

MOTOTRBO[™] PROFESSIONAL DIGITAL TWO-WAY RADIO

MOTOTRBO[™] PORTABLE SL1M BASIC SERVICE MANUAL

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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.



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

Disclaimer

The information in this document is carefully examined, and is believed to be entirely reliable. However, no responsibility is assumed for inaccuracies. Furthermore, Motorola Solutions reserves the right to make changes to any products herein to improve readability, function, or design. Motorola Solutions does not assume any liability arising out of the applications or use of any product or circuit described herein; nor does it cover any license under its patent rights nor the rights of others.

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.



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

Document History

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

Edition	Description	Date
MN000916A01-AA	Initial Release	September 2014
MN000916A01-AB	Compliance with the new Motorola Solutions design standard.	September 2018
	Updated Battery Eliminator part number in Chapters such as Service Aids, Customer Programming Software Setup, and Radio Tuning Setup.	
	Updated part numbers of PTT Paddle, Dust Cover, Audio Jack, and micro USB in explo- ded view parts list.	
	Added item 2.9 PC Ring in exploded view and parts list.	
	Added VHF antennas, PMAD4154_, PMAD4155_ and PMAD4156_ to VHF model chart and Accessories list.	
MN000916A01-AC	Updated RF Antenna Adaptor part number to TL000068A01 in Service Aids and Customer Programming Software sections.	January 2020
	Updated RF Antenna Adaptor Holder part number to HW000406A02 in Service Aids and Customer Programming Software sections.	
MN000916A01-AD	Updated UHF Model Chart and VHF Model Chart.	October 2020
MN000916A01-AE	Updated Dust Cover, Audio Jack, and USB part number in Exploded View Parts List top- ic.	February 2023
MN000916A01-AF	Updated FCC and IC description.	March 2024

Related Publications

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

- 6804110J47, Product Safety and RF Energy Exposure Booklet for Portable Two-Way Radios
- 6866552D01, Product Safety Booklet for Battery Chargers
- 68009553001, MOTOTRBO™ SL Series Digital Portable Radios Quick Reference Guide
- MN000892A01, MOTOTRBO™ SL Series SL1M Display Portable Radios User Guide
- MN000899A01, MOTOTRBO™ SL1M Portable Radio Quick Reference Guide
- MN000898A01, MOTOTRBO™ SL1M CMM Leaflet

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European Union (EU) and United Kingdom (UK) Waste of Electrical and Electronic Equipment (WEEE) Directive



The European Union's WEEE directive and the UK's WEEE regulation require that products sold into EU countries and the UK must have the crossed-out wheelie bin label on the product (or the package in some cases). As defined by the WEEE directive, this crossed-out wheelie bin label means that customers and end users in EU and UK countries should not dispose of electronic and electrical equipment or accessories in household waste.

Customers or end users in EU and UK countries should contact their local equipment supplier representative or service center for information about the waste collection system in their country.

Disclaimer

Please note that certain features, facilities, and capabilities described in this document may not be applicable to or licensed for use on a specific system, or may be dependent upon the characteristics of a specific mobile subscriber unit or configuration of certain parameters. Please refer to your Motorola Solutions contact for further information.

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Legal and Compliance Statements

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.

Warranty and Service Support

Motorola Solutions 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.

Warranty Period and Return Instructions

The terms and conditions of warranty are defined fully in the Motorola Solutions Dealer, 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 Solutions. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

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

Prior to shipping any radio back to the appropriate Motorola Solutions warranty depot, please contact Customer Resources or your Motorola Solutions dealer, distributor, or reseller. All returns must be accompanied by a Warranty Claim Form, available from your Customer Service representative or Motorola Online (MOL) or your Motorola Solutions dealer, distributor, or reseller. Products should be shipped back in the original packaging, or correctly packaged to ensure no damage occurs in transit.

After Warranty Period

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

- Motorola Solutions Managed Technical Services (MTS) offers a repair service to both end users and dealers at competitive prices.
- MTS supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.

Battery and Charger Warranty

Workmanship Warranty

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

Lithium-Ion 2300 mAh Battery	12 Months
Chargers	

Capacity Warranty

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

Lithium-Ion 2300 mAh Battery	12 Months
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Replacement Parts Ordering

Some replacement parts, spare parts, and/or product information can be ordered directly from the Motorola Solutions local distribution organization or through Motorola Online.

Basic Ordering Information

While parts may be assigned with a Motorola Solutions part number, they may not be available from the Motorola Solutions Radio Products and Solutions Organization (RPSO).

NOTE: RPSO was formerly known as the Radio Products Services Division (RPSD) and/or the Accessories and Aftermarket Division (AAD).

Some parts may have become obsolete and are 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.

Place orders for replacement parts, kits, and assemblies directly on Motorola Solutions local distribution organization or through Motorola Online. When ordering replacement parts or equipment information, include the complete identification number. 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 of, and sufficient description of the desired component to identify it.

To identify non-referenced spare parts, request for help from the Customer Care organization of a Motorola Solutions local area representative.

Motorola Online

The product catalog is available on the Motorola Online website. To register for login access:

• For APAC and ANZ regions, sign up at https://asiaonline.mot-solutions.com.

Replacement Parts and Kits

This manual covers Level 1 and 2 Maintenance.

Level 1 maintenance is the assessment and/or repair of fault in terms of a faulty accessory or physical aspect of product; not including disassembly of the unit. It is limited to the replacement of antenna, battery, handset, external microphones, external knobs, all related frequency programming to customers, and sometimes alignment or tuning by the Customer Programming Software (CPS).

Level 2 maintenance includes all Level 1 activities plus assessment that require the disassembly of the radio and rectifying a fault by replacement of major mechanical parts (such as replacement of bezels).

Level 2 maintenance does not incorporate discrete component replacement.

For Level 2 maintenance, only Motorola Solutions Service Centers or Authorized Motorola Solutions Service Dealers can perform these functions. Any tampering by unauthorized Motorola Solutions Service Dealers voids the warranty of your radio.

To find out more about Motorola Solutions Service Center, visit http://www.motorolasolutions.com.

NOTE: Only Motorola Solutions Service Center/Depot can perform Level 3 maintenance as it can deeply affect the performance of the radio.

