MOTOTRBO™ PORTABLE
PROFESSIONAL DIGITAL TWO-WAY RADIO

MOTOTRBO™ PORTABLE XPR 7000e Series BASIC SERVICE MANUAL

SEPTEMBER 2018

MN002178A01-AD

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Foreword

This manual 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, Motorola Solutions authorized dealers, self-maintained customers, and distributors.

⚠️ **CAUTION:** These servicing instructions are for the use of qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Product Safety and RF Exposure Compliance

⚠️ **CAUTION:** Before using this product, read the Product Safety and RF Exposure booklet enclosed with your radio which contains important operating instructions for safe usage and RF energy awareness and control for Compliance with applicable Standards and Regulations.

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

TIA 4950

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

The radio models listed in the UL Safety Manual, when properly equipped with the battery PMNN4489_, is certified for use per the classification below:

- Classification Rating Division 1, Class Ⅰ Group 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.

⚠️ **CAUTION:** Repairs of Motorola Solutions TIA 4950 certified intrinsically safe radios must be carried out only by Motorola Solutions I.S. trained personnel, who are aware of the special parts required and the procedures necessary to maintain the TIA 4950 conformance of the product. The Motorola Solutions internal service centers undergo regular training and receive a Motorola Solutions internal certification that enables them to conduct TIA 4950 repairs.

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Trademarks

Document History

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

Edition	Description	Date
MN002178A01-AA	Initial Release	January 2016
MN002178A01-AB	Added Full Keypad SMA models to VHF, UHF, and 800/900 MHz bands.	December 2016
MN002178A01-AC	Added battery information for PMNN4543_ and PMNN4544_ to General Specifications, Additional Parts List and Accessories sections. Updated Self Quieter Frequencies in Specification section.	December 2017
MN002178A01-AD	Updated TIA Label for Non Keypad Model Parts List and Full Keypad Model Parts List.	September 2018

Notations Used in This Manual

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

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

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

NOTICE: NOTICE indicates an operational procedure, practice, or condition that is essential to emphasize.

Related Publications

The following list contains part numbers and titles of related publications.

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

Commercial Warranty

Limited Warranty

For information on warranty terms, see the Support page at https://www.motorolasolutions.com.

I. What This Warranty Covers And For How Long

Motorola Solutions Inc. ("Motorola Solutions") warrants the Motorola Solutions manufactured Communication Products listed below ("Product") against defects in material and workmanship under normal use and service for a period of time from the date of purchase as scheduled below:

Portable Radios	Two Years
Product Accessories (Excluding Batteries and Chargers)	One Year

The radios 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 price pages or Motorola Online (https://businessonline.motorolasolutions.com) > Resource Center > Services > Service Product Offerings > Repair Service Advantage or Extended Warranty.

Motorola Solutions, at its option, will at no charge either repair the Product (with new or reconditioned parts), replace it (with a new or reconditioned Product), or refund the purchase price of the Product during the warranty period provided it is returned in accordance with the terms of this warranty. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts of Product shall become the property of Motorola Solutions.

This express limited warranty is extended by Motorola Solutions to the original end user purchaser only and is not assignable or transferable to any other party. This is the complete warranty for the Product manufactured by Motorola Solutions. Motorola Solutions assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of Motorola Solutions. Unless made in a separate agreement between Motorola Solutions and the original end user purchaser, Motorola Solutions does not warrant the installation, maintenance or service of the Product.

Motorola Solutions cannot be responsible in any way for any ancillary equipment not furnished by Motorola Solutions which is attached to or used in connection with the Product, or for operation of the Product with any ancillary equipment, and all such equipment is expressly excluded from this warranty. Because each system which may use the Product is unique, Motorola Solutions disclaims liability for range, coverage, or operation of the system as a whole under this warranty.

II. General Provisions

This warranty sets forth the full extent of Motorola Solutions responsibilities regarding the Product. Repair, replacement or refund of the purchase price, at Motorola Solutions option, is the exclusive remedy.

This warranty is given in lieu of all other express warranties, implied warranties, including without limitation, implied warranties of merchantability and fitness for a particular purpose, are limited to the duration of this limited warranty. In no event shall Motorola Solutions be liable for damages in excess of the purchase price of the product, for any loss of use, loss of time, inconvenience, commercial loss, lost profits or savings or other incidental, special or consequential damages arising out of the use or inability to use such product, to the full extent such may be disclaimed by law.

III. State Law Rights (Applicable Only in U.S.A.)

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitation on how long an implied warranty lasts, so the above limitation or exclusions may not apply.

This warranty gives specific legal rights, and there may be other rights which may vary from state to state.

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 Solutions 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 Solutions at 1-800-927-2744 US/Canada.

V. What This Warranty Does Not Cover

This warranty does not cover the following conditions:

- Defects or damage resulting from use of the Product in other than its normal and customary manner.
- Defects or damage from misuse, accident, water, or neglect.
- Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment.
- Breakage or damage to antennas unless caused directly by defects in material workmanship.
- A Product subjected to unauthorized Product modifications, disassemblies or repairs (including, without limitation, the addition to the Product of non-Motorola Solutions supplied equipment) which adversely affect performance of the Product or interfere with Motorola Solutions normal warranty inspection and testing of the Product to verify any warranty claim.
- Product which has had the serial number removed or made illegible.
- 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.
- Freight costs to the repair depot.
- A Product which, due to illegal or unauthorized alteration of the software/firmware in the Product, does not function in accordance with Motorola Solutions published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from Motorola Solutions.
- Scratches or other cosmetic damage to Product surfaces that does not affect the operation of the Product.
- Normal and customary wear and tear.

VI. Patent And Software Provisions

Motorola Solutions 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 Solutions 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:

- Motorola Solutions will be notified promptly in writing by such purchaser of any notice of such claim.

- Motorola Solutions will have sole control of the defense of such suit and all negotiations for its settlement or compromise.

- Product or parts become, or in Motorola Solutions opinion be likely to become, the subject of a claim of infringement of a United States patent, that such purchaser will permit Motorola Solutions, 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 Solutions.

Motorola Solutions will have no liability with respect to any claim of patent infringement which is based upon the combination of the Product or parts furnished hereunder with software, apparatus or devices not furnished by Motorola Solutions, nor will Motorola Solutions have any liability for the use of ancillary equipment or software not furnished by Motorola Solutions which is attached to or used in connection with the Product. The foregoing states the entire liability of Motorola Solutions with respect to infringement of patents by the Product or any parts thereof.

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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 Years
IMPRES Chargers (Single-Unit and Multi-Unit, Non-Display)	Two Years
IMPRES Chargers (Multi-Unit with Display)	One Year
Core Chargers (Single-Unit and Multi-Unit, Non-Display)	Two 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
Radio Description

The radios are available in the following frequency ranges and power levels.

Table 1: Radio Frequency Ranges and Power Levels

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

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.

1.1.1
Full Keypad Model

Figure 1: Full Keypad Model

Figure 2: Full Keypad Model (with SMA Connector)

Table 2: Callout Legend

Label	Button Name	Description
1	Channel Selector Knob	Rotate clockwise to increment and counter-clockwise to decrement the channel.
2	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.
3	LED Indicator	Red, green, and orange light-emitting diodes indicate operating status.
4	Side Buttons	These buttons are field programmable using the Customer Programming Software (CPS).
5	Push-To-Talk (PTT)	Press to execute voice operations (for example, Group Call and Private Call).
6	Microphone	Allows the voice to be sent when PTT or voice operations are activated.
7	Keypad	Twelve keys that allows the user to input characters for various text based operations. (For color display only)
8	Menu Navigation Buttons	Five buttons to provide menu navigation and selection interface.

Label	Button Name	Description
9	Liquid Crystal Display (LCD)	132 x 90 highly transflective color display provides visual information about many radio features.
10	Speaker	Outputs all tones and audio that are generated by the radio (for example, features like keypad tones and voice audio).
11	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.
12	Emergency Button	Turns on and off the Emergency Operations.
13	Antenna	Provides the needed RF amplification when transmitting or receiving.

1.1.2

Non Keypad Model

Figure 3: Non Keypad Model
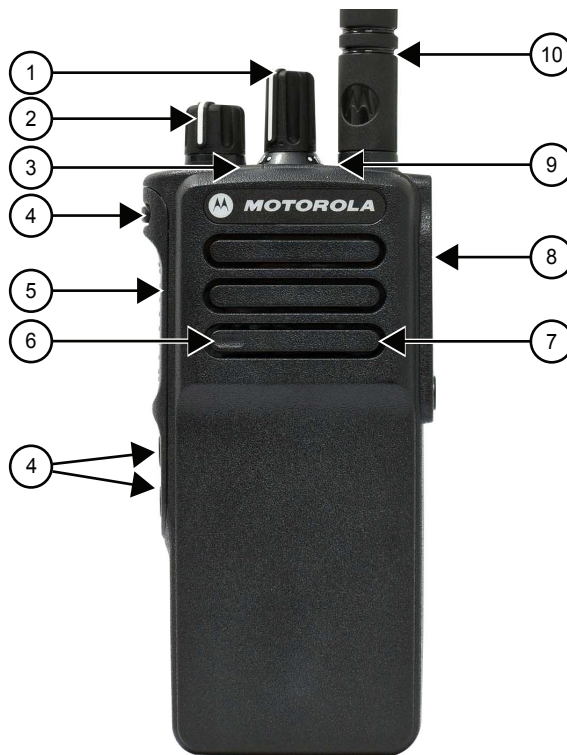
Table 3: Callout Legend

Label	Button Name	Description
1	Channel Selector Knob	Rotate clockwise to increment and counter-clockwise to decrement the channel.
2	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

Label	Button Name	Description
		volume level; rotate counter-clockwise to decrease volume level.
3	LED Indicator	Red, green, and orange light-emitting diodes indicate operating status.
4	Side Buttons	These buttons are field programmable using the Customer Programming Software (CPS).
5	Push-To-Talk (PTT)	Press to execute voice operations (for example, Group Call and Private Call).
6	Microphone	Allows the voice to be sent when PTT or voice operations are activated.
7	Speaker	Outputs all tones and audio that are generated by the radio (for example, features like keypad tones and voice audio).
8	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.
9	Emergency Button	Turns on and off the Emergency Operations.
10	Antenna	Provides the needed RF amplification when transmitting or receiving.

1.2

Portable Radio Model Numbering Scheme

Table 4: Portable Radio Model Numbering Scheme

Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Typical Model Number	AA	H	5	6	J	D	N	9	R	A	1	A	N

Table 5: Sales Models – Description of Symbols

Position	Description	Value
1	Region	AA = North America
		AZ = Asia
		LA = Latin America
		MD = Europe/Middle East/Africa
2	Type of Unit	H = Portable
3	Model Series	56 = XPR 7000e Model Series
4		
5	Band	J = 136–174 MHz
		N = 350–400 MHz
		R = 403–512 MHz

Position	Description	Value
		U = 806–941 MHz
6	Power Level	C = 1.0, 2.0, 2.5, or 3.5 W
		D = 3.5, 4.0, or 5.0 W
7	Physical Packages	C = Plain Model
		N = Color Display Full Keypad
		R = Color Display Full Keypad with SMA Antenna
		S = Plain Model with SMA Antenna
8	Channel Information	8 = Variable/Programmable Channel Spacing with unique number of channels
		9 = Variable/Programmable Channel Spacing
9	Primary Operation	R = Bluetooth, GNSS, and WiFi
		W = GNSS only
10	Primary System Type	A = Conventional
		B = Trunking
		C = Analog Only
11	Feature Level	1 = Standard with UL
		2 = Non-UL
12	Version Letter	N/A
13	Unique Variation	N = Standard Package

1.3
Model Charts

NOTICE:
"X" = Part is compatible with checked model.

"_" = The latest version kit. When ordering a kit, refer to your specific kit for the suffix number.

1.3.1
VHF Model Charts

Table 6: XPR 7000e Series, VHF, 136–174 MHz, 5 W Model Chart

				Model/Item	Description
				AAH56JDN9RA1AN	**XPR 7550e, 136–174 MHz, 5 W, Full Keypad (FKP), GNSS, Bluetooth, Wi-Fi**
				AAH56JDN9WA1AN	**XPR 7550e, 136–174 MHz, 5 W, Full Keypad (FKP), GNSS, CFS, Bluetooth, Wi-Fi**
				AAH56JDR9RA1AN	**XPR 7550e, 136–174 MHz, 5 W, Full Keypad (FKP), GNSS, Bluetooth, Wi-Fi, GOB, SMA**
				AAH56JDC9RA1AN	**XPR 7350e, 136–174 MHz, 5 W, Non-Keypad (NKP), GNSS, Bluetooth, Wi-Fi**
X	X			PMLD4727_S	Back Cover Kit, 136–174 MHz, 5 W, FKP with GNSS
			X	PMLD4729_S	Back Cover Kit, 136–174 MHz, 5 W, NKP with GNSS
		X		PMLD4853_S	Back Cover Kit, 136–174 MHz, 5 W, SMA FKP with GNSS, Bluetooth, WLAN
X	X			PMLN7238_	Front Cover Kit, Roman Keypad, GNSS
		X		PMLN7614_	Front Cover Kit, Roman Keypad, GNSS (for SMA Models only)
			X	PMLN7239_	Front Cover Kit, NKP, GNSS
X	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
X	X		X	PMAD4147_	VHF Whip Antenna, 136–174 MHz, 20 cm
		X		PMAD4088_ [1]	VHF Flexible Whip Antenna, 136–174 MHz, 21 cm
		X		PMAD4093_ [1]	VHF Stubby Antenna, 136–147 MHz, 11 cm
		X		PMAD4094_ [1]	VHF Stubby Antenna, 147–160 MHz, 11 cm
		X		PMAD4095_ [1]	VHF Stubby Antenna, 160–174 MHz, 11 cm

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[1] Can be used on SMA version of radio only. Using other antennas may cause damage or malfunction of the radio.

1.3.2
UHF Model Charts

Table 7: XPR 7000e Series, UHF, 403–512MHz Model Chart

				Model/Item	Description
				AAH56RDN9WA1AN	**XPR 7550e, 403–512 MHz, 4 W, Full Keypad (FKP), GNSS, GNSS, CFS Bluetooth, Wi-Fi**
				AAH56RDN9RA1AN	**XPR 7550e, 403–512 MHz, 4 W, Full Keypad (FKP), GNSS, Bluetooth, Wi-Fi**
				AAH56RDR9RA1AN	**XPR 7550e, 403–512 MHz, 4 W, Full Keypad (FKP), GNSS, Bluetooth, Wi-Fi, GOB, SMA**
				AAH56RDC9RA1AN	**XPR 7350e, 403–512 MHz, 4 W, Non-Keypad (NKP), GNSS, Bluetooth, Wi-Fi**
X	X			PMLE5064_S	Back Cover Kit 403–512 MHz, 4 W, FKP with GNSS
		X		PMLE5066_S	Back Cover Kit 403–512 MHz, 4 W, NKP with GNSS
	X			PMLE5178_S	Back Cover Kit 403–512 MHz, 4 W, SMA FKP with GNSS, Bluetooth, Wi-Fi
X	X			PMLN7425_	Front Cover Kit, Roman Keypad, GNSS
	X			PMLN7612_	Front Cover Kit, Roman Keypad, GNSS (for SMA Models only)
		X		PMLN7239_	Front Cover Kit, NKP, GNSS
X	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
	X			PMAE4022_ [2]	UHF Flexible Whip Antenna, 403–470 MHz, 16 cm
	X			PMAE4049_ [2]	UHF Flexible Whip Antenna, 450–512 MHz, 16 cm
	X			PMAE4100_ [2]	UHF Stubby Antenna, 380–470 MHz, 9 cm
	X			PMAE4102_ [2]	UHF Stubby Antenna, 450–512 MHz, 9 cm

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[2] Can be used on SMA version of radio only. Using other antennas may cause damage or malfunction of the radio.

1.3.3
800/900 MHz Model Charts

Table 8: XPR 7000e Series, 800/900 MHz Model Chart

Model/Item				Description
AAH56UCN9WB1AN				**XPR 7580e 800/900 MHz, 2.5 W, Full Keypad (FKP), GNSS, CFS Bluetooth, Wi-Fi**
	AAH56UCN9RB1AN			**XPR 7580e, 800/900 MHz, 2.5 W, Full Keypad (FKP), GNSS, Bluetooth, Wi-Fi**
		AAH56UCR9RB1AN		**XPR 7580e, 800/900 MHz, 2.5 W, Full Keypad (FKP), GNSS, Bluetooth, Wi-Fi, GOB, SMA**
			AAH56UCC9RB1 AN	**XPR 7380e 800/900 MHz, 2.5 W, Non-Keypad (NKP), GNSS, Bluetooth, Wi-Fi**
X	X		PMLF4158_S	Back Cover Kit 806–941 MHz, 2.5W, FKP, GNSS, Bluetooth, Wi-Fi
		X	PMLF4160_S	Back Cover Kit 806–941 MHz, 2.5W, NKP, GNSS, Bluetooth, Wi-Fi
	X		PMLF4192_S	Back Cover Kit 806–941 MHz, 2.5W, SMA FKP, GNSS, Bluetooth, Wi-Fi
X	X		PMLN7238_	Front Cover Kit, Roman Keypad, GNSS
	X		PMLN7614_	Front Cover Kit, Roman Keypad, GNSS (for SMA Models only)
		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	X	PMLN7324_S	Generic Option Board Kit
		X	NAF5087_[3]	800 MHz 1/2 Wave Whip Antenna
		X	NAF5088_[3]	900 MHz 1/2 Wave Whip Antenna

1.4
Specifications

Table 9: General Specifications

General	Full Keypad	Non-Keypad
Channel Capacity	1000	32
Frequency	VHF: 136–174 MHz	

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[3] Can be used on SMA version of radio only. Using other antennas may cause damage or malfunction of the radio.

General	Full Keypad	Non-Keypad
	UHF: 403–512 MHz 800 Band: 806–825 MHz; 851–870 MHz 900 Band: 896–902 MHz; 935–941 MHz	
Dimensions (HxWxT) with 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 with PMNN4493_ IM-PRES Low Volt Li-Ion (1500 mAh)	347 g	322 g
Weight with PMNN4489_ IM-PRES TIA 4950 Hi-Cap Li-Ion (2900 mAh)	402 g	377 g
Weight with PMNN4491_ Slim IMPRES (2100 mAh)	325 g	300 g
Power Supply	7.5 V nominal	
FCC Description	VHF: AZ489FT7066 UHF: AZ489FT7065 800/900 MHz: AZ489FT7067	
IC Description	VHF: 109U-89FT7066 UHF: 109U-89FT7065 800/900 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 hr	
	Digital: 15.5 hr	
IMPRES Hi-Cap Li-Ion Non-FM (2250 mAh)	Analog: 16.0 hr	
	Digital: 21.0 hr	
IMPRES Low Volt Hi-Cap Li-Ion (3000 mAh)	Analog: 21.5 hr	
	Digital: 28.0 hr	
IMPRES TIA 4950 Hi-Cap Li-Ion (2900 mAh)	Analog: 20.5 hr	
	Digital: 27.0 hr	
IMPRES Li-Ion (2050 mAh)	Analog: 14.5 hr	
	Digital: 19.0 hr	
IMPRES Hi-Cap Li-Ion FM (2300 mAh)	Analog: 16.0 hr	
	Digital: 21.5 hr	
IMPRES Hi-Cap Li-Ion TIA4950 (2500 mAh)	Analog: 17.5 hr	
	Digital: 23.5 hr	
Core Li-Ion IP68 Battery (2450 mAh)	Analog: 17.0 hr	
	Digital: 22.0 hr	

General	Full Keypad	Non-Keypad
IMPRES Li-Ion IP68 Battery (2450 mAh)	Analog: 17.0 hr	
	Digital: 22.0 hr	

TIA 4950 UL Approval

MOTOTRBO Portable Radios are 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 Solutions UL approved battery option. They are also approved for use in Class I, Division 2, Groups A, B, C, D.

NOTICE: Weight can have 5% margin of error.

Table 10: Receiver Specifications

General	Full Keypad	Non-Keypad
Frequency	VHF: 136–174 MHz UHF: 403–512 MHz 800 Band: 851–870 MHz 900 Band: 935–941 MHz	
Channel Spacing	12.5 kHz/20 kHz/25 kHz[4, 5]	
Frequency Stability (-30 °C to +60 °C)	+/-0.5 ppm	
Analog Sensitivity (12 dB SINAD)	0.23 µV (0.17 µV typical) for VHF/UHF 0.25 µV (0.19 µV typical) for 800/900 MHz	
Digital Sensitivity (5% BER)	0.18 µV (0.14 µV typical) for VHF/UHF 0.22 µV (0.18 µV typical) for 800/900 MHz	
Intermodulation (TIA603C/D)	70 dB	
Adjacent Channel Selectivity TIA603	60 dB @ 12.5 kHz, 70 dB @ 20 kHz/25 kHz[4, 5]	
Adjacent Channel Selectivity TIA603C/D	45 dB @ 12.5 kHz, 70 dB @ 20 kHz/25 kHz[4, 5]	
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[4, 5]	
Audio Response	TIA603C/D	

---

[4] 20 kHz not supported by 350/800/900 MHz band.
[5] 25 kHz not supported by 900 MHz band.

