PROFESSIONAL DIGITAL TWO-WAY RADIO

MOTOTRBO™ SL SERIES
SL4000 & SL4010 PORTABLES
BASIC SERVICE MANUAL
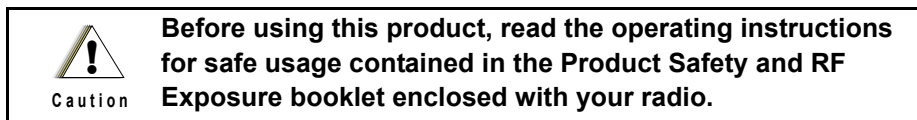
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Foreword

This manual covers all models of the SL4000 series Portable Radios, unless otherwise specified. It includes all the information necessary to maintain peak product performance and maximum working time, using levels 1 and 2 maintenance procedures. This level of service goes down to the board replacement level and is typical of some local service centers, self-maintained customers, and distributors.

Product Safety and RF Exposure Compliance

⚠️ **Caution**	**Before using this product, read the operating instructions for safe usage contained in the Product Safety and RF Exposure booklet enclosed with your radio.**

ATTENTION!

This radio is restricted to occupational use only to satisfy FCC/ICNIRP energy exposure requirements. Before using this product, read the RF energy awareness information and operating instructions in the Product Safety and RF Exposure booklet enclosed with your radio (Motorola Publication part number 6864117B25) to ensure compliance with RF energy exposure limits.

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

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Notes

Document History

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

Edition	Description	Date
68012004076-A	Initial Release	Jan 2012

Notes

Table of Contents

List of Figures

List of Tables

Notes

Related Publications

Notes

Commercial Warranty

Limited Warranty

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

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C. Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment.

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- the damage or defect is caused by charging or using the battery in equipment or service other than the Product for which it is specified.

H. Freight costs to the repair depot.

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    B.   that MOTOROLA will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and

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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.

Lithium-Ion (Li-Ion) Batteries (BT70 and BT90)	One (1) Year
Chargers	Two (2) Years

Capacity Warranty

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

Lithium-Ion (Li-Ion) Batteries (BT70 and BT90)	12 Months

Chapter 1   Introduction

1.1   Notations Used in This Manual

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

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

![Caution] CAUTION indicates a potentially hazardous situation which, if not avoided, might result in equipment damage.

Caution

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

WARNING

1.2   Radio Description

The SL4000 series portable radios are available in the following frequency ranges and power levels.

Table 1-1. Radio Frequency Ranges and Power Levels

Frequency Band	Bandwidth	Power Level
UHF	403 – 470 MHz	2 Watts

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

1.2.1   Radio Overview
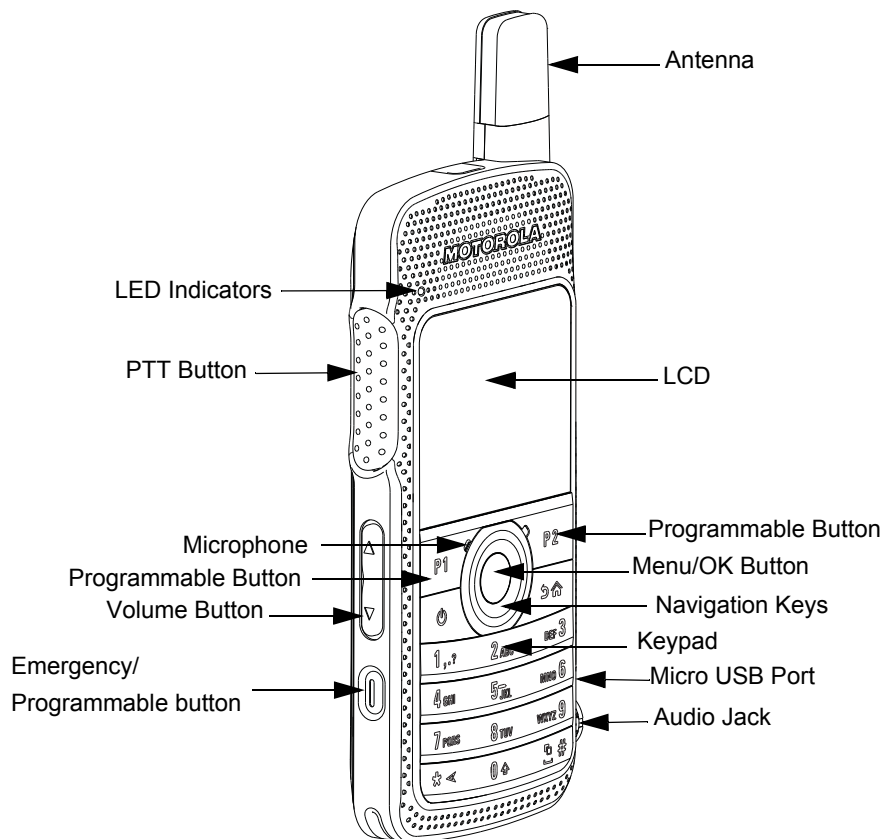
Figure 1-1. Display Model

- LED INDICATORS – Red, green and orange light-emitting diodes indicate operating status.
- LCD (Liquid Crystal Display) – 320x240 Liquid Crystal Display provides visual information about many radio features.
- NAVIGATION KEYS and MENU/OK– To provide menu navigation and to select the interface.
- VOLUME BUTTON - To adjust speaker volume.
- KEYPAD – Twelve keys that allow the user to input characters for various text based operations.
- FRONT and SIDE PROGRAMMABLE BUTTONS – These three buttons are field programmable using the CPS.
- PUSH-TO-TALK (PTT) BUTTON– Press to execute voice operations (e.g. Group call and Private Call).
- ANTENNA – Provides the needed RF radiation when transmitting or receiving.
- MICROPHONE – Allows voice to be sent when PTT or voice operations are activated.
- AUDIO JACK – Interface point for audio accessories to be used with the radio.
- MICRO USB PORT – Programs the radio through the computer and charges the radio through a wall charger.

NOTE   Charging the radio through the computer is not supported.

- EMERGENCY/ PROGRAMMABLE BUTTON – Turns on and off the programmable Emergency Operations.
- SPEAKER – Outputs all tones and audio generated by the radio (e.g. features such as keypad tones and voice audio).

1.3   Portable Radio Model Numbering Scheme

Model No.Example :   AZ   H   8   1   Q   C   N   9   M   A   2   A   N

Position   :   1   2   3   4   5   6   7   8   9   10   11   12

AZ: APAC
LA: Latin America
AA: North America
MD: EMEA

H: Portable

81: SL Series

Band
Q: 403 – 470MHz

Power Level
C: 2W

Physical Packages
N: Color Display FKP

Channel Spacing
9: Variable/Programmable

Primary Operation
M: Standard w/BT
N: GOB w/BT

Primary System Type
A: Conventional

Feature Level
2: Non-FM

Version Letter

Unique Variation
N: Standard Package

Figure 1-2. Portable Radio Model Numbering Scheme

1.4   Model Charts

1.4.1   UHF 2W GOB Enabled (403 – 470 MHz) Model Chart

UHF 403 – 470 MHz 2W, GOB Enabled	
Model	**Description**
MDH81QCN9NA2AN	403–470 MHz, 2W, MOTOTRBO SL4010 Full Keypad Alphanumberic Display Portable, GOB Enabled
Item	**Description**
X PMUE3877_	MOTOTRBO™ Display Portable (GOB Enabled)
X PMAE4078_	Antenna Kit – Band 1 (403 – 425 MHz)
X PMAE4076_	Antenna Kit – Band 2 (420 – 445 MHz)
X PMAE4077_	Antenna Kit – Band 3 (438 – 470 MHz)
X 68012004073	Portable Quick Reference Guide and Safety Booklet
X = Item Included _ = The latest version kit. When ordering a kit, refer to your specific kit for the suffix number.	

1.4.2   UHF 2W Non-GOB Enabled (403 – 470 MHz) Model Chart

UHF 403 – 470 MHz 2W, Non-GOB Enabled	
Model	**Description**
MDH81QCN9MA2AN	403–470 MHz, 2W, MOTOTRBO SL4000 Full Keypad Alphanumberic Display Portable, Non-GOB Enabled
Item	**Description**
X PMUE3876_	MOTOTRBO Display Portable (Non-GOB Enabled)
X PMAE4078_	Antenna Kit – Band 1 (403 – 425 MHz)
X PMAE4076_	Antenna Kit – Band 2 (420 – 445 MHz)
X PMAE4077_	Antenna Kit – Band 3 (438 – 470 MHz)
X 68012004073	Portable Quick Reference Guide and Safety booklet
X = Item Included _ = The latest version kit. When ordering a kit, refer to your specific kit for the suffix number.	

1.5 Specifications

General	SL4000
Channel Capacity	1000
Frequency	UHF: 403 – 470 MHz
Dimensions (HxWxT) with BT70 battery with BT90 battery	121 x 55 x 17.4 mm 121 x 55 x 19.8 mm
Weight with BT70 battery with BT90 battery	153g 165g
Power Supply	3.7 V nominal
FCC Description	ABZ99FT4090
IC Description	109AB-99FT4090
Average battery life at 5/5/90 duty cycle with battery saver enabled	
BT70 1370 mAh battery	8.5 hrs
BT90 1800 mAh battery	11.5 hrs

Receiver	SL4000
Frequencies	403 – 470 MHz
Channel Spacing	12.5 kHz
Frequency Stability (-30°C to +60°C)	+/-1.5 ppm
Digital Sensitivity	5% BER: 0.3µV
Intermodulation (ETSI-EN300 113-1)	65 dB
Adjacent Channel Selectivity (ETSI-EN300 113-1)	60 dB @ 12.5 kHz
Spurious Rejection (ETSI-EN300 113-1)	70 dB
Rated Audio	500 mW
Audio Distortion @ Rated Audio	3% (typical)
Digital Hum and Noise	-40 dB @ 12.5 kHz
Conducted Spurious Emission (ETSI-EN300 113-1)	-57 dBm

Transmitter	SL4000
Frequencies	403 – 470 MHz
Frequency Stability (-30°C to +60°C)	+/-1.5 ppm
Power Output	2 W
Digital Hum and Noise	-40 dB @ 12.5 kHz
Conducted / Radiated Emission	-36 dBm < 1 GHz -30 dBm > 1 GHz
Digital Adjacent Channel Power	60 dB @ 12.5 kHz
Audio Response	+1, -3 dBm
Audio Distortion	3%
4FSK Digital Modulation	12.5 kHz Data: 7K60F1D & 7K60FXD 12.5 kHz Voice: 7K60F1E & 7K60FXE Combination of 12.5 kHz Data & Voice: 7K60F1W
Digital Vocoder Type	AMBE+2
Digital Protocol	ETSI TS 102 361 -1,-2,-3

UHF1 Self-Quieter Frequencies
403.200 MHz ± 15 kHz
404.000 MHz ± 10 kHz
408.000 MHz ± 10 kHz
412.000 MHz ± 5 kHz
420.000 MHz ± 15 kHz
422.400 MHz ± 15 kHz
428.000 MHz ± 5 kHz
432.000 MHz ± 20 kHz
432.100 MHz ± 10 kHz
432.165 MHz ± 10 kHz
432.450 MHz ± 5kHz
436.000 MHz ± 5 kHz
440.000 MHz ± 5 kHz
441.600 MHz ± 15 kHz
443.895 MHz ± 5 kHz
444.000 MHz ± 20 kHz
444.100 MHz ± 10 kHz
451.200 MHz ± 15 kHz
452.000 MHz ± 10 kHz
456.000 MHz ± 20 kHz
460.000 MHz ± 5 kHz
460.800 MHz ± 15 kHz
468.000 MHz ± 20 kHz
468.100 MHz ± 10 kHz

Military Standards		
Applicable MIL–STD	MIL 810F Methods/ Procedures	MIL 810G Methods/ Procedures
Low Pressure	500.4/ Procedure II	500.5/ Procedure II
High Temperature	501.4/ Procedure I/Hot, Procedure II/Hot	501.5/ Procedure I/ A1, Procedure II/A1
Low Temperature	502.4/ Procedure I/ C1, Procedure II/ C1	502.5/ Procedure I/ C1, Procedure II/ C1
Temperature Shock	503.4/ Procedure I	503.5/ Procedure I/C
Solar Radiation	505.4/ Procedure I	505.5/ Procedure I/ A1
Rain	506.4/ Procedure I	506.5/ Procedure I
Dust	510.4/ Procedure I	510.5/ Procedure I
Vibration	514.5/ Procedure I/24	514.6/ Procedure I/24
Shock	516.5/ Procedure IV	516.6/ Procedure IV, VI

Environmental Specifications	
Operating Temperature	-10 °C to +60 °C
Storage Temperature	-30 °C to +70 °C
ESD	IEC 61000-4-2
Water & Dust Intrusion	IP54
Humidity	8 hour soak @ +50 °C and 95% RH
Salt Fog	8 hours exposure to 5% saline solution Sodium Chloride (NaCl) at 35 °C, 16 hours standing period

Notes

Chapter 2   Test Equipment and Service Aids

2.1   Recommended Test Equipment

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

Table 2-1. Recommended Test Equipment

Equipment	Characteristics	Example	Application
Service Monitor	Can be used as a substitute for items marked with an asterisk (*)	Aeroflex Digital Radio Test Set Model 3920 with DMR option	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
Digital RMS Multimeter *	100 µV to 300 V 5 Hz to 1 MHz 10 Mega Ohm Impedance	Fluke 179 or equivalent (www.fluke.com)	AC/DC voltage and current measurements. Audio voltage measurements
RF Signal Generator *	100 MHz to 1 GHz -130 dBm to +10 dBm FM Modulation 0 kHz to 10 kHz Audio Frequency 100 Hz to 10 kHz	Agilent 443X R&S Signal Generator	Receiver measurements
Oscilloscope *	2 Channel 50 MHz Bandwidth 5 mV/div to 20 V/div	Leader LS8050 (www.leaderusa.com), Tektronix TDS1001b (www.tektronix.com), or equivalent	Waveform measurements
Power Meter and Sensor *	5% Accuracy 100 MHz to 500 MHz 50 Watts	Bird 43 Thruline Watt Meter (www.bird-electronic.com) or equivalent	Transmitter power output measurements
RF Millivolt Meter	100 mV to 3 V RF 10 kHz to 1 GHz	Boonton 92EA (www.boonton.com) or equivalent	RF level measurements
Power Supply	0 V to 32 V 0 A to 20 A	B&K Precision 1790 (www.bkprecision.com) or equivalent	Voltage supply

2.2   Service Aids

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

Table 2-2. Service Aids

Motorola Part No.	Description	Application
25-124330-01R	Portable Programming Cable	Cable connects the radio to a USB port for radio programming and data applications.
28012039001	RF Antenna Adaptor	Adapts radio's antenna port to test equipment.
07012042001	RF Antenna Adaptor Holder	Holds the RF antenna adaptor.
PMNN4429_	Battery Eliminator	Connects to radio via battery eliminator cable.
GMVN5141_	MOTOTRBO CPS, Tuner, and AirTracer Applications CD	CPS allows Dealers/Distributors to program radio parameters. Tuner allows to tune and test MOTOTRBO subscriber, repeater and base station products in the available systems.
GMVN5520_	MOTOTRBO RDAC CD	RDAC allows system technicians to remotely monitor the status of the radio and gather real-time radio hardware failure reports via alarm messages reported by the radio.

