



MTP850

TETRA Handportable Terminal
380-430 MHz (PT911B)
806-870 MHz (PT711B)

Basic Service Manual

Part Number: 6866537D77-F



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SAFETY

Product Safety and RF Exposure for Portable Two-Way Radios

THIS CHAPTER IS AN EXTRACT OF THE MULTI LINGUAL PORTABLE SAFETY BOOKLET PUBLICATION No. 6864117B25. FOR THE LATEST SAFETY INFORMATION REFER TO THE SEPARATE SAFETY BOOKLET DELIVERED WITH YOUR RADIO.



Caution

BEFORE USING THIS RADIO, READ THIS BOOKLET WHICH CONTAINS IMPORTANT OPERATING INSTRUCTIONS FOR SAFE USAGE AND RF ENERGY AWARENESS AND CONTROL INFORMATION AND OPERATIONAL INSTRUCTIONS FOR COMPLIANCE WITH RF ENERGY EXPOSURE LIMITS IN APPLICABLE NATIONAL AND INTERNATIONAL STANDARDS. ALSO READ THE OPERATIONAL INSTRUCTIONS FOR SAFE USAGE. FOR RADIOS THAT HAVE BEEN APPROVED AS INTRINSICALLY SAFE, READ THE INSTRUCTIONS AND INFORMATION ON INTRINSIC SAFETY ON PAGE VIII.

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

NOTICE: 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. Very 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 two-way radios are designed, manufactured, and tested to ensure 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.

Please 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>

Federal Communication Commission (FCC) Regulations (US markets only)

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for portable 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. Exposure awareness can be facilitated by the use of a product label directing users to specific user awareness information. Your Motorola two-way radio has a RF Exposure Product Label. Do not remove this RF Exposure Label from the device. Also, your Motorola user manual, or separate safety booklet includes information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

Compliance with RF Exposure Standards

Your Motorola two-way radio is designed and tested to comply with a number of national and International standards and guidelines (listed below) for human exposure to radio frequency electromagnetic energy. **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 and is authorized by the IEEE/ICNIRP for occupational use only.**

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.**

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.

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

- United States Federal Communications Commission, Code of Federal Regulations; 47 CFR part 2 sub-part J
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard, 2003
- ANATEL ANNEX to Resolution No. 303 of July 2, 2002 "Regulation of limitation of exposure to electrical, magnetic and electromagnetic fields in the radio frequency range between 9 KHz and 300 GHz" and "Attachment to resolution # 303 from July 2, 2002"

RF Exposure Compliance and Control Guidelines and Operating Instructions

To control your exposure and ensure compliance with the occupational/controlled environment exposure limits, always adhere to the following procedures:

Guidelines:

- User awareness instructions should accompany device when transferred to other users.
- Do not use this device if the operational requirements described herein are not met.

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. Transmitting 50% of the time, or less, is important because this radio generates measurable RF energy exposure only when transmitting (in terms of measuring for standards compliance).
- When worn on the body, always place the radio in a Motorola-approved clip, holder, holster, case, or body harness for this product. Using approved body-worn accessories is important because the use of non-Motorola-approved accessories may result in exposure levels, which exceed the IEEE/ICNIRP occupational/controlled environment RF exposure limits.
- If you are not using a body-worn accessory and are not using the radio in the intended use position, along side the head in the phone mode (TETRA only), in front of the face in the hand held mode, then ensure the antenna and the radio are kept 2.5 cm (one inch) from the body when transmitting. Keeping the radio at a proper distance is important because RF exposures decrease with increasing distance from the antenna.

Hand-held Mode - Operating Instructions:

- 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. Antenna should be kept away from the eye. Keeping the radio at a proper distance is important since RF exposures decrease with increasing distance from the antenna.



Phone Mode (TETRA only) - Operating Instructions:

- When placing or receiving a phone call, hold your radio product as you would a wireless telephone. Speak directly into the microphone.

Approved Accessories

- Use only Motorola-approved supplied or replacement antennas, batteries, and accessories. Use of non-Motorola - approved antennas, batteries and accessories may exceed IEEE/ICNIRP RF exposure guidelines. For a list of Motorola-approved antennas, batteries, and other accessories please see your dealer or local Motorola contact. Your nearest dealer can be found at the following web site:

<http://www.motorola.com/governmentandenterprise/wemea/en-gb/public/functions/dealerlocator/dealerlocator.aspx>

Additional Information

For additional information on exposure requirements or other training information, visit

<http://www.motorola.com/rfhealth>

Electromagnetic Interference/Compatibility

NOTE: Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or otherwise configured for electromagnetic compatibility.

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.

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.

Medical Devices

Pacemakers

The Advanced Medical Technology Association (AdvaMed) recommends that a minimum separation of 15 centimeters (6 inches) be maintained between a handheld 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 centimeters 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 for 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.

Use of Communication Devices While Driving

Always check 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 vehicle manufacturer's manual prior to installation of electronic equipment to avoid interference with air bag wiring.

Do not place a portable radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a portable 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 prior to entering any area with a potentially explosive atmosphere, unless it is a radio type especially qualified for use in such areas as "Intrinsically Safe" (for example, Factory Mutual, CSA, UL, CENELEC or ATEX 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 referred to above include fuelling 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

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

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

Intrinsically Safe Radio Information

The Intrinsically safe approval unit refers to a product that has been approved as intrinsically safe by an approval agency (for example FM Approvals, CSA, UL, CENELEC or ATEX) and certifies that a particular product meets the Agency's applicable intrinsic safety standards for specific types of hazardous classified locations. A portable radio that has been approved for intrinsic safety will have Approval label attached to the radio to identify the unit as being Approved for specified hazardous atmospheres. This label specifies the hazardous Class/Division/Group along with the part number of the battery that must be used. The Intrinsically Safe Approval Label will be located on the portable radio unit.

Operational Cautions for Intrinsic Safe Equipment



Caution

- Do not operate radio communications equipment in a hazardous atmosphere unless it is a type especially qualified (for example, FM, UL, CSA, or CENELEC or ATEX 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.

Operational Cautions for Intrinsic Safe Equipment

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

A modification changes the unit's hardware from its original design configuration. Modifications can only be made by the original product manufacturer.



WARNING

- **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 the radio off 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 specifically approved 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 will negate 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



REPAIRS FOR MOTOROLA PRODUCTS WITH INTRINSICALLY SAFE APPROVAL ARE THE RESPONSIBILITY OF THE USER.

- **Repairs to a Motorola 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 for assistance regarding repairs and service of Motorola intrinsically safe equipment.**

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

Items not considered as repairs are those 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.

Do Not Substitute Options or Accessories

The Motorola communications equipment certified as intrinsically safe by the approving agency, (FM, UL, CSA, CENELEC or ATEX) 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 communications equipment unit. Approved configurations are listed by the Approving Agency (FM, UL, CSA, CENELEC or ATEX).

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

The manual PN 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 intrinsically safe battery and or accessory with the Motorola approved radio unit will void the intrinsically safe approval of that radio unit.

European Union Directives Conformance Statement

This product is in conformance with the TETRA (TErrestrial Trunked RAdio) standard.
This product is in conformance with the requirements of the applicable EU Council Directives.
Declarations of Conformance with the requirements are located at:

Motorola a/s
Sydvestvej 15
DK-2600 Glostrup

Denmark

Notes

DOCUMENT HISTORY

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

| Edition | Description | Date |
|--------------|--|-----------|
| 6866537D77-A | Initial edition | June 2005 |
| 6866537D77-B | Chapter Test Setup & Testing: Note added for battery eliminator. | Aug. 2005 |
| | Chapter Maintenance: Note added for Bottom Connector cleaning. Exploded Views and related tables updated. | |
| | App. A: Service Replacement Kit Matrix updated. | |
| 6866537D77-C | New frequency range 380–430MHz added. Publications list updated chapter scope. Recommended Programming Equipment & Service Replacement Kit Matrix updated Appendix A (page A-6 & 7). Chapter Maintenance: Replacement Part Table updated with Motorola Logo Label. | May 2006 |
| 6866537D77-D | Updated 380–430MHz Full Band radio information (new design for Receiver & GPS). | Dec. 2007 |
| 6866537D77-E | Appendix A: Updated service tanapa list. | Apr. 2008 |
| 6866537D77-F | Added information for the new 1.8 Watt radio. | July 2009 |

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CHAPTER 1

SCOPE & WARRANTY

Scope of this Manual

This manual contains information necessary to test and maintain the MTP850 TETRA Handportable Terminal at the module level. It also contains information on radio assembling and disassembling. Accordingly, information in this manual is divided into the following sections:

- Copyright
- Safety
- Contents
- Document History
- CHAPTER 1 Scope & Warranty
- CHAPTER 2 Model Information
- CHAPTER 3 Overview
- CHAPTER 4 Programming the Radio
- CHAPTER 5.1 Test Setup & Testing 380-430 MHz
- CHAPTER 5.2 Test Setup & Testing 806-870 MHz
- CHAPTER 6 Maintenance
- APPENDIX A Service Information
- APPENDIX B Connector Pin Functions

Manual Revisions

Changes which occur after this manual is printed are described in Manual Revisions. These Manual Revisions provide complete information on changes including pertinent parts listing data.

Related EMEA Publications (Europe, Middle East and Africa Region)

- 6866537D79 MTP850 Basic User Guide (EN / DE / FR / ES / NL)
- 6866539D03 MTP850 Basic User Guide (EN / PL / EL / RU / AR / MK)
- 6866539D04 MTP850 Basic User Guide (EN / IT / SV / NO / PT-BR / DA)
- 6866539D52 MTP850 Basic User Guide (EN / HU / LT / HR)
- 68015000027 MTP850 Basic User Guide - EN
- 68015000026 MTP850 Basic User Guide - FR
- 68015000025 MTP850 Basic User Guide - ES
- 68015000024 MTP850 Basic User Guide - PT-BR
- 68015000014 MTP850 Basic User Guide - IT
- 68015000023 MTP850 Basic User Guide - DE
- 68015000010 MTP850 Basic User Guide - NL
- 68015000008 MTP850 Basic User Guide - SV
- 68015000006 MTP850 Basic User Guide - NO
- 68015000028 MTP850 Basic User Guide - DA
- 68015000004 MTP850 Basic User Guide - RU
- 68015000021 MTP850 Basic User Guide - MK
- 68015000020 MTP850 Basic User Guide - EL
- 68015000019 MTP850 Basic User Guide - PL
- 68015000018 MTP850 Basic User Guide - HR
- 68015000017 MTP850 Basic User Guide - LT
- 68015000016 MTP850 Basic User Guide - HU
- 68015000022 MTP850 Basic User Guide - AR
- 6866537D80 MTP850 Feature User Guide - English
- 6866539D53 MTP850 Feature User Guide - EN, HU
- 6866537D28 MTP850 Feature User Guide - EN, DE
- 6866537D27 MTP850 Feature User Guide - EN, DA
- 6866537D21 MTP850 Feature User Guide - EN, HR
- 6866537D20 MTP850 Feature User Guide - EN, MK
- 6866537D83 Accessory Leaflet - English
- 68015000002 TETRA Terminals Product Information Manual - English
- 6866537D77 MTP850 Basic Service Manual - English
- 6866537D78 MTP850 806-870MHz Detailed Service Manual - English
- 6866539D07 MTP850 380-430MHz Detailed Service Manual - English
- 6802974C10 MTP850 CPS Start Up Guide - English
- 6866539D55 TETRA CPS Start-up User Guide - EN, HU
- 6866588D27 TETRA CPS Start-up User Guide - EN, DE
- 6866588D36 TETRA CPS Start-up User Guide - EN, IT
- 6864117B25 EMEA Portable Safety Booklet - Multilingual

- IFR-Operational Manual Supplement 46882-324
- IFR-Operational Manual 46882-274T

Related APAC Publications (Asia Pacific Region)

- 6815687H01 MTP850 Basic User Guide - English, Traditional Chinese
- 6815688H01 MTP850 Basic User Guide - English, Simplified Chinese
- 6815689H01 MTP850 Basic User Guide - English, Korean
- 6815690H01 MTP850 Feature User Guide - Traditional Chinese
- 6815691H01 MTP850 Feature User Guide - Simplified Chinese
- 6815682H01 MTP850 Feature User Guide - Korean
- 6866537D83 Accessory Leaflet - English
- 68015000002 TETRA Terminals Product Information Manual - English
- 6815897H01 MTP850 Basic Service Manual - English
- 6815899H01 MTP850 Detailed Service Manual - English
- 6815621H01 CPS Start Up Manual - Traditional Chinese
- 6815625H01 CPS Start Up Manual - Simplified Chinese
- 6815626H01 CPS Start Up Manual - Korean
- 6804113J24 APAC/LACR TETRA Portable Safety Booklet - Multilingual
- IFR-Operational Manual Supplement 46882-324
- IFR-Operational Manual 46882-274T

Warranty and Service Support

Motorola offers long term support for its products. This support includes full exchange and/or repair of the product during the warranty period, and service/ repair or spare parts support out of warranty. Warranty Period and Return Instructions

The terms and conditions of warranty are defined fully in the Motorola Dealer or Distributor or Reseller contract. These conditions may change from time to time and the following notes are for guidance purposes only. In instances where the product is covered under a “return for replacement” or “return for repair” warranty, a check of the product should be performed prior to shipping the unit back to Motorola. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

Prior to shipping any radio back to the appropriate Motorola warranty depot, please contact Customer Resources or your Motorola dealer, distributor or reseller. All returns must be accompanied by a Warranty Claim Form, available from your Customer Service representative or Motorola Online Extranet (MOL) or your Motorola dealer, distributor or reseller (refer to list in Appendix A). 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 continues to support its products in two ways.

- Motorola's Regional Radio Support Centers offer a repair service to both end users and dealers at competitive prices.
- AAD supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.