General	Full Keypad	Non-Keypad
Conducted Spurious Emission (TIA603C/D)	-57 dBm	

Table 11: Transmitter Specifications

General	Full Keypad	Non-Keypad
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	
Channel Spacing	12.5 kHz/20 kHz/25 kHz[6, 7]	
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	
	350 MHz Band: 4 W	
	800/900 MHz Band: 2.5 W	
Modulation Limiting	+/-2.5 kHz @ 12.5 kHz	
	+/-4.0 kHz @ 20 kHz[6]	
	+/-5.0 kHz @ 25 kHz[7]	
FM Hum and Noise	-40 dB @ 12.5 kHz	
	-45 dB @ 20 kHz/25 kHz[6, 7]	
Conducted/Radiated Emission	-36 dBm < 1 GHz	
	-30 dBm > 1 GHz	
Adjacent Channel Power	60 dB @ 12.5 kHz	
	70 dB @ 20 kHz/25 kHz[6, 7]	
Audio Response	TIA603C/D	
Audio Distortion	3%	
FM Modulation	12.5 kHz: 11K0F3E	
	25 kHz: 16K0F3E	
4FSK Digital Modulation	12.5 kHz Data Only: 7K60F1D and 7K60FXD	
	12.5 kHz Data and Voice: 7K60F1E and 7K60FXE	
	Combination of 12.5 kHz Voice and Data: 7K60F1W	
Digital Vocoder Type	AMBE+2™	

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[6] 20 kHz not supported by 350/800/900 MHz band.
[7] 25 kHz not supported by 900 MHz band.

General	Full Keypad	Non-Keypad
Digital Protocol	ETSI-TS102361-1	
	ETSI-TS102361-2	
	ETSI-TS102361-3	

Table 12: Self-Quieter Frequencies

VHF (MHz)	UHF (MHz)	800/900 MHz
136.8 ± 10 kHz	408 ± 10 kHz	864 ± 10 kHz
138 ± 10 kHz	410.4 ± 10 kHz	866.4 ± 10 kHz
139.2 ± 10 kHz	417.6 ± 10 kHz	936 ± 10 kHz
144 ± 10 kHz	422.4 ± 10 kHz	940.8 ± 10 kHz
148.8 ± 10 kHz	432 ± 10 kHz	-
150 ± 10 kHz	436.8 ± 10 kHz	-
151.17 ± 5 kHz	451.2 ± 10 kHz	-
153.6 ± 10 kHz	456 ± 10 kHz	-
156 ± 10 kHz	460.8 ± 10 kHz	-
158.4 ± 10 kHz	468 ± 10 kHz	-
160 ± 5 kHz	470.4 ± 10 kHz	-
162 ± 10 kHz	475.2 ± 10 kHz	-
163.2 ± 10 kHz	480 ± 5 kHz	-
168 ± 10 kHz	484.8 ± 10 kHz	-
172.8 ± 10 kHz	489.6 ± 10 kHz	-
174 ± 10 kHz	499.2 ± 10 kHz	-
-	500 ± 5 kHz	-
-	501.6 ± 10 kHz	-
-	504 ± 10 kHz	-
-	504.32 ± 10 kHz	-
-	505.345 ± 10 kHz	-
-	508.8 ± 10 kHz	-
-	514.56 ± 10 kHz	-
-	518.4 ± 10 kHz	-
-	519.25 ± 10 kHz	-

Table 13: Bluetooth Specifications

Bluetooth	
Version	Supports Bluetooth 4.0LE + EDR Specification

Bluetooth	
Range	Class 2, 10 m

Table 14: Wi-Fi Specifications

Wi-Fi	
Version	Supports 802.11 b/g/n, 2.4 GHz band

Table 15: GNSS Specifications

GNSS/GPS	
TTFF (Time To First Fix) Cold Start @ -130 dBm (95%)	≤ 60 seconds
TTFF (Time To First Fix) Hot Start @ -130 dBm (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)	

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

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[8] Tested to MIL standard G which supersedes previous version.

Military Standards										
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/ CatF/ 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

Table 16: Environmental Specifications

Parameter	Value
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

NOTICE:
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.

This product meets IP68 as defined by Motorola Solutions, for example, submersion to a depth of two meters for two 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 is 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.

Chapter 2

Test Equipment and Service Aids

This chapter lists the recommended test equipment and service aids, as well as information on field programming equipment that can be used in servicing and programming Motorola Solutions radios.

2.1
Recommended Test Equipment

The list of equipment contained in the following table includes most of the standard test equipment required.

Table 17: Test Equipments

Equipment	Characteristics	Example	Application
Service Monitor	Can be used as a substitute.	Aeroflex 3920 (www.aeroflex.com) or equivalent	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment.
Digital RMS Multimeter[9]	100 µV to 300 V	Fluke 179 (www.fluke.com) or equivalent	AC/DC voltage and current measurements. Audio voltage measurements.
	5 Hz to 1 MHz		
	10 MΩ Impedance		
RF Signal Generator[9]	100 MHz to 1 GHz	Agilent N5181A (www.agilent.com), Ramsey RSG1000B (www.ramseyelectronics.com), or equivalent	Receiver measurements
	-130 dBm to +10 dBm		
	FM Modulation: 0 kHz to 10 kHz		
	Audio Frequency: 100 Hz to 10 kHz		
Oscilloscope[9]	2 Channel	Tektronix TDS1001b (www.tektronix.com) or equivalent	Waveform measurements
	50 MHz Bandwidth		
	5 mV/div to 20 V/div		
Power Meter and Sensor[9]	5% Accuracy	Bird 43 Thruline Watt Meter (www.bird-electronic.com) or equivalent	Transmitter power output measurements
	100 MHz to 500 MHz		
	50 W		
RF Millivoltmeter	100 mV to 3 V RF	Boonton 92EA (www.boonton.com) or equivalent	RF level measurements
	10 kHz to 1 GHz		
Power Supply	0 V to 32 V	B&K Precision 1790 (www.bkprecision.com) or equivalent	Voltage supply
	0 A to 20 A		

---

[9] Can use Service Monitor as substitute.

2.2
Service Aids

The following table lists the service aids recommended for working on the radio.

While all of these items are available from Motorola Solutions, most are standard workshop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

Table 18: Service Aids Part Number and Part Description

Motorola Solutions 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 [10]	Portable Programming Cable	This cable connects the radio to a USB port for radio programming and data applications.
PMKN4013C [10]	Portable Programming, Testing & Alignment Cable	This cable connects the radio to a USB port for radio programming, testing and alignment.
PMNN4428_	7.5 V 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.
5880384G68	DMR SMA to BNC RF Adaptor	Adapts radio's antenna port to BNC cabling of test equipment.
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.

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[10] Earlier versions of programming cables will not work with the radio.

Programming, Testing, and Alignment Cable

Figure 4: Programming, Testing, and Alignment Cable
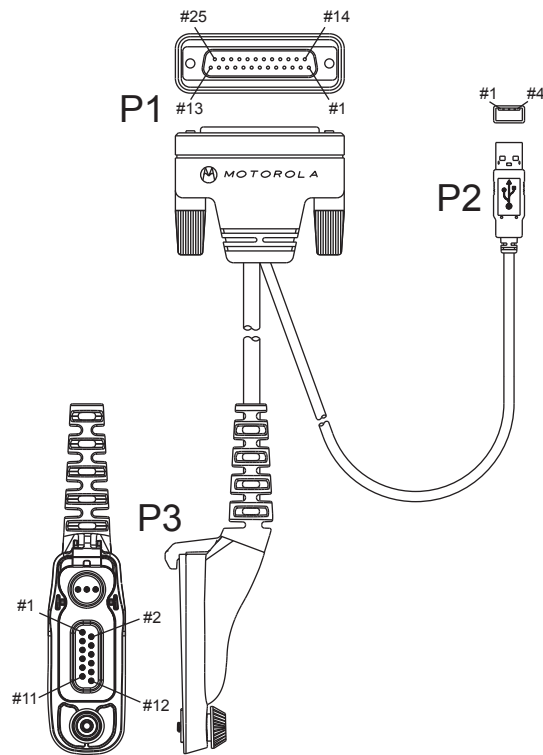
Table 19: Pin Configuration of Side Connector

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 and 5		7	EXTERNAL SPEAKER+
2 and 7		8	EXTERNAL SPEAKER-
20		9	EXTERNAL PTT
17		10	EXTERNAL MIC+
16		11	EXTERNAL MIC-

Figure 5: Pin Layout of Side Connector
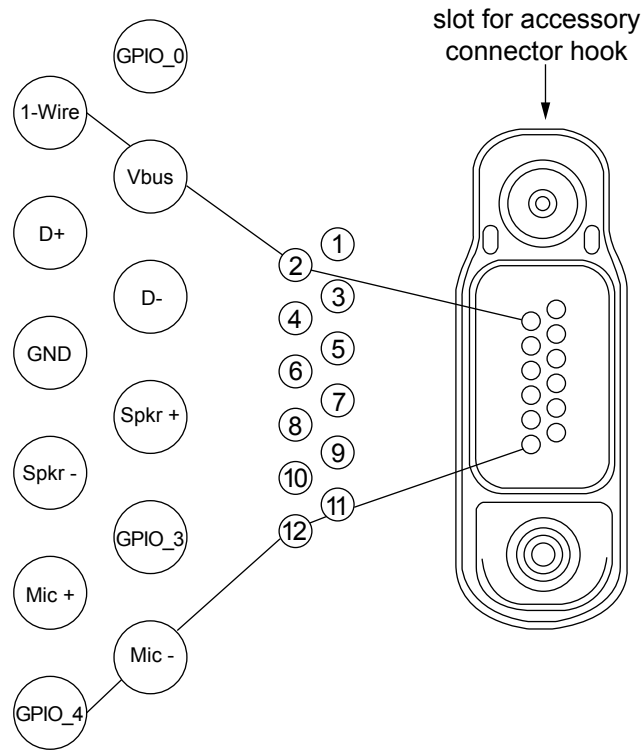
Chapter 3

Transceiver Performance Testing

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 calibration schedule recommended by the manufacturer.

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

3.1
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 Setup chapter.

⚠️ **WARNING:** Do NOT use any form of connector, for example wires, crocodile clips, and probes, to supply voltage to the radio, other than the Motorola Solutions approved battery eliminator.

Initial equipment control settings must be as indicated in the following table:

Table 20: Initial Equipment Control Settings

Service Monitor	Power Supply	Test Set
Monitor Mode: Power Monitor	Voltage: 7.5 Vdc	Speaker set: A
RF Attn: -70	DC on/standby: Standby	Speaker/load: Speaker
AM, CW, FM: FM	Volt Range: 10 V	PTT: OFF
Oscilloscope Source: Mod Oscilloscope Horizontal: 10 ms/Div Oscilloscope Vertical: 2.5 kHz/Div Oscilloscope Trigger: Auto Monitor Image: Hi Monitor Bandwidth: Narrow Monitor Squelch: Middle setting Monitor Vol: 1/4 setting	Current: 2.5 A	

Set up the DMR Transmitter and Receiver Test as per the following figure:

1 Connect the Programming cable to the radio and to the computer.

2 Remove the orange RF plug as shown in Figure 10: RF Plug Removal on page 56.

3 Connect the RF antenna adaptor to the 50 Ω RF Input/Output port of the radio.

4 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 the figure.

See for complete RF Adaptor Assembly steps.

Figure 6: DMR Radio Transmitter and Receiver Testing Setup
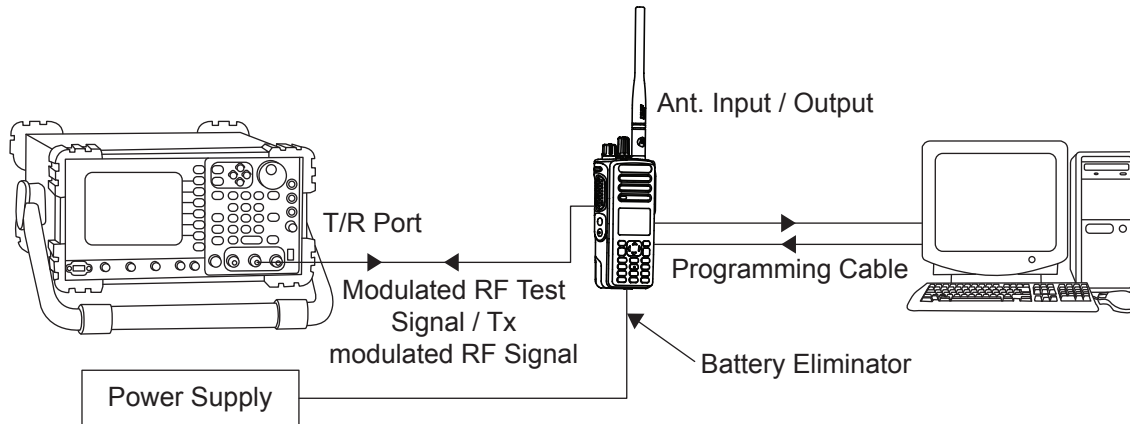
3.2
Display Model Test Mode

3.2.1
Entering Display Radio Test Mode

Procedure:

1 Turn the radio on.

2 Within 10 seconds after Self-Test is complete, press **Side Button 2** five times in succession.

   The radio beeps and shows a series of displays regarding various version numbers and subscriber-specific information. The displays are described in the following table.

Table 21: 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 model number as programmed in the codeplug.	Always
MSN	The radio serial number as programmed in the codeplug.	Always
FLASHCODE	The FLASH codes as programmed in the codeplug.	Always
RF Band	The radio band.	Always

> **NOTICE:** The radio stops at each display for 2 seconds before moving to the next information display. If the information cannot fit into one line, the radio display scrolls automatically character by character after 1 second to view the whole information. If the **Left** button is pressed before the last information is displayed, the radio suspends the information display until the user presses the **Right** button to resume the information display. The last display shows `RF Test Mode`.

3.2.2
LCD Flicker Test Mode

Procedure:

1   Press and hold **Side Button 1** to access the Flicker test.

A black screen is displayed. The screen remains black for a properly functioning display.

> **NOTICE:** If there is any flickering, send the radio to the service depot to be fixed.

2   Press and hold **Side Button 1** for two seconds to be taken to the LCD Display test mode.

3.2.3
LCD Display Test Mode

Procedure:

1   Press any button to test the LCD display, then press the **Right** button.

The display is fixed.

2   Press and hold the first side button.

The screen changes.

3   Press the **Right** button.

The housing displays a white screen with two pixels wide of a black border inset from the edge by two pixels.
The radio shows `Display Test Mode` in black.

4   Press the **Right** button.

The housing displays a black screen with two pixels wide of a white border inset from the edge by two pixels.
The radio shows `Display Test Mode` in white.

5   Press the **Right** button.

The housing displays a full screen in Red.

6   Press the **Right** button.

The housing displays a full screen in Green.

7   Press the **Right** button.

The housing displays a full screen in Blue.

8   Press the **Right** button.

The housing displays growing horizontal bars with a cyclic color of Red->Green->Blue->Black->Red->Green->Blue->Black->Red (Full Screen).

9   Press the **Right** button.

The housing displays growing vertical bars with a cyclic color of Red->Green->Blue->Black->Red->Black (Full Screen).

3.2.4
RF Test Mode

When the radio is operating in its normal environment, the radio 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 with a special routine, called Test Mode or air test.

3.2.4.1
Testing RF Channel Selections

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.

Prerequisites:

> **NOTICE:** The default test environment is CSQ.

Procedure:

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.

> **NOTICE:** DIG is digital mode and other test environments are analog mode as described in Test Environments.

Table 22: Test Environments

No. of Beeps	Description	Function
1	Carrier Squelch (CSQ)	RX: unsquelch 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: unsquelch 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.

The radio beeps once when radio toggles to 20 kHz, beeps twice for 25 kHz, and beeps three times for 12.5 kHz.

3 Turn **Channel Knob** to change the test channel from 1 to 16.

See Test Frequencies for the test channel descriptions.

The radio beeps in each position.

Table 23: Test Frequencies

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

Table 24: Transmitter Performance Checks

Test Name	Communications Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON Fourth channel test frequency [11]	Test Mode, Test Channel 4 carrier squelch	PTT to continuously transmit (during the	Frequency error to be: ±68 Hz for VHF ±201 Hz for UHF

Test Name	Communications Analyzer	Radio	Test Set	Comments
	Monitor: Frequency error Input at RF In/Out		performance check)	±403 Hz for 800/900 MHz
Power RF	As above	As above	As above	Low Power: 0.9–1.5 W (UHF/ VHF) 0.9–1.5 W (800/900 MHz) High Power: 4.0–4.8 W 2.4–3.0 W (800/900 MHz) 5.0–5.8 W (VHF)
Voice Modulation	Mode: PWR MON Fourth channel test frequency[11] atten to -70, input to RF In/Out Monitor: DVM: AC Volts Set 1 kHz Mod Out level for 0.025 Vrms at test set, 80 mVrms at AC/DC test set jack	As above	As above, meter selector to mic	Deviation: ≥ 4.0 kHz but ≤ 5.0 kHz (25 kHz Ch Sp).
Internal Voice Modulation	Mode: PWR MON Fourth channel test frequency[11] atten to -70, input to RF In/Out	Test Mode, Test Channel 4 carrier squelch output at antenna	Remove modulation input	Press **PTT** to switch on radio. Say "four" loudly into the radio mic. Measure deviation: ≥ 4.0 kHz but ≤ 5.0 kHz (25 kHz Ch Sp)
TPL Modulation	As above Fourth channel test frequency[11] BW to narrow	Test Mode, Test Channel 4 TPL	As above	Deviation: ≥500 Hz but ≤1000Hz (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 ~1.5 V.

---

[11] See Test Frequencies.

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 648 Hz +/- 10% and 1944 Hz +/- 10%
Transmitter BER	DMR Mode	As above	As above	Transmitter BER should be 0%

Table 25: Receiver Performance Checks

Test Name	Communications Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON Fourth 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: ±68 Hz for VHF ±201 Hz for UHF ±403 Hz for 800/900 MHz
Rated Audio	Mode: GEN Output level: 1.0 mV RF Sixth channel test frequency[11] Mod: 1 kHz tone at 3 kHz 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 12 dB SINAD.	As above	PTT to OFF (center)	RF input to be: <0.23 µV for UHF/VHF <0.25 µV for 800/900 MHz
Noise Squelch	RF level set to 1 mV RF	As above	PTT to OFF (center), meter selec-	Set volume control to 2.83 Vrms

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[12] See Test Frequencies.

Test Name	Communications Analyzer	Radio	Test Set	Comments
Threshold (only radios with conventional system need to be tested)			tion to Audio PA, speaker/load to speaker	
	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 μV. Preferred SINAD = 9–10 dB
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 μV 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 = 2.83 V
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%

3.2.5
LED Test Mode

Procedure:

1   Press and hold **Side Button 1** after Display Test Mode.

    The radio beeps once and displays `LED Test Mode`.

2   Press any button/key.

    The red LED lights up and the radio displays `Red LED On`.

3   Press any button/key.

    The red LED is turned off. The green LED lights up and the radio displays `Green LED On`.

4   Press any button/key.

    The green LED is turned off. The radio lights up both LEDs up while displaying `Both LEDs On`. The orange LED lights up.

    NOTICE: Do not use the ON/OFF Button to change the LED status.

3.2.6
Accelerometer Test

Procedure:

1 Press and hold **Side Button 1**.

 The radio beeps once and displays `Accelerometer Test Mode`.

2 Hold the radio horizontally and press the **OK** button.

 The display shows `Accelerometer Test Passed` or `Accelerometer Test Failed` accordingly.

3.2.7
Backlight Test Mode

Procedure:

 Press and hold **Side Button 1** after LED Test Mode.

 The radio beeps once and displays `Backlight Test Mode`.

The radio turns on both LCD and keypad backlight.

3.2.8
Speaker Tone Test Mode

Procedure:

 Press and hold **Side Button 1** after Backlight Test Mode.

 The radio beeps once and displays `Speaker Tone Test Mode`.

The radio generates a 1 kHz tone with the internal speaker.

3.2.9
Earpiece Tone Test Mode

Procedure:

1 Connect the external accessory to the radio.

2 Press and hold **Side Button 1** after Speaker Tone Test Mode.

 The radio beeps once and displays `Earpiece Tone Test Mode`.

The radio generates a 1 kHz tone from the earpiece.

3.2.10
Audio Loopback Earpiece Test Mode

Procedure:

 Press and hold **Side Button 1** after the Earpiece Tone Test Mode.

 The radio beeps once and displays `Audio Loopback Earpiece Test Mode`.

The radio routes any audio on the external mic to the earpiece.

3.2.11
Battery Check Test Mode

Procedure:

       Press and hold **Side Button 1** after Audio Loopback Earpiece Test Mode.

       The radio beeps once and momentarily displays `Battery Check Test Mode`.