Chapter 3   Transceiver Performance Testing

3.1   General

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

3.2   Setup

Supply voltage is provided using a 3.7 VDC power supply. The equipment required for alignment procedures is connected as shown in the Radio Tuning Equipment Setup Diagram, Figure 4-2.

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

The tables in this chapter contain the following related technical data:

Table Number	Title
Table 3-1	Front Panel Access Test Mode Displays
Table 3-2	Test Frequencies
Table 3-3	Transmitter Performance Checks
Table 3-4	Receiver Performance Checks

Setup:

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

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

     b. Remove the radio's name plate label and the RF Plug (blue) as shown in Figure 3-2. and Figure 3-3.

     c. Connect the RF antenna adaptor to the 50 Ohm RF Input/Output port of the radio as shown in Figure 3-4.

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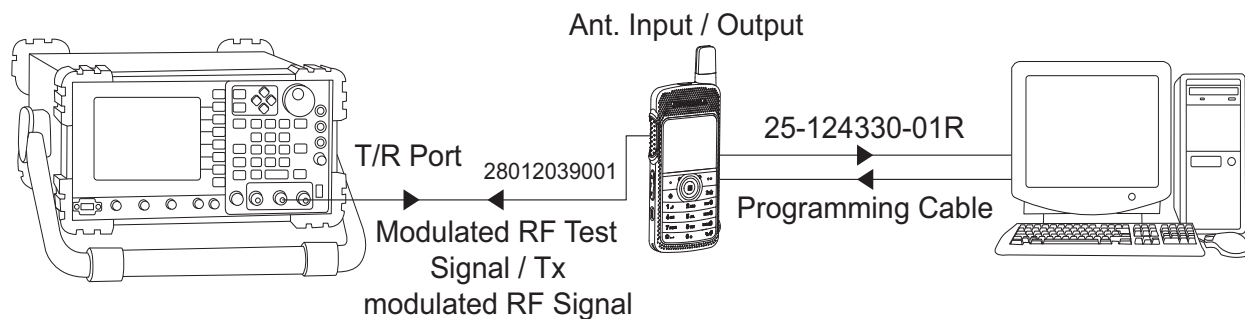

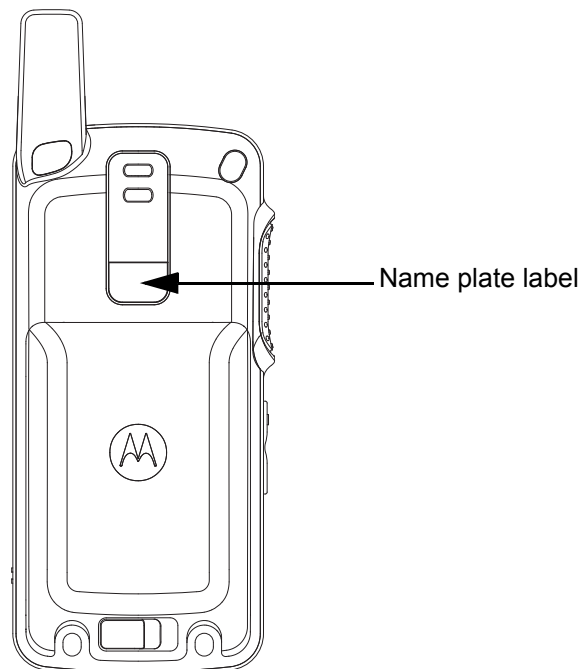*Figure 3-1. DMR Radio Transmitter and Receiver Testing Setup*
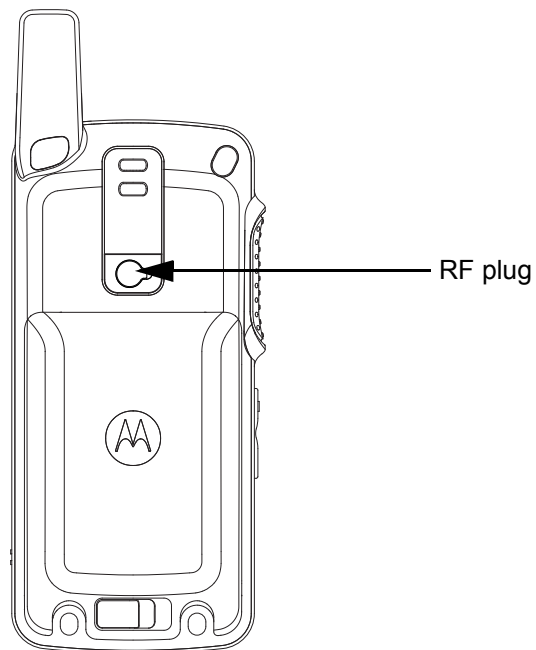

Figure 3-2. Name plate label
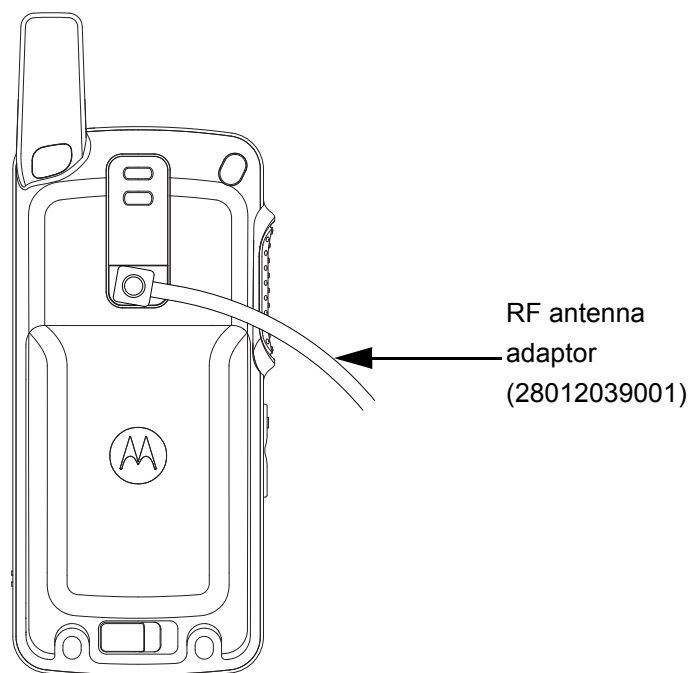
Figure 3-3. RF plug

Figure 3-4. Connect RF Antenna adaptor to radio RF input/output port

3.3   Test Mode

3.3.1   Radio Test Mode

1. Turn the radio on.
2. Within 10 seconds after Self Test is complete, press the **P2 button** five times in succession.
3. The radio beeps and shows a series of display that gives information regarding various version numbers and subscriber specific information.

The displays are described in Table 3-1.

Table 3-1. Front Panel Access Test Mode Displays

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

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

3.3.2   RF Test Mode

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

In RF Test Mode, the display upon the first line is "RF Test". The display upon the second line is the test environment, the channel number and channel spacing. The default test environment is DIG.

NOTE DIG is digital mode.

1. Press of channel selector button will cycle through the test channel 1->2->3->4->5->6->7->1 as described in Table 3-2. The radio beeps in each position. Frequency units in the table below is in MHz.

Table 3-2. Test Frequencies

Frequency	UHF RX	UHF TX
F1	403.075	403.075
F2	414.075	414.075
F3	425.075	425.075
F4	436.075	436.075
F5	447.075	447.075
F6	458.075	458.075
F7	469.075	469.075

Table 3-3. Transmitter Performance Checks

Test Name	IFR Setting	Radio	Test Set	Comments
RF Power	DMR mode. Slot 1 Power and Slot 2 Power	TEST MODE, Digital mode, transmit without modulation	Key up radio without modulation using Tuner	TTR Enable is needed and IFR to be set to trigger mode with signal level ~1.5V
FSK Error	DMR mode. FSK error	TEST MODE, Digital mode, transmit with 0153 test pattern	Key up radio with 0513 test pattern modulation using Tuner	Not Exceed 5%
Magnitude Error	DMR mode. Magnitude error	As above	As above,	Not Exceed 1%.
Symbol Deviation	DMR mode. Symbol deviation	As above	As above	Symbol Deviation should be within 648Hz +/-10% and 1944Hz +/-10%
Transmitter BER	DMR mode	As above	As above	Transmitter BER should be 0%

Table 3-4. Receiver Performance Checks

Test Name	IFR Setting	Radio	Test Set	Comments
Receiver BER	IFR DMR mode. Signal generator with 0.153 test pattern	Test Mode, Digital mode, receive 0.153 test pattern	Read BER using Tuner. Adjust RF level to get 5% BER	RF level to be <0.35uV for 5% BER

3.3.3   Display Test Mode

1. Press and hold the **P1 button** in RF Test Mode. The radio beeps once and momentarily displays "Display Test Mode."

2. Upon entering the Display Test Mode, the radio displays a white background with "Display Test Mode" in black font.

3. Upon any button/key press, the radio displays black active background with "Display Test Mode" in white font.

4. Upon any button/key press, the radio shows solid red color display.

5. Upon any button/key press following the above display, the radio shows green color display.

6. Upon any button/key press following the above display, the radio shows blue color display.

7. Upon any button/key press following the above display, the radio shows a big 46% grey "+" on black background.

8. Upon any button/key press following the above display, the radio shows a big 46% grey 90 degrees rotated "H" on black background.

9. Upon any button/key press following the above display, the radio shows a big 46% grey "H" on black background.

10. Upon any button/key press following the above display, the radio displays a black horizontal line in between two white horizontal lines.

11. Upon any button/key press following the above display, the radio displays a red horizontal line in between two white horizontal lines (increasing one colored horizontal line above and one below the center row). Once the horizontal lines cover up the screen, the radio shows red color display.

NOTE   Each key press will change the screen color from, red->green->blue->black->red.

12. When the screen is filled up with horizontal lines, any button/key press clears the screen and displays red and white vertical lines at column 0,3,6,9,12,15,18,21,24,27,30. Any button/ key press fills the screen with vertical lines of the next color, (1 line to the right of any existing line) until the display is filled up with black display.

NOTE   Each key press will change the screen color from red->green->blue->black->red->black.

13. Once the radio shows solid black color display, the next button/key press clears the screen and displays the first 10 available icons on the screen. Successive button/key press displays the remaining 4 icons.

3.3.4   Photosensor Test Mode

1. Press and hold the **P1 button** after Display Test Mode. The radio beeps once and displays "Photosensor Test Mode".
2. Upon any button/ key press, the radio displays "Step 1", then "Place Radio in Light", followed by "Press OK".
3. Upon the **Menu/OK Button** press, the radio takes few seconds to read the photosensor and to compare it with the predefined value, the result of this test is shown at the end of photosensor mode. The radio displays "Step 2", then "Cover Photosensor", followed by "Press OK".
4. By pressing the **Menu/OK Button** the second time, the radio takes a few seconds to read the photosensor and compare it with the predefined value, the result will then be shown on screen. The four possible results are:- Photosensor Test Step 1 Failed, Photosensor Test Step 2 Failed, Photosensor Test Both Steps Failed, or Photosensor Test Passed.

NOTE   Select "Press OK" by pressing the center button of the navigation keys.

3.3.5   Accelerometer Test Mode

1. Press and hold the **P1 button** after Photosensor Mode. The radio beeps once and displays "Accelerometer Test Mode".
2. Upon any button/ key press, the radio reads the x, y, z position and compare it with the predefined values (x, y, z) and displays the result on the screen. A pass result will only occur when the radio is placed in a horizontal position. The possible results are: Accelerometer Test Failed, Accelerometer Test Passed.

3.3.6   Vibrator Test Mode

Press and hold the **P1 button** after the Accelerometer Mode. The radio beeps once and vibrates twice, first a short vibration and second a longer vibration, and displays "Vibrator Test Mode".

3.3.7   LED Test Mode

1. Press and hold the **P1 button** after Vibrator Test Mode. The radio beeps once and displays "LED Test Mode".
2. Upon any button/key press, the radio's red LED lights up and displays "Red LED On".
3. Upon any button/key press following the above display, the red LED turns off. The green LED will then light up and displays "Green LED On".
4. Upon any button/key press following the above display, the green LED turns off. Both the LEDs will then light up and displays "Both LEDs On".

NOTE   As there is only one LED on the radio, the LED color is in orange when both the LED lights up.

3.3.8   Backlight Test Mode

1. Press and hold the **P1 button** after LED Test Mode. The radio beeps once and displays "Backlight Test Mode".
2. The radio turns on both LCD and keypad backlight at the same time.

3.3.9   Speaker Tone Test Mode

1. Press and hold the **P1 button** after Backlight Test Mode. The radio beeps once and displays "Speaker Tone Test Mode".

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

3.3.10   Earpiece Tone Test Mode

1. Press and hold the **P1 button** after Speaker Tone Test Mode. The radio beeps once and displays "Earpiece Tone Test Mode".

2. The radio generates a 1 kHz tone with the earpiece.

3.3.11   Audio Loopback Earpiece Test

1. Press and hold the **P1 button** after Earpiece Tone Test Mode. The radio beeps once and displays "Audio Loopback Earpiece Test Mode".

2. The radio shall route any audio on the external mic to the earpiece.

3.3.12   Battery Check Test Mode

1. Press and hold the **P1 button** after Audio Loopback Earpiece Test Mode. The radio beeps once and momentarily displays "Battery Check Test Mode".

2. The radio will display the following:

Figure 3-5. Battery Check Test Mode Display

3.3.13   Button/Knob/PTT Test Mode

1. Press and hold the **P1 button** after Battery Check Test Mode. The radio beeps once and displays "Button Test"(line 1) and displays "160/1".

