



MTP8500Ex/MTP8550Ex

Basic Service Manual

JUNE 2023

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Legal and Compliance Statements

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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 wheeled bin label on the product (or the package in some cases). As defined by the WEEE directive, this crossed-out wheeled 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 centre 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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Safety Information

This chapter is an extract of the multilingual safety booklet publication. For the latest safety information, refer to the separate safety booklet delivered with your radio.

RF Energy Exposure and Product Safety Guide for Portable Two-Way Radios

ATTENTION!

This radio is restricted to Occupational use only. Before using the radio, read the RF Energy Exposure and Product Safety Guide for Portable Two-Way Radios which contains important operating instructions for safe usage and RF energy awareness and control for Compliance with applicable standards and Regulations.

For a list of Motorola Solutions-approved antennas, batteries, and other accessories, visit the following website:

<http://www.motorolasolutions.com>

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with Motorola Solutions-approved antenna with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Compliance with RF Exposure Standards

Your Motorola Solutions two-way radio is designed and tested to comply with various national and international standards and guidelines for human exposure to radio frequency electromagnetic energy.

Your Motorola Solutions two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission (FCC), Code of Federal Regulations; 47 CFR et seq.
- FCC, OET Bulletin 65
- Institute of Electrical and Electronic Engineers (IEEE) C95.1
- International Commission on Non-Ionizing Radiation Protection (ICNIRP)
- Ministry of Health (Canada) Safety Code 6
- Industry Canada RSS-102
- Australian Communications Authority Radiocommunications Standard et seq.
- ANATEL ANNEX to Resolution No. 303 et seq.

This radio complies with the IEEE (FCC) and ICNIRP exposure limits for occupational/controlled RF exposure environments at operating duty factors of up to 50 % talk-50 % listen. The IEEE/ICNIRP authorizes this radio for occupational use only.



NOTE: The approved batteries, supplied with the portable radio, are rated for a 5-5-90 duty cycle (5 % talk-5 % listen-90 % standby), even though this radio complies with IEEE/ICNIRP occupational exposure limits at usage factors of up to 50 % talk.

In terms of measuring RF energy for compliance with these exposure guidelines, your radio generates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode.

Federal Communication Commission (FCC) Regulations

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for two-way radios before they can be marketed in the U.S.

When two-way radios are used as a consequence of employment, the FCC requires users to be fully aware of and able to control their exposure to meet occupational requirements. The use of a product label directing users to specific user awareness information can facilitate exposure awareness. Your Motorola Solutions two-way radio has Exposure Product Label. Do not remove this RF Exposure Label from the device. Also, your Motorola Solutions user manual, or separate safety booklet includes information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

RF Energy Exposure Awareness, Control Information, and Operational Instructions for Occupational Use



NOTE: This radio is intended for use in occupational/controlled conditions where users have full knowledge of their exposure and can exercise control over their exposure to meet the occupational limits in FCC/ICNIRP and International standards. This radio device is not authorized for general population consumer use.

This two-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance. It uses radio frequency (RF) energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly, can cause biological damage. High levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health, and industry work with organizations to develop standards for safe exposure to RF energy. These standards provide recommended levels of RF exposure for both workers and the general public. These recommended RF exposure levels include substantial margins of protection.

All Motorola Solutions two-way radios are designed, manufactured, and tested to ensure that they meet government-established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of two-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it.

Refer to the following websites for more information on what RF energy exposure is and how to control your exposure to assure compliance with established RF exposure limits:

<http://www.fcc.gov/oet/rfsafety/rf-faqs.html>

<http://www.osha.gov/SLTC/radiofrequencyradiation/index.html>

RF Exposure Compliance and Control Guidelines

Always adhere to the following procedures to control RF exposure to yourself and others and also to comply to the occupational/controlled environment exposure limits.

- Do not remove the RF Exposure Label from the device.
- User awareness instructions should accompany device when transferred to other users.
- Do not use this device if it does not meet the operational requirements.

Operating Instructions

- Transmit no more than the rated duty factor of 50% of the time. To transmit (talk), push the Push-To-Talk (PTT) button. To receive calls, release the PTT button. It is important to transmit 50% of the time or less, because this radio generates measurable RF energy exposure only when transmitting.
- Hold the radio in a vertical position in front of the face with the microphone (and other parts of the radio including the antenna) at least 2.5 cm (one inch) away from the nose or lips. Keep the antenna away from the eye. Keeping the radio at a proper distance is important as RF exposure decreases with increasing distance from the antenna.
- When worn on the body, always place the radio in a Motorola Solutions-approved clip, holder, holster, case, or body harness. The use of non-Motorola Solutions-approved accessories may result in exposure levels exceeding the IEEE/ICNIRP occupational/controlled environment RF exposure limits.
- When placing or receiving a phone call, hold your radio as you would a wireless telephone. Speak directly into the microphone.

Approved Accessories

Use only Motorola Solutions-approved supplied or replacement antennas, batteries, and accessories. Use of non-Motorola Solutions-approved antennas, batteries, and accessories may exceed IEEE/ICNIRP RF exposure guidelines.

For a list of Motorola Solutions-approved antennas, batteries, and other accessories, contact your dealer or local Motorola Solutions contact. Your nearest dealer can be found at www.motorolasolutions.com.

Additional Information

For additional information on exposure requirements or other training information, visit <http://responsibility.motorolasolutions.com/index.php/downloads/dow07-rfexposureassessmentstand/>

Intrinsically Safe Radio Information

The TETRA portable radios MTP8550 Ex and MTP8500 Ex are approved for use in potentially explosive environments according to the ATEX EC Directive 94/9/EC and IECEx certification scheme. The radio and battery approval labels give the information in which types/levels of hazardous areas the radios and battery can be used. Repair/service instructions in this manual is written to ensure compliance with the IEC 60079-19, IEC 60079-0 ,IEC 60079-11 standards.

Figure 1: MTP8500Ex Bottom Label:



Figure 2: MTP8550Ex Bottom Label:



IECEX – BVS 15.0107 X

The radio systems listed above, when properly equipped with the battery NNTN8570_, are certified for use per the classification below:

- Ex ib IIC T4 Gb (Approved for Zone 1, 2, Equipment group II, Gasgroup C, Temperature class T4)
- Ex ib IIIC T90°C Db (Approved for Zone 21, 22, Equipment group III, Dustgroup C)
- Ex ib I Mb (Approved for Zone M2, Equipment group I)

ATEX – BVS 12 ATEX E 117 X

The radio systems listed above, when properly equipped with the battery NNTN8570_, are certified for use per the classification below:

- II 2G Ex ib IIC T4 Gb (Approved for Category 2G/Zone 1, 2, Equipment group II, Gasgroup C, Temperature class T4)
- II 2D Ex ib IIIC T90°C Db (Approved for Category 2D/Zone 21, 22, Equipment group III, Dustgroup C)
- I M2 Ex ib I Mb (Approved Category/Zone M2, Equipment group I)

Ambient temperature range: $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq 55^{\circ}\text{C}$

Ingress protection level: IP66/67

To view IECEX online certificate go to:

<http://iecex.iec.ch/iecex/iecexweb.nsf/welcome>

Operating safety instruction can be obtained from the Product Safety Leaflet MN002135A01 located in the Motorola Solutions AGILE system or equivalent.

Operational Cautions for Intrinsic Safe Equipment

Radios must be shipped from the Motorola Solutions manufacturing facility with the hazardous atmosphere capability and the intrinsic safety approval labeling (FM, UL, CSA, CENELEC, or ATEX/IECEX). Radios will not be upgraded to this capability and labeled once they have been shipped to the field.

A modification changes the hardware of the unit from its original design configuration. Only the original product manufacturer can modify the hardware.



WARNING:

- Do not operate radio communications equipment in a hazardous atmosphere unless it is a type especially qualified (such as FM, UL, CSA, CENELEC, or ATEX/IECEX approved). An explosion or fire may result.
- Do not operate a radio unit that has been approved as intrinsically safe product in a hazardous atmosphere if it has been physically damaged (for example, cracked housing). An explosion or fire may result.
- Do not replace or charge batteries in a hazardous atmosphere. Contact sparking may occur while installing or removing batteries and cause an explosion or fire.
- Do not replace or change accessories in a hazardous atmosphere. Contact sparking may occur while installing or removing accessories and cause an explosion or fire.
- Turn off the radio before removing or installing a battery or accessory.
- Do not disassemble an intrinsically safe product in any way that exposes the internal circuits of the unit.
- Failure to use an intrinsically safe approved battery or approved accessories for the radio unit may result in the dangerously unsafe condition of an unapproved radio combination being used in a hazardous location.
- Unauthorized or incorrect modification of the intrinsically safe approved product negates the approval rating of the product.
- Incorrect repair or relabeling of any intrinsically safe agency-approved radio could adversely affect the approval rating of the unit.
- Use of a radio that is not intrinsically safe in a hazardous atmosphere could result in serious injury or death.

Repair

A repair constitutes something done internally to the unit that would bring it back to its original condition.

Repairs for Motorola Solutions products with intrinsically safe approval are the responsibility of the user. Repairs to a Motorola Solutions FM approved radio product should only be done at a location that has been FM audited under the FM 3605 repairs and service standard. Contact Motorola Solutions for assistance regarding repairs and service of Motorola Solutions intrinsically safe equipment.

Items not considered as repairs are items in which an action is performed on a unit which does not require the outer casing of the unit to be opened in a manner which exposes the internal electrical circuits of the unit.

ATEX/IECEX Repairs

ED 50010

Global repair process and responsibilities

ED 50011

Repair checklist

ED 50013

ATEX/IECEX list of approved components/assemblies

This radio is certified to the ATEX/IECEX requirements. Radios need to be repaired in Motorola Solutions certified/compliant repaired centers. Repair is conducted to the requirements of IEC60079-19 standard.

Do Not Substitute Options or Accessories

The Motorola Solutions communications equipment certified as intrinsically safe by the approving agency (FM, UL, CSA, CENELEC, or ATEX/IECEX) is tested as a complete system which consists of the listed agency approved portable, approved battery, and approved accessories or options, or both. This approved portable and battery combination must be strictly observed. There must be no substitution of items, even if the substitute has been previously approved with a different Motorola Solutions communications equipment unit. The approving agency (FM, UL, CSA, CENELEC, or ATEX/IECEX) lists all the approved configurations.

The Intrinsically Safe Approval Label affixed to the radio refers to the intrinsically safe classification of that radio product, and the approved batteries that can be used with that system.

The manual part number referenced on the Intrinsically Safe Approval Label identifies the approved accessories and/or options that can be used with that portable radio unit.

Using a non-Motorola Solutions intrinsically safe battery and/or accessory with the Motorola Solutions approved radio unit voids the intrinsically safe approval of that radio unit.

Electromagnetic Interference/Compatibility

If inadequately shielded, designed, or otherwise configured for electromagnetic compatibility, nearly every electronic device is susceptible to Electromagnetic Interference (EMI).

Facilities

To avoid electromagnetic interference and/or compatibility conflicts, turn off your radio in any facility where posted notices instruct you to do so. Hospitals or health care facilities may be using equipment that is sensitive to external RF energy.

Medical Devices

Pacemakers

The Advanced Medical Technology Association (AdvaMed) recommends that a minimum separation of 15 cm (6 in.) be maintained between a hand-held wireless radio and a pacemaker. These recommendations are consistent with those of the U.S. Food and Drug Administration. Persons with pacemakers should:

- ALWAYS keep the radio more than 15 cm from their pacemaker when the radio is turned ON.
- Not carry the radio in the breast pocket.
- Use the ear opposite the pacemaker to minimize the potential of interference.
- Turn the radio OFF immediately if you have any reason to suspect that interference is taking place.

Hearing Aids

Some digital wireless radios may interfere with some hearing aids. In the event of such interference, you may want to consult your hearing aid manufacturer to discuss alternatives.

Other Medical Devices

If you use any other personal medical device, consult the manufacturer of your device to determine if it is adequately shielded from RF energy. Your physician may be able to assist you in obtaining this information.

Aircraft

When instructed to do so, turn off your radio when on board an aircraft. Any use of a radio must be in accordance with applicable regulations per airline crew instructions.

Conformance Statement

This product is in conformance with the TETRA (TErrestrial Trunked Radio) standard.

Use of Communication Devices While Driving

Always obey the laws and regulations on the use of radios in the area where you drive.

- Give full attention to driving and to the road.
- Use hands-free operation, if available.
- Pull off the road and park before making or answering a call if driving conditions or regulations so require.

Operational Warnings



WARNING:

For vehicles with an air bag, refer to the manual of the vehicle manufacturer before installation of electronic equipment to avoid interference with air bag wiring.

Do not mount or place a radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a radio is placed in the air bag deployment area and the air bag inflates, the radio may be propelled with great force and cause serious injury to occupants of the vehicle.

Potentially Explosive Atmospheres (explosive atmospheres refers to hazard classified locations that may contain hazardous gas, vapors, or dusts)

Turn off your radio before entering any area with a potentially explosive atmosphere, unless it is a radio type especially qualified for use in such areas as "Intrinsically Safe" (such as Factory Mutual, CSA, UL, CENELEC, or ATEX/IECEX approved). Do not remove, install, or charge batteries in such areas. Sparks in a potentially explosive atmosphere can cause an explosion or fire resulting in bodily injury or even death.

The areas with potentially explosive atmospheres include fueling areas such as below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles, such as grain, dust, or metal powders. Areas with potentially explosive atmospheres are often but not always posted.

Blasting Caps And Blasting Areas

To avoid possible interference with blasting operations, turn off your radio when you are near electrical blasting caps, in a blasting area, or in areas posted: "Turn Off Two-way Radio". Obey all signs and instructions.

Operational Cautions



CAUTION: Do not power on the SIM version radio until you have confirmed a dummy SIM card has been inserted in the SIM card connector.

Antennas

Do not use any portable radio that has a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn can result.