CHAPTER 2 MODEL INFORMATION

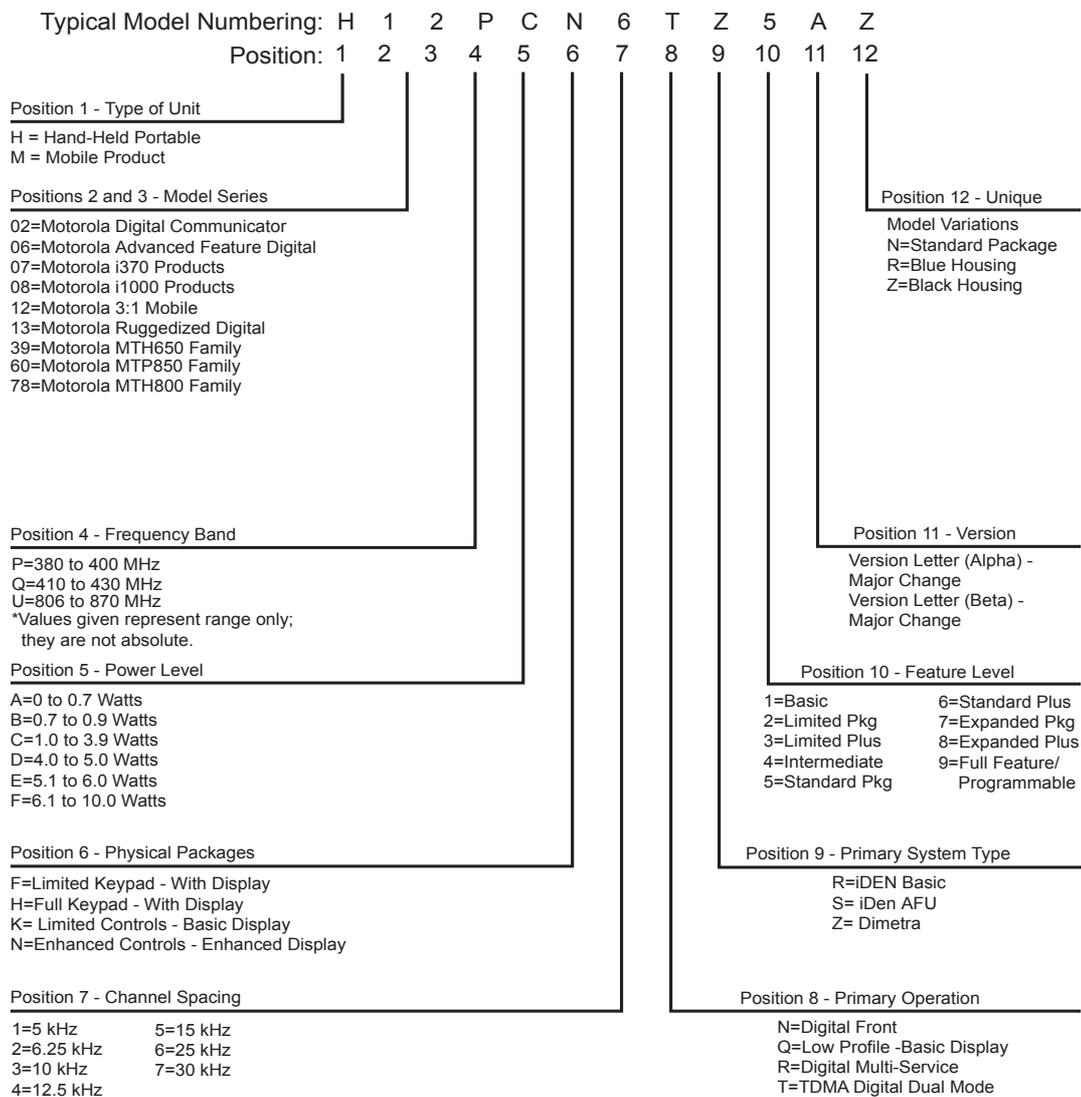
MTP850 Model Information

This manual applies to the following MTP850, 1 W and 1.8 W, TETRA Handportable Terminal model:

H60UCN6TZ5AN, 806–870 MHz

H60PCN6TZ5AN, 380–430 MHz

MODEL NUMBERING SYSTEM



MTP850 Model Specifications

| GENERAL | | RECEIVER | | TRANSMITTER | |
|---|--|---|--|--|---|
| ETSI | ETS 300 019-1-7 | Receiver Type: | Class A and B | Modulation Type: | $\pi/4$ DQPSK |
| Type Number: | 806–870 MHz 380–430 MHz | Frequency Range: | 851–870 MHz 380–430 MHz | RF Power: | 1 Watt 1.8 Watt |
| Temperature Range for Transceiver: | | Channel Spacing: | 25 kHz | Frequency Range 800MHz: | TMO 806–825 MHz DMO 851–870 MHz |
| Operating: | -30 °C to +60 °C | Sensitivity (4%) BER: | -112 dBm (1 W radio) -114 dBm (1.8 W radio) | Frequency Range 380MHz: | TMO 380–430 MHz DMO 380–430 MHz |
| Storage: | -40 °C to +85 °C | Intermodulation: Interfering Signal Level: | (4%) BER -47 dBm | Frequency Stability: | Locked to Base ± 100 Hz Not Locked to Base ± 1000 Hz |
| Battery Types: Standard | FTN6573A 950mAh (Li Ion) - not available for 1.8W radio FTN6574A UltraHigh 1850mAh (Li Ion) | Selectivity Blocking: (50–100 kHz) Interfering Signal Level: | (4%) BER -40 dBm | Spurious Emissions: | |
| Battery Voltage: | | Spurious Rejection: Interfering Signal Level: | (4%) BER -45 dBm | Conducted | 30MHz–1GHz -36dBm 1GHz–12.75GHz -30dBm |
| Minimum: | 3.2 Vdc | Frequency Stability: | | Radiated | 30MHz–1GHz -36dBm 1GHz–12.75GHz -30dBm |
| Nominal: | 3.8 Vdc | Locked to Base: | ± 100 Hz | | |
| Portable Dimensions (HxWxD in MMs): | 125x50x33.5 mm with standard battery 125x50x37.5 mm with ultra high battery | Unlocked to Base: | ± 1000 Hz | Adjacent Channel Power (at ± 25kHz): | 55dBc (1W radio) 60dBc (1.8W radio) |
| Weight 380–430MHz: | | Audio Rated: | 1 W | | |
| 181 g | Radio only (with antenna) | Distortion at Rated Audio: | 15% Max. | | |
| 218 g | with standard battery | | | | |
| 238 g | with ultra high battery | | | | |
| Weight 860–870MHz: | | | | | |
| 175 g | Radio only (with antenna) | | | | |
| 215 g | with standard battery | | | | |
| 233 g | with ultra high battery | | | | |

Specifications subject to change without notice.

CHAPTER 3 OVERVIEW

General

To achieve a high spectrum efficiency, the MTP850 uses digital modulation technology and sophisticated voice-compression algorithm. The voice of the person speaking into the microphone is converted into a digital bit stream consisting of zeros (0) and ones (1). This stream is then modulated into a radio-frequency (RF) signal, which is transmitted over the air to another radio. The process is called digital modulation.

Digital Modulation Technology

The MTP850 is a TETRA Handportable Terminal that can operate in dispatch and phone modes. The radio can also operate in TMO (Trunked Mode Operation) and DMO (Direct Mode Operation) modes. It uses two digital technologies: $\pi/4$ DQPSK and Time Division Multiple Access (TDMA).

$\pi/4$ DQPSK is a modulation technique that transmits information by altering the phase of the radio frequency (RF) 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. Time Division Multiple Access (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 voice information without interference from other transmitting units. Transmission from a unit or base station is accommodated in time-slot lengths of 15 milliseconds and frame lengths of 60 milliseconds. The TDMA technique requires sophisticated algorithms and a digital signal processor (DSP) to perform voice compressions/decompressions and RF modulation/demodulation.

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 MTP850 uses a coding technique called ACELP (Algebraic Code Excited Linear Prediction). The compressed voice-data bits modulate the RF signal.

Description

Transceiver Description

All the radio circuitry is contained in the Digital/RF Board and the keypad board. The Digital/RF board is divided into the following sections: digital, frequency generating, transmitter, and receiver.

Digital Section Description

The digital section includes the Patriot IC that consists of the Mcore risk machine and the Digital Signal Processor (DSP).

The Mcore is the controller of the Digital/RF Board. It controls the operation of the transmitter, receiver, audio, and synthesizer integrated circuits located in the RF section. It communicates with the keypad and display.

The Digital Signal Processor (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 ACELP speech coding. It carries out linear 16-bit analog to digital conversions, audio filtering, and level amplification for the microphone audio input and the received audio output.

The power and audio section is based on the PCAP and includes power supplies, 13-bit CODEC, audio routing, microphone and earpiece amplifiers. PCAP audio power amplifier is used for the loudspeaker.

Transmitter Path Description

The transmitter circuitry includes a linear class AB Power Amplifier (PA) for the linear modulation of the MTP850. It includes a Cartesian Loop to enhance its transmitter linearity and reduced splattering power into adjacent channels.

The transmitter path consists of a Cartesian Loop that contains the forward and feedback paths. The forward path includes the JAVELIN IC, BALUN, Attenuator, Power Amplifier. The Loop feedback path includes the directional coupler, attenuator, BALUN, and JAVELIN IC.

The Cartesian Loop output power passes to the antenna through the Antenna Switch, Harmonic Filter and Duplexer.

Receiver Path Description for 806–870 MHz

The receiver section in MTP850 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 Antenna Switch, Limiter, 10dB Step Attenuator, Front Filter, LNA integrated with 23dB Step Attenuator and 40dB of AGC continuous attenuation, Pre-selector SAW Filter, Balun, Half-Life Mixer, 1-pole filter, and the Tomahawk IC which consists of all the base band receive chain.

Receiver Path Description for 380–430 MHz

The receiver section in MTP850 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 Duplexer, Antenna Switch, Limiter, 10dB Step Attenuator, Discrete Front Filter, RF switches, LNA integrated with 30dB Step Attenuator, 22dB of Gain and 40dB of AGC continuous attenuation (in parallel with LNA bypass feature), Discrete post-selector Filter, BALUN, Half-Life Mixer, one-pole baseband filter, and the Tomahawk IC which consists of all the base band receive chain.

Frequency Generating Section Description

The frequency generating section provides description of the following main components: Tomahawk IC fractional-N Synthesizer, Escort synthesizer, Reference oscillator, Main VCO, Tx VCO and buffer.

Global Positioning System (GPS) Section Description

The GPS section includes the following main components: Duplexer, Front filter, LNA, Post Filter, Instant GSCi-5000, RTC, and TCXO.

The GPS in the MTP850 is based on the SIRF Instant GSCi-5000, which comprises a standalone ROM-based multimode GPS receiver in a single chip BGA Package.

Notes

CHAPTER 4

PROGRAMMING THE RADIO

NOTE: For programming the radio, refer to 6802974C10 TETRA Customer Programming Software (CPS) user guide for MTP850.

Notes

CHAPTER 5.1

TEST SETUP & TESTING 380–430MHz



Caution

Any level 3 repairs can deeply affect the performance of the MTP850 and may cause a new tuning procedure. This tuning procedure can be applied by certain authorised Motorola depots where the appropriate TEST & TUNE EQUIPMENT is available. The appropriate TEST & TUNE EQUIPMENT is a special automated test equipment which is only available at some Motorola factories and Motorola repair centers.

Typical Test Setup

Carry out the following instructions before testing:

- Check that you have a fully charged battery (not required when using Battery Eliminator (FTN6904_)).
- For testing the radio a special RF radio rear antenna adapter (FTN6905_) with RF cable is required.
- Detach the antenna from the radio.
- Connect the special RF adapter to the rear side antenna connector of your radio and fix it by screwing the wing nut into the antenna thread.
- Connect the other side of the cable to the N-type RF Connector of the IFR using a N-type-to-SMA-adapter.
- Connect the power supply to the battery eliminator wires.



Take care not to mix-up the red (+) and black (-) wire of the battery eliminator when connecting power just as for the right voltage (3.8VDC, max. 4.2VDC) or this could damage the radio and/or the power supply.

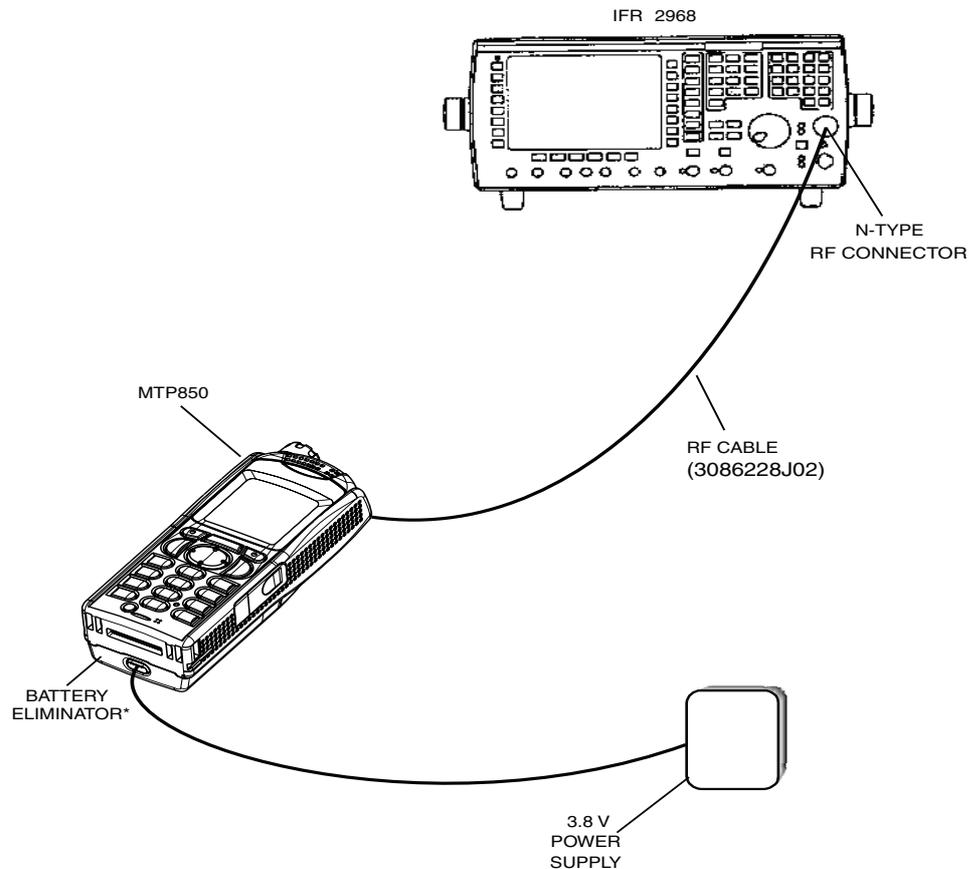


Figure 1 Typical Test Setup

Alternative Test Setup

Cable adapter 2888482K04 enables connecting to the vehicle adapter connector on a stand-alone main board. Thus, it allows testing of the main board in a disassembled unit. On one side, the cable adapter has a mating vehicle adapter connector with mechanical grasping mechanism; on the other side the connection is SMA male.

