

PROFESSIONAL DIGITAL TWO-WAY RADIO SYSTEM



# MOTOTRBO™ PORTABLE

XPR 7550e

XPR 7580e

XPR 7350e

XPR 7380e

## BASIC SERVICE MANUAL



 Bluetooth™

 WiFi™

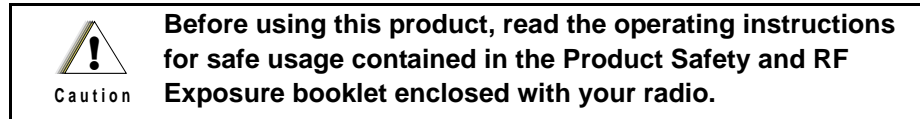
 DMR



# Foreword

This manual covers all models of the XPR™ Series Portable Radios, unless otherwise specified. It includes all the information necessary to maintain peak product performance and maximum working time, using levels 1 and 2 maintenance procedures. This level of service goes down to the board replacement level and is typical of some local service centers, self-maintained customers, and distributors.

## Product Safety and RF Exposure Compliance



**For a list of Motorola-approved antennas, batteries, and other accessories, visit the following web site:**  
<http://www.motorolasolutions.com>

**For a list of Motorola TIA 4950 approved radio models, antennas, batteries, and other accessories, please refer to UL Safety manual MN001111A01 enclosed with your radio.**

## TIA 4950

The radio models listed in UL Safety Manual MN001111A01, when properly equip with the battery PMNN4489\_, is certified for use per the classification below:

- Classification Rating Division 1, Class I, Groups C, D; Class II Group E, F, G; Class III. T3C.  
 Tamb = -25°C to +60 °C.
- Classification Rating Division 2, Class I, Groups A, B, C, D.



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## Document History

The following major changes have been implemented in this manual since the previous edition:

Edition	Description	Date
MN002178A01-AA	Initial Release	Jan. 2016

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# Related Publications

IMPRES Adaptive Single-Unit Charger User Manual .....	6816787H01
IMPRES Adaptive Multi-Unit Charger User Manual.....	6816789H01
IMPRES Adaptive Multi-Unit Charger Service Manual .....	6871357L01
Remote Speaker Microphone User Manual .....	6871003L01
IMPRES Remote Speaker Microphone User Manual .....	6871004L01
UL Safety Manual .....	MN001111A01

# Commercial Warranty

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Product Accessories (Excluding Batteries and Chargers)	One (1) Year

The portables additionally ship with a standard 1-year Repair Service Advantage (RSA) (for U.S. customers) or 1-year Extended Warranty (for Canada customers). However, at the time of order, you may choose to omit these warranties. For more RSA or Extended Warranty information, please refer to the portable price pages or Motorola Online (<https://businessonline.motorola.com>) > Resource Center > Services > Service Product Offerings > Repair Service Advantage or Extended Warranty.

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## II. General Provisions

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## IV. How To Get Warranty Service

You must provide proof of purchase (bearing the date of purchase and Product item serial number) in order to receive warranty service and, also, deliver or send the Product item, transportation and insurance prepaid, to an authorized warranty service location. Warranty service will be provided by Motorola through one of its authorized warranty service locations. If you first contact the company which sold you the Product, it can facilitate your obtaining warranty service. You can also call Motorola at 1-800-927-2744 US/Canada. <https://businessonline.motorolasolutions.com>

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- B. Defects or damage from misuse, accident, water, or neglect.
- C. Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment.
- D. Breakage or damage to antennas unless caused directly by defects in material workmanship.
- E. A Product subjected to unauthorized Product modifications, disassemblies or repairs (including, without limitation, the addition to the Product of non-Motorola supplied equipment) which adversely affect performance of the Product or interfere with Motorola's normal warranty inspection and testing of the Product to verify any warranty claim.
- F. Product which has had the serial number removed or made illegible.
- G. Rechargeable batteries if:
  - any of the seals on the battery enclosure of cells are broken or show evidence of tampering.
  - the damage or defect is caused by charging or using the battery in equipment or service other than the Product for which it is specified.
- H. Freight costs to the repair depot.



- I. A Product which, due to illegal or unauthorized alteration of the software/firmware in the Product, does not function in accordance with MOTOROLA's published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from MOTOROLA.
- J. Scratches or other cosmetic damage to Product surfaces that does not affect the operation of the Product.
- K. Normal and customary wear and tear.

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MOTOROLA will defend, at its own expense, any suit brought against the end user purchaser to the extent that it is based on a claim that the Product or parts infringe a United States patent, and MOTOROLA will pay those costs and damages finally awarded against the end user purchaser in any such suit which are attributable to any such claim, but such defense and payments are conditioned on the following:

- A. that MOTOROLA will be notified promptly in writing by such purchaser of any notice of such claim;
- B. that MOTOROLA will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and
- C. should the Product or parts become, or in MOTOROLA's opinion be likely to become, the subject of a claim of infringement of a United States patent, that such purchaser will permit MOTOROLA, at its option and expense, either to procure for such purchaser the right to continue using the Product or parts or to replace or modify the same so that it becomes noninfringing or to grant such purchaser a credit for the Product or parts as depreciated and accept its return. The depreciation will be an equal amount per year over the lifetime of the Product or parts as established by MOTOROLA.

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## VII. Governing Law

This Warranty is governed by the laws of the State of Illinois, USA.

# Battery and Charger Warranty

## Workmanship Warranty

The workmanship warranty guarantees against defects in workmanship under normal use and service.

All MOTOTRBO Batteries	Two (2) Years
IMPRES Chargers (Single-Unit and Multi-Unit, Non-Display)	Two (2) Years
IMPRES Chargers (Multi-Unit with Display)	One (1) Year
Core Chargers (Single-Unit and Multi-Unit, Non-Display)	Two (2) Years

## Capacity Warranty

The capacity warranty guarantees 80% of the rated capacity for the warranty duration.

Nickel Metal-Hydride (NiMH) or Lithium-Ion (Li-Ion) Batteries	12 Months
IMPRES Batteries, When Used Exclusively with IMPRES Chargers	18 Months

# Chapter 1 Introduction

## 1.1 Notations Used in This Manual

Throughout the text in this publication, you will notice the use of note and caution notations. These notations are used to emphasize that safety hazards exist, and due care must be taken and observed.

**NOTE** An operational procedure, practice, or condition that is essential to emphasize.



**CAUTION** indicates a potentially hazardous situation which, if not avoided, might result in equipment damage.



**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or injury.

## 1.2 Radio Description

The XPR 7000e series portable radios are available in the following frequency ranges and power levels.

*Table 1-1. Radio Frequency Ranges and Power Levels*

Frequency Band	Bandwidth	Power Level
VHF	136–174 MHz	1 Watt or 5 Watt
UHF	403–512 MHz	1 Watt or 4 Watt
800/900 RX/TX Talk Around	851–870 MHz 935–941 MHz	1 Watt or 2.5 Watt
800/900 TX Trunking	806–825 MHz 896–902 MHz	1 Watt or 2.5 Watt

These digital radios are among the most sophisticated two-way radios available. They have a robust design for radio users who need high performance, quality, and reliability in their daily communications. This architecture provides the capability of supporting a multitude of legacy and advanced features resulting in a more cost-effective two-way radio communications solution.

### 1.2.1 Full Keypad Model



*Figure 1-1. Full Keypad Model*

- **ON/OFF/VOLUME KNOB** – Rotate clockwise until click is heard to turn on radio; rotate counter-clockwise until click is heard to turn off radio. Rotate clockwise to increase volume level; rotate counter-clockwise to decrease volume level.
- **LED INDICATORS** – Red, green and orange light-emitting diodes indicate operating status.
- **LCD (Liquid Crystal Display):**
  - 132x90 highly transfective color display provides visual information about many radio features.
- **MENU NAVIGATION KEYS** – Five keys to provide menu navigation and selection interface.
- **KEYPAD** – Twelve keys that allows the user to input characters for various text based operations. (For color display only)
- **FRONT BUTTONS and SIDE BUTTONS** – These five buttons are field programmable using the CPS.
- **CHANNEL SELECTOR KNOB** – Rotate clockwise to increment and counter clockwise to decrement the channel.
- **PUSH-TO-TALK (PTT)** – Press to execute voice operations (e.g. Group call and Private Call).
- **ANTENNA** – Provides the needed RF amplification when transmitting or receiving.
- **MICROPHONE** – Allows the voice to be sent when PTT or voice operations are activated.
- **UNIVERSAL CONNECTOR FOR ACCESSORIES** – Interface point for all accessories to be used with the radio. It has twelve points to which specific accessories will connect and be activated.
- **EMERGENCY BUTTON** – Turns on and off the Emergency Operations.

- 
- **SPEAKER** – Outputs all tones and audio that are generated by the radio (e.g. features like keypad tones and voice audio).

### 1.2.2 Non Keypad Model



*Figure 1-2. Non Keypad Model*

- **ON/OFF/VOLUME KNOB** – Rotate clockwise until click is heard to turn on radio; rotate counter-clockwise until click is heard to turn off radio. Rotate clockwise to increase volume level; rotate counter-clockwise to decrease volume level.
- **LED INDICATORS** – Red, green and orange light-emitting diodes indicate operating status.
- **SIDE BUTTONS** – These 3 buttons are field programmable using the CPS.
- **CHANNEL SELECTOR KNOB** – Rotate clockwise to increment and counter clockwise to decrement the channel.
- **PUSH-TO-TALK (PTT)** – Press to execute voice operations (e.g. Group call and Private Call).
- **ANTENNA** – Provides the needed RF amplification when transmitting or receiving.
- **MICROPHONE** – Allows the voice to be sent when PTT or voice operations are activated.
- **UNIVERSAL CONNECTOR FOR ACCESSORIES** – Interface point for all accessories to be used with the radio. It has twelve points to which specific accessories will connect to and be activated.
- **EMERGENCY BUTTON** – Turns on and off the Emergency Operations.
- **SPEAKER** – Outputs all tones and audio that are generated by the radio (e.g. features like keypad tones and voice audio).

## 1.3 Portable Radio Model Numbering Scheme

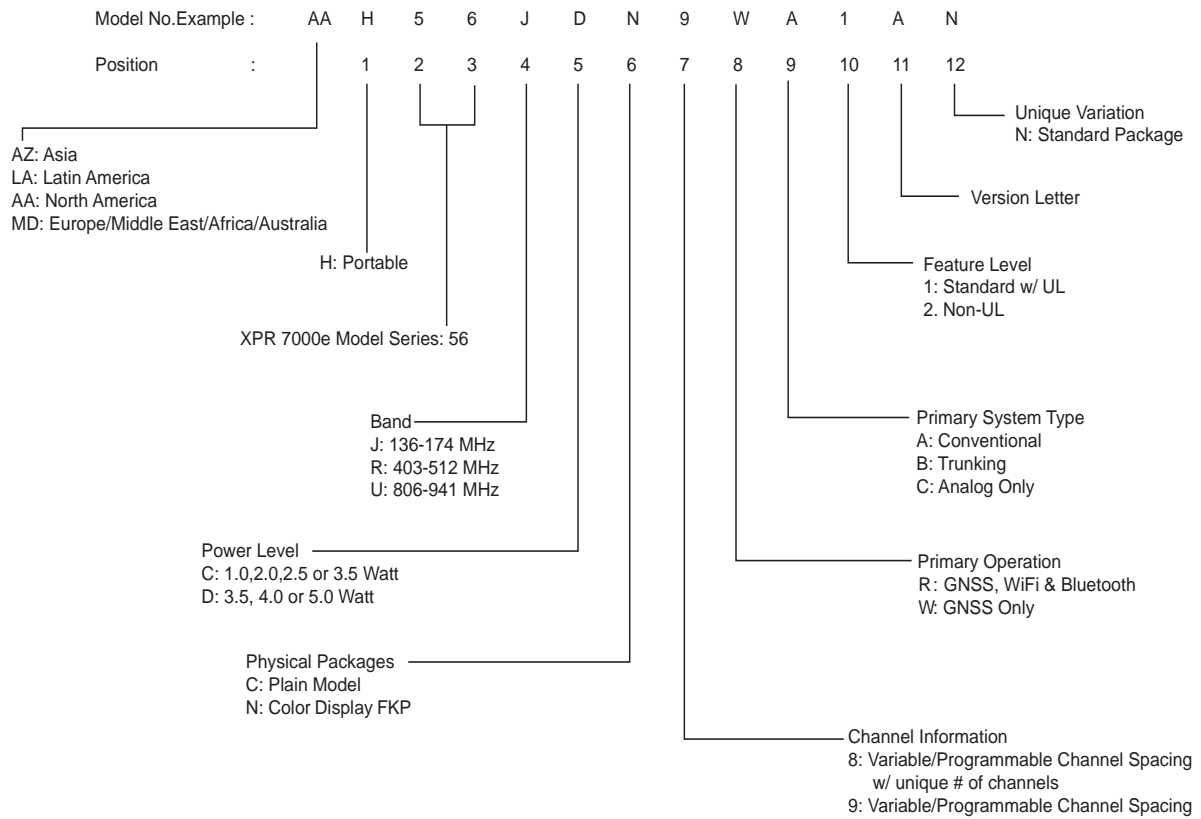


Figure 1-3. Portable Radio Model Numbering Scheme

## 1.4 Model Charts

### 1.4.1 VHF Model Chart

<b>XPR 7000e Series, VHF, 136–174 MHz</b>				
<b>Model</b>			<b>Description</b>	
AAH56JDN9RA1AN			XPR 7550e, 136–174 MHz, 5W, FKP, GNSS, Bluetooth, WiFi	
AAH56JDN9WA1AN			XPR 7550e, 136–174 MHz, 5W, FKP, GNSS, CFS Bluetooth, WiFi	
AAH56JDC9RA1AN			XPR 7350e, 136–174 MHz, 5W, NKP, GNSS, Bluetooth, WiFi	
			<b>Item</b>	<b>Description</b>
X	X		PMLD4727_S	BC Kit, 136–174 MHz, 5W, FKP with GNSS
		X	PMLD4729_S	BC Kit, 136–174 MHz, 5W, NKP with GNSS
X	X		PMLN7238_	Front Cover Kit, Roman Keypad, GNSS
		X	PMLN7239_	Front Cover Kit, NKP, GNSS
X	X	X	PMLN7324_S	Generic Option Board Kit
X	X	X	PMAD4117_	VHF Helical Antenna 136–155 MHz
X	X	X	PMAD4116_	VHF Helical Antenna 144–165 MHz
X	X	X	PMAD4118_	VHF Helical Antenna 152–174 MHz
X	X	X	PMAD4119_	VHF Stubby Antenna 136–148 MHz
X	X	X	PMAD4120_	VHF Stubby Antenna 146–160 MHz
X	X	X	PMAD4121_	VHF Stubby Antenna 160–174 MHz



## 1.4.2 UHF Model Chart

<b>XPR 7000e Series, UHF, 403–512MHz</b>				
<b>Model</b>			<b>Description</b>	
AAH56RDN9WA1AN			XPR 7550e, 403–512 MHz, 4W, FKP, GNSS, GNSS, CFS Bluetooth, WiFi	
AAH56RDN9RA1AN			XPR 7550e, 403–512 MHz, 4W, FKP, GNSS, Bluetooth, WiFi	
AAH56RDC9RA1AN			XPR 7350e, 403–512 MHz, 4W, NKP, GNSS, Bluetooth, WiFi	
			<b>Item</b>	<b>Description</b>
X	X		PMLE5064_S	BC Kit 403–512MHz, 4W, FKP with GNSS
		X	PMLE5066_S	BC Kit 403–512MHz, 4W, NKP with GNSS
X	X		PMLN7425_	Front Cover Kit, Roman Keypad, GNSS
		X	PMLN7239_	Front Cover Kit, NKP, GNSS
X	X	X	PMLN7324_S	Generic Option Board Kit
X	X	X	PMAE4069_	UHF Stubby Antenna 403–450 MHz
X	X	X	PMAE4070_	UHF Stubby Antenna 440–490 MHz
X	X	X	PMAE4071_	UHF Stubby Antenna 470–512 MHz
X	X	X	PMAE4079_	UHF Slim Whip Antenna 403–512 MHz

### 1.4.3 800/900 MHz Model Chart

<b>XPR 7000e Series, 800/900 MHz</b>				
<b>Model</b>			<b>Description</b>	
AAH56UCN9WB1AN			XPR 7580e 800/900 MHz, 2.5W, FKP, GNSS, CFS Bluetooth, WiFi	
AAH56UCN9RB1AN			XPR 7580e, 800/900 MHz, 2.5W, FKP, GNSS, Bluetooth, WiFi	
AAH56UCC9RB1AN			XPR 7380e 800/900 MHz, 2.5W, NKP, GNSS, Bluetooth, WiFi	
			Item	Description
X	X		PMLF4158_S	BC Kit 806–941 MHz, 2.5W, FKP, GNSS, BT, WiFi
		X	PMLF4160_S	BC Kit 806–941 MHz, 2.5W, NKP, GNSS, BT, WiFi
X	X		PMLN7238_	Front Cover Kit, Roman Keypad, GNSS
		X	PMLN7239_	Front Cover Kit, NKP, GNSS
X	X	X	PMAF4011_	800/900 MHz Whip Antenna 806–870 MHz
X	X	X	PMAF4012_	800/900 MHz Whip Antenna 896–941 MHz
X	X	X	PMAF4009_	800/900 Stubby Antenna 806–870 MHz
X	X	X	PMAF4010_	800/900 Stubby Antenna 896–941 MHz
X	X	X	PMLN7324_S	Generic Option Board Kit

## 1.5 Specifications

General	Full Keypad XPR 7550e/ XPR 7580e	Non Keypad XPR 7350e/ XPR 7380e
Channel Capacity	1000	32
Frequency	VHF: 136 – 174 MHz UHF: 403 – 512 MHz 800 Band: 806 – 825 MHz ; 851 – 870 MHz 900 Band: 896 – 902 MHz ; 935 – 941 MHz	
Dimensions (HxWxT) w/ PMNN4406_ Core Slim Li-Ion (1500 mAH)	130.3 x 55.2 x 35.8 mm	130.3 x 55.2 x 34.3 mm
Weight (w/ PMNN4493_ IMPRES Low Volt Li-Ion (1500 mAH) (w/ PMNN4489_ IMPRES TIA 4950 Hi-Cap Li-Ion (2900 mAH) (w/ PMNN4491_ Slim IMPRES (2100 mAH)	347g  402g 325g	322g  377g 300g
Power Supply	7.5V nominal	
FCC Description	VHF: AZ489FT7066 UHF: AZ489FT7065 8/900 MHz: AZ489FT7067	
IC Description	VHF: 109U-89FT7066 UHF: 109U-89FT7065 8/900 MHz: 109U-89FT7067	
Average battery life at 5/5/90 duty cycle with battery saver enabled in carrier squelch and transmitter in high power.		
Core Slim Li-Ion (1650 mAH)	Analog: 11.5 hrs Digital: 15.5 hrs	Analog: 11.5 hrs Digital: 15.5 hrs
IMPRES Hi-Cap Li-ion Non-FM (2250 mAH)	Analog: 16.0 hrs Digital: 21.0 hrs	Analog: 16.0 hrs Digital: 21.0 hrs
IMPRES Low Volt Hi-Cap Li-ion (3000 mAH)	Analog: 21.5 hrs Digital: 28.0 hrs	Analog: 21.5 hrs Digital: 28.0 hrs
IMPRES TIA 4950 Hi-Cap Li_Ion (2900 mAH)	Analog: 20.5 hrs Digital: 27.0 hrs	Analog: 20.5 hrs Digital: 27.0 hrs
IMPRES Li-Ion (2050 mAH)	Analog: 14.5 hrs Digital: 19.0 hrs	Analog: 14.5 hrs Digital: 19.0 hrs
IMPRES Hi-Cap Li-Ion FM (2300 mAH)	Analog: 16.0 hrs Digital: 21.5 hrs	Analog: 16.0 hrs Digital: 21.5 hrs
IMPRES Hi-Cap Li-Ion TIA4950 (2500 mAH)	Analog: 17.5 hrs Digital: 23.5 hrs	Analog: 17.5 hrs Digital: 23.5 hrs

### TIA 4950 UL Approval

MOTOTRBO XPR 7000e Series portable radios is certified by UL to standards ANSI/TIA 4950 and CAN/CSA C22.2 No. 157-92 as intrinsically safe for use in Class I, II, III, Division 1, Groups C, D, E, F, G, when properly equipped with a Motorola UL approved battery option. They are also approved for use in Class I, Division 2, Groups A, B, C, D.