Batteries

If a conductive material such as jewelry, keys, or beaded chains touch exposed battery terminals, it can cause property damage and/or bodily injury such as burns. The conductive material may complete an electrical circuit (short circuit) and become hot. Exercise care in handling any charged battery, particularly when placing it inside a pocket, purse, or other container with metal objects.

Document History

Table 1: Document History

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

Edition	Description	Date
MN002465A01-AA	Initial edition	November 2015
MN002465A01-AB	Updated Transmitter RF Power specs to Class 3L and Class 4.	January 2016
MN002465A01-AC	Added ATEX/IECEX Repairs.	December 2017
MN002465A01-AD	Added Vent Port Handling Precaution and Care After Submersion in Maintenance chapter. Updated Operating Temperature to reflect radio temperature in hazardous and non-hazardous conditions.	July 2018
MN002465A01-AE	Internal software update and content restructuring.	October 2018
MN002465A01-AF	Updated the values for power class in the Test Setup and Testing chapter.	January 2019
MN002465A01-AG	Removed Motorola Solutions Propriety footer.	June 2019
MN002465A01-AH	Updated the EU Contact information in Service Information .	November 2019
MN002465A01-AJ	Added reference to the Torque Specification Chart for torque values.	March 2021
MN002465A01-AK	Changed micro SD HSM/microcyprtr to Micro HSM.	October 2021
MN002465A01-AL	<ul style="list-style-type: none"> Removed the eDOC50013 reference from a note in Level 2 and Level 3 Maintenance on page 72. Rename Man Down to Man Down (Fall Alert). 	January 2022
MN002465A01-AM	<ul style="list-style-type: none"> Added MTP8500Ex and MTP8550Ex Replacement Parts List on page 56 in Maintenance chapter Added Removing the Knob on page 62. Added Installing the Knob on page 64. 	April 2023
MN002465A01-AN	<ul style="list-style-type: none"> Updated Operational Cautions on page 14. Updated Installing the SIM Card Door on page 65. 	June 2023

Read Me First

This manual contains information necessary to test and maintain the TETRA radio at the module level. It also contains information on radio assembling and disassembling.

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.

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 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 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.

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.

- Motorola Solutions Regional Radio Support Centers offer a repair service to both end users and dealers at competitive prices.

Related EMEA Region Publications

This section contains part numbers and titles of related Europe, Middle East, and Africa (EMEA) region publications.

Table 2: MTP8500Ex Quick Start Guides



Part Number	Language
MN002014A01	Brazilian Portuguese
MN002015A01	Norwegian (Bokmål)
MN002016A01	Dutch
MN002017A01	German
MN002018A01	Polish
MN002019A01	French
MN002020A01	Danish
MN002021A01	Swedish
MN002022A01	Arabic (Egypt)
MN002023A01	Latin Spanish
MN002024A01	English
MN002028A01	Spanish
MN002029A01	Russian
MN002031A01	Hungarian
MN002032A01	Italian
MN003198A01	Finnish
MN004976A01	Catalan
MN005274A01	Turkish

Table 3: MTP8550Ex Quick Start Guides

Part Number	Language
MN001995A01	Brazilian Portuguese
MN001996A01	Norwegian (Bokmål)
MN001997A01	Dutch
MN001998A01	German
MN001999A01	Polish
MN002000A01	French
MN002001A01	Danish
MN002002A01	Swedish
MN002003A01	Arabic (Egypt)
MN002004A01	Latin Spanish

Part Number	Language
MN002005A01	English
MN002009A01	Spanish
MN002010A01	Russian
MN002012A01	Hungarian
MN002013A01	Italian
MN003197A01	Finnish
MN004975A01	Catalan
MN005273A01	Turkish

Table 4: MTP8500Ex and MTP8500Ex User Manuals

Part Number	Description	Language
MN006260A01	MTP8000Ex Series Feature User Guide	English
MN006267A01		Brazilian Portuguese
MN006269A01		French (Canada)
MN006262A01		German
MN006261A01		Hungarian
MN002942A01		Russian
MN002039A01		Spanish
MN002033A01	MTP8500Ex Feature User Guide	English
MN002040A01	 NOTE: This manual has been discontinued, and is replaced with <i>MTP8000Ex Series Feature User Guide</i> .	Brazilian Portuguese
MN005516A01		French (Canada)
MN002035A01		German
MN002034A01		Hungarian
MN006388A01		Polish
MN006268A01		Russian
MN006266A01		Spanish
MN002041A01	MTP8550Ex Feature User Guide	English
MN002048A01	 NOTE: This manual has been discontinued, and is replaced with <i>MTP8000Ex Series Feature User Guide</i> .	Brazilian Portuguese
MN005517A01		French (Canada)
MN002043A01		German
MN002042A01		Hungarian
MN005445A01		Polish
MN002943A01		Russian
MN002047A01		Spanish
MN002049A01	MTP8500Ex Product Information Manual	English

Part Number	Description	Language
MN002050A01	MTP8550Ex Product Information Manual	English

Table 5: Service Manuals

Part Number	Description	Language
MN002465A01	MTP8500Ex/MTP8550Ex Basic Service Manual	English
MN003541A01		German

Table 6: TETRA Terminals CPS Plus Start-up User Guide

Part Number	Language
6802974C10	English
6866539D55	Hungarian
6866588D27	German
6866588D36	Italian
MN002597A08	Brazilian Portuguese
MN002597A07	Spanish

Table 7: Other Related Manuals

Part Number	Description	Language
6864117B25	TETRA Portable Safety Leaflet	Multilingual
68015000885	CPS Plus Upgrade/Downgrade Matrix	English
MN001721A01	TETRA Portable RTTE Leaflet	Multilingual
MN002135A01	MTP85x0 Ex Important Safety Instruction and Approved Accessory Booklet	Multilingual
MN002136A01	MTP85x0Ex DoC and ATEX Certificate UHF	English
MN002137A01	MTP85x0Ex DoC and ATEX Certificate 800	English

Chapter 1

Model Information

This manual applies to the following MTP8500Ex/MTP8550Ex, Class 3L and Class 4, TETRA ATEX/IECEX Handportable Terminal model.

Table 8: MTP8500Ex/MTP8550Ex Sales Models

Type Designator No.	Sales Model No.	Short Description
PT951NMEEEx	AZH16PCF6TZ5AN	MTP8500Ex UHF Limited Keypad (LKP) ATEX
	MDH16PCF6TZ5AN	MTP8500Ex UHF LKP ATEX
	ANH16PCF6TZ5AN	MTP8500Ex UHF LKP ATEX ADC
PT951NPEEEx	AZH17PCH6TZ5AN	MTP8550Ex UHF Full Keypad (FKP) ATEX
	MDH17PCH6TZ5AN	MTP8550Ex UHF FKP ATEX
	ANH17PCH6TZ5AN	MTP8550Ex UHF FKP ATEX ADC

1.1

Model Specifications



NOTE: Specifications subject to change without notice.

Table 9: General Specifications

GENERAL	
ETSI:	ETS 300 019-1-7
Frequency Range:	350–470 MHz
Temperature Range for Transceiver:	
Operating	–20 °C to +55 °C (hazardous locations)
	–30 °C to +55 °C (non-hazardous locations)
Storage	–40 °C to +85 °C Operating temperature with Li-Ion battery is –10 °C to +55 °C.
Battery Types:	
Standard	NNTN8570_ 1250 mAh Li-Ion
Battery Voltage:	
Minimum	6.7 Vdc

GENERAL	
Nominal	7.6 Vdc
Portable Dimensions: (HxWxD in mm)	145.2 x 56.6 x 39.6 mm
Weight:	
Full Keypad (FKP) non-SIM	438 ± 2 g
FKP SIM	441 ± 2 g
Limited Keypad (LKP) non-SIM	440 ± 2 g
LKP SIM	442 ± 2 g

Table 10: Receiver Specifications

RECEIVER	
Receiver Type:	Class A and B
Frequency Range:	350–470 MHz
Channel Spacing:	25 kHz
Sensitivity (3.5%) BER:	–116 dBm (guaranteed) –118 dBm (typical)
Intermodulation:	(3.5 %) BER
Interfering Signal Level	–47 dBm
Selectivity Blocking: (50–100 kHz)	(3.5 %) BER
Interfering Signal Level	–40 dBm
Spurious Rejection:	(3.5 %) BER
Interfering Signal Level	–45 dBm
Frequency Stability:	
Locked to Base	±100 Hz
Unlocked to Base	±1000 Hz
Audio Rated	1.3 W
Distortion at Rated Audio:	15 % Max.

Table 11: Transmitter Specifications

TRANSMITTER	
Modulation Type:	$\pi/4$ DQPSK
RF Power:	Class 3L Class 4
Frequency Range:	
TMO	350–470 MHz


TRANSMITTER	
DMO	350–470 MHz
Frequency Stability:	
Locked to Base:	±100 Hz
Unlocked to Base:	±1000 Hz
Spurious Emissions:	
Conducted	
30 MHz–1 GHz:	–36 dBm
1 GHz–12.75 GHz:	–30 dBm
Radiated	
30 MHz–1 GHz:	–36 dBm
1 GHz–12.75 GHz:	–30 dBm
Adjacent Channel Power (at ±25 kHz):	
Class 4	55 dBc
Class 3L	60 dBc

1.2 Sales Model Nomenclature

Table 12: Model Numbering Scheme

Typical Model Number	MD	H	1	6	P	C	F	6	T	Z	5	A	Z
Position	0	1	2	3	4	5	6	7	8	9	10	11	12

Table 13: Sales Models – Description of Positions

Position	Description	Value
0	Applicable Region	AZ = Asia/Latin America Central Region (APAC/LACR) AN = Australia & New Zealand (ANZ) MD = Europe, Middle East, and Africa (EMEA)
1	Type of Unit	H = Hand-Held Portable M = Mobile Product
2	Model Series	16 = Motorola Solutions MTP8500Ex
3		17 = Motorola Solutions MTP8550Ex
4	Frequency Band	P = 350–470 MHz U = 806–870 MHz
		 NOTE: Values given represent range only; they are not absolute.
5	Power Level	A = 0–0.7 W

Position	Description	Value
		B = 0.7–0.9 W C = 1.0–3.9 W D = 4.0–5.0 W E = 5.1–6.0 W F = 6.1–10.0 W
6	Physical Packages	F = Limited Keypad – With Display H = Full Keypad – With Display K = Limited Controls – Basic Display N = Enhanced Controls – Enhanced Display
7	Channel Spacing	1 = 5 kHz 2 = 6.25 kHz 3 = 10 kHz 4 = 12.5 kHz 5 = 15 kHz 6 = 25 kHz 7 = 30 kHz
8	Primary Operation	N = Digital Front Q = Low Profile – Basic Display R = Digital Multi-Service T = TDMA Digital Dual Mode
9	Primary System Type	Z = Dimetra
10	Feature Level	1 = Basic 2 = Limited Pkg 3 = Limited Plus 4 = Intermediate 5 = Standard Pkg 6 = Standard Plus 7 = Expanded Pkg 8 = Expanded Plus 9 = Full Feature/Programmable
11	Version	Major Change to the radio will have an up-revision
12	Unique Model Variations	N = Standard Package R = Blue Housing Z = Black Housing

1.3

TEDS Specifications

The radio has the capability for TETRA Enhanced Data Service (TEDS).

Tx Maximum Output Power

0.56 W

Modulation Type

4QAM

16QAM

64QAM

Channel Spacing

25 kHz

50 kHz

Table 14: TEDS Specifications

Channel Bandwidth	Data Rate	Receiver Sensitivity
25 kHz	38.4 kbit/s or less	-109 dBm
	38.5 kbit/s to 76.8 kbit/s	-102 dBm
	Greater than 76.8 kbit/s	-97 dBm
50 kHz	76.8 kbit/s or less	-106 dBm
	76.9 kbit/s to 153.6 kbit/s	-99 dBm
	Greater than 153.6 kbit/s	-93 dBm

Chapter 2

Overview

To achieve a high spectrum efficiency, the radio uses digital modulation technology and sophisticated voice-compression algorithm. The voice received by the microphone is converted into a digital bit stream consisting of zeros (0) and ones (1).

This stream is modulated into a radio frequency (RF) signal. It is transmitted over-the-air to another radio. The process is called digital modulation.

2.1

Digital Modulation Technology

The radio operates in dispatch and phone modes.

The radio also operates in Trunked Mode Operation (TMO) and Direct Mode Operation (DMO). It uses the $\pi/4$ Differential Quadrature PhaseShift Keying (DQPSK) and Time Division Multiple Access (TDMA) digital technologies.

$\pi/4$ DQPSK is a modulation technique that transmits information by altering the phase of the signal. Data is converted into complex symbols, which alter the RF signal and transmit the information. When the signal is received, the change in phase is converted back into symbols and then into the original data.

The system can accommodate 4-voice channels in the standard 25 kHz channel as used in the two-way radio. TDMA is used to allocate portions of the RF signal by dividing time into four slots, one for each unit.

Time allocation enables each unit to transmit its data information without interference from other transmitting units. Transmission from a unit or base station is accommodated in time-slot lengths of 15 ms and frame lengths of 60 ms. The TDMA technique requires sophisticated algorithms and a Digital Signal Processor (DSP) to perform voice compressions/decompressions and RF modulation/demodulation.

In addition, the MTP8000 UHF radios can operate in TETRA2 (TEDS) mode and supports several modulations in 64QAM, 16QAM, and 4QAM with channel bandwidth (BW) of 50 kHz and 25 kHz for data services. The 800 MHz model hardware is not ready for TEDS support.

2.2

Voice Compression Technology

Voice is converted into a digital bit stream by sampling the voice at high rate and converting the samples into numbers, which are represented by bits.

Voice compression reduces the number of bits per second while maintaining the voice at an acceptable quality level. The radio uses a coding technique called Algebraic Code Excited Linear Prediction (ACELP). The compressed voice-data bits modulate the RF signal.

2.3

Transceiver

All radio circuitry are contained in the Digital/RF board and the keypad board.