Test Check List

The following table summarises the required test setups.

| No. | Test Name | Test Setup | Radio Setup | Test Conditions | Limits |
|-----|---------------------------|--------------------------|--|-----------------|--|
| 1. | Base Station Registration | | | | |
| | | Control Channel | 390.125 MHz | 3605 | TETRA 380+0MS |
| | | Traffic Channel | 390.125 MHz | 3605 | TETRA 380+0MS |
| | | Time Slot | | 3 | |
| | | Country Code | | 234 | |
| | | Network Code | | 2392 | |
| | | Base Color | | 1 | |
| | | Location Area | | 23 | |
| | | Min Rx Level | | | -110dBm |
| | | Max Tx Level | | | 30dBm (1W radio) 32.5dBm (1.8W radio) |
| | | Access Parameter | | -53dBm | |
| | | Mobile Power | 30dBm (1W radio) 32.5dBm (1.8W radio) | | |
| | | Burst Type | | Normal | |
| 2. | Transmitter Burst Power | | | | |
| | | RF Gen Level Burst Power | | -90dBm | 28–32dBm (1W radio) 30.5–34.5dBm (1.8W radio) |
| | | Timing Error | | | <=0.25 Symbols |
| | | Vector Error | | | Max 10% RMS, 30% Peak |

| No. | Test Name | Test Setup | Radio Setup | Test Conditions | Limits |
|-----|--------------------------------|-----------------------------|--------------------------------|-----------------|--|
| | | Frequency Error | | | ± 100Hz |
| | | | | | |
| 3. | Call Processing Talk Back | | | | |
| | | 1KHz Test Signal Group Mode | | -50dBm | |
| | | | | | |
| 4. | Call Processing Call to Mobile | | | | |
| | | Private | 4 digit random number & "Send" | | 28–32dBm (1W radio) 30.5-34.5dBm (1.8W radio) |
| | | RF Gen Level Burst Power | | -90dBm | 28–32dBm (1W radio) 30.5-34.5dBm (1.8W radio) |
| | | Timing Error | | | <=0.25 Symbols |
| | | Vector Error | | | Max 10% RMS, 30% Peak |
| | | Frequency Error | | | -/+ 100Hz |

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

Call Processing Tests

1. Talk Back
2. Call to Mobile

Duplex Test

Digital Duplex Test (Tx)

Measurement Capabilities:

Bar charts (Tx Power, Freq. Err, Vector Rms.), Spectrum Analyser, Power Analyser, Vector Analyser, Vector Diagrams

How to Configure the IFR 2968 Setup

Perform the following steps to configure the IFR 2968 with the radio set:

1. Turn ON the IFR.
2. Press “Systems” Mode Key (wait until the digital system is initialized).
3. Press “Tetra Mobile” soft key.
4. Press “Setup” soft key and enter the System Parameters Screen.
5. Press “Channel Plan” soft key.
6. Press “Tetra 380+0MS” soft key. The “Control Channel” automatically changes to “3600”; and “Traffic Channel” automatically changes to 3700.
7. Press twice the “Traffic Channel” soft key and check that the marker goes to Timeslot. Press Data key “3” followed by the “Traffic Channel” soft key, to change to Timeslot “3”.
8. Press “Country Code” soft key. Enter “234” and press again “Country Code” soft key.
9. Press “Network Code” soft key. Thereafter, enter “2392” and press “Network Code” soft key.
10. Press “Base Color” soft key. Thereafter, enter “1” and press “Base Color” soft key.
11. Press “More” soft key.
12. Press “Location Area” soft key. Thereafter, enter “22” and press “Location Area” soft key.
13. Press “More” soft key.
14. Press “Min Rx Level” soft key. Thereafter, enter “-110dBm” and press “Min Rx Level” soft key.
15. Press “Max Tx Level” soft key. Thereafter, enter “30dBm” (for 1W radios) or “32.5dBm” (for 1.8W radios). Press “Max Tx Level” soft key.
16. Press “Access Parameter” soft key. Thereafter, enter “-53dBm” and press “Access Parameter” soft key.
17. Press “Base Service” soft key.

Note: You are entering base services setup.

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

Power On Registration: required

Power Off Deregistration: required

Priority Cell: yes

Minimum Mode Service: may be used

Migration: supported

System Wide Services: normal mode

18. Press “More” soft key.

TETRA Voice Service: supported

Circuit Mode Data Service: supported

(Reserved): available

SNDCD Service: available

Air Interface Encryption: not available

Advanced Link: not supported

19. Press the “Return” soft key.

20. Press the “Neighbr Cell” soft key.

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 SUPPORTED

BROADCAST INTERVAL: 5s

NEIGHBOUR CELL CHANNEL: 3500

NEIGHBOUR CELL LOCATION AREA: 00017

NEIGHBOUR CELL IDENTIFIER: 01

SLOW RE-SELECT THRESHOLD: 10dB

PRESS “MORE” SOFT KEY

SLOW RE-SELECT HYSTERESIS: 10dB

FAST RE-SELECT THRESHOLD: 10dB

FAST RE-SELECT HYSTERESIS: 10dB

22. Press the “Return” soft key.

23. Press the “Trunk Type” soft key and the “message Trunked” soft key (Transmission).

24. Press “More” Softkey.

Note: The displayed values are factory defaults and should not be changed. It is not required to configure “Call Types” “Call Times” and “Messages”.

25. Press “More” Softkey.

How to Configure the IFR 2968 Manual Test Screen

1. To enter “Manual test” screen, press “Manual” soft key.
2. Press “Control Channel” soft key. Thereafter, “3605” and press “Control Channel” soft key (IFR 3605 = Rx 390.125000MHz).
3. Press “Traffic Channel” soft key. Enter “3605” and press “Traffic Channel” soft key. The marker goes to Timeslot. Enter “3” and press “Traffic Channel” soft key. (Note that the Traffic Channel number changes automatically after entering the Control Channel number).
4. Press “RF Gen Level” soft key. Thereafter, enter “-75” and press “dBm” data keys followed by “RF Gen Level” soft key.
5. Press “Mobile Power” soft key, enter “30 dBm/1W” or “32.5 dBm/1.8W”, using soft key.
6. Press “Burst Type” soft key and “Normal” soft key.

This completes the test equipment configuration setup.

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

RF Tests

Receiver Tests

Note: This test requires programming the radio. Refer to 6802974C10 TETRA Customer Programming Software (CPS) for MTP850.

Verify that your radio is in “Group Mode”.

1. Using the Depot version CPS, enable the Test Page field in the radio codeplug and flash the radio.
2. Turn the radio ON.
3. Check that registration and “ITSI ---/---: xxxx” is displayed on the IFR “Manual Test” screen

STATUS: REGISTRATION (ITSI ATTCHED)
GSSI: XXXXXXXX SELECTED

Transmitter Tests

1. Verify that your radio is in “Test Group Mode”.
2. Press the “RF Gen Level” soft key. Enter “-90dBm” by pressing the data keys and “RF Gen Level” Key.
3. Press the “PTT” of the radio and monitor the IFR “Manual Test” screen which displays the Burst Power, Power Profile, Timing Error, Vector Error, and Frequency Error.

Note: You have to hold the PTT in the pressed position long enough to enable you to read the results.

- Burst Power Required Results: 28–32dBm (1W radio) or
30.5–34.5dBm (1.8W radio).

- Power Profile: Passed.

- Timing Error: ≤ 0.25 symbols.

- Vector Error: Max 10% RMS, Max 30% Peak, Max 5% residual.

- Frequency Error: ± 100 Hz.

4. Press the “Clear Down” soft key, to proceed with other tests.

Call Processing Test

Talk Back

Before you start this test, make sure that handset and test equipment are configured the same as given in the Transmitter Test.

1. Press the “PTT” and speak into the mic of the radio. You will hear the last three seconds of the speech frames before the “PTT” is released.
2. Press the “Test Sound” soft key to provide the 1kHz signal to the radio speaker.
3. Release the “PTT”, you will hear a 1kHz tone from the radio speaker for about three seconds.
4. Press the “Silence” soft key to mute the 1KHz Audio Signal of the speaker.
5. Press the “Clear Down” soft key and check that the “Cleardown Complete” status appear on the IFR “Manual Test” screen.

Call to Mobile

1. Press the “Call Mobile” soft key on the IFR.

Note: Select type of call.

2. Press “Private” Call.

Note: You will hear beeps from the handset speaker.

3. Press “Abort Call” soft key. Duplex Test (Phone/Private Mode).

Note: Repeat step 1 through 3 for Phone and Emergency calls.

Digital Duplex Test (Tx)

1. Perform the following test in “Phone” or “Private” mode.
2. Dial a random number “9359” using the Alphanumeric keys of the radio and press the “Send” Key.

The following results are displayed on the IFR “Manual Test” Screen.

- Burst Power Required Results: 28–32dBm (1W radio) or
30.5–34.5dBm (1.8W radio)
- Power Profile: Passed
- Timing Error: <0.25 Symbols.
- Vector Error: Max 10% RMS, Max 30% Peak, Max 5% residual.
- Frequency Error: -/+ 100Hz

3. Speak into the handset microphone and hear your speech (after a short delay) from the handset internal earpiece.

Note: If you need more details, press the “Duplex Test” mode key.

4. Press the “duplex test (Tx)” soft key twice. The “Digital Duplex test” results will be displayed on the IFR screen providing you with the following bar charts measurement capabilities:

- Power
- Vector RMS
- Frequency Error

For Power Analyser Graph:

5. Press “power ana” soft key.
6. Check that the power frame falls within the limits.

For Spectrum Analyser Graph:

7. Press “Spect ana” soft key.
8. Monitor the Tx frequency.

For Vector Analyser Diagram:

9. Press the “Vect Anal” soft key
10. Monitor the constellation diagram.
11. Press the “Vector Diagram” soft key.
12. Press the “Rotated vector” to zoom in on the constellation.
13. Press the handset “End” key.

Manual Mode Testing

Preparation for Testing

1. Verify that the radio is turned off.
2. Press the “4”, “5” and “6” keys together and then, press the On/Off key to turn the radio on.
3. The display shows “LCD Color test Press Any Key To Proceed”.

Tests

Note: Any key that will be pressed will cause the test to advance from one step to the next.

1. Press any key consecutively. The display shows horizontal red lines that becomes thicker with every key press, until it becomes fully red.
2. Press any key again, the display shows four colored rectangles.
3. Press any key consecutively. The display shows vertical green lines that becomes thicker with every key press, until it becomes fully green.
4. Press any key again. The display becomes fully blue and the message “END LCD test !!!” appears.
5. Press any key again. The display shows “Battery Interface Test”.
6. Press any key again. The display shows “Battery Interface Test PASS”.
7. Press any key again. The display shows “Vibrator On”, verify that the radio is vibrating.
8. Press any key again. The display shows “Red Led on” and the Red LED at the top of the radio is lit.
9. Press any key again. The display shows “Green Led on” and the Green LED at the top of the radio is lit.
10. Press any key. The display shows “Both Leds on” and the LED located on the top of the radio is blinking in amber (combination of red and green lights of the two halves of the LED).
11. Press any key again. The display shows “Keypad Backlight On” and the keypad backlight is On.
12. Press any key again. The display shows “Display Backlight On” and the display backlight is On.

Note: The following readings appears only when a Universal Crypto Module (UCM) board is installed in the unit.

13. Press any key again. The display shows “UCM Detected”.

14. Press any key again. The display shows “UCM Power up Success”.

15. Press any key again. The display shows “UCM Ping Success”.

Note: The following reading appears only when a UCM board is not installed in the unit.

16. Press any key again. The display shows “UCM Not Detected”.

17. Press the Programmable Side Keys 1 twice to “Tones Test”. Press any key again. The display shows “Internal Speaker Tone Test”, a tone is heard via the speaker.

18. Press any key again. The display shows “Internal Earpiece Tone Test”, a tone is heard via the internal earpiece.

19. Press any key again. The display shows “Connect PHF for the following Tests”. Insert a headset into the PHF connector and plug the PHF earpiece into your ear.

20. Press any key again. The display shows “PHF Earpiece Tone Test”, “PHF connected”. A tone is heard via the PHF earpiece.

21. Press any key again. The display shows “Connect RSM-SIDE for the following test”. Press any key again. The display shows “RSM Side tone test RSM-SIDE connected”. A tone is heard via the RSM speaker.

22. Press any key again. The display shows “Int Mic to INT ERP Loopback Test”. Speak into the bottom microphone, and you will hear your voice via the earpiece.

23. Press any key again. The display shows “TOP Mic to PHF EAR Loopback Test”. Speak into the top microphone, and you will hear your voice via the PHF earpiece.

24. Press any key again. The display shows “PHF Mic to INT EAR Loopback Test”. Speak into the PHF microphone, and you will hear your voice via the radio earpiece

25. Press any key again. The display shows “Connect RSM- SIDE for the following tests”. Press any key again. The display shows “RSM Side MIC to INT EAR loopback Test”.

Speak into the RSM microphone, and you will hear your voice via earpiece.

26. Press any key again. The display shows “Chopper-Noise Test Int MIC to internal earp”. Place the internal earpiece close to your ear and listen for chopper noise. Make sure chopper noise is not audible.

27. Press any key again The display shows “Connect PHF for the following tests”.

28. Press any key again. The display shows “Chopper-Noise test TOP Mic to PHF EAR”. 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 chopper noise is not audible.
29. Press any key again. The display shows “Chopper-Noise test PHF Mic to Int earp”. Bind around the antenna one binding of the earpiece cable and listen for chopper noise at the radio earpiece. Make sure chopper noise is not audible.
30. Press any key again. The display shows “Connect RSM - SIDE for the following tests”. Press any key again. The display shows “Chopper-Noise test RSM SIDE Connector MIC to INT ERP.” and listen for chopper noise at the radio earpiece.
31. Press any key again. The display shows “Int Mic to Int earp Loopback Test with UCM”. Speak into the bottom microphone, and you will hear your voice via the earpiece.

Note: Tests 22-31 work also without UCM.

32. Press any key again. The display shows “Connect PHF for the following Tests”.
33. Press any key again. The display shows “TOP Mic PHF ERP Loopback Test with UCM”. Speak into the top microphone, and you will hear your voice via the PHF earpiece
34. Press any key again. The display shows “PHF Mic to Int earp Loopback Test with UCM”. Speak into the PHF microphone, and you will hear your voice via earpiece.
35. Press any key again. The display shows “Connect RSM SIDE for following Tests”.
36. Press any key again. The display shows “RSM side Mic to Int ear loopback test with UCM”. Speak into the RSM microphone, and you will hear your voice via earpiece.
37. Press any key again. The display shows “Chopper Noise INT MIC to INT EAR with UCM” and listen for chopper noise at radio earpiece. Make sure chopper noise is not audible
38. Press any key again. The display shows “Connect PHF for the following Tests”.
39. Press any key again. The display shows “Chopper-Noise TOP mic to PHF EAR with UCM”. 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 chopper noise is not audible.
40. Press any key again. The display shows “Chopper-Noise PHF mic to Int earpiece with UCM”. Bind around the antenna one binding of the earpiece cable and listen for chopper noise at radio earpiece. Make sure chopper noise is not audible
41. Press any key again. The display shows “Connect RSM SIDE for the following tests”.

42. Press any key again. The display shows “Chopper-Noise RSM- SIDE mic to Int earp with UCM”. Bind around the antenna one binding of the RSM cable and listen for chopper noise at radio earpiece. Make sure chopper noise is not audible.

43. Press and key. The display shows

Emergency

| | Left | Menu | Right |
|------|------|------|-------|
| Send | 1 | 2 | 3 |
| Up | 4 | 5 | 6 |
| Ptt | 7 | 8 | 9 |
| Down | * | 0 | # |

Every time you press causes the respective display to disappear

44. The display shows “press any key to continue”.

45. Press  Key. The display shows:

```

*
*
*
*
<<<< >>>>
*
*
*

```

Every time you press causes the respective display to disappear.

46. After pressing all keys, the display is clear.

47. Press any key to continue. The display shows “Rotary test”. Turn the rotary switch clockwise, each click causes the respective clockwise arrow sign to disappear.

Then, a set of counter clockwise arrows appear, turn the rotary switch counter clockwise, each click causes the respective counter clockwise arrow sign to disappear. The display shows “Press the rotary”.

48. Press any key to continue. The display shows “To next test Press any key”.

49. Press any key to continue. The display shows “To begin the photo sensor test press any key”.

50. Press any key again. The display shows “Place the photo sensor in the lighted place and press any key”. Expose the photo sensor (located between the key of 8 and #) to a lighted place.

51. Press any key again. The display shows “Cover the photo sensor and press any key”. Do as told and observe the keypad backlight.