Additional Service Kits Information

NOTE: "X" = Item Included

UHF Super Tanapa

Table 1: SL1M, UHF 403-470 MHz 2-3 W

Model/Item		Description
AZH88QCP9JA2AN		403–470 MHz, 2–3 W, SL1M Display Model
Х	PMUE4541AAMAAA	SL1M 403–470 MHz 2–3 W Display Model
Х	PMUE4541AAMACA	SL1M 403–438 MHz 2–3 W Display Model

VHF Super Tanapa

Table 2: SL1M, VHF 136–174 MHz 2–3 W

Мо	del/ltem	Description
AZ	H88JCP9JA2AN	136–174 MHz, 2–3 W, SL1M Display Model
X	PMUD3334AAMAAA	SL1M 136–174 MHz 2–3 W Display Model

Introduction

Radio Description

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

		_	_		_	
Table 3 [.]	Radio I	Frequency	Randes	and	Power	I AVAIS
	i tudio i	requeries	runges	unu	1 01101	201010

Frequency Band	Bandwidth	Power Level
VHF	136–174 MHz	Analog: 2 or 1 W, Digital: 3 or 1 W
UHF	403–470 MHz	Analog: 2 or 1 W, Digital: 3 or 1 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 Radio Overview

Radio overview explains the buttons, icons, and LED indications of your radio.

Figure 1: Display Model



Table 4: Callout Legend

Label	Item	Description
1	Channel Rocker	To select channel.
2	Power/Information button	To turn your radio on or off.
		When the radio is turned on, you can perform the following actions:
		• To check the battery strength.
		 To check the Received Signal Strength Indicator (RSSI).
		 To check radio name by pressing the button twice.
3	LED Indicator	The red, green, and amber light-emitting diodes indicate operating status.
4	Push-To-Talk (PTT) button	To execute voice operations (for example, Group Call and Private Call).
5	Volume Up or Down button	To adjust volume.
6	Side button	This button is field programmable using the Customer Programming Software (CPS).
7	Display	To provide visual information about many radio features.
8	Microphone	Allows the voice to be sent when PTT or voice operations are activated.
9	Micro-USB Connector	To charge radio.
10	Accessory Connector	Interface point for all accessories to be used with the radio. It has twelve points to which specific accessories will con- nect and be activated.
11	Speaker	Outputs all tones and audio that are generated by the radio (for example, features like keypad tones and voice audio).
12	Antenna	Provides the needed RF amplification when transmitting or receiving.

1.2 **Portable Radio Model Numbering Scheme**

10 Position 1 2 3 4 5 6 7 8 9 12 11 13 Typical Model Num-ΑZ Н Q С Ρ 9 J А 2 А 8 8 Ν ber

Table 5: Portable Radio Model Numbering Scheme

Position	Description	Value
1	Region	AA = North America
		AZ = Asia/Australia
		LA = Latin America
		MD = Europe/Middle East/Africa
2	Type of Unit	H = Portable
3	Model Series	88 = SL Series
4		
5	Band	Q = 403–470 MHz
		J = 136–174 MHz
6	Power Level	C = 2 W, 3 W
7	Physical Packages	C = Plain Model
		P = LED Matrix Display, No Keypad
8	Channel Spacing	9 = Variable/Programmable
9	Primary Operation	J = Basic
10	Primary System Type	A = Conventional
11	Feature Level	2 = Non-FM
12	Version Letter	N/A
13	Unique Variation	N = Standard Package

Table 6: Sales Models – Description of Symbols

1.3 **Model Chart**

NOTE: "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 Chart**

Table 7: SL1M, VHF 136–174 MHz

Мо	del/Item	Description
AZ	H88JCP9JA2_N	136–174 MHz, 2–3 W, LED Matrix Display, Non Keypad
X	PMLD4699_	Back Housing Kit Assembly
Х	PMLD4697_	Display Front Kit Assembly
Х	PMLD4696_S	Main Board Assembly Service Kit
Х	PMAD4144_	VHF Stubby Antenna (136–144 MHz)
Х	PMAD4145_	VHF Stubby Antenna (144–156 MHz)

Model/Item		Description	
AZH88JCP9JA2_N		136–174 MHz, 2–3 W, LED Matrix Display, Non Keypad	
X	PMAD4146_	VHF Stubby Antenna (156–174 MHz)	
Х	PMAD4154_	VHF Whip Antenna (136–144 MHz)	
Х	PMAD4155_	VHF Whip Antenna (144–156 MHz)	
Х	PMAD4156_	VHF Whip Antenna (156–174 MHz)	

1.3.2 UHF Model Chart

Table 8: SL1M, UHF 403-470 MHz

Мо	del/l	tem	Description	
AZH88QCP9JA2_N		QCP9JA2_N	403–438 MHz, 2–3 W, LED Matrix Display, Non Keypad	
	AZ	H88QCP9JA2_N	403–470 MHz, 2–3 W, LED Matrix Display, Non Keypad	
X	X	PMLE5029_	Back Housing Kit Assembly	
Х	X	PMLE5027_	Display Front Kit Assembly	
X	X	PMLE5020_S	Main Board Assembly Service Kit	
Х	X	PMAE4093_	UHF Stubby Antenna (403–425 MHz)	
Х	X	PMAE4094_	UHF Stubby Antenna (420–445 MHz)	
Х	X	PMAE4095_	UHF Stubby Antenna (435–470 MHz)	



NOTE: 403–438 MHz is only available in Indonesia.

^{1.4} Specifications

NOTE: Specifications are subject to change without notice. All specifications shown are typical values. For latest information about your radio specifications, refer to the data sheet of your radio model at https://www.motorolasolutions.com/en_xp/products/mototrbo/portable-radios.html.

Table 9: General Specifications

Parameter	Value
Channel Capacity	Display: 256
Frequency	VHF: 136–174 MHz
	UHF: 403–407 MHz
Dimensions (HxWxT) with Li-Ion Battery	125.7 x 55.0 x 22.0 mm
Weight with	VHF: 168.9 g
Li-Ion Battery	UHF: 165.6 g
Power Supply	3.7 V nominal

Parameter	Value	
FCC Description	VHF: AZ489FT3835 and AZ489FT3855	
	UHF: AZ489FT4922 and AZ489FT4977	
IC Description	VHF: 109U-89FT3835 and 109U-89FT3855	
	UHF: 109U-89FT4922 and 109U-89FT4977	
Average battery life at 5/5/90 duty cycle with battery saver enabled		
Li-Ion Battery for Display Model	Analog: 11.8 hr	
	Digital: 14 hr	

NOTE: Weight can have 5% margin of error.