The radio displays the following:

Figure 7: Battery Check Test Mode Display
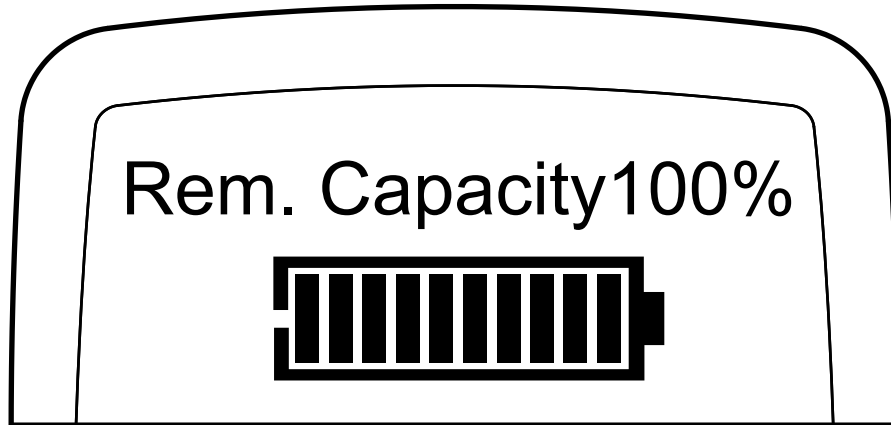
3.2.12
Button/Knob/PTT Test Mode

Any key press causes the test to advance from one step to the next.

Table 26: Button/Knob/PTT Checks

Action	Result
Press and hold **Side Button 1**.	The radio displays `Button Test` (line 1). The radio beeps once.
Rotate the **Volume Knob**.	`2/1` through `2/255` appears. The radio beeps at each position.
Rotate the **Channel Knob** clockwise.	`4/1` appears. The radio beeps at each position.
Rotate the **Channel Knob** counterclockwise.	`4/-1` appears. The radio beeps at each position.
Press **Side Button 1**.	`96/1` appears. The radio beeps.
Release the button.	`96/0` appears. The radio beeps.
Press **Side Button 2**.	`97/1` appears. The radio beeps.
Release the button.	`97/0` appears.

Action	Result
	The radio beeps.
Press **Side Button 3**.	`98/1` appears. The radio beeps.
Release the button.	`98/0` appears. The radio beeps.
Press the **PTT** button.	`1/1` appears. The radio beeps.
Release the button.	`1/0` appears. The radio beeps.
Press the **Top Button**.	`148/1` appears. The radio beeps.
Release the button.	`148/0` appears. The radio beeps.

Table 27: Keypad Checks

Action	Result
Press **0**.	`48/1` appears. The radio beeps.
Release the button.	`48/0` appears. The radio beeps.
Press **1** button.	`49/1` appears. The radio beeps.
Release the button.	`49/0` appears. The radio beeps.
Press **2** button.	`50/1` appears. The radio beeps.
Release the button.	`50/0` appears. The radio beeps.
Press **3** button.	`51/1` appears. The radio beeps.
Release the button.	`51/0` appears. The radio beeps.
Press **4** button.	`52/1` appears. The radio beeps.
Release the button.	`52/0` appears. The radio beeps.
Press **5** button.	`53/1` appears. The radio beeps.

Action	Result
Release the button.	`53/0` appears. The radio beeps.
Press **6** button.	`54/1` appears. The radio beeps.
Release the button.	`54/0` appears. The radio beeps.
Press **7** button.	`55/1` appears. The radio beeps.
Release the button.	`55/0` appears. The radio beeps.
Press **8** button.	`56/1` appears. The radio beeps.
Release the button.	`56/0` appears. The radio beeps.
Press **9** button.	`57/1` appears. The radio beeps.
Release the button.	`57/0` appears. The radio beeps.
Press ***** button.	`58/1` appears. The radio beeps.
Release the button.	`58/0` appears. The radio beeps.
Press **#** button.	`59/1` appears. The radio beeps.
Release the button.	`59/0` appears. The radio beeps.
Press the **P1** button.	`160/1` appears. The radio beeps.
Release the button.	`160/0` appears. The radio beeps.
Press the **P2** button.	`161/1` appears. The radio beeps.
Release the button.	`161/0` appears. The radio beeps.
Press the **MENU** button.	`85/1` appears. The radio beeps.
Release the button.	`85/0` appears. The radio beeps.

Action	Result
Press the **BACK** button.	`129/1` appears. The radio beeps.
Release the button.	`129/0` appears. The radio beeps.
Press the **Left** button.	`128/1` appears. The radio beeps.
Release the button.	`128/0` appears. The radio beeps.
Press the **Right** button.	`130/1` appears. The radio beeps.
Release the button.	`130/0` appears. The radio beeps.
Press the **Up** button.	`135/1` appears. The radio beeps.
Release the button.	`135/0` appears. The radio beeps.
Press the **Down** button.	`136/1` appears. The radio beeps.
Release the button.	`136/0` appears. The radio beeps.

3.3
Non-Display Model Test Mode

3.3.1
Entering Non-Display Radio Test Mode

Procedure:

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

The radio beeps.

3.3.2
RF Test Mode

When the radio is operating in its normal environment, the radio microcontroller controls the RF channel selection, transmitter key-up, and receiver muting, according to the customer codeplug configuration.

When and where to use: However, when the unit is on the bench for testing, alignment, or repair, it must be removed from its normal environment by using a special routine, called Test Mode or "air test".

Procedure:

1 Short press **Side Button 2** to change 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.

DIG is digital mode and other test environments are analog mode as described in Table 22: Test Environments on page 41.

2 Short press **Side Button 1** to toggle the channel spacing between 20 kHz, 25 kHz, and 12.5 kHz.

The radio beeps once when radio toggles to 20 kHz, beeps twice for 25 kHz and beeps three times for 12.5 kHz.

3 Turn the **Channel Knob** to change the test channel from 1 to 16.

The radio beeps at each position.

Refer to "Test Frequencies" for the test channel descriptions.

3.3.3
LED Test Mode

Procedure:

1 Press and hold **Side Button 1** after RF Test Mode.

The radio beeps once.

2 Press any button/key.
The red LED lights up.

3 Press any button/key.
The red LED turns off and the radio lights up the green LED.

4 Press any button/key.

The green LED turns off and the radio turns on both LEDs.

3.3.4
Speaker Tone Test Mode

Procedure:

Press and hold **Side Button 1** after LED Test Mode.

The radio beeps once.

The radio generates a 1 kHz tone with the internal speaker.

3.3.5
Earpiece Tone Test Mode

Procedure:

Press and hold **Side Button 1** after Speaker Tone Test Mode.

The radio beeps once.

The radio generates a 1 kHz tone with the earpiece.

3.3.6
Audio Loopback Earpiece Test Mode

Procedure:

Press and hold **Side Button 1** after Earpiece Tone Test Mode.

The radio beeps once.

The radio routes any audio on the external mic to the earpiece.

3.3.7
Battery Check Test Mode

Procedure:

Press and hold **Side Button 1** after Audio Loopback Earpiece Test Mode.
The radio beeps once.

The radio LED lights up as follows:

- Green LED for High Battery Level
- Orange LED for Mid Battery Level
- Blinking red LED for Low Battery Level

3.3.8
Button/Knob/PTT Test Mode

Any key press causes the test to advance from one step to the next.

Table 28: Button/Knob/PTT Checks

Action	Result
Press and hold **Side Button 1**.	The radio beeps once.
Rotate the **Volume Knob**.	The radio beeps at each position.
Rotate the **Channel Knob**.	The radio beeps at each position.
Press **Side Button 1**.	The radio beeps.
Release the button.	The radio beeps.
Press **Side Button 2**.	The radio beeps.
Release the button.	The radio beeps.
Press **Side Button 3**.	The radio beeps.
Release the button.	The radio beeps.
Press the **PTT** button.	The radio beeps.
Release the button.	The radio beeps.
Press the **Top Button**.	The radio beeps.
Release the button.	The radio beeps.

Chapter 4

Radio Programming and Tuning

This chapter provides an overview of the MOTOTRBO Customer Programming Software (CPS), Tuner, and AirTracer applications, which are all designed for use in a Windows 8/7/2000/XP/Vista environment.

> **NOTICE:** Refer to the online help files of the appropriate program for the programming procedures.

These programs are available in one kit as listed in the following table. An Installation Guide is also included with the kit.

Table 29: Software Installation Kits Radio Tuning Setup

Description	Part Number
MOTOTRBO CPS, Tuner, and AirTracer Applications CD	RVN5115_

4.1
Customer Programming Software Setup

Program the radio using the following setup.

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

Figure 8: CPS Programming Setup

Radio

Battery

Programming, Testing
& Alignment Cable
PMKN4012B
PMKN4013C or later.
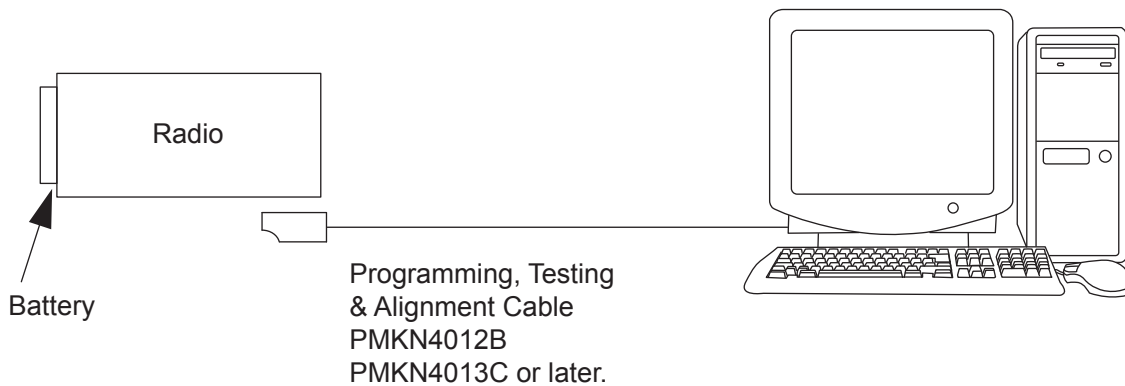
4.2
AirTracer Application Tool

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 Solutions personnel to suggest improvements in system configurations or to help isolate problems.

4.3
Radio Tuning Setup

Retuning is not required if service kit has been replaced and factory tuned. However, check service kit for performance before use.

Before keying up the radio, set the Bias DAC for the appropriate final device bias current. If the bias is not properly set, it may cause damage to the transmitter.

⚠ **CAUTION:** Only Motorola Solutions Service Centers or Authorized Motorola Solutions Service Dealers can perform this function.

A personal computer (PC) with Windows, Windows 2000/XP/Vista/Windows 7 and a tuner program are required to tune the radio. See Figure 9: Radio Tuning Equipment Setup on page 55 to perform tuning procedures.

Figure 9: Radio Tuning Equipment Setup
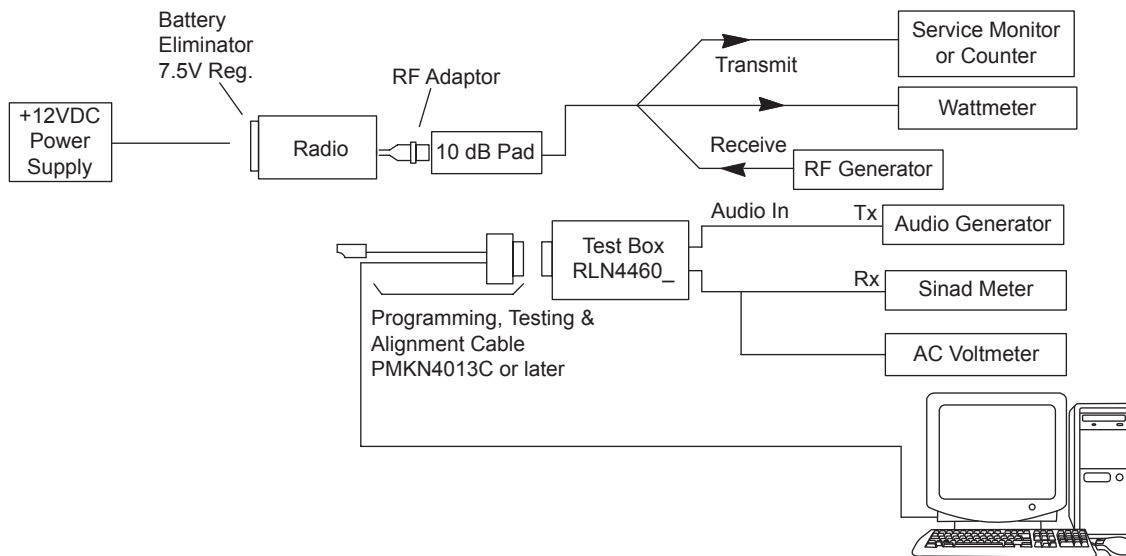
4.4
RF Adaptor Assembly (not applicable for SMA models)

Procedure:

1 Remove the RF plug.

Figure 10: RF Plug Removal
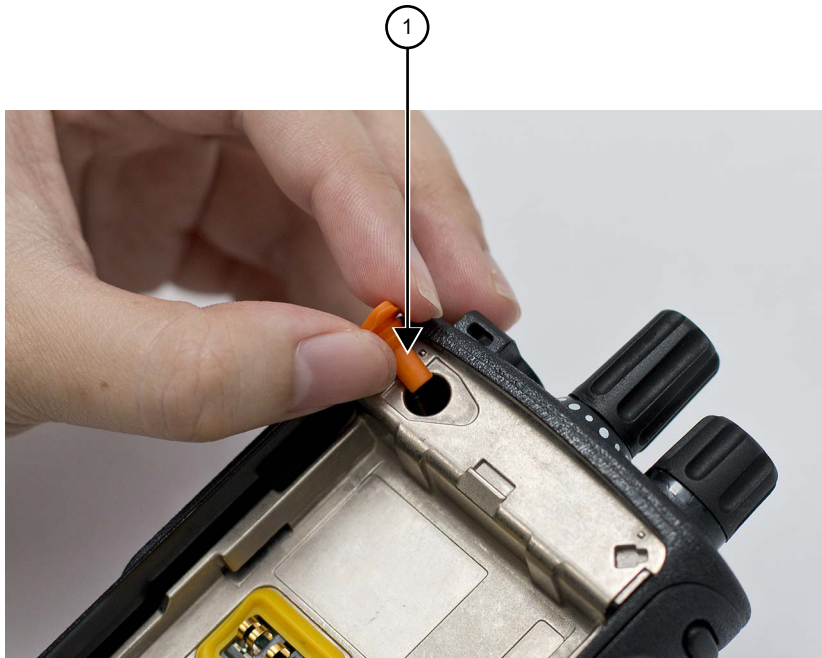
Label	Description
1	RF Plug

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 11: RF Adaptor Holder
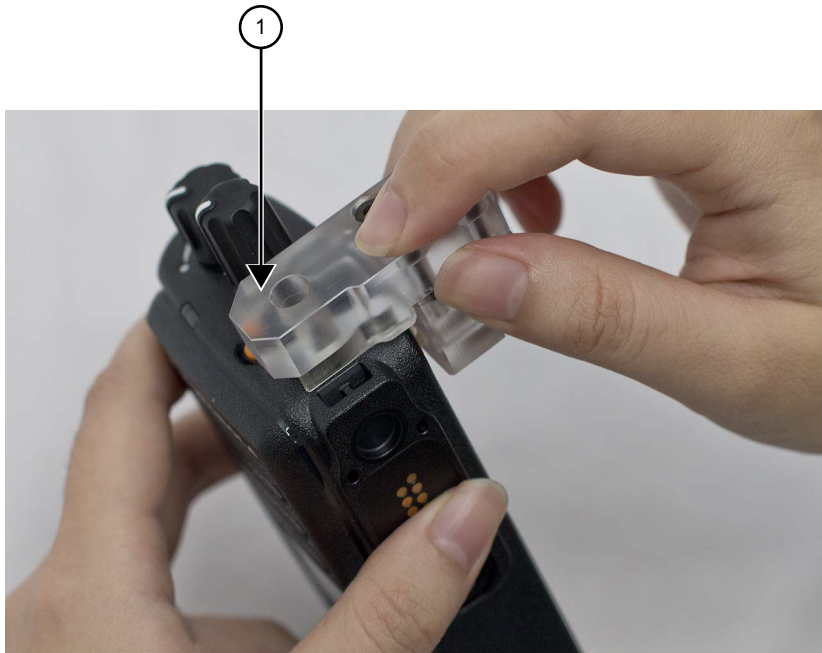
Label	Description
1	RF Adaptor

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

Figure 12: RF Adaptor Screw

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

Figure 13: RF Adaptor Complete Assembly
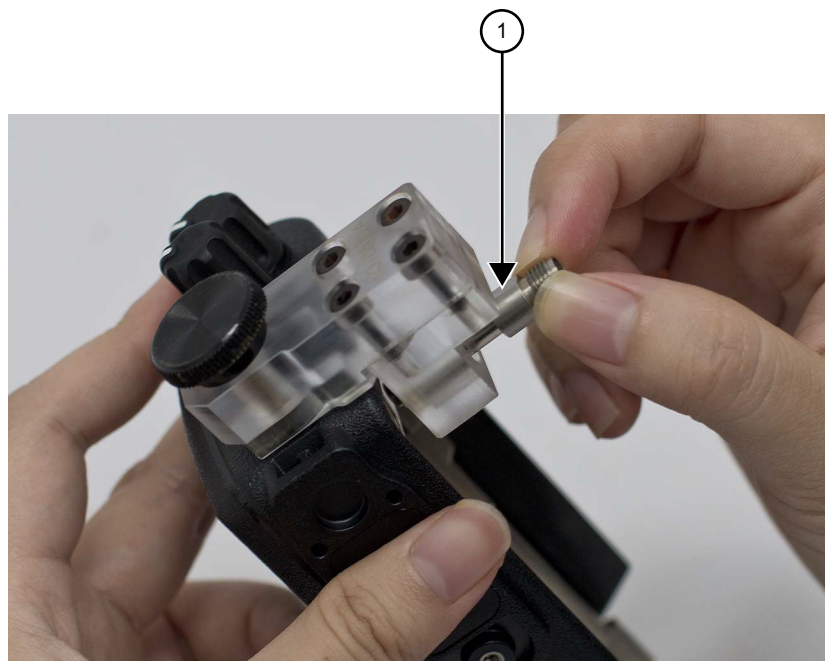
Label	Description
1	RF Connector

Chapter 5

Disassembly/Reassembly Procedures

This chapter provides details about the following:

- Preventive maintenance (inspection and cleaning).

- Safe handling of CMOS and LDMOS devices.

- Repair procedures and techniques.

- Disassembly and reassembly of the radio.

5.1
Preventive Maintenance

Periodic visual inspection and cleaning are recommended.

Inspection

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

Cleaning Procedures

The following procedures describe the recommended cleaning agents and the methods to clean the external and internal surfaces of your radio.

External surfaces include the front cover, housing assembly, and battery. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime.

⚠ **CAUTION:** Use all chemicals as prescribed by the manufacturer. Follow all safety precautions as defined on the label or material safety data sheet.

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

📝 **NOTICE:**
Only clean internal surfaces when your radio is disassembled for service or repair.

Cleaning External Plastic Surfaces

⬦ **IMPORTANT:** The only recommended agent for cleaning the external radio surfaces is a 0.5% solution of a mild dish-washing detergent in water.

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

5.2
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 your radio without referring to the following caution statement.

⚠️ **CAUTION:**
This radio contains static-sensitive devices. Do not open your 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. It is recommended that you use a wrist strap, two ground cords, a table mat, a floor mat, electrostatic discharge (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 Solutions 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.

- Handle CMOS/LDMOS devices by the package and not by the leads. Before 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.

5.3
General Repair Procedures and Techniques

Environmentally Preferred Products (EPP) 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 Solutions specified parts in this manual.

For the identification of lead (Pb) free assemblies, all EPP products carry the EPP Marking, shown in the following examples, on the Printed Circuit Board (PCB). This marking provides information to those performing assembly, servicing, and recycling operation on this product, adhering to the JEDEC Standard No. 97. The EPP Marking takes the form of a label or marking on the PCB.
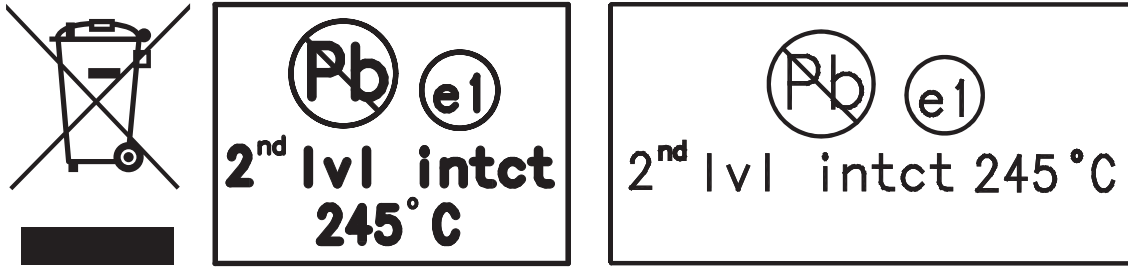
Any rework or repair on Environmentally Preferred Products must be done using the appropriate lead-free solder wire and lead-free solder paste as stated in the following tables:

Table 30: Lead Free Solder Wire Part Number List

Motorola Solutions 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%	217 °C	52171	0.015 in.	1 lb spool

Table 31: Lead Free Solder Paste Part Number List

Manufacturer Part Number	Viscosity	Type	Composition and Percent Metal	Liquid Temperature
NC-SMQ230	900–1000KCPs Brookfield (5 rpm)	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 must be used. If the identical replacement part is not locally available, check the parts list for the proper Motorola Solutions part number and order the part.