The Digital/RF board is divided into the following sections.

- Digital

- Transmitter
- Receiver
- Frequency Generating

2.3.1

Digital Section

The digital section is based on a Dual Core System On a Chip (SoC) processor. It consists of a low-power Advanced RISC Machine (ARM) application core and Digital Signal Processor (DSP) core with floating point. This section also has a coprocessor that does keypad scanning and several input or output (IO) interfaces.

The dual-core architecture of the Dual Core Processor SoC provides benefits of both DSP and Reduced Instruction Set Computing (RISC) technologies.

The DSP performs modulation and de-modulation functions for the radio. It also performs Forward Error Correction and other correction algorithms for overcoming channel errors and Algebraic Code Excited Linear Prediction (ACELP) speech coding. The DSP carries the following function:

- linear 16-bit analog to digital conversions
- audio filtering
- level amplification for the microphone audio input and the received audio output

The power and audio section is based on the Power Management IC. This section includes power supplies, audio routing, microphone, and earpiece amplifiers. An audio power amplifier that is external is used for the loudspeaker.

2.3.2

Transmitter Path

The transmitter circuitry includes a linear class AB Power Amplifier (PA) for the TETRA linear modulation of the terminal. It includes a Cartesian Loop to enhance its transmitter linearity and reduce splattering power into adjacent channels.

The transmitter path consists of a Cartesian Loop that contains forward and feedback paths. The forward path includes the following items.

- Tx Power Control Integrated Circuit
- Balanced-Unbalanced Converter (BALUN)
- Forward Attenuator
- Power Amplifier
- Duplexer
- Coupler
- Antenna Switch

The loop feedback path includes the following items.

- Directional Coupler
- Feedback Attenuator
- BALUN
- Tx Power Control Integrated Circuit

2.3.3

Receiver Path

The receiver section in the radio is based on the DCR (Direct Conversion) technology. The main concept of this technology is down converting of the RF signal directly into a base band signal, skipping the intermediate stage of IF signal.

The receiver path includes the following items.

- Diplexer
- Antenna Switch
- RF Switch (for bypass control)
- Off Channel Detector and Inverting Schmitt Trigger
- Balanced-Unbalanced Converter (BALUN)
- Limiter Diodes with Pre-selector Filters
- LNA Module
- 2-bit 6/12/18 dB Step Attenuator
- Discrete Front Filter
- RF Coupler
- Tunable Post-selector Filter (350 MHz)
- Saw Filter (800 MHz) Off Channel Detector
- Comparator
- Low Noise Amplifier (LNA) integrated with Step Attenuator and Automatic Gain Control (AGC) continuous attenuation
- RFIC for mixing
- Baseband filtering and internal 55 dB AGC continuous attenuation (inclusive of the internal 10 dB step attenuator) which consists of all the baseband receive chain and mixer.

2.3.4

Frequency Generating Section

The frequency generating section includes the following components.

- Low Band VCO (350–410 MHz)
- High Band VCO (410–470 MHz)
- RFIC Fractional-N Synthesizer
- Reference Oscillator
- Loop Filter
- Voltage Multiplier

2.4

Global Positioning System, Bluetooth, and Global Navigation Satellite System Section

The GPS/BT is provided by a single chip solution in 65-nm CMOS process that integrates GPS and Bluetooth functions. The GNSS is a concurrent GNSS (GPS, GLONASS, and BeiDou) positioning chip.

The GPS/BT and GNSS section includes the following main components:

- Duplexer
- Front filters (separate filters for GPS and BT)
- Temperature Compensated Crystal Oscillator (TCXO)

Chapter 3

Programming the Radio

For programming the radio, refer to *6802974C10 TETRA Customer Programming Software (CPS) Plus Start-up User Guide*.

Figure 3: Sample of the TETRA CPS Plus Initializing Interface



Chapter 4

Test Setup and Testing

This chapter provides a general overview for testing Motorola Solutions radios.

There may be some differences caused by the variety of software versions running on the testing equipment. Please consult the user guides of the respective testing equipment for further details.

4.1

Typical Test Setup

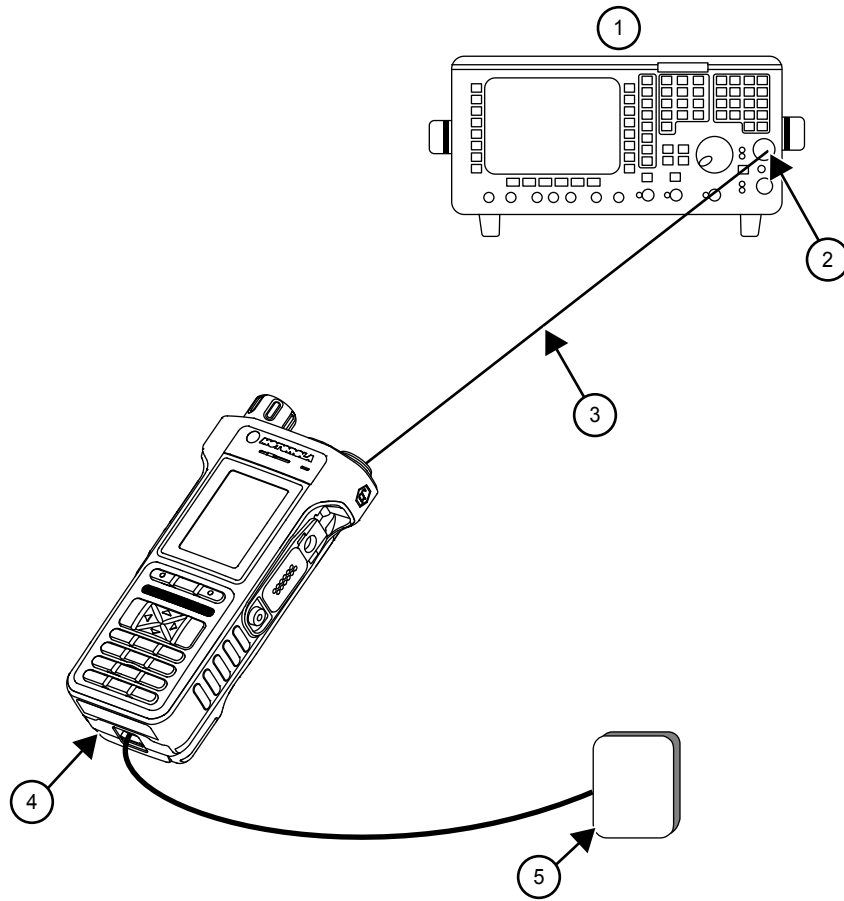
Carry out the following instructions before testing:

- Check that you have a fully charged battery (not required when using Battery Eliminator and RF radio antenna adapter).
- To test the radio, a special Battery Eliminator (PMLN7407_) and SMA cable is required.
- Detach the antenna from the radio.
- Connect the RF adapter to the RF switch at the rear side of your radio and fix it by screwing the wing nut into the antenna nut.
- Connect the other side of the cable to the N-type RF Connector of the IFR using an N-type-to-SMA-adapter.
- Connect the power supply to the battery eliminator wires.



CAUTION: Connect the red (+) and black (–) wires of the battery eliminator to the respective positive and negative points of the power supply, and use the correct voltage (3.8 VDC, maximum 4.2 VDC). Failing to properly connect the wires would damage your radio and/or the power supply.

Figure 4: Typical Test Setup



Label	Description
1	IFR 39xx/IFR 2968
2	N-Type RF Connector
3	SMA Cable
4	Battery Eliminator (PMLN7407_)
5	7.6 V Power Supply

4.2

Test Check List

Table 15: Test Setup for 350–470 MHz Radio Models

The following table summarizes the required test setup for 380–430 MHz radio models.

Test Name	Test Setup	Radio Setup	Test Conditions	Limits
Base Station Registration	Control Channel	390.125 MHz	3605	TETRA 380+0MS
	Traffic Channel	390.125 MHz	3605	TETRA 380+0MS

Test Name	Test Setup	Radio Setup	Test Conditions	Limits
	Time Slot	N/A	3	N/A
	Country Code	N/A	234	N/A
	Network Code	N/A	2392	N/A
	Base Color	N/A	1	N/A
	Location Area	N/A	22	N/A
	Min Rx Level	N/A	N/A	-110 dBm
	Max Tx Level	N/A	N/A	30 dBm (Class 4) 32.5 dBm (Class 3L)
	Access Parameter	N/A	-53 dBm	N/A
	Mobile Power	30 dBm (Class 4) 32.5 dBm (Class 3L)	N/A	N/A
	Burst Type	N/A	Normal	N/A
Transmitter Burst Power	RF Gen Level Burst Power	N/A	-90 dBm	28-32 dBm (Class 4) 30.5-34.5 dBm (Class 3L)
	Timing Error	N/A	N/A	±0.25 Symbols
	Vector Error	N/A	N/A	Max 10% RMS, 30% Peak
	Frequency Error	N/A	N/A	±100 Hz
Call Processing Talk Back	1 kHz Test Signal Group Mode	N/A	-50 dBm	N/A
Call Processing Call to Mobile	Private	4 digit random number and Send	N/A	28-32 dBm (Class 4) 30.5-34.5 dBm (Class 3L)
	RF Gen Level Burst Power	N/A	-90 dBm	28-32 dBm (Class 4) 30.5-34.5 dBm (Class 3L)
	Timing Error	N/A	N/A	±0.25 Symbols
	Vector Error	N/A	N/A	Max 10% RMS, 30% Peak
	Frequency Error	N/A	N/A	±100 Hz

4.2.1

Transmitter Tests

- 1 Power Burst (Control Range)
- 2 Power Profiles
- 3 Tx Burst Timing Error
- 4 Vector Error RMS and Peak
- 5 Tx Frequency Error

4.2.2

Call Processing Tests

- 1 Talk Back
- 2 Call to Mobile

4.2.3

Duplex Test

Digital Duplex Test (Tx)

Measurement Capabilities:

- Bar charts (Tx Power, Frequency Error, Vector Error RMS)
- Spectrum Analyzer
- Power Analyzer
- Vector Analyzer
- Vector Diagrams

4.3

Configuring IFR 3901/IFR 3902/IFR 3920 Setup

Use these procedures to configure the IFR 3901/IFR 3902/IFR 3920 setup.

Procedure:

- 1 Turn ON the IFR.
- 2 Press **CONFIG**→**CONFIG**. Select **System**→**TETRA**→**MS**.
- 3 Press **CONFIG**→**CONFIG**. Select **Configure**→**Channel Plan**.
- 4 Perform one of the following actions:
 - For 350–470 MHz radios, press **SELECT**→**TETRA 380+0MS**.
 - For 806–870 MHz radios, press **SELECT**→**TETRA 800MS**.
- 5 Press **CONFIG**. Select **System ID & Access Params**.
- 6 Enter 234 for Mobile Country Code (MCC). Press **Enter**.
- 7 Enter 2392 for Mobile Network Code (MNC). Press **Enter**.
- 8 Enter 1 for Base Station Color Code (BCC). Press **Enter**.
- 9 Enter 22 for Location Area Code (LA). Press **Enter**.
- 10 Enter -110 for Min Rx Level For Access. Press **Enter**.
- 11 Perform one of the following actions:

- For 350–470 MHz radios, enter 30 for Max Tx Level. Press **Enter**.
- For 806–870 MHz radios, enter 30 (Class 4 radio) or 32.5 (Class 3L radio) for Max Tx Level. Press **Enter**.

12 Enter -53 for Access Parameter. Press **Enter**.

13 Press **CONFIG**. Select **Base Services**.



NOTE: You are entering base services setup. The displayed values are factory defaults and should not be changed.

```
Power On Registration: Required
Power Off De-registration: Required
Priority Cell: Yes
Minimum Mode Service: May Be Used
Migration: Supported
System Wide Services: Normal Mode
TETRA Voice Service: Supported
Circuit Mode Data Service: Supported
(Reserved): Available
TETRA Packet Data Service: Available
Air Interface Encryption: Not Available
Advanced Link: Not Supported
```

14 Press **CONFIG**. Select **Neighbor Cell Info**.

15 Verify that the following NEIGHBOUR CELL INFO values are displayed:



NOTE: The displayed values are factory defaults and should not be changed.

```
BROADCAST: Not Supported
BROADCAST INTERVAL: 5 s
NEIGHBOUR CELL CHANNEL: 8500
NEIGHBOUR CELL LOCATION AREA: 0017
NEIGHBOUR CELL IDENTIFIER: 01
SLOW RE-SELECT THRESHOLD ABOVE FAST: 10 dB
FAST RE-SELECT THRESHOLD: 10 dB
SLOW RE-SELECT HYSTERESIS: 10 dB
FAST RE-SELECT HYSTERESIS: 10 dB
```

16 Press **CONFIG**. Select **Call Timers & Trunking**.

17 Select **Transmission** for Trunking Type.

18 Select **Continuous** for Test Set Transmit Mode.

4.4

Configuring IFR 2968 Setup

Use these procedures to configure the IFR 2968 setup.

Procedure:

- 1 Turn ON the IFR.
- 2 Press **Systems** Mode Key and wait until the digital system is initialized.
- 3 Press **Tetra Mobile**→**Setup**. Enter the System Parameters Screen.
- 4 Press **Channel Plan**.
- 5 Perform one of the following actions:
 - For 350–470 MHz, press **Tetra 380+OMS**.
The Control Channel automatically changes to 3600, and Traffic Channel automatically changes to 3700.

- For 806–870 MHz radios, press **Tetra 800MS**.
The Control Channel automatically changes to 2040, and Traffic Channel automatically changes to 2140.