Table 10: Receiver Specifications

Parameter	Value
Frequencies	VHF: 136–174 MHz
	UHF: 403–470 MHz
Channel Spacing	12.5 kHz/25 kHz
Frequency Stability (-30 °C to +60 °C, +25 °C Ref)	±1.5 ppm
Analog Sensitivity (12 dB SINAD)	0.3 μV
	0.22 μV (typical)
Digital Sensitivity (5% BER)	0.25 μV
	0.19 μV (typical)
Intermodulation (TIA603D)	70 dB
Adjacent Channel Selectivity (TIA603D)	45 dB (12.5 kHz)
	70 dB (25 kHz)
Spurious Rejection (TIA603D)	70 dB
Rated Audio	0.5 W (internal)
Audio Distortion (Rated Audio)	5% (3% typical)
Hum and Noise	-40 dB (12.5 kHz)
	-45 dB (25 kHz)
Audio Response	TIA603D
Conducted Spurious Emission (TIA603D)	-57 dBm
Speaker Impedance	4 Ω (internal)
Voltage (Rated Audio)	1.414 V (internal)

Table 11: Transmitter Specifications

Parameter	Value
Frequencies	VHF: 136–174 MHz

Parameter	Value
	UHF: 403–470 MHz
Channel Spacing	12.5 kHz/25 kHz
Frequency Stability (-30 °C to +60 °C)	±1.5 ppm
Power Output (Low Power)	1 W
Power Output (High Power)	Analog: 2 W
	Digital: 3 W
Modulation Limiting	±2.5 kHz @ 12.5 kHz
	±5.0 kHz (25 kHz)
FM Hum and Noise	-40 dB (12.5 kHz)
	-45 dB (25 kHz)
Conducted/Radiated Emission	-36 dBm < 1 GHz
	-30 dBm > 1 GHz
Adjacent Channel Power	60 dB (12.5 kHz)
	70 dB (25 kHz)
Audio Response	TIA603D
Audio Distortion	3% (typical)
4FSK Digital Modulation	12.5 kHz Data: 7K60F1D and 7K60FXD
	12.5 kHz Voice: 7K60F1E and 7K60FXE
	Combination of 12.5 kHz Voice and Data: 7K60F1W
Digital Vocoder Type	AMBE+2™
Digital Protocol	ETSI-TS102361-1
	ETSI-TS102361-2
	ETSI-TS102361-3

Conforms to:

- ETSI TS 102 361 (Parts 1, 2, and 3) ETSI DMR Standard
- ETSI EN 300 086 ETSI RF Specifications (Analog)
- ETSI EN 300 113 ETSI RF Specifications (Digital)
- 1999/5/EC (R&TTE Radio and Telecommunications Terminal Equipment)
- 2011/65/EU (RoHS 2 Banned Substances)
- 2012/19/EU (WEEE Waste Electrical and Electronic Equipment)
- 94/62/EC (Packaging and Packaging Waste)
- Radio meets applicable regulatory requirements.

Table 12: Self-Quieter Frequencies

UHF	VHF
403.20 MHz ± 15 kHz	139.20 MHz ± 10 kHz
408.00 MHz ± 10 kHz	144.00 MHz ± 10 kHz
412.80 MHz ± 10 kHz	148.80 MHz ± 10 kHz
417.60 MHz ± 10 kHz	153.60 MHz ± 10 kHz
422.40 MHz ± 15 kHz	158.40 MHz ± 10 kHz
427.20 MHz ± 10 kHz	163.20 MHz ± 10 kHz
432.00 MHz ± 20 kHz	168.00 MHz ± 15 kHz
436.80 MHz ± 10 kHz	172.80 MHz ± 10 kHz
441.60 MHz ± 20 kHz	-
446.40 MHz ± 10 kHz	-
451.20 MHz ± 20 kHz	-
456.00 MHz ± 10 kHz	-
460.80 MHz ± 20 kHz	-
465.60 MHz ± 10 kHz	-

	Military Standards									
Appli-	810C		810D) 810E			810F		810G	
cable MIL– STD	Meth- ods	Pro- ce- dures	Meth- ods	Pro- ce- dures	Meth- ods	Pro- ce- dures	Meth- ods	Pro- ce- dures	Meth- ods	Pro- de- cures
Low Pres- sure	500.1	I	500.2	=	500.3	Ξ	500.4	Π	500.5	=
High Tem- pera- ture	501.1	I, II	501.2	l/ A1,II/ A1	501.3	I/A1, II/A1	501.4	I/Hot, II/Hot	501.5	I/A1, II
Low Tem- pera- ture	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
Tem- pera- ture Shock	503.1	-	503.2	I/A1/C 3	503.3	I/A1/C 3	503.4	I	503.5	I/C
Solar Radi- ation	505.1	II	505.2	1	505.3	I	505.4	I	505.5	I/A1
Rain	506.1	I, II	506.2	I, II	506.3	1,11	506.4	I, III	506.5	I, III

	Military Standards									
Hu- midity	507.1	11	507.2	11	507.3	11	507.4	_	507.5	II/ Ag- gra- vated
Salt fog	509.1	-	509.2	-	509.3	-	509.4	-	509.5	-
Dust	510.1	I	510.2	I	510.3	I	510.4	I	510.5	I
Vibra- tion	514.2	VIII/F, Curve -W	514.3	I/10, II/3	514.4	I/10, II/3	514.5	I/24	514.6	I/24, II/5
Shock	516.2	1, 11	516.3	I, IV	516.4	I, IV	516.5	I, IV	516.6	I, IV, V, VI

Environmental Specifications			
Operating Temperature ¹	-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 3		
Dust and Water Intrusion	IEC 60529 -IP54		
Packaging Test	MIL-STD 810D and E		

¹ Operating temperature specification with Li-Ion battery is -10 $^{\circ}$ C to +60 $^{\circ}$ C.

Chapter 2

Test Equipment and Service Aids

This section lists the recommended test equipment and service aids, and information on field programming equipment. You can use this information in servicing and programming radios.

Recommended Test Equipment

The list of equipment contained in Table 13: Recommended Test Equipment on page 25 includes most of the standard test equipment required for servicing Motorola Solutions portable radios.