Rigid Circuit Boards

This family of radios use bonded, multi-layer, printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The plated-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.

For soldering components with Hot-Air or infra red solder systems, check the user guide of your solder system to get information on solder temperature and time for the different housings of the integrated circuits and other components.

5.4
Disassembling and Reassembling the Radio

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.

⚠️ **CAUTION:** To assure the safety and regulatory compliance of your radio, repair your radio only at Motorola Solutions service facilities. Please contact your local dealer or Point of Sale for further instructions.

The following tools are required for disassembling the radio:

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

The following 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)

📝 **NOTICE:** If a unit requires further testing or service than is customarily performed at the basic level, send radio to Motorola Solutions Service Center.

5.5
Detailed Radio Disassembly

The section describes the detailed disassembly procedure of your radio.

5.5.1
Front Cover from Chassis Disassembly

Procedure:

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 14: Battery Removal

Figure 15: Battery Removal (for SMA model)

3 Remove the antenna by turning it counterclockwise.

Figure 16: Antenna Removal

Figure 17: Antenna Removal (for SMA model)

4 Hook the knob opener under the shroud and detach it with a downward motion.

Figure 18: Shroud Removal

Label	Description
1	Shroud

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

Figure 19: Volume Knob and Channel Selector Knob Removal

> 📝 **NOTICE:** Both knobs slide on and off. However, they are supposed to fit very tightly on their shafts.

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 20: Chassis Removal
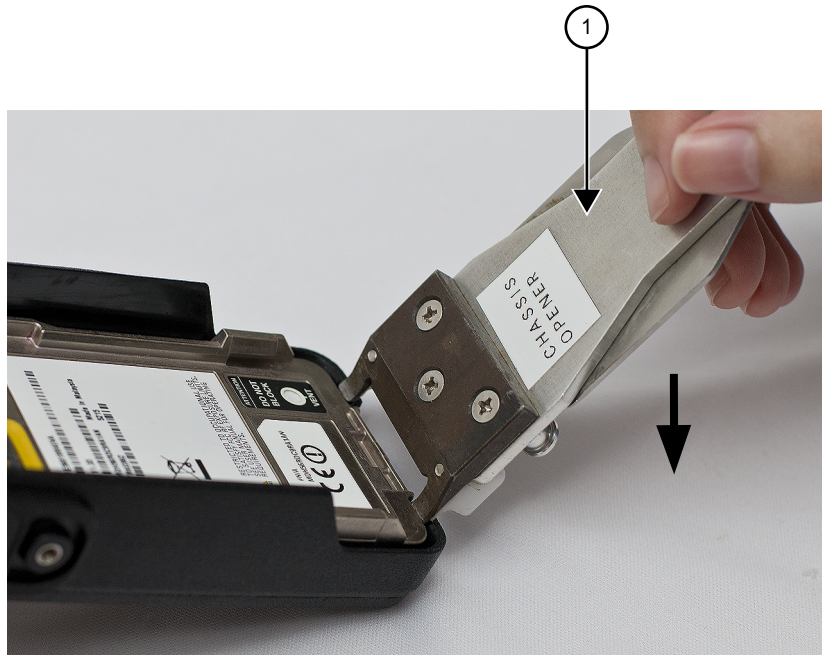
Label	Description
1	Chassis Opener

7 Place the chassis at a 120 degree angle to facilitate removal of the two flexes connecting the chassis to the front housing

Figure 21: Chassis and Front Housing
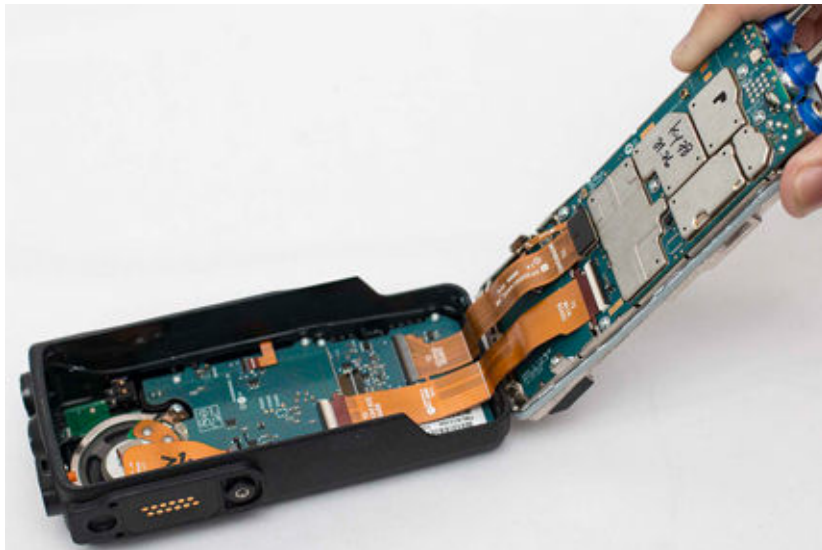
8 Release the keypad flex from its connector.

Figure 22: Keypad Flex Removal
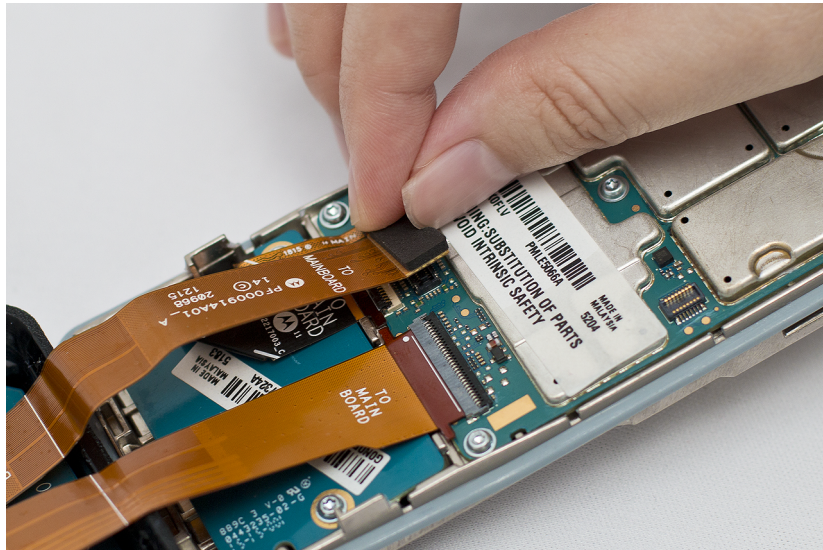
9 Remove the interface flex from main board by pulling it out of its connector gently.

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

Figure 23: Interface Flex Removal
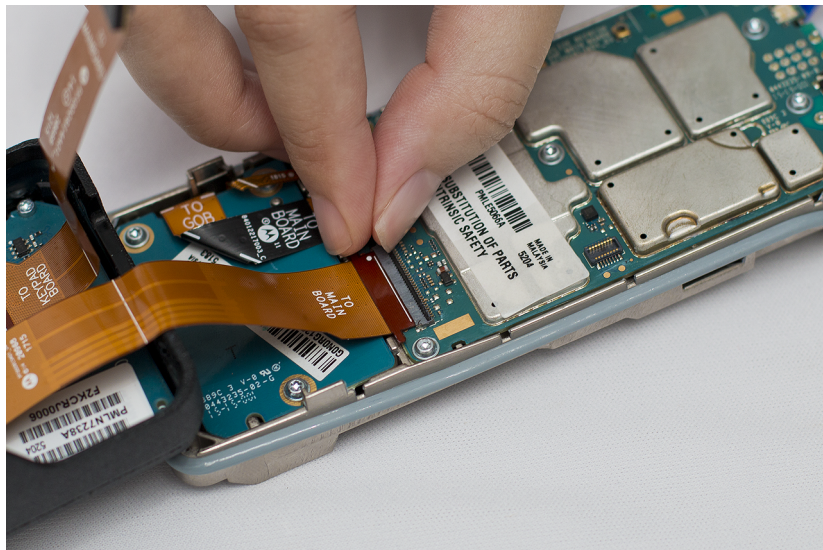
5.5.2
Chassis Disassembly

Procedure:

1 Remove the two Generic Option Board (GOB) flexes from the main board.

Figure 24: GOB and Mini GOB Flex Removal
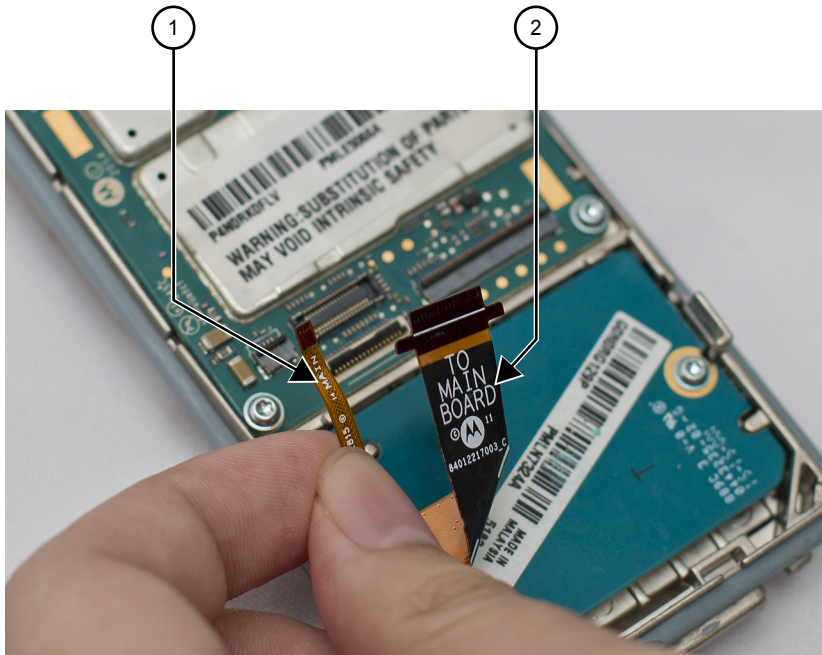
Label	Description
1	Mini GOB Flex
2	GOB Flex

> **NOTICE:** This step also applies to the MPT Option Board and the Connect Plus Option Board.

2 Remove the five screws on the main board using a 6 IP Torx Plus screwdriver head. Separate the main board from the chassis.

Figure 25: Main Board Removal

3 Remove the top control seal.

Figure 26: Top Control Seal Removal
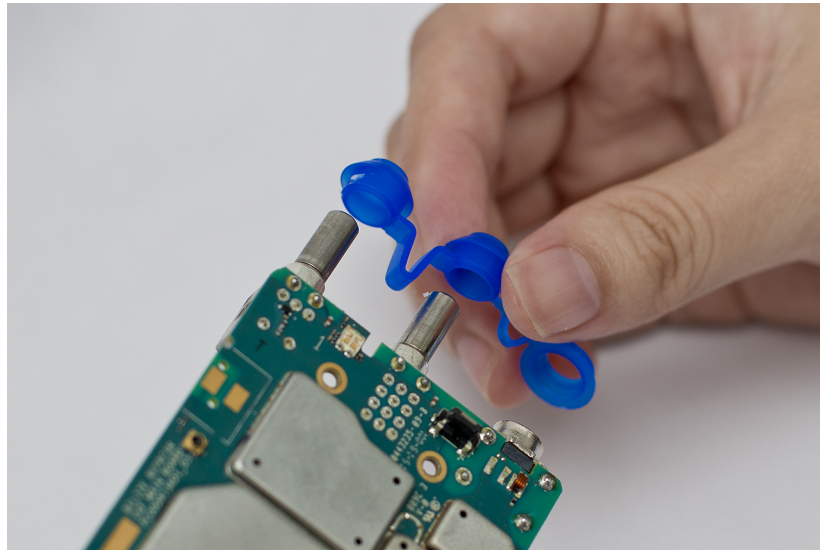
4 Remove the three screws on the GOB using a 6IP Torx Plus screwdriver head. Separate the GOB from the chassis.

Figure 27: GOB Removal
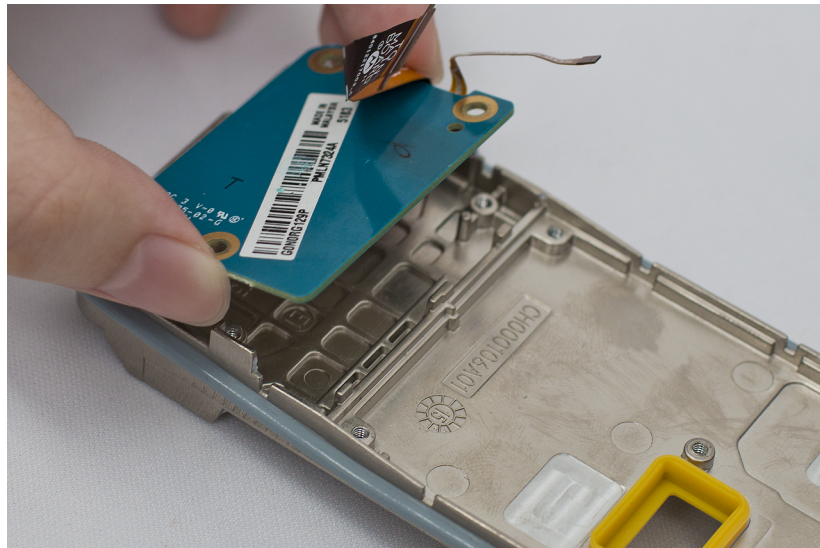
5 Remove the battery contact seal.

Figure 28: Battery Contact Seal Removal

6 Remove the RF rubber plug.

Figure 29: RF Rubber Plug Removal

Figure 30: RF Rubber Plug Removal (for SMA Model)
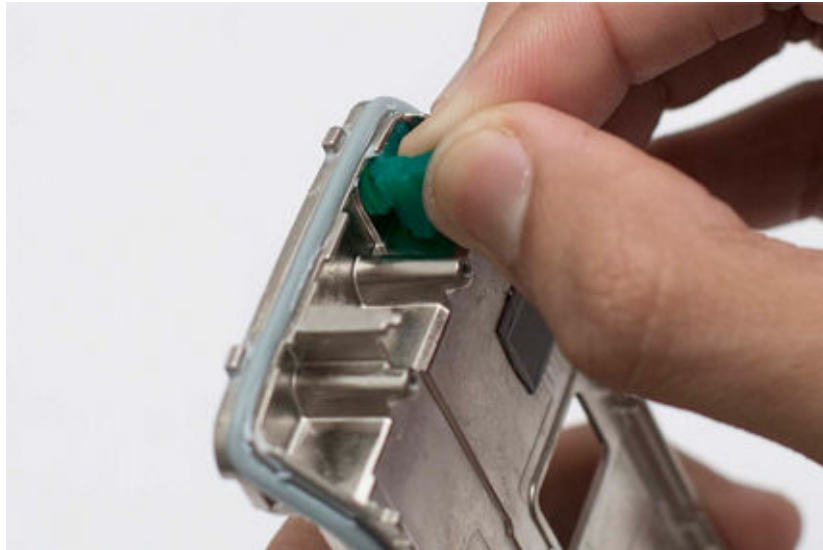
5.5.3
Interface Board, Keypad Board and LCD Disassembly

Procedure:

1   Unlatch and remove the interface flex.

   Figure 31: Interface Flex Removal
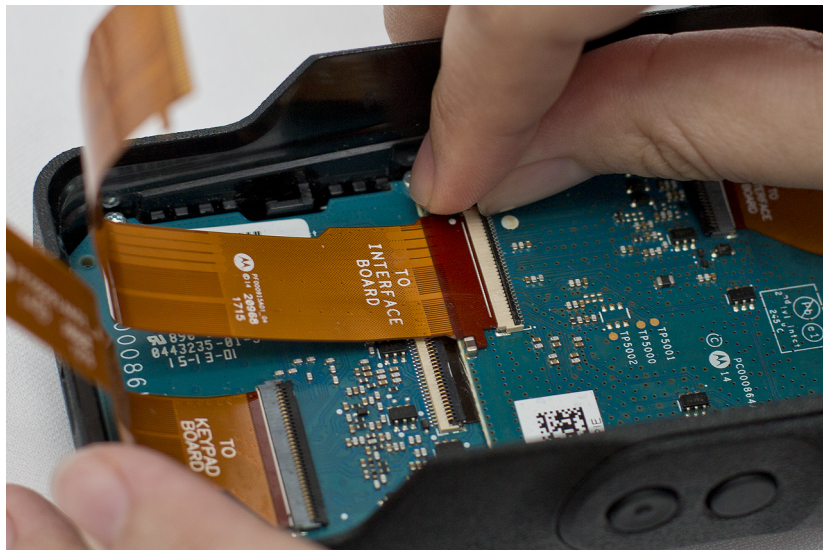
2   Disconnect the UC flex.

Figure 32: UC Flex Removal
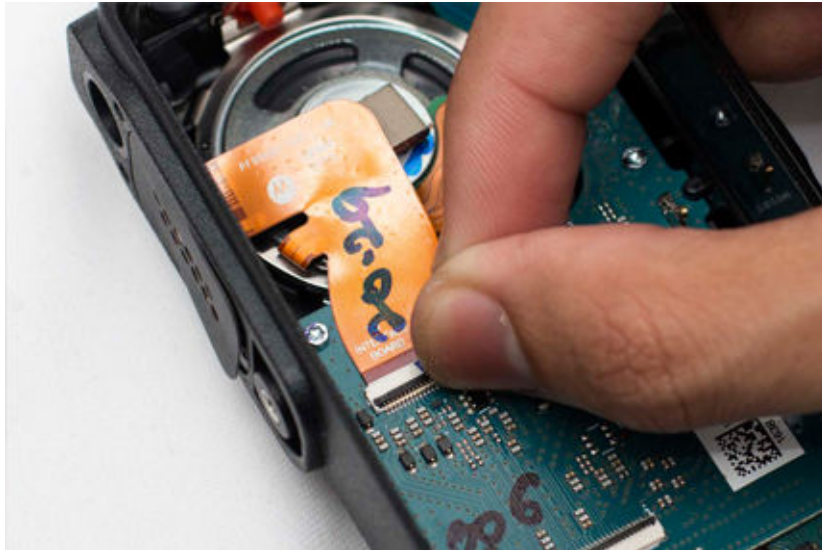
3 Use a tweezer to disconnect the PTT flex.

Figure 33: PTT Flex Removal
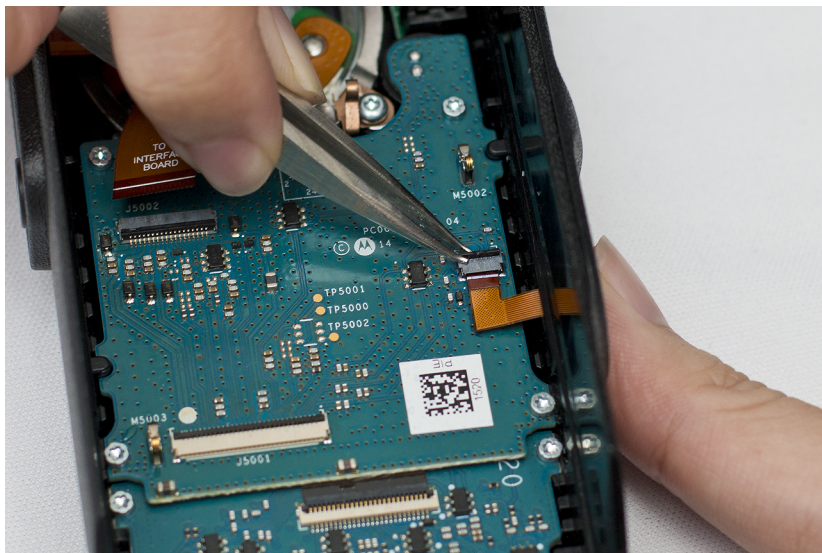
4 Remove the four screws and gently lift out the interface board from the front housing.

Figure 34: Interface Board Removal

> **NOTICE:** 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 35: Keypad Board Removal

6 Gently lift out the display module.

Figure 36: Display Module Removal

5.5.4
Speaker and Universal Connector Flex Disassembly

Procedure:

1 Peel off the UC escutcheon with a tweezer.

Figure 37: UC Escutcheon Removal

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

Figure 38: UC Flex Removal

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

Figure 39: Speaker Assembly Removal

4   Remove the speaker retainer from the speaker module.

Figure 40: Speaker Removal
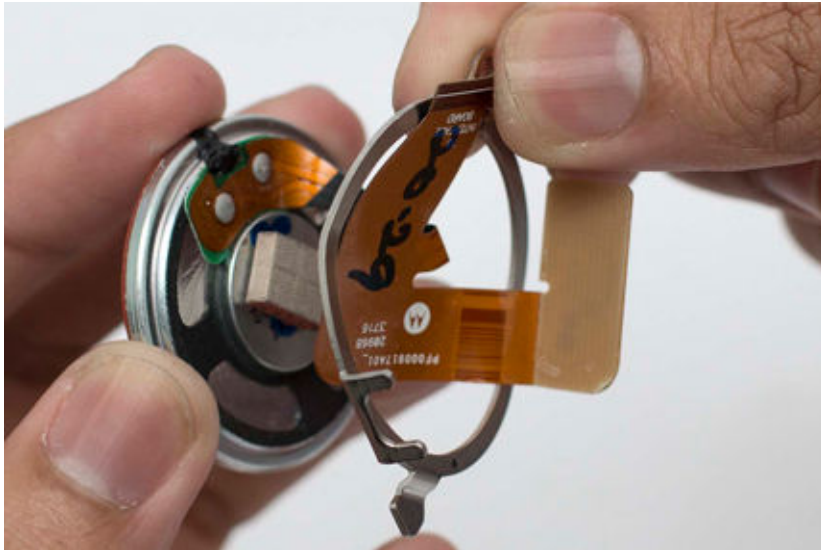
5.5.5
Emergency Button Disassembly

Procedure:

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

Figure 41: Emergency Button Removal

5.5.6
Bluetooth GPS Antenna Disassembly

Procedure:

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

Figure 42: Bluetooth GPS Antenna Removal

5.6
Detailed Radio Reassembly

The section describes the detailed reassembly procedure of your radio.