- 6 Press **Traffic Channel**→**Traffic Channel**. Check that the marker goes to Timeslot.
- 7 To change to Timeslot 3, press **3**→**Traffic Channel**.
- 8 Press **Country Code**. Enter 234 and press **Country Code**.
- 9 Press **Network Code**. Enter 2392 and press **Network Code**.
- 10 Press **Base Color**. Enter 1 and press **Base Color**.
- 11 Press **More**.
- 12 Press **Location Area**. Enter 22 and press **Location Area**.
- 13 Press **More**.
- 14 Press **Min Rx Level**. Enter -110 dBm and press **Min Rx Level**.
- 15 Press **Max Tx Level**. Enter 30 dBm and press **Max Tx Level**.
- 16 Press **Access Parameter**. Enter -53 dBm and press **Access Parameter**.
- 17 Press **Test Mode**→**Enable**.
- 18 Press **Base Service**.



NOTE: You are entering base services setup. The displayed value are factory defaults and should not be changed.

```
Power On Registration: Required
Power Off De-registration: Required
Priority Cell: Yes
Minimum Mode Service: May Be Used
Migration: Supported
System Wide Services: Normal Mode
```

- 19 Press **More**.

```
TETRA Voice Service: Supported
Circuit Mode Data Service: Supported
(Reserved): Available
SNDP Service: Available
Air Interface Encryption: Not Available
Advanced Link: Not Supported
```

- 20 Press **Return**. Select **Neighbor Cell**.

- 21 Verify that the following NEIGHBOUR CELL INFO values are displayed:



NOTE: The displayed values are factory defaults and should not be changed.

```
NEIGHBOUR CELL BROADCAST: Not Required
BROADCAST INTERVAL: 5 s
NEIGHBOUR CELL CHANNEL: 8500
NEIGHBOUR CELL LOCATION AREA: 00017
NEIGHBOUR CELL IDENTIFIER: 01
SLOW RE-SELECT THRESHOLD: 10 dB
```

- 22 Press **More**.

```
FAST RE-SELECT THRESHOLD: 10 dB
SLOW RE-SELECT HYSTERESIS: 10 dB
FAST RE-SELECT HYSTERESIS: 10 dB
```

- 23 Press **Return**.

24 Press **Trunk Type**→**message Trunked** (Transmission).

25 Press **More**.



NOTE: The displayed values are factory defaults and should not be changed. It is not required to configure Call Types, Call Aerial, and Messages.

26 Press **More**.

4.5

Configuring IFR 3901/IFR 3902/IFR 3920 Manual Screen Test

Use these procedures to configure the IFR 3901/IFR 3902/IFR 3920 manual screen test.

Procedure:

- 1 Press **TEST**→**TAB**.
- 2 Perform one of the following actions:
 - For 350–470 MHz, enter 3600 for Control Channel.
 - For 806–870 MHz, enter 2072 for Control Channel.
- 3 Perform one of the following actions:
 - For 350–470 MHz, enter 3700 for Traffic Channel.
 - For 806–870 MHz, enter 2072 for Traffic Channel.
- 4 Enter 3 for Slot.
- 5 Enter -75 for RF Gen Level.
- 6 Select **Expected**→**30.0 dBm/1 W** for Mobile Power.
- 7 To select Tx Measurements, press **TAB**.
- 8 Press **Normal** for Burst.

The test equipment configuration setup is completed.



NOTE: The System Setup Configuration Data is saved even after the power is turned off. However, the Manual Test Setup is not saved.

4.6

Configuring IFR 2968 Manual Screen Test

Use these procedures to configure the IFR 2968 manual screen test.

Procedure:

- 1 Press **Manual** to enter the Manual Test screen.
- 2 Press **Control Channel**. Perform one of the following actions:
 - For 350–470 MHz, enter 3605 and press **Control Channel**. (IFR 3605 = Rx 390.125000 MHz)
 - For 806–870 MHz, enter 2072 and press **Control Channel**. (IFR 2072 = Rx 851.8125 MHz).
- 3 Press **Traffic Channel**. Perform one of the following actions:
 - For 350–470 MHz, enter 3605 and press **Traffic Channel**.
 - For 806–870 MHz, enter 2072 and press **Traffic Channel**.

The marker goes to Timeslot.

- 4 Enter 3 and press **Traffic Channel**.



NOTE: The Traffic Channel number changes automatically after entering the Control Channel number.

- 5 Press **RF Gen Level**. Enter -75 and press **dBm**→**RF Gen Level**.
- 6 Press **Mobile Power**. Enter 30 dBm/1 W.
- 7 Press **Burst Type**→**Normal**.

The test equipment configuration setup is completed.



NOTE: The System Setup Configuration Data is saved even after the power is turned off. However, the Manual Test Setup is not saved.

4.7

RF Tests

This section lists the applicable RF Tests and its procedures for the radio.

4.7.1

Testing Receiver using IFR 3901/IFR 3902/IFR 3920

Prerequisites: This test requires programming the radio. Refer to TETRA Customer Programming Software (CPS) User Guide.

Procedure:

- 1 Turn ON the radio.
- 2 Do one of the following to enter the radio test page:
 - Use CPS.
 - Press **Left**→**Right**→**Left**→**Menu**.
- 3 Check that registration and `ITSI ---/---`: `xxxx` is displayed on the IFR Operations/Status screen.

```
GROUP: XXXXXXXX SELECTED
```

4.7.2

Testing Receiver using IFR 2968

Prerequisites: This test requires programming the radio. Refer to TETRA Customer Programming Software (CPS) User Guide.

Procedure:

- 1 Turn ON the radio.
- 2 Do one of the following to enter the radio test page:
 - Use CPS.
 - Press **Left**→**Right**→**Left**→**Menu**.
- 3 Check that registration and `ITSI ---/---`: `xxxx` is displayed on the IFR Manual Test screen.

```
STATUS: REGISTRATION (ITSI ATTCHED)  
GSSI: XXXXXXXX SELECTED
```

4.7.3

Testing Transmitter using IFR 3901/IFR 3902/IFR 3920

Procedure:

- 1 To select RF Settings, press **TAB**.
- 2 Enter -90 for RF Gen level.
- 3 Switch ON the RF Gen.
- 4 Switch OFF the Pre Amp.
- 5 Press **PTT**.



NOTE: Press and hold the **PTT** to read the results.

Monitor the **Tx Measurement** window which displays the Power Profile, Burst Timing, Vector Peak, Vector RMS, Freq Error, and Residual Carrier.

```
Burst Power Required Results: 28.0-32.0 dBm (Class 4) or 30.5-34.5 dBm  
(Class 3L)  
Power Profile: Passed  
Burst Timing: ± 0.25 Symbols  
Vector Error: Max 10% RMS, Max 30% Peak, Max 5% residual  
Frequency Error: ± 100 Hz
```

- 6 Press **TAB** to select Operations/Status.
- 7 Press **Call Mobile**→**Group Call**→**Cleardown**.

4.7.4

Testing Transmitter using IFR 2968

Procedure:

- 1 Press **RF Gen Level**. Enter -90 dBm and press **RF Gen Level**.
- 2 Press **PTT**.



NOTE: Press and hold the **PTT** to read the results.

Monitor the IFR Manual Test screen which displays the Burst Power, Power Profile, Timing Error, Vector Error, and Frequency Error.

```
Burst Power Required Results: 28.0-32.0 dBm (Class 4) or 30.5-34.5 dBm  
(Class 3L)  
Power Profile: Passed  
Timing Error: +/- 0.25 Symbols  
Vector Error: Max 10% RMS, Max 30% Peak, Max 5% residual  
Frequency Error: ± 100 Hz
```

- 3 Press **Clear Down** to proceed with other tests.

4.8

Call Processing Tests

This section list the applicable Call Processing Tests and its procedures.

4.8.1

Talk Back using IFR 3901/IFR 3902/IFR 3920

Prerequisites: Ensure that the handset and test equipment are configured the same as given in the Transmitter Test before you start this test.

Procedure:

- 1 Press **Call Mobile**→**Group Call**.
- 2 Press **TALKBACK**.
- 3 Press **PTT** and speak into the microphone of the radio.
The last 3 sec of the speech frames is heard after **PTT** is released.
- 4 Press **Test Sound** to provide the 1 kHz signal to the radio speaker.
A 1 kHz tone is heard from the radio speaker for about 3 sec.
- 5 Press the **Silence** to mute the 1 kHz Audio Signal of the speaker.
- 6 Press **Clear Down**.

4.8.2

Talk Back using IFR 2968

Prerequisites: Ensure that handset and test equipment are configured the same as given in the Transmitter Test before you start this test.

Procedure:

- 1 Press **PTT** and speak into the microphone of the radio.
The last 3 sec of the speech frames is heard after **PTT** is released.
- 2 Press **Test Sound** to provide the 1 kHz signal to the radio speaker.
A 1 kHz tone from the radio speaker is heard for about 3 sec.
- 3 Press the **Silence** to mute the 1 kHz Audio Signal of the speaker.
- 4 Press **Clear Down**. Check that the `Cleardown Complete` status appears on the IFR Manual Test screen.

4.8.3

Call to Mobile

Procedure:

- 1 Press **Call Mobile** on the IFR.
- 2 Press **Private**.



NOTE: Select the type of call.

The handset beeps.

- 3 Press **Abort Call**.
- 4 Repeat [step 1](#) through [step 3](#) for Phone and Emergency calls.

4.9

Digital Duplex Test (Tx) using IFR 3901/IFR 3902/IFR 3920

Procedure:

- 1 On the radio, press **Menu**→**Contact**→**Contact 1**→**Send**.

The following results are displayed on the **Tx Measurements** window.

```
Burst Power Required Results: 28.0–32.0 dBm (Class 4) or 30.5–34.5 dBm
(Class 3L)
Power Profile: Passed
Burst Timing: ± 0.25 Symbols
Vector Error: Max 10% RMS, Max 30% Peak, Max 5% residual
Frequency Error: ± 100 Hz
```

- 2 Press **Call Mobile**→**Group Call**→**TALKBACK**.

- 3 Speak into the microphone of the handset.

You hear your speech (after a short delay) from the internal earpiece of the handset.

- 4 If you need more details, select ▼ at the Rx Measurement Window.

Option	Actions
Power Analyzer Graph	<ol style="list-style-type: none"> a Select Power→Profile Full. b To view the detail of Profile Full, select <input type="checkbox"/> and press Select. c To minimize the window, press Select. d To view the rest of the power analyzer graphs, select any item under Power drop-down list.
Vector Analyzer Diagram	<ol style="list-style-type: none"> a Select Mod Accuracy→Vector Error. b To view the detail of Vector Error, select <input type="checkbox"/>, and press Select. c To minimize the window, press Select. d To view the rest of the vector analyzer graphs, select any item under Mod Accuracy drop-down list.

- 5 Press **End** on the handset.

4.10

Digital Duplex Test (Tx) using IFR 2968

Procedure:

- 1 On the radio, press **Menu**→**Contact**→**Contact 1**→**Send**.

The following results are displayed on IFR Manual Test Screen.

```
Burst Power Required Results: 28.0–32.0 dBm (Class 4) or 30.5–34.5 dBm
(Class 3L)
Power Profile: Passed
Burst Timing: ± 0.25 Symbols
Vector Error: Max 10% RMS, Max 30% Peak, Max 5% residual
Frequency Error: ± 100 Hz
```

2 Speak into the microphone of the handset.

You hear your speech (after a short delay) from the internal earpiece of the handset.



NOTE: If you need more details, press **Duplex Test**.

3 Press **Duplex Test (Tx)**.

The Digital Duplex test results are displayed on the IFR screen providing you with the following bar charts measurement capabilities:

- Power
- Vector RMS
- Frequency Error

4 Perform one of the following actions:

Option	Actions
Power Analyzer Graph	<p>a Press power ana.</p> <p>b Check that the power frame falls within the limits.</p>
Spectrum Analyzer Diagram	<p>a Press spec ana.</p> <p>b Monitor the Tx frequency.</p>
Vector Analyzer Diagram	<p>a Press vector ana.</p> <p>b Monitor the constellation diagram.</p> <p>c Press vector diagram.</p> <p>d Monitor the vector diagram.</p> <p>e To zoom in on the constellation, press rotated vector.</p>

5 Press **End** on the handset.

4.11

Manual Mode Testing

When and where to use: Use these procedures to set up radio for DALT Mode testing.

Procedure:

- 1 Verify that the radio is turned OFF.
- 2 Perform one of the following actions:
 - For Full Keypad, press and hold **1**, **2**, and **3** keys simultaneously and press the **On/Off** button for more than 5 seconds to enter DALT mode.
 - For Limited Keypad, press and hold **Left** and **Right** keys simultaneously and press the **On/Off** button for more than 5 seconds to enter DALT mode.

4.11.1

Testing in DALT Mode



NOTE: Any key pressed causes the test to advance from one step to the next. You are to respond accordingly to the instructions on the screen.

Procedure:

Display Test

- 1 The display shows:

```
Display  
Test
```

- 2 Do the following:

Action	The display shows:
Press any key.	Horizontal red lines.
Press any key consecutively.	Horizontal red lines become thicker with every key press, until it becomes fully red.
Press any key.	Four colored rectangles.
Press any key consecutively.	Vertical green lines that become thicker with every key press, until it becomes fully green.
Press any key.	White screen.
Press any key.	Black screen.
Press any key.	Blue screen and END LCD test!!!

- 3 Press the corresponding key to proceed to the next test.

Battery Test

- 4 The display shows:

```
Battery  
Test
```

- 5 Do the following:

Action	The display shows:
Press any key.	Battery Interface Test PASSED

- 6 Press the corresponding key to proceed to the next test.

SIM Card Test

- 7 The display shows:

```
SIM card  
Test
```

- 8 Do the following:

Action	Result
Press any key.	<ul style="list-style-type: none">• If SIM card is detected in SIM slot, the display shows:

Action	Result
	SIM card PASSED Press Any key To Continue

9 Press the corresponding key to proceed to the next test.

Vibrator Test

10 The display shows:

Vibrator
 Test

11 Do the following:

Action	Result
Press any key.	The display shows: Vibrator On The radio vibrates.