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

Table 13: Recommended Test Equipment

² Service Monitor can be used as a 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	14:	Service	Aids
-------	-----	---------	------

Motorola Solutions Part No.	Description	Application
PMVN4130_	Customer Programming Software and AirTracer on CD-ROM	CPS allows Dealers/Distributors to program radio parameters. AirTracer allows the capturing of radio traffic into logs for analysis by Motorola Solutions.
CB000262A01	Micro USB Programming Cable	This cable connects the radio to a USB port for radio program- ming and data applications.
CB000233A01	Audio Test Cable	This cable connects the radio to RLN4460_ Portable Test Set for test and measurement.
PMKN4128	Portable Programming Cable with TTR	This cable connects the radio to a USB port for radio program- ming and data applications.
TL000068A01	RF Antenna Adaptor	Adapts radio's antenna port to test equipment.
HW000405A02	Battery Eliminator	Connects to radio via battery eliminator cable.
HW000406A02	RF Antenna Adaptor Holder	Holds the RF antenna adaptor.
N/A	Flat Square Tip Plastic Tweez- ers	Removes components during disassembly.
PMVN4131_	MOTOTRBO Tuner on CD	This tuner tunes and test MO- TOTRBO subscriber, repeater, and base station products in the available systems.
RLN4460_	Portable Test Set	Enables connection to the audio/accessory jack. Allows switching for radio testing.
6680702Z01	Opener Back Housing	To dismantle the back housing from front housing.

Figure 2: Portable Programming Cable with TTR (PMKN4128_)



Table 15: Pin Configuration of Portable Programming Cable with TTR

Connection						
P1 P2 P3 Function						
1	1	-	VCC(5 V)			
2	2	-	DATA-			
3	3	-	DATA+			
4	-	BNC Center Pin	TTR			
5	4	BNC Shell	GROUND			

Figure 3: Micro USB Programming Cable (CB000262A01)



Table 16: Pin Configuration of Micro USB Programming Cable

Connection				
CONN 1	CONN 2	Function		
1	1	VBUS		
2	2	DATA-		
3	3	DATA+		
5	4	GROUND		

Figure 4: Audio Test Cable (CB000233A01)



	J			
Connection				
P1	P2	Function		
1, 5	2	SPK+		
17	1	MIC+		
2, 7, 16	3	MIC-, SPK-		
20	5	PTT		

Table 17:	Pin	Configuration	of Audio	Test	Cable

Chapter 3

Transceiver Performance Testing

These radios meet published specifications through their manufacturing process by using high-accuracy, laboratory-quality test equipment.

The recommended field service equipment approaches the accuracy of the manufacturing equipment with a few exceptions. This accuracy must be maintained 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 3.7 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 18: Initial Equipment Control Settings

Service Monitor	Power Supply	Test Set
Monitor Mode: Power Monitor	Voltage:	Speaker set: A
RF Attn: -70	DC on/standby: Standby	Speaker/load: Speaker
AM, CW, FM: FM	Volt Range: 4.44 V	PTT: OFF
Oscilloscope Source: Mod	Current: 2.5 A	
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		

3.2 Entering Display Radio Test Mode

Procedure:

1. Turn the radio on.

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

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

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

Table 19: Front Panel Access Test Mode Displays

NOTE: 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. The last display shows RF Test Mode.

3.2.1 Power Up

3.2.1.1 Powering Up The Display Model

Procedure:

- 1. Press and hold the **ON/OFF Button**. Audible sound is heard when the radio is powering up.
- 2. The radio will display the following:

Figure 5: Power-Up Screen Icon



3.2.2 Front Panel Access Test Mode

3.2.2.1 Entering The Front Panel Access Test Mode

Procedure:

- 1. To enter test mode, press the **Side Programmable Button** five times within 10 seconds after the radio powers up.
- 2. The radio beeps once, when it enters test mode successfully.

3.2.3 RF Test Mode

Upon entering RF Test Mode, the default channel is CSQ, CH1, and 12.5 kHz channel spacing. For display model, your radio shows RF for 2 seconds and shows the default channel profile. For example, C010 is for CSQ, CH1, and 12.5 kHz.

Figure 6: Channel Profile Screen Icon



Label	Description
1	Test Environment
2	Channel Index
3	Channel Spacing

3.2.3.1 Performing RF Test

Procedure:

1. To change the test environment, press the **Side Programmable Button**.

Table 20: Test Environments

No. of Beeps	Description	Function
1	Carrier Squelch (CSQ)	RX: If Carrier is detected TX: Mic Audio

No. of Beeps	Description	Function
2	Tone Private-Line (TPL)	RX: Unsquelch if Carrier and Tone are detec- ted TX: Mix Audio + Tone
3	Digital Mode (DIG)	RX: If Carrier is detected TX: Mic Audio
4	Unsquelch (USQ)	RX: Constant unsquelch TX: Mic Audio

2. To select a channel, press the Volume +/– Button.

- Channel 1 to channel 8 is for TX Low Power
- Channel 9 to channel 16 is for TX High Power
- 3. Push the Rocker to change between 12.5 kHz, 20 kHz, and 25 kHz.
 - For 20 kHz, the amber LED illuminates and the radio beeps once.
 - For 25 kIHz, the red LED illuminates and the radio beeps twice.
 - For 12.5 kHz, the green LED illuminates and the radio beeps three times

Table 21: Test Frequencies

Channel Se- lector Switch Posi- tion	Test Chan- nel	UHF RX	UHF TX	VHF RX	VHF TX
1 Low Power 9 High Power	TX#1 or #9 RX#1 or #9	403.150	403.150	136.075	136.075
2 Low Power 10 High Pow- er	TX#2 or #10 RX#2 or #10	414.150	414.150	142.575	142.575
3 Low Power 11 High Pow- er	TX#3 or #11 RX#3 or #11	425.150	425.150	146.575	146.575
4 Low Power 12 High Pow- er	TX#4 or #12 RX#4 or #12	436.450	436.450	155.575	155.575
5 Low Power 13 High Pow- er	TX#5 or #13 RX#5 or #13	447.150	447.150	161.575	161.575
6 Low Power 14 High Pow- er	TX#6 or #14 RX#6 or #14	458.150	458.150	167.575	167.575
7 Low Power 15 High Pow- er	TX#7 or #15 RX#7 or #15	469.850	469.850	173.975	173.975
8 Low Power	TX#8 or #16 RX#8 or #16	470.000	470.000	174.000	174.000

Channel Se- lector Switch Posi- tion	Test Chan- nel	UHF RX	UHF TX	VHF RX	VHF TX
16 High Pow- er					

Table 22: Transmitter Performance Checks

Test Name	Communications An- alyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency Monitor: Frequency er- ror Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch	PTT to continuously transmit (during the performance check)	Frequency error to be ±201 Hz for UHF ±68 Hz for VHF
Power RF	As above	As above	As above	Low Power: 1 W (VHF/UHF) High Power (Ana- log): 2 W (VHF/UHF) High Power (Digital): 3 W (VHF/UHF)
Voice Modulation	Mode: PWR MON 4th channel test frequency atten to -70, input to RF In/Out Monitor: DVM: AC Volts Set 1kHz Mod Out lev- el for 0.025 Vrms at test set, 80mVrms 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).
Voice Modulation (internal)	Mode: PWR MON 4th channel test frequency atten to -70, input to RF In/Out	TEST MODE, Test Channel 4 carrier squelch out- put at anten- na	Remove modulation input	Press PTT 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 4th channel test frequency	TEST MODE, Test Channel 4 TPL	As above	Deviation: ≥500 Hz but ≤1000 Hz (25 kHz Ch Sp).

