2113741A51	.018
C47	2113741A45	.01
C48	2113741A53	.022±5%
C49	2113740A23	6.2pF±30%
C50	-----	Not Used
C51 thru 53	2113741A51	.018
C54	2113740A55	100pF ±30%
C55	-----	Not Used
C56	2113741A51	.018
C57 thru 60	2113741A53	Not Used
C61	2113741A53	.022±5%
C62,63	-----	Not Used
C64	2113741A51	.018
C65	2113740A55	100pF ±30%
C66	-----	Not Used
C67	2160521G37	0.1+80-20%
C68	2113740A63	220pF±30%
C69	-----	Not Used
C70	2113741A51	.018
C71 thru 74	2113740A55	Not Used
C75	-----	100pF ±30%
C76	2113740A55	Not Used
C77	2113740A55	100pF ±30%
C200	2113740A44	43pF±30%
C201	-----	Not Used
C202	2113740A50	62pF±30%
C203	2113740A49	56pF±30%
C204	2113740A55	100pF ±30%
C205	2113740A51	68pF±30%
C206	2113740A33	15pF±30%
C207	2113740A11	2.2pF±30%
C208	2113740A33	15pF±30%
C209	-----	Not Used
C210	2311049J14	4.7; 20V
C211	-----	Not Used
C212,213	2113741A51	.018
C214	2311049J07	3.3±10%; 20V
C215	2113740A75	680pF ±30%
C216	2311049J26	10; 16V
C217	2113741A51	.018
C218	2113741B61	.047

C219	2113741A13	470pF±5%
C220	2113740A55	100pF ±30%
C221 thru 223	2113741A51	.018
C224	2160521G37	0.1+80-20%
C225	2113741A51	.018
C226	2311049J26	10; 16V
C227	2113741A51	.018
C228	-----	Not Used
C229,230	2113741A51	.018
C231	-----	Not Used
C232	2113741A13	470pF±5%
C233	2113741A51	.018
C234 thru 236	-----	Not Used
C237	2113741A51	.018
C238 thru 240	-----	Not Used
C241	2113740A17	3.9pF±30%
C400,401	2113740A33	15pF±30%
C402	2311049J26	10; 16V
C403	2311049J12	4.7; 16V
C404	-----	Not Used
C405,406	2113741A45	.01
C407,408	2160521G37	0.1+80-20%
C409,410	-----	Not Used
C411,412	2160521G37	0.1+80-20%
C500	2113740A55	100pF ±30%
C501 thru 508	-----	Not Used
C509	2113741A51	.018
C510 thru 512	-----	Not Used
C513	2113741A51	.018
C514,515	-----	Not Used
C516	2113741A51	.018
C517	-----	Not Used
C518	2113741A51	.018
C519	-----	Not Used
C520	2113740A55	100pF±30%
C521	2113740A43	39pF±30%
C522 thru 577	-----	Not Used
C578	2113740A55	100pF±30%
C579	-----	Not Used
C580 thru 582	2113740A55	100pF±30%
C583	2113740B49	100pF
C700,701	2160521G37	0.1+80-20%
C702	2311049J07	3.3±10%; 20V
C703	2311049A05	.47 ±10%
C704	2311049J12	4.7; 16V
C705	2160521G37	0.1+80-20%
CR1 thru 50	-----	DIODE: See Note 1
CR51	4805129M64	Not Used
CR200	-----	SOT-23
CR201	4805129M05	Not Used
CR400	4805729G34	SOT
CR401	4805729G35	LED, Red
CR402	4805129M64	LED, Yellow
-----	-----	SOT-23
E200,201	2484657R01	CORE:
-----	-----	Ferrite Bead
F900	0105955P27	FUSE:
-----	-----	ASSEMBLY, 5 Amp
FL1	-----	FILTER:
FL2	9105685Q05	Not Used
FL3	9105685Q06	Ceramic; 450kHz; 20kHz BW
-----	-----	Ceramic; 450kHz; 15kHz BW
J1	0905287C05	JACK:
-----	-----	Socket, Printed Circuit
J2	0905287C05	(LCD Interconnect)(10 req'd)
-----	-----	Socket, Printed Circuit
J3	0905287C05	(PTT Controls Flex)(11 req'd)
-----	-----	Socket, Printed Circuit
-----	-----	(Speaker/Mic Connector)(4 req'd)
L1	2405452C66	COIL, RF: unless stated
L2	2462575A03	1800nH±5%
L3	2405452C09	820nH±10%
L4,5	2462575A08	50nH±5%
L6 thru 50	-----	5600nH±10%
L51	2462575A08	Not Used
L52	2405452C38	5600nH±10%
L200	-----	Not Used
L201	2405855Q01	50nH
L202 thru 204	-----	Not Used
L205	2405452C62	1200nH±5%
L206	-----	Not Used