**NOTE** Weight can have 5% margin of error

Receiver	Full Keypad XPR 7550e/ XPR 7580e	Non Keypad XPR 7350e/ XPR 7380e
Frequencies	VHF: 136 – 174 MHz UHF: 403 – 512MHz 800 Band: 851 – 870 MHz 900 Band: 935 – 941 MHz	
Channel Spacing	12.5 kHz/ 20 kHz*/ 25 kHz**	
Frequency Stability (-30°C to +60°C)	+/-0.5 ppm	
Analog Sensitivity (12 dB SINAD)	0.23 $\mu$ V (0.17 $\mu$ V typical) for VHF/UHF 0.25 $\mu$ V (0.19 $\mu$ V typical) for 800/900 MHz	
Digital Sensitivity (5% BER)	0.18 $\mu$ V (0.14 $\mu$ V typical) for VHF/UHF 0.22 $\mu$ V (0.18 $\mu$ V typical) for 800/900 MHz	
Intermodulation (TIA603C/D)	70 dB	
Adjacent Channel Selectivity TIA603 TIA603C/D	60 dB @ 12.5 kHz, 70 dB @ 20 kHz*/ 25 kHz** 45 dB @ 12.5 kHz, 70 dB @ 20 kHz*/ 25 kHz**	
Spurious Rejection (TIA603C/D)	70 dB	
Rated Audio	0.5 W	
Audio Distortion @ Rated Audio	5% (typical)	
Hum and Noise	-40 dB @ 12.5 kHz -45 dB @ 20 kHz*/ 25 kHz**	
Audio Response	TIA603C/D	
Conducted Spurious Emission (TIA603C/D)	-57 dBm	

**NOTE** \* 20 kHz not supported by 800/900 band.  
\*\* 25 kHz not supported by 900 band.

Transmitter	Full Keypad XPR 7550e/ XPR 7580e	Non Keypad XPR 7350e/ XPR 7380e
Frequencies	VHF: 136 – 174 MHz UHF: 403 – 512 MHz 800 Band: 806 – 825 MHz ; 851 – 870 MHz 900 Band: 896 – 902 MHz ; 935 – 941 MHz	
Channel Spacing	12.5 kHz/ 20 kHz* /25 kHz**	
Frequency Stability (-30°C to +60°C)	+/-0.5 ppm	
Power Output (Low Power)	1 W	
Power Output (High Power)	VHF: 5 W UHF: 4 W 8/900 MHz Band: 2.5 W	
Modulation Limiting	+/-2.5 kHz @ 12.5 kHz +/-4.0kHz @ 20 kHz* +/-5.0 kHz @ 25 kHz**	
FM Hum and Noise	-40 dB @ 12.5 kHz -45 dB @ 20 kHz*/25 kHz**	
Conducted / Radiated Emission	-36 dBm < 1GHz -30 dBm > 1GHz	
Adjacent Channel Power	60 dB @ 12.5 kHz 70 dB @ 20 kHz*/25 kHz**	
Audio Response	TIA603C/D	
Audio Distortion	3%	
FM Modulation	12.5 kHz: 11K0F3E 25 kHz: 16K0F3E	
4FSK Digital Modulation	12.5kHz Data: 7K60F1D & 7K60FXD 12.5kHz Voice: 7K60F1E & 7K60FXE Combination of 12.5kHz Voice and Data: 7K60F1W	
Digital Vocoder Type	AMBE+2™	
Digital Protocol	ETSI TS 102 361 -1,-2,-3	

**NOTE** \* 20 kHz not supported by 800/900 MHz band.

\*\* 25 kHz not supported by 900 MHz band.

VHF Self-Quieten Frequencies
138
139.2
144
148.8
150
151.17 ± 5kHz
153.6
156
158.4
160 ± 5kHz
162
163.2
168
172.8
174

UHF Self-Quieten Frequencies
417.6
422.4
432
436.8
451.2
460.8
470.4
475.2
480 ± 5kHz
484.8
489.6
499.2
500 ± 5kHz
504
504.32
505.345
508.8
514.56
518.4
519.25

800/900 MHz Self-Quieten Frequencies
864 MHz
936 MHz
940.8 MHz

GNSS	Full Keypad XPR 7550e/ XPR 7580e	Non Keypad XPR 7350e/ XPR 7380e
TTFF (Time To First Fix) Cold Start @ -130dBm (95%)	≤ 60 seconds	
TTFF (Time To First Fix) Hot Start @ -130dBm (95%)	≤ 10 seconds	
Horizontal Accuracy (2D Accuracy) Cold Start	< 5 meters	
Accuracy specs are for long-term tracking (95th percentile values > 5 satellites visible at a nominal -130 dBm signal strength)		

<b>Bluetooth®</b>	<b>Full Keypad XPR 7550e/ XPR 7580e</b>	<b>Non Keypad XPR 7350e/ XPR 7380e</b>
Version	Supports Bluetooth 4.0LE + EDR Specification	
Range	Class 2, 10 meters	

Military Standards										
Applicable MIL-STD	810C		810D		810E		810F		810G*	
	Methods	Procedures	Methods	Procedures	Methods	Procedures	Methods	Procedures	Methods	Procedures
Low Pressure	500.1	I	500.2	II	500.3	II	500.4	II	500.5	II
High Temperature	501.1	I, II	501.2	I/A1, II/A1	501.3	I/A1, II/A1	501.4	I/Hot, II/Hot	501.5	I/A1, II/A1
Low Temperature	502.1	I	502.2	I/C3, II/C1	502.3	I/C3, II/C1	502.4	I/C3, II/C1	502.5	I/C3, II/C1
Temperature Shock	503.1	I	503.2	A1/C3	503.3	A1/C3	503.4	I	503.5	I-C
Solar Radiation	505.1	II	505.2	I/Hot-Dry	505.3	I/Hot-Dry	505.4	I/Hot-Dry	505.5	I/A1
Rain	506.1	I, II	506.2	I, II	506.3	I, II	506.4	I, III	506.5	I, III
Humidity	507.1	II	507.2	II/Hot-Humid	507.3	II/Hot-Humid	507.4	—	507.5	I/Hot-Humid
Salt fog	509.1	I	509.2	I	509.3	I	509.4	—	509.5	—
Dust	510.1	I, II	510.2	I, II	510.3	I, II	510.4	I, II	510.5	I, II
Vibration	514.2	VIII/Cat F, Curve-W, XI	514.3	I/Cat10, II/Cat3	514.4	I/Cat10, II/Cat3	514.5	I/Cat24, II/Cat5	514.6	I/Cat24, II/Cat5
Shock	516.2	I, II	516.3	I, IV	516.4	I, IV	516.5	I, IV	516.6	I, IV

**NOTE** \*Tested to MIL standard G which supersedes previous version



Environmental Specifications	
Operating Temperature*	-30 °C to +60 °C
Storage Temperature	-40 °C to +85 °C
Thermal Shock	Per MIL-STD
Humidity	Per MIL-STD
ESD	IEC 61000-4-2 Level 4
Water Intrusion	IEC 60529 -IP68, 6.6 ft (2 m) for 2 hours
Salt Fog	Per MIL-STD
Packaging Test	MIL-STD 810D and E

\* Operating temperature specification with Li-Ion battery is -10 °C to +60 °C.  
Operating temperature specification with NiMH battery is -20 °C to +60 °C.

**NOTE** This product meets IP\*68 as defined by Motorola Solutions ie submersion to a depth of 2 meters for 2 hours duration in tap water (or any source of clean freshwater)

\*The IP (Ingress Protection) rating is an international standard for gauging the level of resistance of dust and water intrusion of a device. The first digit in the two-digit IP code provides information on the level of protection against solid objects, including dust. The second digit indicates the resistance against water intrusion. The IP rating specified in Motorola Solutions' devices are certified and independently tested to meet this standard. These devices are tested in accordance with the IP standard and with appropriate ports and external electrical connections being firmly closed by covers, bumpers or external antenna. Minor discoloration on electrical contact surfaces can be expected with no impact to functional performance. Abuse and improper use of devices will invalidate warranty claims. For more information, see specific device basic operation manual and service manual.

## **Notes**

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## Chapter 2 Test Equipment and Service Aids

### 2.1 Recommended Test Equipment

The list of equipment contained in Table 2-1 includes most of the standard test equipment required for servicing Motorola portable radios.

*Table 2-1. Recommended Test Equipment*

Equipment	Characteristics	Example	Application
Service Monitor	Can be used as a substitute for items marked with an asterisk (*)	Aeroflex 3920 ( <a href="http://www.aeroflex.com">www.aeroflex.com</a> ),	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
Digital RMS Multimeter *	100 $\mu$ V to 300 V 5 Hz to 1 MHz 10 Mega Ohm Impedance	Fluke 179 or equivalent ( <a href="http://www.fluke.com">www.fluke.com</a> )	AC/DC voltage and current measurements. Audio voltage measurements
RF Signal Generator *	100 MHz to 1 GHz -130 dBm to +10 dBm FM Modulation 0 kHz to 10 kHz Audio Frequency 100 Hz to 10 kHz	Agilent N5181A ( <a href="http://www.agilent.com">www.agilent.com</a> ), Ramsey RSG1000B ( <a href="http://www.ramseyelectronics.com">www.ramseyelectronics.com</a> ), or equivalent	Receiver measurements
Oscilloscope *	2 Channel 50 MHz Bandwidth 5 mV/div to 20 V/div	Leader LS8050 ( <a href="http://www.leaderusa.com">www.leaderusa.com</a> ), Tektronix TDS1001b ( <a href="http://www.tektronix.com">www.tektronix.com</a> ), or equivalent	Waveform measurements
Power Meter and Sensor *	5% Accuracy 100 MHz to 500 MHz 50 Watts	Bird 43 Thruline Watt Meter ( <a href="http://www.bird-electronic.com">www.bird-electronic.com</a> ) or equivalent	Transmitter power output measurements
RF Millivolt Meter	100 mV to 3 V RF 10 kHz to 1 GHz	Boonton 92EA ( <a href="http://www.boonton.com">www.boonton.com</a> ) or equivalent	RF level measurements
Power Supply	0 V to 32 V 0 A to 20 A	B&K Precision 1790 ( <a href="http://www.bkprecision.com">www.bkprecision.com</a> ) or equivalent	Voltage supply

## 2.2 Service Aids

Table 2-2 lists the service aids recommended for working on the radio. While all of these items are available from Motorola, most are standard workshop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

*Table 2-2. Service Aids*

Motorola Part No.	Description	Application
RLN4460_	Portable Test Set	Enables connection to the audio/accessory jack. Allows switching for radio testing.
RVN5115_	Customer Programming Software on CD-ROM	Allows servicer to program radio parameters, tune and troubleshoot radios.
PMKN4012B*	Portable Programming Cable	This cable connects the radio to a USB port for radio programming and data applications.
PMKN4013C*	Portable Programming, Testing & Alignment Cable	This cable connects the radio to a USB port for radio programming, testing and alignment.
PMNN4428_	7.5V Universal Battery Eliminator	Connects to radio via battery eliminator cable.
PMLN6154_	RF Adaptor	Adapts radio's antenna port to SMA cabling of test equipment.
PMLN6422_	RF Cable	This cable measures RF related measurements.
TL000015A01	Chassis and Knob Opener	Enables the removal of chassis from radio housing.
PMLN6155_	RF Adaptor Holder	Holds RF connector to radio.
NLN9839_	Vacuum Pump Kit	Allows servicer to test for leakages.
NTN4265_	Pressure Pump Kit	Allows servicer to locate leakages.
5871134M01	Connector Fitting	This connector allows the vacuum hose to be connected to the radio chassis.
3271133M01	Fitting Seal	This seal secures the connector fitting to the radio chassis.

\*Earlier versions of programming cables will not work with the radio.

## 2.3 Programming, Testing and Alignment Cable

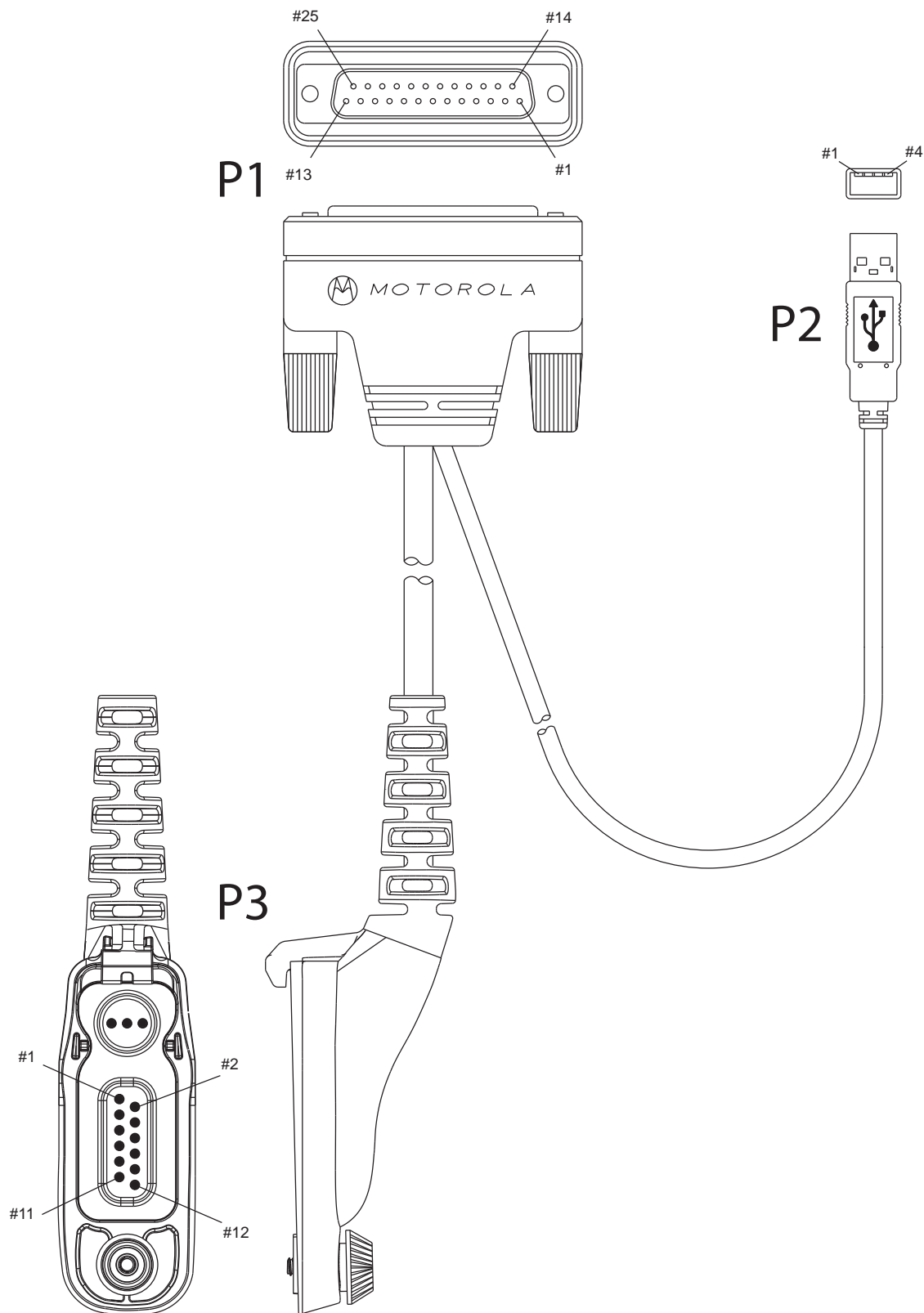


Figure 2-1. Programming, Testing and Alignment Cable

Table 2-3. Pin Configuration of Side Connector

CONNECTION			
P1	P2	P3	
Pin	Pin	Pin	Function
		1	GROUND
	1	3	VCC (5V)
	3	4	DATA+
	2	5	DATA-
16	4	6	GROUND
1 & 5		7	EXTERNAL SPEAKER+
2 & 7		8	EXTERNAL SPEAKER-
20		9	EXTERNAL PTT
17		10	EXTERNAL MIC+
16		11	EXTERNAL MIC-

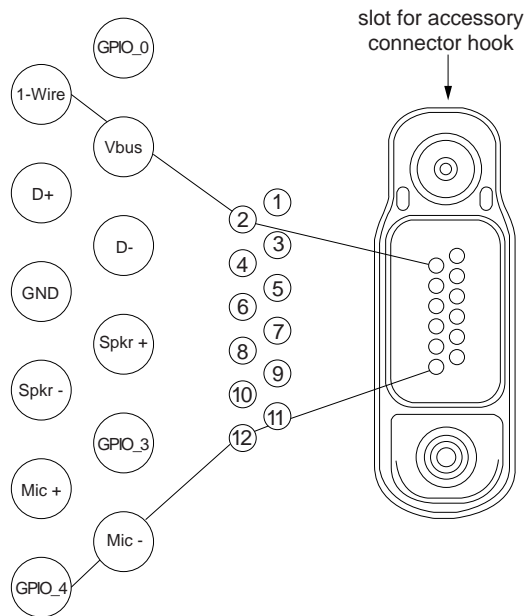


Figure 2-2. Pin Layout of Side Connector

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## Chapter 3 Transceiver Performance Testing


### 3.1 General

These radios meet published specifications through their manufacturing process by utilizing high-accuracy laboratory-quality test equipment. The recommended field service equipment approaches the accuracy of the manufacturing equipment with few exceptions. This accuracy must be maintained in compliance with the manufacturer's recommended calibration schedule.

Although these radios function in digital and analog modes, all testing is done in analog mode.

### 3.2 Setup

Supply voltage is provided using a 7.5 VDC power supply. The equipment required for alignment procedures is connected as shown in the Radio Tuning Equipment Setup Diagram, Figure 4-2.

 WARNING	<b>Do NOT use any form of connector, e.g. wires, crocodile clips, and probes, to supply voltage to the radio, other than the Motorola approved battery eliminator.</b>
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Initial equipment control settings should be as indicated in Table 3-1. The remaining tables in this chapter contain the following related technical data:

Table Number	Title
3-2	Front Panel Access Test Mode Displays
3-3	Test Environments
3-4	Test Frequencies
3-5	Transmitter Performance Checks
3-6	Receiver Performance Checks

*Table 3-1. Initial Equipment Control Settings*

Service Monitor	Power Supply	Test Set
Monitor Mode: Power Monitor	Voltage: 7.5Vdc	Speaker set: A
RF Attn: -70	DC on/standby: Standby	Speaker/load: Speaker
AM, CW, FM: FM	Volt Range: 10V	PTT: OFF

*Table 3-1. Initial Equipment Control Settings*

Service Monitor	Power Supply	Test Set
Oscilloscope Source: Mod Oscilloscope Horizontal: 10mSec/Div Oscilloscope Vertical: 2.5kHz/Div Oscilloscope Trigger: Auto Monitor Image: Hi Monitor Bandwidth: Narrow Monitor Squelch: Middle setting Monitor Vol: 1/4 setting	Current: 2.5A	



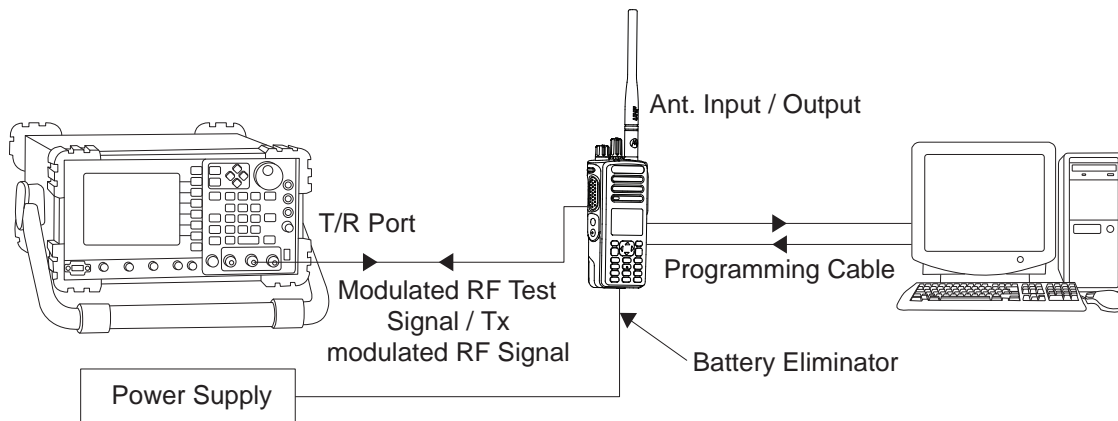
**Setup:**

Set up the DMR Transmitter and Receiver Test as per Figure 3-1.

- a. Connect the Programming cable to the radio and to the computer.
- b. Remove RF plug (orange) as shown in Figure 4-3, on page 4-3
- c. Connect the RF antenna adaptor to the 50 Ohm RF Input/Output port of the radio.

Connect the other end of the RF antenna adaptor to the T/R port of the Radio Test Set 3920 using the RF cable shown in Figure 3-1.

See "RF Adaptor Assembly" on page 4-3 for complete RF Adaptor Assembly steps.



*Figure 3-1. DMR Radio Transmitter and Receiver Testing Setup*

### 3.3 Display Model Test Mode

#### 3.3.1 Entering Display Radio Test Mode

1. Turn the radio on.
2. Within 10 seconds after Self Test is complete, press **Side Button 2** five times in succession
3. The radio beeps and will show a series of displays that will give information regarding various version numbers and subscriber specific information. The displays are described in Table 3-2.

Table 3-2. Front Panel Access Test Mode Displays

Name of Display	Description	Appears
Service Mode	The literal string indicates the radio has entered test mode.	Always
Host Version	The version of host firmware.	Always
DSP Version	The version of DSP firmware.	Always
Model Number	The radio's model number as programmed in the codeplug.	Always
MSN	The radio's serial number as programmed in the codeplug.	Always
FLASHCODE	The FLASH codes as programmed in the codeplug.	Always
RF Band	The radio's band.	Always

**NOTE** The radio stops at each display for 2 seconds before moving to the next information display. If the information cannot fit into 1 line, the radio display scrolls automatically character by character after 1 second to view the whole information. If the Left Navigation Key (◀) is pressed before the last information display, the radio shall suspend the information display until the user presses Right Navigation Key (▶) to resume the information display. The radio beeps for each button press. After the last display, RF Test Mode will be displayed.

#### 3.3.2 LCD Flicker Test Mode

1. Press and hold side button 1 to access the flicker test. A black screen will appear on the display.
2. The screen will remain black for a properly functioning display.
3. If there is any flickering, send to the service depot to be fixed.
4. Press and hold side button one for 2 seconds to be taken to the LCD Display test mode.

#### 3.3.3 LCD Display Test Mode

1. Press any button to test the LCD display, press button ▶ until the display are fixed. Then, press and hold the first side button until the screen change.
2. Upon key ▶ press, the housing shall display a White screen with 2 pixels wide of a black border inset from the edge by 2 pixels and the text "Display Test Mode" in black.
3. Upon key ▶ press, the housing shall display a Black screen with 2 pixels wide of a White boarder inset from the edge by 2 pixels and the text "Display Test Mode" in White.
4. Upon key ▶ press, the housing shall display a full screen in Red.

5. Upon key ► press, the housing shall display a full screen in Green.
6. Upon key ► press, the housing shall display a full screen in Blue.
7. Upon key ► press, the housing shall display the growing horizontal bars with a cyclic color of Red>Green>Blue>Black>Red>Green>Blue>Black>Red (Full Screen).
8. Upon key ► press, the housing shall display the growing vertical bars with a cyclic color of Red>Green>Blue>Black>Red>Black (Full Screen).