Test Name	Communications An- alyzer	Radio	Test Set	Comments
	BW to narrow			
RF Power	DMR mode. Slot 1 Power and Slot 2 Power	TEST MODE, Digital Mode, transmit with- out modula- tion	Key up radio with- out modulation us- ing Tuner	TTR Enable is nee- ded and IFR to be set to trigger mode with signal level ~1.5 V
FSK Error	DMR Mode. FSK Error	TEST MODE, Digital Mode,transmit with O.153 test pattern	Key up radio with O.513 test pattern modulation using Tuner	Not Exceed 5%
Magnitude Error	DMR Mode. Magni- tude 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 23: Receiver Performance Checks

Test Name	Communications Ana- lyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency Monitor: Frequency er- ror Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch output at an- tenna	PTT to continuously transmit (during the performance check)	Frequency error to be ±201Hz for UHF ±68Hz for VHF
Rated Audio	Mode: GEN Output level: 1.0 mV RF 6th channel test frequency Mod: 1 kHz tone at 3 kHz deviation Monitor: DVM: AC Volts	TEST MODE . Test Chan- nel 6 carrier squelch	PTT to OFF (center), meter se- lector to Audio PA	Set volume control to 0.4 Vrms (Through audio jack)
Distortion	As above, except to distortion	As above	As above	Distortion <5.0%
Sensitivity (SINAD)	As above, except SI- NAD, lower the RF level for 12 dB SINAD.	As above	PTT to OFF (cen- ter)	RF input to be <0.3 μV

Test Name	Communications Ana- lyzer	Radio	Test Set	Comments
Noise Squelch Threshold (only radios with conventional system need to be tested)	RF level set to 1 mV RF	As above	PTT to OFF (cen- ter), meter selec- tion to Audio PA, speaker/load to speaker	Set volume control to 0.4 Vrms (Through audio jack)
	As above, except change frequency to a conventional system. Raise RF level from zero until radio un- squelches.	Out of TEST MODE; select a conventional system	As above	Unsquelch to occur at <0.25 μV. Preferred SINAD = 9 dB to 10 dB
Receiver BER	IFR DMR mode. Signal generator with O.153 test pattern	TEST MODE, Digi- tal Mode,trans- mit with O.153 test pattern	Read BER using Tuner. Adjust RF level to get 5% BER	RF level to be <0.25 μV for 5% BER
Receiver Rat- ed Audio	IFR DMR Mode. Signal generator with 1031 test pattern	Test Mode, Digital Mode, receive 1031 test pattern	RF level = -47 dBm. Set audio analyzer to read Vrms. Adjust vol- ume to get rated audio.	Adjust volume until Vrms = 0.4 V (Through audio jack)
Receiver Au- dio Distortion	IFR DMR Mode. Signal generator with 1031 test pattern	As above	As above. Then set audio analyzer to measure distor- tion	Not exceed 5%

3.2.4 Performing The LED Status Test

Procedure:

1. Press and hold the **Side Programmable Button**, to switch from RF Test Model to LED Status Test Mode.

For Display model, the radio beeps once, and display shows ${\tt LED}.$

2. Press Side Programmable Button or Volume +/- Button.

The red LED lights up.

3. Press any button/key.

The red LED is turned off. The green LED lights up.
4. Press any button/key.

The green LED is turned off. The radio lights up both LEDs. The orange LED lights up.

NOTE: Do not use the **On/Off** button to change the LED status.

3.2.5 Performing The LED Display Matrix Test

Procedure:

1. Press and hold the **Side Programmable Button**, to switch from LED Status Test Mode, to LED Display Matrix Test Mode.

The radio beeps once.

2. Press any button/key.

LEDs are turned on and displayed in a column format. There are total of 19 columns, moving from Left to Right.

3. Press any button/key.

LEDs are turned on and displayed in a row format. There are total of 5 rows, moving from Top to Bottom.

3.2.6 Performing The Speaker Tone Test

Procedure:

Press and hold the **Side Programmable Button**, to switch the radio from LED Display Matrix Test Mode to Speaker Tone Test Mode.

For Display model, the radio beeps once, and 1 kHz tone is heard from the internal speaker. The radio display shows SKPR.

3.2.7 Performing The Earpiece Tone Test

Procedure:

Press and hold the **Side Programmable Button**, to switch from Speaker Tone Test Mode to External Earpiece Tone Test Mode.

For Display model, the radio beeps once, and 1 kHz tone is heard from the earpiece. The radio display shows EAR.

3.2.8 Performing The Audio Loopback Test

Procedure:

Press and hold the **Side Programmable Button**, to switch from Earpiece Tone Test Mode, to Audio Loopback Earpiece Test Mode.

For Display model, the radio beeps once, and route any audio on the external mic to the earpiece. The radio display shows LOOP.

3.2.9 Performing the Battery Check Test

Procedure:

Press and hold the **Side Programmable Button**, to switch from Audio Loopback Earpiece Test Mode to Battery Check Test Mode.

Display Model:

- The radio beeps once.
- The radio's LED indicator shows green for High battery level, amber for Mid battery level, and red for Low battery level.
- The radio display shows BATT.

3.2.10 Performing The Button Test

Procedure:

- 1. Press and hold the **Side Programmable Button**, to switch from Battery Check Test Mode to Button Test Mode.
- 2. Press any button/key.

For Display model, the radio beeps once and radio display shows BTN.



NOTE: Upon completion of the final Button Test, press the **On/Off** button to power down the radio.

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 Windows 2000 onwards environment.