52. Press any key again. The display shows “PHOTO SENSOR TEST PASSED”, “press any key to continue to next test”.

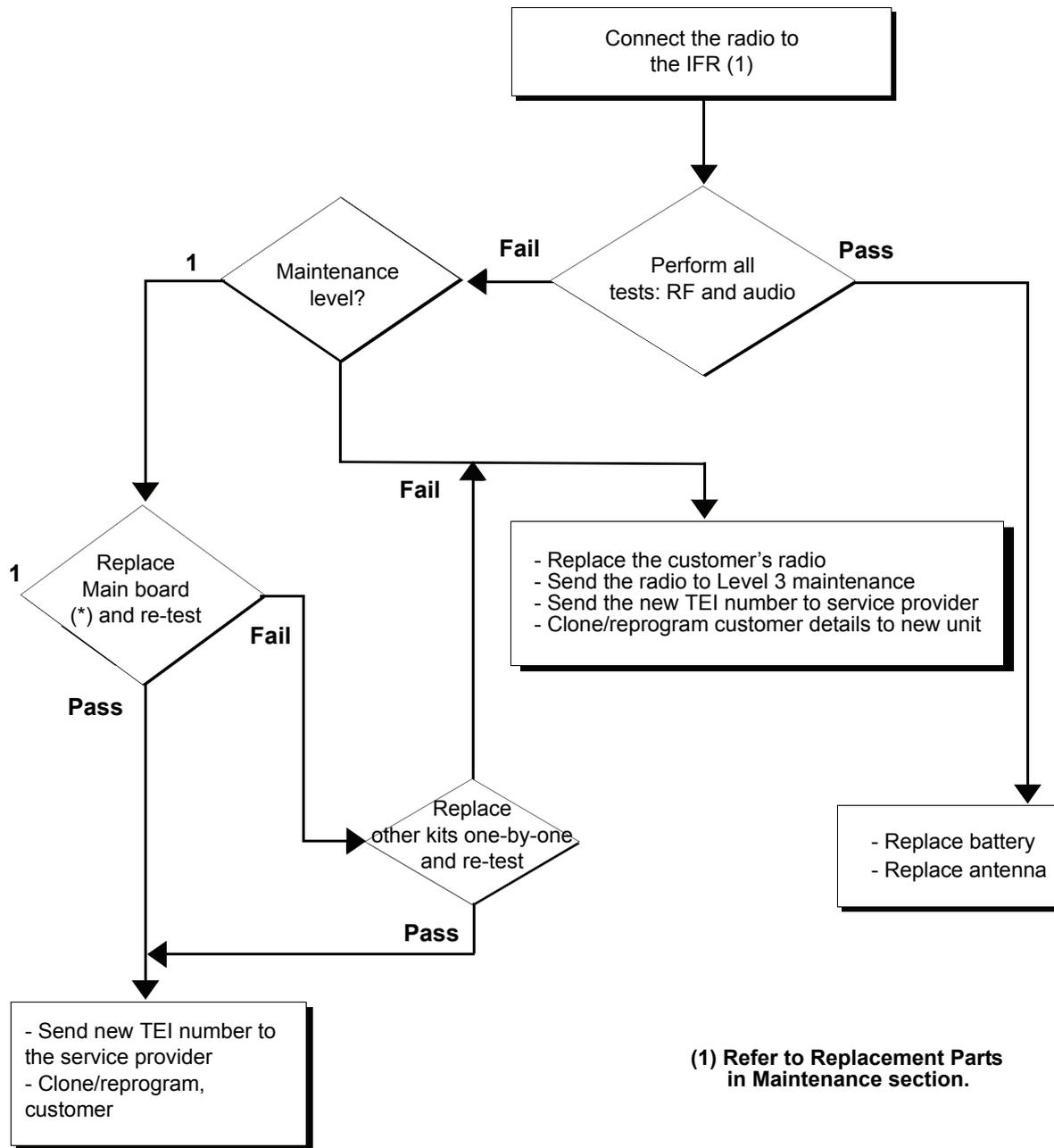
53. Press any key again. The display shows “The test is completed”, “Press any key to turn the radio OFF”.

54. This completes the test. Press any key to turn the radio OFF.

Charger Recognition Test

- Turn the radio ON.
- Connect the Rapid Travel Charger accessory connector to the handset. Check whether the LCD display shows “charger connected” and that the keypad backlight is turned ON.
- Connect the Vehicle Power Adapter (VPA) Charger accessory connector to the handset. Check whether the LCD display shows “charger connected” and that the keypad backlight is turned ON.
- Connect the handset to the Desktop Charger. Check whether the LCD display shows “charger connected” and that the keypad backlight is turned ON.
- Verify that the battery charger is in progress (the process advance is indicated on the Battery Strength icon).
- Press the “ON/OFF” key. The radio should turn OFF.

Service Flowchart



(1) Refer to Replacement Parts in Maintenance section.

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

CHAPTER 5.2

TEST SETUP & TESTING 806-870MHz



Caution

Any level 3 repairs can deeply affect the performance of the MTP850 and may cause a new tuning procedure. This tuning procedure can be applied by certain authorised Motorola depots where the appropriate TEST & TUNE EQUIPMENT is available. The appropriate TEST & TUNE EQUIPMENT is a special automated test equipment which is only available at some Motorola factories and Motorola repair centers.

Typical Test Setup

Carry out the following instructions before testing:

- Check that you have a fully charged battery (not required when using Battery Eliminator (FTN6904_)).
- For testing the radio a special RF radio rear antenna adapter (FTN6905_) with RF cable is required.
- Detach the antenna from the radio.
- Connect the special RF adapter to the rear side antenna connector of your radio and fix it by screwing the wing nut into the antenna thread.
- Connect the other side of the cable to the N-type RF Connector of the IFR using a N-type-to-SMA-adapter.
- Connect the power supply to the battery eliminator wires.



Take care not to mix-up the red (+) and black (-) wire of the battery eliminator when connecting power just as for the right voltage (3.8VDC, max. 4.2VDC) or this could damage the radio and/or the power supply.

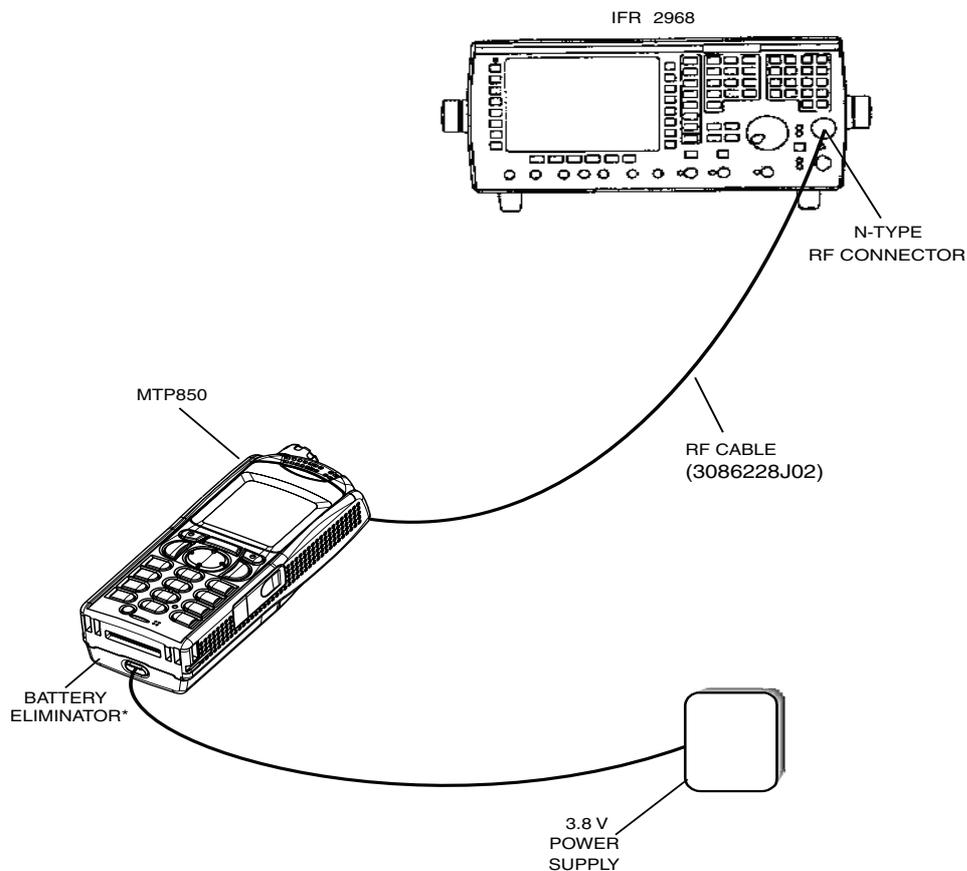


Figure 2 Typical Test Setup

Alternative Test Setup

Cable adapter 2888482K04 enables connecting to the vehicle adapter connector on a stand-alone main board. Thus, it allows testing of the main board in a disassembled unit. On one side, the cable adapter has a mating vehicle adapter connector with mechanical grasping mechanism; on the other side the connection is SMA male.

Test Check List

The following table summarises the required test setups.

| No. | Test Name | Test Setup | Radio Setup | Test Conditions | Limits |
|-----|---------------------------|--------------------------|----------------|-----------------|-----------------------|
| 1. | Base Station Registration | | | | |
| | | Control Channel | 851.812500 MHz | 2072 | TETRA 800MS |
| | | Traffic Channel | 851.812500 MHz | 2072 | TETRA 800MS |
| | | Time Slot | | 3 | |
| | | Country Code | | 234 | |
| | | Network Code | | 2392 | |
| | | Base Color | | 1 | |
| | | Location Area | | 22 | |
| | | Min Rx Level | | | -110dBm |
| | | Max Tx Level | | | 30dBm |
| | | Access Parameter | | -53dBm | |
| | | Mobile Power | 30dBm | | |
| | | Burst Type | | Normal | |
| | | | | | |
| 2. | Transmitter Burst Power | | | | |
| | | RF Gen Level Burst Power | | -90dBm | 28–32dBm |
| | | Timing Error | | | <=0.25 Symbols |
| | | Vector Error | | | Max 10% RMS, 30% Peak |
| | | Frequency Error | | | -/+ 100Hz |
| | | | | | |

| No. | Test Name | Test Setup | Radio Setup | Test Conditions | Limits |
|-----|-----------------------------------|-----------------------------------|--------------------------------------|-----------------|--------------------------|
| 3. | Call Processing Talk Back | | | | |
| | | 1KHz Test Signal Group Mode | | -50dBm | |
| | | | | | |
| 4. | Call Processing Call to Mobile | | | | |
| | | Private | 4 digit random number & "Send" | | 28-32dBm |
| | | RF Gen Level Burst Power | | -90dBm | 28-32dBm |
| | | Timing Error | | | <=0.25 Symbols |
| | | Vector Error | | | Max 10% RMS, 30% Peak |
| | | Frequency Error | | | -/+ 100Hz |

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

Call Processing Tests

1. Talk Back
2. Call to Mobile

Duplex Test

Digital Duplex Test (Tx)

Measurement Capabilities:

Bar charts (Tx Power, Freq. Err, Vector Rms.), Spectrum Analyser, Power Analyser, Vector Analyser, Vector Diagrams

How to Configure the IFR 2968 Setup

Perform the following steps to configure the IFR 2968 with the radio set:

1. Turn ON the IFR.
2. Press "Systems" Mode Key (wait until the digital system is initialized).
3. Press "Tetra Mobile" soft key.
4. Press "Setup" soft key and enter the System Parameters Screen.
5. Press "Channel Plan" soft key.
6. Press "More" soft key.
7. Press "Tetra 800MS" soft key. The "Control Channel" automatically changes to "2040"; and "Traffic Channel" automatically changes to 2140.
8. Press twice the "Traffic Channel" soft key and check that the marker goes to Timeslot. Press Data key "3" followed by the "Traffic Channel" soft key, to change to Timeslot "3".
9. Press "Country Code" soft key. Enter "234" and press again "Country Code" soft key.
10. Press "Network Code" soft key. Thereafter, enter "2392" and press "Network Code" soft key.
11. Press "Base Color" soft key. Thereafter, enter "1" and press "Base Color" soft key.
12. Press "More" soft key.
13. Press "Location Area" soft key. Thereafter, enter "22" and press "Location Area" soft key.
14. Press "More" soft key.
15. Press "Min Rx Level" soft key. Thereafter, enter "-110dBm" and press "Min Rx Level" soft key.
16. Press "Max Tx Level" soft key. Thereafter, enter "30dBm" and press "Max Tx Level" soft key.
17. Press "Access Parameter" soft key. Thereafter, enter "-53dBm" and press "Access Parameter" soft key.
18. Press "Base Service" soft key.

Note: You are entering base services setup.

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

Power On Registration: required

Power Off Deregistration: required

Priority Cell: yes

Minimum Mode Service: may be used

Migration: supported

System Wide Services: normal mode

19. Press "More" soft key.

TETRA Voice Service: supported

Circuit Mode Data Service: supported

(Reserved): available

SNDCD Service: available

Air Interface Encryption: not available

Advanced Link: not supported

20. Press the "Return" soft key.

21. Press the "Neighbr Cell" soft key.

22. 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 SUPPORTED

BROADCAST INTERVAL: 5s

NEIGHBOUR CELL CHANNEL: 3500

NEIGHBOUR CELL LOCATION AREA: 00017

NEIGHBOUR CELL IDENTIFIER: 01

SLOW RE-SELECT THRESHOLD: 10dB

PRESS "MORE" SOFT KEY

SLOW RE-SELECT HYSTERESIS: 10dB

FAST RE-SELECT THRESHOLD: 10dB

FAST RE-SELECT HYSTERESIS: 10dB

23. Press the "Return" soft key.

24. Press the "Trunk Type" soft key and the "message Trunked" soft key (Transmission).

25. Press "More" Softkey.

Note: The displayed values are factory defaults and should not be changed. It is not required to configure "Call Types" "Call Times" and "Messages".

26. Press "More" Softkey.

How to Configure the IFR 2968 Manual Test Screen

1. To enter "Manual test" screen, press "Manual" soft key.
2. Press "Control Channel" soft key. Thereafter, "2072" and press "Control Channel" soft key (IFR 2072 = Rx 851.81250MHz).
3. Press "Traffic Channel" soft key. Enter "2072" and press "Traffic Channel" soft key. The marker goes to Timeslot. Enter "3" and press "Traffic Channel" soft key. (Note that the Traffic Channel number changes automatically after entering the Control Channel number).
4. Press "RF Gen Level" soft key. Thereafter, enter "-75" and press "dBm" data keys followed by "RF Gen Level" soft key.
5. Press "Mobile Power" soft key, enter 30 dBm/1W, using soft key.
6. Press "Burst Type" soft key and "Normal" soft key.

This completes the test equipment configuration setup.

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

RF Tests

Receiver Tests

Note: This test requires programming the radio. Refer to 6802974C10 TETRA Customer Programming Software (CPS) for MTP850.

Verify that your radio is in "Group Mode".

1. Using the Depot version CPS, enable the Test Page field in the radio codeplug and flash the radio.
2. Turn the radio ON.
3. Check that registration and "ITSI ---/---: xxxx" is displayed on the IFR "Manual Test" screen

STATUS: REGISTRATION (ITSI ATTCHED)
GSSI: XXXXXXXX SELECTED

Transmitter Tests

1. Verify that your radio is in "Test Group Mode".
2. Press the "RF Gen Level" soft key. Enter "-90dBm" by pressing the data keys and "RF Gen Level" Key.
3. Press the "PTT" of the radio and monitor the IFR "Manual Test" screen which displays the Burst Power, Power Profile, Timing Error, Vector Error, and Frequency Error.

Note: You have to hold the PTT in the pressed position long enough to enable you to read the results.