### 3.3.4 RF Test Mode

When the radio is operating in its normal environment, the radio's microcontroller controls the RF channel selection, transmitter key-up, and receiver muting, according to the customer codeplug configuration. However, when the unit is on the bench for testing, alignment, or repair, it must be removed from its normal environment via a special routine, called **TEST MODE** or air test.

In RF Test Mode, the display upon the first line is "RF Test", together with the power level icon at the right end of the first line. The display upon the second line is the test environment, the channel number and channel spacing. The default test environment is CSQ.

1. Each short press of **Side Button 2** changes the test environment (CSQ->TPL->DIG->USQ ->CSQ). The radio beeps once when radio toggles to CSQ, beeps twice for TPL, beeps three times for DIG and beeps four times for USQ.

**NOTE** DIG is digital mode and other test environments are analog mode as described in Table 3-3.

Table 3-3. Test Environments

No. of Beeps	Description	Function
1	Carrier Squelch (CSQ)	RX: if carrier detected TX: mic audio
2	Tone Private-Line (TPL)	RX: unsquelch if carrier and tone detected TX: mic audio + tone
3	Digital Mode (DIG)	RX: if carrier detected TX: mic audio
4	Unsquelch (USQ)	RX: constant unsquelch TX: mic audio

2. Each short press of **Side Button 1** toggles the channel spacing between 25 kHz, 12.5 kHz and 20 kHz as. The radio beeps once when radio toggles to 20kHz, beeps twice for 25 kHz and beeps three times for 12.5 kHz.
3. Turning of the **Channel Knob** changes the test channel from 1 to 16 as described in Table 3-4. The radio beeps in each position.

Channel Selector Switch Position	Test Channel	UHF	VHF	800/900 MHz Band
1 Low Power 9 High Power	TX#1 or #9 RX#1 or #9	403.15 403.15	136.075 136.075	855.725 855.725
2 Low Power 10 High Power	TX#2 or #10 RX#2 or #10	423.25 423.25	142.575 142.575	865.225 865.225
3 Low Power 11 High Power	TX#3 or #11 RX#3 or #11	444.35 444.35	146.575 146.575	936.025 936.025
4 Low Power 12 High Power	TX#4 or #12 RX#4 or #12	465.45 465.45	155.575 155.575	939.925 939.925
5 Low Power 13 High Power	TX#5 or #13 RX#5 or #13	485.55 485.55	161.575 161.575	806.175 851.025
6 Low Power 14 High Power	TX#6 or #14 RX#6 or #14	506.65 506.65	167.575 167.575	824.925 860.525
7 Low Power 15 High Power	TX#7 or #15 RX#7 or #15	526.75 526.75	173.975 173.975	896.175 869.925
8 Low Power 16 High Power	TX#8 or #16 RX#8 or #16	527.00 527.00	174.000 174.000	901.925 940.925

Table 3-5. Transmitter Performance Checks

Test Name	Communications Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency* Monitor: Frequency error Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch	PTT to continuously transmit (during the performance check)	Frequency error to be $\pm 68\text{Hz}$ for VHF $\pm 201\text{Hz}$ for UHF $\pm 403\text{Hz}$ for 800/900 MHz
Power RF	As above	As above	As above	Low Power: 0.9 – 1.5W (VHF/300/MHz Band/UHF) 0.9 – 1.5W (800/900) High Power: 4.0 – 4.8W (UHF/300/MHz Band) 2.4 – 3.0W (800/900) High Power: 5.0 – 5.8W (VHF)
Voice Modulation	Mode: PWR MON 4th channel test frequency* atten to -70, input to RF In/Out Monitor: DVM: AC Volts Set 1kHz Mod Out level for 0.025Vrms at test set, 80mVrms at AC/DC test set jack	As above	As above, meter selector to mic	Deviation: $\geq 4.0\text{ kHz}$ but $\leq 5.0\text{ kHz}$ (25 kHz Ch Sp).
Voice Modulation (internal)	Mode: PWR MON 4th channel test frequency* atten to -70, input to RF In/Out	TEST MODE, Test Channel 4 carrier squelch output at antenna	Remove modulation input	Press PTT switch on radio. Say “four” loudly into the radio mic. Measure deviation: $\geq 4.0\text{ kHz}$ but $\leq 5.0\text{ kHz}$ (25 kHz Ch Sp)
TPL Modulation	As above 4th channel test frequency* BW to narrow	TEST MODE, Test Channel 4 TPL	As above	Deviation: $\geq 500\text{Hz}$ but $\leq 1000\text{Hz}$ (25 kHz Ch Sp).
RF Power	DMR mode. Slot 1 Power and Slot 2 Power	TEST MODE, Digital Mode, transmit without modulation	Key up radio without modulation using Tuner	TTR Enable is needed and IFR to be set to trigger mode with signal level ~1.5V

Table 3-5. Transmitter Performance Checks (Continued)

Test Name	Communications Analyzer	Radio	Test Set	Comments
FSK Error	DMR Mode. FSK Error	TEST MODE, Digital Mode, transmit with O153 test pattern	Key up radio with O513 test pattern modulation using Tuner	Not Exceed 5%
Magnitude Error	DMR Mode. Magnitude error	As above	As above	Not Exceed 1%
Symbol Deviation	DMR Mode. Symbol Deviation	As above	As above	Symbol Deviation should be within 648Hz +/- 10% and 1944Hz +/- 10%
Transmitter BER	DMR Mode	As above	As above	Transmitter BER should be 0%

\* See Table 3-4

Table 3-6. Receiver Performance Checks

Test Name	Communications Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency* Monitor: Frequency error Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch output at antenna	PTT to continuously transmit (during the performance check)	Frequency error to be $\pm 68\text{Hz}$ for VHF $\pm 201\text{Hz}$ for UHF $\pm 403\text{Hz}$ for 800/900 MHz
Rated Audio	Mode: GEN Output level: 1.0mV RF 6th channel test frequency* Mod: 1kHz tone at 3kHz deviation Monitor: DVM: AC Volts	TEST MODE Test Channel 6 carrier squelch	PTT to OFF (center), meter selector to Audio PA	Set volume control to 2.83 Vrms
Distortion	As above, except to distortion	As above	As above	Distortion <3.0%
Sensitivity (SINAD)	As above, except SINAD, lower the RF level for 12dB SINAD.	As above	PTT to OFF (center)	RF input to be <0.23 $\mu\text{V}$ for VHF/UHF <0.25 $\mu\text{V}$ for 800/900 MHz
Noise Squelch Threshold (only radios with conventional system need to be tested)	RF level set to 1mV RF	As above	PTT to OFF (center), meter selection to Audio PA, speaker/load to speaker	Set volume control to 2.83Vrms
	As above, except change frequency to a conventional system. Raise RF level from zero until radio unsquelches.	Out of TEST MODE; select a conventional system	As above	Unsquelch to occur at <0.25 $\mu\text{V}$ . Preferred SINAD = 9 – 10dB
Receiver BER	IFR DMR mode. Signal generator with 1031 test pattern	Test Mode, Digital Mode, receive 1031 test pattern	Read BER using Tuner. Adjust RF level to get 5% BER	RF level to be <0.35 $\mu\text{V}$ for 5% BER
Receiver Rated Audio	IFR DMR Mode. Signal generator with 1031 test pattern	Test Mode, Digital Mode, receive 1031 test pattern	RF level = -47dBm. Set audio analyzer to read Vrms. Adjust volume to get rated audio	Adjust volume until Vrms = 2.83V
Receiver Audio Distortion	IFR DMR Mode. Signal generator with 1031 test pattern	As above	As above. Then set audio analyzer to measure distortion	Not exceed 5%

\* See Table 3-4

### 3.3.5 LED Test Mode

1. Press and hold **Side Button 1** after Display Test Mode. The radio beeps once and displays "LED Test Mode".
2. Upon any button/key press, the radio lights the red LED and displays "Red LED On".
3. Consequently, upon any button/key press, the red LED is turned off and the radio lights the green LED and displays "Green LED On".
4. Upon any successive button/key press, the green LED is turned off, and the radio shall light both LEDs up while displaying "Both LEDs On". Since there is only one LED on the portable, the LED color will be orange when the radio lights both LEDs.

### 3.3.6 Accelerometer Test

1. Long press **Side Button 1**, the radio will enter accelerometer test mode and the display will show Accelerometer Test Mode.
2. Hold the radio horizontally and press OK button
3. The display will show Accelerometer Test Passed or Accelerometer Test Failed accordingly.

### 3.3.7 Backlight Test Mode

1. Press and hold **Side Button 1** after LED Test Mode. The radio beeps once and displays "Backlight Test Mode".
2. The radio turns on both LCD and keypad backlight together.

### 3.3.8 Speaker Tone Test Mode

1. Press and hold **Side Button 1** after Backlight Test Mode. The radio beeps once and displays "Speaker Tone Test Mode".
2. The radio generates a 1 KHz tone with the internal speaker.

### 3.3.9 Earpiece Tone Test Mode

1. Press and hold **Side Button 1** after Speaker Tone Test Mode. The radio beeps once and displays "Earpiece Tone Test Mode".
2. The radio generates a 1 KHz tone with the earpiece.

### 3.3.10 Audio Loopback Earpiece Test Mode

1. Press and hold **Side Button 1** after Earpiece Tone Test Mode. The radio beeps once and displays "Audio Loopback Earpiece Test Mode".
2. The radio shall route any audio on the external mic to the earpiece.



### 3.3.11 Battery Check Test Mode

1. Press and hold **Side Button 1** after Audio Loopback Earpiece Test Mode. The radio beeps once and momentarily displays "Battery Check Test Mode".
2. The radio will display the following:

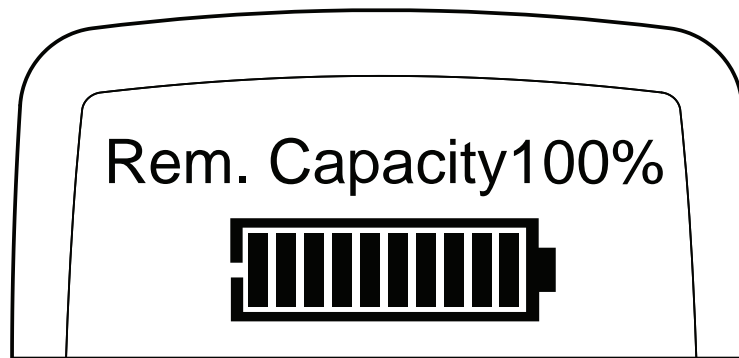


Figure 3-2. Battery Check Test Mode Display

### 3.3.12 Button/Knob/PTT Test Mode

1. Press and hold **Side Button 1** after Battery Check Test Mode. The radio beeps once and displays "Button Test"(line 1).
2. Rotate the **Volume Knob**; "2/1" through "2/255" appears. The radio beeps at each position.
3. Rotate the **Channel Knob**; When rotate the channel knob in clockwise, "4/1" appear. When rotate the channel knob in counter clockwise, "4/-1" appear. The radio beeps at each position.
4. Press **Side Button 1**; "96/1" appears & radio beeps; release, "96/0" appears & radio beeps.
5. Press **Side Button 2**; "97/1" appears & radio beeps; release, "97/0" appears & radio beeps.
6. Press **Side Button 3**; "98/1" appears & radio beeps; release, "98/0" appears & radio beeps.
7. Press the **PTT Switch**; "1/1" appears & radio beeps; release, "1/0" appears & radio beeps.
8. Press **Top Button**; "148/1" appears & radio beeps; release, "148/0" appears & radio beeps.
9. Keypad Checks:
  - Press **0**, "48/1" appears & radio beeps; release, "48/0" appears & radio beeps.
  - Press **1**, "49/1" appears & radio beeps; release, "49/0" appears & radio beeps.
  - Press **2**, "50/1" appears & radio beeps; release, "50/0" appears & radio beeps.
  - Press **3**, "51/1" appears & radio beeps; release, "51/0" appears & radio beeps.
  - Press **4**, "52/1" appears & radio beeps; release, "52/0" appears & radio beeps.
  - Press **5**, "53/1" appears & radio beeps; release, "53/0" appears & radio beeps.
  - Press **6**, "54/1" appears & radio beeps; release, "54/0" appears & radio beeps.
  - Press **7**, "55/1" appears & radio beeps; release, "55/0" appears & radio beeps.
  - Press **8**, "56/1" appears & radio beeps; release, "56/0" appears & radio beeps.
  - Press **9**, "57/1" appears & radio beeps; release, "57/0" appears & radio beeps.
  - Press **\***, "58/1" appears & radio beeps; release, "58/0" appears & radio beeps.
  - Press **#**, "59/1" appears & radio beeps; release, "59/0" appears & radio beeps.
  - Press **P1**, "160/1" appears & radio beeps; release, "160/0" appears & radio beeps.
  - Press **P2**, "161/1" appears & radio beeps; release, "161/0" appears & radio beeps.
  - Press **MENU**, "85/1" appears & radio beeps; release, "85/0" appears & radio beeps.

- Press **BACK**, "129/1" appears & radio beeps; release, "129/0" appears & radio beeps.
- Press ◀, "128/1" appears & radio beeps; release, "128/0" appears & radio beeps.
- Press ▶, "130/1" appears & radio beeps; release, "130/0" appears & radio beeps.
- Press ▲, "135/1" appears & radio beeps; release, "135/0" appears & radio beeps.
- Press ▼, "136/1" appears & radio beeps; release, "136/0" appears & radio beeps.

## 3.4 Non-Display Model Test Mode

### 3.4.1 Entering Non-Display Radio Test Mode

1. Turn the radio on.
2. Within 10 seconds after “Self Test” is complete, press **Side Button 2** five times in succession.
3. The radio beeps.

### 3.4.2 RF Test Mode

When the radio is operating in its normal environment, the radio's microcontroller controls the RF channel selection, transmitter key-up, and receiver muting, according to the customer codeplug configuration. However, when the unit is on the bench for testing, alignment, or repair, it must be removed from its normal environment via a special routine, called **TEST MODE** or “air test”.

1. Each short press of **Side Button 2** changes the test environment (CSQ->TPL->DIG->USQ ->CSQ). The radio beeps once when radio toggles to CSQ, beeps twice for TPL, beeps three times for DIG and beeps four times for USQ.

**NOTE** DIG is digital mode and other test environments are analog mode as described in Table 3-3.

2. Each short press of **Side Button 1** toggles the channel spacing between 25 KHz, 12.5 KHz and 20 KHz as. The radio beeps once when radio toggles to 20KHz, beeps twice for 25KHz and beeps three times for 12.5KHz.
3. Turning of the **Channel Knob** changes the test channel from 1 to 16 as described in Table 3-4. The radio beeps in each position.

### 3.4.3 LED Test Mode

1. Press and hold **Side Button 1** in RF Test Mode. The radio beeps once.
2. Upon any button/key press, the radio lights up the red LED.
3. Consequently, upon any button/key press, the red LED is turned off and the radio turns on the green LED.
4. Consequently, upon any button/key press, the green LED is turned off the radio shall turn on both LEDs.

### 3.4.4 Speaker Tone Test Mode

1. Press and hold **Side Button 1** after LED Test Mode. The radio beeps once.
2. The radio generates a 1 KHz tone with the internal speaker.

### 3.4.5 Earpiece Tone Test Mode

1. Press and hold **Side Button 1** after Speaker Tone Test Mode. The radio beeps once.
2. The radio generates a 1 KHz tone with the earpiece.

### 3.4.6 Audio Loopback Earpiece Test Mode

1. Press and hold **Side Button 1** after Earpiece Tone Test Mode. The radio beeps once.
2. The radio shall route any audio on the external mic to the earpiece.

### 3.4.7 Battery Check Test Mode

1. Press and hold **Side Button 1** after Audio Loopback Earpiece Test Mode. The radio beeps once.
2. The radio LED lights up accordingly; green LED for High Battery Level, orange LED for Mid Battery Level and blinking red LED for Low Battery Level.

### 3.4.8 Button/Knob/PTT Test Mode

1. Press and hold **Side Button 1** after Battery Check Test Mode. The radio beeps once.
2. Rotate the **Volume Knob**; the radio beeps at each position.
3. Rotate the **Channel Knob**; the radio beeps at each position.
4. Press **Side Button 1**; the radio beeps; release, the radio beeps.
5. Press **Side Button 2**; the radio beeps; release, the radio beeps.
6. Press **Side Button 3**; the radio beeps; release, the radio beeps.
7. Press the **PTT Switch**; the radio beeps; release, the radio beeps.
8. Press **Top Button**; the radio beeps; release, the radio beeps.

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## Chapter 4 Radio Programming and Tuning

### 4.1 Introduction

This chapter provides an overview of the MOTOTRBO Customer Programming Software (CPS), as well as the Tuner and AirTracer applications, which are all designed for use in a Windows 8/72000/XP environment. These programs are available in one kit as listed in Table 4-1. An Installation Guide is also included with the kit.

**NOTE** Refer to the appropriate program on-line help files for the programming procedures.

*Table 4-1. Software Installation Kits Radio Tuning Setup*

Description	Part Number
MOTOTRBO CPS, Tuner and AirTracer Applications CD	RVN5115

### 4.2 Customer Programming Software Setup

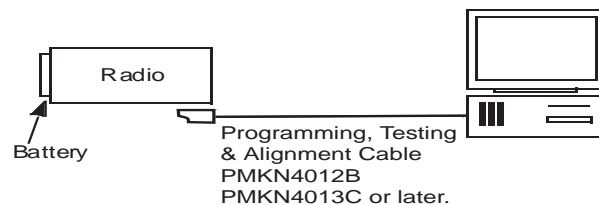
The CPS programming setup, shown in Figure 4-1 is used to program the radio.

**NOTE** Refer to appropriate program on-line help files for the programming procedures.



**Caution**

Computer USB ports can be sensitive to Electrostatic Discharge. Do not touch exposed contacts on cable when connected to a computer.



*Figure 4-1. CPS Programming Setup*

### 4.3 AirTracer Application Tool

The MOTOTRBO AirTracer application tool has the ability to capture over-the-air digital radio traffic and save the captured data into a file. The AirTracer application tool can also retrieve and save internal error logs from MOTOTRBO radios. The saved files can be analyzed by trained Motorola personnel to suggest improvements in system configurations or to help isolate problems.

### 4.4 Radio Tuning Setup

A personal computer (PC), Windows 2000/XP/Windows 7 and a tuner program are required to tune

**NOTE** Refer to appropriate program on-line help files for the programming procedures.

the radio. To perform the tuning procedures, the radio must be connected to the PC, radio interface box (RIB), and test equipment setup as shown in Figure 4-2.

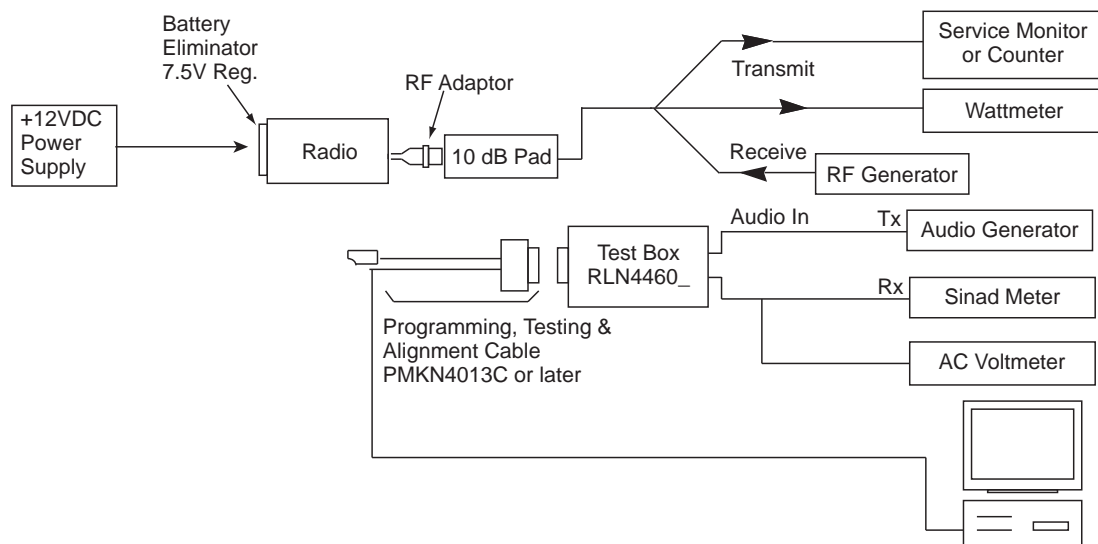
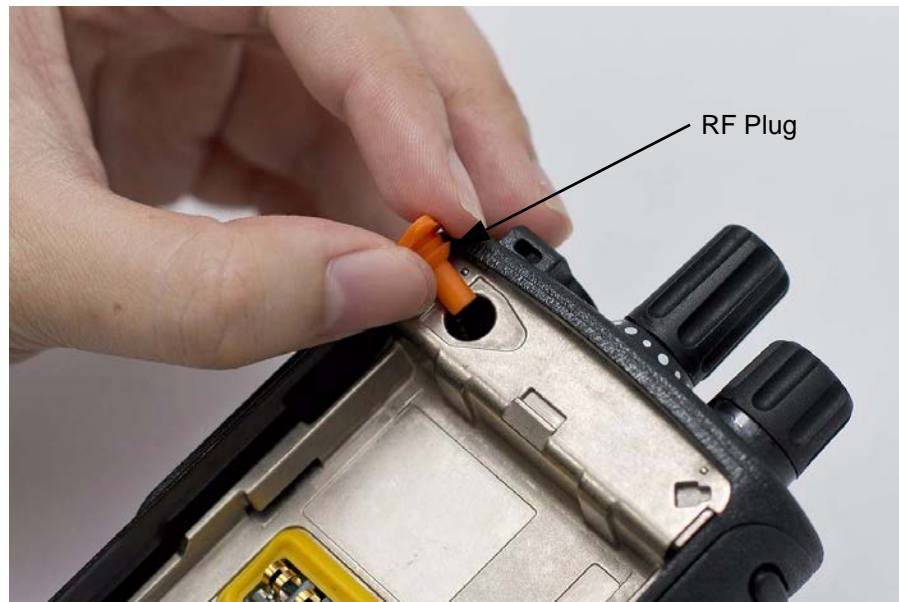


Figure 4-2. Radio Tuning Equipment Setup

## 4.5 RF Adaptor Assembly

1. Remove the RF plug.



*Figure 4-3. RF Plug removal*

2. Align RF Adaptor Holder to the antenna opening of the housing. The RF Adaptor Holder should fit snugly around the outer wall of the antenna opening.