5.6.1
Bluetooth GPS Antenna Reassembly

Procedure:

Slide in the Bluetooth GPS antenna and affix the screw.

5.6.2
Emergency Button Reassembly

Procedure:

Insert the emergency button into the proper slot.

Figure 43: Emergency Button Reassembly

5.6.3
Speaker and Universal Connector Flex Reassembly

Procedure:

1   Insert the UC flex circuit through the speaker retainer.

Figure 44: Speaker Retainer Reassembly
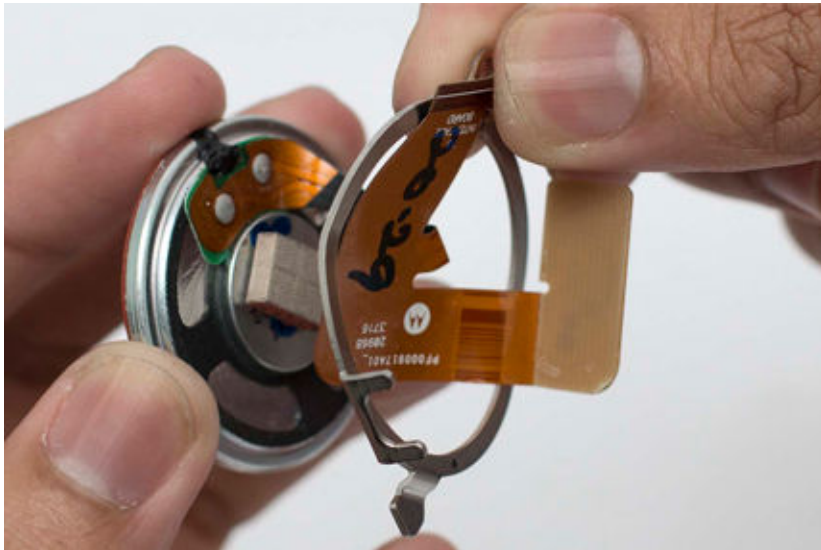
2   Seat the speaker module in the recess of the front housing and firmly screw in the speaker retainer.

> **NOTICE:** Ensure 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 45: Speaker Reassembly
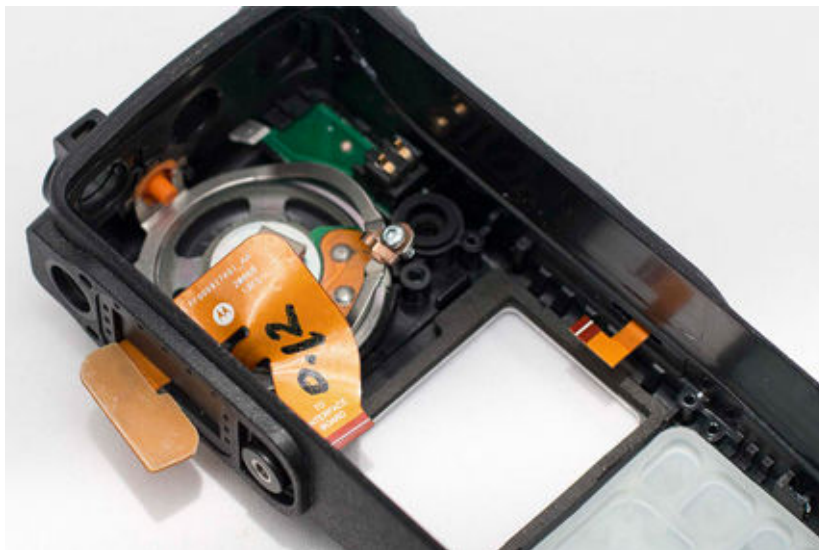
4 Firmly stick the UC flex circuit on the housing and replace a new UC escutcheon.

Figure 46: UC Escutcheon Replacement

> 🖉 **NOTICE:** Clean the area on the housing with IPA before sticking the UC flex and escutcheon.

5.6.4
Interface Board, Keypad Board and LCD Reassembly

Procedure:

1 Place the display module in the front housing.

Figure 47: 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 48: 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.

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

Figure 49: Front Housing Reassembly
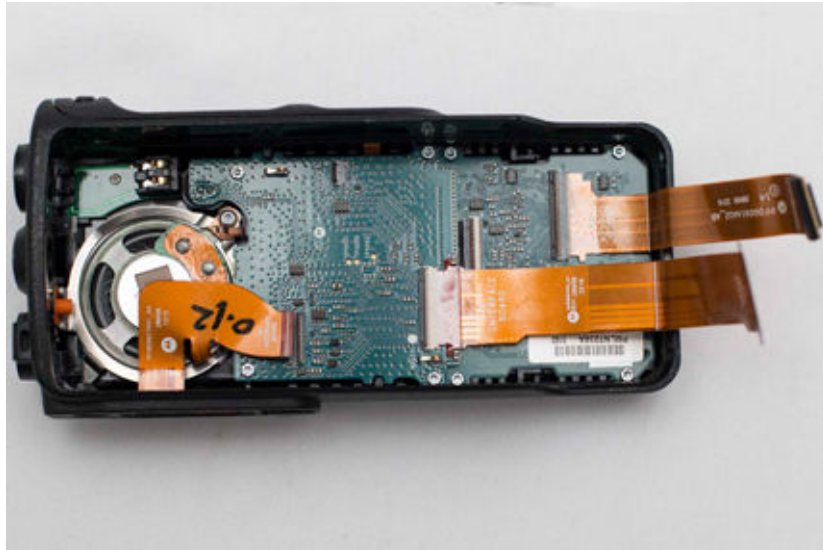
5.6.5
Chassis Reassembly

Procedure:

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

Figure 50: Chassis Reassembly
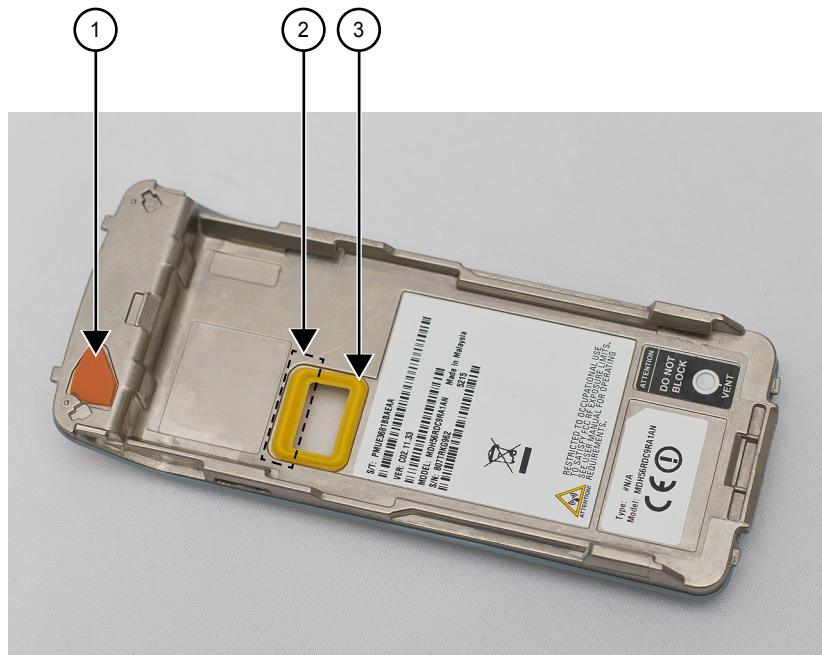
Figure 51: Chassis Reassembly (for SMA model)
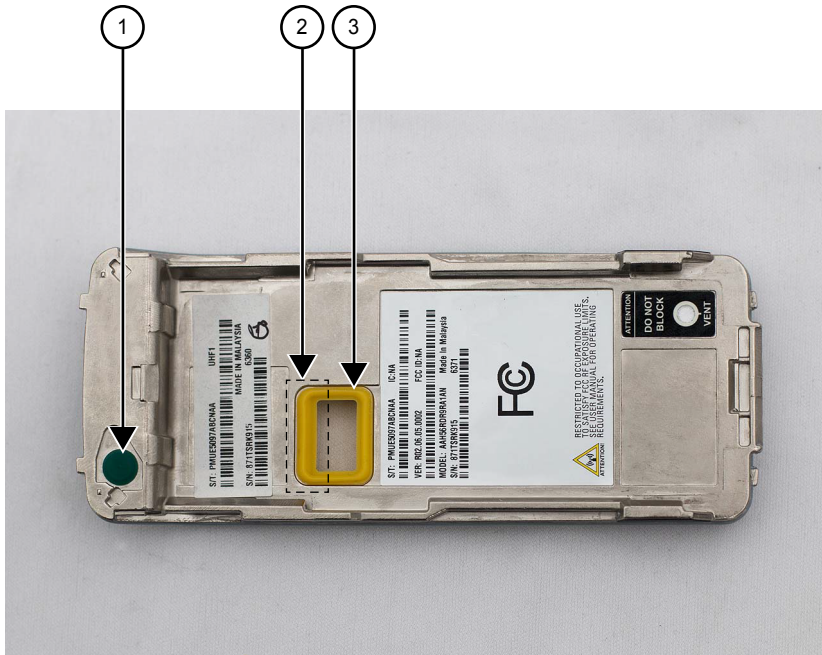
Label	Description
1	RF Plug
2	Rubber Lip
3	Battery Contact Seal

📝 **NOTICE:** Ensure the rubber lip of the battery contact seal rests on top as shown in Figure 50: Chassis Reassembly on page 81.

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

Figure 52: Thermal Pad
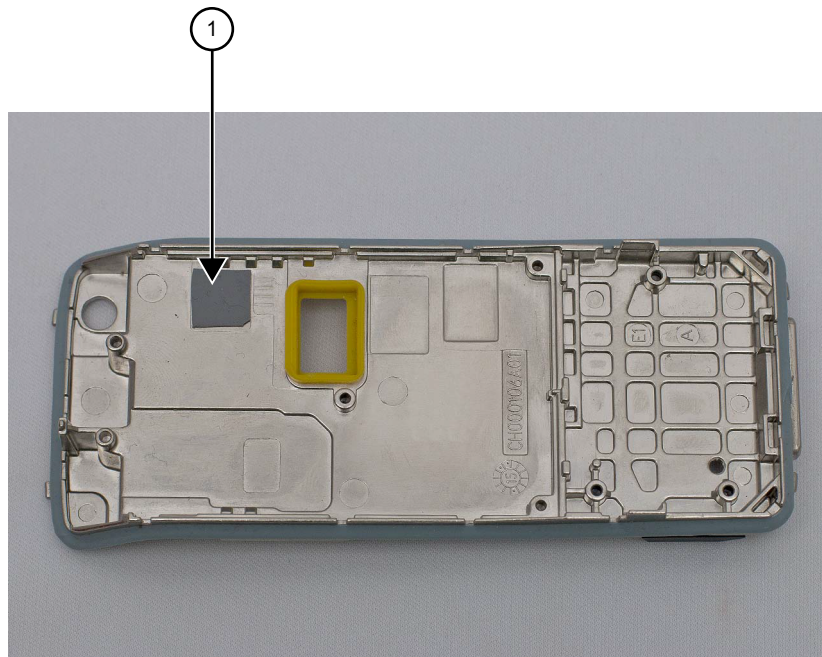
3 Replace the top control seal.

Figure 53: Top Control Seal Reassembly
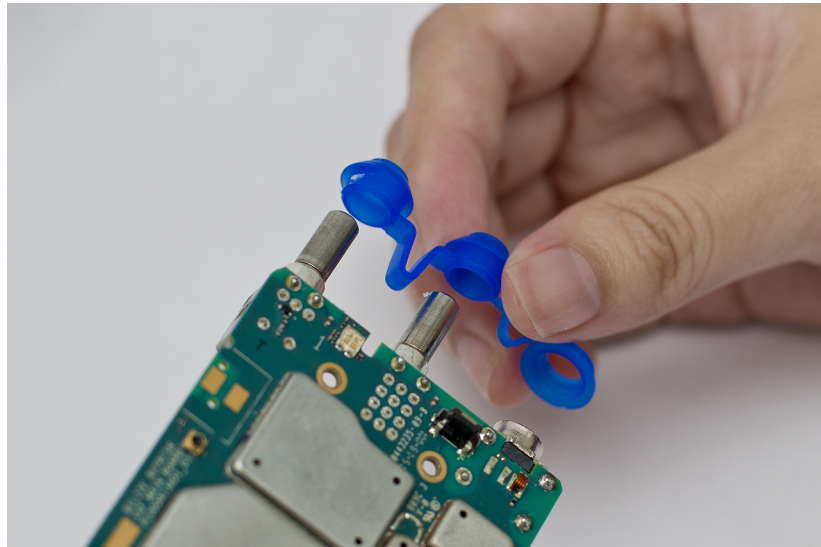
4 Screw in the main board and the GOB onto the chassis and connect the two GOB flex to the main board.

Figure 54: Main Board and GOB Reassembly
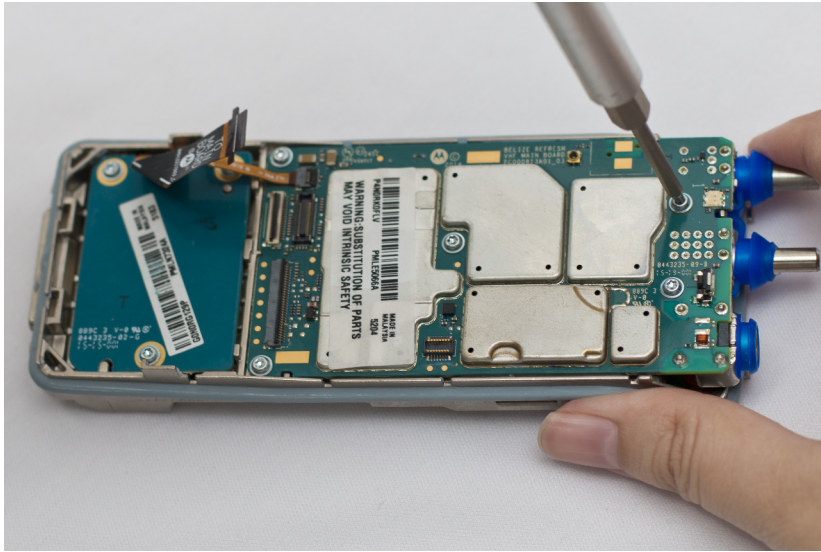
5.6.6
Chassis and Front Cover Reassembly

Procedure:

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

   Figure 55: Main Board Connectors.
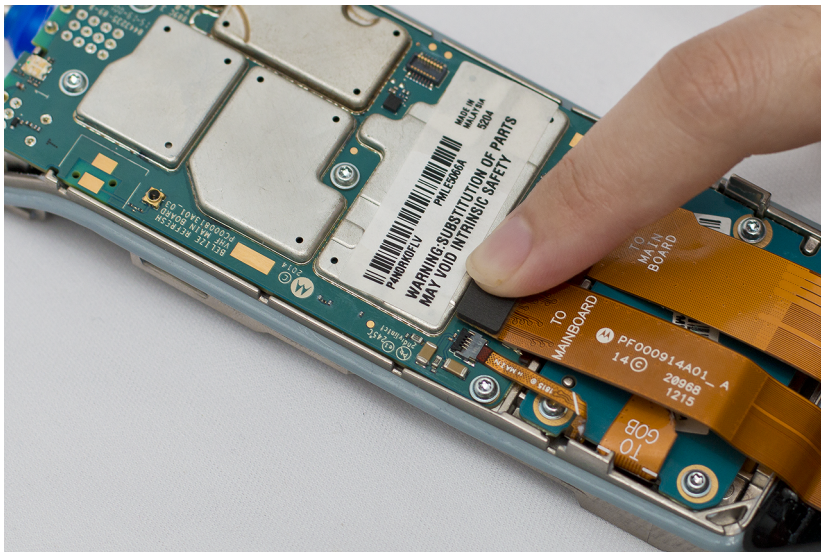
2   Apply grease to the full perimeter of the chassis's O-Ring.

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 56: Chassis Reassembly

Figure 57: Chassis Reassembly (for SMA model)

5 Insert knobs, antenna, shroud, and battery.

Figure 58: Shroud Reassembly (for SMA model)
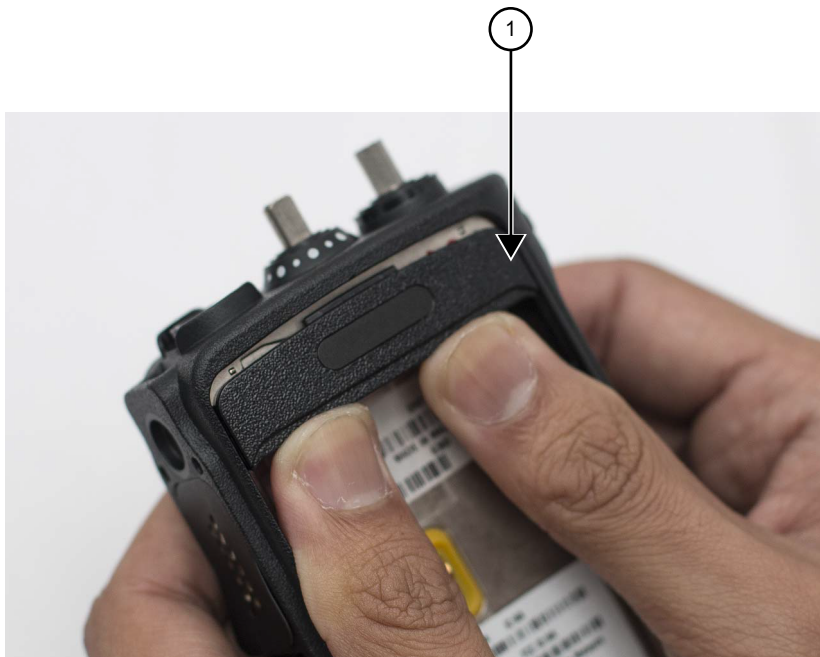
Label	Description
1	Shroud

Figure 59: Channel Selector Knob Reassembly (for SMA model)

Figure 60: On/Off Volume Knob Reassembly (for SMA model)

Figure 61: Antenna Reassembly (for SMA model)

Figure 62: Battery Reassembly (for SMA model)

5.7
Ensuring Radio Immersibility

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

5.7.1
Servicing

Radios shipped from the Motorola Solutions factory have passed vacuum testing and are capable of restoring the watertight integrity of your radio.

⚠️ **CAUTION:** It is strongly recommended to defer your radio maintenance to qualified service personnel and service shops. This is of paramount importance as service by unauthorized persons may cause irreparable damage to your radio. If disassembly is necessary, unauthorized attempts to repair the radio may void any existing warranties or extended performance agreements with Motorola Solutions. It is also recommended for qualified service personnel/workshop that is authorized by Motorola Solutions to perform annual check on your radio immersibility.

5.7.2
Accidental Immersion

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

5.7.3
Specialized Test Equipment

This section summarizes the specialized test equipment necessary for testing the integrity of the 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

mentioned in the "Service Aids" chapter is authorized by Motorola Solutions and needed to perform the vacuum check and pressure testing, if required. Any equipment/tools/instruments not mentioned in this chapter must not be used to perform these tests.

5.7.4
Vacuum Pump Kit

The vacuum pump kit includes a vacuum pump with gauge, and a vacuum hose.

A connector fitting (5871134M01) and fitting seal (3271133M01) pump connector, which must be ordered separately, connects the vacuum hose to the radio chassis.

Figure 63: Connector Fitting - Fitting Seal Pump Connector
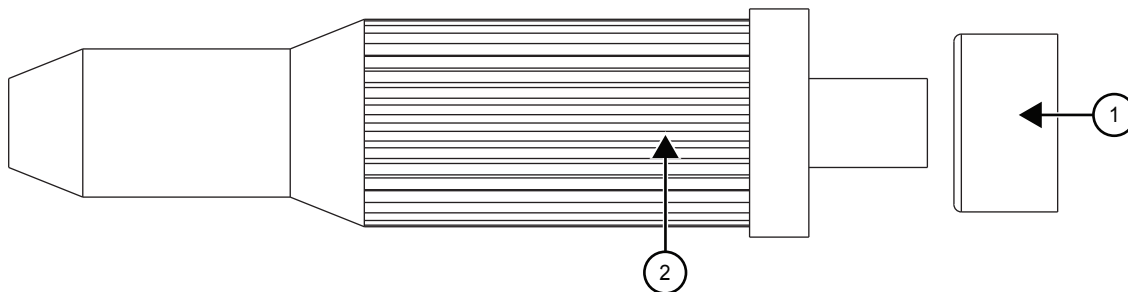
Label	Description
1	Fitting Seal
2	Connector Fitting

5.7.5
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 chassis.