12 Press the corresponding key to proceed to the next test.

LEDs Test

13 The display shows:

LEDs
 Test

14 Do the following:

Action	Result
Press any key.	The display shows: Red LED on LED Status Indicator lights up in red.
Press any key.	The display shows: Green LED on LED Status Indicator lights up in green.
Press any key.	The display shows: Amber LED on LED Status Indicator lights up in amber.
Press any key.	The display shows: All LEDs on LED on the top of the radio blinks in combination of red, green, and amber.

15 Press the corresponding key to proceed to the next test.

Backlight Test

16 The display shows:

Backlight
 Test

17 Do the following:

Action	Result
Press any key.	The display shows: Keypad Backlight On The radio keypad backlight lights up.
Press any key.	The display shows: Display Backlight On The radio display backlight lights up.

18 Press the corresponding key to proceed to the next test.

MACE Test

19 The display shows:

```
MACE
Press Any key
To Continue
```

20 Do the following:

Action	Result
Press any key.	<ul style="list-style-type: none"> If Micro HSM card is detected in SD slot, the display shows: MACE ping test PASSED Press Any key To Continue If Micro HSM card is not detected in SD slot, the display shows: MACE ping test FAILED Press Any key To Continue

21 Press the corresponding key to proceed to the next test.

Accessory Connect Test

22 The display shows:

```
Accessory
Connect Test
```

23 Do the following:

Action	Result
Press any key.	The display shows: Connect GCAI 1. Core Accy 2. IMPRES Accy to the radio and press any key
Attach Core or IMPRES accessory to the SLIM connector.	Core RSM connected or IMPRES RSM PMMNxxxx connected

24 Press the corresponding key to proceed to the next test.

Tones Test

25 The display shows:

Tones
Test

26 Do the following:

Action	Result
Press any key.	The display shows: Internal Speaker Tone Test The speaker plays a continuous tone.
Press any key.	The display shows: Internal Earpiece Tone Test The internal earpiece plays a continuous tone.
Press any key.	The display shows: Connect RSM accessory to the radio (RSM connected)
Attach RSM accessory to the radio.	The display shows: RSM Tone Test (RSM connected) The RSM earpiece plays a continuous tone.

27 Press the corresponding key to proceed to the next test.

Loopback Test

28 The display shows:

Loopback
Test

29 Do the following:

Action	Result
Press any key.	The display shows: INT MIC to INT EAR Loopback Test
Speak into the internal microphone.	You hear your voice from the internal earpiece.
Press any key to continue.	The display shows: Connect RSM accessory to the radio
Attach RSM accessory to the radio.	The display shows: TOP MIC 1 to RSM Loopback Test (RSM connected)

Action	Result
Speak into the top microphone.	You hear your voice from the RSM earpiece.
Press any key to continue.	The display shows: Connect RSM accessory to the radio (RSM connected)
Attach RSM accessory to the radio.	The display shows: RSM MIC to INT EAR Loopback Test (RSM connected)
Speak into the RSM microphone.	You hear your voice from the internal earpiece.

30 Press the corresponding key to proceed to the next test.

Chopper Noise Test

31 Do the following:

Action	Result
Press any key.	The display shows: Int MIC to internal earp
Place the internal earpiece close to your ear and listen for Chopper Noise Test.	Make sure that chopper noise is not audible.
Press any key.	The display shows: Connect RSM accessory to the radio (RSM Connected)
Press any key.	The display shows: TOP Mic to RSM Chopper Noise Test (RSM connected)
Bind around the antenna one binding of the earpiece cable and place the external earpiece close to your ear and listen for chopper noise.	Make sure that chopper noise is not audible.
Press any key.	The display shows: Connect RSM accessory to the radio (RSM connected)
Press any key.	The display shows: RSM MIC to INT Ear Chopper Noise Test
Listen for chopper noise at the radio earpiece.	Make sure that chopper noise is not audible.
Press any key.	The display shows: Connect RSM accessory to the radio (RSM connected)
Press any key.	The display shows:

Action	Result
	TOP Mic to RSM Chopper Noise Test (RSM connected)
Bind around the antenna one binding of the earpiece cable and place the external ear-piece close to ear and listen for chopper noise.	Make sure that chopper noise is not audible.

32 Press the corresponding key to proceed to the next test.

Keypad Test

33 The display shows:

```
Keypad
Test
```

34 Do the following:

Action	Result
Press any key.	<p>The display shows:</p> <ul style="list-style-type: none"> For Full Keypad model: <pre> Emergency Left Menu Right Send Up 1 2 3 Ptt 4 5 6 Down 7 8 9 * 0 # Rotary to Exit</pre> For Limited Keypad model: <pre> Emergency Left Menu Right Send Up Ptt Down Rotary to Exit</pre>
Press the corresponding key to continue.	The respective display disappears every time you press a key. Continue until display is empty.

35 Press the corresponding key to proceed to the next test.

Navigation Button Test

36 The display shows:

```
Navigation
Test
```

37 Do the following:

Action	Result
Press any key.	The display shows:

Action	Result
	<pre> * * * * <<<< >>>> * * * * </pre>
Press the corresponding key to continue.	The respective display disappears every time you press a key. Continue until display is empty.

38 Press the corresponding key to proceed to the next test.

Rotary Knob Test

39 The display shows:

```
Rotary
Test
```

40 Do the following:

Action	Result
Press any key.	The display shows: <pre> > > > > > > > > > > </pre>
Turn the rotary knob clockwise. Each click removes the respective clockwise arrow until display is empty.	The display shows: <pre> < < < < < < < < < < </pre>
Turn the rotary knob counter-clockwise. Each click removes the respective clockwise arrow until display is empty.	The display shows: <pre>Press the Rotary</pre>

41 Press the corresponding key to proceed to the next test.

Man Down (henceforth known as Fall Alert) Test

42 The display shows:

```
Mandown
Test
```

43 Do the following:

Action	Result
Press any key.	The display shows: 45 Degree Angle Angle Detection Mandown Test
Place the radio horizontally on a flat surface.	A beep sounds after 10 seconds. Man Down (Fall Alert) angle detection feature is functional.
Press any key to continue.	The display shows: No-Movement Mandown Test
Place the radio in a stable position.	A beep sounds after 10 seconds. Man Down (Fall Alert) angle detection feature is functional.

44 Press the corresponding key to proceed to the next test.

Bluetooth Test

45 The display shows:

Bluetooth
Test

46 Do the following:

Action	Result
Press any key.	The display shows: BT test - pairing WAIT !!!
Wait for result.	The display shows pairing test result.
Press any key to continue.	The display shows pairing connection test result.
Press any key to continue.	The display shows: BT microphone test - start
Speak into the internal microphone.	You hear yourself in the paired Bluetooth audio speaker.
Press any key to continue.	The display shows: BT speaker test - start
Speak into the paired Bluetooth microphone.	You hear yourself in the internal speaker.

47 Press the corresponding key to proceed to the next test.

The display shows:

TX Power Class 3L test

48 Press the corresponding key to proceed to the next test.

The display shows:

```
TX Power Class 4 test
```

The display shows:

```
The test is
completed.
Press any key
to turn the
radio OFF.
```

Test is completed. Press any key to turn the radio OFF.

4.11.2

Testing Charger Recognition

Procedure:

- 1 Turn the radio ON.
- 2 Connect the Rapid Travel Charger accessory connector to the handset. Check the following:
 - LCD display shows `charger connected`.
 - A beep is heard.
 - Keypad back-light is turned ON.
 - Charging icon is shown.
- 3 Connect the Vehicle Power Adapter (VPA) Charger accessory connector to the handset. Check the following:
 - LCD display shows `charger connected`.
 - Keypad back-light is turned ON.
- 4 Connect the handset to the Desktop Charger. Check the following:
 - LCD display shows `charger connected`.
 - A beep is heard.
 - Keypad back-light is turned ON.
 - Charging icon is shown.
- 5 Connect the handset to the USB Charger. Check the following:
 - LCD display shows `charger connected`.
 - Three beeps are heard.
 - Keypad back-light is turned ON.
 - Charging icon is shown.
- 6 Connect the handset to the MUC Charger. Check the following:
 - LCD display shows `charger connected`.
 - A beep is heard.
 - Keypad back-light is turned ON.
 - Charging icon is shown.
- 7 Verify that the battery charger is in progress.



NOTE: The process advance is indicated on the Battery Strength icon.

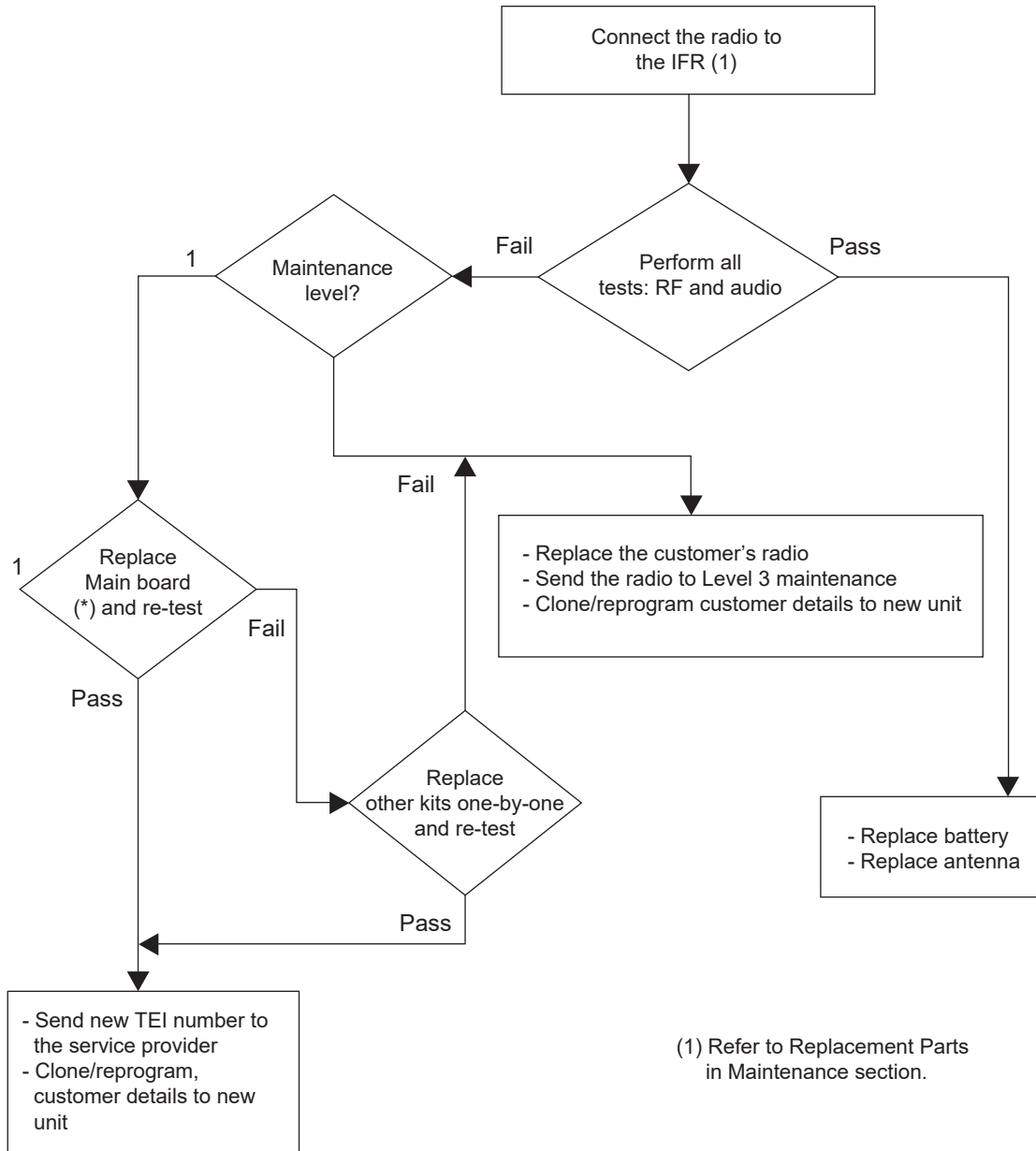
- 8 Press the **Power ON/OFF**.
 The radio turns OFF.

4.12

Service Flowchart

The service flowchart shows the expected results and their next required actions for the testing procedure of the radio.

Figure 5: Service Flowchart



Note: (*) Main Board – See Service Replacement Kit, in Appendix A. Not field replaceable for Latin America.

Chapter 5

Maintenance

This chapter provides information about the care and maintenance of this radio.

5.1

Preventive Maintenance

Periodic visual inspection and cleaning are recommended.

Inspection

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

Cleaning Procedures

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

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



CAUTION: Use all chemicals as prescribed by the manufacturer. Follow all safety precautions as defined on the label or material safety data sheet. The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners, and other chemicals.



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

Cleaning Radios Deployed to Chemical Environments

For radios exposed to environments with harmful chemicals to plastic, remove accessories and rinse the radio under a faucet of running water. Dry the radio thoroughly with a soft, lint-free cloth.

If the radio is continuously deployed to harmful chemical environments, you must frequently clean and thoroughly rinse the radio with clean water. Dry the radio thoroughly with a vacuum cleaner or lint-free cloth. You are recommended to clean your radio at least twice per shift.

If the battery contact area of the radio is exposed to water, thoroughly dry and clean the radio battery contacts before attaching a battery to the radio. Otherwise, the water can short circuit the radio.

If an accessory or a side connector cover is attached to the radio, check the interface after rinsing with water to ensure that water does not penetrate the seal. Water left at this interface can reduce the performance of accessories. When all parts are thoroughly dried, you can reattach the accessory or side connector cover.

Shake the radio briskly to remove water that is trapped inside the speaker grille and microphone port. Water reduces the audio quality of the radio.

After cleaning, test the talk/listen and button functions of your radio. This test confirms normal audio performance and optimal tactile performance.

Certain chemicals and vapor can harm plastic and metal plating. Do **not** use solvents or sprays to clean your radio.



NOTE: Regardless of the use-case scenario, this cleaning procedure does not guarantee the lifespan of the radio.