*Figure 4-4. RF Adaptor holder*

3. Fasten the screw provided to hold the RF Adaptor in place.



*Figure 4-5. RF Adaptor screw*

4. Slot the RF Connector into the RF Adaptor Holder slot.



*Figure 4-6. RF Adaptor complete assembly*



## Chapter 5 Disassembly/Reassembly Procedures

### 5.1 Introduction

This chapter provides details about the following:

- Preventive maintenance (inspection and cleaning).
- Safe handling of CMOS and LDMOS devices.
- Disassembly and reassembly of the radio.
- Repair procedures and techniques.

### 5.2 Preventive Maintenance

Periodic visual inspection and cleaning is recommended.

#### 5.2.1 Inspection

Check that the external surfaces of the radio are clean, and that all external controls and switches are functional. It is not recommended to inspect the interior electronic circuitry.

#### 5.2.2 Cleaning Procedures

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external and internal surfaces of the radio. External surfaces include the front cover, housing assembly and battery case. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime.

**NOTE** Internal surfaces should be cleaned only when the radio is disassembled for service or repair.

The only recommended agent for cleaning the external radio surfaces is a 0.5% solution of a mild dishwashing detergent in water. The only factory recommended liquid for cleaning the printed circuit boards and their components is isopropyl alcohol (100% by volume).



**Caution**

The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners and other chemicals.

### Cleaning External Plastic Surfaces

Apply the 0.5% detergent-water solution sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the radio. Use a soft, absorbent, lintless cloth or tissue to remove the solution and dry the radio. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

### Cleaning Internal Circuit Boards and Components

Isopropyl alcohol (100%) may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the radio. Make sure that controls or tunable components are not soaked with alcohol. Do not use high-pressure air to hasten the drying process since this could cause the liquid to collect in unwanted places. After completing of the cleaning process, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, front cover or back cover.

**NOTE** Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).



**Caution**

Use all chemicals as prescribed by the manufacturer. Be sure to follow all safety precautions as defined on the label or material safety data sheet.

## 5.3 Safe Handling of CMOS and LDMOS Devices

Complementary Metal Oxide Semiconductor (CMOS) and Laterally Diffused Metal Oxide Semiconductor (LDMOS) devices are used in this family of radios, and are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair.

Handling precautions are mandatory for CMOS/LDMOS circuits and are especially important in low humidity conditions.

DO NOT attempt to disassemble the radio without first referring to the following CAUTION statement.

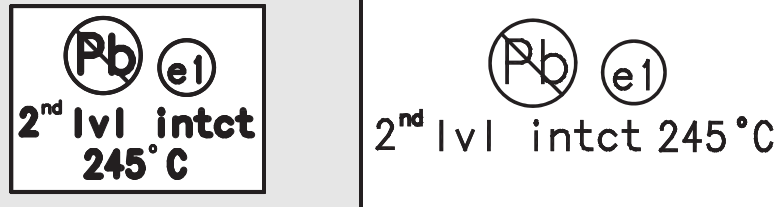
**Caution**

**This radio contains static-sensitive devices. Do not open the radio unless you are properly grounded. Take the following precautions when working on this unit:**

- Store and transport all CMOS/LDMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS/LDMOS devices into conventional plastic “snow” trays used for storage and transportation of other semiconductor devices.
- Ground the working surface of the service bench to protect the CMOS/LDMOS device. We recommend using a wrist strap, two ground cords, a table mat, a floor mat, ESD shoes, and an ESD chair.
- Wear a conductive wrist strap in series with a 100k resistor to ground. (Replacement wrist straps that connect to the bench top covering are Motorola part number 4280385A59).
- Do not wear nylon clothing while handling CMOS/LDMOS devices.
- Do not insert or remove CMOS/LDMOS devices with power applied. Check all power supplies used for testing CMOS/LDMOS devices to be certain that there are no voltage transients present.
- When straightening CMOS/LDMOS pins, provide ground straps for the apparatus used.
- When soldering, use a grounded soldering iron.
- If at all possible, handle CMOS/LDMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

## 5.4 Repair Procedures and Techniques – General

**NOTE** Environmentally Preferred Products (EPP) (refer to the marking on the printed circuit boards — examples shown below) were developed and assembled using environmentally preferred components and solder assembly techniques to comply with the European Union's Restriction of Hazardous Substances (ROHS 2) Directive 2011/65/EU and Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU. To maintain product compliance and reliability, use only the Motorola specified parts in this manual.



Any rework or repair on Environmentally Preferred Products must be done using the appropriate lead-free solder wire and lead-free solder paste as stated in the following table:

*Table 5-1. Lead Free Solder Wire Part Number List*

Motorola Part Number	Alloy	Flux Type	Flux Content by Weight	Melting Point	Supplier Part number	Diameter	Weight
1088929Y01	95.5Sn/3.8Ag/0.7Cu	RMA Version	2.7-3.2%	217C	52171	0.015"	1lb spool

*Table 5-2. Lead Free Solder Paste Part Number List*

Motorola Part Number	Manufacturer Part Number	Viscosity	Type	Composition & Percent Metal	Liquid Temperature
1085674C03	NC-SMQ230	900-1000KCPs Brookfield (5rpm)	Type 3 (-325/+500)	(95.5%Sn-3.8%Ag-0.7%Cu) 89.3%	217°C

### Parts Replacement and Substitution

When damaged parts are replaced, identical parts should be used. If the identical replacement part is not locally available, check the parts list for the proper Motorola part number and order the part from the nearest Motorola Radio Products and Solutions Organization (RPSO) listed in [Appendix A](#) of this manual.

### Rigid Circuit Boards

This family of radios uses bonded, multi-layer, printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The printed-through holes may interconnect multiple layers of the printed circuit. Therefore, exercise care to avoid pulling the plated circuit out of the hole.

When soldering near a connector:

- Avoid accidentally getting solder in the connector.
- Be careful not to form solder bridges between the connector pins.
- Examine your work closely for shorts due to solder bridges.

## 5.5 Disassembling and Reassembling the Radio — General

When disassembling and reassembling the radio, it is important to pay particular attention to the snaps and tabs, and how parts align with each other.

The following tools are required for disassembling the radio:

- TORX™ T4 and 6IP TORX Plus screwdriver
- Chassis and Knob Opener (TL000015A01)

The following item and tools are required for reassembling the radio:

- Grease (1185937A01)
- TORX™ T4 and 6IP TORX Plus screwdriver
- Vacuum Pump Kit (NLN9839) - Radio Immersibility Test
- Pressure Pump Kit (NTN4265) - Radio Immersibility Test
- Connector Fitting (5871134M01) - Radio Immersibility Test
- Fitting Seal (3271133M01) - Radio Immersibility Test
- Seal Port (3286058L01)
- Label Ventilation (5478220A01)

If a unit requires further testing or service than is customarily performed at the basic level, please send the radio to a Motorola Service Center listed in Appendix B.



**Caution**

To assure the safety and regulatory compliance of the XPR 7000 Series, the radio must be repaired only at Motorola service facilities. Please call Motorola at 800-422-4210 for the address and contact information of your nearest service center

## 5.6 Radio Disassembly – Detailed

### 5.6.1 Front Cover from Chassis Disassembly

1. Turn off the radio.
2. Remove the battery:
  - a. Release the battery latch by moving it upwards.
  - b. Hold the latch in the release position and slide the battery out.
  - c. Remove the battery from the radio.



*Figure 5-1. Battery removal*

3. Remove the antenna by turning it counterclockwise.



*Figure 5-2. Antenna removal.*

4. Remove the channel selector knob and volume knob off from their shafts using the knob removal tool.

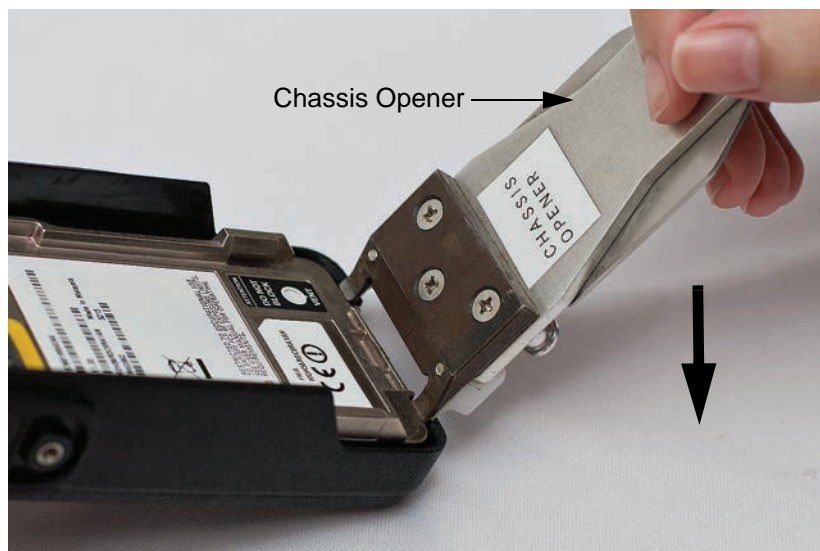
**NOTE** Both knobs slide on and off. However, they are supposed to fit very tightly on their shafts.

5. Hook the knob opener under the shroud as shown in Figure 5-3 and detach it with a downward motion.



*Figure 5-3. Shroud removal*

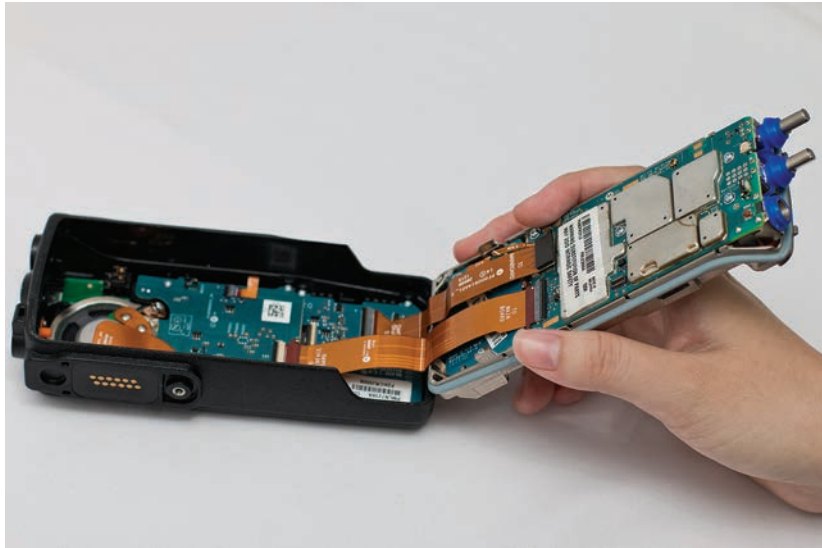
6. Separate the chassis from the housing assembly as follows:
  - a. Insert the chassis opener into the recess at the bottom of the radio. Apply a downward force to separate the chassis from the front housing.
  - b. Remove the chassis from the front housing.



*Figure 5-4. Chassis removal*

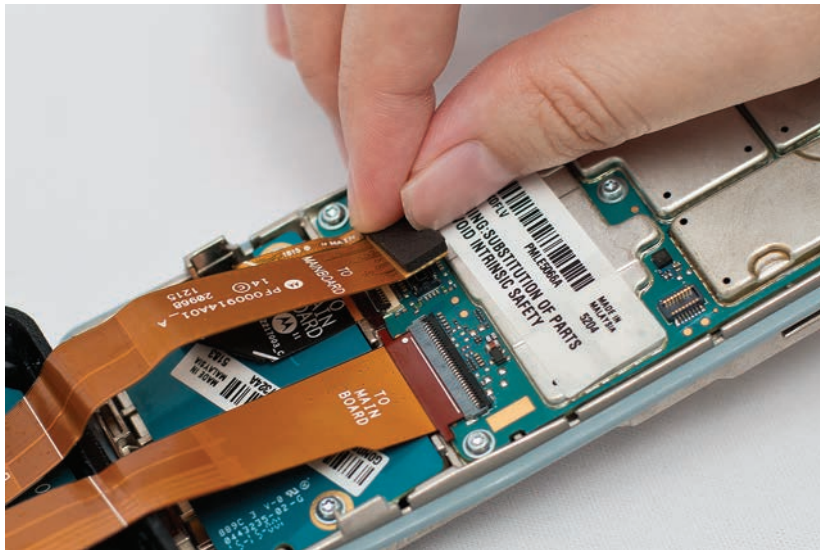


7. Place the chassis at a 120 degree angle to facilitate removal of the 2 flex connecting the chassis to the front housing



*Figure 5-5. Chassis and Front Housing*

8. Release the keypad flex from its connector.

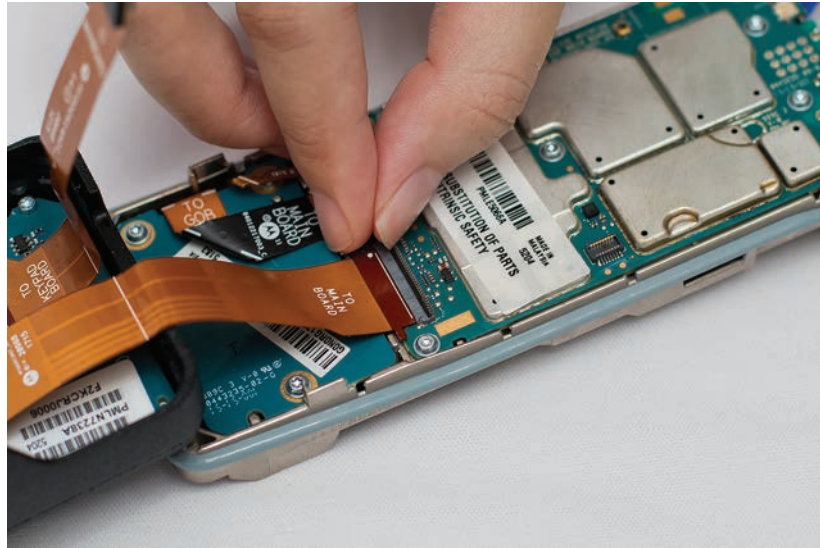


*Figure 5-6. Keypad flex removal*



9. Remove the interface flex from main board by pulling it out of its connector gently.

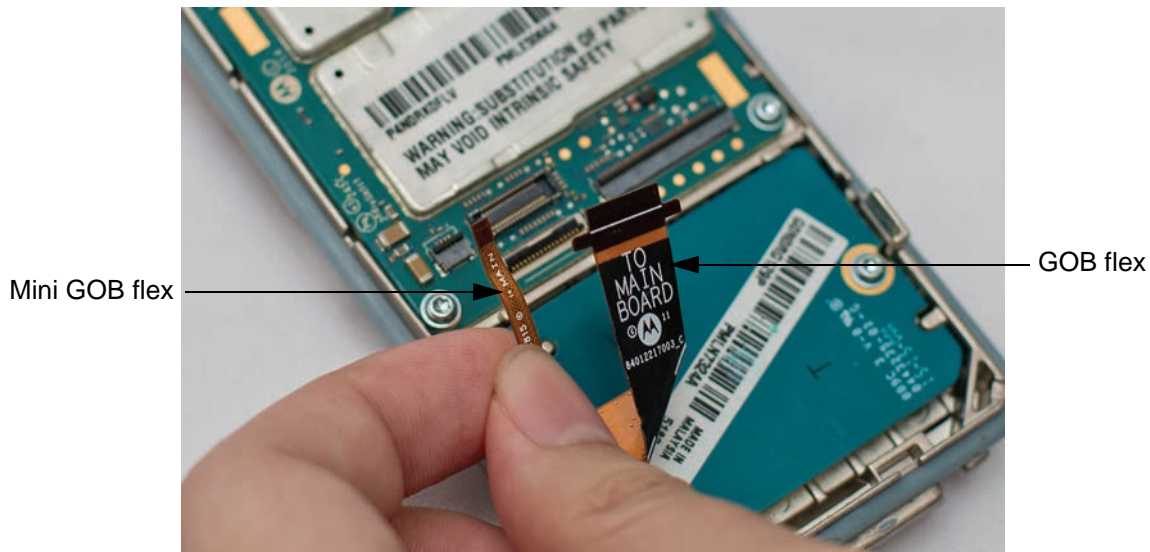
**NOTE** Do not open the keypad flex by lifting it straight but by applying pressure to the side



*Figure 5-7. Interface flex removal*

## 5.6.2 Chassis Disassembly

1. Remove the 2 GOB (Generic Option Board) flexes from the mainboard.



*Figure 5-8. GOB and mini GOB flex removal*

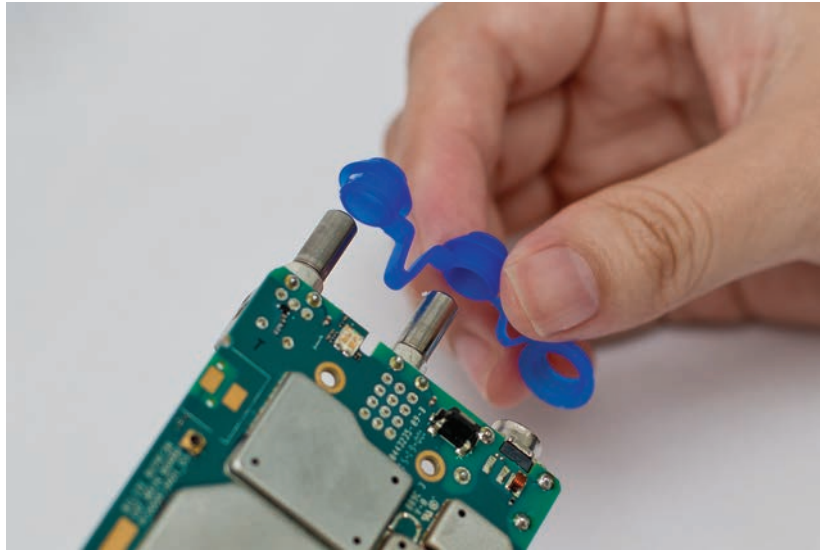
**NOTE** This step also applies to the MPT Option Board and the Connect Plus Option Board.