- Burst Power Required Results: 28–32dbm.
 - Power Profile: Passed.
 - Timing Error: ≤ 0.25 symbols.
 - Vector Error: Max 10% RMS, Max 30% Peak, Max 5% residual.
 - Frequency Error: $-/+ 100$ Hz.
4. Press the "Clear Down" soft key, to proceed with other tests.

Call Processing Test

Talk Back

Before you start this test, make sure that handset and test equipment are configured the same as given in the Transmitter Test.

1. Press the "PTT" and speak into the mic of the radio. You will hear the last three seconds of the speech frames before the "PTT" is released.
2. Press the "Test Sound" soft key to provide the 1kHz signal to the radio speaker.
3. Release the "PTT", you will hear a 1kHz tone from the radio speaker for about three seconds.
4. Press the "Silence" soft key to mute the 1KHz Audio Signal of the speaker.
5. Press the "Clear Down" soft key and check that the "Cleardown Complete" status appear on the IFR "Manual Test" screen.

Call to Mobile

1. Press the "Call Mobile" soft key on the IFR.

Note: Select type of call.

2. Press "Private" Call.

Note: You will hear beeps from the handset speaker.

3. Press "Abort Call" soft key. Duplex Test (Phone/Private Mode)

Note: Repeat step 1 through 3 for Phone and Emergency calls

Digital Duplex Test (Tx)

1. Perform the following test in "Phone" or "Private" mode.
2. Dial a random number "9359" using the Alphanumeric keys of the radio and press the "Send" Key.

The following results are displayed on the IFR “Manual Test” Screen.

- Burst Power Required Results: 28–32dbm
- Power Profile: Passed
- Timing Error: <0.25 Symbols.
- Vector Error: Max 10% RMS, Max 30% Peak, Max 5% residual.
- Frequency Error: -/+ 100Hz

3. Speak into the handset microphone and hear your speech (after a short delay) from the handset internal earpiece.

Note: If you need more details, press the “Duplex Test” mode key.

4. Press the “duplex test (Tx)” soft key twice. The “Digital Duplex test” results will be displayed on the IFR screen providing you with the following bar charts measurement capabilities:

- Power
- Vector RMS
- Frequency Error

For Power Analyser Graph:

5. Press “power ana” soft key.
6. Check that the power frame falls within the limits.

For Spectrum Analyser Graph:

7. Press “Spect ana” soft key.
8. Monitor the Tx frequency.

For Vector Analyser Diagram:

9. Press the “Vect Anal” soft key
10. Monitor the constellation diagram.
11. Press the “Vector Diagram” soft key.
12. Press the “Rotated vector” to zoom in on the constellation.
13. Press the handset “End” key.

Manual Mode Testing

Preparation for Testing

1. Verify that the radio is turned off.
2. Press the “4”, “5” and “6” keys together and then, press the On/Off key to turn the radio on.
3. The display shows “LCD Color test Press Any Key To Proceed”.

Tests

Note: Any key that will be pressed will cause the test to advance from one step to the next.

1. Press any key consecutively. The display shows horizontal red lines that becomes thicker with every key press, until it becomes fully red.
2. Press any key again, the display shows four colored rectangles.
3. Press any key consecutively. The display shows vertical green lines that becomes thicker with every key press, until it becomes fully green.
4. Press any key again. The display becomes fully blue and the message “END LCD test !!!” appears.
5. Press any key again. The display shows “Battery Interface Test”.
6. Press any key again. The display shows “Battery Interface Test PASS”.
7. Press any key again. The display shows “Vibrator On”, verify that the radio is vibrating.
8. Press any key again. The display shows “Red Led on” and the Red LED at the top of the radio is lit.
9. Press any key again. The display shows “Green Led on” and the Green LED at the top of the radio is lit.
10. Press any key. The display shows “Both Leds on” and the LED located on the top of the radio is blinking in amber (combination of red and green lights of the two halves of the LED).
11. Press any key again. The display shows “Keypad Backlight On” and the keypad backlight is On.
12. Press any key again. The display shows “Display Backlight On” and the display backlight is On.

Note: The following readings appears only when a Universal Crypto Module (UCM) board is installed in the unit.

13. Press any key again. The display shows "UCM Detected".
14. Press any key again. The display shows "UCM Power up Success".
15. Press any key again. The display shows "UCM Ping Success".

Note: The following reading appears only when a UCM board is not installed in the unit.

16. Press any key again. The display shows "UCM Not Detected".
17. Press any key again. The display shows "Speaker Tone Test", a tone is heard via the speaker.
18. Press any key again. The display shows "Internal Earpiece Tone Test", a tone is heard via the internal earpiece.
19. Press any key again. The display shows "Insert PHF for the following Tests". Insert a headset into the PHF connector and plug the PHF earpiece into your ear.
20. Press any key again. The display shows "PHF Earpeace Tone Test", "PHF connected". A tone is heard via the PHF earpiece.
21. Press any key again. The display shows "RSM CE connector is not connected".
Press any key again. The display shows "Connect RSM from side connector to the radio and press any key".
Press any key again. The display shows "RSM Side connector is not connected".
22. Press any key again. The display shows "Int Mic Int earp Loopback Test". Speak into the bottom microphone, and you will hear your voice via the earpiece.
23. Press any key again. The display shows "TOP Mic PHF spk Loopback Test". Speak into the top microphone, and you will hear your voice via the PHF earpiece.
24. Press any key again. The display shows "PHF Mic Int earp Loopback Test". Speak into the PHF microphone, and you will hear your voice via earpiece.
25. Press any key again. The display shows "RSM CE connector is not connected".
Press any key again. The display shows "RSM Side connector is not connected".
26. Press any key again. The display shows "Chopper-Noise Int earp". Place the internal earpiece close to your ear and listen for chopper noise. Make sure chopper noise is not audible.
27. Press any key again. The display shows "Chopper-Noise TOP Mic PHF spkr". Bind around the antenna one binding of the earpiece cable and place the internal earpiece close to your ear and listen for chopper noise. Make sure chopper noise is not audible.

28. Press any key again. The display shows "Chopper-Noise PHF Mic Int earp". Bind around the antenna one binding of the earpiece cable and place the PHF earpiece in your ear and listen for chopper noise. Make sure chopper noise is not audible.
29. Press any key again. The display shows "RSM CE connector is not connected". Press any key again. The display shows "RSM CE connector is not connected". Press any key again. The display shows "RSM Side connector is not connected".
30. Press any key again. The display shows "Int Mic Int earp Loopback Test with UCM". Speak into the bottom microphone, and you will hear your voice via the earpiece.

Note: Tests 31-37 work also without UCM.

31. Press any key again. The display shows "TOP Mic PHF spk Loopback Test with UCM". Speak into the top microphone, and you will hear your voice via the PHF earpiece
32. Press any key again. The display shows "PHF Mic Int earp Loopback Test with UCM". Speak into the PHF microphone, and you will hear your voice via earpiece
33. Press any key again. The display shows "RSM CE connector is not connected". Press any key again. The display shows "RSM Side connector is not connected".
34. Press any key again. The display shows "Chopper-Noise INT mic Int earp with UCM". Place the internal earpiece close to your ear and listen for chopper noise. Make sure chopper noise is not audible.
35. Press any key again. The display shows "Chopper-Noise TOP mic PHF spk with UCM". Bind around the antenna one binding of the earpiece cable and place the internal earpiece close to your ear and listen for chopper noise. Make sure chopper noise is not audible.
36. Press any key again. The display shows "Chopper-Noise PHF mic Int earp with UCM". Bind around the antenna one binding of the earpiece cable and place the PHF earpiece in your ear and listen for chopper noise. Make sure chopper noise is not audible
37. Press any key again. The display shows "RSM CE connector is not connected"
38. Press any key again. The display shows "RSM CE connector is not connected". Press any key again. The display shows "RSM Side connector is not connected".
39. Press any key again. The display shows all the radio keys.
40. Press every key, one by one. Each key you press causes its respective display to disappear.
41. Press any key to continue.