L207 thru 209	2405452C62	1200nH±5%
L400	2460578C43	33uH
L500 thru 517	-----	Not Used
L518,519	2405452C07	148nH±5%
P1	-----	PLUG:
P2	2805520Q01	Not Used
P3,4	-----	Connector
P5	3905446Q03	Not Used
P6	3905445Q03	Contact, Antenna
P7 thru 9	-----	Contact, RF Wireform
P10	3905889R01	Not Used
-----	-----	Clip, Frame
Q1	4805128M16	TRANSISTOR: See Note 1
Q2	-----	PNP; SOT
Q3	4805218N03	Not Used
Q200,201	4805128M12	NPN; SOT
Q202	4805128M27	PNP; SOT-89
Q203,204	4805128M16	PNP; SOT
Q205	-----	Not Used
Q206	4805128M16	PNP; SOT
Q400	-----	Not Used
Q401	4805128M27	PNP; SOT-89
Q402	4805128M12	NPN; SOT-23
Q403	4805218N50	NPN; SOT
Q404,405	4805128M12	NPN; SOT-23
-----	-----	RESISTOR, Fixed: Ω±5%; 1/8W
-----	-----	unless stated.
R1	0660079K02	75k±1%
R2	-----	Not Used
R3	0660076E76	13k±1%
R4	0660078T24	91k
R5	0660078T01	10k
R6	-----	Not Used
R7	0660078J80	49.9k±1%
R8	-----	Not Used
R9	0660078G33	2k±1%
R10	-----	Not Used
R11	0660078G33	2k±1%
R12	0660079U73	1k
R13 thru 15	-----	Not Used
R16	0660078L01	100k±1%
R17	0660076A67	5.6k
R18	0660076E89	47k±1%
R19	0660079U73	1k
R20,21	-----	Not Used
R22	0660076A92	62k
R23 thru 50	-----	Not Used
R51,52	0660076A85	33k
R53	0660076A41	470
R54	0660076A73	10k
R55 thru 59	-----	Not Used
R60	0660076A29	150
R61	0660076A77	15k
R62	-----	Not Used
R63	0605021K01	0
R200	-----	Not Used
R201	0660076A89	47k
R202	-----	Not Used
R203	0660078G33	2k±1%
R204 thru 208	-----	Not Used
R209	0660076A48	910
R210	0660078J80	49.9k±1%
R211,212	0660078G33	2k±1%
R213	0660078J23	16.2k±1%
R214	0660076B01	100k
R215	-----	Not Used
R216,217	0660076A73	10k
R218	0660076B01	100k
R219	0660076B05	150k
R400	-----	Not Used
R401	0660076N65	4.7k
R402	0660076B25	1M±5%
R403	0660076B01	100k
R404	-----	Not Used
R405	0660076B01	100k
R406	0660076A73	10k
R407	0660076A65	4.7k
R408	0660076B01	100k
R409	0660076A29	150
R410	0660076A41	470
R411	0660076A80	20k
R412,413	0660078L01	100k±1%
R414	0660076A73	10k
R415 thru 417	0660076B01	100k