2. Press the **Volume Up Button**; "80/1" appears and radio beeps; release, "80/0" appears and radio beeps.

3. Press the **Volume Down Button**; "81/1" appears and radio beeps; release, "80/1" appears and radio beeps.

4. Press the **PTT Button**; "1/1" appears and radio beeps; release, "1/0" appears and radio beeps.

5. Press the **Emergency/ Programmable Button**; "148/1" appears and radio beeps; release, "148/0" appears and radio beeps.

6. Keypad Checks:

   - Press **0**, "48/1" appears and radio beeps; release, "48/0" appears and radio beeps.

   - Press **1**, "49/1" appears and radio beeps; release, "49/0" appears and radio beeps.

   - Press **2**, "50/1" appears and radio beeps; release, "50/0" appears and radio beeps.

   - Press **3**, "51/1" appears and radio beeps; release, "51/0" appears and radio beeps.

   - Press **4**, "52/1" appears and radio beeps; release, "52/0" appears and radio beeps.

   - Press **5**, "53/1" appears and radio beeps; release, "53/0" appears and radio beeps.

- Press **6**, "54/1" appears and radio beeps; release, "54/0" appears and radio beeps.
- Press **7**, "55/1" appears and radio beeps; release, "55/0" appears and radio beeps.
- Press **8**, "56/1" appears and radio beeps; release, "56/0" appears and radio beeps.
- Press **9**, "57/1" appears and radio beeps; release, "57/0" appears and radio beeps.
- Press *****, "58/1" appears and radio beeps; release, "58/0" appears and radio beeps.
- Press **#**, "59/1" appears and radio beeps; release, "59/0" appears and radio beeps.
- Press **P1**, "160/1" appears and radio beeps; release, "160/0" appears and radio beeps.
- Press **P2**, "161/1" appears and radio beeps; release, "161/0" appears and radio beeps.
- Press **Menu/OK**, "85/1" appears and radio beeps; release, "85/0" appears and radio beeps.
- Press **Back/Home**, "129/1" appears and radio beeps; release, "129/0" appears and radio beeps.
- Press ◀, "128/1" appears and radio beeps; release, "128/0" appears and radio beeps.
- Press ▶, "130/1" appears and radio beeps; release, "130/0" appears and radio beeps.
- Press ▲, "135/1" appears and radio beeps; release, "135/0" appears and radio beeps.
- Press ▼, "136/1" appears and radio beeps; release, "136/0" appears and radio beeps.

7. After the test mode is completed, turn the radio off.
8. Turn the radio on.

Notes

Chapter 4 Radio Programming and Tuning

4.1 Introduction

This chapter provides an overview of the MOTOTRBO Customer Programming Software (CPS), as well as the Tuner and AirTracer applications, which are all designed for use in Windows XP/Vista/Windows 7 environment. These programs are available in one kit as listed in Table . An Installation Guide is also included with the kit.

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

Description	Kit Number
MOTOTRBO CPS, Tuner and AirTracer Applications CD	GMVN5141_

Table 4-1. Software Installation Kits Radio Tuning Setup

4.2 Customer Programming Software Setup

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

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

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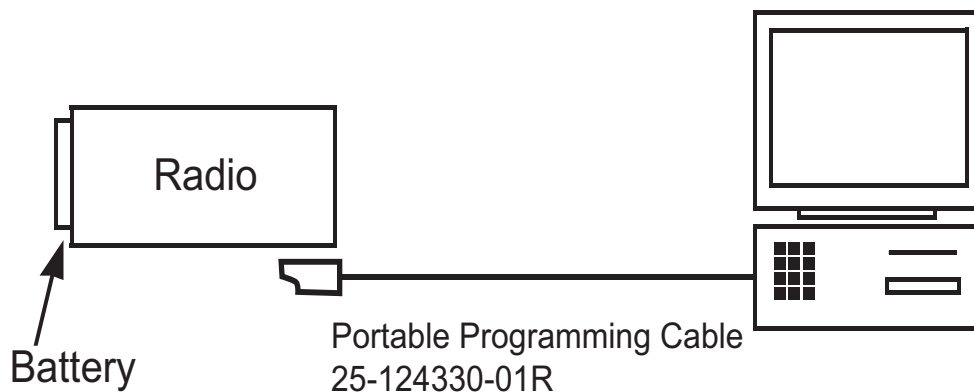

Figure 4-1. CPS Programming Setup

4.3   AirTracer Application Tool

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

4.4   Radio Tuning Setup

A personal computer (PC), Windows XP/Vista/Win7 and a tuner program are required to tune the radio. To perform the tuning procedures, the radio must be connected to the PC and test equipment setup as shown in Figure 4-2.
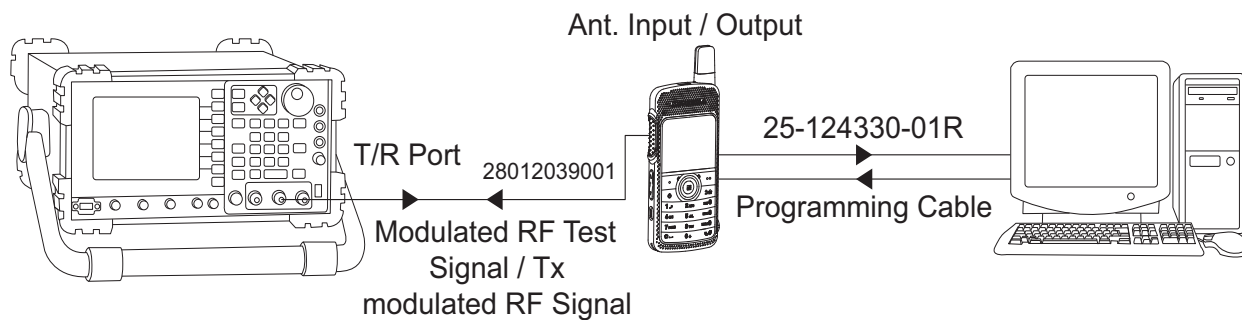

Figure 4-2. Radio Transmitter and Receiver Tuning Setup

Chapter 5   Disassembly/Reassembly Procedures

5.1   Introduction

This chapter provides details about the following:

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

> ⚠️
> **Caution**
>
> Only Motorola Service Centers or Authorized Motorola Service Dealers can perform this function.

5.2   Preventive Maintenance

Periodic visual inspection and cleaning is recommended.

5.2.1   Inspection

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

5.2.2   Cleaning Procedures

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

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

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

> ⚠️
> **Caution**
>
> Use all chemicals as prescribed by the manufacturer. Be sure to follow all safety precautions as defined on the label or material safety data sheet.
>
> The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners and other chemicals.

Cleaning External Plastic Surfaces

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

Cleaning Internal Circuit Boards and Components

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

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

5.3   Safe Handling of CMOS and LDMOS Devices

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

Handling precautions are mandatory for CMOS/LDMOS circuits and are especially important in low humidity conditions. DO NOT attempt to disassemble the radio without first referring to the CMOS CAUTION paragraph in the Disassembly and Reassembly section of the manual.

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

⚠

C a u t i o n

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

- Store and transport all CMOS/LDMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS/LDMOS devices into conventional plastic "snow" trays used for storage and transportation of other semiconductor devices.

- Ground the working surface of the service bench to protect the CMOS/LDMOS device. We recommend using the Motorola Static Protection Assembly (part number 0180386A82), which includes a wrist strap, two ground cords, a table mat, and a floor mat.

- Wear a conductive wrist strap in series with a 100k resistor to ground. (Replacement wrist straps that connect to the bench top covering are Motorola part number 4280385A59).

- Do not wear nylon clothing while handling CMOS/LDMOS devices.

- Do not insert or remove CMOS/LDMOS devices with power applied. Check all power supplies used for testing CMOS/LDMOS devices to be certain that there are no voltage transients present.

- When straightening CMOS/LDMOS pins, provide ground straps for the apparatus used.

- When soldering, use a grounded soldering iron.

- If at all possible, handle CMOS/LDMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

5.4   Repair Procedures and Techniques – General

> **NOTE** Environmentally Preferred Products (EPP) (refer to the marking on the printed circuit boards — examples shown below) were developed and assembled using environmentally preferred components and solder assembly techniques to comply with the European Union's **Restriction of Hazardous Substances (ROHS) Directive 2002/95/EC** and **Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC**. To maintain product compliance and reliability, use only the Motorola specified parts in this manual.
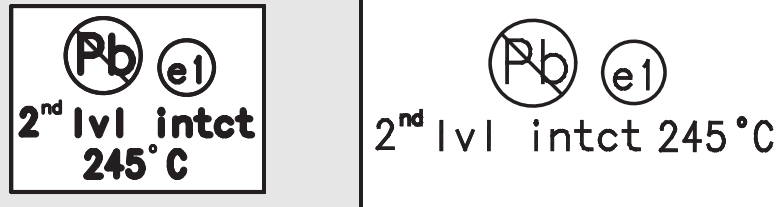
Any rework or repair on Environmentally Preferred Products must be done using the appropriate lead-free solder wire and lead-free solder paste as stated in the following table:

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

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

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

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

Parts Replacement and Substitution

When damaged parts are replaced, identical parts should be used. If the identical replacement part is not locally available, check the parts list for the proper Motorola part number and order the part

Rigid Circuit Boards

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

When soldering near a connector:

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

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

5.5   Disassembling and Reassembling the Radio – General

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

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

- 6IPTorx Plus^{TM}
- 4IPTorx Plus
- Torque wrench
- Tweezers

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

⚠️ **Caution**   To assure the safety and regulatory compliance of the SL4000, the radio must be repaired only at Motorola service facilities. Please call Motorola at 8004224210 for the address and contact information of your nearest service center.

5.6   Radio Disassembly – Detailed

5.6.1   External Antenna Disassembly

1. Turn off the radio.
2. Remove the antenna plug and the escutcheon cover from the back housing as shown in Figure 5-1.

> **NOTE** a. Remove the antenna plug with fingers.
>
> b. Remove the escutcheon cover with tweezers. Dispose the escutcheon cover once it has been removed.
>
> c. Use a cotton bud and IPA (Isopropyl alcohol) to remove the glue residue on the back cover.
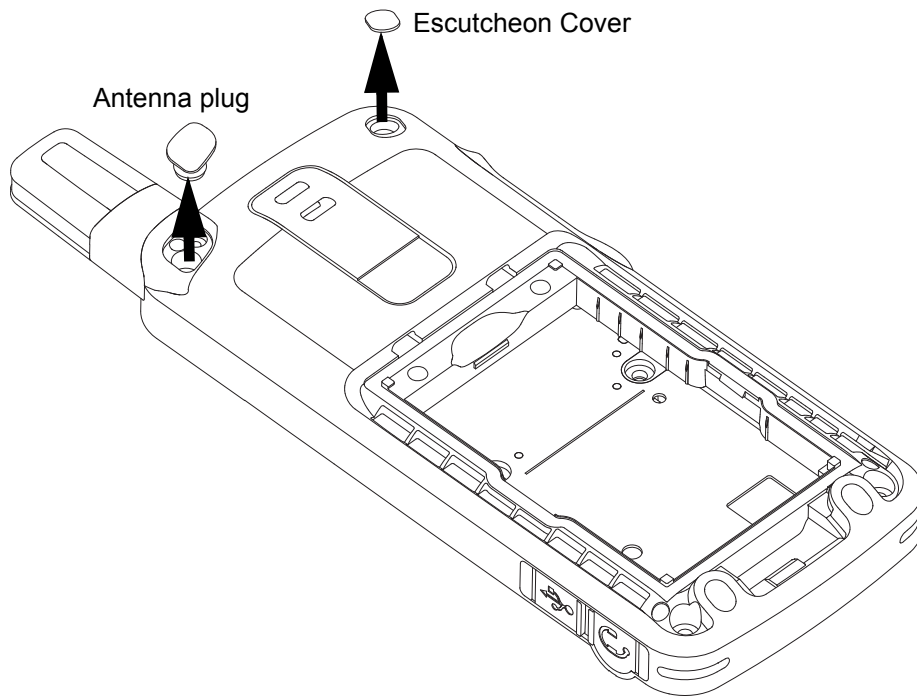
Figure 5-1. Antenna plug and escutcheon cover removal

3. Remove the antenna screw with the 4IP Torx Plus screwdriver as shown in Figure 5-2.
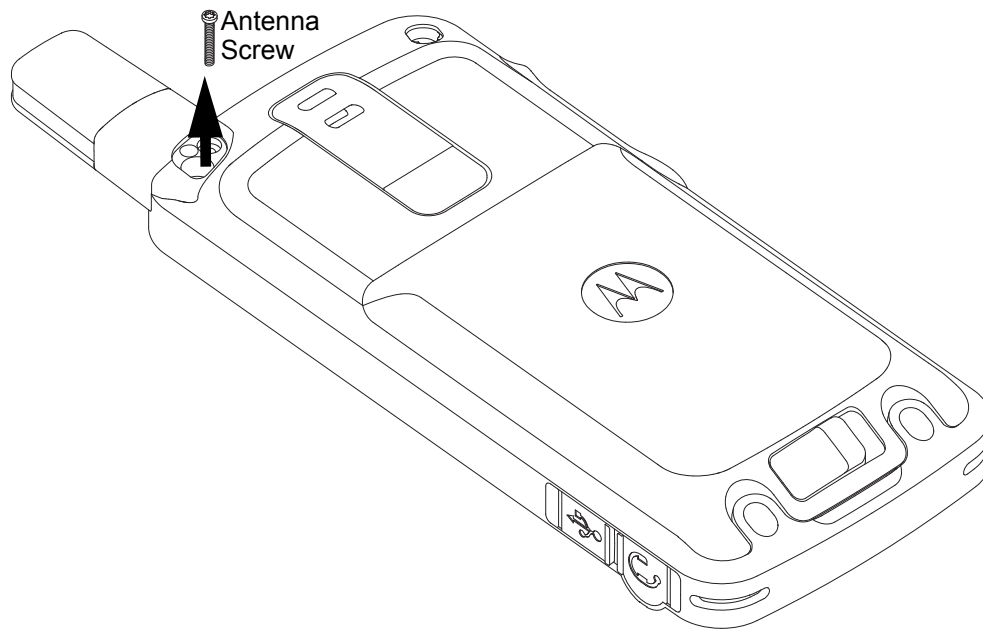
Figure 5-2. Antenna screw removal