NOTE: 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 24: Software Installation Kits Radio Tuning Setup

Description	Part Number
MOTOTRBO CPS and AirTracer on CD-ROM	PMVN4130_
MOTOTRBO Tuner on CD-ROM	PMVN4131_

4.1

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.

Use a fully charged battery or battery eliminator, HW000405A02.

Figure 7: CPS Programming Setup



Figure 8: Connecting RF Antenna Adaptor to Radio RF Input/Output Port



Label	Description
1	RF Antenna Adaptor (TL000068A01)
2	RF Antenna Adaptor Holder (HW000406A02)

Figure 9: RF Plug



Label	Description
1	RF Plug (EN000047A01)

4.2

AirTracer Application Tool

The MOTOTRBO AirTracer application tool captures over-the-air digital radio traffic and saves the data captured 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

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

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



NOTE: Refer to the appropriate program online help files for the tuning procedures.

A personal computer (PC), Windows 7 or Windows 8 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 Radio Tuning Equipment Setup.

Figure 10: Radio Tuning Equipment Setup



Chapter 5

Disassembly and Reassembly Procedures

CAUTION: To assure the safety and regulatory compliance of your radio, repair your radio only at Motorola Solutions service facilities. Contact your dealer for further instructions.

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.
- Radio Exploded Mechanical View and Parts List.
- Battery Maintenance.

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.



NOTE:

Only clean internal surfaces when your radio is disassembled for service or repair.

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. These are in compliant 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 on the Printed Circuit Board (PCB). The following images show examples of the EPP Marking, adhering to the JEDEC Standard No. 97. This marking provides information to those performing assembly, servicing, and recycling operation on this product. 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. These requirements are stated in the following tables:

Motorola Sol- utions Part Number	Alloy	Flux Type	Flux Content by Weight	Melting Point	Supplier Part number	Diame- ter	Weight
1088929Y01	95.5Sn/3.8Ag/0.7Cu	RMA Version	2.7–3.2%	217 °C	52171	0.015 in.	1 lb spool

Table 25: Lead Free Solder Wire Part Number List

Table 26: Lead Free Solder Paste Part Number List

Manufacturer Part Number	Viscosity	Туре	Composition and Per- cent Metal	Liquid Tem- perature
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 uses bonded, multilayer, printed circuit boards. Special considerations are required when soldering and desoldering components as the inner layers are not accessible. 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 infrared 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

Radio Disassembly and Reassembly

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.



4

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 and reassembling the radio:

- T06 TORX Plus[®]
- Torque wrench
- Tweezers

NOTE: 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

This section describes the detailed disassembly procedure of your radio.

5.5.1 Holster Disassembly

Procedure:

Remove the holster from radio.

Figure 11: Holster Removal



5.5.2 External Antenna Disassembly

Procedure:

- 1. Turn off the radio.
- 2. Turn the antenna counterclockwise to remove it.

Figure 12: External Antenna Removal



5.5.3 Back Housing Disassembly

Procedure:

Í.

1. Remove the two screw plugs from the back housing.

NOTE: Remove the screw plugs with plastic tweezers.

Figure 13: Screw Plug Removal



- 2. Remove the RF plug from the back housing.
 - **NOTE:** Remove the RF plug with plastic tweezers.

Figure 14: RF Plug Removal



3. Unlock the battery door by sliding the latch to the right.

Figure 15: Unlock The Battery Door



4. Remove the battery door by lifting it upwards.

Figure 16: Battery Door Removal



5. Once the battery door is removed, remove the battery from its battery compartment. To remove the battery, grasp the battery groove at the bottom of the battery and lift it up.



Figure 17: Battery Removal



Remove the screws on the back housing by using a T06 Torx Plus screwdriver.
Figure 18: Screw Removal



Detach the back housing using the back housing opener. Lift the back housing from the front housing .
Figure 19: Back Housing Removal







5.5.4 Main PCB Disassembly

Procedure:

1. Detach the Top Control Flex, PTT Flex, and Display Flex from the main PCB, using plastic tweezers.

Figure 20: PCB Catch Disassembly



Label	Description
1	PCB Catch
2	Display Flex
3	PTT Flex
4	Top Control Flex

2. Pull the PCB catch backwards, and lift the main PCB upwards.

Figure 21: Uplifting Of The Main PCB



3. Detach the Audio Jack, Speaker, Micro USB, Microphone Flex, and Display Flex from the main PCB, using plastic tweezers.

Figure 22: Audio Jack, Speaker, Micro USB, Microphone Flex, and Display Flex Disassembly



Label	Description
1	Display Flex Disassembly
2	Audio Jack, Speaker, Micro USB, and Micro- phone Flex

5.5.5

Audio Jack Flex, Micro USB Flex, Microphone (MIC), Speaker Flex, LCD Display, and Internal Antenna Disassembly

Procedure:

Remove the internal frame screws by using T06 Torx Plus screwdriver.
Figure 23: Internal Frame Screws Disassembly



2. Lift the internal frame. Pull the internal frame out from the front housing.

Figure 24: Internal Frame Disassembly



3. Remove the micro USB carefully, followed by the microphone, the audio jack, and the speaker. Figure 25: Speaker Disassembly



Label	Description
1	Audio Jack
2	Microphone
3	Micro USB
4	Speaker

4. Remove the display module by lifting upwards.

Figure 26: Display Module Disassembly



5. Remove the internal antenna by lifting upwards.

Figure 27: Internal Antenna Disassembly



5.5.6 Dust Cover Disassembly

Procedure:

1. Cut off the dust cover head.

Figure 28: Dust Cover Head Removal



2. Pull the dust cover out from the front housing.

Figure 29: Dust Cover Removal



5.6 Detailed Radio Reassembly

This section describes the detailed reassembly procedure of your radio.

NOTE: Motorola Solutions recommends using a low rotation speed setting when using an electric screwdriver with a selectable rotation speed. The bit must be inline with the direction of the screw when assembling the screws.

5.6.1 Dust Cover Reassembly

Procedure:

1. Insert the dust cover tail into the front housing middle hole opening.

Figure 30: Dust Cover Tail Insertion



2. Use a long nose plier and pull the tail inward from the inner side of the housing until the head is fully inserted.

Label	Description
1	Dust Cover Tail

3. Cut off the tail with a cutter.

5.6.2 Internal Antenna Reassembly

Procedure:

Insert the internal antenna into the front housing.