R418 thru 424	-----	Not Used
R425	0660076A73	10k
R426 thru 429	-----	Not Used
R430	0660076A29	150
R431,432	-----	Not Used
R433	0660076A21	68
R434	-----	Not Used
R435	0660079U73	1k
R436	0660076A41	470
R500	0660076A73	10k
R501 thru 506	-----	Not Used
R507	0660076B01	100k
R700	0660078J80	49.9k±1%
R701	0660079U73	1k
R702	-----	Not Used
R703	0660076E89	47k±1%
R800	RPX4690A	Potentiometer, Kit, On/Off/Volume (includesS800)
R801 thru 805	-----	Not Used
R806	0660079U73	1k
-----	-----	SWITCH:
S800	RPX4690A	Kit, On/Off/Volume (includes R800)
S801/S804	4005221R01	Dual-Function, Clear/Code (S804)(Standard) and Emergency (S801)(Optional)
S802	-----	Not Used
S803	RPX4694A	Kit, Contact Snapdome, PTT
S805	RPX4694A	Kit, Contact Snapdome, Monitor
S806 thru 822	-----	Not Used
S823	RPX4689A	Kit, Frequency
T1	2405548Q03	TRANSFORMER:
-----	-----	CIRCUIT MODULE: See Note 1
U1	NFD6111A	Filter, 2-Pole (136-150.8MHz)
or	NFD6112A	Filter, 2-Pole (146-174MHz)
U2	NFD6091A	Filter, 5-Pole (136-150.8MHz)
or	NFD6092A	Filter, 5-Pole (146-174MHz)
U4	NLD8180A	Receiver Front End (136-174MHz)
U100	0105958P77	IC, I-F
U101	0105958P80	IC, Audio Filter, CMOS
U102	0105958P74	IC, Audio, Bipolar
U103	5105469E65	IC, Regulator
U200	0105953N05	IC, Digital/Analog Converter, CMOS
U201	0105959P66	Transmit Automatic Level Control
U202	NLD8121A	Power Amplifier (136-150.8MHz)
or	NLD8122A	Power Amplifier (146-162MHz)
or	NLD8133A	Power Amplifier, Low-Power (146-174MHz)
or	NLD8123A	Power Amplifier (157-174MHz)
U203	NFD6131A	FDS (136-150.8MHz)
or	NFD6132A	FDS (146-174MHz)
U300	NLD8201A	Synthesizer/VCO (136-150.8MHz)
or	NLD8210A	Synthesizer/VCO (146-174MHz)
U301	NXN6269A	Oscillator, Reference; 16.8MHz
U400	0105956S06	Microcomputer, MC68HC11; Binary
U700	0105954S43	Signalling
U900	NTN4720A	SECURENET Bypass Module
or	-----	Optional Encryption Module
VR800	4805129M35	DIODE: See Note 1
VR801	4805129M49	Zener, 5.6V
VR802	-----	Zener, 16V
VR803 thru 807	4805129M35	Not Used
VR808	4805129M49	Zener, 5.6V
VR809 thru 812	4805129M35	Zener, 16V
VR813	-----	Zener, 5.6V
VR814	4805129M49	Not Used
VR815	-----	Zener, 16V
VR816	4805129M35	Not Used
-----	-----	Zener, 5.6V
Y400	4805664G32	CRYSTAL:
-----	-----	7.3728MHz
NONREFERENCED ITEMS		
-----	0905287C07	SOCKET, Printed Circuit
-----	1405881R01	(for all modules)(94 req'd)
-----	.7505934Q01	BOOT, Crystal (For Y400)
-----	8405342U01	PAD, Oscillator (For U301)
-----	-----	PC BOARD, Main

NOTE:

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

SYSTEMS SABER Controller Board
Electrical Parts List

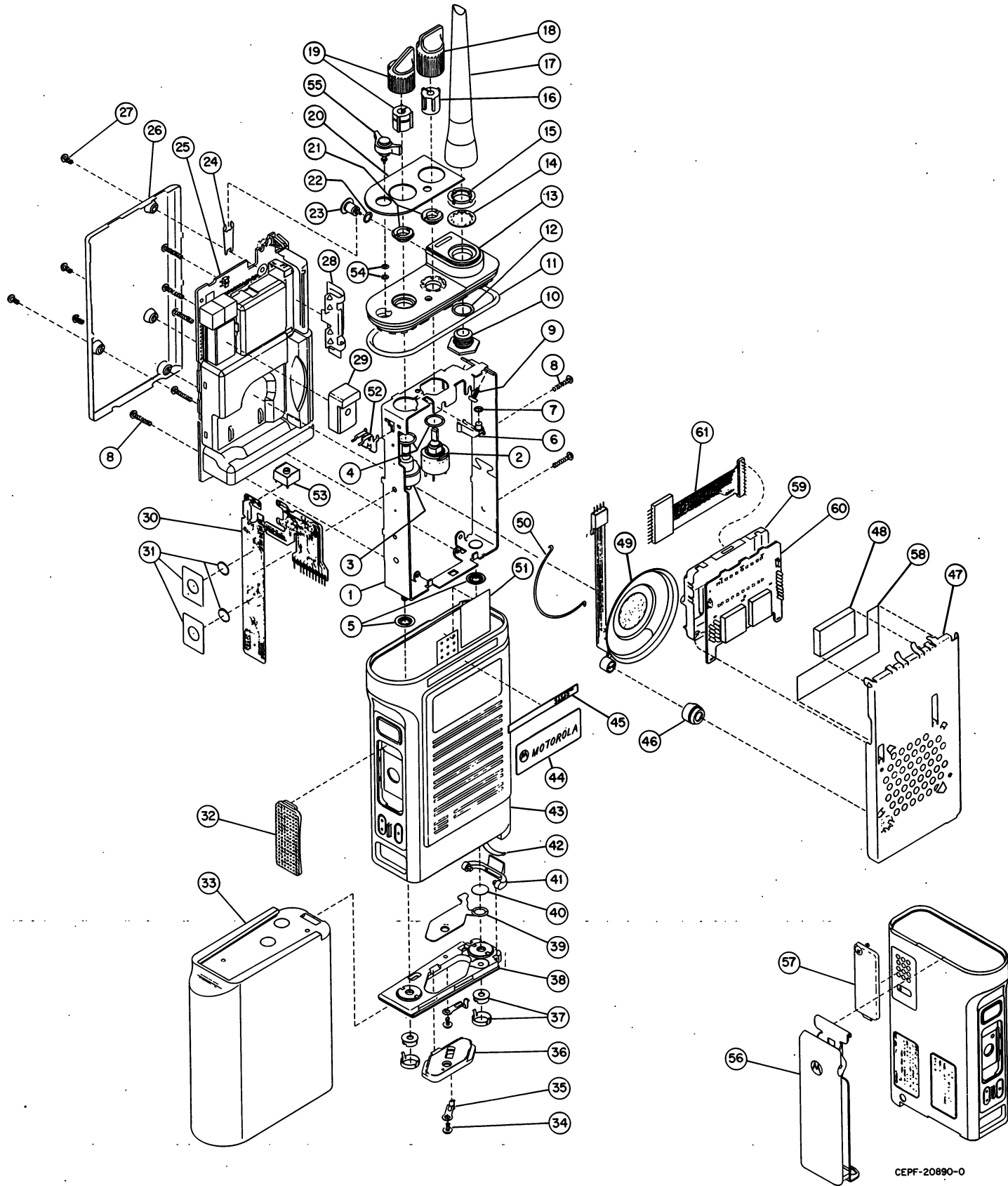
TPLF-3908-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C500,501 C502 thru 505 C506 C507 thru 510 C511 C512 C513,514 C515 C516 C517 thru 519	----- 2113740F51 2113740A55 2113740F51 2311049A37 2113741B69 2113740A38 2113740A13 2113741A45 2113741B69	CAPACITOR, Fixed: pF±30%; 50V unless stated Not Used 100 100 100 100 1µF ±20% .1µF 24 2.7±.25pF .01µF .1µF
CR501,502 CR503	4805729G37 4805129M06	DIODE: See Note 1 LED; Green SMD (See Note 2) Dual; SOT-23 (See Note 2)
J7 J8	0905287C10 0905287C10	JACK: Socket, Keypad; (qty 9) Socket, LCD; (qty 10)
L501,502 L503	2462575A23 2460578C43	COIL, RF: Unless stated .1µH 33µH
Q501 Q502 Q503	4805128M12 4805218N50 4805128M12	TRANSISTOR: See Note 1 NPN; BCW60B (RH) (See Note 2) NPN; SOT-23 NPN; BCW60B (RH) (See Note 2)
R501 R502 R503 R504,505 R506 R507,508 R509 R510 R511 R512 R513 R514 R515 R516 R517 R518 R519 R520 R521,522 R523 R524 R525 R526 thru 533 R534 R535 R536 R537 R538 thru 547	0660076A09 0660076A69 0660079V13 ----- 0660079V13 0660076N49 0660079V13 0660076N39 0660076N49 0660076A39 0660076N85 0660076N39 0660079U89 0660076B12 0660079U89 0660076A73 0660079V13 0660079V25 0660079V13 0660076A73 0660079U73 0660076F08 0660079V13 0660076A73 0660076N85 0660076A73 0660079U89 0660076N73	RESISTOR, Fixed: Ω±5%; 1/8W unless stated 22 (See Note 2) 6.8k (See Note 2) 33k Not Used 33k 1K 33k 390 1k 390 33k 390 4.7k 300k 4.7k 10k 33k 100k (See Note 2) 33k (See Note 2) 10k (See Note 2) 1k (See Note 2) 200k±1% (See Note 2) 33k 10k 33k 10k 4.7k 10k
U501 U502 U503 U504 U505	5105414S38 5105226P50 5105226P39 5105165R24 5195007D02	CIRCUIT MODULE: See Note 1 Microprocessor, HCMOS LCD Driver (See Note 2) RAM; 8k x 8 EEPROM; 8k x 8 EPROM; 128k x 8
Y501	4860875A01	CRYSTAL: 7.3728 MHz
NONREFERENCED ITEMS		
	8405543U01 1305321R02 6105534T01 5105892T01 2805397L06	PCB (See Note 2) BEZEL (See Note 2) LIGHTPIPE (See Note 2) LCD (See Note 2) ELASTOMER (See Note 2)