2. Remove the 5 screws on the mainboard using a 6IP Torx Plus screwdriver head. Separate the mainboard from the chassis.



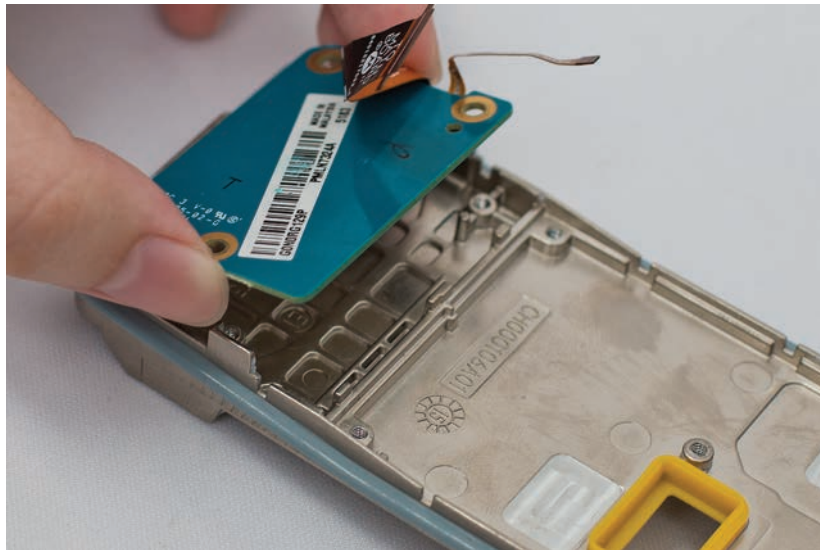
*Figure 5-9. Mainboard removal*

3. Remove the top control seal.



*Figure 5-10. Top control seal removal*

4. Remove the 3 screws on the GOB using a 6IP Torx Plus screwdriver head. Separate the GOB from the chassis.



*Figure 5-11. GOB removal*

5. Remove the battery contact seal.



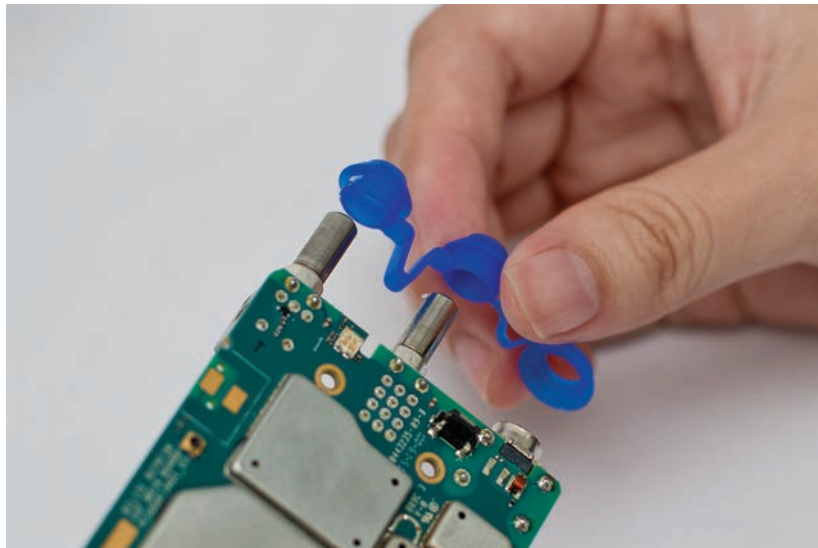
*Figure 5-12. Battery contact seal removal*

6. Remove the RF rubber plug.



*Figure 5-13. RF rubber plug removal*

7. Remove the top control seal.





### 5.6.3 Interface Board, Keypad Board and LCD Disassembly

1. Unlatch and remove the interface flex.

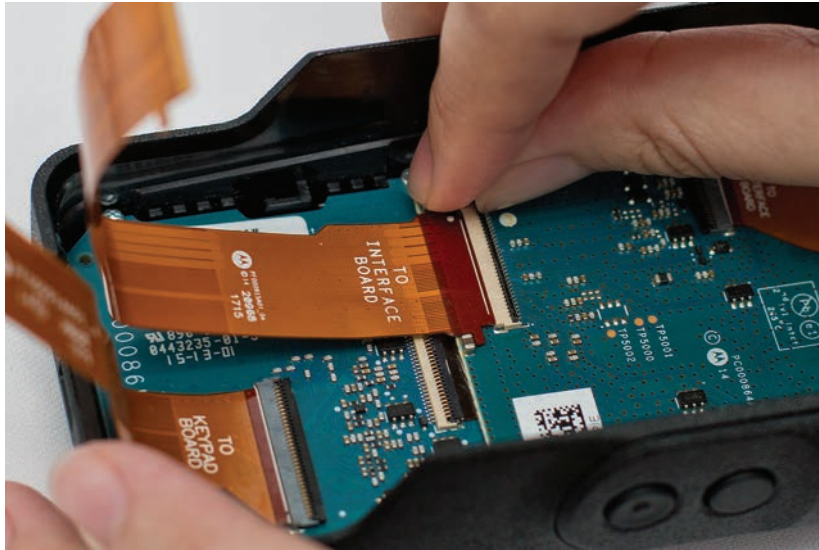


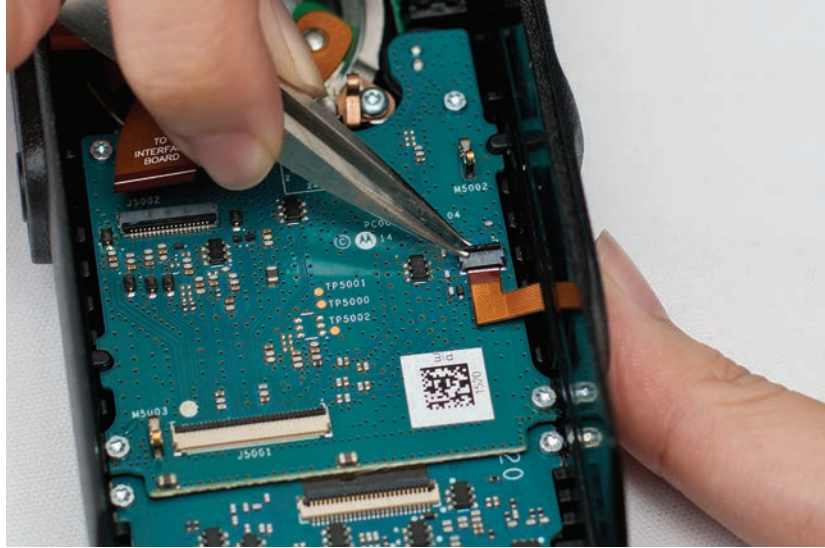
Figure 5-14. Interface flex removal

2. Disconnect the UC flex.



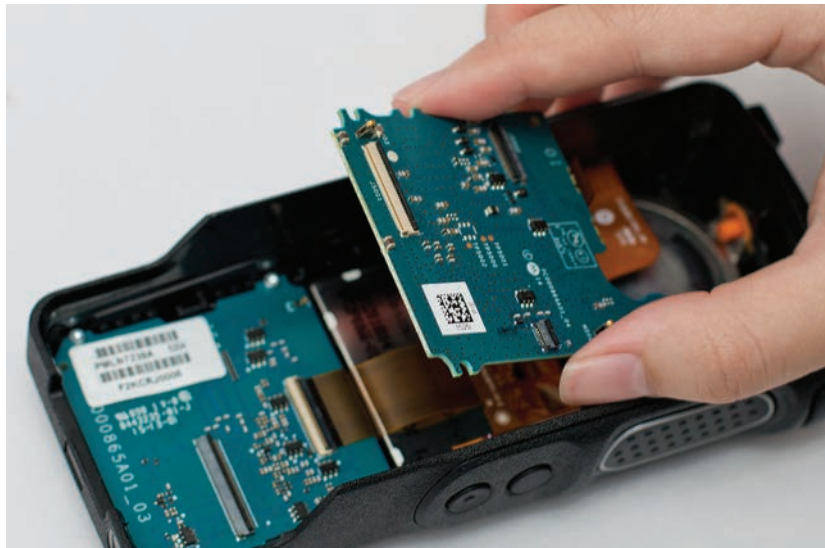
Figure 5-15. UC flex removal

3. Use a tweezer to disconnect the PTT flex.



*Figure 5-16. PTT flex removal*

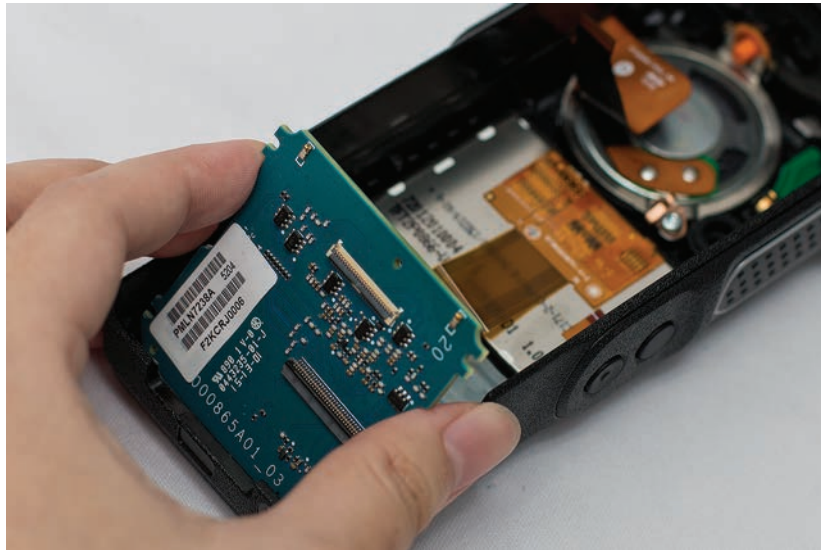
4. Remove the four screws and gently lift out the interface board from the front housing.



*Figure 5-17. Interface board removal*

**NOTE** Ensure the mic boot is removed from the front housing.

5. Unlatch and remove the LCD flex. Remove the four screws holding the keypad board and lift it out from the front housing.



*Figure 5-18. Keypad board removal*

6. Gently lift out the display module.



*Figure 5-19. Display module removal*



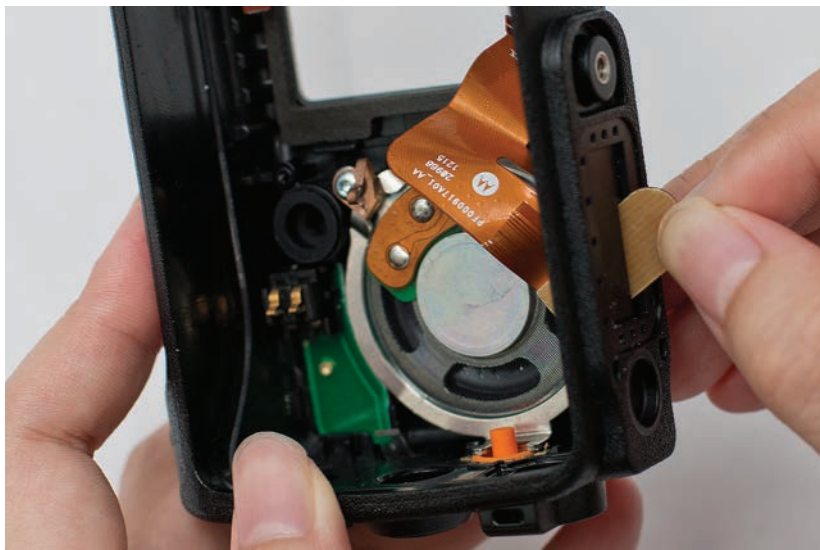
### 5.6.4 Speaker and Universal Connector Flex Disassembly

1. Peel off the UC escutcheon with a tweezer.



*Figure 5-20. UC escutcheon removal*

2. Gently pry out the UC flex circuit and push it into the front housing through the UC slot.



*Figure 5-21. UC flex removal*

3. Unscrew the single screw holding the speaker retainer assembly and remove it from the front housing.



*Figure 5-22. Speaker assembly removal*

4. Remove the speaker retainer from the speaker module.



*Figure 5-23. Speaker removal*

### 5.6.5 Emergency Button Assembly Dissassembly

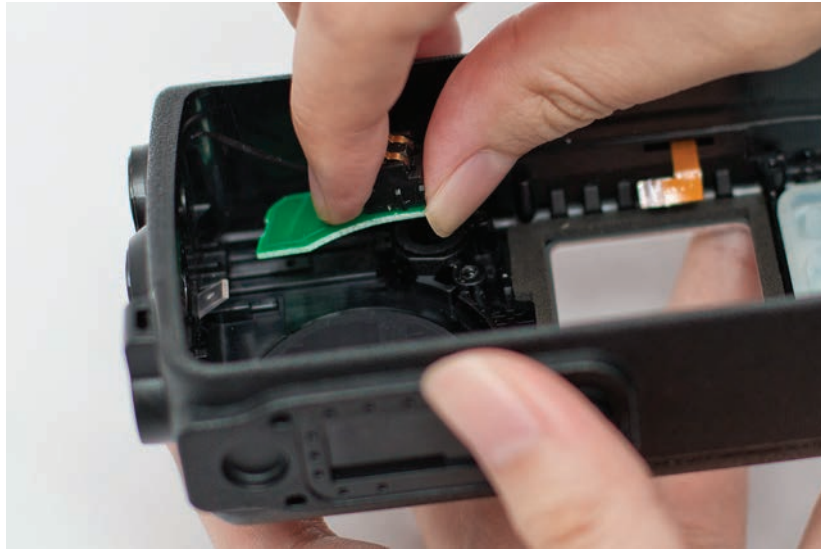
1. The Emergency button can be removed without the use of tools once the speaker retainer is removed.



*Figure 5-24. Emergency button removal*

### 5.6.6 Bluetooth GPS Antenna Disassembly

1. Use a T4 head to unscrew the Bluetooth GPS antenna module and remove it by sliding out from the front housing.



*Figure 5-25. Bluetooth GPS antenna removal*

## 5.7 Radio Reassembly - Detailed

### 5.7.1 Bluetooth GPS Antenna and Emergency Button Reassembly

1. Slide in the Bluetooth GPS antenna and affix the screw.



*Figure 5-26. Bluetooth GPS antenna reassembly*

2. Insert the emergency button into the proper slot.



*Figure 5-27. Emergency button reassembly*



### 5.7.2 Speaker and Universal Connector Flex Reassembly

1. Insert the UC flex circuit through the speaker retainer.

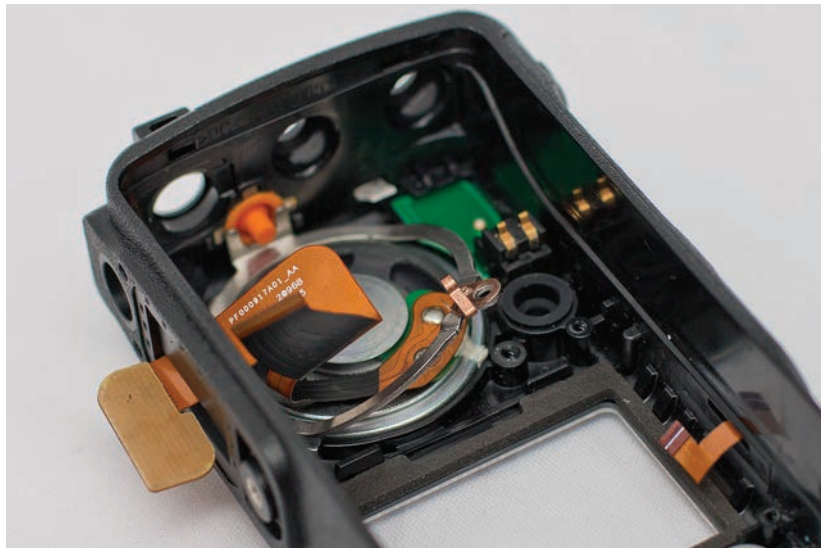


*Figure 5-28. Speaker retainer reassembly*

2. Seat the speaker module in the recess of the front housing and firmly screw in the speaker retainer.

**NOTE** Ensure there is no unnecessary pressure is applied to the spring contact on the speaker retainer.

3. Push the UC flex circuit through the UC slot on the front housing.



*Figure 5-29. Speaker reassembly*

4. Firmly stick the UC flex circuit on the housing and replace a new UC escutcheon.



*Figure 5-30. UC Escutcheon replacement*

**NOTE** Clean the area on the housing with IPA before sticking the UC flex and escutcheon.

### 5.7.3 Interface Board, Keypad Board and LCD Reassembly

1. Place the display module in the front housing.



Figure 5-31. Display module reassembly

2. Insert the keypad board and ensure it sits properly by using the notches on the front housing as a guide. Connect the display module flex and affix the screws.

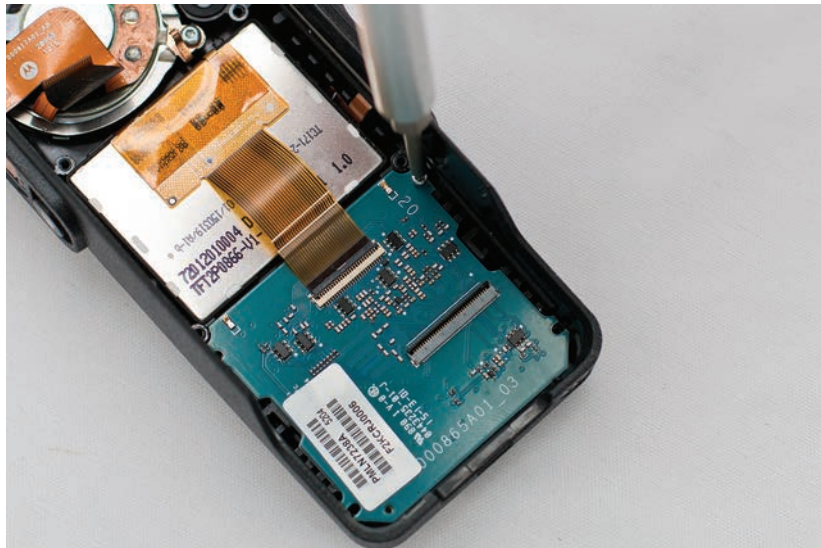


Figure 5-32. Keypad Board reassembly



3. Screw in the interface board. Ensure the PTT flex is on top of the interface board. Attach the keypad flex, interface flex, PTT flex and the UC flex.

**NOTE** Ensure to push the interface flex in all the way and the wings are not on top of the capacitors.

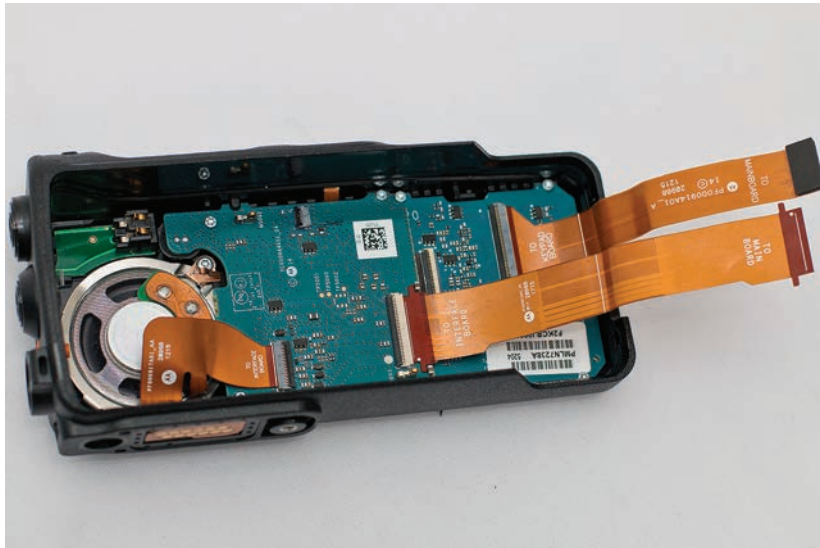


Figure 5-33. Front housing reassembly

### 5.7.4 Chassis Reassembly

1. Insert or replace the RF rubber plug and battery contact seal on the chassis.

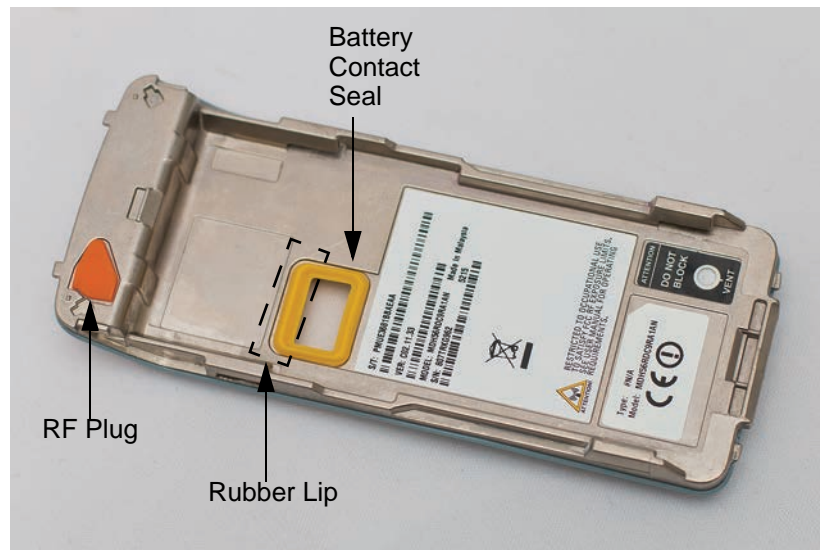


Figure 5-34. Chassis reassembly

**NOTE** Ensure the rubber lip of the battery contact seal rests on top as shown in the Figure 5-34.

2. Paste the thermal pad in the designated location on the underside of the chassis.

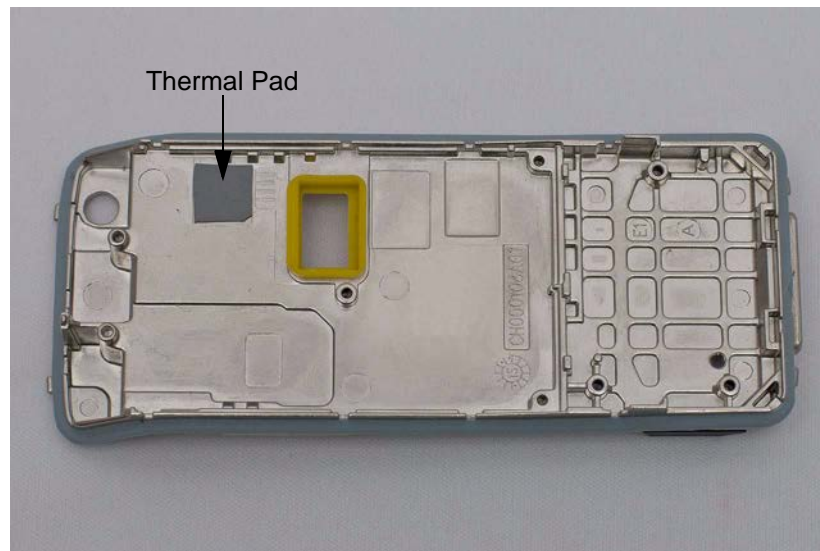
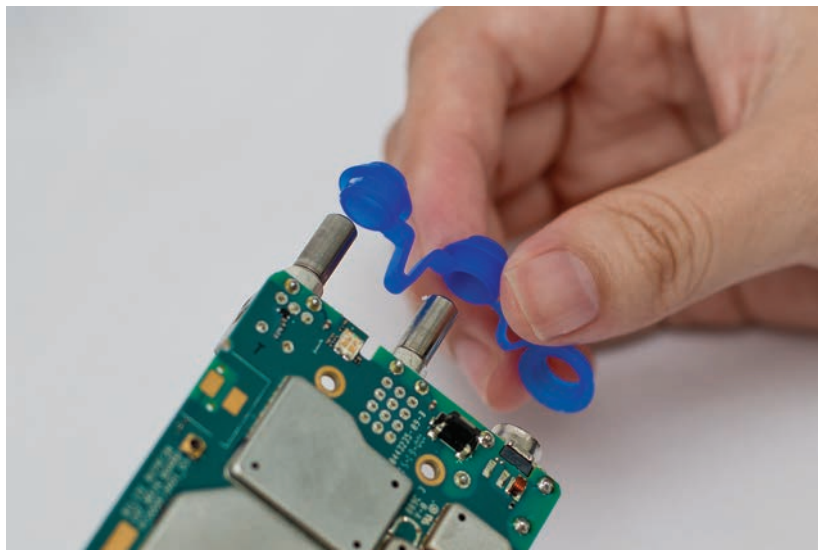


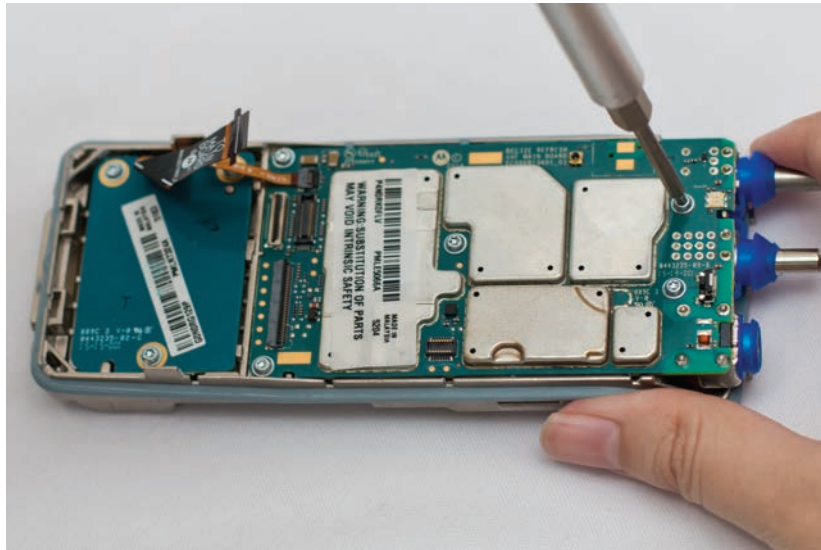
Figure 5-35. Thermal Pad

3. Replace the top control seal.



*Figure 5-36. Top control seal reassembly*

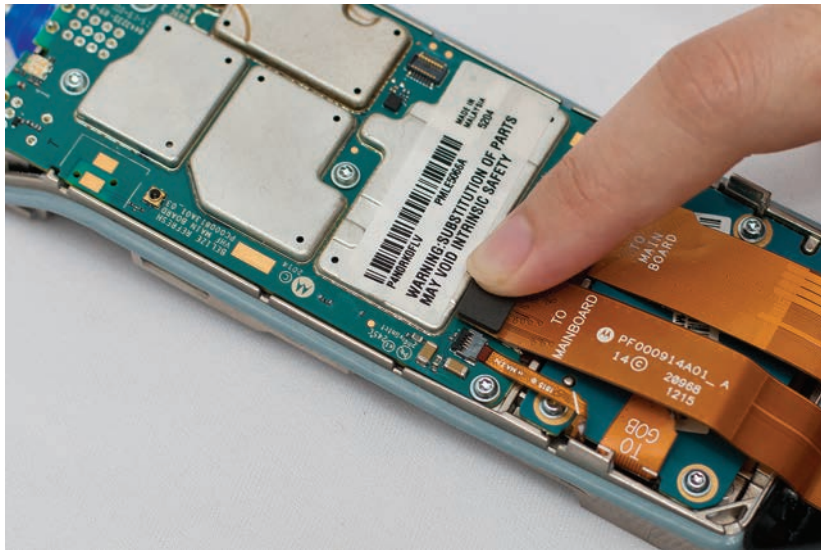
4. Screw in the main board and the GOB onto the chassis and connect the two GOB flex to the mainboard.