42. Press  Key. The display shows:

```

*
*
*
*
<<<<  >>>>
*
*
*
*

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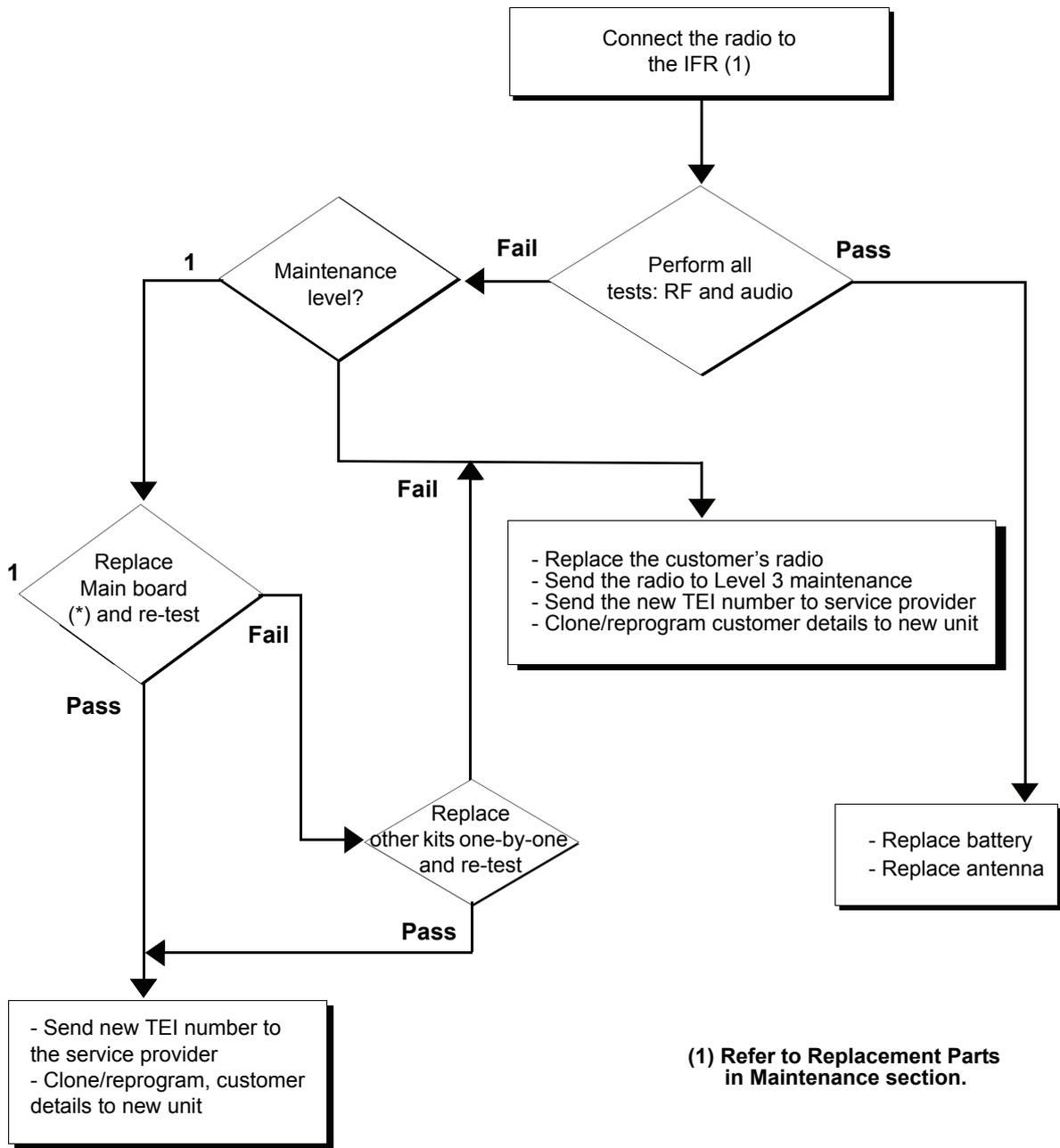
Every time you press causes the respective display to disappear.

43. After pressing all keys, the display is clear.
44. Press any key to continue. The display shows "Rotary test". Turn the rotary switch clockwise, each click causes the respective clockwise arrow sign to disappear. Then, a set of counter clockwise arrows appear, turn the rotary switch counter clockwise, each click causes the respective counter clockwise arrow sign to disappear. The display shows "Press the rotary".
45. Press any key to continue. The display shows "To next test Press any key".
46. Press any key to continue. The display shows "To begin the photo sensor test press any key".
47. Press any key again. The display shows "Place the photo sensor in the lighted place and press any key". Expose the photo sensor (located between the key of 8 and #) to a lighted place.
48. Press any key again. The display shows "Cover the photo sensor and press any key". Do as told and observe the keypad backlight.
49. Press any key again. The display shows "PHOTO SENSOR TEST PASSED", "press any key to continue to next test".
50. Press any key again. The display shows "The test is completed", "Press any key to turn the radio OFF".
51. This completes the test. Press any key to turn the radio OFF.

Charger Recognition Test

- Turn the radio ON.
- Connect the Rapid Travel Charger accessory connector to the handset. Check whether the LCD display shows "charger connected" and that the keypad backlight is turned ON.
- Connect the Vehicle Power Adapter (VPA) Charger accessory connector to the handset. Check whether the LCD display shows "charger connected" and that the keypad backlight is turned ON.
- Connect the handset to the Desktop Charger. Check whether the LCD display shows "charger connected" and that the keypad backlight is turned ON.
- Verify that the battery charger is in progress (the process advance is indicated on the Battery Strength icon).
- Press the "ON/OFF" key. The radio should turn OFF.

Service Flowchart



(1) Refer to Replacement Parts in Maintenance section.

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

Notes

CHAPTER 6

MAINTENANCE

Preventive Maintenance

This TETRA Handportable Terminal does not require a scheduled preventive maintenance program. However, periodic visual inspection is recommended.

Inspection

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

Cleaning

The following procedures describe the recommended cleaning agents and methods to be used when cleaning the external and internal surfaces of the radio. External surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, compound, or grime. Internal surfaces (circuit boards and components) should be cleaned only when the radio is disassembled for servicing or repair.

The only recommended agent for cleaning external radio surfaces is a 0.5% solution (one teaspoon of detergent per gallon of water) of mild dishwashing detergent in water. The internal surfaces should be cleaned only with isopropyl alcohol (100% by volume).

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

Take care to clean the bottom connector frequently and particularly prior to the programming procedure e.g. with a soft brush (do not use fluids).



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

Cleaning External Plastic Surfaces

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

Cleaning Internal Circuit Boards and Components

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

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

Safe Handling of CMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in the radio. While the attributes of CMOS devices are many, their characteristics make them susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failure occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair. The following handling precautions are mandatory for CMOS circuits, and are especially important in low humidity conditions.

- All CMOS devices must be stored or transported in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are used for storage or transportation of other semiconductor devices.
- All CMOS devices must be placed on a grounded bench surface and the technician must also be grounded before handling the devices. This is done most effectively by having the technician wear a conductive wrist strap in series with a 100k Ω resistor to ground.
- Do not wear nylon clothing while handling CMOS circuits.
- Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices and be certain there are no voltage transients present.
- When straightening CMOS device leads, provide ground straps for the apparatus used.
- When soldering, use a grounded soldering iron.
- All power must be turned off in a system before printed circuit boards containing CMOS devices are inserted, removed, or soldered.

Pre-baking of Integrated Circuits

Electronic components are generally coated with plastic material which has the nature of not being waterproof. If kept unsealed the components can absorb humidity. When soldered to the board (especially with reflow techniques) the sudden change in temperature can cause fissure or crack which can result in malfunction or damage.

To avoid this problem these moisture sensitive components (MS) should be stored and shipped in a sealed wrapping (dry pack). Processing must take place only with dry components when an uninterrupted dry storage can be guaranteed, otherwise the components have to be pre-baked.

If a reflow procedure takes place close to MS components the whole board must be pre-baked.

Please refer to the following table:

For 1W radios

| P/N | MSL* | DESCRIPTION |
|-------------|------|---------------------------|
| 5104932K08 | 3 | Tomahawk, U200 |
| 5186988577 | 3 | Javelin, U900 |
| 5108683Y44 | 2 | TETRA PA, U901 |
| 5185941F32 | 3 | PCAP 2.4 |
| 5187943V03 | 3 | Patriot ROM3 |
| 5115443M01 | 3 | LNA- Life, U500 |
| 5187512V01 | 3 | Half-Life, U501 |
| 5109509A69 | 3 | PSRAM |
| 51859355V27 | 3 | FLASH 32M |
| 5189378V12 | 3 | EEPROM |
| 5188450M52 | 3 | SiRF Instant GSCi-5000 IC |
| 5114004M42 | 1 | Backlight Booster |

For 1.8W radios

| P/N | MSL* | DESCRIPTION |
|-------------|------|-----------------|
| 5104932K08 | 3 | Tomahawk, U200 |
| 5186988J77 | 3 | Javelin, U900 |
| 5171354L01 | 2 | TETRA PA, U901 |
| 5185941F32 | 3 | PCAP 2.4 |
| 5171266M01 | 3 | Patriot ROM3 |
| 5115443H02 | 3 | LNA- Life, U502 |
| 5187512V01 | 3 | Half-Life, U507 |
| 5164852H34 | 3 | PSRAM, U402 |
| 51859355V27 | 3 | FLASH 32M |
| 5189378V12 | 3 | EEPROM |

| P/N | MSL* | DESCRIPTION |
|------------|------|---------------------------|
| 5188450M58 | 3 | SiRF Instant GSCi-5000 IC |
| 5114004M42 | 1 | Backlight Booster |

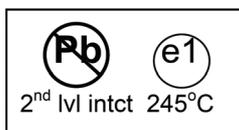
* Out of dry package Moisture Sensitivity Level (MSL) 1) No dry pack required
 2) 1 year
 3) 168 hrs

Level 1 and Level 2 Maintenance

This manual covers Level 1 and Level 2 Maintenance: at Level 1 maintenance you replace the terminal and/or accessories and send the faulty unified chassis and/or accessories to a higher level of maintenance; at level 2 maintenance a faulty kit is replaced. For Level 3 please refer to Appendix A.



Environmentally Preferred Products (EPP), refer to the indications on the printed circuit boards, are developed and assembled using environmentally preferred components and solder assembly techniques in compliance to the European Union's **Restriction of Hazardous Substances (ROHS) Directive 2002/95/EC** and **Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC**. To maintain product compliance and reliability, use only the Motorola specified parts in this manual.



For the identification of lead (Pb) free assemblies, all EPP products will carry the EPP Marking with the symbol shown below on the PCB. The marking provides information to those performing assembly, servicing and recycling operation on these product adhering to the JEDEC standard #97. The EPP Marking will be in the form of label or marking on printed circuit board (PCB).

Disassembling and Reassembling the MTP850 Unit

Mechanical checks and self tests should be performed on the unit at the basic level of service. To perform testing at the field level, it is sometimes necessary to remove the antenna and the housing from the unit. Procedures for disassembling and reassembling the unit are described in the sections that follow.

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

Protecting Static-Sensitive Devices

This unit contains static-sensitive devices that must be protected when opening the unit, or storing and transporting any printed-circuit board.

To create a proper ground

- Ground the working surface of your service bench. If possible, use the Motorola Static Protection Assembly (part #0180386A82) to ground your service bench. This assembly contains a wrist strap, two ground cords, a table mat, and a floor mat.