SYSTEMS SABER I SECURENET VHF
Exploded View Parts List

TPLF-3910-O

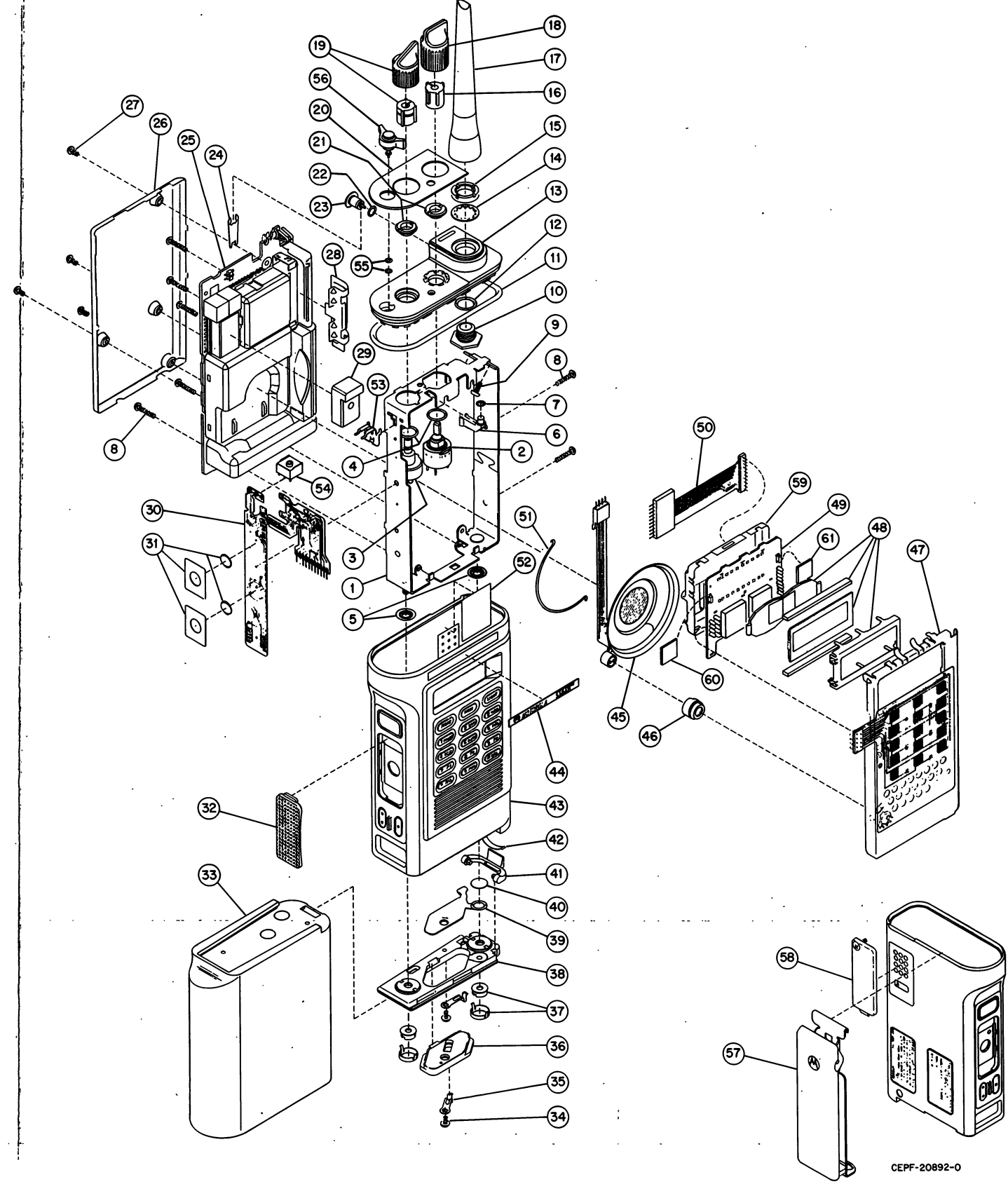
ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	RPX4720A	ASSEMBLY, Frame Stud (includes item 5)
2	4005640Q08	SWITCH, Frequency (S823)
3	1805799P02	SWITCH, On/Off (S800) /Volume Control (R800)
4	3205082E62	GASKET, O-Ring (2 req'd)
5	3205422Q01	SEAL, Stud (2 req'd) (part of item 1)
6	6105436Q01	LIGHTPIPE, LED
7	3205082E59	GASKET, O-Ring
8	0305714J10	SCREW, Module, Ph Pan Hd; 2-56x.4" (7 req'd)
9	0300140332	SCREW, Top Panel; 3-28x.187" (2 req'd)
10	RPX4693A	KIT, Antenna Bushing (includes item 12)
11	3205082E80	GASKET, O-Ring (part of item 13)
12	3205082E58	GASKET, O-Ring (part of item 10)
13	RPX4692A	KIT, Control Top Panel (includes item 11)
14	0400139731	LOCKWASHER, Internal Tooth
15	0205591R01	NUT, Antenna Bushing
16	4305141R03	INSERT, Frequency Knob
17	NAD6471A	ANTENNA, VHF Helical (136 - 150.8 MHz)
or	NAD6472A	ANTENNA, VHF Helical (146 - 162 MHz)
or	NAD6473A	ANTENNA, VHF Helical (157 - 174 MHz)
18	3605526Q01	Frequency Knob
19	RPX4698A	KIT, On/Off/Volume Knob
20	1305622Q32	ESCUTCHEON
or	1305622Q36	ESCUTCHEON, Submersible
21	0205916P01	NUT, Spanner (2 req'd)
22	3205082E61	GASKET, O-Ring (part of item 23)
23	RPX4691A	KIT, RF Connector (includes items 22,24)
24	4205852N01	CONTACT, Ground, RF (part of item 23)
25	NLD8740A	ASSEMBLY, VHF Main PC Board
26	NTN4726A	ASSEMBLY, Back Shield (includes item 27)
27	0305706Q01	SCREW, Captive; 2-56 (4 req'd) (part of item 26)
28	4205577Q01	CLIP, Ground
29	1405156U01	BOOT, Oscillator
30	8405895T01	PTT/Controls Flex