4. Remove the antenna from the radio by pulling it upwards as shown in Figure 5-3.
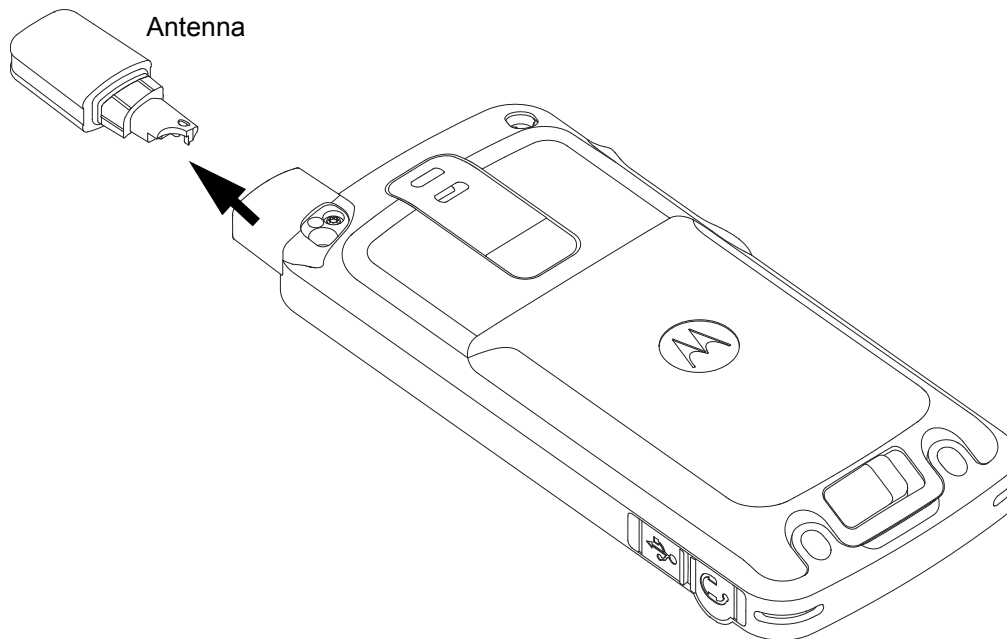
Figure 5-3. Antenna removal

5.6.2   **Back housing Disassembly**

1. Remove the battery door from the back housing by unlocking the latch as shown in Figure 5-4.
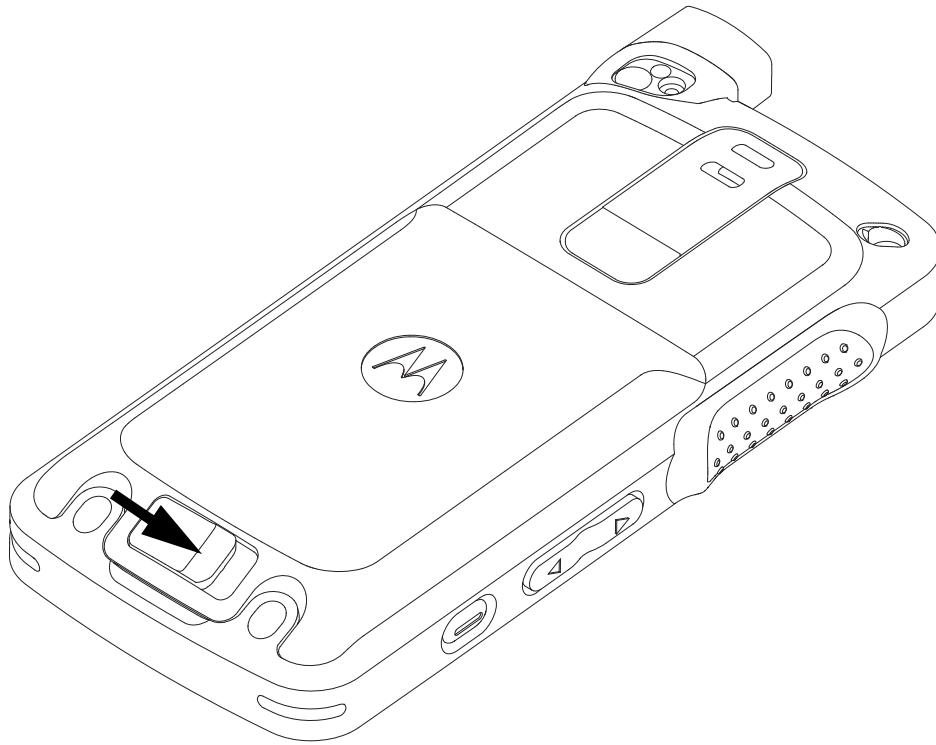
Figure 5-4. Unlatching battery door

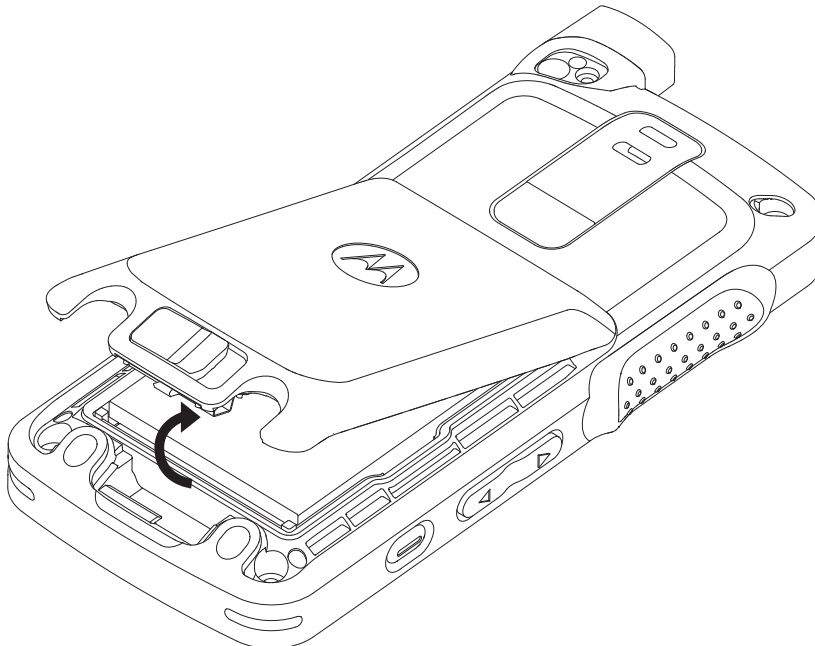2. Remove the battery door by lifting it upwards as shown in Figure 5-5.

Figure 5-5. Battery door removal

3. After removing the battery door, remove battery from battery compartment as shown
    in Figure 5-6. To remove battery, grasp the battery groove at the top of the battery and lift up the
    battery.

NOTE The battery cannot be removed bottom first.
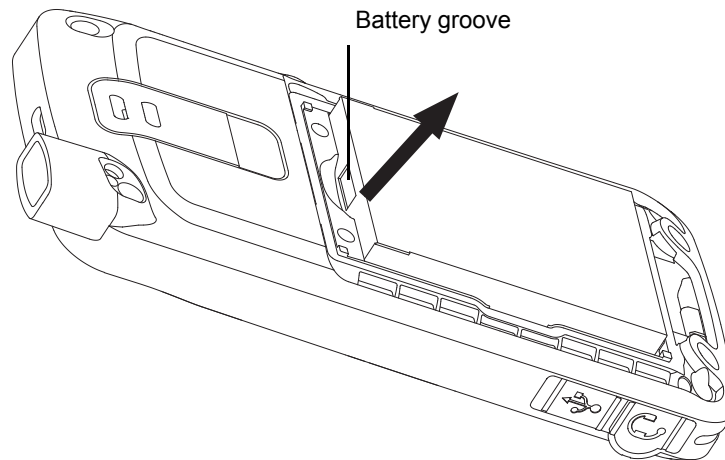
Figure 5-6. Battery removal

4. Remove the self tapping screws from four corners of the back housing marked (a, b, c, d) by
    using the 6IP Torx Plus as shown in Figure 5-7.

5. Remove the two machine screws in the battery compartment marked (e and f) by using the 6IP
    Torx Plus as shown in Figure 5-7.
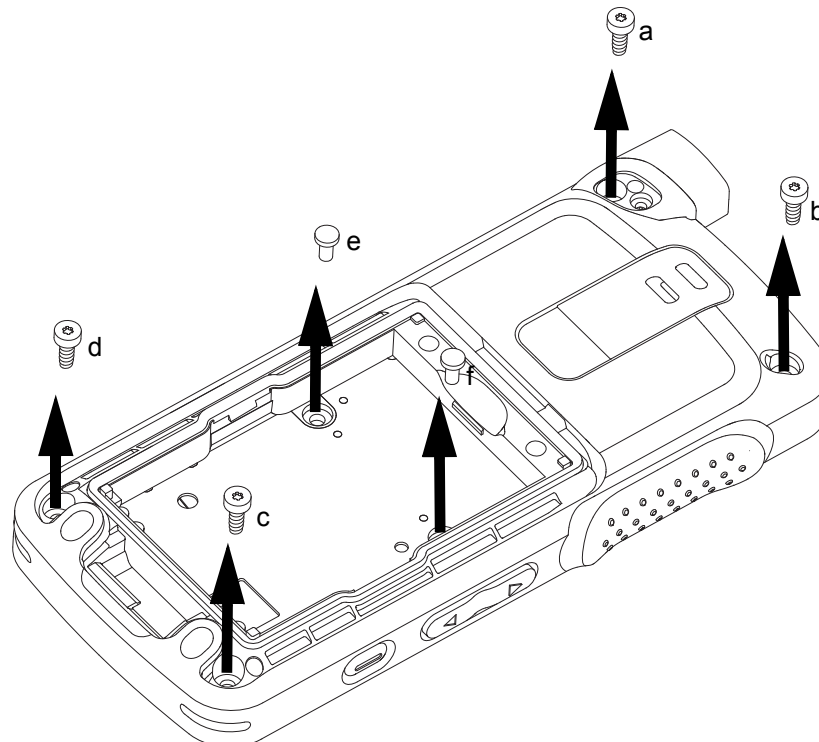
Figure 5-7. Self tapping screws and machining screws removal

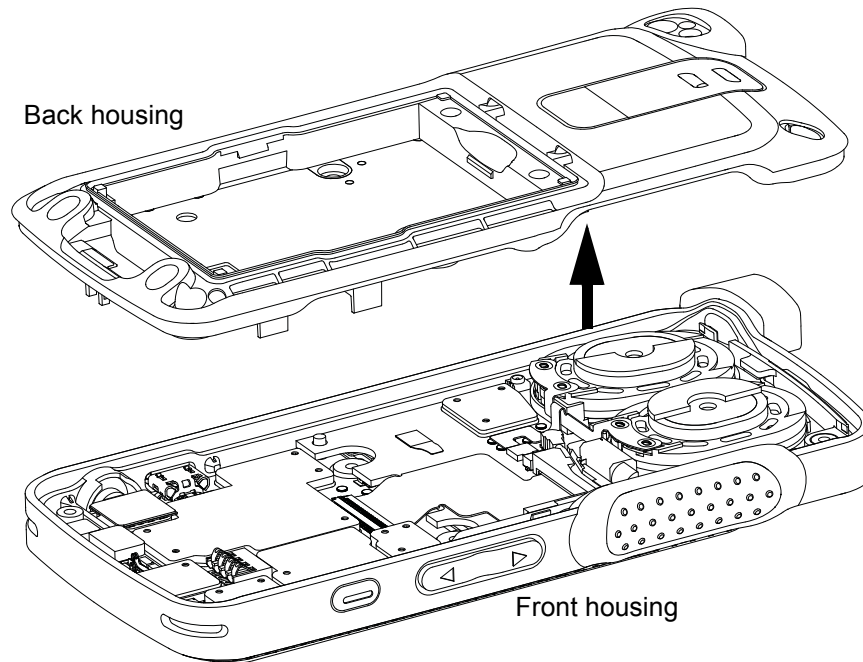6. Lift back housing from the front housing as shown in Figure 5-8.

Back housing

Front housing

Figure 5-8. Back housing removal

5.6.3   Internal Antenna Disassembly

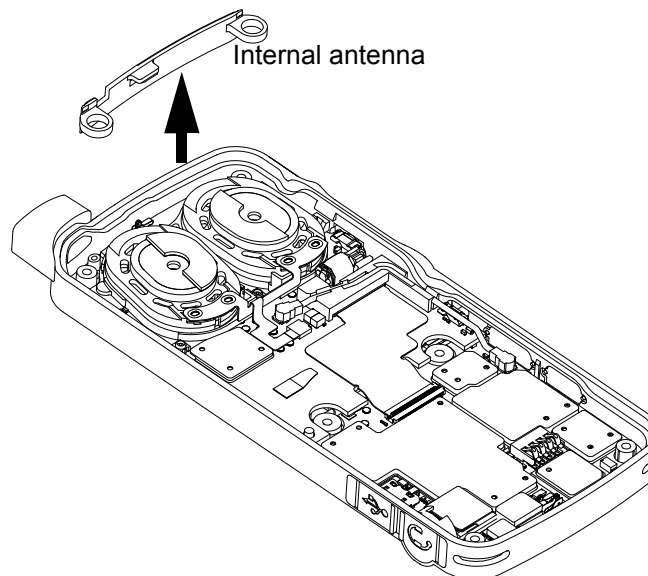1. Remove the internal antenna upwards by using tweezers as shown in Figure 5-9.