Vent Port Handling Precaution

The portable device has a vent port that allows for pressure equalization in the device. The pressure equalization vent is located at the battery compartment area. Never touch the equalization vent. Ensure that no oily substances come in contact with this vent. Never poke this vent with any objects, such as needles, tweezers, or screwdrivers. This create a leak path into the device and lost the submersibility of the device.

Care After Submersion

The radio (device with antenna and battery assembled) is IP67 compliant. It is fully protected from dust, and can withstand being submerged up to 30 minutes in one meter of static water.

If the device has been submerged in water, shake the device to remove any water that is trapped inside the speaker grille and microphone port. Otherwise, the water will decrease the audio quality and connectivity performance of the device.

Ensure that no water has penetrated the seal. Check the interface if any accessory or the Universal Connector Dust Cover is covering the Universal Connector and Bottom Connector. Water left in this interface can degrade the performance of the accessories.

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

MTP8500Ex and MTP8550Ex Replacement Parts List

The radio replacement parts list identifies all the serviceable components and part/kit numbers of the radio.

For complete information on ordering required parts and kits, contact your local customer service representative.

Table 16: MTP8500 and MTP8550 Replacement Parts List

No.	Part/Kit Number	Description	Remark
1	HW000183A01	Knob	Serviceable.

5.4

Accessories Replacement Parts List

For the latest accessories replacement parts list, refer to the *MTP8*** Ex Important Safety Instruction and Approved Accessory Booklet* (Part No: MN002135A01) or visit <https://learning.motorolasolutions.com/>.

5.5

Radio Disassembly and Reassembly

Mechanical checks and self-tests should be performed on the unit at the basic level of service.



NOTE: Read each procedure thoroughly before performing the actual task.

5.5.1

Torque Specification Chart

Use the recommended torque value in this chart when fastening different parts of the radio.

Table 17: Torques Specifications Chart

Description	Part/Kit	Quantity	Torque
SIM door screw (M2)	FN000114A01	2	Refer to PD003153A02 for Torque values.

5.5.2

Disassembling the Radio

Only Motorola Solutions Service Centers or Authorized Motorola Solutions Service Dealers can disassemble the radio for repair or maintenance.

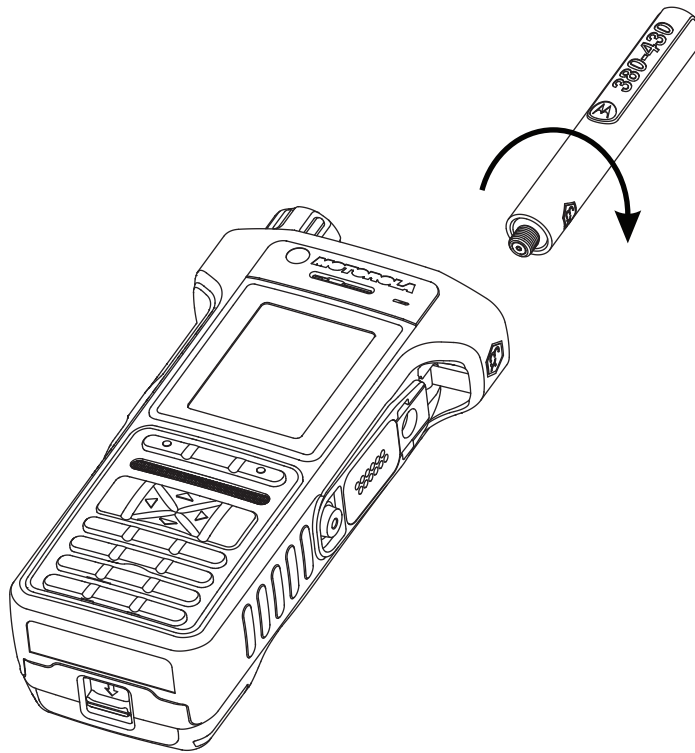
5.5.2.1

Removing the Antenna

Procedure:

Turn the antenna counter clockwise until it is detached from the radio.

Figure 6: Antenna Removal



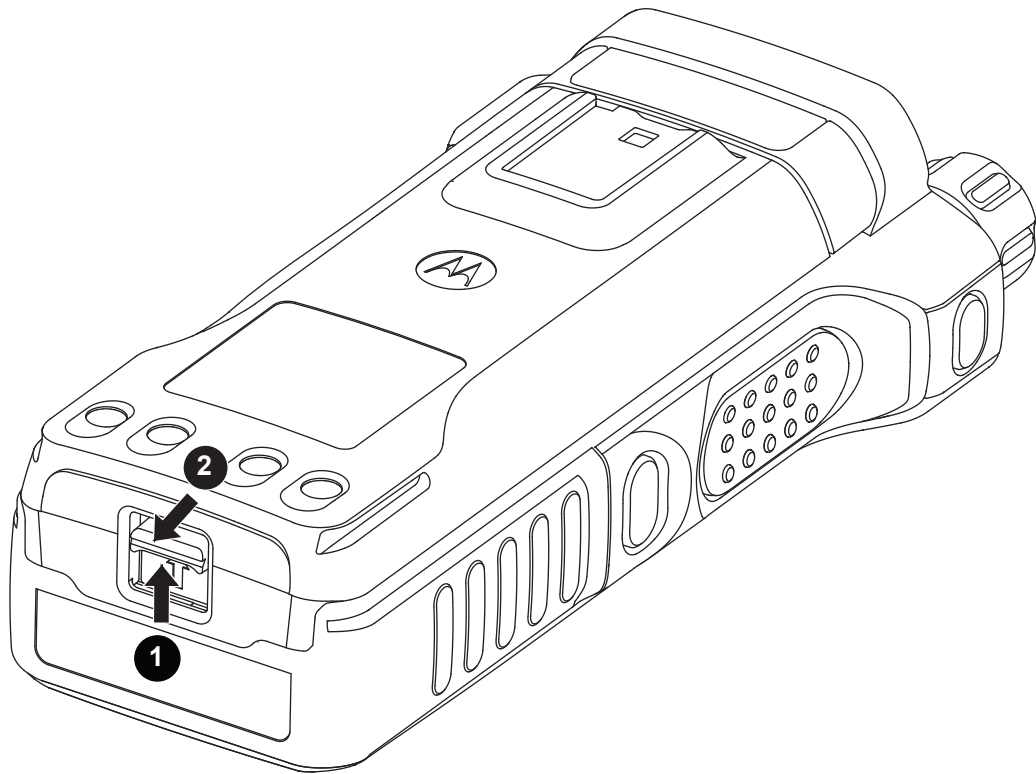
5.5.2.2

Removing the Battery

Procedure:

- 1 Place the unit facing down on the work area.
- 2 Lift the battery latch and slide the battery downwards away from the radio to remove the battery.

Figure 7: Battery Removal



Annotation	Description
1	Lift battery latch
2	Slide to remove battery

5.5.2.3

Removing the Dust Cover

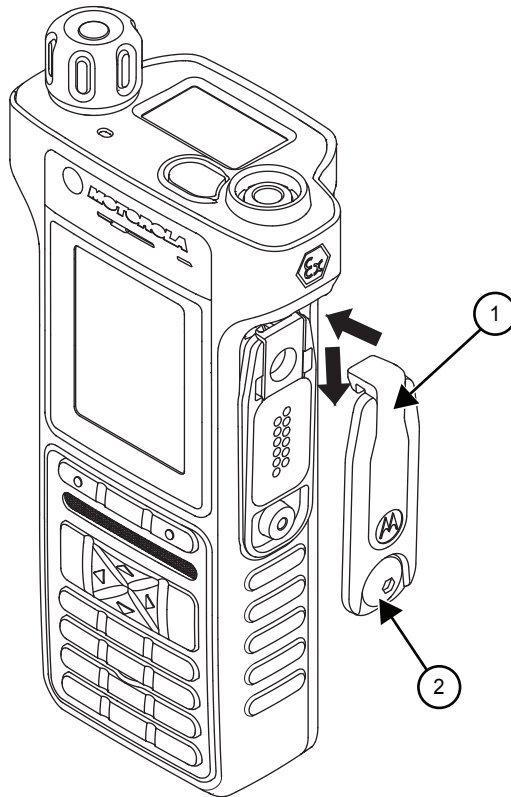
Prerequisites: Recommended tools:

- 3 mm hex key

Procedure:

- 1 Using the hex key, unscrew the dust cover thumb screw from the front housing.
- 2 Remove the dust cover while being cautious of the dust cover hook at the top of the front housing pocket.

Figure 8: Dust Cover Removal



Annotation	Description
1	Dust cover
2	Thumb screw

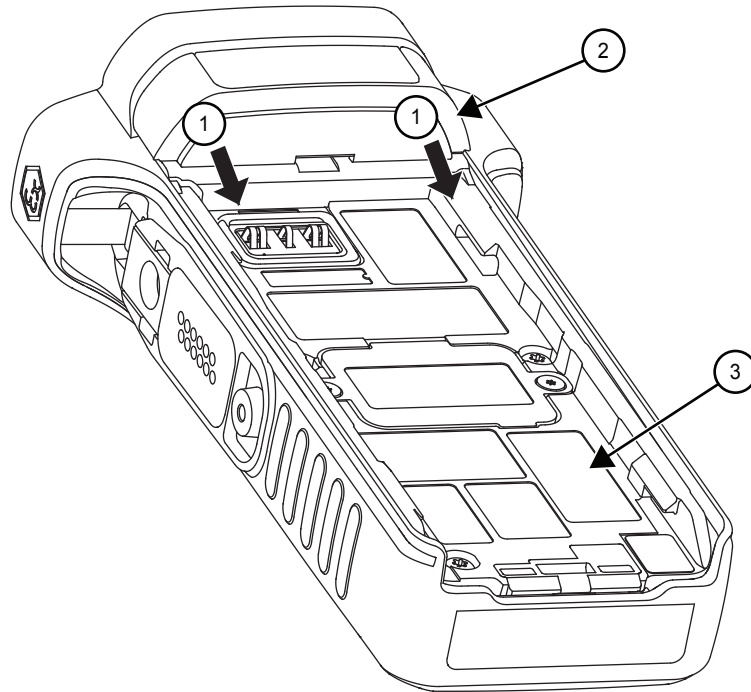
5.5.2.4

Removing the Back Cover Identification Kit

Procedure:

- 1 Using your finger, slide the back cover identification kit downwards from either left or right side.
- 2 Once one of the side is detached, slide the other side to fully remove the back cover identification kit from the back chassis.

Figure 9: Back Cover Identification Kit Removal



Annotation	Description
1	Left or right side
2	Back cover identification kit
3	Back chassis

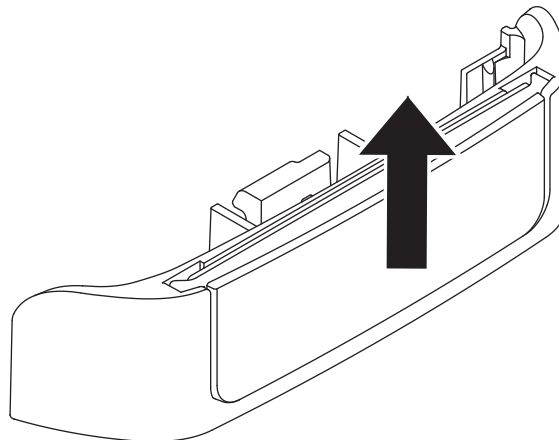
5.5.2.5

Removing the Back Cover Lens and Identification Tag

Procedure:

Slide the back cover lens upwards to remove the back cover lens and identification tag.

Figure 10: Back Cover Lens and Identification Tag Removal



5.5.2.6

Removing the SIM Card Door

Prerequisites:

Recommended tools:

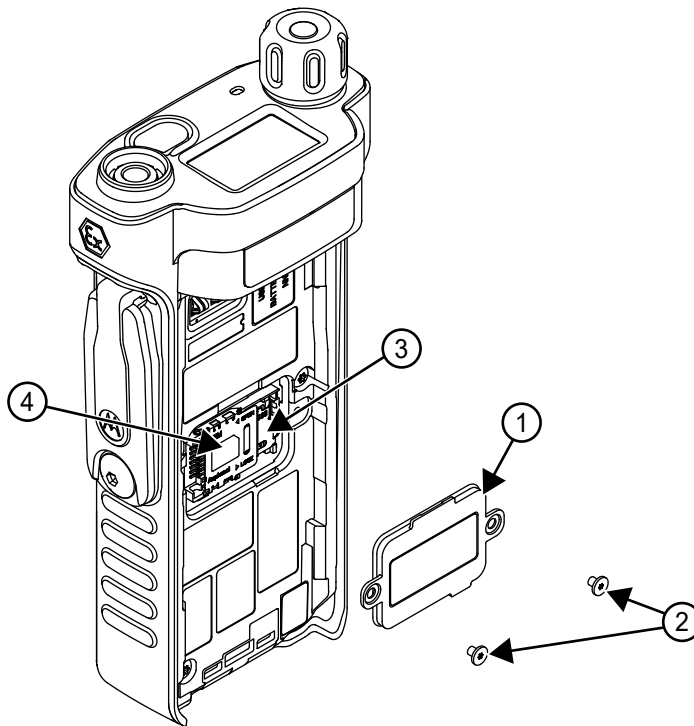
- T-5IP torx-plus bit
- Torx driver

Refer to the [Torque Specification Chart](#) for torque values.

Procedure:

- 1 Remove the battery.
- 2 Using the torx driver with the T-5IP torx-plus bit, unscrew the two screws fastening the SIM card door.
- 3 Remove the SIM card door from the back chassis.

Figure 11: SIM Card Door Removal



Annotation	Description
1	SIM card door
2	SIM card door screws

5.5.2.7

Removing the Knob

The procedures below are for removing the knob.