or	0105956Q93	KIT, PTT/Controls Flex Assembly (includes items 2,3,31)
31	RPX4694A	KIT, Contact Snapdome (S803, 805) (2 req'd) (part of item 30)
32	4505022P02	LEVER, PTT (part of item 43)
33	NTN4595B	BATTERY, 1500 mAh
34	0305706Q02	SCREW, Baseplate, Ph Pan Hd; 2-56x3/32" (2 req'd) (part of item 43)
35	3905453Q01	CONTACT, Power (2 req'd) (part of item 43)
36	4205669T01	RETAINER, Baseplate (part of item 43)
37	RPX4696A	KIT, Slotted Spanner Nut (2 req'd) (part of item 43)
38	6405847N03	BASEPLATE (part of item 43)
39	3205783T01	SEAL, Elastomer (part of item 43)
40	3205472M02	SEAL, Vacuum Port (part of item 43)
41	5505333Q01	LATCH, Battery (part of item 43)
42	4105775Q01	SPRING, Latch (part of item 43)
43	NHN6410A	ASSEMBLY, Housing, SABER I (includes items 32, 34 thru 42)
or	NHN6408A	ASSEMBLY, Housing, SABER I Submersible (includes items 32, 34 thru 42)
44	3305183R03	LABEL, Bottom Nameplate
45	3305183R14	LABEL, Top Nameplate
or	3305183R37	LABEL, Top Nameplate, Submersible
46	1405490Q01	BOOT, Microphone
47	0705830N05	BRACKET, Speaker
48	7505316J07	PAD, Shock
49	0105958M34	ASSEMBLY, Speaker/Microphone Flex
50	4205872S01	RETAINER, Speaker
51	1405182M03	INSULATOR, Universal Connector
52	0705319R01	BRACKET, Switch
53	4005221R02	SWITCH, Dual-Function (S801, 804)
54	3205082E68	GASKET, O-Ring, Emergency (2 req'd)
55	NTN5068A	KIT, Push-and-Rotate Knob (includes item 54)
56	NTN4788A	ASSEMBLY, Belt Clip
57	NTN5025A	Cover, Universal Connector
58	1405888Q03	INSULATOR, Front Shield
59	2605682U01	SHIELD, LCD Board
60	0105953R65	ASSEMBLY, Controller PC Board
61	8405681U01	FLEX CIRCUIT, LCD Interconnect