5.7.6
Miscellaneous Hardware

Other items needed for testing radio immersibility are:

• Large water container

• Deionized (DI) water

• A supply of replacement parts: Battery Contact Seal, Breathing Vent Label, and Breathing Vent Membrane.

5.7.7
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.

Prerequisites:

• Remove the battery.

- Remove the universal connector dustcover to expose the universal connector.

- Remove the breathing vent label and breathing vent membrane.

Procedure:

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:** 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 min.

   - 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 .

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

5.7.8
Pressure Test

Pressure testing involves creating a positive pressure condition inside your radio, immersing radio in water, and observing radio for a stream of bubbles (leak). Since all areas of your radio are being checked, observe the entire unit carefully for the possibility of multiple leaks before completing this test.

   ✎ **NOTICE:** 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.

Procedure:

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

⚠️ **CAUTION:** 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 to the following areas:

- Front Housing
- Chassis kit
- Battery Contact Seal

8 Remove the radio from the water container, and dry the radio thoroughly.

⚠️ **CAUTION:** Keep the area around the chassis vacuum port dry by ensuring that there is no water around it.

📝 **NOTICE:** Dry the area around the main seal with extra care to prevent contamination of the internal electronics while the unit is open.

9 Remove the pump connector from the chassis.

Postrequisites: After performing Pressure Test, your radio 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.

5.7.9
Troubleshooting Leak Areas

Before repairing any leak, read steps in the applicable section. This helps to eliminate unnecessary disassembly and reassembly of a radio with multiple leaks.

Troubleshoot only the faulty seal areas listed in Pressure Test on page 90, and when multiple leaks exist, in the order listed.

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

5.7.9.1
Front Housing Troubleshooting

Procedure:

Do one or both of the following:

- If a leak occurs at the Lens (Display Models only), Universal Connector, Chassis/Housing interface, or PTT button area of the housing, replace the housing, refer to Detailed Radio Disassembly on page 61.

  1 Remove the housing assembly from the radio.

  2 Discard the housing assembly.

  3 Install a new housing assembly to the radio.

- If the leak occurs at the control top area, remove the knobs in order to determine the leak location:

  1 Conduct the Pressure Test.

  2 Identify the leak location.

5.7.9.2
Replacing Battery Contact Seal

Procedure:

1   Remove the Battery Contact Seal from the Chassis. Refer to "Radio Disassembly" Chapter.

2   Inspect the Battery Contact Seal, Chassis, and surrounding areas for foreign material that might prevent the Battery Contact Seal from sealing properly.

3   Install a new Battery Contact Seal, discard the old Seal.

4   Reassemble the Chassis assembly followed by installing into Front Kit. Refer to "Radio Reassembly" Chapter.

5.7.9.3
Replacing Air Ventilation Label

Prerequisites: Both Air Ventilation Label and Gasket need to be replaced after vacuum test, pressure test, or water leakage troubleshooting.

Procedure:

1   Remove the Air Ventilation label from the chassis.

2   Ensure that the chassis 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 is 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 surface to ensure good adhesion.

5.7.10
Battery Maintenance

Maintain your radio battery annually or as required; when battery contacts are dirty or show signs of wear. Battery Maintenance prolongs battery contacts life and free battery interface from contamination.

It is recommended that the Battery Radio-side and Charger-side contacts are cleaned with DeoxIT GOLD cleaner/lubricant.

DeoxIT GOLD (Supplier CAIG Labs, part number: G100P) cleaner/lubricant pen is very effective at cleaning and extending the life of the battery contacts. DeoxIT GOLD cleaner/lubricant pen is available at numerous electronics suppliers (Radio Shack, McMaster Carr, Fry's, and more) and directly from manufacturer, CAIG Labs, at http://www.caig.com.

This pen-based package is recommended as it provides better access to the recessed contacts of the battery. The pen tip may need to be modified (trimmed on the sides) to improve penetration into the battery contact slots.

Advanced contact wear is defined as wear through the contact platings (gold and nickel) to the base metal (copper). Copper exposure is characterized by a distinctive orange-brown metal appearance surrounded by silvery nickel underplate and gold top coat.

In some cases, a magnified (10 times 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 as a need for replacement. Replace battery when advanced wear is evident.

5.7.10.1
Maintaining the Battery

Procedure:

1 Shake the lubricant pen until the fluid begins to flow.

2 Wipe battery contact surface with felt tip.

3 After cleaning the contact areas of any foreign material, let the lubricant/cleaner dry for 2 minutes.

4 Replace the battery on the radio. Make sure the battery is attached properly on the radio.

Postrequisites: After cleaning, inspect the contact surfaces for signs of advanced contact wear. See Battery Maintenance on page 92 for advanced contact wear.

5.7.11
Troubleshooting Charts

Figure 64: Troubleshooting Flow Chart for Vacuum Test (Sheet 1 of 2)

```
                        ┌─────────┐
                        │  Start  │
                        └─────────┘
                             │
                             ▼
          ┌──────────────────────────────────┐
          │ 1. Remove Battery                │
          │ 2. Remove Universal              │
          │    Connector Dustcover           │
          │ 3. Remove breathing vent label   │
          │    and membrane                  │
          └──────────────────────────────────┘
                             │
     ┌───┐                   ▼
     │ A │─────────────────►◄─────────────────────────────────┐
     └───┘                   │                                 │
                             ▼                                 │
          ┌──────────────────────────────────┐                │
          │ 1. Attach antenna firmly to the  │                │
          │    radio.                        │                │
          │ 2. Attach vacuum hose to vacuum  │                │
          │    pump                          │                │
          │ 3. Ensure fitting seal is        │                │
          │    attached to hose-to-chassis   │                │
          │    pump connector                │                │
          │ 4. Screw pump connector into     │                │
          │    chassis's tapped hole         │                │
          │ 5. Attach vacuum hose to pump    │                │
          │    connector                     │                │
          │ 6. Place radio on flat surface   │                │
          │ 7. Operate pump (gauge = 9 in.   │                │
          │    Hg)                           │                │
          └──────────────────────────────────┘                │
                             │                                 │
                             ▼                                 │
                     ╱───────────╲          ╱───────────╲      │
                    ╱ Gauge        ╲        ╱  Full       ╲     │
                   ╱ does not fall   ╲ No  ╱ equipment for ╲ Yes │  ┌──────────────┐
                  ╱   below           ╲──►╱  pressure test  ╲───┼─►│ Run Pressure │
                   ╲  0.5 in. Hg     ╱    ╲  procedure      ╱     │ Test         │
                    ╲               ╱      ╲  available    ╱      └──────────────┘
                     ╲─────────────╱        ╲─────────────╱
                           │ Yes                  │ No
                           ▼                      ▼
          ┌──────────────────────────┐        ┌───┐
          │ 1. Replace air           │        │ B │
          │    ventilation label     │        └───┘
          │    and gasket            │
          │ 2. Radio approved        │
          │    for immersibility     │
          └──────────────────────────┘
                      │
                      ▼
                 ┌─────────┐
                 │   End   │
                 └─────────┘
```

Figure 65: Troubleshooting Flow Chart for Vacuum Test (Sheet 2 of 2)

```
        ( B )
          │
          ▼
      ( Start )
          │
          ▼
┌──────────────────────┐                    ┌──────────────────────┐
│ 1. Remove pump and   │                    │    Send radio to     │
│ connectors from radio│                    │   Motorola Depot     │
│ 2. Remove antenna    │                    │        or            │
│ 3. Separate front    │                    │ Motorola Service     │
│    housing kit       │                    │      Center          │
└──────────────────────┘                    └──────────────────────┘
          │                                            ▲
          ▼                                          Yes
      ◇ Changed         Yes      ◇ Changed │
       front housing ─────────►   chassis
         kit                        kit
          │                         │
         No                        No
          ▼                         ▼
┌──────────────────────┐   ┌──────────────────────────────┐
│   Replace front      │   │  Apply grease to the full    │
│  housing kit with    │   │ perimeter of the chassis     │
│     new unit         │   │ O-ring and replace the       │
│                      │   │ Chassis Kit without PCBs     │
└──────────────────────┘   └──────────────────────────────┘
          │                         │
          ◄─────────────────────────┘
          ▼
        ( A )
```
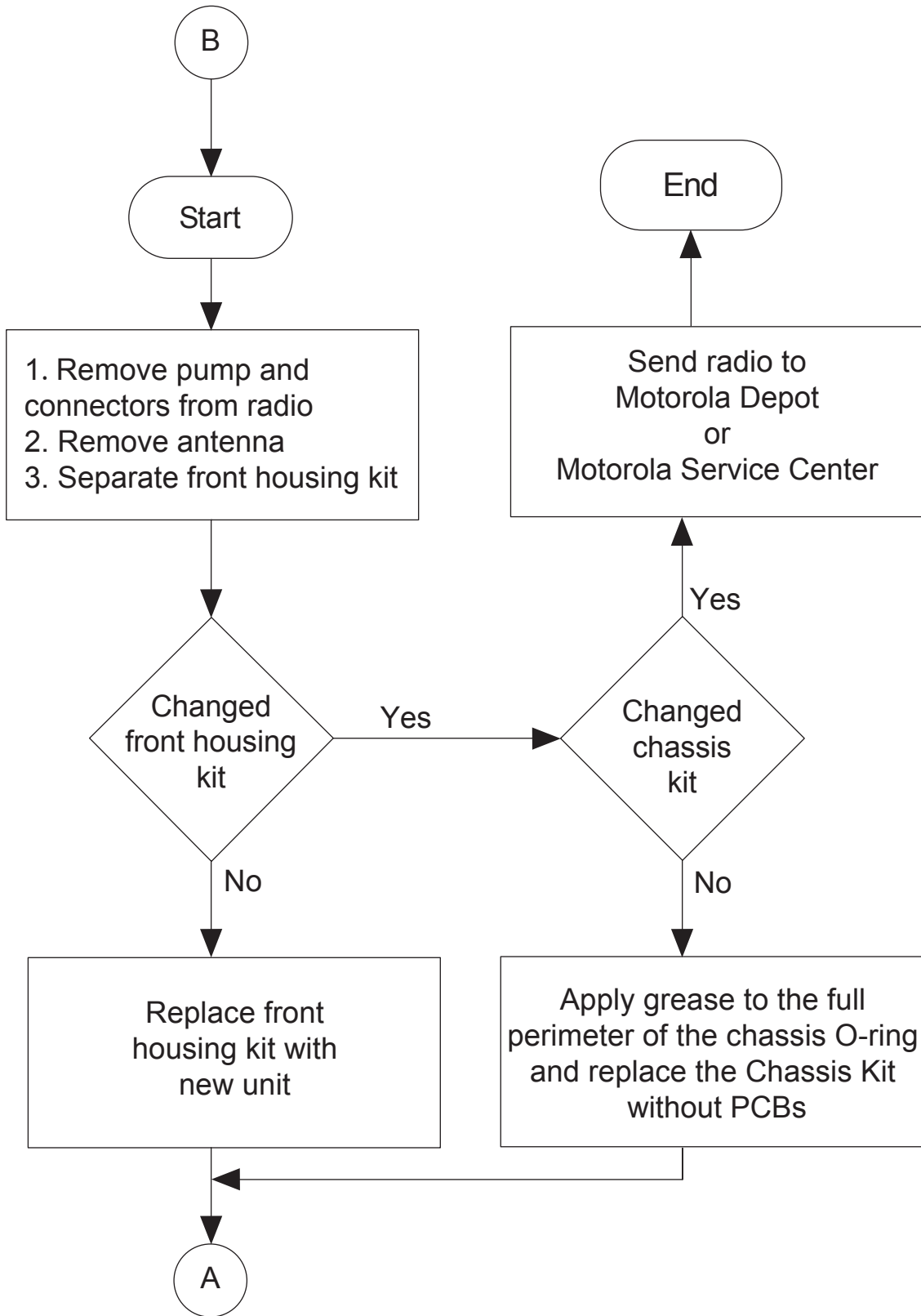
Figure 66: Troubleshooting Flow Chart for Pressure Test

```
                          ┌─────────┐
                          │  Start  │
                          └────┬────┘
                               │
              ┌────────────────▼────────────────┐
              │ 1. Remove vacuum hose from       │
              │    pump connector                │
              │ 2. Attach pressure hose to       │
              │    pump connector                │
              └────────────────┬────────────────┘
                               │
              ┌────────────────▼────────────────┐        ┌──────────────────┐
              │ 1. Operate pressure pump         │◄───────│ 1. Remove Knobs  │
              │    (pressure = 1 psig)           │        └────────▲─────────┘
              │ 2. Immerse radio into a water-   │                 │ No
              │    filled container              │
              └────────────────┬────────────────┘
```

- Continuous Series of bubbles — Yes → Bubbles from Front Housing — Yes → Bubbles from Lens*/Universal Connector/ chassis/ Housing Interface/ PTT — Yes →
  1. Dry the radio
  2. Apply grease to the full perimeter of the chassis O-Ring and replace Chassis Kit and repeat steps in Troubleshooting Flow Chart for Vacuum Test

  (Bubbles from Lens*/Universal Connector/chassis/Housing Interface/ PTT — No → Remove Knobs)

  * Only for Display Model

- Continuous Series of bubbles — No →
  1. Dry the radio
  2. Replace Air Ventilation Label and Gasket
  3. Radio approved for immersibility
  → End

- Bubbles from Front Housing — No → Bubbles from Chassis — Yes →
  1. Dry the radio
  2. Apply grease to the full perimeter of the chassis O-Ring and replace Chassis Kit and repeat steps in Troubleshooting Flow Chart for Vacuum Test

- Bubbles from Chassis — No → Bubbles from Battery Contact Seal — Yes →
  1. Dry the radio
  2. Replace Battery Contact Seal, Apply grease to the full perimeter of the chassis O-Ring and replace Chassis Kit. Repeat steps in Troubleshooting Flow Chart for Vacuum Test

- Bubbles from Battery Contact Seal — No → End

5.8
Radio Exploded Mechanical Views and Parts Lists

5.8.1
Full Keypad Model Exploded View and Parts List

Figure 67: Full Keypad Model Exploded View

Table 32: Full Keypad Model Exploded View Parts List

Item		Description	Part Number
1.0		Antenna	See Model Charts
2.0		Front Kit Assembly	See Additional Parts List Table on page 103
	2.01	Front Housing Assembly	See Additional Parts List Table on page 103
	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 Additional Parts List Table on page 103
	2.07	Screw Shoulder, M1.2 x 3.2 mm	0371160D01
	2.08	Speaker Mesh	SL000217A01
	2.09	Speaker	AC000028A02

Item		Description	Part Number
	2.10	UC Flex	PF000917A01
	2.11	Interface Flex	PF000915A01
	2.12	Keypad Flex	See Additional Parts List Table on page 103
	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
3.0		Back Cover Kit Assembly	See Additional Parts List Table on page 103
	3.01	Screw, Main Board and GOB Board	03012034001
	3.02	Option Board Kit	See Additional Parts List Table on page 103
	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	Non-Field Replaceable
4.0		Nameplate	See Additional Parts List Table on page 103
5.0		Volume Knob	36012005001
6.0		Frequency Knob	36012004001
7.0		Dust Cover Assembly	15012157001

Item		Description	Part Number
8.0		Battery	See Additional Parts List Table on page 103
9.0		Belt Clip	See Additional Parts List Table on page 103
10.0		Antenna ID	See Additional Parts List Table on page 103

5.8.2

Non Keypad Model Exploded View and Parts List

Figure 68: Non Keypad Exploded View
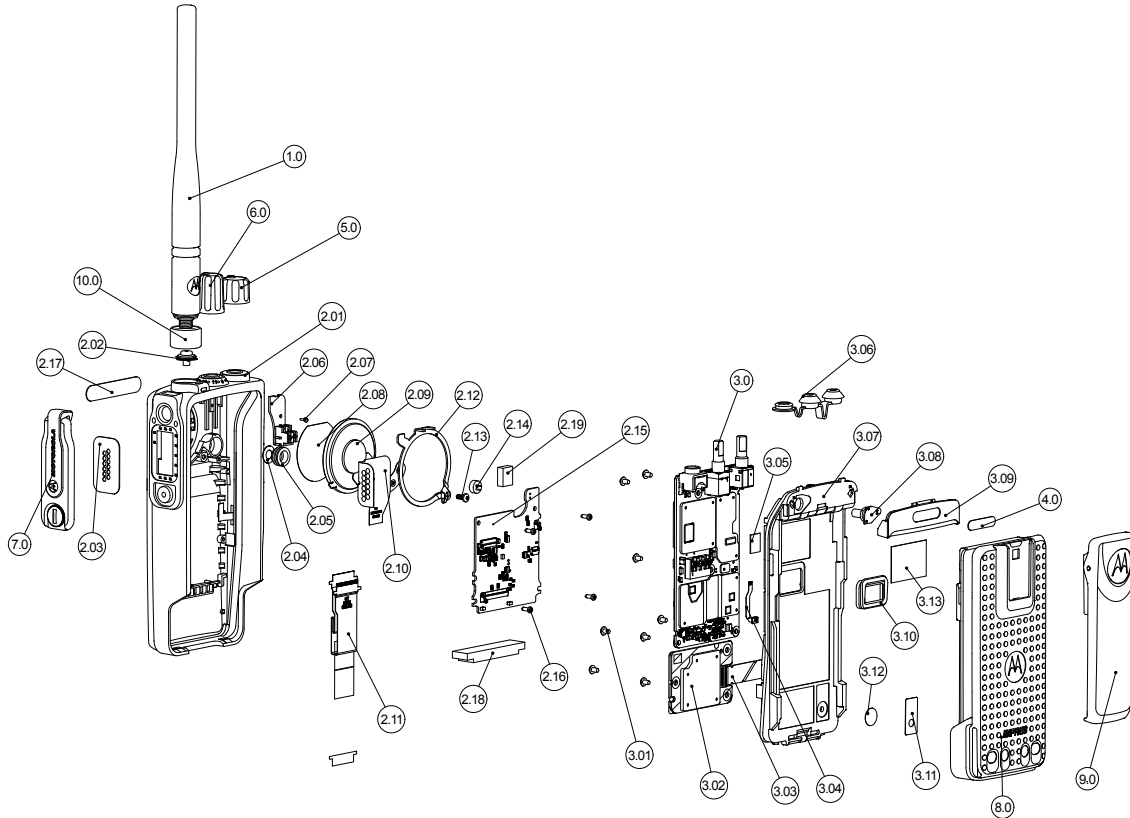
Table 33: Non Keypad Model Exploded View Parts List

Item		Description	Part Number
1.0		Antenna	See Model Charts
2.0		Front Kit Assembly	See Additional Parts List Table on page 103
	2.01	Front Housing Assembly	See Additional Parts List Table on page 103
	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 Additional Parts List Table on page 103

Item		Description	Part Number
	2.07	Screw Shoulder, M1.2 x 3.2 mm	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
3.0		Back Cover Kit Assembly	See Additional Parts List Table on page 103
	3.01	Screw, Main Board and GOB Board	03012034001
	3.02	Option Board Kit	See Additional Parts List Table on page 103
	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	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	Non-Field Replaceable
4.0		Nameplate	See Additional Parts List Table on page 103
5.0		Volume Knob	36012005001
6.0		Frequency Knob	36012004001
7.0		Dust Cover Assembly	15012157001
8.0		Battery	See Additional Parts List Table on page 103
9.0		Belt Clip	See Additional Parts List Table on page 103
10.0		Antenna ID	See Additional Parts List Table on page 103