Internal antenna

Figure 5-9. Internal antenna removal

5.6.4   PCB Disassembly

1. Unplug the board flex cable and coax cable connector from the main board. To remove the board to board flex, unlatch the flex connector tab as shown in Figure 5-10.
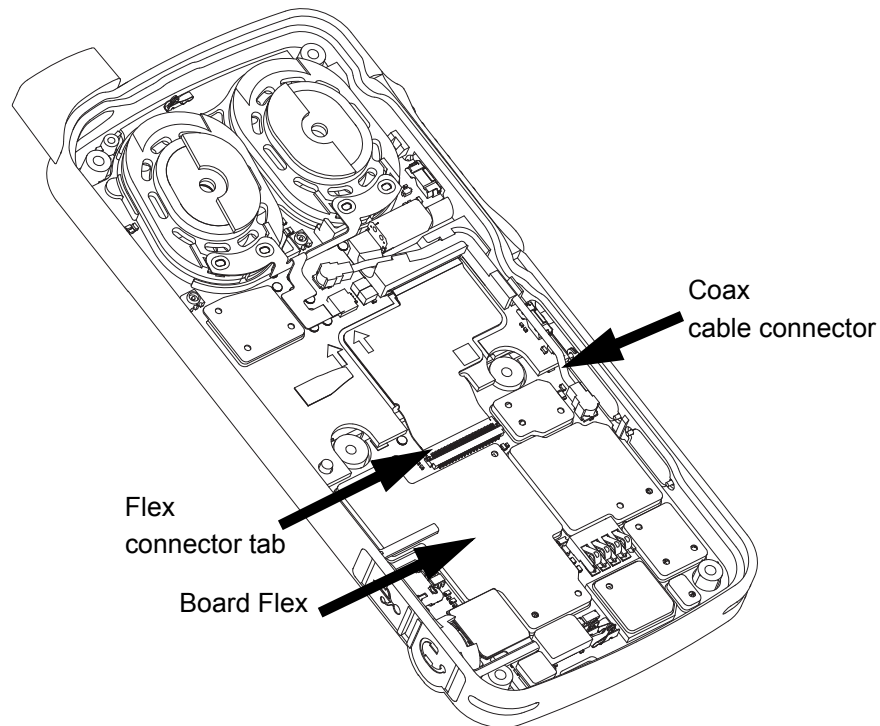
Coax
cable connector

Flex
connector tab

Board Flex

Figure 5-10.   Board flex and coax cable connector disassembly

2. Remove the interface board from the front housing by sliding it out from the PCB retainer catch as shown in Figure 5-11.
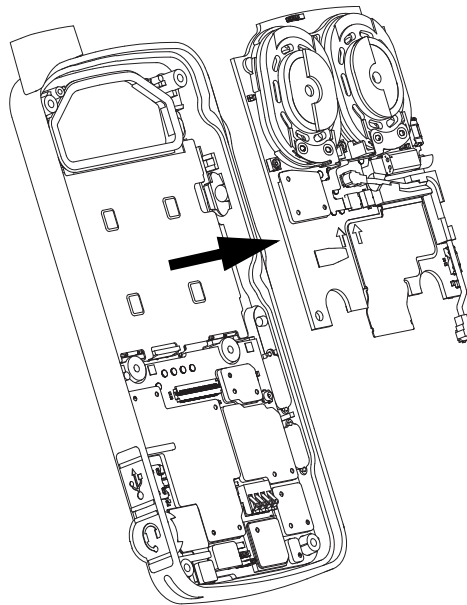
Figure 5-11.   Interface board removal

5.6.5   Audio Jack Disassembly

1. Unplug the keypad flex connector from the main board.
2. Unplug the audio jack flex connector from the main board.
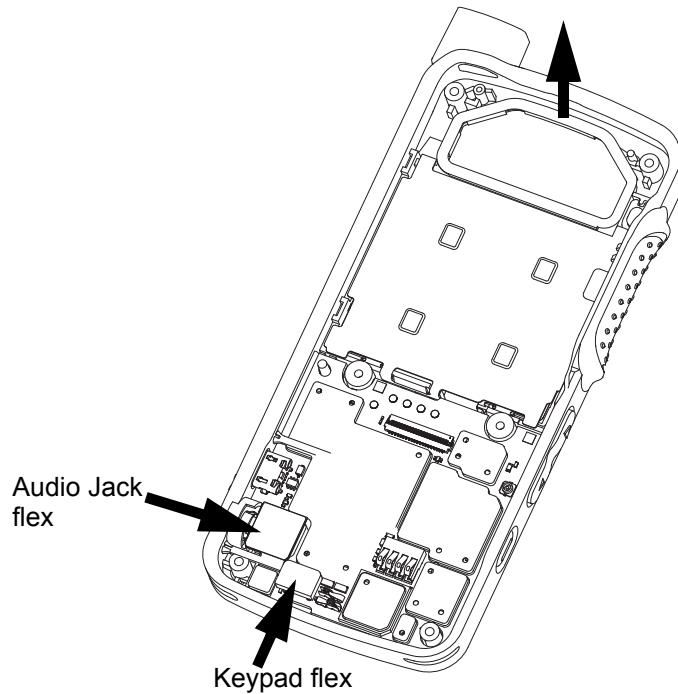3. Remove the audio seal as shown in Figure 5-12.

Audio Jack flex

Keypad flex

Figure 5-12. Audio jack flex and keypad flex disassembly

4. Lift and pull out the audio jack from its recess as shown in Figure 5-13.
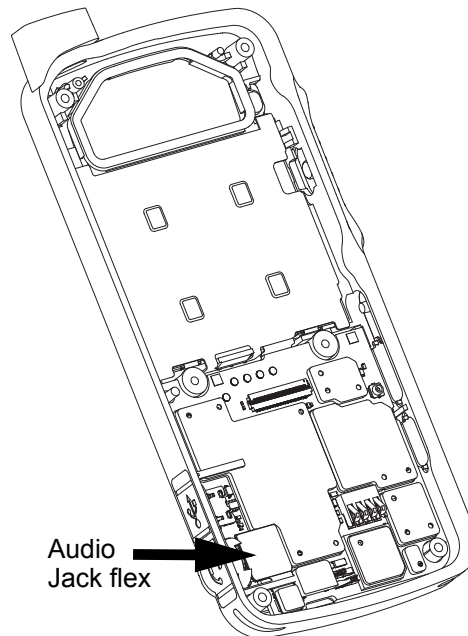
Audio Jack flex

Figure 5-13. Audio jack flex removal

5.6.6 LCD Display Disassembly

1. Lift the PCB slightly from the right corner using tweezers as shown in Figure 5-14.
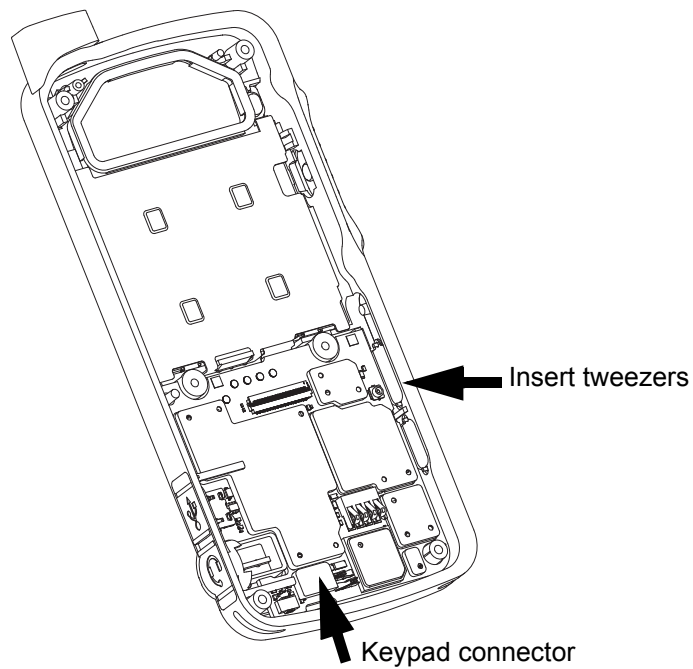
Insert tweezers

Keypad connector

Figure 5-14. LCD display disassembly

2. Remove the main PCB from the front housing by turning it slightly counter-clockwise to release the PCB retainer catch.
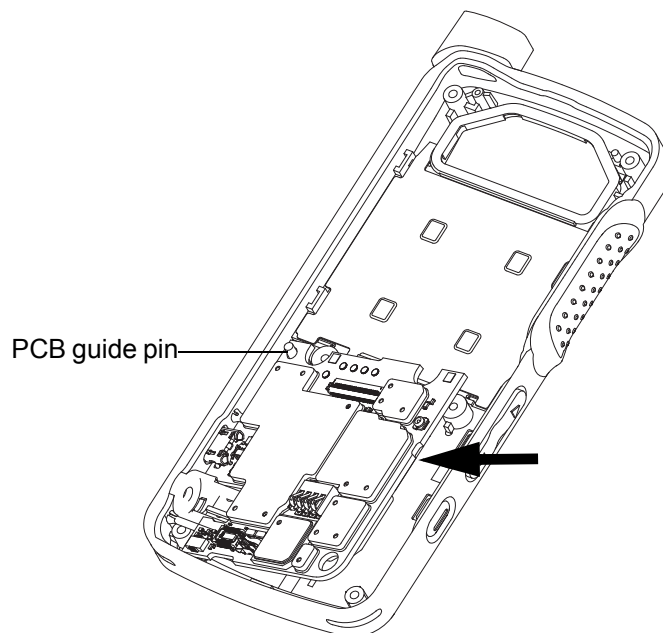3. Lift the PCB upwards and away from the PCB guide pin as shown in Figure 5-15.

PCB guide pin

Figure 5-15. Lifting of PCB board

4. Remove the main PCB from the front housing by unlatching its flex connector tab as shown in Figure 5-16.
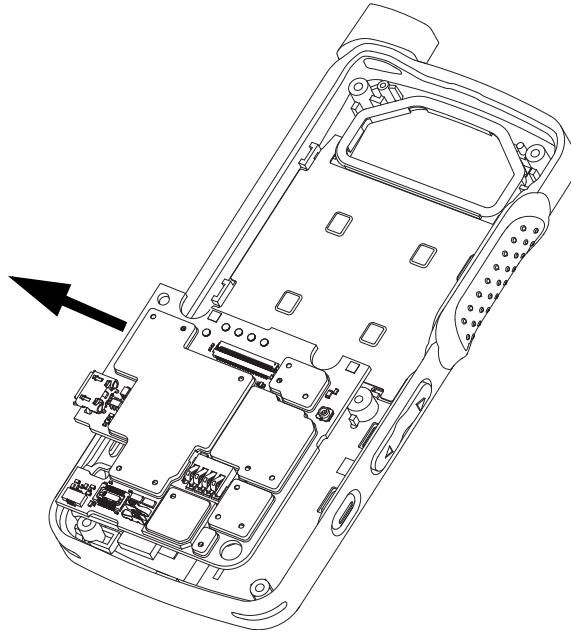

Figure 5-16. PCB board removal

5. Remove the speaker seal.
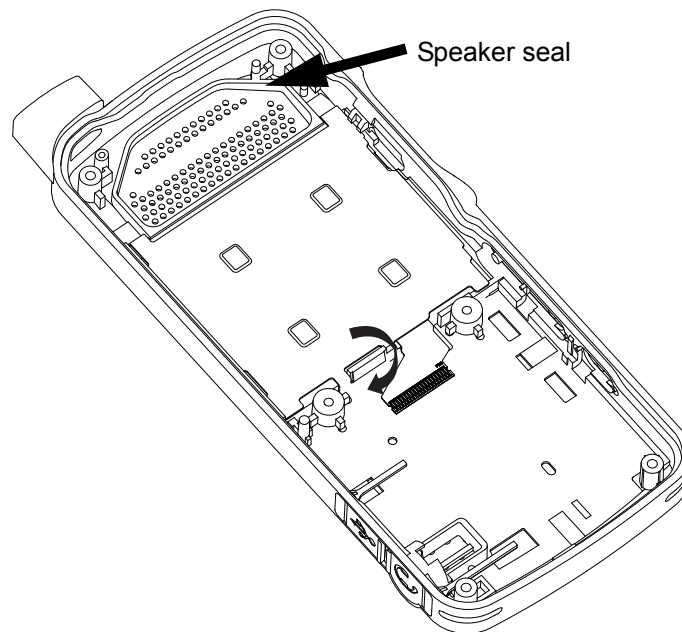6. Unlatch the display retainer lock as shown in Figure 5-17.

Figure 5-17. Display retainer lock removal

7. Remove the display retainer by sliding it upwards to clear the PCB retainer catch.

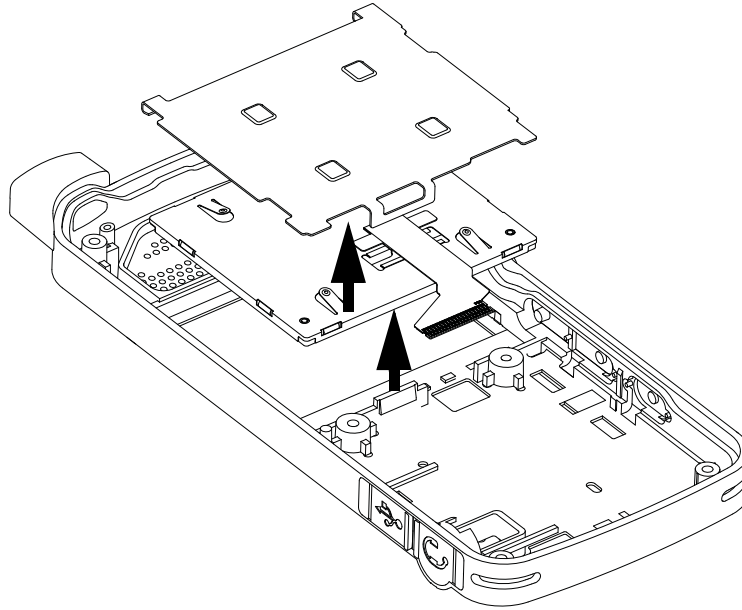8. Remove the LCD display as shown in Figure 5-18.

Figure 5-18. LCD display removal

5.7   Radio Reassembly – Detailed

5.7.1   LCD Display Reassembly

1. Insert the LCD display.

2. Insert the display retainer slightly higher than the display module and slide it to fit below the PCB retainer catch as shown in Figure 5-19.