Figure 32: Internal Antenna Reassembly



5.6.3 LCD Display Reassembly

Procedure:

Insert the display module into front housing. Figure 33: Display Module Reassembly



^{5.6.4} Audio Jack Flex, Micro USB Flex, Microphone (MIC), and Speaker Flex Reassembly

Procedure:

- 1. Insert the Microphone flex into its recess on the front housing.
- 2. Insert the speaker into the front housing.
- 3. Insert the Micro USB flex into the front housing.
- 4. Insert the Audio Jack flex into the front housing.
- **5.** Press to close the dust cover.

Figure 34: Speaker Reassembly



Label	Description
1	Audio Jack
2	Microphone
3	Micro USB
4	Speaker

5.6.5 Internal Frame Reassembly

Procedure:

1. Insert the internal frame into the front housing in a slanting direction to ensure the internal frame is properly seated on the front housing ribs.

Figure 35: Internal Frame Reassembly



Label	Description
1	Housing Rib
2	Internal Frame

2. Screw in the internal frame using T06 Torx Plus screwdriver.

Figure 36: Internal Frame Screw Reassembly



CAUTION: Do not over torque the screws. Please refer to the Torque Chart Chapter for screw torque specifications.

5.6.6 Main PCB Reassembly

Procedure:

- **1.** Attach the Audio Jack, Speaker, Micro USB, and Microphone Flex to the connector located at the bottom side of the main PCB.
- 2. Attach the Display Flex to the connector located at the bottom of the main PCB.





Label	Description
1	Display Flex
2	Audio Jack, Speaker, Micro USB, and Micro- phone Flex

- **3.** Insert the main PCB onto the internal frame.
- 4. Attach the Top Control Flex to the connector located at the upper side of the main PCB.

CAUTION: Only press on Poron Pad on Top Control Flex, while attaching the flex to the connector.

- 5. Attach the PTT Flex to the connector located at upper side of the main PCB.
- 6. Attach the Display Flex to the connector located at the LCD display module.

Figure 38: Main PCB Reassembly



Label	Description
1	Top Control Flex
2	Display Flex
3	PTT Flex

5.6.7 Back Housing Reassembly

Procedure:

1. Press the back housing onto the front housing and press the back housing towards the front housing.

Figure 39: Back Housing Reassembly



2. Screw in all the six screws to the back housing using a T06 Torx Plus screwdriver.

CAUTION: Do not over torque the screws. Refer to Torque Chart Chapter for screws torque specifications.

Figure 40: Screw Reassembly



3. Insert the battery .



NOTE: Only battery PMNN4468 can be used for this radio.

Figure 41: Battery Reassembly



4. Attach and lock the battery door by sliding the latch to the left.Figure 42: Lock The Battery Door



5. Insert one RF plug, and two new screw plugs at the back housing.

Figure 43: Attaching One RF Plug And Two Screw Plugs



5.6.8 External Antenna Reassembly

Procedure:

- **1.** Turn the antenna clockwise to engage the antenna to the front housing. Do not over torque.
- 2. Ensure the "M" logo is at the front.

Figure 44: External Antenna Reassembly



5.6.9 Holster Reassembly

Procedure:

Attach the holster to radio.

Figure 45: Holster Reassembly



^{5.7} Radio Exploded Mechanical View and Parts List

Figure 46: Radio Exploded View



Table 27: Exploded View Parts List

Item		Description	Part Number		
1.0		Product Nameplate	33012015035		
2.0		Front Kit, Assembly	UHF: PMLE5028_		
			VHF: PMLD4698_		
	2.1	PTT Paddle	0104078J25		
2.2		Front Housing, Assembly	PMLN7198_		
	2.3	Internal Antenna Frame, Assembly	UHF: 0104064J35		
			VHF: 0104064J36		
	2.4	Audio Jack, Speaker, Micro USB, and Microphone Flex, Assembly	0104063J28		
	2.5	Internal Frame Assembly	0104064J28		
	2.6	Screw, Internal Frame	0378212A02		
	2.7 ³	Display, Assembly	UHF: 0104064J38		
			VHF: 0104064J97		

³ Only available for Display Model.

Item		Description	Part Number		
	2.8	Dust Cover, Audio Jack and Micro USB	SL000095A03		
	2.9	PC Ring	HW001548A01		
3.0		Antenna	See Authorized Accessories List on page 76		
4.0		Thermal Pad	7515526H01		
5.0		Main PCB, Assembly	UHF: PMLE5036_S		
			VHF: PMLD4703_S		
6.0		Back Housing Assembly	UHF: PMLE5029_		
			VHF: PMLD4699_		
7.0		Screw, Back Housing	FN000069A01		
8.0		RF Plug	EN000047A01		
9.0		Screw Plug	EN000037A01		
10.0		Battery Door Kit Assembly	PMLN7074_		
11.0		Battery	See Authorized Accessories List on page 76		
12.0 ³		Display Flex, Assembly	0104063J29		

5.8

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.



CAUTION: A proper torque screwdriver must be used during installation to ensure that these torque values are not exceeded.

Table 28: Torque Specifications for Screws

Part Number	Description	Qty	Driver/	Torque		
			Socket	N-m	lbs-in	kgf-cm
FN000069A0 1	Main Screw	6	T06 Torx Plus	0.11–0.14	1.0–1.2	1.2–1.4
0378212A02	Screw, Internal Frame	4	T06 Torx Plus	0.12– 0.15	1.1–1.3	1.3–1.5
Chapter 6

Basic Troubleshooting

This chapter contains error codes and board replacement procedures.

If the board does not pass all the performance checks or exhibits an error code listed below, then the circuit board must be replaced. If repair requires knowledge on details of component level troubleshooting, please send the radio to the Motorola Solutions Offices.

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

6.1

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.



NOTE: Power-Up error codes are only applicable to Display Models.

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.

NOTE: If Non-Display radios fail the self test, the radios emit the Self-Test Fail Tone and sound the error messages through Voice Announcement.

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.

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.