- Wear a conductive wrist strap in series with a 1M ohm resistor to ground.
- Do not wear nylon clothing when handling any printed-circuit board.
- Prior to touching any printed-circuit board, touch an electrical ground to remove any static charge that might have accumulated.

To store or transport a circuit board

- Place the printed-circuit board in conductive, anti-static material.
- Do not insert the printed-circuit board into conventional plastic "snow" trays used for transporting other devices.

Removing and Installing the Antenna

Note: The antenna must be removed each time the back housing is removed.

Recommended tools: no tools are required.

To remove the antenna from the unit

Unscrew the antenna counter clockwise until it is detached from the handset.

To install the antenna in the unit

Screw the antenna clockwise to the handset.

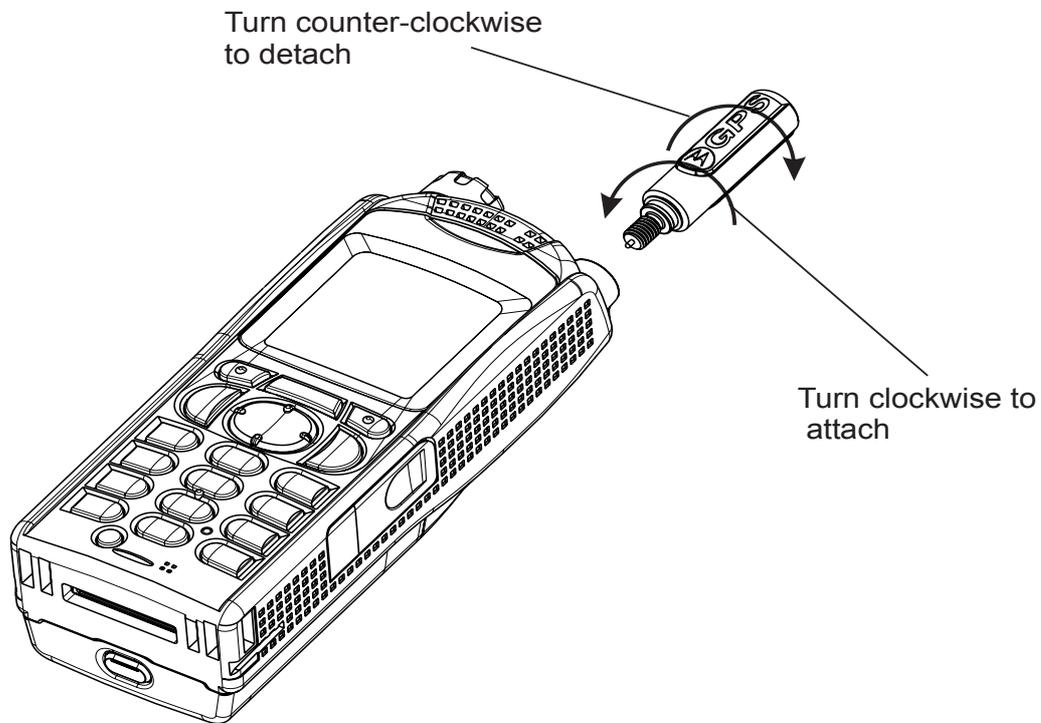


Figure 3 Antenna Removal and Installation

Removing and Installing the Battery

Recommended tools: no tools are required.

To remove the battery from the unit

1. Place the unit facing down on the work area.
2. Press the battery release button, lift the bottom of the battery away from the unit and remove battery from the unit.

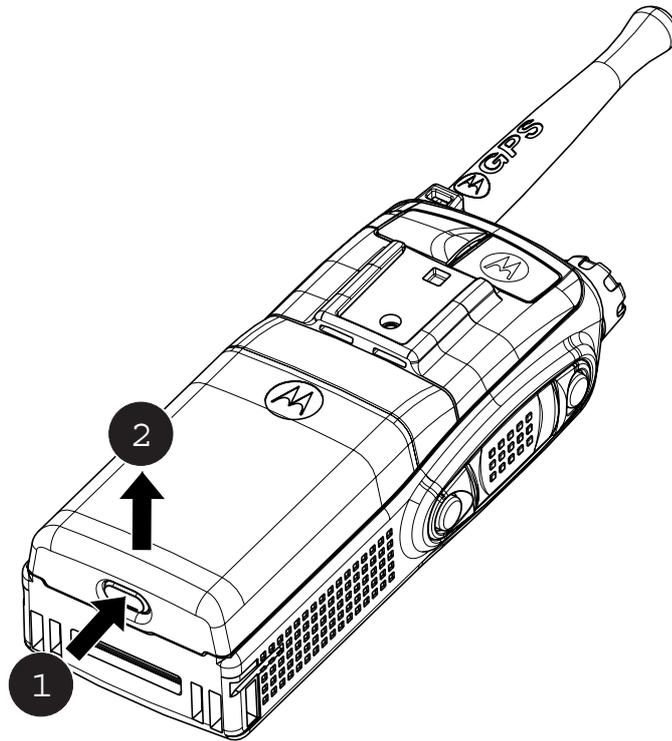


Figure 4 Battery Removal

To install the battery

1. Locate the battery so that the upper two tabs are inserted below the tabs on the back housing.
2. Carefully press the battery (lower part) down until it snaps into location.

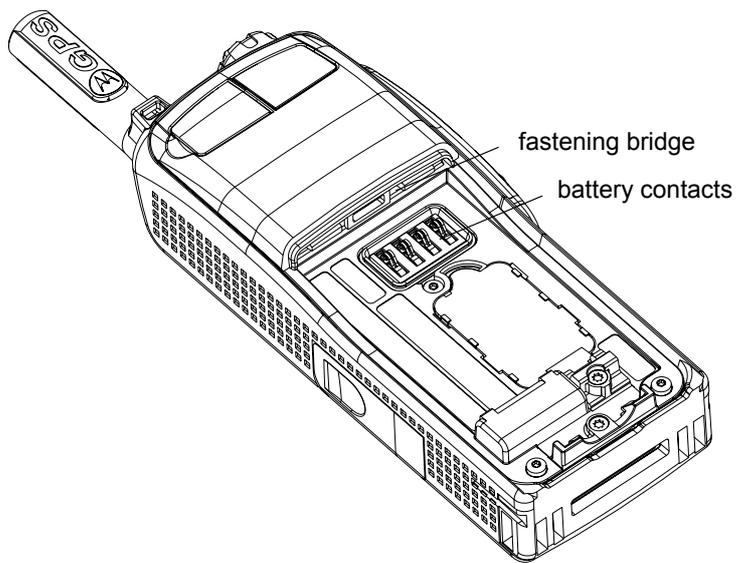


Figure 5 Location of Fastening Bridge & Battery Contacts

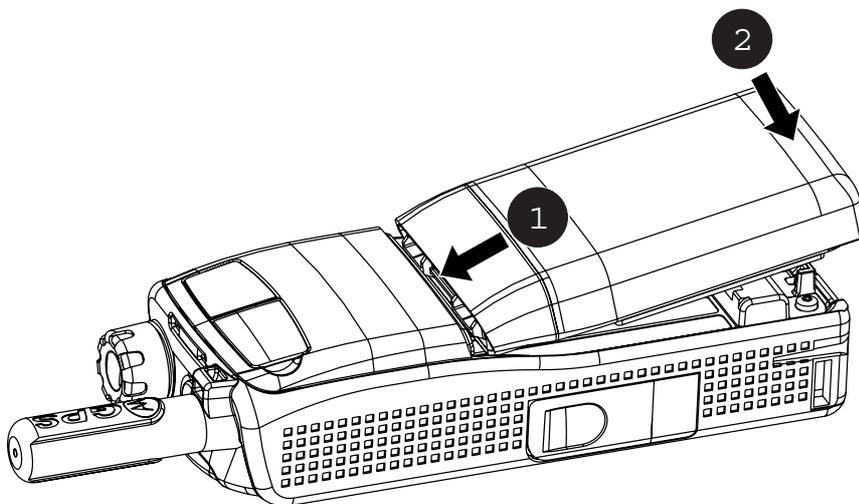


Figure 6 Battery Installation

Removing and Installing the Top Cover and Back Housing

Recommended tools: T-6 Torx bit, Torx driver, mini flat-tip screwdriver.

To remove the top cover from the unit

1. Place the unit facing down on clean work area.
2. Using the flat-tip screwdriver remove the label at the top of the unit (Logo label) to gain access to the single screw fastening the top cover.
3. Clean the adhesive remains of the labels using alcohol.
4. Using the Torx driver with the T-6 Torx bit, unscrew the screw fastening the top cover.
5. Carefully remove the top cover from the unit.

To install the top cover

1. Position the top cover over the unit.
2. Verify that the cover is positioned correctly, the screw hole is aligned to the threads of the front housing and the external antenna connector is visible through its dedicated hole.
3. Using the Torx driver with the T-6 Torx bit, screw with a torque of 3.0 ± 0.5 in-lb (0.34 ± 0.056 Nm).
4. Glue a new label over the screw hole.

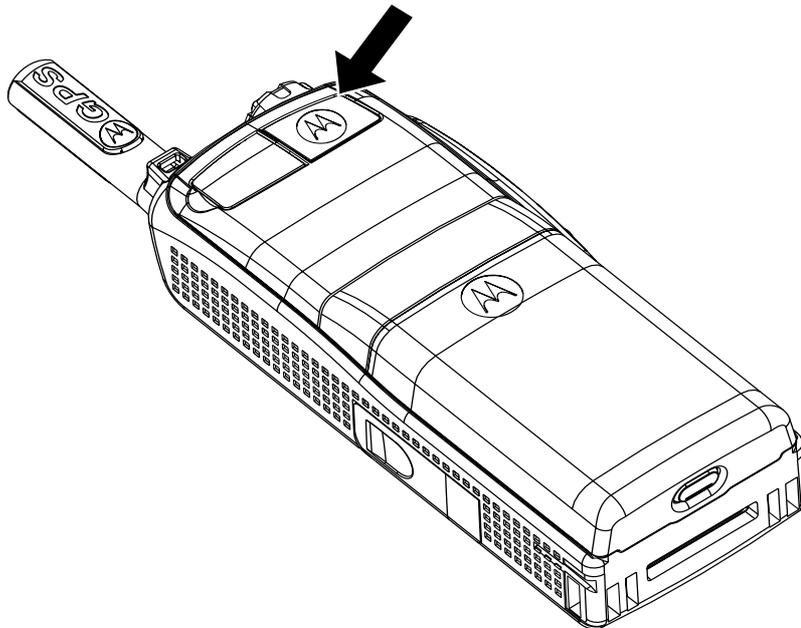


Figure 7 Top Cover Removal and Installation

To remove the back housing from the unit

1. Remove the antenna.
2. Remove the battery.
3. Remove the top cover.
4. Place the unit facing down on the clean work area.
5. Using the screwdriver remove the Tamper Evident label to gain access to all three screws fastening the back housing.
6. Clean the adhesive remains of the labels using alcohol.
7. Using the Torx driver with the T-6 Torx bit, unscrew the three screws fastening the back housing. Do not remove the two flathead screws at the bottom of the unit that hold the latch in place.
8. Carefully remove the back housing from the unit, lifting the bottom away from the unit first and then carefully removing the top away from under the front housing tab.
9. The main seal can then be removed from the back housing.
10. The battery seal can then be removed from the back housing.

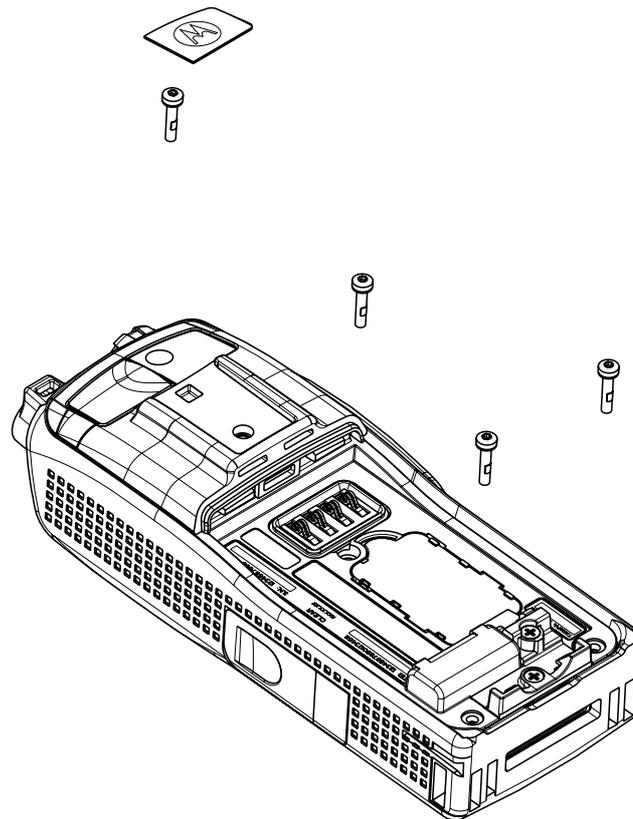


Figure 8 Back Housing Removal and Installation

To install the back housing

11. Place main seal in back housing making sure all tabs fit well in the back housing and the seal rests in the groove that goes around the back housing.
12. Place the battery seal in position in the back housing.
13. Position the back housing over the unit.
14. Carefully insert the top of the back housing under the front housing tab, and move the bottom of the back housing to the unit, making sure the main seal stays located on the back housing and the battery seal remains in place and around the battery connector.
15. Verify that the back housing is positioned correctly, screw holes are aligned to the threads of the front housing, external antenna connector is visible through its dedicated hole.
16. Using the Torx driver with the T-6 Torx bit, screw with a torque of 3.0 ± 0.5 in-lb (0.34 ± 0.056 Nm).
17. Replace top cover.
18. Glue a new Tamper Evident label.

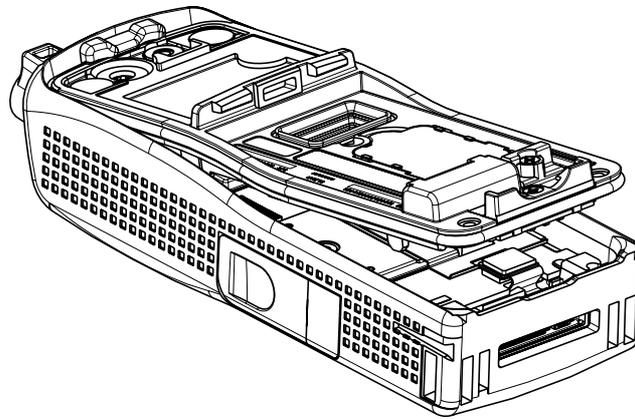


Figure 9 Back Housing Installation

Removing and Installing the Vibrator

Recommended tool: mini flat-tip screwdriver.

To remove the vibrator

1. Remove the back housing. Refer to “Removing and Installing the Back Housing” on page 6-9.
2. Turn the back housing up side down and, using the screwdriver, remove the vibrator from its chamber inside the back housing.

To install the vibrator

1. Carefully push the vibrator into its chamber in the back housing.
2. Install the back housing.

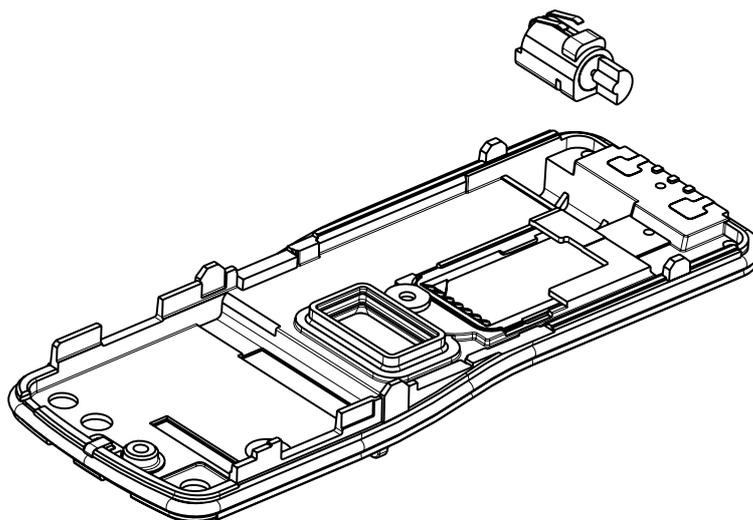


Figure 10 Vibrator Removal and Installation

Removing and Installing the Sim Card Door

Recommended tools: T-6 Torx bit, Torx driver.

To remove the Sim Card Door from the unit

1. Remove the battery.
2. Using the Torx driver with the T-6 Torx bit, unscrew the two screws fastening the latch to the back housing.
3. Remove the latch from the back housing.
4. Remove the Sim card Door.

To install the Sim Card Door onto the unit

1. Place the Sim card Door into position on the back housing.
2. Place the latch onto the back housing, including two flathead screws.
3. Using the Torx driver with the T-6 Torx bit, screw the two screws fastening the latch to the back housing.
4. Install the battery.

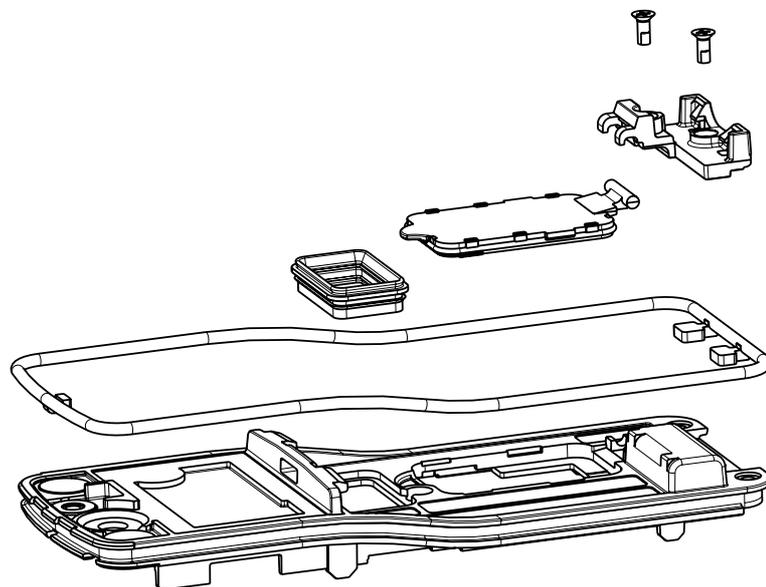


Figure 11 SIM Card Door Removal and Installation

Removing and Installing the Emergency Button

Recommended tools: tweezers, mini flat-tip screwdriver.

To remove the Emergency Button from the unit

The Emergency button can be pried from the main housing by use of a tweezers or mini flat-tip screwdriver.

To install the Emergency Button

Press the Emergency button into place until it clicks.

Removing and installing the UCM Board

Recommended tools: Phillips screwdriver.

To remove the UCM board from the main board

1. Remove the back housing. Refer to “Removing and Installing the Top Cover and Back Housing” on page 6-9.
2. Open the UCM fastening screw.
3. Gently remove the UCM Board from the Main Board. Verify not to damage the UCM connector when removing the board.
4. The Retainer rotary connector will also come off, as it is also secured by the UCM fastening screw.
5. Remove the retainer from the bushing on the main PCB.
6. The Retainer UCM will be adhered to the bottom of the UCM and it can be gently pried away. The Retainer UCM could also be still fixed to the main board shield. In this case, gently pull it off the shield.

To install the UCM board on the main board

1. Hold the Main Board with the UCM connector facing you.
2. Place the Retainer UCM as shown on the main board shield.
3. Install the retainer and align it with the bushing on the main PCB.
4. Place the Retainer rotary connector in position over the rotary connector, aligning its hole with the hole in the stud on the main board.
5. Carefully attach the UCM Board to the Main Board. Verify the connector is connected correctly.

6. Place and close the UCM fastening screw. Screw to 2.0 ± 0.5 in-lb (0.23 ± 0.058 Nm).

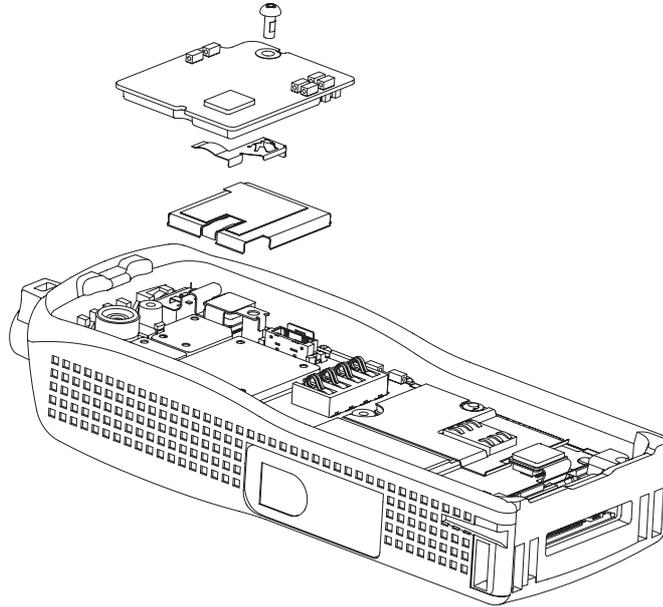


Figure 12 UCM Board Removal and Installation

Removing and Installing the Internal Assembly

Recommended tools: mini flat-tip screwdriver.

To remove the Internal Assembly from the unit

1. Remove the back housing. Refer to "Removing and Installing the Back Housing" on page 6-9.
2. Remove the UCM Board and the Retainer Rotary Connector. Refer to "Removing and installing the UCM Board" on page 6-14.
3. Open the audio jack plug before removal of the Internal Assembly.
4. Disconnect the accessory flex cable from the main board.
5. Remove the Retainer Accessory Connector with the screwdriver.
6. Carefully remove the accessory connector being careful not to damage the flex cable.
7. Disconnect the rotary flex cable from the main board.

8. In order to remove the internal assembly from the front housing, the front housing side walls must be spread apart such that the internal catches that hold the internal assembly in the front housing are freed. Gently pry towards the outside the front housing sidewalls and remove the internal assembly from the unit.
9. Remove the Cover audio jack from the side of the Internal Assembly.

To install the Internal Assembly

1. Place the Cover audio jack into place on the side of the Internal Assembly.