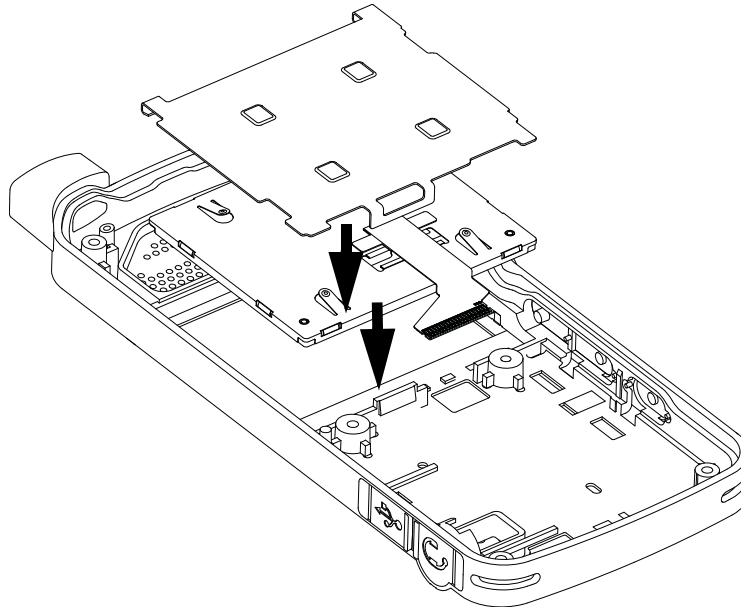
Figure 5-19. LCD display reassembly

3. Press down on the display retainer lock to secure the display retainer.

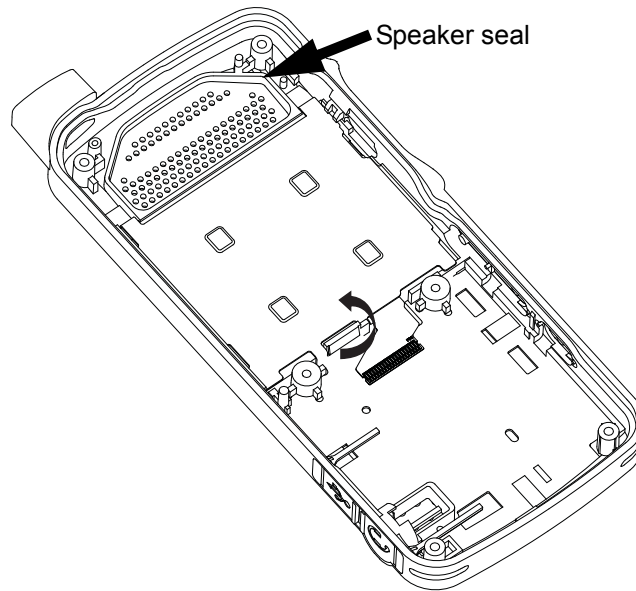4. Insert the speaker seal as shown in Figure 5-20.

Figure 5-20. Display retainer lock reassembly

5. Attach the main PCB flex to the main PCB and secure it in place by latching the flex connector tab as shown in Figure 5-21.
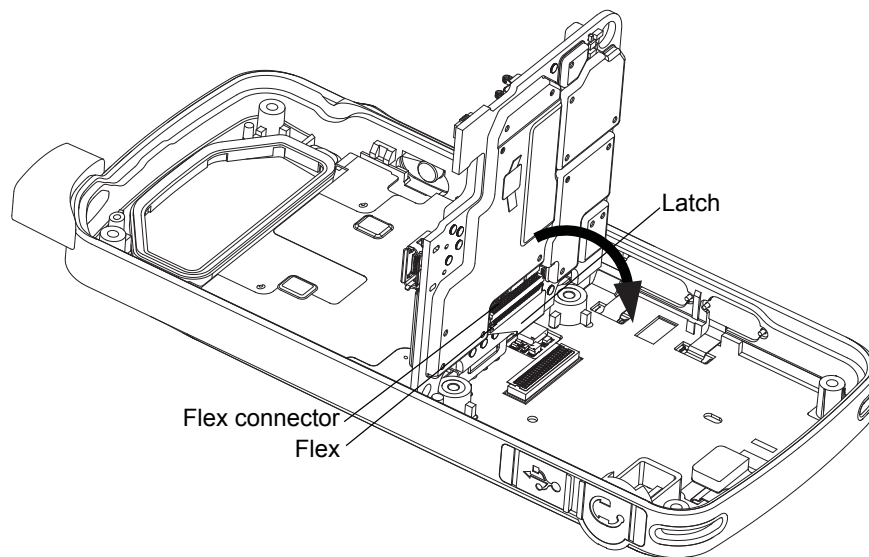
Figure 5-21. Flex connector tab reassembly

6. Place the main PCB onto the PCB guide pin and pivot the PCB into the front housing by turning it clockwise slightly so that it slots under the PCB retainer catch as shown in Figure 5-22.
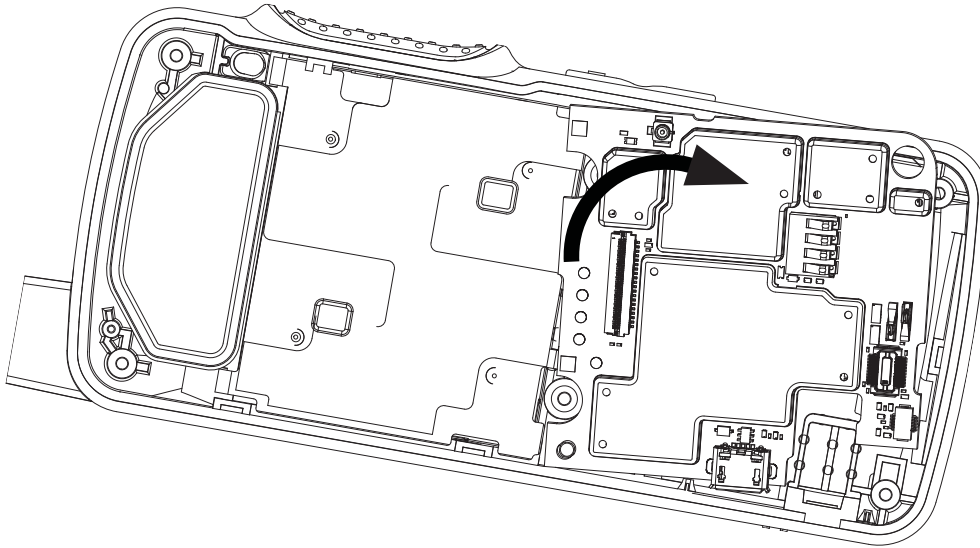
Figure 5-22. PCB board reassembly

5.7.2   Audio Jack Reassembly

1. Place the audio jack into its recess on the front housing as shown in Figure 5-23.
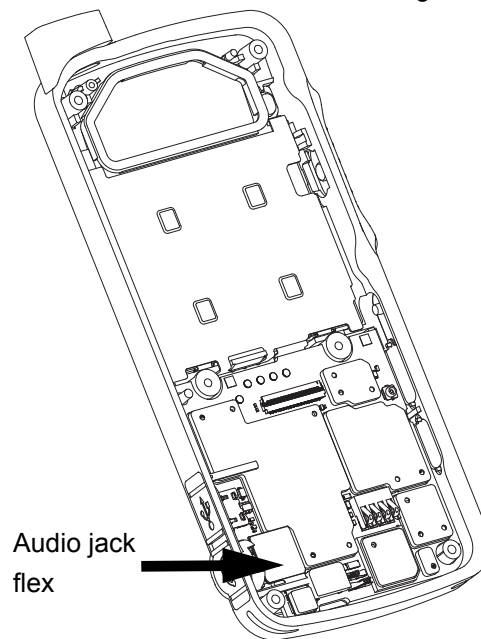
Audio jack flex

Figure 5-23. Audio jack connector reassembly

2. Attach the audio jack flex connector and keypad flex connector to the main board as shown in Figure 5-24.

Audio jack flex
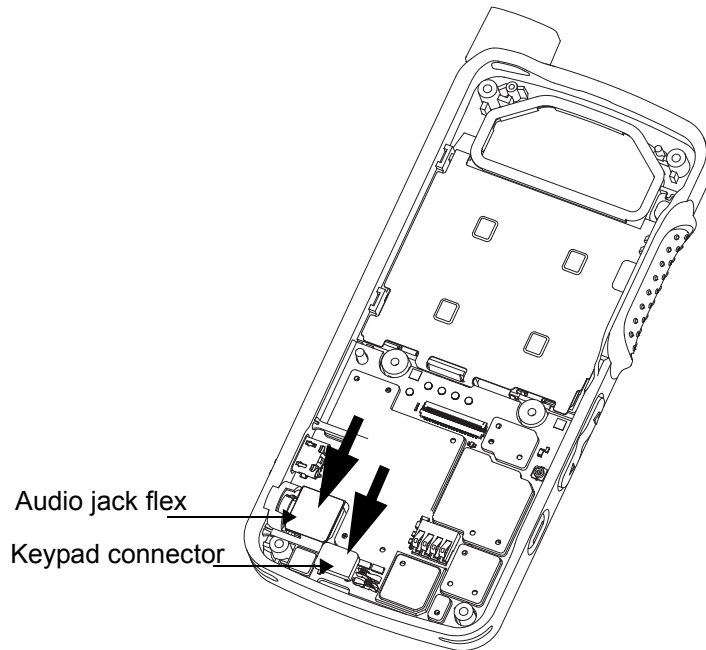
Keypad connector

Figure 5-24. Audio jack flex connector and keypad connector reassembly

5.7.3   PCB Reassembly

1. Insert the interface board into the front housing by sliding it under the PCB retainer catch as shown in Figure 5-25

Front
Housing
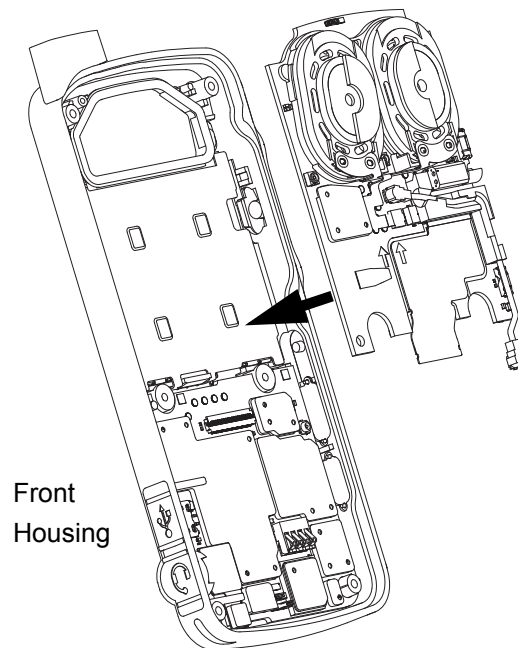
Figure 5-25. Interface board reassembly

2. Attach the board flex cable to the main board connector and secure it by latching the flex connector tab.

3. Plug in the coax cable connector to the main board as shown in Figure 5-26.

Coax cable connector

Flex connector tab
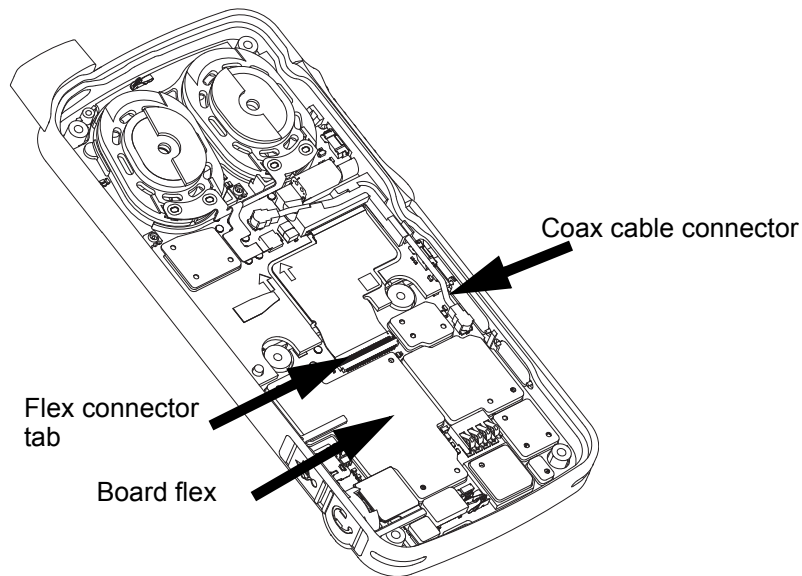
Board flex

Figure 5-26. Board flex reassembly

5.7.4   Internal Antenna Reassembly

1. Insert the internal antenna by using tweezers as shown in Figure 5-27.
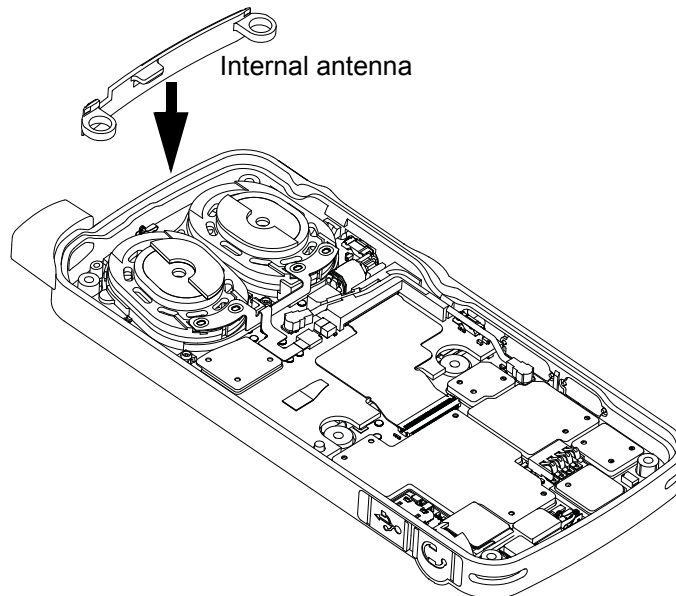
Internal antenna

Figure 5-27. Internal antenna reassembly

5.7.5 Back Housing Reassembly

1. Place the back housing onto the front housing as shown in Figure 5-28.

Back housing

Front housing
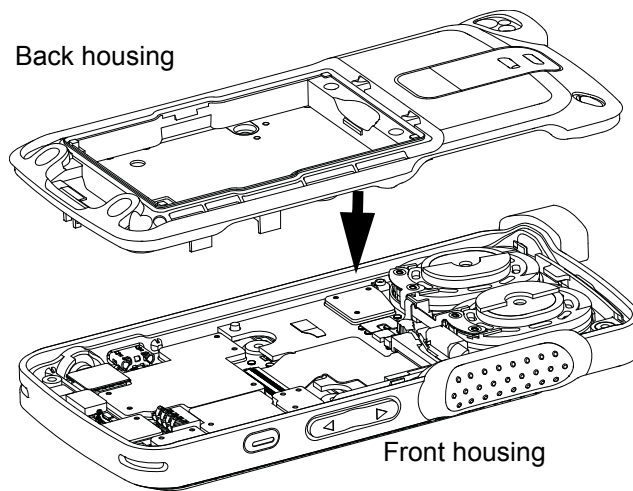
Figure 5-28. Back housing reassembly

2. Using a torque wrench, screw in the self tapping screws at all four corners from back housing marked (a, b, c, d) by using the 6IP Torx Plus as shown in Figure 5-29.