*Figure 5-37. Main board and GOB reassembly*

### 5.7.5 Chassis and Front Cover Reassembly

1. Connect the keypad flex and interface flex to the main board.



*Figure 5-38. Main board connectors.*

2. Apply grease to the full perimeter of the chassis's O-Ring.
3. Insert top chassis tabs into the recesses on front cover and the tabs are fully inserted.
4. Gently push down the chassis into the front cover until it snaps in place.



*Figure 5-39. Chassis reassembly*

5. Insert knobs, antenna, shroud and battery.

## 5.8 Ensuring Radio Immersibility

This section discusses radio immersibility concerns, tests, and disassembly and reassembly of the XPR series radios.

### 5.8.1 Servicing

The XPR series radios shipped from the Motorola factory have passed vacuum testing and should be capable of restoring the watertight integrity of the radio.



**Caution**

It is strongly recommended that the maintenance of the radio be deferred to qualified service personnel and service shops. This is of paramount importance as irreparable damage to the radio can result from service by unauthorized persons. If disassembly is necessary, unauthorized attempts to repair the radio may void any existing warranties or extended performance agreements with Motorola. It is also recommended that immersibility be checked annually by qualified service personnel/workshop that is authorized by Motorola.

### 5.8.2 Accidental Immersion

If the radio is accidentally dropped in water, shake the radio to remove the excess water from the speaker grille and microphone port area before operating; otherwise, the sound may be distorted until the water has evaporated, or is dislodged from these areas.

### 5.8.3 Specialized Test Equipment

This section summarizes the specialized test equipment necessary for testing the integrity of the XPR series radios.

To ensure that the radio is truly a watertight unit, special testing, test procedures, and specialized test equipment are required. The special testing involves a vacuum check of the radio and pressure testing (troubleshooting) for water leaks if the vacuum check fails. The specialized test equipment/instrument (Table 2-2 on page 2-2) is authorized by Motorola and needed to perform the vacuum check and pressure testing, if required. Any equipment/tools/instruments not mentioned in the table must not be used to perform these test.

### 5.8.4 Vacuum Pump Kit NLN9839

The vacuum pump kit includes a vacuum pump with gauge, and a vacuum hose. A connector fitting (part number 5871134M01) and fitting seal (part number 3271133M01) pump connector, which must be ordered separately, connects the vacuum hose to the radio's chassis.

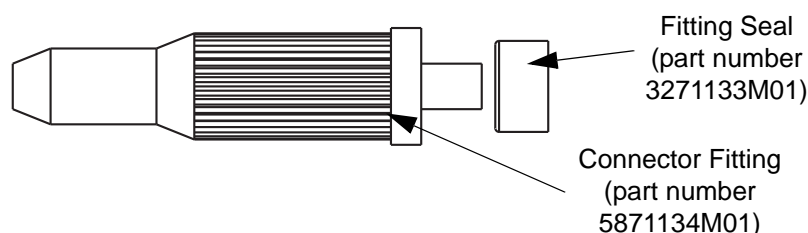


Figure 5-40. Connector Fitting - Fitting Seal Pump Connector



### 5.8.5 Pressure Pump Kit NTN4265

The pressure pump kit includes a pressure pump with gauge, and a pressure hose. As with the vacuum pump kit above, the connector fitting - fitting seal pair connects the pressure hose to the radio's chassis.

### 5.8.6 Miscellaneous Hardware

Other items needed for testing the immersibility radio include:

- Large water container
- Deionized (DI) water
- A supply of replacement parts: Battery Contact Seal, Breathing Vent Label and Breathing Vent Membrane.

### 5.8.7 Vacuum Test

The vacuum test uses a vacuum pump and gauge. The pump creates a vacuum condition inside the radio, and the gauge monitors the radio for a stable vacuum reading; that is, checking for a properly sealed, watertight unit. Before starting the vacuum test:

- Remove the battery.
- Remove the universal connector dustcover to expose the universal connector.
- Remove the breathing vent label and breathing vent membrane.

To conduct the vacuum test:

1. Attach antenna firmly to the radio.
2. Attach the vacuum hose to the vacuum pump. Check the pump and hose for leaks by blocking off the open end of the hose and operating the pump a few times. The actual reading of the gauge at this point is not important; it is important that the gauge pointer remained steady, indicating no vacuum leaks in the pump.
3. Ensure that the fitting seal is attached to the hose-to-chassis pump connector. Screw the pump connector into the tapped hole in the chassis.



**Caution**

Please do not bend or over tighten pump connector to the chassis.

4. Attach the open end of the hose to the pointed end of the pump connector.
5. Place the radio on a flat surface with the chassis facing upward.
6. Operate the pump until the gauge indicates 10 in. Hg of vacuum on the radio. Observe the gauge for approximately 2 minutes.
  - If the needle falls 0.5 in. Hg or less (one scale interval, for example, from 10 in. Hg to 9.5 in. Hg), then the radio has passed the vacuum test and is approved for immersibility. No additional testing will be required.
  - If the needle falls more than 0.5 in. Hg (one scale interval, for example, from 10 in. Hg to less than 9.5 in. Hg), then the radio has failed the vacuum test and the radio might leak if

immersed. Additional troubleshooting of the radio will be required; complete this procedure, then go to Section 5.8.8 "Pressure Test".

7. Remove the vacuum hose and pump connector from the radio.

### 5.8.8 Pressure Test

Pressure testing the radio is necessary only if the radio has failed the vacuum test. Do not perform the pressure test until the vacuum test has been completed. Pressure testing involves creating a positive pressure condition inside the radio, immersing the radio in water, and observing the radio for a stream of bubbles (leak). Since all areas of the radio are being checked, observe the entire unit carefully for the possibility of multiple leaks before completing this test.

To conduct the pressure test:

1. Screw the pump connector (with fitting seal) into the tapped hole in the chassis.
2. Attach one end of the pressure hose to the pump connector and the other end to the pressure pump.
3. Attach antenna firmly to the radio.
4. Operate the pump until the gauge reads approximately 1 psig.



**Caution**

Pressure any greater than 1 psig might push air around the main seal

5. Maintain the pressure at 1 psig and immerse the radio into a water-filled container.
6. Watch for any continuous series of bubbles. A stream of bubbles indicates a sign of leakage.

**NOTE** Some air entrapment may cause the accumulation of bubbles, especially in the grille area, but the bubbles should not be continuous.



**Caution**

Please do not bend or over tighten pump connector to the chassis.

7. Note all of the seal areas that show signs of leakage. Pinpoint the problem(s) to one (or more) of the following areas:
  - Front Housing
  - Chassis kit
  - Battery Contact Seal
8. Remove the radio from the water container, and dry the radio thoroughly. Be especially careful to dry the area around the main seal to prevent contamination of the internal



electronics while the unit is open

**Caution**

Keep the area around the chassis's vacuum port dry by ensuring that there is no water around it.

9. Remove the pump connector from the chassis.
10. Radio after performing Pressure Test must undergo baking process in a temperature chamber for constant temperature soaking at 60°C for 1 hour. This is to ensure no moisture is trapped inside the radio and prevent contamination of the internal electronics after reassembling the radio.

## 5.8.9 Troubleshooting Leak Areas

Before repairing any leak, first read all of the steps within the applicable section. This will help to eliminate unnecessary disassembly and reassembly of a radio with multiple leaks. Troubleshoot only the faulty seal areas listed in Section 5.8.8 "Pressure Test" on page 5-32, and when multiple leaks exist, in the order listed.

**NOTE** Before reassembling the radio, always install a Battery Contact Seal in the defective area.

### 5.8.9.1 Front Housing

Do one or both of the following:

1. If a leak occurs at the Lens (Display Models only), Universal Connector, chassis/Housing interface, PTT button area of the housing, replace the housing. Refer to Section 5.6 "Radio Disassembly – Detailed" on page 5-6.
  - a. Remove the housing assembly from the radio.
  - b. Discard the housing assembly.
  - c. Install a new housing assembly to the radio.
2. If the leak occurs at the control top area, remove the knobs in order to determine the leak location:
  - a. Conduct the Pressure Test.
  - b. Identify the leak location.

### 5.8.9.2 Battery Contact Seal

To replace the Battery Contact Seal:

1. Refer to Section 5.6 "Radio Disassembly – Detailed" on page 5-6 to remove the Battery Contact Seal.
2. Remove the Battery Contact Seal from the Chassis.
3. Inspect the Battery Contact Seal, Chassis and surrounding areas for foreign material that might prevent the Battery Contact Seal from sealing properly.
4. Install a new Battery Contact Seal; discard the old Seal.
5. Reassemble the chassis assembly followed by installing into Front Cover. (Refer to Section 5.7 "Radio Reassembly - Detailed" on page 5-21).

**IMPORTANT:** Both Air Ventilation Label (54012316001) and Gasket (3286058L01) need to be replaced after vacuum test, pressure test or water leakage troubleshooting.

### 5.8.9.3 Air Ventilation Label

To replace the Air Ventilation Label:

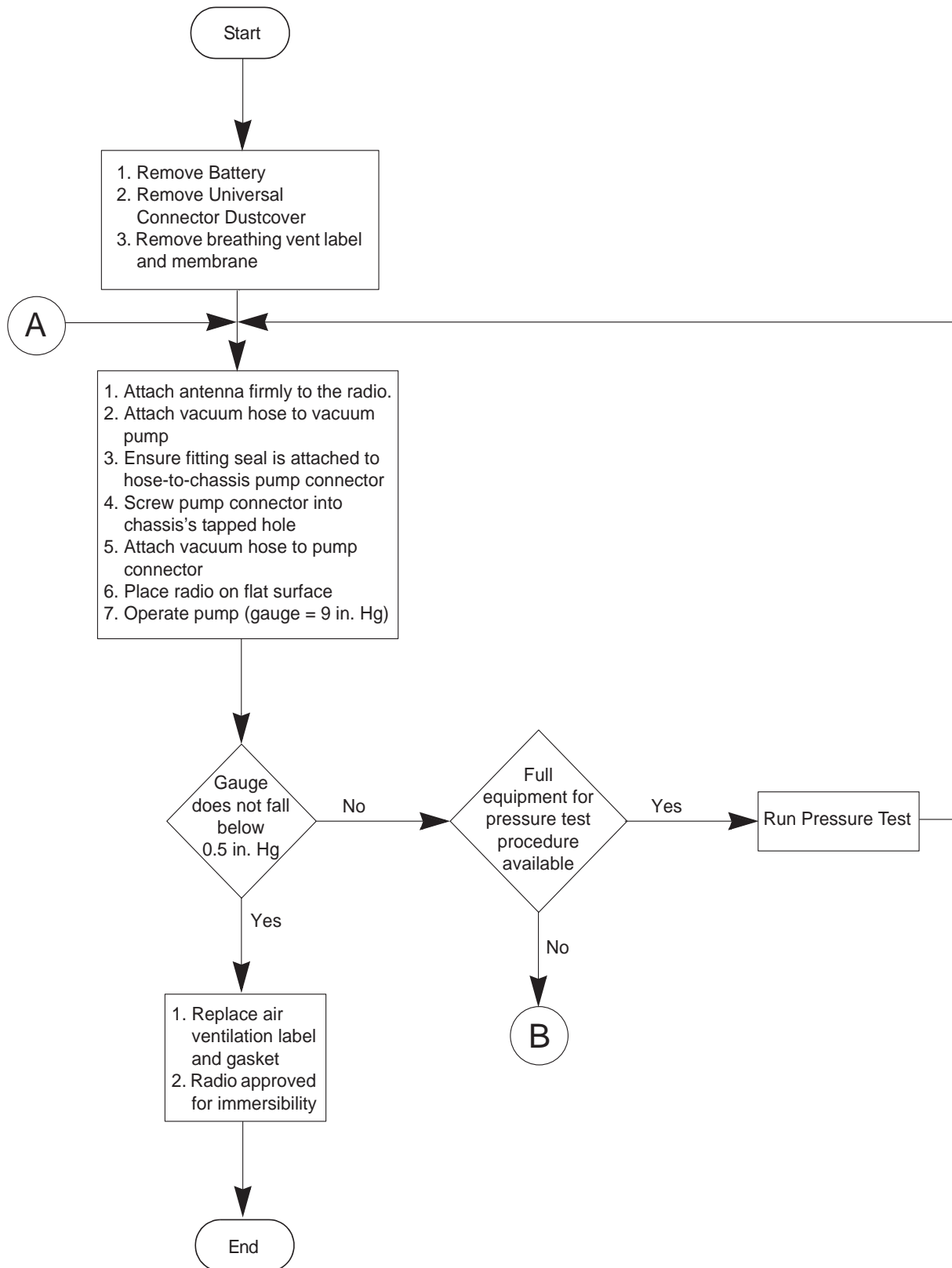
1. Remove the Air Ventilation label from the chassis.
2. Ensure that the chassis's surface (at the Air Ventilation label recess) is clean, no/minimum scratches and free from any adhesive or other foreign materials.
3. Install a new Air Ventilation label, covering the vent port hole, in the small recessed area in the chassis. Ensure that no oily substance come in contact with the seal.
4. Install a new Air Ventilation label in the larger recessed area in the chassis. Press down evenly over the label's surface to ensure good adhesion.

### 5.8.9.4 Battery Maintenance

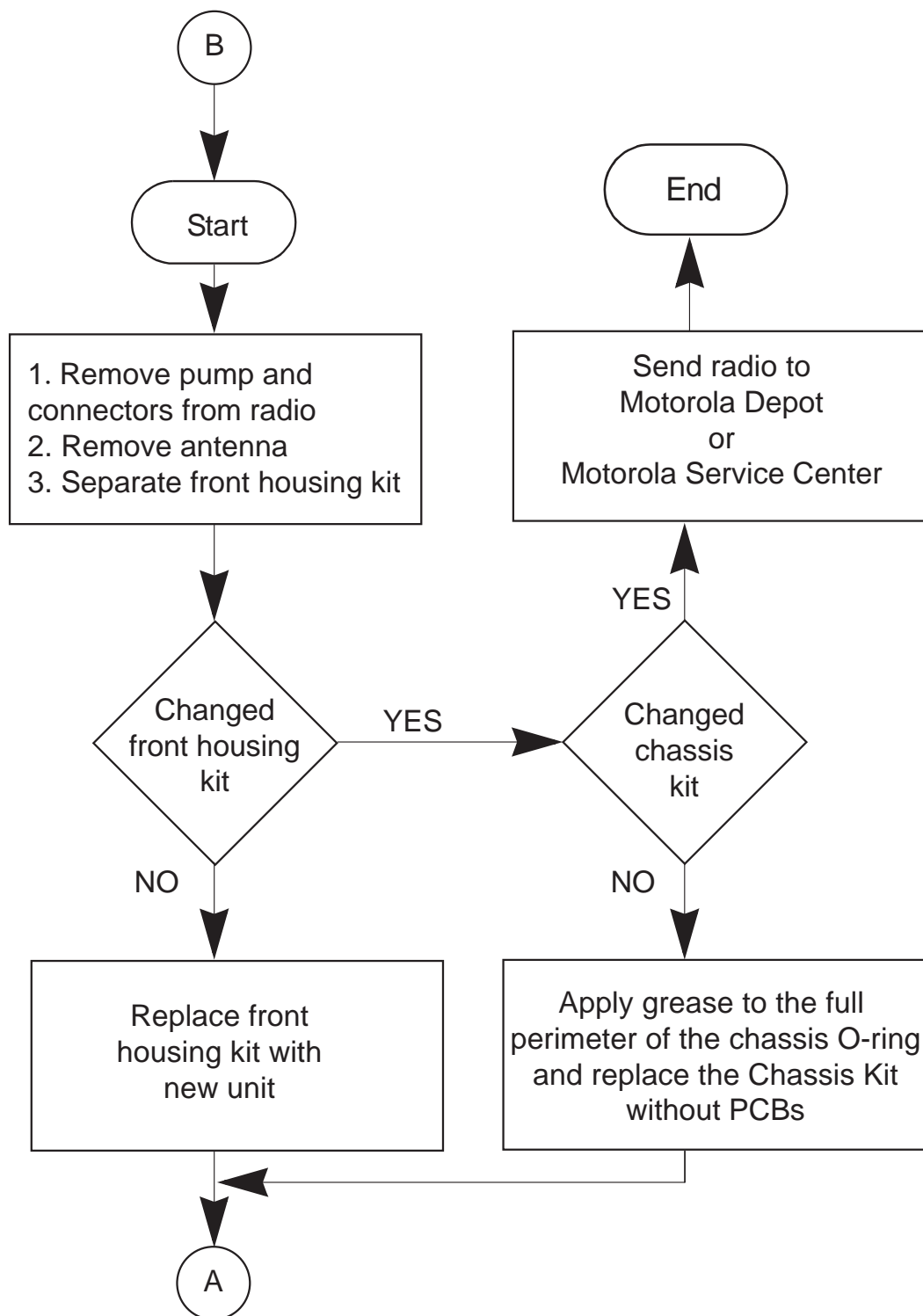
1. As part of an Annual Battery Maintenance Program or as required (when the battery contacts are dirty or show signs of wear) it is recommended that the Battery's Radio-side and Charger-side contacts are cleaned with DeoxIT®GOLD cleaner/lubricant.
2. DeoxIT®GOLD (Supplier CAIG Labs, P/N G100P) cleaner/lubricant pen has been found to be very effective at cleaning and extending the life of the battery's contacts. DeoxIT®GOLD cleaner/lubricant is available at numerous electronics suppliers (Radio Shack, McMaster Carr, Fry's, etc.) and directly from manufacturer, CAIG Labs, at <http://www.caig.com>.
3. This pen based package is recommended as it provides better access to the recessed contacts of the battery. The pen's tip may need to be modified (trimmed on the sides) to improve penetration into the battery contact slots. Per the manufacturer's instructions, shake the pen until the fluid begins to flow and wipe the battery's contact surface with the felt tip. After cleaning, inspect the contact surfaces for signs of advanced wear.
4. Advanced contact wear is defined as wear through either the contact platings (gold and nickel) to the base metal (copper). Copper exposure is characterized by a distinctive orange-brown metal appearance surrounded by the silvery nickel underplate and gold top coat.
5. In some cases, a magnified (10x minimum) inspection may be required to verify wear through to the base material. Polishing of the gold or nickel surface is common and is not considered a need for replacement. In instances where advanced wear is evident, the battery should be replaced.
6. After cleaning the contact areas of any foreign material, let the lubricant/cleaner dry for 2 minutes. Replace the battery on the radio and test for intermittency by moving the battery relative to the radio as might occur in regular use.