Option 1: Removing the Knob using the Knob Opener

Prerequisites: Recommended tools:

- Knob opener (Part number: TL000081A01)

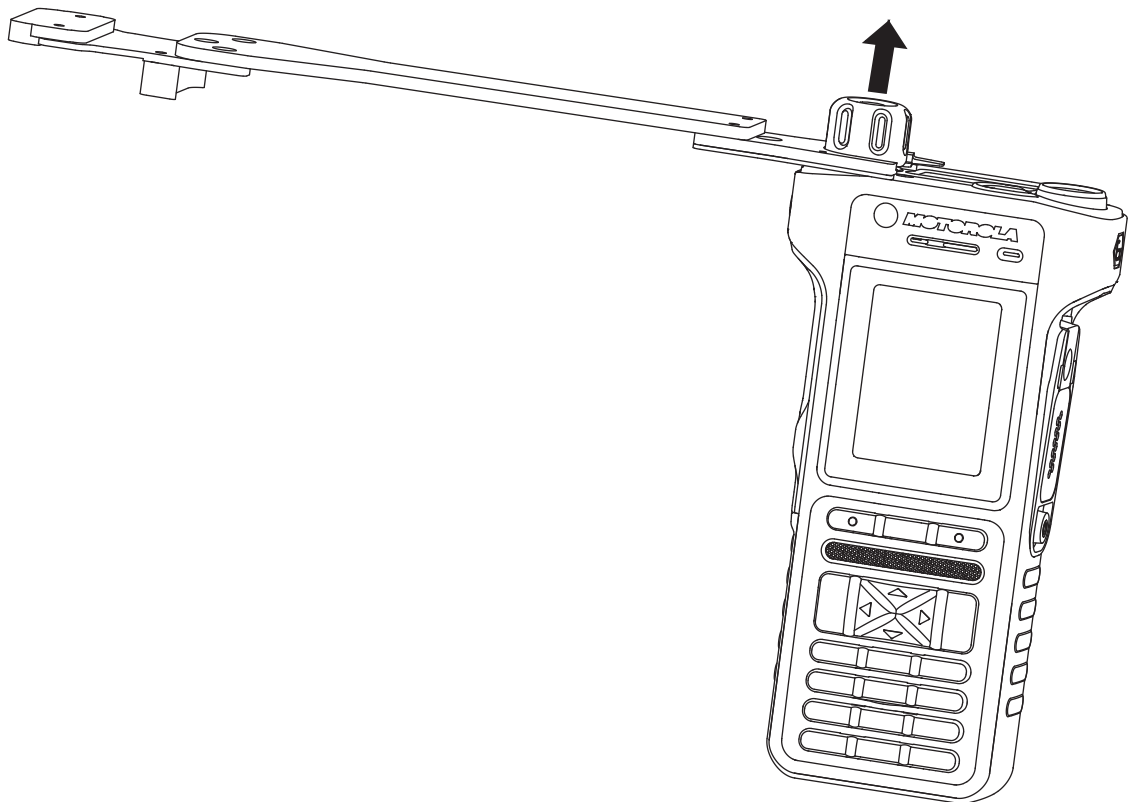
Procedure:

- 1 Hold the radio in one hand so that the top of the radio faces upward, and the front of the radio faces you.
- 2 With the other hand, slide the knob opener into the knob from the left. With the knob opener firmly latching onto the knob, push the knob upwards away from the encoder.



NOTE: Pay attention on the knob opener direction and the sequence of the knobs removal.

Figure 12: Knob Removal Using the Knob Opener

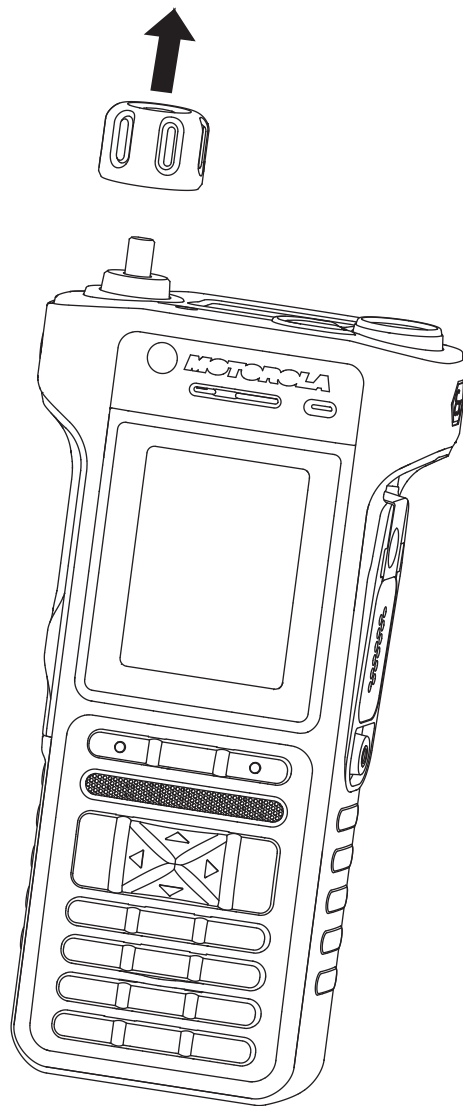


Option 2: Removing the Knob Manually

Procedure:

- 1 Hold the radio in one hand so that the top of the radio faces upward, and the front of the radio faces you.
- 2 Grasp the knob with the other hand and pull it upwards until the knob is free from the encoder.

Figure 13: Knob Removal Using Hand



5.5.3

Reassembling the Radio

Only Motorola Solutions Service Centers or Authorized Motorola Solutions Service Dealers can disassemble the radio for repair or maintenance.

5.5.3.1

Installing the Knob

Procedure:

- 1 Insert the knob vertically into their respective switches.



NOTE: Ensure the knob is pushed all the way into the respective switch.

5.5.3.2

Installing the SIM Card Door

Prerequisites:

Recommended tools:

- T-5IP torx-plus bit
- Torx driver

Refer to the [Torque Specification Chart](#) for torque values.

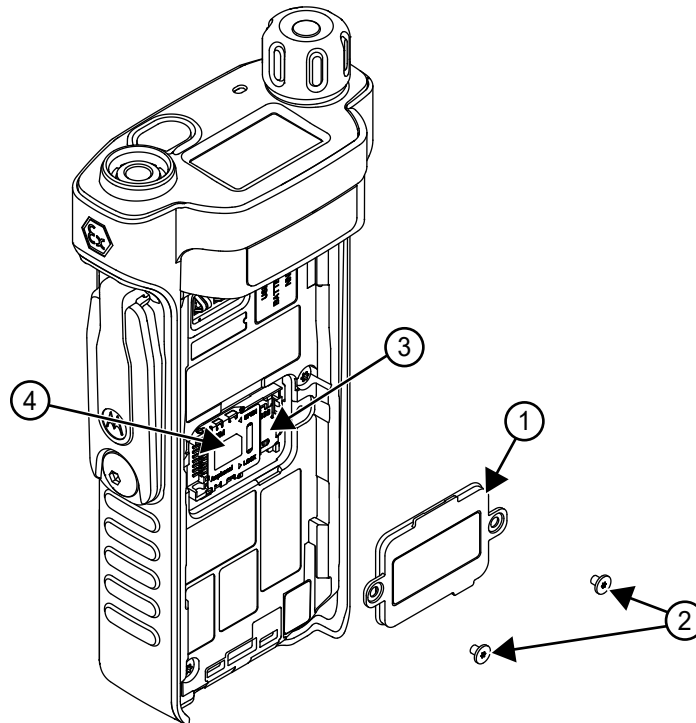


CAUTION: Insert the dummy SIM card into the SIM card connector before the SIM card door installation.

Procedure:

- 1 Visually inspect the SIM card door O-ring. Replace the SIM card door assembly if the O-ring is found torn or damaged.
- 2 Apply some grease¹ on the perimeter of the SIM card door O-ring.
- 3 Insert the SIM card door into the back chassis SIM opening. Ensure the SIM card door O-ring is not pinched.
- 4 Using the torx driver with the T-5IP torx-plus bit, tighten the two screws to fasten the SIM card door to the back chassis.

Figure 14: SIM Card Door Installation



Annotation	Description
1	SIM card door
2	SIM card door screws

¹ Part No: 1110027B23

Annotation	Description
3	Dummy SIM card
4	SIM card connector

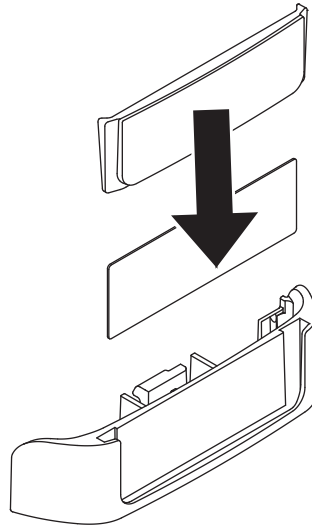
5.5.3.3

Installing the Back Cover Lens and Identification Tag

Procedure:

Place the identification tag with the back cover lens together, and slide downwards to install onto the back cover.

Figure 15: Back Cover Lens and Identification Tag Installation



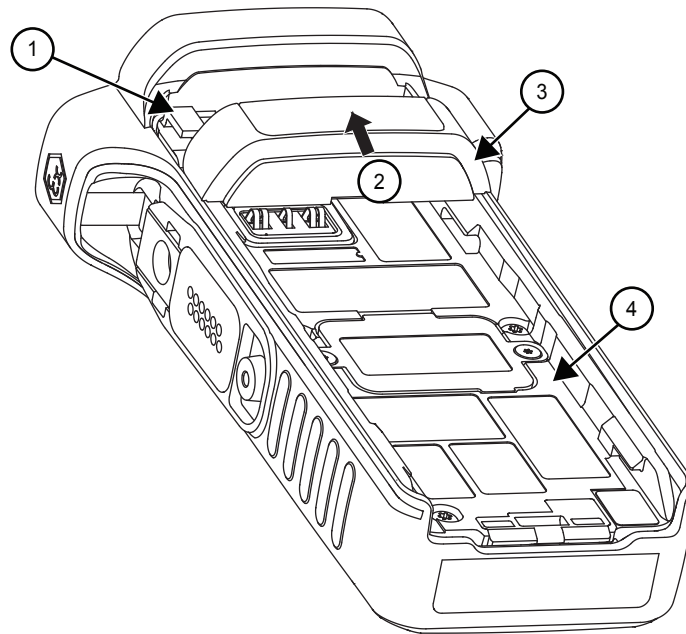
5.5.3.4

Installing the Back Cover Identification Kit

Procedure:

Slide the back cover identification kit upwards along the grooves on the back chassis.

Figure 16: Back Cover Identification Kit Installation



Annotation	Description
1	Grooves
2	Slide the back cover identification kit upwards
3	Back cover identification kit
4	Back chassis

5.5.3.5

Installing the Dust Cover

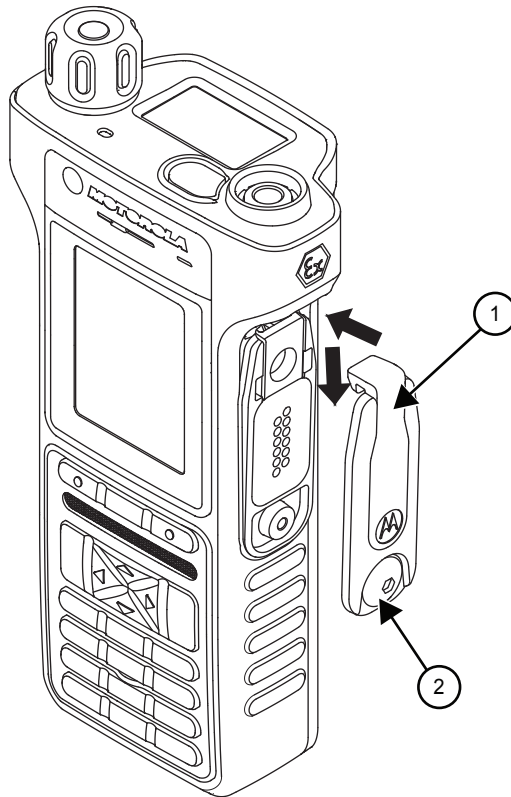
Prerequisites: Recommended tools:

- 3 mm hex key

Procedure:

- 1 Hook the dust cover onto the front housing pocket.
- 2 Using the hex key, fasten the dust cover screw to the front housing.

Figure 17: Dust Cover Installation



Annotation	Description
1	Dust cover
2	Thumb screw

5.5.3.6 Installing the Seal Port or Gore Membrane

Prerequisites:

Use the recommended tools:

- Plastic tweezers
- Seal Port Hand-Press Jig TL000151A01

Procedure:

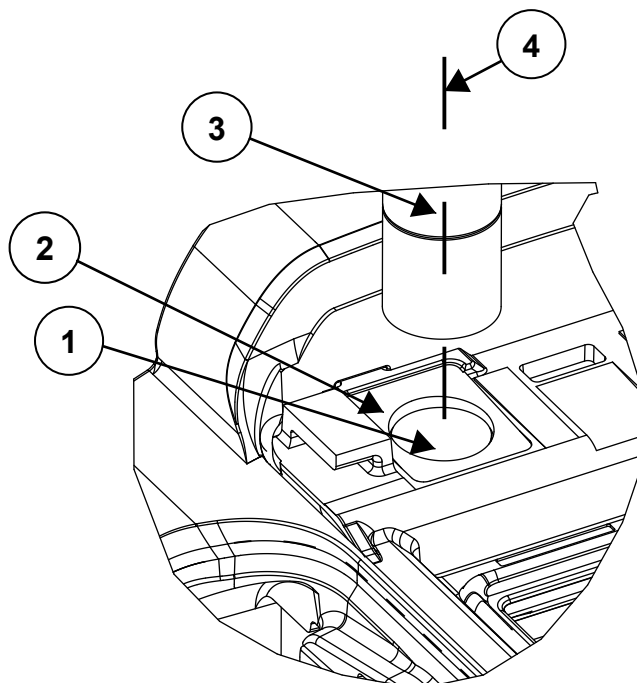
- 1 Damp a lint-free cloth with Isopropyl Alcohol (IPA).
- 2 Using plastic tweezers, clean the seal port recess with the damped lint-free cloth until the inside of the recess is free of foreign material.
- 3 When the seal port recess is clean and dry, assemble a new gore membrane with clean plastic tweezers.
- 4 Gently press down the gore membrane with a hand-press jig, TL000151A01, for about 10 seconds.