5.8.3
SMA Full Keypad Model Exploded View and Parts List

Figure 69: SMA Full Keypad Model Exploded View
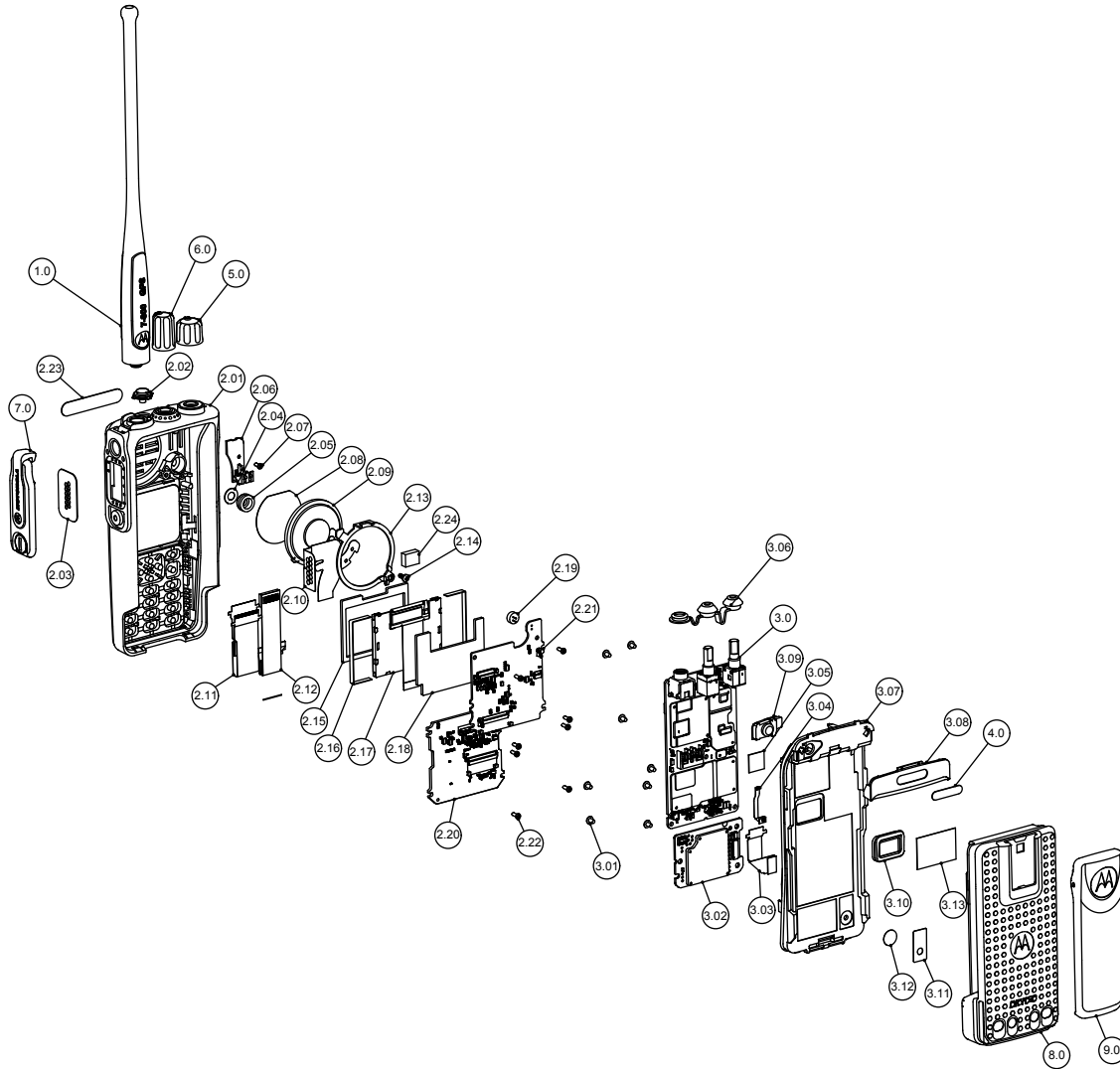
Table 34: SMA Full Keypad Model Exploded View Parts List

Item		Description	Part Number
1.0		Antenna	See Model Charts
2.0		Front Kit Assembly	See Additional Parts List Table on page 103
	2.01	Front Housing Assembly	See Additional Parts List Table on page 103
	2.02	Emergency Button	HW001212A01
	2.03	UC Escutcheon	13012035001
	2.04	Mic Membrane With Stiffener	SL000209A01
	2.05	Boot, Microphone	SL000208A01
	2.06	GPS/GLONASS Antenna	AN000151A01

Item		Description	Part Number
	2.07	Screw Shoulder, M1.2 x 3.2 mm	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 Additional Parts List Table on page 103
	2.13	Speaker Retainer - Grounding Contact Assembly	0104075J65
	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
3.0		Back Cover Kit Assembly	See Additional Parts List Table on page 103
	3.01	Screw, Main Board and GOB Board	03012034001
	3.02	Option Board Kit	See Additional Parts List Table on page 103
	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	HW001214A01
	3.10	Battery Contact Seal	SL000213A01
	3.11	Air Ventilation Label	54012316001
	3.12	Gasket	3286058L01
	3.13	TIA Label	Non Field Replaceable

Item		Description	Part Number
4.0		Nameplate	See Additional Parts List Table on page 103
5.0		Volume Knob	36012005001
6.0		Frequency Knob	36012004001
7.0		Dust Cover Assembly	15012157001
8.0		Battery	See Additional Parts List Table on page 103
9.0		Belt Clip	See Additional Parts List Table on page 103

5.8.4

Additional Parts List Table

Table 35: Front Kit

	Item	Part Number
VHF/800/900 MHz		
	Front Cover Kit, Roman Key-pad, GNSS, Front Assembly FKP (for SMA Models only)	PMLN7614_
	Front Cover Kit, Roman Key-pad, GNSS	PMLN7238_
	Front Cover Kit, Roman Key-pad, GNSS (Yellow)	PMLN7515_
	Front Cover Kit, NKP, GNSS	PMLN7239_
	Front Cover Kit, NKP, GNSS (Yellow)	PMLN7514_
	VHF Front Cover Kit, NKP	PMLN7323_
UHF/350 MHz		
	Front Cover Kit, Roman Key-pad, GNSS	PMLN7425_
	Front Cover Kit, Roman Key-pad, GNSS (Yellow)	PMLN7515_
	Front Cover Kit, Roman Key-pad, GNSS, Front Assembly FKP (for SMA Models only)	PMLN7612_
	Front Cover Kit, NKP, GNSS	PMLN7239_
	Front Cover Kit, NKP, GNSS (Yellow)	PMLN7514_
	UHF Front Cover Kit, NKP	PMLN7323_

Table 36: Front Housing Assembly

Item	Part Number
Front Housing Assembly FKP, English	0104065J42

Item	Part Number
Front Housing Assembly NKP	0104065J43
Front Housing Assembly FKP, English (for SMA Models only)	0104075J66

Table 37: Back Kit

	Item	Part Number
VHF		
	BC Kit, 136–174 MHz, 5 W, FKP with GNSS	PMLD4727_S
	BC Kit, 136–174 MHz, 5 W, MOTOTRBO NKP with GNSS	PMLD4729_S
	BC Kit, 136–174 MHz, 5 W, FKP with GNSS, BT, WLAN (for SMA Models only)	PMLD4853_S
UHF		
	BC Kit, 403–527 MHz, 4 W, MOTOTRBO FKP with GNSS	PMLE5064_S
	BC Kit, 403–527 MHz, 4 W, MOTOTRBO NKP with GNSS	PMLE5066_S
	BC Kit, 403–527 MHz, 4 W, FKP with GNSS, BT, Wi-Fi (for SMA Models only)	PMLE5178_S
800/900 MHz		
	BC Kit, 806–941 MHz, 2.5 W, FKP, GNSS, BT, WiFi	PMLF4158_S
	BC Kit, 806–941 MHz, 2.5 W, NKP, GNSS, BT, WiFi	PMLF4160_S
	BC Kit, 806–941 MHz, 2.5 W, FKP with GNSS, BT, Wi-Fi (for SMA Models only)	PMLF4192_S

🖉 **NOTICE:** For defective main boards, customers must order Back Kit.

Table 38: Option Board Kit

Item	Part Number
Generic Option Board Kit	PMLN7324_S

Table 39: Keypad Flex

Item	Part Number
Assy Flex, Main Board to Keypad Board (VHF, 800/900 MHz)	0104065J46

Item	Part Number
PCBA Flex Assembly, 3 Layer (UHF)	PA001338A01

Table 40: Nameplate

Item	Part Number
XPR 7350e Nameplate	33012015038
XPR 7550e Nameplate	33012015039
XPR 7380e Nameplate	33012015040
XPR 7580e Nameplate	33012015041

Table 41: Antenna ID Band

Item	Part Number
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

Table 42: Battery

Item	Part Number
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 IP67 Li-Ion 2700 mAh 2800T	PMNN4448_R
Li-Ion IP57 2000 mAh	PMNN4463_
Li-Mn 1400 mAh low temp -30 °C 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_
Core Li-Ion 2450 mAH IP68	PMNN4543_
IMPRES Li-Ion 2450 mAH IP68	PMNN4544_

Table 43: Belt Clips

Item	Part Number
Belt Clip 2"	PMLN4651_
Belt Clip 2.5"	PMLN7008_
Vibrating Belt Clip 2.5"	PMLN7296_

Table 44: GNSS Antenna

Item	Part Number
Antenna, Chip, Beidou BT/GPS Antenna Module	AN000151A02

5.8.5

Torque Chart

The following table 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 45: Torque Specifications for Screws

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

Chapter 6

Basic Troubleshooting

This chapter contains error codes and board replacement procedures.

If the board does not pass all the performance checks in Transceiver Performance Testing on page 38 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 the radio to a Motorola Solutions Service Center.

To access the various connector pins, use the housing eliminator/test fixture along with the diagrams found in this section of the manual. See "Service Aids" for the appropriate Motorola Solutions service aids and tools part numbers.

6.1
Replacement Back Cover Kit Procedures

Once a problem has been isolated to a specific board, install the appropriate back cover kit (Refer to "Model Charts"), which is orderable from Motorola Solutions Radio Products and Solutions Organization.

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 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.

6.2
Power-Up Error Codes

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.

> 📝 **NOTICE:** Power-Up error codes are only applicable to Display Models only.

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.

> 📝 **NOTICE:** Non-display radios emit only the Self-Test Fail Tone if it fails the self-test.

There are two classes of detectable errors: fatal and non-fatal.

Fatal errors

Normal radio operation is inhibited when your radio encounters fatal errors.

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 a false sense of security that others are receiving your messages.

Non-fatal errors

Corrupted codeplug blocks of call IDs, or their associated aliases are considered non-fatal errors.

Normal communication is still possible, but the user may be inconvenienced.

Table 46: Types of Error Code

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.
FAIL 01/88	Radio RAM test failure.	Fatal	Retest radio by turning it off and turning it on again.
FAIL 01/90 or FAIL 02/90	General hardware test failure.	Fatal	Retest radio by turning it off and turning it on again.
FAIL 02/81	DSP ROM Checksum is wrong.	Fatal	Reprogram FLASH Memory, then retest.
FAIL 02/82	DSP RAM1 test failure.	Fatal	Retest radio by turning it off and turning it on again.
FAIL 02/84	DSP RAM2 test failure.	Fatal	Retest radio by turning it off and turning it on again.
FAIL 02/88	DSP RAM test failure.	Fatal	Retest radio by turning it off and turning it on again.
FAIL 02/C0	DSP ROM Checksum is wrong.	Fatal	Retest radio by turning it off and turning it on again.
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.

NOTICE:
If error message reoccurs, replace main board or send radio to nearest Motorola Solutions Depot.

6.3
Operational Error Codes

During radio operation, your radio performs dynamic tests to determine if your radio is working properly. Problems detected during these tests are presented as error codes on your radio display. Use the following table to aid in understanding particular operational error codes.

Table 47: Types of Error Code

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

> **NOTICE:** If error message reoccurs, send radio to nearest Motorola Solutions Service Centers or Authorized Motorola Solutions Service Dealers.

Authorized Accessories List

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

Antennas

- VHF, 144–165 MHz, Helical Antenna (PMAD4116_)
- VHF, 136–155 MHz, Helical Antenna (PMAD4117_)
- VHF, 152–174 MHz, Helical Antenna (PMAD4118_)
- VHF, 136–148 MHz, Stubby Antenna (PMAD4119_)
- VHF, 146–160 MHz, Stubby Antenna (PMAD4120_)
- VHF, 160–174 MHz, Stubby Antenna (PMAD4121)
- VHF, 136–174 MHz, Whip Antenna 20 cm (PMAD4147_)
- UHF, 403–450 MHz, Stubby Antenna (PMAE4069_)
- UHF, 440–490 MHz, Stubby Antenna (PMAE4070_)
- UHF, 470–527 MHz, Stubby Antenna (PMAE4071_)
- UHF, 403–527 MHz, Slim Whip Antenna (PMAE4079_)
- 800/900, 806–870 MHz, Short Whip Antenna (PMAF4009_)
- 800/900, 896–941 MHz, Short Whip Antenna (PMAF4010_)
- 800/900, 806–870 MHz, Whip Antenna (PMAF4011_)
- 800/900, 896–941 MHz, Whip Antenna (PMAF4012_)

Batteries

- IMPRES Hi-Capacity Li-Ion, 2300 mAh Battery (FM) (NNTN8129_)[13]
- Core Slim Li-Ion, 1600 mAh Battery (PMNN4406_R)
- IMPRES Li-Ion, 1600 mAh Slim Battery (PMNN4407_R)
- IMPRES Hi-Capacity Li-Ion, 2250 mAh Battery (PMNN4409_R)
- Core NiMH, 1400 mAh Battery (PMNN4412_)[14]
- IMPRES Li-Ion, 2700 mAh Battery (PMNN4448_R)
- Battery Li-Ion, IP57 2050 mAh (PMNN4463_)[15]
- IMPRES Li-Ion, 3000 mAh IP68 Battery for Vibrating Belt Clip (PMNN4488_)
- IMPRES Li-Ion, 2900 mAh TIA 4950 HAZLOC IP68 Battery (PMNN4489_) [16]
- IMPRES Slim Li-Ion, 2100 mAh IP68 Battery (PMNN4491_)
- IMPRES Li-Ion, 3000 mAh IP68 Battery, low voltage (PMNN4493_)

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[13] Not applicable to XPR 7550e/XPR 7580eXPR 7350e/XPR 7380e
[14] Not applicable to the 800/900 bands.
[15] Your radio is compatible with the accessories listed here. Contact your dealer for details.
[16] Applicable to XPR 7550e/XPR 7580e XPR 7350e/XPR 7380e only.

- Core Li-Ion, 2450 mAh IP68 Battery (PMNN4543_)
- IMPRES Li-Ion, 2450 mAh IP68 Battery (PMNN4544_)

Carry Devices

- Belt Clip for 2 in. Belt Width (PMLN4651_)
- 2.5 in. Replacement Leather Swivel Belt Loop (PMLN5610_)
- 3 in. Replacement Leather Swivel Belt Loop (PMLN5611_)
- Hard Leather Carry Case with 3 in. Fixed Belt Loop for Full-Keypad Radio (PMLN5838_)
- Hard Leather Carry Case with 3 in. Fixed Belt Loop for Non-Display Radio (PMLN5839_)
- Hard Leather Carry Case with 3 in. Swivel Belt Loop for Full-Keypad Radio (PMLN5840_)
- Hard Leather Carry Case with 2.5 in. Swivel Belt Loop for Full-Keypad and Limited-Keypad Radio (PMLN5842_)
- Hard Leather Carry Case with 2.5 in. Swivel Belt Loop for Non-Display Radio (PMLN5843_)
- Nylon Carry Case with 3 in. Fixed Belt Loop for Full-Keypad and Limited-Keypad Radio (PMLN5844_)
- Nylon Carry Case with 3 in. Fixed Belt Loop for Non-Display Radio (PMLN5845_)
- Hard Leather Carry Case with 3 in. Swivel Belt Loop for Non-Display Radio (PMLN5846_)
- Belt Clip for 2.5 in. Belt Width (PMLN7008_)
- Vibrating Belt Clip for 2.5-Inch Belt Width (PMLN7296_)
- Leather Radio Strap (RLN6486_)[17]
- Leather Radio Strap, Size XL (RLN6487_)[17]
- Anti-Sway Leather Radio Strap (RLN6488_)[17]

Chargers

- Travel Charger Micro USB Fast Rate Fixed-Sprint (EPNN9288_)
- IMPRES Battery Fleet Management License Key (HKVN4036_)
- Wall Mount Bracket for IMPRES Multi-Unit Charger (NLN7967_)[18]
- IMPRES Battery Reader (NNTN7392_)
- IMPRES Vehicular Charger (NNTN7616_)
- IMPRES Battery Fleet Management Multi-Unit Charger Interface Unit (NNTN7677_)[18]
- IMPRES Battery Fleet Management Single-Unit Charger Interface Unit (NNTN8045_)[18]
- Core Single-Unit Charger, Base Only (NNTN8117_)
- Standard Single-Unit Charger with Power Supply, Linear PRC (NNTN8224_)
- Standard Single-Unit Charger with Power Supply, Linear, 110 V ac US Plug (NNTN8226_)
- Standard Single-Unit Charger with Power Supply, Switch-Mode – 21 W, NA/LA (NNTN8275_)
- Travel Charger, Rapid Rate with Voltage Regulated Vehicular Charger Adapter, Custom Charger Base, Mounting Bracket, and Coil Cord (NNTN8525_)[18]
- 110 VAC 50/60 HZ US IMPRES Single-Unit Charger (WPLN4243_)
- IMPRES Multi-Unit Charger, Base Only (WPLN4211_)

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[17] Your radio is compatible with the accessories listed here. Contact your dealer for details.
[18] Your radio is compatible with the accessories listed here. Contact your dealer for details.

- IMPRES Multi-Unit Charger, US Plug (WPLN4212_)
- IMPRES Multi-Unit Charger with Display Base Only (WPLN4218_)
- IMPRES Multi-Unit Charger with Display, US plug (WPLN4219_)
- Core Single-Unit Charger, Base Only (WPLN4225_)
- 110 VAC 50/60 Hz US Core Single-Unit Charger (WPLN4227_)
- IMPRES Single-Unit Charger, US plug (WPLN4232_)
- IMPRES Multi Unit Charger US 1-Up Display (WPLN4239_)
- LTD Single-Unit Charger IMPRES (SMPS NA/LA) (WPLN4253_)

Earbuds and Earpieces

- Receive-Only Earbud (AARLN4885_)
- 1–Wire Receive-Only Earpiece, Beige (BDN6664_)
- Extra Loud Receive-Only Earpiece, Beige (BDN6665_)
- Earpiece with Volume Control (BDN6666_)
- Earpiece with 3.5 mm threaded plug (BDN6719_)
- 1–Wire Receive-Only Earpiece, Black (BDN6726_)
- Extra Loud Receive-Only Earpiece, Black (BDN6727_)
- Receive-Only Earpiece with Volume Control, Black (BDN6728_)
- Earbud, Single Speaker (BDN6781_)
- Receive-Only Earbud (MDRLN4885_)
- D-Shell Receive-Only Earpiece (PMLN4620_)
- D-Shell Earset (PMLN5096_)
- IMPRES Temple Transducer with In-line Push-to-Talk (PMLN5101_)
- Ear Receiver with In-line Mic/PTT, MagOne (PMLN5973_)
- Swivel Earpiece with MIC/PTT, MagOne (PMLN5975_)
- Earset with Boom MIC In-line PTT, MagOne (PMLN5976_)
- Earbud with In-line Mic/PTT, MagOne (PMLN6069_)
- Flexible Fit Swivel Earpiece with Boom Mic (PMLN7181_)[19]
- Flexible Fit Swivel Earpiece with Boom Mic, Multipack (PMLN7203_)[19]
- Completely Discreet Earpiece Kit (RLN4922_)[19]
- Receive-Only Earpiece (RLN4941_)
- Replacement Ear Tubes for CommPort Earpiece, Pack of 10 (RLN5037_)
- Receive-Only Noise Surveillance Kit, Black (RLN5313_)
- Receive-Only Noise Surveillance Kit, Beige (RLN5314_)
- Standard Earpiece, Black (RLN6279_)
- Standard Earpiece, Beige (RLN6280_)
- Replacement Foam Ear Pad and Windscreen (RLN6283_)
- Earpiece with Acoustic Tube Assembly, Beige (RLN6284_)

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[19] Your radio is compatible with the accessories listed here. Contact your dealer for details.