Table 29: Types of Error Code

Error Code	Description	Error Type	Corrective Action
ERROR 01/22	Tuning Codeplug block check- sum is wrong.	Non-Fatal	Normal communication is still possible.
Fatal Error 01/82	External Codeplug block check- sum is wrong.	Fatal	Reprogram codeplug.
Fatal Error 01/92	Secure Codeplug checksum er- ror.	Fatal	Reprogram codeplug.
Fatal Error 01/93	Codeplug error.	Fatal	Reprogram codeplug.
Fatal Error 01/A2	Tuning Codeplug block check- sum is wrong.	Fatal	Reprogram codeplug.
Fatal Error 01/81	ROM Checksum is wrong.	Fatal	Reprogram FLASH Memory, then retest.
Fatal Error 01/88	Radio RAM test failure.	Fatal	Retest radio by turning it off and turning it on again.
Fatal Error 01/90 or Fatal Error 02/90	General hardware test failure.	Fatal	Retest radio by turning it off and turning it on again.
Fatal Error 02/81	DSP ROM Checksum is wrong.	Fatal	Reprogram FLASH Memory, then retest. Send radio to the nearest Motor- ola Service Centers or Author- ized Motorola Service Centers.
Fatal Error 02/82	DSP RAM1 test failure.	Fatal	Retest radio by turning it off and turning it on again.
Fatal Error 02/84	DSP RAM2 test failure.	Fatal	Retest radio by turning it off and turning it on again.
Fatal Error 02/88	DSP RAM test failure.	Fatal	Retest radio by turning it off and turning it on again.
Fatal Error 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 dam- aged.	Fatal	Check connection between main board and display module. Re- place with new display module. Send radio to the nearest Mo- torola Solutions Service Centers or Authorized Motorola Solutions
			Service Dealers.

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

6.2 **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 30: Types of Error Code

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

NOTE: If error message reoccurs, send radio to the nearest Motorola Solutions Service Centers or Authorized Motorola Solutions Service Dealers.

Chapter 7

Authorized Accessories List

Motorola Solutions provides a list of accessories to improve the productivity of your radio.

Table 31: Antenna

Part Number	Description
PMAD4144_	VHF, 136–144 MHz, 5.0 cm, Stubby Antenna
PMAD4145_	VHF, 144–156 MHz, 5.0 cm, Stubby Antenna
PMAD4146_	VHF, 156–174 MHz, 5.0 cm, Stubby Antenna
PMAD4154_	VHF, 136–144 MHz, 9.0 cm, Whip Antenna
PMAD4155_	VHF, 144–156 MHz, 9.0 cm, Whip Antenna
PMAD4156_	VHF, 156–174 MHz, 9.0 cm, Whip Antenna
PMAE4093_	UHF, 403–425 MHz, 4.5 cm, Stubby Antenna
PMAE4094_	UHF, 420–445 MHz, 4.5 cm, Stubby Antenna
PMAE4095_	UHF, 435–470 MHz, 4.5 cm, Stubby Antenna
PMAE4099_	UHF, 445–480 MHz, 4.5 cm, Stubby Antenna

Table 32: Battery

Part Number	Description
PMNN4468_	BT100x Lithium-Ion 2300 mAh Battery Pack

Table 33: Carry Devices

Part Number	Description
PMLN6074_	Nylon Wrist Strap
PMLN7076_	Flexible Quick Release Hand Strap
PMLN7128_	Heavy-Duty Swivel Belt Clip
PMLN7190_	Swivel Carry Holster

Table 34: Chargers

Part Number	Description
PMLN7093_	Standard Multi-Unit Charger
PMLN7094_	Standard Single Unit Charger
PMLN7100_	Standard Multi-Unit Charger, China Plug
PMLN7103_	Standard Multi-Unit Charger, AUS/NZ Plug
PMLN7105_	Standard Multi-Unit Charger, Korea Plug

Part Number	Description
PMLN7107_	Standard Multi-Unit Charger, Japan Plug
PMLN7108_	Standard Single Unit Charger, China Plug
PMLN7111_	Standard Single Unit Charger, AUS/NZ Plug
PMLN7113_	Standard Single Unit Charger, Korea Plug
PMLN7115_	Standard Single Unit Charger, Japan Plug
PS000042A11	Micro-USB Power Supply Adaptor, AC/DC Switch Mode, Wall Cube, 5 W, 100 V–240 V, US/Japan Plug
PS000042A13	Micro-USB Power Supply Adaptor, AC/DC Switch Mode, Wall Cube, 5 W, 100 V–240 V, UK/HK Plug
PS000042A14	Micro-USB Power Supply Adaptor, AC/DC Switch Mode, Wall Cube, 5 W, 100 V–240 V, AUS/NZ Plug
PS000042A16	Micro-USB Power Supply Adaptor, AC/DC Switch Mode, Wall Cube, 5 W, 100 V–240 V, China Plug
PS000042A17	Micro-USB Power Supply Adaptor, AC/DC Switch Mode, Wall Cube, 5 W, 100 V–240 V, Korea Plug

Table 35: Earbuds and Earpieces

Part Number	Description
PMLN7156_	Earbud with In-line Mic/PTT, MagOne
PMLN7157_	2-Wire with Transparent Tube, Black
PMLN7158_	1-Wire Surveillance Earpiece, In-Line Mic and PTT
PMLN7159_	Adjustable D-Style with In-Line Mic and PTT
PMLN7189_	Swivel Earpiece, In-line Mic and PTT
RLN6242_	Transparent Acoustic Tube
5080384F72	High Noise Yellow Foam Earpieces

Table 36: Miscellaneous

Part Number	Description
PMLN7074_	Battery Door

Table 37: Wireless

Part Number	Description
NNTN8191_	Push-to-Talk Module, without Charger
NNTN8294_	1-Wire Earbud, 29 cm Cord, Black
NNTN8295_	1-Wire Earbud, 116 cm Cord, Black
NNTN8299_	Eartips for Operations Critical Wireless Earbuds (Replacement for NNTN8294_ and NNTN8295_)
NNTN8385_	Wireless Neckloop Y-adapter and retention hook for Completely Dis- creet Kit

Part Number	Description
NNTN8433_	Discreet Surveillance Kit
PMLN6463_	Business Wireless Accessory Kit
PMLN7052_	Operations Critical Wireless 1-Wire Surveillance Kit with Translucent Tube
RLN4922_4	Completely Discreet Earpiece Kit
RLN6490_	XBT Behind-the-Neck, Non-secure Wireless Heavy Duty Headset
RLN6491_	XBT Overhead, Non-secure Wireless Heavy Duty Headset
RLN6550_4	Swivel Earpiece with In-Line Microphone
89409N	Non-Secure HK200 Mobile Bluetooth Headset with US Plug

⁴ Contact your dealer on the availability of these accessories.

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.

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 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 nonconductive 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 computer to communicate directly with certain radios 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.

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 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 wireless data transmission protocol based on IEEE 802.11.