The pressed mark is visible on the activated gore membrane.

Figure 18: Hand-Press Jig



Figure 19: Vertical Pressure to the Gore Membrane



Annotation	Description
1	Seal port or gore membrane
2	Back chassis
3	Hand-press jig
4	Alignment and vertical pressure of the hand-press jig to the gore membrane

- 5 Slide the back cover upwards along the grooves on the back chassis.

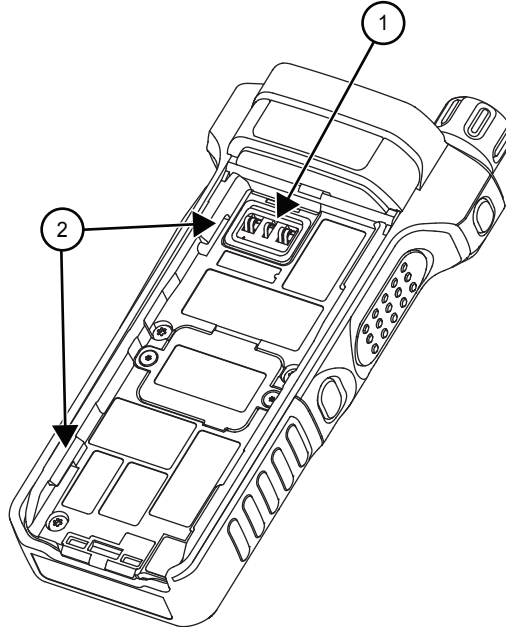
5.5.3.7

Attaching the Battery

Procedure:

- 1 Align the top fastening bridge of the battery to the top fastening bridge on the radio.

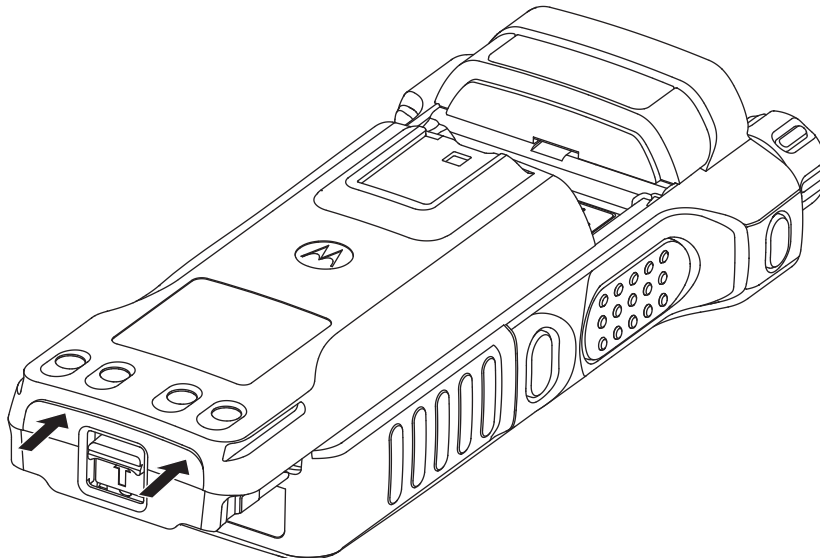
Figure 20: Location of Fastening Bridge and Battery Contacts



Annotation	Description
1	Battery contacts
2	Fastening bridge

- 2 Slide the battery in from the bottom towards the top of the radio until it clicks into place.

Figure 21: Battery Installation



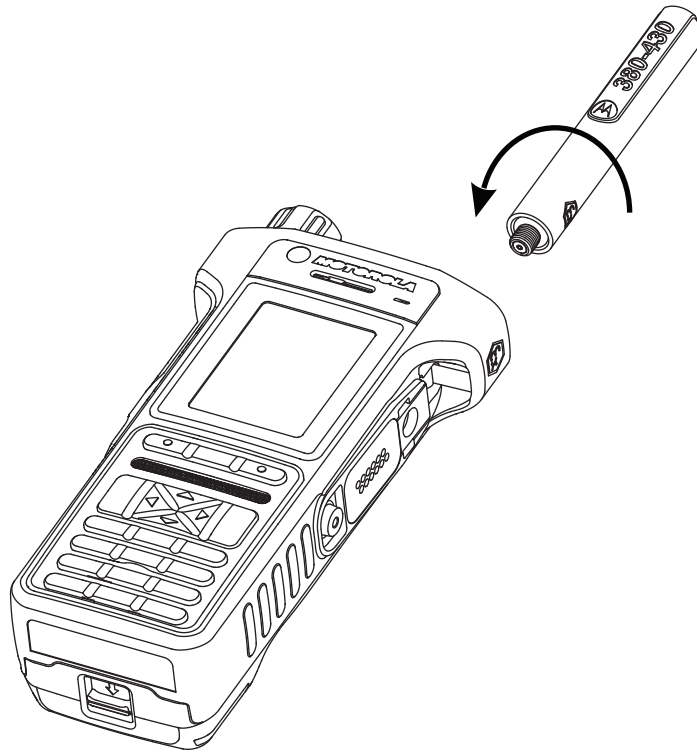
5.5.3.8

Installing the Antenna

Procedure:

Tighten the antenna clockwise to the radio.

Figure 22: Installing the Antenna



Appendix A

Service Information

Only Motorola Solutions I.S. trained personnel who are aware of the special parts required and the procedures necessary to maintain the ATEX/IECEX conformance of the product can repair Motorola Solutions ATEX/IECEX certified radios. The Motorola Solutions internal service centers undergo regular training and receive a Motorola Solutions internal certification that enables them to conduct ATEX repairs.

Refer to [Repair](#) on page 12 for more details.

Level 1 Maintenance

This manual covers Level 1 Maintenance.

You replace the transceiver and/or accessories and send the faulty transceiver and/or accessories to higher level of maintenance.

The radios are programmed at the factory. They cannot be tuned at the field service level.

Level 2 and Level 3 Maintenance

Level 2 and Level 3 Maintenance can only be done at the Motorola Solutions Service Center/Depot. To find out more about Motorola Solutions Service Center, visit <http://www.motorolasolutions.com/>.



NOTE:

For radios that are stored for more than 6 months in Distribution Center, it is recommended to stimulate the radios registration or link to Base Station. Refer to [Test Setup and Testing](#) on page 32. Repeat for every 6 months for radios that continued to be kept in storage.

Replacement Parts

Damaged parts are replaced with identical replacement parts. For complete information on ordering required parts and kits, contact your local customer service representative.

A.1

Service Information

Technical & Repair Support (for Contracted Customers Only)

If you would like to contact the Motorola Solutions Customer Care team, use the appropriate contact details below. Please be prepared to provide your contract number, product serial numbers, and detailed issue description for a faster response and a resolution. If the support request is Technical Support related, the request will be handled by the Technical Support Operations (TSO) team. This team of highly skilled professionals provides Technical Support to help resolve technical issues and quickly restore networks and systems. If you are unsure whether your current service agreement entitles you to benefit from this service, or if you would like more information about the Technical or Repair Support Services, contact your local customer support or account manager for further information.

Contact Details

Technical Requests: techsupport.emea@motorolasolutions.com

Repair Support: repair.emea@motorolasolutions.com

Contact Us: https://www.motorolasolutions.com/en_xu/support.html

Parts Identification and Ordering

If you need help with identifying non-referenced spare parts, direct a request to the Customer Care Organization of a local area Motorola Solutions representative. Orders for replacement parts, kits, and assemblies should be placed directly at the local distribution organization of Motorola Solutions.

However, you cannot order export-controlled products or spare parts such as TEA-related boards through Motorola Online. Send an order form with actual end-customer details by e-mail to your customer care team.

A.2

Recommended Programming Equipment

Table 18: Recommended Programming Equipment

Name	Part Number
Customer CPS User Guide	6802974C10
Boot Programming/USB Data Cable Ex	PMKN4158_
RS-232 Programming cable Ex (set cable switch to FLASH)	PMKN4159_
USB Data Cable Ex	PMKN4160_
E2EE KVL Cable Ex	PMKN4161_

Appendix B

Service Aids

This section lists the test equipments required to service the radio.

Table 19: Service Aids List

Name	Part Number
Anritsu Digital Signal Generator ²	MG3660A
Power Meter ²	HP437B
Power Supply ²	HP6032A
Universal Multimeter ²	HP3457A
RF Probe ²	HP85024A
Spectrum Analyzer ²	HP8560E
R&S Audio Analyzer ²	UPL16
IFR System ²	2968/3920/3901/3902
Multichannel GPS simulator ²	Spirent STR4500
Battery Eliminator	PMLN7407_
USB Programming Cable Ex	PMKN4160_
Serial Data Cable	PMKN4159_
Chassis Opener	TL000081A01
Seal Port Hand-Press Jig	TL000151A01

² This test equipment is not provided by Motorola Solutions. You are required to obtain the equipment from external vendors. Any other equipment of equivalent specifications can be used as well.

Glossary

Advanced RISC Machine (ARM) A processor architecture based on a 32-bit reduced instruction set (RISC) computer.

Air Interface Encryption (AIE) Provides confidentiality on the radio link over the air.

Algebraic Code Excited Linear Prediction A speech (or other audio signals) encoding algorithm where a limited set of pulses is distributed as excitation to linear prediction filter.

| **Abbreviation:** ACELP

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

Analog-to-Digital Converter A device that converts analog signals into digital data. Also known as codec.

| **Abbreviation:** ADC

Automatic Gain Control (AGC) A process or means by which gain is automatically adjusted in a specified manner as a function of a specified parameter, such as received signal level.

BALUN Balanced-unbalanced converter.

Band Frequencies allowed for a specific purpose.

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

CMOS Complementary Metal-Oxide Semiconductor

Co-uP Co-Processor

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

Default A pre-defined set of parameters.

Differential Quadrature Phase Shift Keying (DQPSK) A sub-class of the QPSK methods of transmitting data. Rather than using the absolute value of phase (as in QPSK), only the difference between the current value of phase and the previous value of phase are used. By using phase differences, the implementation is simpler (since an absolute reference source is not required).

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-to-Analog Converter A device that converts a digital value to a corresponding dc voltage value.

| **Abbreviation:** DAC

Digital Signal Processor (DSP) A special-purpose microprocessor that can perform math calculations very rapidly.

Electrically Erasable Programmable Read-Only Memory (EEPROM) Integrated circuit used to store data, which can be erased by electrical methods.

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).

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

Global Core Accessory Interface
Motorola Solutions proprietary accessory port for use with Motorola Solutions approved cables. USB and RS232 styles supported.

| **Abbreviation:**GCAI

Global Navigation Satellite System A standard generic term for satellites orbiting the Earth to determine the geographical location. GNSS uses satellites from the GPS, GLONASS, Galileo, and BeiDou systems.

| **Abbreviation:**GNSS

Global Positioning System (GPS) System of 24 satellites that identify earth locations, launched by the U.S. Department of Defense. By triangulating signals from three of the satellites, a GPS receiving unit can pinpoint its current location anywhere on earth to within a few meters.

Input Output For computers, bi-directional input/output (I/O) ports couple the micro-controller to external devices. This interface can operate in parallel or serial form and is usually digital (0 to +5Vdc) logic. Parallel interfaces allow I/O data transfer of eight bits at a time to parallel ports on the micro-controller. The technology is typically used to transfer data between the micro-controller and the external logic it controls. Screen reader support enabled.

| **Abbreviation:**I/O

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.

integrated Terminal Management
integrated Terminal Management in Motorola Solutions Dimetra radio systems.

| **Abbreviation:**iTM

Intermediate Frequency A range of frequent audio and radio frequencies.

| **Abbreviation:**IF

Joint Test Action Group Same as IEEE std 1149.1a, which defines signals and behavior for serial testing.

| **Abbreviation:**JTAG

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

LDMOS Laterally Diffused Metal Oxide Semiconductor

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

Local Oscillator A tunable oscillator used in a radio or TV receiver to select a particular channel for reception.

| **Abbreviation:**LO

Low Noise Amplifier (LNA) The main amplifying unit in the receiver.

Low-Pass Filter A filter that passes only frequency components lower than a certain frequency.

| **Abbreviation:**LPF

Man Machine Interface (MMI) An interface that enables information to be passed between a human user and hardware or software components of a computer system.

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

Phase-locked Loop (PLL) A circuit in which an oscillator is kept in phase with a reference, usually after passing through a frequency divider.

Printed Circuit Board (PC Board) A circuit manufactured so that many or all of the components are attached to a non-conductive

circuit board with copper strips on one or both sides to replace wires.

Programming Cable A cable that allows the computer to communicate directly with certain radios using USB.

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

Radio Frequency Power Amplifier Amplifier having one or more active devices to amplify radio signals.

| **Abbreviation:**RFPA

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.

Request-To-Send In General Packet Radio Service (GPRS), a handshaking signal used with some communication links to indicate that data is ready for transmission.

| **Abbreviation:**RTS

RESET Reset line; an input to the microcontroller that restarts execution.

Signal An electrically transmitted electromagnetic wave.

SLIM Slim Connector

Spectrum Frequency range within which radiation has specific characteristics.

Static Random Access Memory Static-RAM chip used for volatile, program/data memory.

| **Abbreviation:**SRAM

Subscriber Identity Module A smart card that holds subscriber information (including the authentication key) and is inserted into the radio to grant its personality.

| **Abbreviation:**SIM

System-On-a-Chip An integrated circuit with all the required circuitry and components of an electronic system on a single chip.

| **Abbreviation:**SoC

Time Division Multiple Access (TDMA) A channel access method to allow several users to share the same frequency channel by dividing the signal into different time slots

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.

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

Voltage Controlled Oscillator (VCO) An oscillator whereby the frequency of oscillation can be varied by changing a control voltage.