- Earpiece with Acoustic Tube Assembly, Black (RLN6285_)
- Earpiece with High Noise Kit, Beige (RLN6288_)
- Earpiece with High Noise Kit, Black (RLN6289_)
- Clear EP7-Small Hearing Protectors [Sonic Defenders] Ultra Earplugs, Noise reduction = 28 dB (RLN6511_)[19]
- Clear EP7-Medium Hearing Protectors [Sonic Defenders] Ultra Earplugs, Noise reduction = 28 dB (RLN6512_)[19]
- Clear EP7-Large Hearing Protectors [Sonic Defenders] Ultra Earplugs, Noise reduction = 28 dB (RLN6513_)[19]
- Swivel Earpiece with In-Line Microphone for Bluetooth Accessory Kit Pod, Pack of 3 (RLN6550_)[19]
- 1-Wire Earbud, 29 cm Cord, Black (NNTN8294_)
- 1-Wire Earbud, 116 cm Cord, Black (NNTN8295_)
- Wireless Covert Kit, includes two sets of 2-Wire Earbuds (1 Black and 1 White), 1-Wire Earbud (Black), and a 3.5 mm Adapter to plug into any off-the-shelf headphones (NNTN8296_)
- Replacement Ear Tips Kit for Wireless Ear Buds (NNTN8316_)
- Over-the-Ear Receiver for Remote Speaker Microphone (WADN4190_)
- Replacement Ear Seal Cloth Cover (1580376E32)
- Replacement Boom Mic Windscreen (5080548E02)
- Replacement Windscreen O-Ring (3280376E35)
- Wireless Earpiece Maintenance Kit (NTN8821_)
- Ear Straps for CommPort Earpiece (for Secure Attachment to Ear), Pack of 10 (NTN8988_)
- Wireless Neckloop Y-adapter and retention hook for Completely Discreet Kit (NNTN8385_)[19]

Headsets and Headset Accessories

- Earpiece 12 in. Cable (Replacement for NNTN8125_) (NTN2572_)
- Non-Secure Wireless Headset and Push-to-Talk Device with Push-to-Talk Audio, 12 in. Cable (NNTN8125_)
- Non-Secure Wireless Headset and Push-to-Talk Device with Push-to-Talk Audio, 9.5 in. Cable (NNTN8126_)
- Non-Secure Wireless Push-to-Talk Device (NNTN8127_)
- Push-to-Talk Module, without Charger (NNTN8191_)
- Ultra-Lite Headset (PMLN5102_)
- Heavy Duty Noise-Canceling Headset (PMLN5275_)
- Lightweight Headset with Boom Mic and PTT, MagOne (PMLN5974_)
- Breeze Headset with Boom MIC and PTT, MagOne (PMLN5979_)
- MT Series Over-the-Head Headset with Nexus connector (PMLN6088_)
- PTT Nexus Adapter for MT Series Headsets (PMLN6095_)
- Business Wireless Accessory Kit (PMLN6463_)
- Next Generation Behind-the-Head Heavy Duty Headset GCAI (PMLN6852_)
- Next Generation Behind-the-Head Heavy Duty Headset GCAI TIA 4950 (PMLN6853_)
- Earmuff Hygiene Kit, Black Earseals (RLN4923_)

- MT Series Neckband Headset with Nexus connector (RLN6477_)
- MOTOTRBO Bluetooth Accessory Kit with NA Power Supply (RLN6500_)
- Earmuff Hygiene Kit, Gel Sealing (RLN6541_)
- Hygiene Tape for Microphone (RLN6542_)
- Boom Microphone Wind Screen (RLN6543_)
- MT Series Hard Hat Attached Headset with Nexus connector (RMN4051_)
- TacticalPro Series Over-The-Head Headset with Nexus Connector (RMN4052_)
- TacticalPro Series Hard Hat Headset with Nexus Connector (RMN4053_)
- HT Series Listen Only Over-the-Head Headset with 3.5 mm non-threaded connector (RMN4055_)
- HT Series Listen Only Over-the-Head Headset with 3.5 mm threaded connector (RMN4056_)
- HT Series Listen Only Hard Hat Headset with 3.5 mm threaded connector (RMN4057_)
- Lightweight Headset (RMN5058_)
- Metal Boom with Microphone (RMN5131_)
- HT Series Listen Only Neckband Headset with 3.5 mm non-threaded connector (RMN5132_)
- HT Series Listen Only Hard Hat Headset with 3.5 mm non-threaded connector (RMN5133_)
- TacticalPro Series Neckband Headset with Nexus Connector (RMN5135_)
- MT Series Over-the-Head Headset, direct radio connect (RMN5137_)
- MT Series Neckband Headset, direct radio connect (RMN5138_)
- MT Series Hard Hat Attached Headset, direct radio connect (RMN5139_)

Remote Speaker Microphones

- IMPRES Remote Speaker Microphone, IP57 (NNTN8382_)
- IMPRES Remote Speaker Microphone, with Earjack (NNTN8383_)
- Remote Speaker Microphone (PMMN4024_)
- IMPRES Remote Speaker Microphone (PMMN4025_)
- Remote Speaker Microphone, Submersible (IP57) (PMMN4040_)
- IMPRES Remote Speaker Microphone, with Volume, IP57 (PMMN4046_)
- IMPRES Remote Speaker Microphone, with Earjack, Noise Canceling (PMMN4050_)
- IMPRES Remote Speaker Microphone Large, APX IP68 Delta T (GCAI) (PMMN4083_)[20]
- Operational Critical Wireless Remote Speaker Microphone (PMMN4096_)
- IMPRES Noise Cancelling Remote Speaker Microphone, 3.5 mm Jack, Long Coil Cable, with Nexus Connector (PMMN4102_)
- IMPRES Noise Cancelling Remote Speaker Microphone, 3.5 mm Jack, Long Coil Cable, with Nexus Connector (Green Housing) (PMMN4102B_GRN)
- IMPRES OMNI Remote Speaker Microphone, 3.5 mm Jack, Long Coil Cable, with Nexus Connector (PMMN4113_)
- Remote Speaker Microphone Replacement Coil Cord Kit (For Use with PMMN4024_ and PMMN4040_) (RLN6074_)
- Remote Speaker Microphone Replacement Coil Cord Kit (For Use with PMMN4025_ , PMMN4046_, PMMN4050_) (RLN6075_)

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[20] Your radio is compatible with the accessories listed here. Contact your dealer for details.

Surveillance Accessories

- 1-Wire Surveillance Kit with Translucent Tube, Black (NNTN8459_)
- IMPRES 3-Wire Surveillance, Black (PMLN5097_)
- IMPRES 3-Wire Surveillance, Beige (PMLN5106_)
- IMPRES 3-Wire Surveillance with Acoustic Tube, Black (PMLN5111_)
- IMPRES 3-Wire Surveillance with Acoustic Tube, Beige (PMLN5112_)
- Receive Only Surveillance Kit, Black (Single Wire) (PMLN6125_)
- Receive Only Surveillance Kit, Beige (Single Wire) (PMLN6126_)
- IMPRES 2-Wire Surveillance Kit, Black (PMLN6127_)
- IMPRES 2-Wire Surveillance Kit, Beige (PMLN6128_)
- IMPRES 2-Wire Surveillance Kit with Clear, Comfortable Acoustic Tube, Black (RLN5882_)
- IMPRES 2-Wire Surveillance Kit with Clear, Comfortable Acoustic Tube, Black (PMLN6129_)
- IMPRES 2-Wire Surveillance Kit with Clear, Comfortable Acoustic Tube, Beige (PMLN6130_)
- IMPRES 3-Wire Surveillance with Clear, Comfortable Acoustic Tube, Black (PMLN6123_)
- IMPRES 3-Wire Surveillance with Clear, Comfortable Acoustic Tube, Beige (PMLN6124_)
- Operations Critical Wireless 1-Wire Surveillance Kit with translucent tube (PMLN7052_)[21]
- Small Custom Earpiece for Surveillance Kits, Right Ear (RLN4760_)
- Medium Custom Earpiece for Surveillance Kits, Right Ear (RLN4761_)
- Large Custom Earpiece for Surveillance Kits, Right Ear (RLN4762_)
- Small Custom Earpiece for Surveillance Kits, Left Ear (RLN4763_)
- Medium Custom Earpiece for Surveillance Kits, Left Ear (RLN4764_)
- Large Custom Earpiece for Surveillance Kits, Left Ear (RLN4765_)
- Surveillance Low Noise Kit (RLN5886_)
- Surveillance High Noise Kit (RLN5887_)
- Replacement Foam Plugs, Pack of 50 (For Use with RLN5886_) (RLN6281_)
- Replacement Ear Tips, Clear, Pack of 50 (For Use with RLN5887_) (RLN6282_)

Miscellaneous Accessories

- Replacement Strap for RLN4570_ and HLN6602_ Chest Packs (1505596Z02)
- Belt (4200865599)
- Universal RadioPAK Extension Belt (4280384F89)
- Screen Protector, Clear (single pack contains one unit) (AY000267A01_) [22]
- Universal Chest Pack (HLN6602_)
- Waterproof Bag, includes Large Carry Strap (HLN9985_)
- Shoulder Strap (Attaches to D-Ring on Carry Case) (NTN5243_)
- DMR Portable Programming Cable (PMKN4012_)
- Test and Alignment Cable for programming (PMKN4013_)
- DMR Portable Telemetry Cable (PMKN4040_)

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[21] Your radio is compatible with the accessories listed here. Contact your dealer for details.
[22] Your radio is compatible with the accessories listed here. Contact your dealer for details.

- IMPRES Portable Non PC Adapter (PMKN4071_)
- TTR and Programming Cable for test alignment (PMKN4126_)
- Tactical Remote Body Push-to-Talk (PMLN6767_)
- Push-to-Talk Interface Module (PMLN6827_)
- Tactical Remote Ring Push-to-Talk (PMLN6830_)
- Tactical Heavy Duty Temple Transducer with Noise Cancelling Boom Microphone (PMLN6833_)
- Small Clip, Epaulet Strap (RLN4295_)
- Break-A-Way Chest Pack (RLN4570_)
- Universal Radio Pack and Utility Case (Fanny Pack) (RLN4815_)

Appendix A

Replacement Parts Ordering

Basic Ordering Information

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

Orders for replacement parts, kits, and assemblies should be placed directly on Motorola Solutions local distribution organization or through Motorola Online. When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Request for help in identification if non-referenced spare parts should be directed to the Customer Care organization of Motorola Solutions local area representation. Orders for replacement parts, kits, and assemblies should be placed directly on Motorola Solutions local distribution organization or by using Motorola Online.

Motorola Online

Motorola Online users can access our online catalog at
https://businessonline.motorolasolutions.com.

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://businessonline.motorolasolutions.com.

Types of Orders	
Mail Orders	Mail orders are only accepted by the U.S. Federal Government Markets Division (USFGMD).
	Motorola Solutions
	7031 Columbia Gateway Drive
	3rd Floor - Order Processing
	Columbia, MD 21046
	U.S.A.
Telephone Orders and Parts Identification	• RPSO (United States and Canada)
	7:00 AM to 7:00 PM (Central Standard Time)

Types of Orders

	Monday through Friday (Chicago, U.S.A.)
	1-800-422-4210
	1-847-538-8023 (United States and Canada)
	• USFGMD
	1-800-826-1913 Federal Government Parts - Credit Cards Only
	8:30 AM to 5:00 PM (Eastern Standard Time)
Fax Orders	RPSO (United States and Canada)
	1-800-622-6210
	1-847-576-3023 (United States and Canada)
	USFGMD (Federal Government Orders)
	1-800-526-8641 (For Parts and Equipment Purchase Orders)

Product Customer Service

RPSO (United States and Canada)

1-800-927-2744

> **NOTICE:** The Motorola Solutions RPSO was formerly known as the Radio Products Services Division (RPSD) and/or the Accessories and Aftermarket Division (AAD).

Appendix B

Motorola Solutions Service Centers

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 Solutions Service Center as listed below.

Types of Center	Address	Telephone Number
Motorola Solutions Service Centers	1220 Don Haskins Drive Suite A El Paso, TX 79936	915-872-8200
Motorola Solutions Federal Technical Center	10105 Senate Drive Lanham, MD 20706	1800-969-6680 Fax: 1800-784-4113
Motorola Solutions Canadian Technical Logistics Center	181 Whitehall Drive Markham, Ontario L3R 9T1	Toll Free: 1-800-543-3222

Appendix C

Limited Level 3 Servicing

Only Motorola Solutions Service Center or Motorola Solutions Authorized Dealers can perform Limited Level 3 Servicing.

Refer to "Disassembly/Reassembly Procedures" chapter for details of the following:

- Preventive maintenance (inspection and cleaning).

- Safe handling of CMOS and LDMOS devices.

- Repair procedures and techniques.

For soldering components with Hot-Air or infra red solder systems, check the *User Guide* of your solder system to get information on solder temperature and time for the different housings of the integrated circuits and other components.

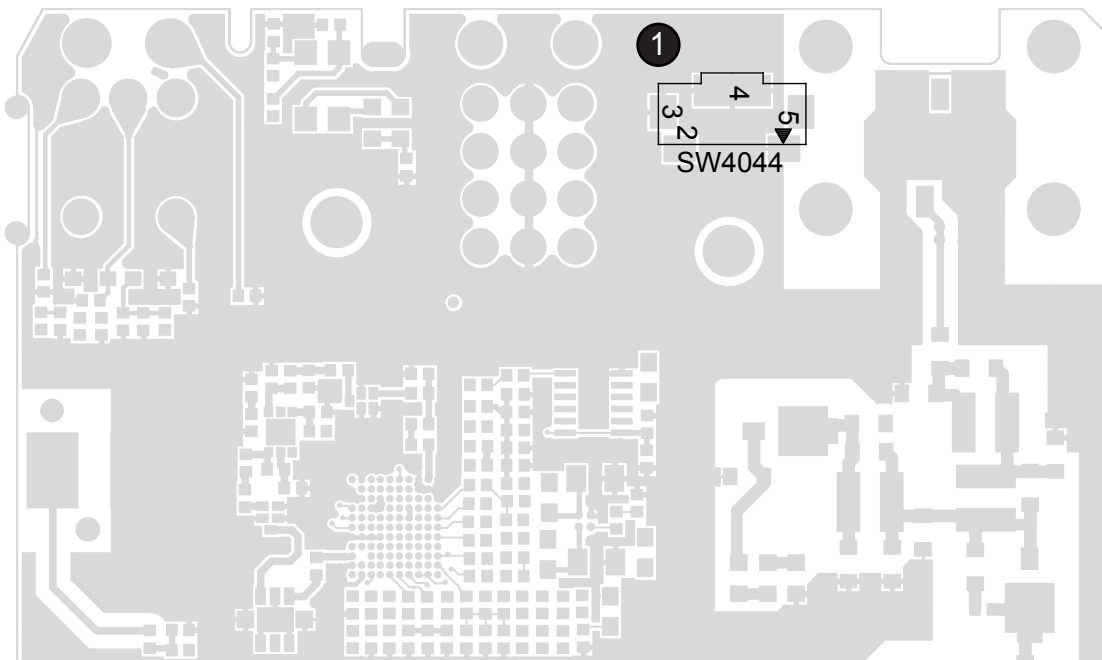C.1
Component and Parts List
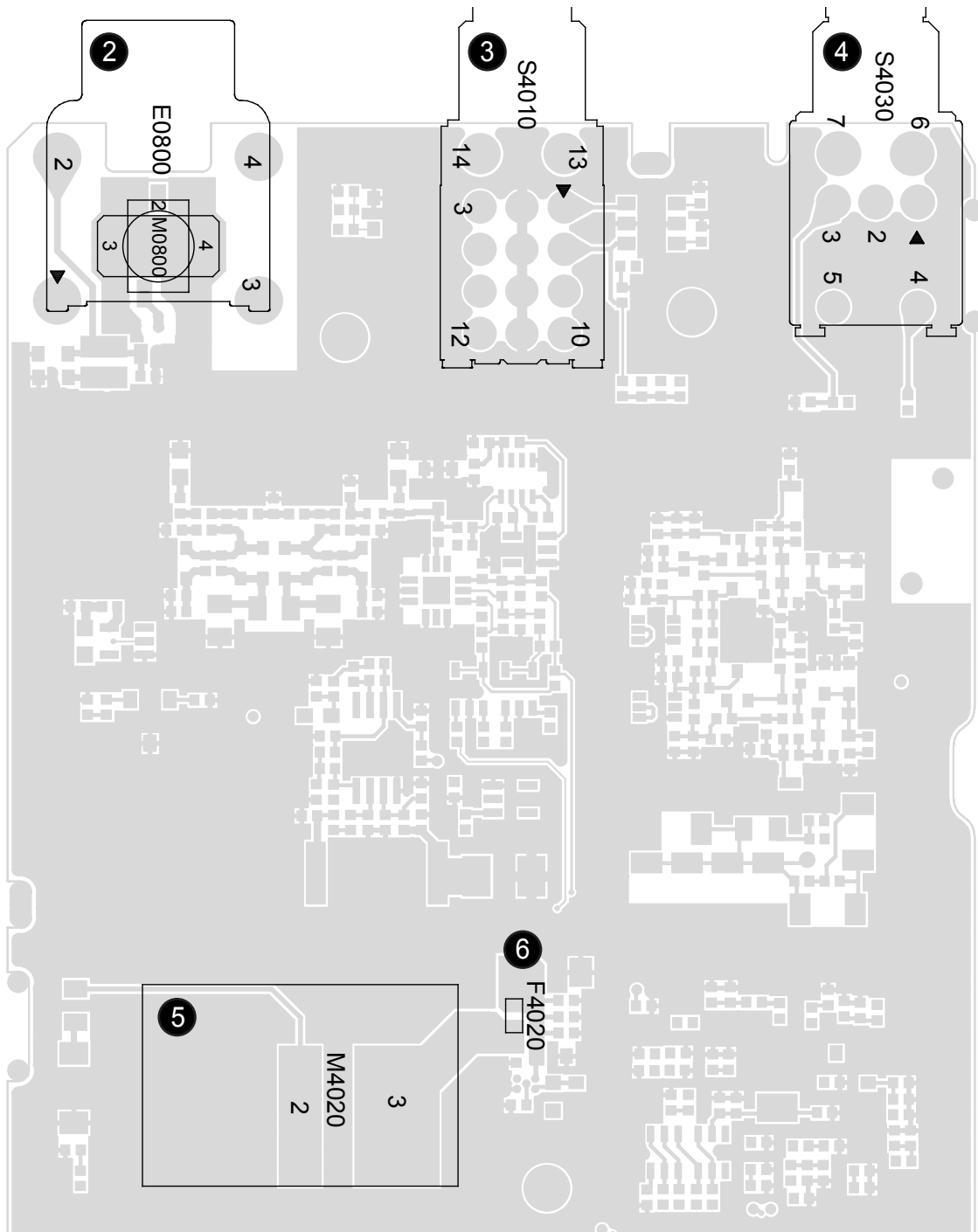
Figure 70: PCB Top View

Figure 71: PCB Bottom View

Table 48: Component Parts List

No.	Circuit Ref	Motorola Solutions Part Number	Description
1	SW4044	4086470Z01	SPST Tact Switch
2	M0800 E0800	0987378K01 CN000794A01	SM Coaxial Connector Female

No.	Circuit Ref	Motorola Solutions Part Number	Description
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 3 A 24 V

Glossary

This glossary contains an alphabetical listing of terms and their definitions that are applicable to portable and mobile subscriber radio products. All terms do not necessarily apply to all radios, and some terms are merely generic in nature.

Analog Refers to a continuously variable signal or a circuit or device designed to handle such signals.

Band Frequencies allowed for a specific purpose.

Bluetooth (BT) A wireless protocol utilizing short-range communications over short distances.

Customer Programming Software (CPS) Software with a graphical user interface containing the feature set of a radio.

Default A pre-defined set of parameters.

Digital 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.

Digital Private-Line (DPL) A type of digital communications that utilizes privacy call, as well as memory channel and busy channel lock out to enhance communication efficiency.

Federal Communications Commission (FCC) Regulates interstate and international communications by radio, television, wire, satellite and cable in all 50 states, the District of Columbia, and U.S. territories. It was established by the Communications Act of 1934 and operates as an independent U.S. government agency overseen by Congress. The commission is committed to being a responsive, efficient and effective agency capable of facing the technological and economic opportunities of the new millennium.

Frequency Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second).

Global Navigation Satellite System (GNSS) GNSS uses satellites from the GPS, GLONASS, and BeiDou systems.
- Global Positioning System (GPS)
  - It includes Satellite-Based Augmentation System (SBAS).
  - Method of location based on reception of multiple satellite signals by a device on the ground or in an airplane.
- Global Navigation Satellite System (GLONASS)
- BeiDou Navigation Satellite System (BDS)
  - Chinese Satellite Navigation System.

General-Purpose Input/Output (GPIO) Pins whose function is programmable.

Integrated Circuit (IC) 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.

kilohertz (kHz) One thousand cycles per second. Used especially as a radio-frequency unit.

Liquid-Crystal Display (LCD) 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.

Light Emitting Diode (LED) An electronic device that lights up when electricity is passed through it.

Motorola Digital Communications (MDC) A Motorola Solutions proprietary signaling scheme permitting the transfer of data communications at the rate of 1200 bits per second. Designed specifically for high reliability in the land-mobile radio environment. Digital encoding allows a much greater amount of information to pass over the channel with each message than with alternative tone encoding methods. Some features include: PTT ID, Emergency, Call Alert, Emergency Alarm, Voice Selection Call (SelCall), Radio Check, and Monitor.

Megahertz (MHz) One million cycles per second. Used especially as a radio-frequency unit.

Paging One-way communication that alerts the receiver to retrieve a message.

Printed Circuit Board (PC Board) A circuit manufactured so that many or all of the components are attached to a non-conductive circuit board with copper strips on one or both sides to replace wires.

Private-Line Tone Squelch (PL) A continuous sub-audible tone that is transmitted along with the carrier.

Programming Cable A cable that allows the CPS to communicate directly with the radio using USB.

Receiver 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.

Repeater Remote transmit/receive facility that re-transmits received signals in order to improve communications range and coverage (conventional operation).

Radio Frequency (RF) The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz).

Signal An electrically transmitted electromagnetic wave.

Spectrum Frequency range within which radiation has specific characteristics.

Squelch 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.

Telecommunications Industry Associatio (TIA) An organization representing the global information and communications technology (ICT) industry that develops and publishes telecommunication standards.

Time-out Timer (TOT) A timer that limits the length of a transmission.

Tone Private Line (TPL) A continuous tone-coded squelch, which contains 29 codes. It is not compatible with DPL, and is common among all radio manufacturers.

Transceiver Transmitter-receiver: A device that both transmits and receives analog or digital signals.

Abbreviation: XCVR

Transmitter Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space.

Ultra-High Frequency (UHF) The term for the International Telecommunication Union (ITU) Radio Band with a frequency range of 300 to 3000 MHz.

Universal Serial Bus (USB) An external bus standard that supports data transfer rates of 12 Mbps.

Wireless Fidelity (Wi-Fi) A mechanism used to wirelessly connect electronic devices.