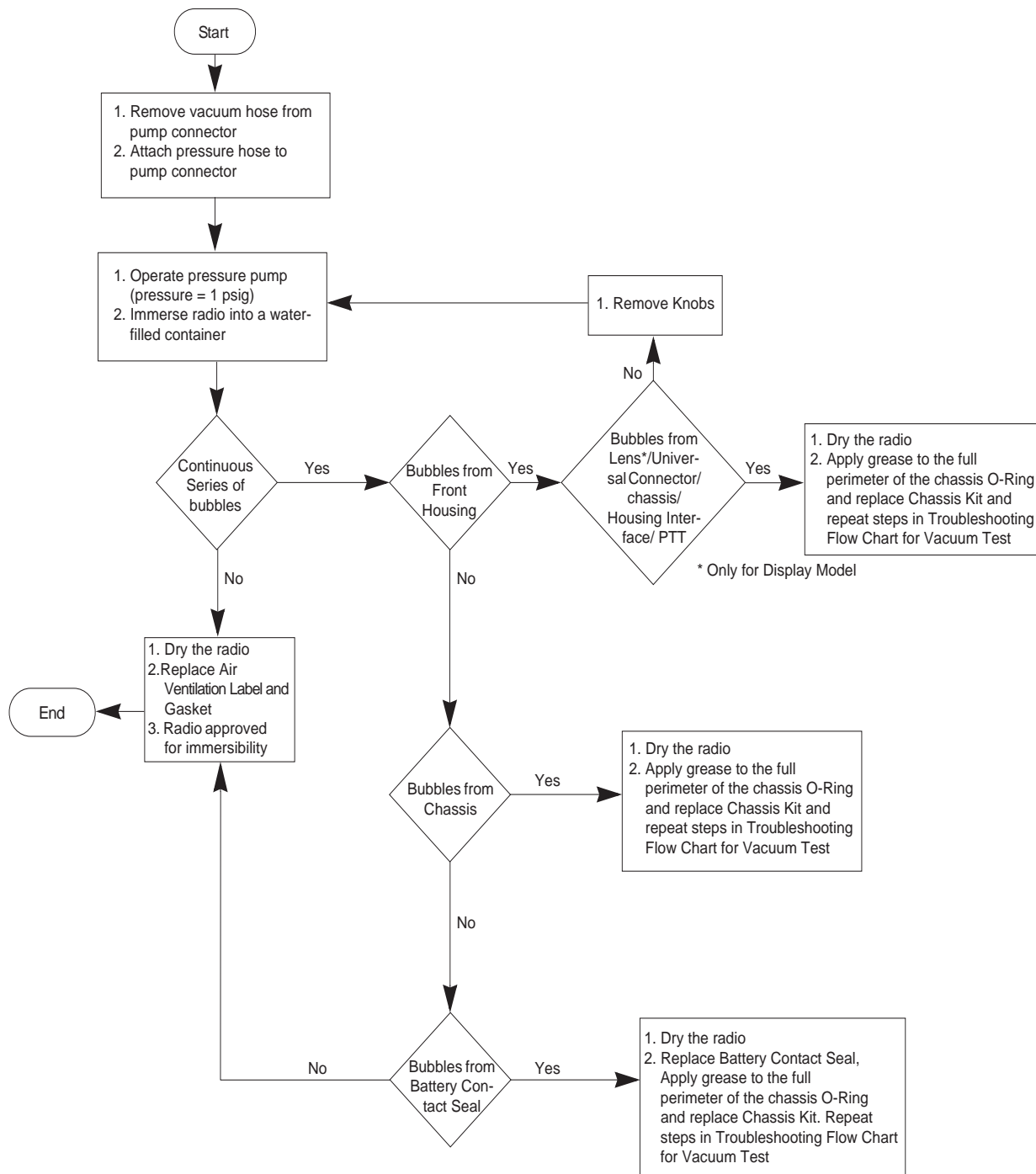
**NOTE** Regular maintenance (at least annually) of this area is recommended to ensure contamination free interface and to prolong the life of the battery contacts.

### 5.8.10 Troubleshooting Charts



***Troubleshooting Flow Chart for Vacuum Test (Sheet 1 of 2)***

**Troubleshooting Flow Chart for Vacuum Test (Sheet 2 of 2)**



***Troubleshooting Flow Chart for Pressure Test & Leakage Areas***

## 5.9 Radio Exploded Mechanical Views and Parts Lists

### 5.9.1 Full Keypad Model Exploded View and Parts List

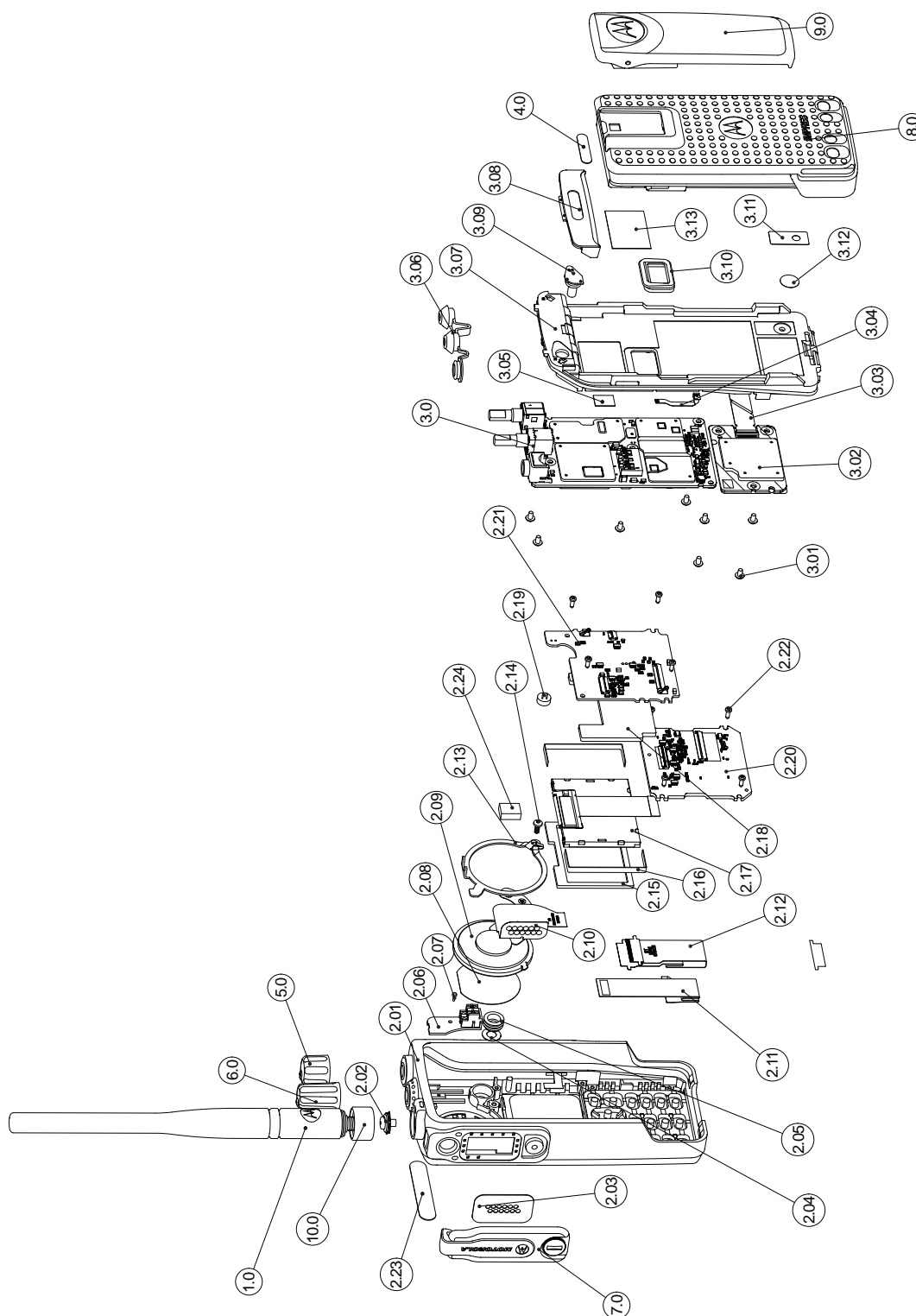


Figure 5-41. Full Keypad Model Exploded View

Table 5-3. Full Keypad Model Exploded View Parts List

Item		Description	Part Number
1		Antenna	See Chapter 7: Accessories
2		Front Kit Assembly	See Table 5-5. Additional Part List Table
	2.01	Front Housing Assembly	See Table 5-5. Additional Part List Table
	2.02	Emergency Button	38012008001
	2.03	UC Escutcheon	13012035001
	2.04	Mic Membrane With Stiffener	SL000209A01
	2.05	Boot, Microphone	SL000208A01
	2.06	GPS/GLONASS Antenna	See Table 5-5. Additional Part List Table
	2.07	Screw Shoulder, M1.2 X 3.2MM	0371160D01
	2.08	Speaker Mesh	SL000217A01
	2.09	Speaker	AC000028A02
	2.10	UC Flex	PF000917A01
	2.11	Interface Flex	PF000915A01
	2.12	Keypad Flex	See Table 5-5. Additional Part List Table
	2.13	Speaker Retainer- Grounding Contact Assembly	0104068J82
	2.14	Screw, Thread Forming	0386434Z02
	2.15	Front Dampener, Color Display	75012070001
	2.16	Display Side Padding	75012137001
	2.17	Display Module	72012010004
	2.18	Back Dampener, Color Display	HW000613A01
	2.19	Microphone	50012012003
	2.20	Keypad Controller (FKP)	0104065J47
	2.21	Interface Board	0104065J48
	2.22	Screw, Keypad Retainer	0378212A04
	2.23	Front Nameplate	33012037001
	2.24	Conductive Pad	75012224001
3		Back Cover Kit Assembly	See Table 5-5. Additional Part List Table



Table 5-3. Full Keypad Model Exploded View Parts List (Continued)

Item		Description	Part Number
	3.01	Screw, Main Board and GOB Board	03012034001
	3.02	Option Board Kit	See Table 5-5. Additional Part List Table
	3.03	GOB Flex	84012217003
	3.04	Flex	PF001167A01
	3.05	Pad, Thermal	75012234001
	3.06	Seal, Top Control	32012269001
	3.07	Chassis, Kit	0104065J49
	3.08	Shroud	15012092001
	3.09	RF Rubber Plug	38012017001
	3.10	Battery Contact Seal	SL000213A01
	3.11	Air Ventilation Label	54012316001
	3.12	Gasket	3286058L01
	3.13	TIA Label Service	Non Field Replaceable
4		Nameplate	See Table 5-5. Additional Part List Table
5		Volume Knob	36012005001
6		Frequency Knob	36012004001
7		Dust Cover Assembly	15012157001
8		Battery	See Table 5-5. Additional Part List Table
9		Belt Clip	See Table 5-5. Additional Part List Table
10		Antenna ID	See Table 5-5. Additional Part List Table

## 5.9.2 Non Keypad Model Exploded View and Parts List

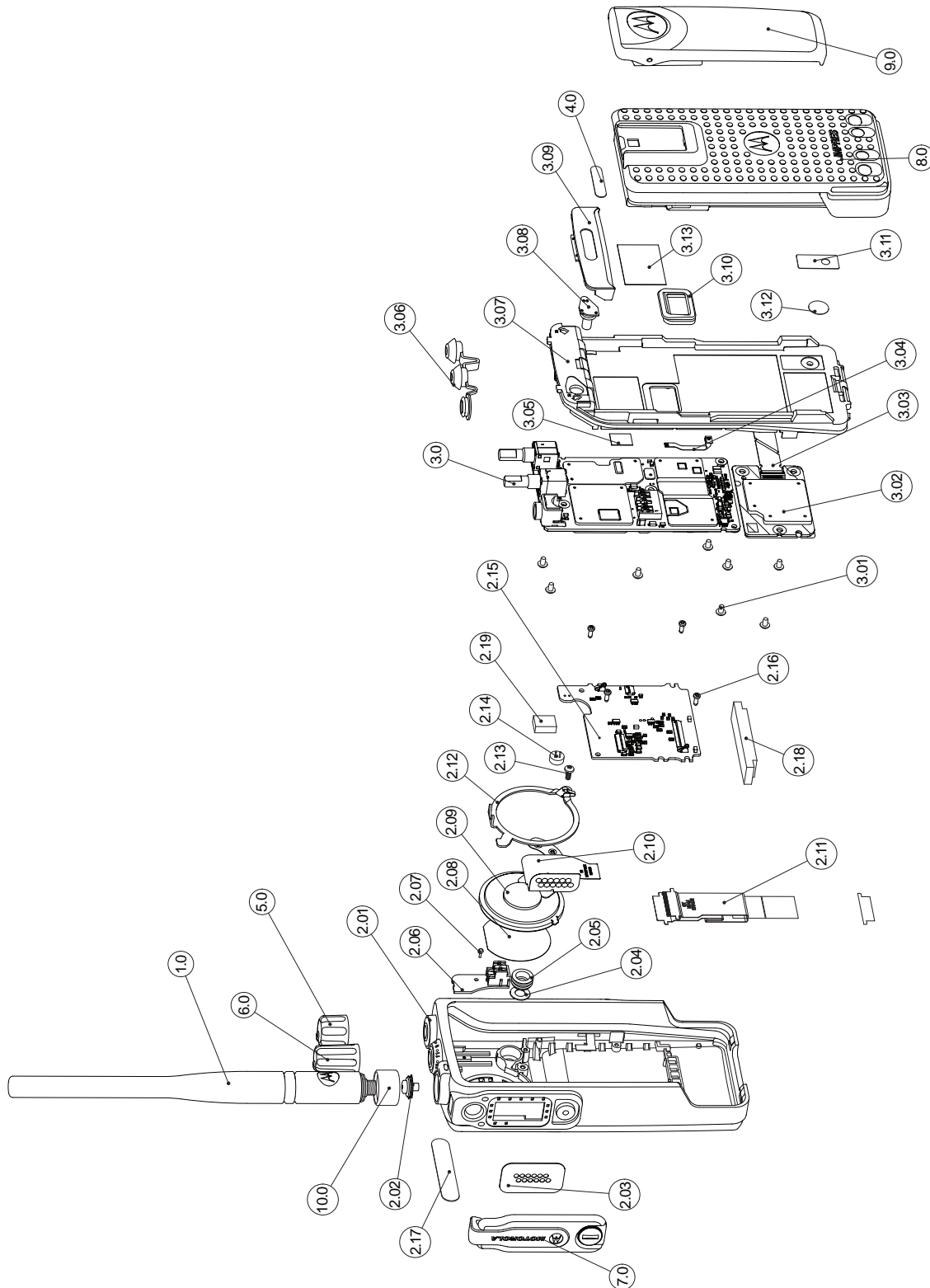


Figure 5-42. Non Keypad Exploded View

Table 5-4. Non Keypad Model Exploded View Parts List

Item		Description	Part Number
1		Antenna	See Chapter 7: Accessories
2		Front Kit Assembly	See Table 5-5. Additional Part List Table
	2.01	Front Housing Assembly	See Table 5-5. Additional Part List Table
	2.02	Emergency Button	38012008001
	2.03	UC Escutcheon	13012035001
	2.04	Mic Membrane With Stiffener	SL000209A01
	2.05	Boot, Microphone	SL000208A01
	2.06	GPS/GLONASS Antenna	See Table 5-5. Additional Part List Table
	2.07	Screw Shoulder, M1.2 X 3.2MM	0371160D01
	2.08	Mesh, Speaker	SL000217A01
	2.09	Speaker	AC000028A02
	2.10	UC Flex	PF000917A01
	2.11	Interface Flex	PF000915A01
	2.12	Speaker Retainer- Grounding Contact Assembly	0104068J82
	2.13	Screw, Thread Forming	0386434Z02
	2.14	Microphone	50012012003
	2.15	Interface Board	0104065J48
	2.16	Screw, Keypad Retainer	0378212A04
	2.17	Nameplate, Front	33012037001
	2.18	Plain Front Housing Poron	75012131001
	2.19	Conductive Pad	75012224001
3		Back Cover Kit Assembly	See Table 5-5. Additional Part List Table
	3.01	Screw, Main Board and GOB Board	03012034001
	3.02	Option Board Kit	See Table 5-5. Additional Part List Table
	3.03	GOB Flex	84012217003
	3.04	Flex	PF001167A01
	3.05	Pad, Thermal	75012234001
	3.06	Seal, Top Control	32012269001
	3.07	Chassis, Kit	0104065J49

Table 5-4. Non Keypad Model Exploded View Parts List (Continued)

Item		Description	Part Number
	3.08	RF Rubber Plug	38012017001
	3.09	Shroud	15012092001
	3.10	Battery Contact Seal	SL000213A01
	3.11	Air Ventilation Label	54012316001
	3.12	Gasket	3286058L01
	3.13	TIA Label Service	Non Field Replaceable
4		Nameplate	See Table 5-5. Additional Part List Table
5		Volume Knob	36012005001
6		Frequency Knob	36012004001
7		Dust Cover Assembly	15012157001
8		Battery	See Table 5-5. Additional Part List Table
9		Belt Clip	See Table 5-5. Additional Part List Table
10		Antenna ID	See Table 5-5. Additional Part List Table

Table 5-5. Additional Part List Table

Front Kit - VHF/8/900 MHz		
	Front Cover Kit, Roman Keypad, GNSS	PMLN7238_
	Front Cover Kit, Roman Keypad, GNSS (Yellow)	PMLN7515_
	Front Cover Kit, NKP	PMLN7323_
	Front Cover Kit, NKP, GNSS	PMLN7239_
	Front Cover Kit, NKP, GNSS (Yellow)	PMLN7514_
Front Kit - UHF		
	Front Cover Kit, Roman Keypad, GNSS	PMLN7425_
	Front Cover Kit, Roman Keypad, GNSS (Yellow)	PMLN7515_
	Front Cover Kit, NKP	PMLN7323_
	Front Cover Kit, NKP, GNSS	PMLN7239_
	Front Cover Kit, NKP, GNSS (Yellow)	PMLN7514_
Front Housing Assembly		
	Front Housing Assembly FKP, English	0104065J42
	Front Housing Assembly NKP	0104065J43
Back Kits*		
VHF		
	BC Kit, 136–174 MHz, 5W, FKP with GNSS	PMLD4727_S
	BC Kit, 136–174 MHz, 5W, FKP	PMLD4776_S
	BC Kit, 136–174 MHz, 5W, MOTOTRBO NKP with GNSS	PMLD4729_S
UHF		
	BC Kit, 403–527 MHz, 4W, MOTOTRBO FKP with GNSS	PMLE5064_S
	BC Kit, 403–527 MHz, 4W, MOTOTRBO NKP with GNSS	PMLE5066_S
800/900 MHz		
	BC Kit, 806–941 MHz, 2.5W, FKP, GNSS, BT, WiFi	PMLF4158_S
	BC Kit, 806–941 MHz, 2.5W, NKP, GNSS, BT, WiFi	PMLF4160_S
Option Board Kit		
	Generic Option Board Kit	PMLN7324_S
Keypad Flex		
	Assy Flex, Mainboard to Keypad Board (VHF & 8/900 MHz)	0104065J46
	PCBA Flex Assembly, 3 Layer (UHF, 300 MHz & 350 MHz)	PA001338A01
Nameplate		
	XPR 7350e Nameplate	33012015038
	XPR 7550e Nameplate	33012015039
	XPR 7380e Nameplate	33012015040
	XPR 7580e Nameplate	33012015041

Table 5-5. Additional Part List Table (Continued)

Antenna ID Band		
	Antenna ID band (Grey-10pcs)	32012244001
	Antenna ID band (Yellow-10pcs)	32012244002
	Antenna ID band (Green-10pcs)	32012244003
	Antenna ID band (Blue-10pcs)	32012244004
	Antenna ID band (Purple-10pcs)	32012244005
Battery		
	IMPRES Li-Ion TIA4950 HAZLOC IP68 2900T LV	PMNN4489_
	Standard NiMH 1300 mAh IP67 1400T	PMNN4412_
	IMPRES Li-Ion Slim 1500 mAh	PMNN4407_
	IMPRES Hi-Cap Li-Ion Non-FM 2150 mAh	PMNN4409_
	Core Slim Li-Ion 1500 mAh	PMNN4406_
	IMPRES FM Li-Ion 2300 mAh 2350T	NNTN8129_
	IMPRES Li-Ion 2300 mAh 2350T	PMNN4424_R**
	IMPRES IP67 Li-Ion 2700 mAh 2800T	PMNN4448_R
	Li-Ion IP57 2000 mAh	PMNN4463_
	Li-Mn 1400 mAh low temp -30C battery Submersible (IP57)	PMNN4435_R
	IMPRES Slim Li-Ion IP68 2100T	PMNN4491_
	IMPRES Li-Ion IP68 3000T LV	PMNN4493_
	IMPRES Li-Ion VIB IP68 3000T LV	PMNN4488_
Belt Clips		
	Belt Clip 2"	PMLN4651_
	Belt Clip 2.5"	PMLN7008_
	Vibrating Belt Clip 2.5"	PMLN7296_
GNSS Antenna		
	Antenna, Chip, Beidou BT/GPS Antenna Module	AN000151A02

\* For defective main boards, customers must order Back Kit.

### 5.9.3 Torque Chart

Table 5-6 lists the various screws by part number and description, followed by the torque values in different units of measure. Torque all screws to the recommended value when assembling the radio.

*Table 5-6. Torque Specifications for Screws*

Part Number	Description	Driver/ Socket	Torque	
			lbs-in	N-m
03012034001	Screw, Main Board (new chassis)	6 IP Torx Plus	3.1 to 3.3	0.35 to 0.37
	Screw, Main Board (rework)	6 IP Torx Plus	2.0	0.22
0386434Z02	Screw, Thread Forming	6 IP Torx Plus	3.5 to 4.3	0.40 to 0.49
0378212A04	Screw, Keypad Retainer	6 IP Torx Plus	1.8 to 2.2	0.20 - 0.25
0371160D01	Screw, Shoulder, M1.2 X 3.2 MM	T4 Torx	0.4 to 0.6	0.04 - 0.06

## Notes



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## Chapter 6 Basic Troubleshooting

### 6.1 Introduction

This chapter contains error codes and board replacement procedures. If the board does not pass all the performance checks in Chapter 3 or exhibits an error code listed below, then the circuit board should be replaced. If repair requires knowledge of details of component level troubleshooting, please send radio to a Motorola Service Center listed in Appendix B.

**NOTE** To access the various connector pins, use the housing eliminator/test fixture along with the diagrams found in this section of the manual. (See the section, "Service Aids" on page 2-2, for the appropriate Motorola service aids and tools parts numbers.)