SYSTEMS SABER III SECURENET VHF
Exploded View Parts List

TPLF-3909-O

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	RPX4720A	ASSEMBLY, Frame Stud (includes item 5)
2	4005640Q08	SWITCH, Frequency (S823)
3	1805799P02	SWITCH, On/Off (S800) /Volume Control (R800)
4	3205082E62	GASKET, O-Ring (2 req'd)
5	3205422Q01	SEAL, Stud (2 req'd) (part of item 1)
6	6105436Q01	LIGHTPIPE, LED
7	3205082E59	GASKET, O-Ring
8	0305714J10	SCREW, Module, Ph Pan Hd; 2-56x.4" (7 req'd)
9	0305381L02	SCREW, Top Panel; 2-32 (2 req'd)
10	RPX4693A	KIT, Antenna Bushing (includes item 12)
11	3205082E71	GASKET, O-Ring (part of item 13)
12	3205082E58	GASKET, O-Ring (part of item 10)
13	RPX4692A	KIT, Control Top Panel (includes item 11)
14	0400139731	LOCKWASHER, Internal Tooth
15	0205591R01	NUT, Antenna Bushing
16	4305141R03	INSERT, Frequency Knob
17	NAE6432A	ANTENNA, UHF Helical (438 - 470 MHz)
or	NAE6440A	ANTENNA, UHF Whip (403 - 512 MHz)
18	3605526Q01	Frequency Knob
19	RPX4698A	KIT, On/Off/Volume Knob
20	1305622Q32	ESCUTCHEON, SYSTEMS SABER
21	0205916P01	NUT, Spanner (2 req'd)
22	3205082E61	GASKET, O-Ring (part of item 23)
23	RPX4691A	KIT, RF Connector (includes items 22,24)
24	4205852N01	CONTACT, Ground, RF (part of item 23)
25	NLE9911A	ASSEMBLY, UHF Main PC Board
26	NTN4726A	ASSEMBLY, Back Shield (includes item 27)
27	0305706Q01	SCREW, Captive (4 req'd) (part of item 26)
28	4205577Q01	CLIP, Ground
29	1405156U01	BOOT, Oscillator
30	8405895T01	PTT/Controls Flex
or	0105956Q93	KIT, PTT/Controls Flex Assembly (includes items 2,3,31)
31	RPX4694A	KIT, Contact Snapdome (S803, 805) (2 req'd) (part of item 30)
32	4505022P02	LEVER, PTT (part of item 43)
33	NTN4595B	BATTERY, 1500 mAh
34	0305706Q02	SCREW, Baseplate, Ph Pan Hd; 2-56x3/32" (2 req'd) (part of item 43)
35	3905453Q01	CONTACT, Power (2 req'd) (part of item 43)
36	4205669T01	RETAINER, Baseplate (part of item 43)
37	RPX4696A	KIT, Slotted Spanner Nut (2 req'd) (part of item 43)
38	6405847N03	BASEPLATE (part of item 43)
39	3205783T01	SEAL, Elastomer (part of item 43)
40	3205472M02	SEAL, Vacuum Port (part of item 43)
41	5505333Q01	LATCH, Battery (part of item 43)
42	4105775Q01	SPRING, Latch (part of item 43)
43	NHN6446A	ASSEMBLY, Housing, SYSTEMS SABER (includes items 32, 34 thru 42)
44	3305183R15	LABEL, Nameplate, SYSTEMS SABER
45	0105958M34	ASSEMBLY, Speaker/Microphone Flex
46	1405490Q01	BOOT, Microphone
47	REX4074A	ASSEMBLY, LCD/Speaker Bracket
48	REX4073A	KIT, LCD Assembly (part of item 49)
49	0105953R66	ASSEMBLY, Controller PC Board, (includes item 48)
50	8405328T01	FLEX CIRCUIT, LCD Interconnect
51	4205872S01	RETAINER, Speaker
52	1405182M03	INSULATOR, Universal Connector
53	0705319R02	BRACKET, Switch
54	4005221R02	SWITCH, Dual-Function (S801, 804)
55	3205082E68	GASKET, O-Ring, Emergency (2 req'd)
56	NTN5068A	KIT, Push-and-Rotate Knob (includes item 54)
57	NTN4788A	ASSEMBLY, Belt Clip
58	NTN5025A	Cover, Universal Connector
59	2605897T01	SHIELD, LCD Board
60	7505316J06	PAD
61	7505316J05	PAD



SERVICE MANUAL QUESTIONNAIRE

We believe that reports from users provide valuable information for producing quality manuals. By taking a few moments to answer the following questions as they relate to this specific manual, you can take an active role in the continuing effort to ensure that our manuals contain the most accurate and complete information of benefit to you. Thank you for your cooperation.

In reference to Manual Number: **68P81067C10-0**

SYSTEMS SABER™ SECURENT™ Handie-Talkie® Portable Radios

1. Please check all the appropriate boxes:

	Complete	Incomplete	Correct	Incorrect	Clear	Confusing	Size Adequate	Size Too Small	Not Covered in This Manual
Disassembly Procedures									
Alignment Procedures									
Exploded Views									
Schematic Diagrams									
Circuit Board Details									
Electrical Parts Lists									
Exploded View Parts List									

2. How would you rate the overall organization of this manual?
☐ excellent ☐ very good ☐ good ☐ fair ☐ poor
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5. We would appreciate any corrections or recommendations for improving this manual. Please include the specific page number(s) of the diagram or procedure in question.
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- b. Alignment Procedures: (Page No. _____)
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d. Schematic Diagrams: (Page No. _____)

e. Component Location Details: (Page No. _____)

f. Electrical Parts List: (Page No. _____)

g. Exploded View Parts List: (Page No. _____)

6. General comments/suggestions:

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When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Crystal and channel element orders should specify the crystal or channel element type number,

crystal and carrier frequency, and the model number in which the part is used.

Orders for active filters, Vibrasender and Vibrasponder resonant reeds should specify type number and frequency, should identify the owner/operator of the communications system in which these items are to be used; and should include any serial numbers stamped on the components being replaced.