3. Using a torque wrench, screw in the two machine screws in the battery compartment of the back housing marked (e and f) by using the 6IP Torx Plus as shown in Figure 5-29.

> **! Caution**   Do not over torque these screws. Please refer to the torque chart on Table 5-5.
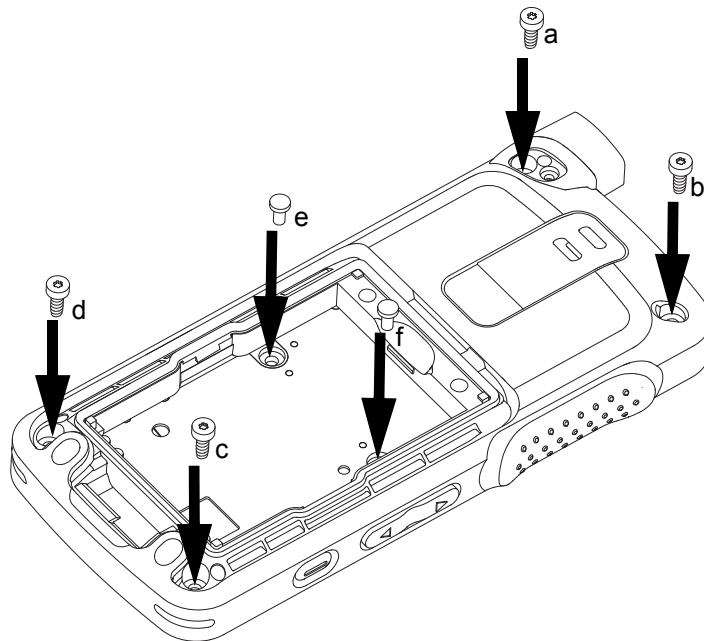
Figure 5-29. Self tapping screws and machining screws reassembly

4. Insert the battery into the battery compartment on the back housing as shown in Figure 5-30.
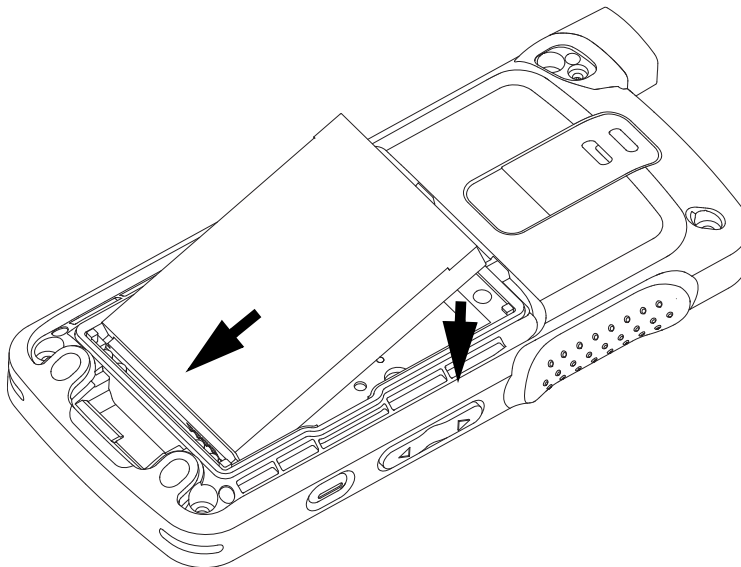
Figure 5-30. Battery reassembly

5. Insert the battery door as shown in Figure 5-31.
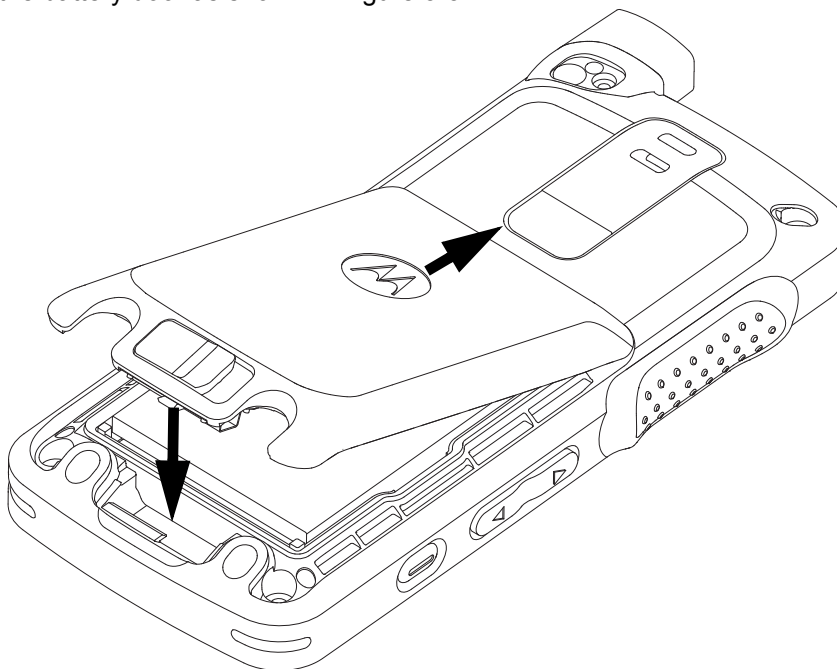
Figure 5-31. Battery door reassembly

6. Fasten the battery door latch as shown in Figure 5-32.
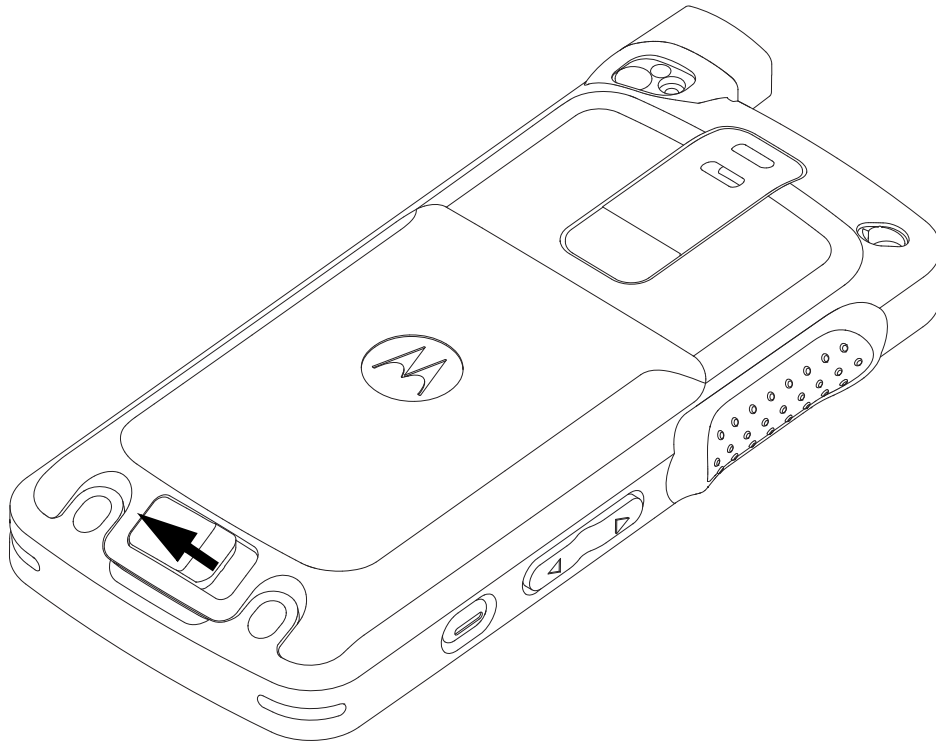
Figure 5-32. Latching battery door

7. Attach the antenna to the radio as shown in Figure 5-33.
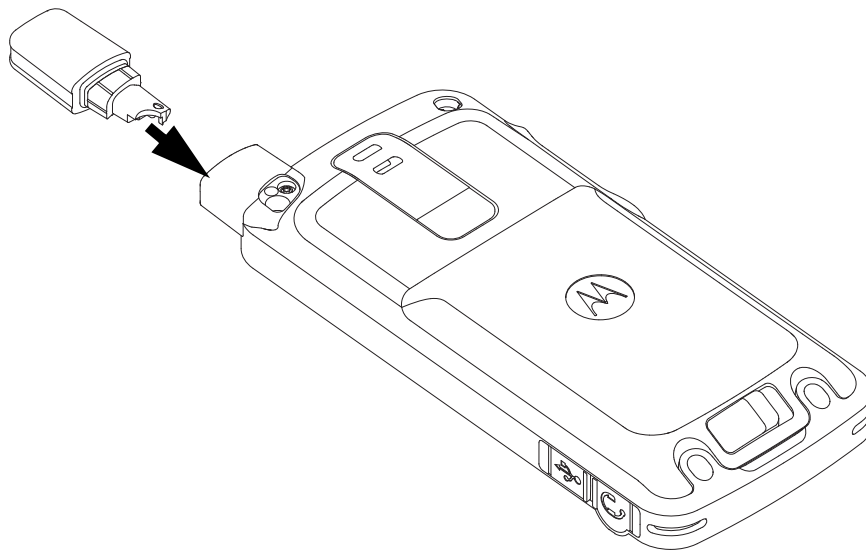
Figure 5-33. Antenna reassembly

8. Using a torque wrench, screw in the antenna screw with the 4IP Torx Plus screwdriver as shown in Figure 5-34.

NOTE a. The antenna <u>must</u> be fully inserted before screwing in the antenna screw.

b. Ensure that there is no gap between the antenna and the housing.

> ⚠️ **Caution**
>
> Tighten the antenna screw with tightening torque as below
>
> → 0.8lbf. in. or
>
> → 0.9 N-m or
>
> → 0.92 kgf-cm
>
> <u>DO NOT</u> over tighten the antenna screw.
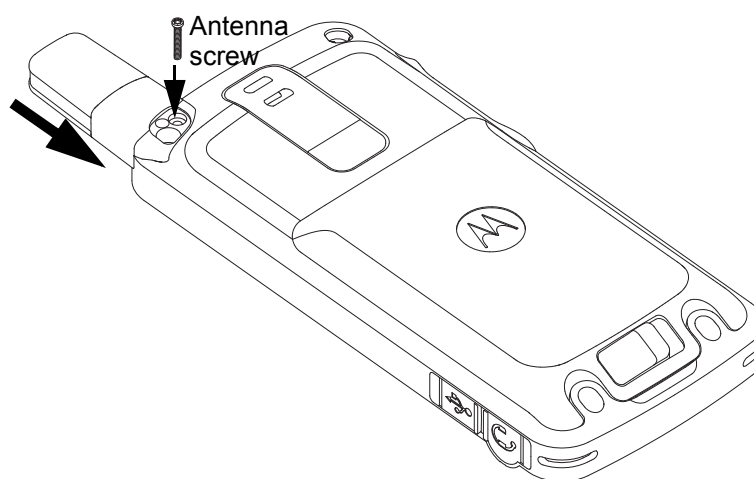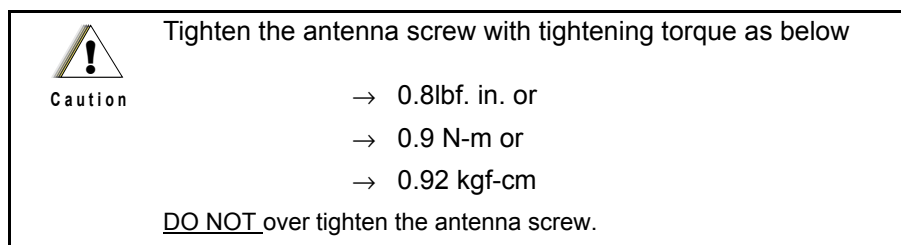
Figure 5-34. Antenna screw reassembly