### 6.2 Replacement Back Cover Kit Procedures

Once a problem has been isolated to a specific board, install the appropriate service kit (See Model Charts in Chapter 1), which is orderable from Motorola Radio Products and Solutions Organization at 1-800-422-4210.

If a board is replaced, it does not necessarily need to be retuned if it has been factory tuned. It should however be checked for performance before being placed into service. Of particular concern is the Bias DAC, which will need to be set for the appropriate final device bias current prior to keying up the radio. If the bias is not properly set it may be possible to cause damage to the transmitter.



**Caution**

The Tuner Tool only allows the serial number of the blank board to be entered once. Be very attentive during this procedure.

### 6.3 Power-Up Error Codes (Display Model only)

Upon powering up, the radio performs certain tests to determine if its basic electronics and software are in working order. Any error detected has an associated error code that is presented on the radio display. These error codes are intended to be used by a service technician when the radio generates the Self Test Fail Tone. If these tests are successfully completed, the radio will generate the Self Test Tone.

There are two classes of detectable errors, fatal and non-fatal. If it is considered as a fatal error, then the normal radio operation will be inhibited. Fatal errors include hardware errors detected by the microprocessor and certain memory errors. These memory errors include incorrect ROM checksum, incorrect RAM checksum, and incorrect checksums of codeplug (Persistent Storage) blocks that contain operating parameters. If the codeplug block operating parameters are corrupted, operation of the unit on the proper frequency, system, and group are in question. Attempts to use this information could provide the user with a false sense of security that others are receiving his messages. Corrupted codeplug blocks of call IDs, or their associated aliases are considered non-fatal errors. While the user may be inconvenienced, normal communication is still possible.

Table 6-1. Power-Up Error Codes

Error Code	Description	Error Type	Corrective Action
ERROR 01/02	Call ID or associated aliases codeplug block checksum is wrong.	Non-Fatal	Normal communication is still possible, but the user may be inconvenienced. Reprogram codeplug.
ERROR 01/22	Tuning Codeplug block checksum is wrong.	Non-Fatal	Normal communication is still possible.
FAIL 01/82	External Codeplug block checksum is wrong.	Fatal	Reprogram codeplug.
FAIL 01/92	Secure Codeplug checksum error	Fatal	Reprogram codeplug.
FAIL 01/A2	Tuning Codeplug block checksum is wrong.	Fatal	Reprogram codeplug.
FAIL 01/81	ROM Checksum is wrong.	Fatal	Reprogram FLASH Memory, then retest. If message reoccurs, replace main board or send radio to nearest Motorola Depot.
FAIL 01/88	Radio RAM Test Failure.	Fatal	Retest radio by turning it off and turning it on again. If message reoccurs, replace main board or send radio to nearest Motorola Depot.
FAIL 01/90 or FAIL 02/90	General hardware test failure.	Fatal	Retest radio by turning it off and turning it on again. If message reoccurs, replace main board or send radio to nearest Motorola Depot.
FAIL 02/81	DSP ROM Checksum is wrong.	Fatal	Reprogram FLASH Memory, then retest. If message reoccurs, replace main board or send radio to nearest Motorola Depot.
FAIL 02/82	DSP RAM1 test failure.	Fatal	Retest radio by turning it off and turning it on again. If message reoccurs, replace main board or send radio to nearest Motorola Depot.

Table 6-1. Power-Up Error Codes (Continued)

Error Code	Description	Error Type	Corrective Action
FAIL 02/84	DSP RAM2 test failure.	Fatal	Retest radio by turning it off and turning it on again. If message reoccurs, replace main board or send radio to nearest Motorola Depot.
FAIL 02/88	DSP RAM test failure.	Fatal	Retest radio by turning it off and turning it on again. If message reoccurs, replace main board or send radio to nearest Motorola Depot.
FAIL 02/C0	DSP ROM Checksum is wrong.	Fatal	Retest radio by turning it off and turning it on again. If message reoccurs, replace main board or send radio to nearest Motorola Depot.
No Display	Display module is not connected properly. Display module is damaged.	Fatal	Check connection between main board and display module. Replace with new display module.

## 6.4 Operational Error Codes

During radio operation, the radio performs dynamic tests to determine if the radio is working properly. Problems detected during these tests are presented as error codes on the radio's display. The presence of an error code should prompt a user that a problem exists and that a Motorola Authorized MOTOTRBO dealer should be contacted. Use Table 6-2 to aid in understanding particular operational error codes.

*Table 6-2. Operational Error Codes*

Error Code	Description	Error Type	Corrective Action
FAIL 001	Synthesizer Out-of-Lock	NON-FATAL	1. Reprogram the codeplug. 2. Refer to Detailed Service Manual.
FAIL 002	Personality checksum or system block error	NON-FATAL	Reprogram the codeplug.

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## Chapter 7 Accessories

### 7.1 Introduction

Motorola provides the following approved accessories to improve the productivity of your digital portable two-way radio.

For a list of Motorola-approved antennas, batteries and other accessories, visit the following web site: <http://www.motorola.com/governmentandenterprise>

#### 7.1.1 Batteries

Kit No.	Description
PMNN4412_	Core NiMH, 1400 mAh Battery
PMNN4406_R	Core Slim Li-Ion, 1600 mAh Battery
PMNN4407_R	IMPRES Li-Ion, 1600 mAh Slim Battery
PMNN4409_R	IMPRES Hi-Capacity Li-Ion, 2250 mAh Battery
NNTN8129_	IMPRES Hi-Capacity Li-Ion, 2300 mAh Battery (FM)
PMNN4463_	Battery Li-Ion, IP57 2050 mAh
PMNN4489_	IMPRES Li-Ion, 2900 mAh TIA4950 HAZLOC IP68 Battery
PMNN4491_	IMPRES Slim Li-Ion, 2100 mAh IP68 Battery
PMNN4493_	IMPRES Li-Ion, 3000 mAh IP68 Battery, low voltage
PMNN4488_	IMPRES Li-Ion, 3000 mAh IP68 Battery for Vibrating Belt Clip
PMNN4424_*	IMPRES Li-Ion, 2350 mAh Battery
PMNN4448_*	IMPRES Li-Ion, 2700 mAh Battery
PMNN4435_R*	Li-Mn 1400 mAh low temp -30C battery Submersible (IP67)
PMNN4406_R*	Core Slim Li-Ion, 1600 mAh IP56 Battery
PMNN4407_R*	IMPRES Slim Li-Ion, 1600 mAh IP56 Battery
PMNN4409_R*	IMPRES Li-Ion Non-FM, 2250 mAh IP56 Battery

### 7.1.2 Antennas

Kit No.	Description
PMAD4116_	VHF, 144 – 165 MHz, Helical Antenna
PMAD4117_	VHF, 136 – 155 MHz, Helical Antenna
PMAD4118_	VHF, 152 – 174 MHz, Helical Antenna
PMAD4119_	VHF, 136 – 148 MHz, Stubby Antenna
PMAD4120_	VHF, 146 – 160 MHz, Stubby Antenna
PMAD4121_	VHF, 160 – 174 MHz, Stubby Antenna
PMAE4079_	UHF, 403 – 527 MHz, Slim Whip Antenna
PMAE4069_	UHF, 403 – 450 MHz, Stubby Antenna
PMAE4070_	UHF, 440 – 490 MHz, Stubby Antenna
PMAE4071_	UHF, 470 – 527 MHz, Stubby Antenna
PMAF4011_	800/900 MHz, Whip Antenna 806–870 MHz
PMAF4012_	800/900 MHz, Whip Antenna 896–941 MHz
PMAF4009_	800/900 MHz, Stubby Antenna 806–870 MHz
PMAF4010_	800/900 MHz, Stubby Antenna 896–941 MHz

### 7.1.3 Carry Devices

Kit No.	Description
PMLN5610_	2.5-Inch Replacement Leather Swivel Belt Loop
PMLN5611_	3-Inch Replacement Leather Swivel Belt Loop
RLN6486_	Leather Radio Strap
RLN6487_	Leather Radio Strap, Size XL
RLN6488_	Anti-Sway Leather Radio Strap
PMLN5838_	Hard Leather Carry Case with 3-Inch Fixed Belt Loop for Full-Keypad Radio
PMLN5840_	Hard Leather Carry Case with 3-Inch Swivel Belt Loop for Full-Keypad Radio
PMLN5842_	Hard Leather Carry Case with 2.5-Inch Swivel Belt Loop for Full-Keypad and Limited-Keypad Radio
PMLN5844_	Nylon Carry Case with 3-Inch Fixed Belt Loop for Full-Keypad and Limited-Keypad Radio
PMLN4651_	Belt Clip for 2-Inch Belt Width
PMLN7008_	Belt Clip for 2.5-Inch Belt Width
PMLN7296_	Vibrating Belt Clip for 2.5-Inch Belt Width

### 7.1.4 CPS

Part No.	Description
RVN5115_	CPS MOTOTRBO

### 7.1.5 Miscellaneous Accesories

Part No.	Description
PMLN7324_S	Generic Option Board

## Notes



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## **Appendix A   Replacement Parts Ordering**

### **A.1   Basic Ordering Information**

Some replacement parts, spare parts, and/or product information can be ordered directly. While parts may be assigned with a Motorola part number, this does not guarantee that they are available from Motorola Radio Products and Solutions Organization (RPSO). Some parts may have become obsolete and no longer available in the market due to cancelations by the supplier. If no Motorola part number is assigned, the part is normally not available from Motorola, or is not a user-serviceable part. Part numbers appended with an asterisk are serviceable by Motorola Depot only.

### **A.2   Motorola Online**

Motorola Online users can access our online catalog at

<https://www.motorola.com/businessonline>

To register for online access, please call 1-800-422-4210 (for U.S. and Canada Service Centers only). International customers can obtain assistance at <https://www.motorola.com/businessonline>

### **A.3   Mail Orders**

Mail orders are only accepted by the US Federal Government Markets Division (USFGMD).

Motorola  
7031 Columbia Gateway Drive  
3rd Floor - Order Processing  
Columbia, MD 21046  
U.S.A.

### **A.4   Telephone Orders**

The Radio Products and Solutions Organization\*  
(United States and Canada)  
7:00 AM to 7:00 PM (Central Standard Time)  
Monday through Friday (Chicago, U.S.A.)  
1-800-422-4210  
1-847-538-8023 (United States and Canada)

U.S. Federal Government Markets Division (USFGMD)  
1-800-826-1913 Federal Government Parts - Credit Cards Only  
8:30 AM to 5:00 PM (Eastern Standard Time)

### **A.5   Fax Orders**

The Radio Products and Solutions Organization\*  
(United States and Canada)  
1-800-622-6210  
847-576-3023 (United States and Canada)

USFGMD  
(Federal Government Orders)  
1-800-526-8641 (For Parts and Equipment Purchase Orders)

## **A.6 Parts Identification**

The Radio Products and Solutions Organization\*  
(United States and Canada)  
1-800-422-4210

## **A.7 Product Customer Service**

Radio Products and Solutions Organization (United States and Canada)  
1-800-927-2744

\* The Radio Products and Solutions Organization (RPSO) was formerly known as the Radio Products Services Division (RPSD) and/or the Accessories and Aftermarket Division (AAD).

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## **Appendix B    Motorola Service Centers**

### **B.1    Servicing Information**

If a unit requires further testing, knowledge and/or details of component level troubleshooting or service than is customarily performed at the basic level, please send the radio to a Motorola Service Center as listed below.

### **B.2    Motorola Service Center**

1220 Don Haskins Drive.

Suite. A

El Paso, TX 79936

Telephone: 915-872-8200

### **B.3    Motorola Canadian Technical Logistics Center**

Motorola Canada Ltd.

8133 Warden Avenue

Markham, Ontario, L6G 1B3

Tel: 1800-543-3222

Fax: 1800-331-9872 or 1-905-948-5970

### **B.4    Motorola Federal Technical Center**

10105 Senate Drive

Lanham, MD 20706

Tel: 1800-969-6680

Fax: 1800-784-4113

## **Notes**

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## Appendix C Limited Level 3 Servicing

### C.1 Maintenance

For details on the following, please refer to [“Chapter 5 Disassembly/Reassembly Procedures” on page 5-1 to section 5.4 on page 5-4.](#)

Section 5.2 on page 5-1 to Section 5.4 on page 5-4.

- Preventive maintenance (inspection and cleaning).
- Safe handling of CMOS and LDMOS devices.
- Repair procedures and techniques.

### C.2 Chip Components

Use a Hot-Air Repair Station for chip component replacement. Adjust the temperature control to 370°C (700°F), and adjust the airflow to a minimum setting. Airflow can vary due to component density.

- **To remove a chip component:**

1. Use a hot-air hand piece and position the nozzle of the hand piece approximately 0.3 cm (1/8") above the component to be removed.
2. Begin applying the hot air. Once the solder reflows, remove the component using a pair of tweezers.
3. Using a solder wick and a soldering iron or a power desoldering station, remove the excess solder from the pads.

- **To replace a chip component using a soldering iron:**

1. Select the appropriate micro-tipped soldering iron and apply fresh solder to one of the solder pads.
2. Using a pair of tweezers, position the new chip component in place while heating the fresh solder.
3. Once solder wicks onto the new component, remove the heat from the solder.
4. Heat the remaining pad with the soldering iron and apply solder until it wicks to the component. If necessary, touch up the first side. All solder joints should be smooth and shiny.

- **To replace a chip component using hot air:**

1. Use the hot-air hand piece and reflow the solder on the solder pads to smooth it.
2. Apply a drop of solder paste flux to each pad.
3. Using a pair of tweezers, position the new component in place.
4. Position the hot-air hand piece approximately 0.3 cm (1/8") above the component and begin applying heat.
5. Once the solder wicks to the component, remove the heat and inspect the repair. All joints should be smooth and shiny.

### C.3 Component and Parts list

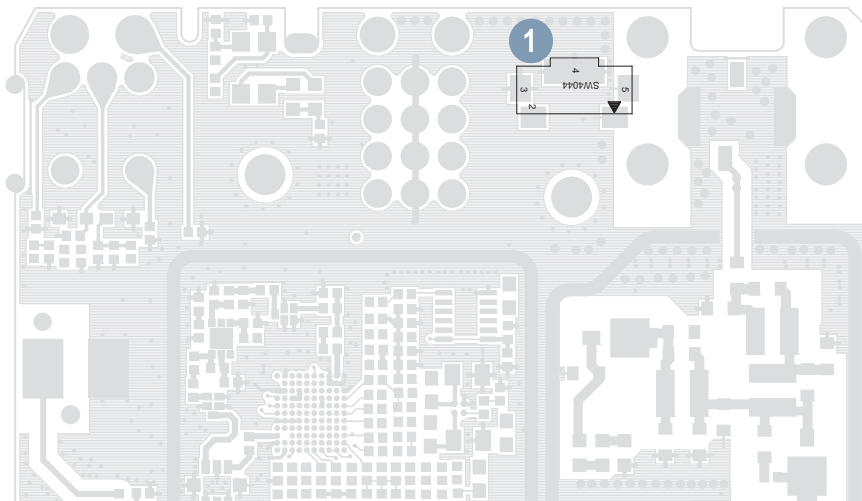


Figure C-1. PCB Top View

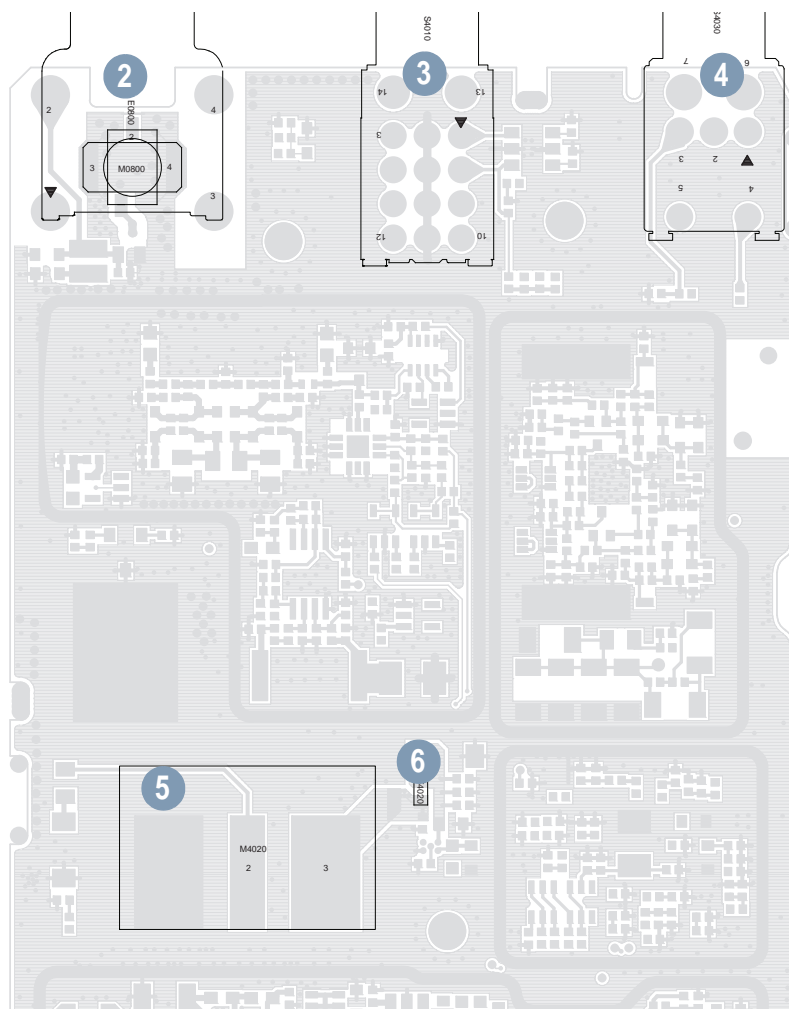


Figure C-2. PCB Bottom View

*Table C-1 Component Parts List*

No.	Circuit Ref	Motorola Part Num.	Description
1	SW4044	4086470Z01	SPST Tact Switch
2	M0800 E0800	0987378K01 CN000794A01	SM Coaxial Connector Female
3	S4010	40012023001	Frequency Switch
4	S4030	1875103C04	Volume Rotary On/Off Switch
5	M4020	09012098002	Battery Contact Connector
6	F4020	6515076H01	Fuse Fast Blow 3A 24V

## Notes



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# Glossary

Term	Definition
<b>Analog</b>	Refers to a continuously variable signal or a circuit or device designed to handle such signals.
<b>Band</b>	Frequencies allowed for a specific purpose.
<b>BC Kit</b>	Back Cover Kit
<b>BT</b>	Bluetooth
<b>CPS</b>	Customer Programming Software: Software with a graphical user interface containing the feature set of a radio.
<b>Default</b>	A pre-defined set of parameters.
<b>Digital</b>	Refers to data that is stored or transmitted as a sequence of discrete symbols from a finite set; most commonly this means binary data represented using electronic or electromagnetic signals.
<b>DPL</b>	Digital Private-Line: A type of digital communications that utilizes privacy call, as well as memory channel and busy channel lock out to enhance communication efficiency.
<b>FCC</b>	Federal Communications Commission.
<b>FKP</b>	Full Keypad Model
<b>Frequency</b>	Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second).
<b>GLONASS</b>	Global Navigation Satellite System
<b>GPIO</b>	General-Purpose Input/Output: Pins whose function is programmable.
<b>GPS</b>	Global Positioning System.
<b>IC</b>	Integrated Circuit: An assembly of interconnected components on a small semiconductor chip, usually made of silicon. One chip can contain millions of microscopic components and perform many functions.
<b>IF</b>	Intermediate Frequency.
<b>kHz</b>	kilohertz: One thousand cycles per second. Used especially as a radio-frequency unit.
<b>LCD</b>	Liquid-Crystal Display: An LCD uses two sheets of polarizing material with a liquid-crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them.

Term	Definition
<b>LED</b>	Light Emitting Diode: An electronic device that lights up when electricity is passed through it.
<b>MDC</b>	Motorola Digital Communications.
<b>MHz</b>	Megahertz: One million cycles per second. Used especially as a radio-frequency unit.
<b>MOR</b>	Ministry of Railway
<b>MPT</b>	Ministry of Posts and Telecommunication.
<b>NKP</b>	Non Keypad Model
<b>Paging</b>	One-way communication that alerts the receiver to retrieve a message.
<b>PC Board</b>	Printed Circuit Board. Also referred to as a PCB.
<b>PL</b>	Private-Line Tone Squelch: A continuous sub-audible tone that is transmitted along with the carrier.
<b>Programming Cable</b>	A cable that allows the CPS to communicate directly with the radio using USB.
<b>Receiver</b>	Electronic device that amplifies RF signals. A receiver separates the audio signal from the RF carrier, amplifies it, and converts it back to the original sound waves.
<b>Repeater</b>	Remote transmit/receive facility that re-transmits received signals in order to improve communications range and coverage (conventional operation).
<b>RF</b>	Radio Frequency: The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz).
<b>RX</b>	Receive.
<b>Signal</b>	An electrically transmitted electromagnetic wave.
<b>Spectrum</b>	Frequency range within which radiation has specific characteristics.
<b>Squelch</b>	Muting of audio circuits when received signal levels fall below a pre-determined value. With carrier squelch, all channel activity that exceeds the radio's preset squelch level can be heard.
<b>TIA</b>	Telecommunications Industry Association
<b>TOT</b>	Time-out Timer: A timer that limits the length of a transmission.
<b>TPL</b>	Tone Private Line.
<b>Transceiver</b>	Transmitter-receiver. A device that both transmits and receives analog or digital signals. Also abbreviated as XCVR.

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Term	Definition
<b>Transmitter</b>	Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space.
<b>TX</b>	Transmit.
<b>UHF</b>	Ultra-High Frequency.
<b>USB</b>	Universal Serial Bus: An external bus standard that supports data transfer rates of 12 Mbps.
<b>VIP</b>	Vehicle Interface Port.
<b>XPR</b>	Refers to Digital Professional Radio model names in the MOTOTRBO Professional Digital Two-Way Radio System.

## Notes





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