MAIL ORDERS

Send written orders to the following addresses:

Replacement Parts/
Test Equipment/
Crystal Service Items:

Motorola Inc.
Communications Parts Division
Attention: Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

Federal Government Orders:

Motorola Inc.
Communications Parts Division
Attention: Order Processing
1701 McCormick Drive
Landover, MD 20785

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Communications Parts Division
Attention: International Order Processing
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Call: 1-800-422-4210
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Telex: 280127 (Domestic)
403305 MOTOPARTS SHBU. UD (International)
FAX: 708-576-6285

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FAX: 301-925-2473 or 301-925-2474

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Replacement Parts/Test Equipment:
Call: 1-800-537-7007

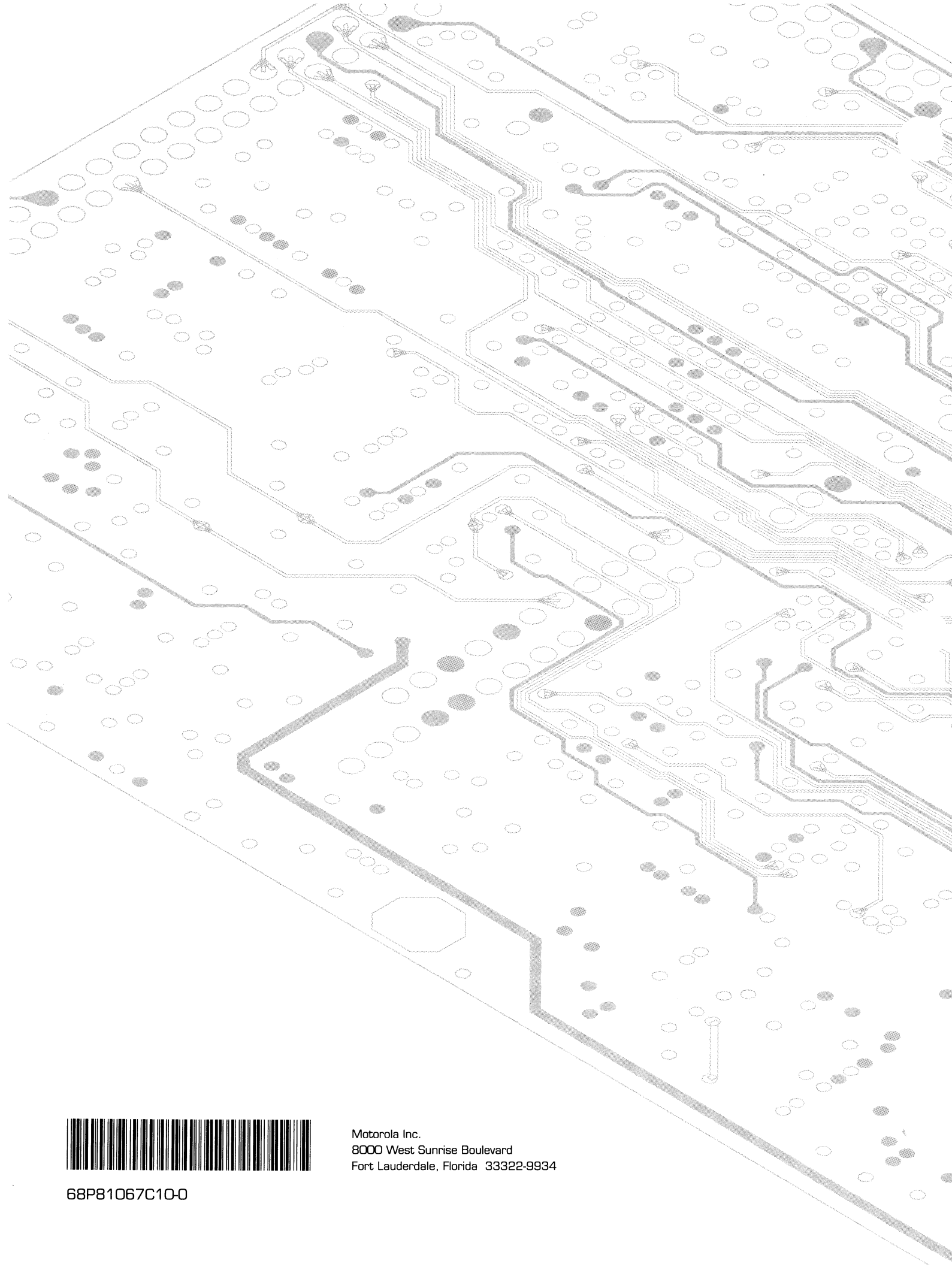
Crystals:
Call: 1-800-323-0234 (except Illinois Residents)
1-800-537-7007 (for Illinois Residents)

Parts Identification:
Call: 708-576-7418

NATIONAL DATA SERVICES

1711 West 17th Street - Tempe, AZ 85281

Call: 602-994-6472
FAX: 602-994-6762



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