9. Insert the antenna plug and a <u>new</u> escutcheon cover to the back housing as shown in Figure 5-35.

10. Turn the radio on.
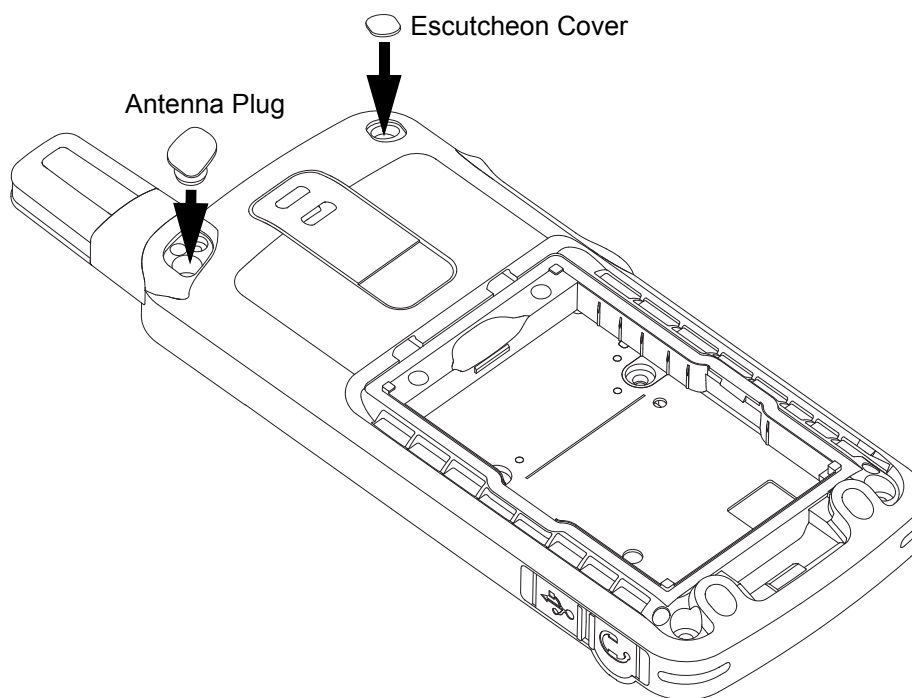
Figure 5-35. Antenna plug and screw plug reassembly

5.8   Radio Exploded Mechanical Views and Parts Lists

5.8.1   Non-GOB Model Exploded View and Parts List
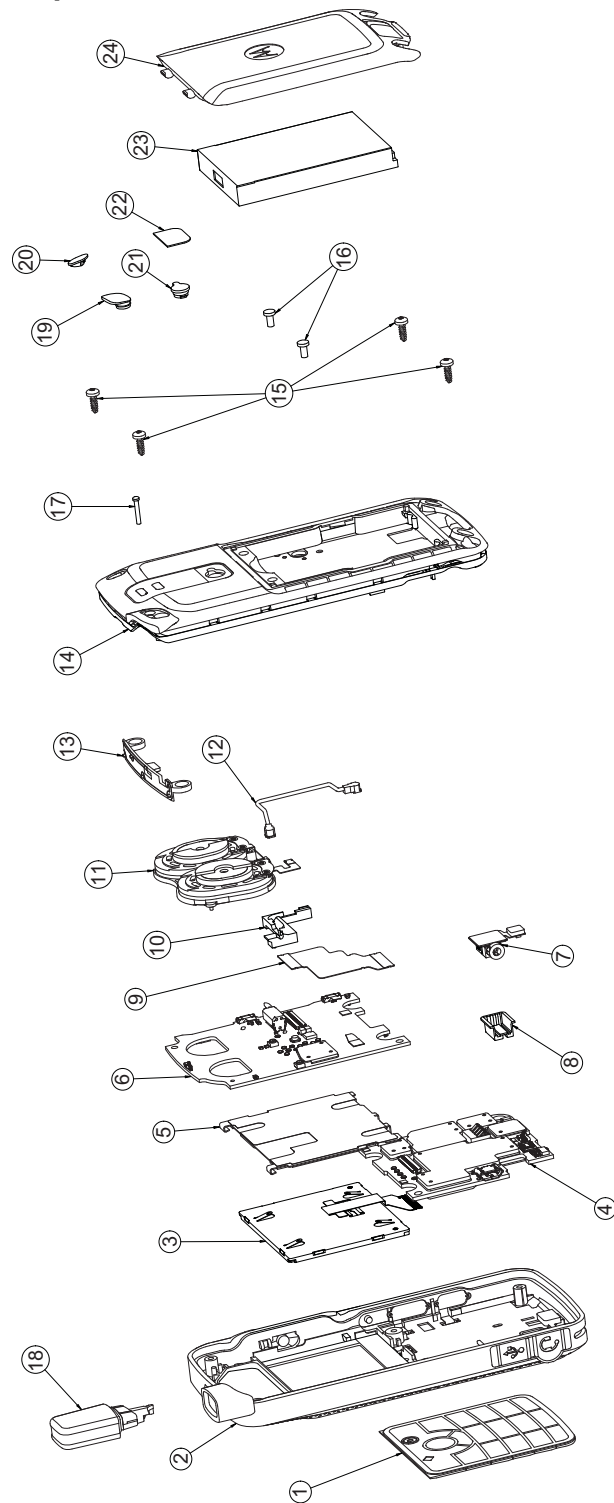
Figure 5-36. SL4000 Non-GOB Model Exploded View

Item	Description	Part Number
1	Keypad Flex Assembly	0104043J44
2	Front Housing Assembly	PMLN5969_
3	LCD Module	72013002001
4	Main Board	PMLE4825_
5	Display Bracket Assembly	0104044J48
6	Interface Board	PMLN5971_
7	Audio jack Flex Assembly	0104043J45
8	Audio jack Boot	32012157001
9	Board to Board Flex	84012346001
10	Coax Cable Holder	07012034001
11	Speaker Module	0104042J77
12	Coax Cable Connector	42012051001
13	Internal Antenna	85012037001
14	Back housing Assembly	PMLN5968_
15	Top and Bottom Screws	03012043001
16	Middle Screws	0386104Z06
17	Antenna Screw	03012044001
18	Stubby Antenna	Please refer to Section 1.4 "Model Charts" for antenna options.
19	Antenna Plug	38012025001
20	Escutcheon Cover	33012045001
21	RF Plug	28012032001
22	Product Label Escutcheon	33012043001
23	Battery Standard (BT70)	PMNN4425_
24	Battery Door Standard	PMLN6000_

Table 5-3. Non-GOB Model Exploded View

5.8.2   Exploded View and Parts List
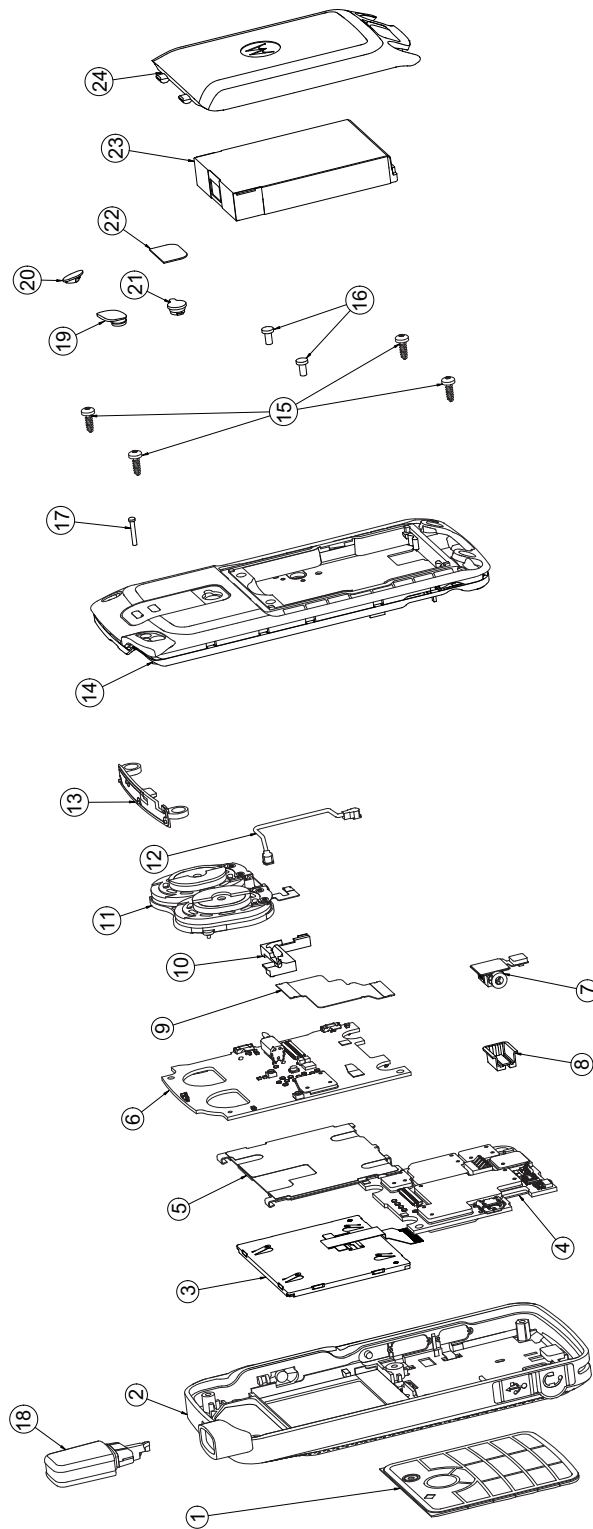
Figure 5-37. SL4010 GOB Model Exploded View

Item	Description	Part Number
1	Keypad Flex Assembly	0104043J44
2	Front Housing Assembly	PMLN5969_
3	LCD Module	72013002001
4	Main Board	PMLE4812_
5	Display Bracket Assembly	0104044J48
6	Interface Board	PMLN5971_
7	Audio Jack Flex Assembly	0104043J45
8	Audio Jack Boot	32012157001
9	Board to Board Flex	84012346001
10	Coax Cable Holder	07012034001
11	Speaker Module	0104042J77
12	Coax Cable Connector	42012051001
13	Internal Antenna	85012037001
14	Back housing Assembly	PMLN5968_
15	Top and Bottom Screws	03012043001
16	Middle Screws	0386104Z06
17	Antenna Screw	03012044001
18	Stubby Antenna	Please refer to Section 1.4 "Model Charts" for antenna options
19	Antenna Plug	38012025001
20	Escutcheon Cover	33012045001
21	RF Plug	28012032001
22	Product Label Escutcheon	33012043001
23	Battery HI-CAP (BT90)	HKNN4013_
24	Battery Door HI-CAP	PMLN6001_

Table 5-4. GOB Model Exploded View Parts List

5.9   Torque Chart

Table 5-5 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.

⚠ **Caution**	A proper torque screwdriver must be used during installation to ensure that these torque values are not exceeded.
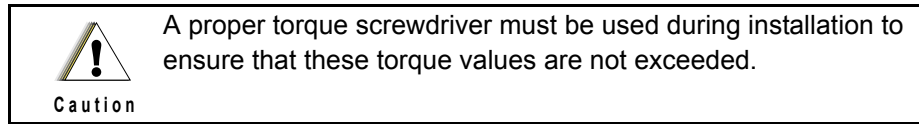
Table 5-5. Torque Specifications for Screws

Part Number	Description	Qty	Driver/ Socket	Torque		
				N-m	**lbs-in**	**kgf-cm**
03012044001	Screw Antenna	1	4IP Torx Plus	0.09	0.80	0.92
0386104Z06	Screw Torx Plus 6IP Machine	2	6IP Torx Plus	0.20	1.80	2.07
03012043001	Screw Torx T-6, M2 self-tapping	4	6IP Torx Plus	0.20	1.80	2.07

Chapter 6   Basic Troubleshooting

6.1   Introduction

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

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

6.2   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. These error codes are intended to be used by a service technician when the radio generates the Self Test Fail Tone. If these tests are successfully completed, the radio will generate the Self Test Tone.

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

6.3   Operational Error Codes

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

Table 6-1. Operational Error Codes

Error Code	Description	Error Type	Corrective Action
FAIL 001	Synthesizer Out-of-Lock.	Non-Fatal	1. Reprogram the codeplug. 2. Refer to Detailed Service Manual. (68012005024)
FAIL 002	Personality checksum or system block error.	Non-Fatal	Reprogram the codeplug.

Appendix A   EMEA Regional Warranty, Service and Technical Support

A.1   Warranty and Service Support

Motorola offers long term support for its products. This support includes full exchange and/or repair of the product during the warranty period, and service/ repair or spare parts support out of warranty. Any "return for exchange" or "return for repair" by an authorized Motorola Dealer must be accompanied by a Warranty Claim Form. Warranty Claim Forms are obtained by contacting an Authorized Motorola Dealer.

A.1.1   Warranty Period and Return Instructions

The terms and conditions of warranty are defined fully in the Motorola Dealer or Distributor or Reseller contract. These conditions may change from time to time and the following notes are for guidance purposes only.

In instances where the product is covered under a "return for replacement" or "return for repair" warranty, a check of the product should be performed prior to shipping the unit back to Motorola. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

Prior to shipping any radio back to the appropriate Motorola warranty depot, please contact Customer Resources (Please see page A-3). All returns must be accompanied by a Warranty Claim Form, available from your Customer Services representative. Products should be shipped back in the original packaging, or correctly packaged to ensure no damage occurs in transit.

A.1.2   After Warranty Period

After the Warranty period, Motorola continues to support its products in two ways.

1. Motorola's Managed Technical Services (MTS) offers a repair service to both end users and dealers at competitive prices.

2. MTS supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.

A.2   European Radio Support Centre (ERSC)

The ERSC Customer Information Desk is available through the following service numbers:

Austria:	08 00 29 75 41	Italy:	80 08 77 387
Belgium:	08 00 72 471	Luxemburg:	08 00 23 27
Denmark:	80 88 58 80	Netherlands:	08 00 22 45 13
Finland:	08 00 11 49 910	Norway:	80 01 11 15
France:	08 00 90 30 90	Portugal:	08 00 84 95 70
Germany:	08 00 18 75 240	Spain:	90 09 84 902
Greece:	00 80 04 91 29 020	Sweden:	02 07 94 307
UK:	08 00 96 90 95	Switzerland:	08 00 55 30 82
Ireland:	18 00 55 50 21	Iceland:	80 08 147

Or dial the European Repair and Service Centre:
Telephone: +49 30 6686 1555
Fax ERSC: +49 30 6686 1579
Email ERSC: ERSC@motorolasolutions.com

Please use these numbers for repair enquiries only.

A.3   Piece Parts

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

Orders for replacement parts, kits and assemblies should be placed directly on Motorola's local distribution/dealer organization or via Motorola Online at: http://www.motorola.com/emeaonline

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

A.4 Technical Support

Motorola Product Services is available to assist the dealers/distributors in resolving any malfunctions which may be encountered.

Russia and Armenia – Andrey Nagornykh
Telephone: +7 495 787 8910
Fax: +7 495 785 0185
Email: mwcb47@motorolasolutions.com

Central and East Europe – Siggy Punzenberger
Telephone: +49 (0) 6128 70 2342
Fax: +49 (0) 6128 95 1096
Email: TFG003@motorolasolutions.com

Middle East and Africa – Wayne Holmes
Telephone: +49 (0) 6126 957 6237
Fax: +49 (0) 6126 957 6826
Email: wayne.holmes@motorolasolutions.com

Germany – Customer Connect Team
Telephone: +49 (0) 30 6686 1539
Fax: +49 (0) 30 6686 1916
Email: ESSC@motorolasolutions.com

France – Armand Roy
Telephone: +33 1 6935 7868
Fax: +33 1 6935 7808
Email: armand.roy@motorolasolutions.com

Italy – Ugo Gentile
Telephone: +39 02 5220 7825
Fax: +39 02 5220 7810
Email: Ugo.Gentile@motorolasolutions.com

France – Laurent Irrmann
Telephone: +33 1 6935 7866
Fax: +33 1 6935 7808
Email: laurent.irrmann@motorolasolutions.com

A.5 Further Assistance From Motorola

You can also contact the Customer Help Desk through the following web address.
http://www.motorolasolutions.com/governmentandenterprise

Notes

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.

Term	Definition
Band	Frequencies allowed for a specific purpose.
CPS	Customer Programming Software: 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.
FCC	Federal Communications Commission.
Frequency	Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second).
kHz	kilohertz: One thousand cycles per second. Used especially as a radio-frequency unit.
LCD	Liquid-Crystal Display: An LCD uses two sheets of polarizing material with a liquid-crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them.
LED	Light Emitting Diode: An electronic device that lights up when electricity is passed through it.
MHz	Megahertz: One million cycles per second. Used especially as a radio-frequency unit.
PC Board	Printed Circuit Board. Also referred to as a PCB.
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.
RF	Radio Frequency: The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz).
RX	Receive.
Signal	An electrically transmitted electromagnetic wave.

Term	Definition
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.
Transceiver	Transmitter-receiver. A device that both transmits and receives digital signals. Also abbreviated as XCVR.
Transmitter	Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space.
TX	Transmit.
UHF	Ultra-High Frequency.
USB	Universal Serial Bus: An external bus standard that supports data transfer rates of 12 Mbps.

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