2. Position the Internal Assembly over the front housing; making sure the audio jack plug on the main housing is in the open position.
3. Gently push the Internal Assembly down into the front housing until two clicks are heard indicating that the Internal Assembly is secured in place.
4. Install the accessory connector into front housing.
5. Install the Retainer Accessory Connector.
6. Connect the accessory flex cable to the main board.
7. Connect the rotary flex cable to the main board.
8. Install the UCM Board and the Retainer Rotary Connector. Refer to "Removing and installing the UCM Board" on page 6-14.
9. Close the audio jack cover.

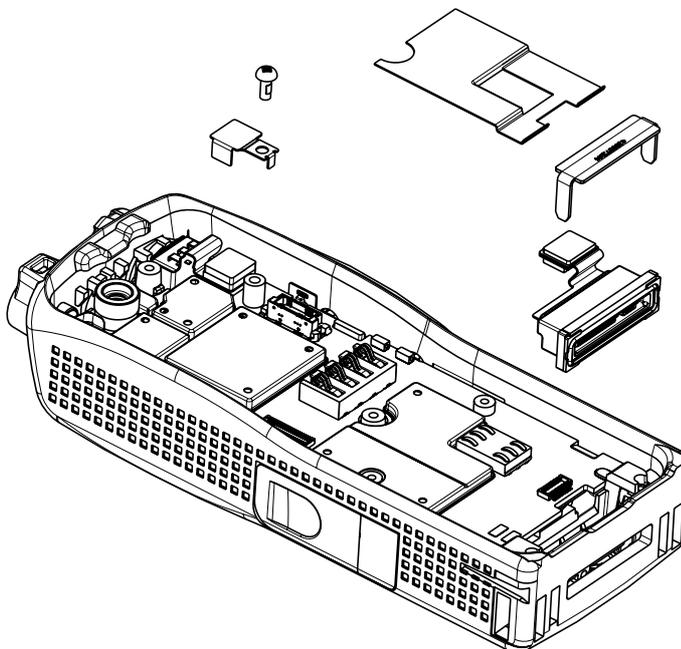


Figure 13 Removal and Installation of the Internal Assembly 1

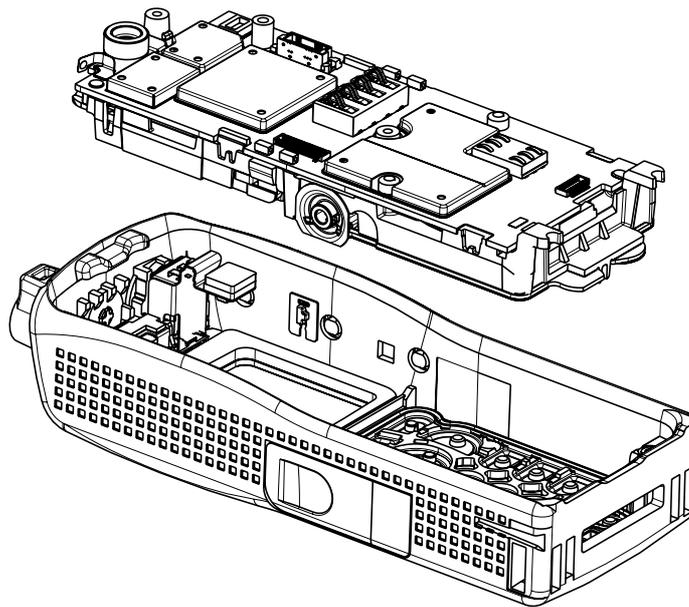


Figure 14 Removal and Installation of the Internal Assembly 2

Removing and Installing the Keypad Board and Main Board

Recommended tools: T-6 Torx bit, Torx driver, mini flat-tip screwdriver.

To remove the Keypad Board and Main Board

1. Remove the internal assembly from the unit. Refer to “Removing and Installing the Internal Assembly” on page 6-15.
2. Using the Torx driver with the T-6 Torx bit, unscrew the two screws fastening the keypad board.
3. Gently remove the keypad board from the assembly.
4. The main board can be separated enough from the chassis to remove the LCD flex connector from the main board, then the main board can be removed.

To install the Keypad Board and Main Board

1. Connect the LCD flex connector to the main board, then place the main board in position on the chassis.
2. Gently place the keypad board into position on the assembly, making sure that the board-to-board connectors mate.
3. Using the Torx driver with the T-6 Torx bit, screw the two screws fastening the keypad board with a torque of 2.0 ± 0.5 in-lb (0.23 ± 0.058 Nm).
4. Install the internal assembly into the front housing. Refer to “Removing and Installing the Internal Assembly” on page 6-15.

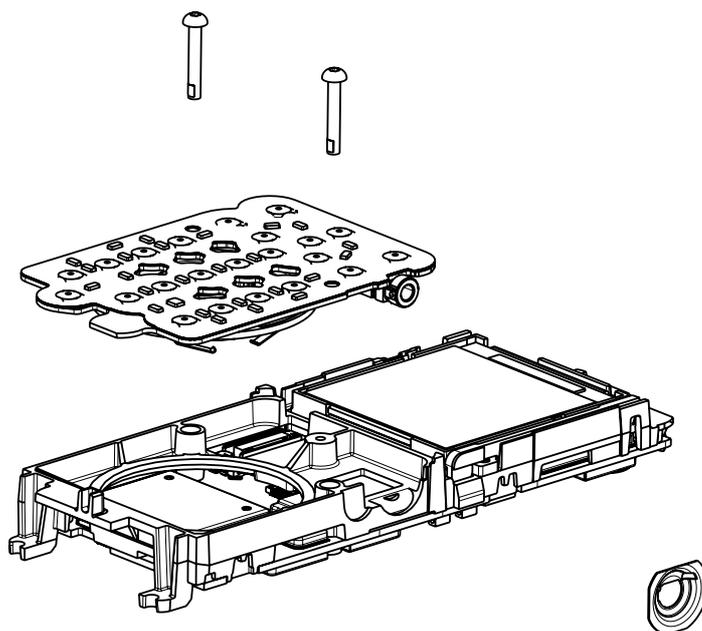


Figure 15 Keypad Board Removal and Installation

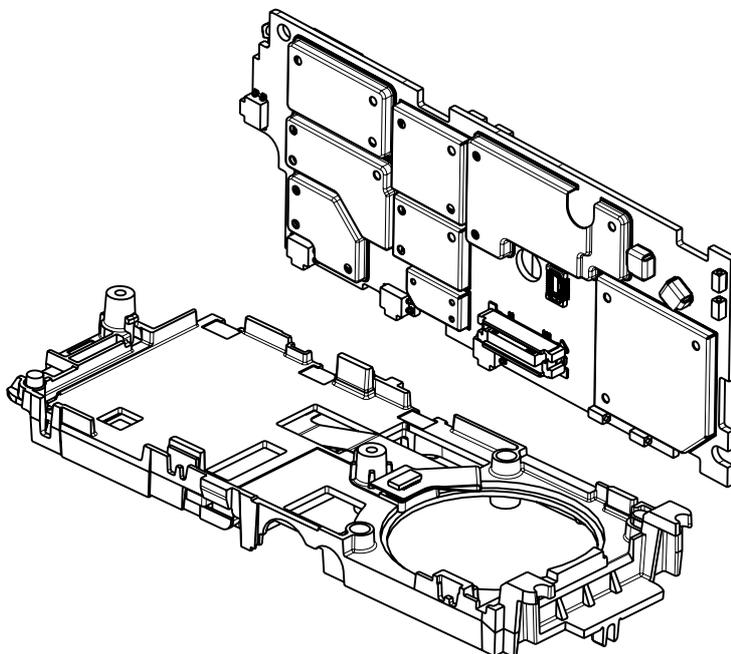


Figure 16 Main Board Removal and Installation

Removing and installing the Display

Recommended tools: mini flat-tip screwdriver

Note: Do not touch the display in the active viewing area; fingerprints on this surface cannot be easily removed. When servicing the display, work in a clean cell using de-ionized air pressure.

To remove the Display from the unit

1. Remove the Keypad Board and Main Board. Refer to “Removing and Installing the Keypad Board and Main Board” on page 6-17.
2. Place the chassis assembly, with the display facing up, on the clean work area.
3. Insert the screwdriver into the side slot in the upper side of the chassis assembly, and gently push the display holder out from the chassis.
4. Carefully remove the display.

To install the Display

1. Verify that no damage exists on the LCD glass. Install the protective film back in place.
2. Locate the display above the chassis and slide left side of LCD under chassis tab and onto left locating pin and ease into place. Verify that the display is inserted into the 2 location pins.
3. Carefully install the display holder. Verify that the holder is securely snapped into the slot.
4. Remove the protective film from the LCD glass.
5. Install the Keypad Board and Main Board. Refer to “Removing and Installing the Keypad Board and Main Board” on page 6-17.

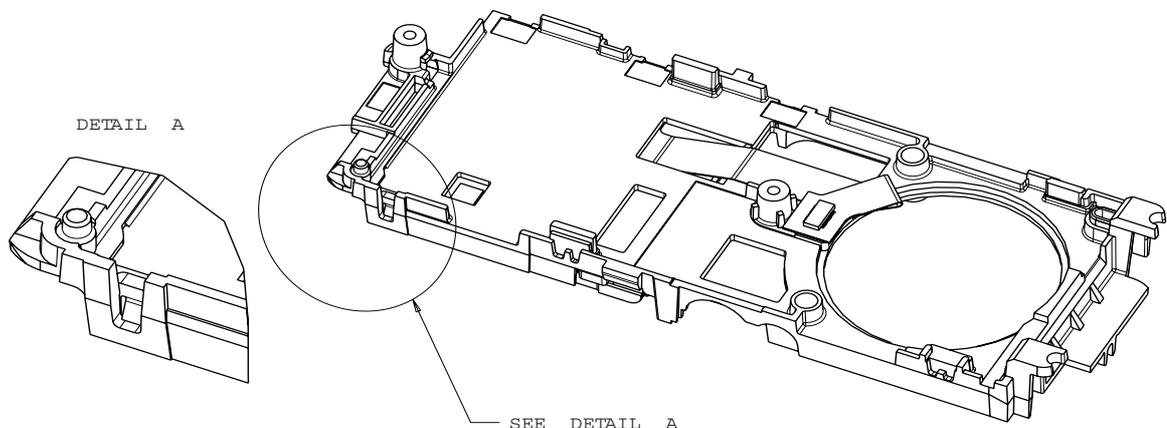


Figure 17 Display Removal and Installation 1

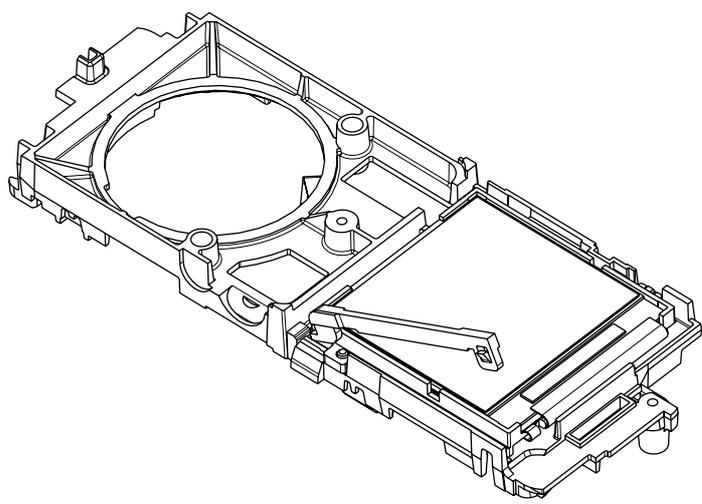


Figure 18 Display Removal and Installation 2

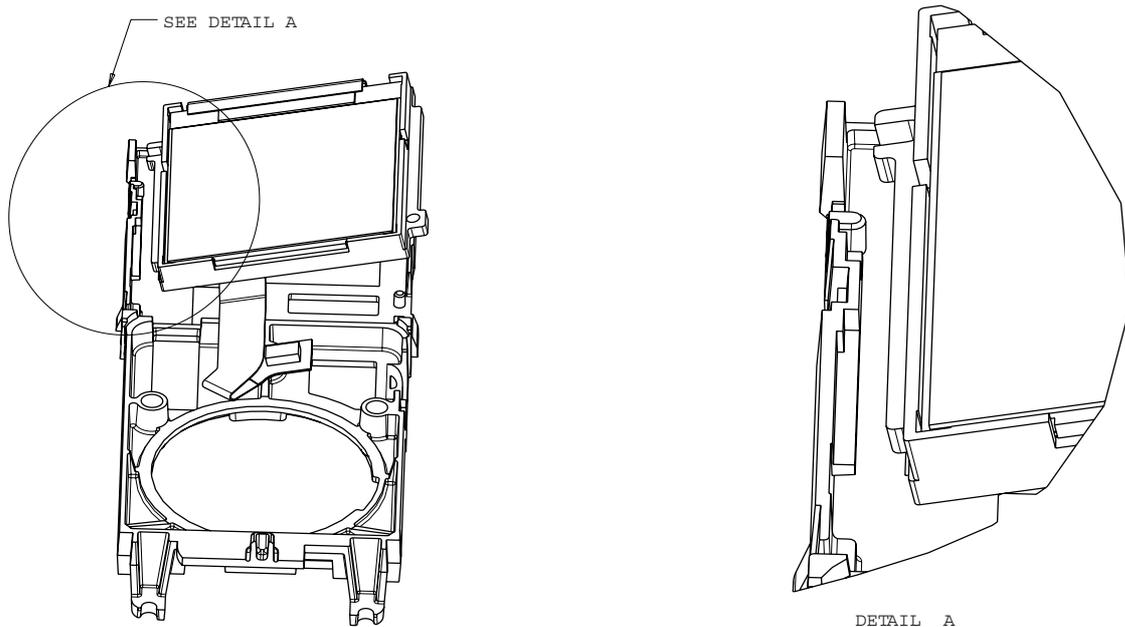


Figure 19 Display Removal and Installation 3

Removing and Installing the Keypad

Recommended tools: no tool is required.

To remove the Keypad

1. Remove the Internal Assembly. Refer to “Removing and Installing the Internal Assembly” on page 6-15.
2. Remove the keypad board from the unit.

To install the Keypad

1. Install the keypad. Verify that all the keys are properly inserted into their dedicated holes.
2. Install the Internal Assembly. Refer to “Removing and Installing the Internal Assembly” on page 6-15.

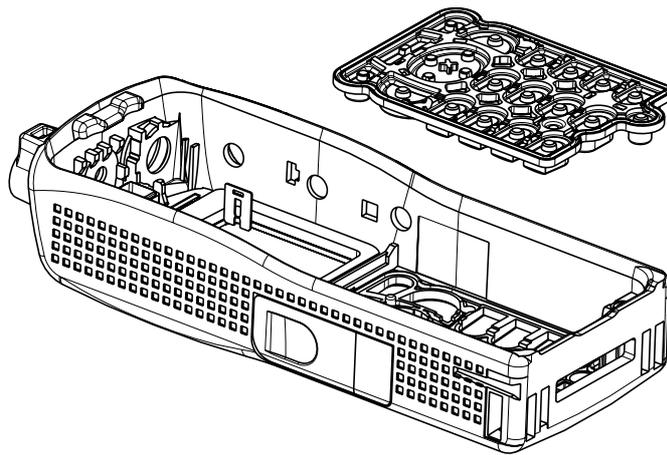


Figure 20 Keypad Removal and Installation

Removing and Installing the Rotary Switch

Recommended tools: T-6 Torx bit, Torx driver, Phillips screwdriver, mini flat-tip screwdriver, nut selector adapter (FR10056AT), hex head screwdriver.

To remove the Rotary Switch

1. Remove the internal assembly from the unit. Refer to “Removing and Installing the Internal Assembly” on page 6-15.
2. Remove the selector knob cover.
3. Unscrew the selector screw.
4. Remove the selector knob.
5. Mount the adapter onto the selector nut. Insert the hex head screwdriver in the adapter and turn counter clockwise to release the selector nut.
6. Remove the Retainer earpiece assembly by inserting the mini flat-tip screwdriver into each of the two tabs and unhooking the Retainer earpiece assembly from the front housing.
7. Remove the rotary switch assembly and rubber o-ring seal.

To install the Rotary Switch

1. Make sure that the o-ring seal is in place.
2. Install the rotary switch assembly.
3. Place Retainer earpiece assembly into position hooking the stiffener under the two tabs of the front housing, and then pressing down until the two metal tabs click into place.
4. Insert the selector nut. Mount the adapter onto the selector nut. Insert the hex head screwdriver in the adapter and turn clockwise to install the selector nut. Screw to 5 ± 0.5 in-lb (0.58 ± 0.058 Nm).
5. Install the selector knob.
6. Install the selector screw. Screw to 2.0 ± 0.5 in-lb (0.23 ± 0.058 Nm).
7. Insert the selector knob until it clicks into place.
8. Install the internal assembly from the unit. Refer to “Removing and Installing the Internal Assembly” on page 6-15.

Removing and Installing the Paddle PTT

Recommended tools: mini flat-tip screwdriver.

To remove the Paddle PTT

1. Remove the internal assembly from the unit. Refer to "Removing and Installing the Internal Assembly" on page 6-15.
2. Remove the Retainer PTT by inserting into the rectangular hole and sliding upwards until the Retainer PTT has been freed.
3. With the mini flat-tip screwdriver, pry the PTT away from the front housing and bezel PTT.
4. With the mini flat-tip screwdriver, pry the Bezel PTT away from the front housing.
5. Remove rubber keypad PTT.

To install the Paddle PTT

1. Place paddle PTT into Bezel PTT by inserting two tabs from one side of the paddle PTT into the respective slots on the bezel PTT. Then, bend the paddle PTT in order to insert the other two tabs.
2. Place rubber keypad PTT into position on the Bezel PTT.
3. Place PTT assembly into the front housing by inserting one tab from one side of the bezel PTT into the respective slot on the front housing. Then, bend the bezel PTT in order to insert the other slot into the front housing.
4. While pressing hard on the paddle PTT, install the PTT retainer.
5. Install the internal assembly from the unit. Refer to "Removing and Installing the Internal Assembly" on page 6-15.

Removing and Installing the Microphones

Recommended tools: tweezers or narrow blade knife, mini flat-tip screwdriver.

To remove the top microphone from the unit

(See Figure 21 on page 6-25, item No. 7)

1. Remove the Rotary Switch from the unit. Refer to "Removing and Installing the Rotary Switch" on.
2. To remove the top microphone, press lightly on its rubber boot and slightly insert the tweezers or knife inside the boot between the microphone plastic housing and the rubber boot.

3. With an upward motion of the tweezers or knife, remove the microphone. The microphone might be damaged during the removal and should then be replaced by a new one.

To install the top microphone

1. Insert the microphone into location.
2. Install the Rotary Switch.

To remove the bottom microphone from the unit

(See Figure 21 on page 6-25, item No. 7)

1. Remove the internal assembly from the unit. Refer to "Removing and Installing the Internal Assembly" on page 6-15.
2. Using tweezers or a mini flat-tip screwdriver, remove the bottom microphone.

To install the bottom microphone

1. Insert the microphone into location.
2. Install the Internal Assembly.

Removing and Installing the Earpiece

Recommended tools: tweezers.

To remove the Earpiece from the unit

(See Figure 21 on page 6-25, item No. 9)

1. Remove the Rotary Switch from the unit. Refer to "Removing and Installing the Rotary Switch" on page 6-22.
2. Using the tweezers grasp the earpiece and with an upward motion remove the earpiece.

To install the Earpiece

1. Be sure to place the earpiece correctly (evenly) into the rubber boot with the spring contacts pointing in the upward direction. Use tweezers for this operation.
2. Gently push the earpiece into the boot until it is firmly inside the boot.
3. Install the Rotary Switch.

Exploded Views

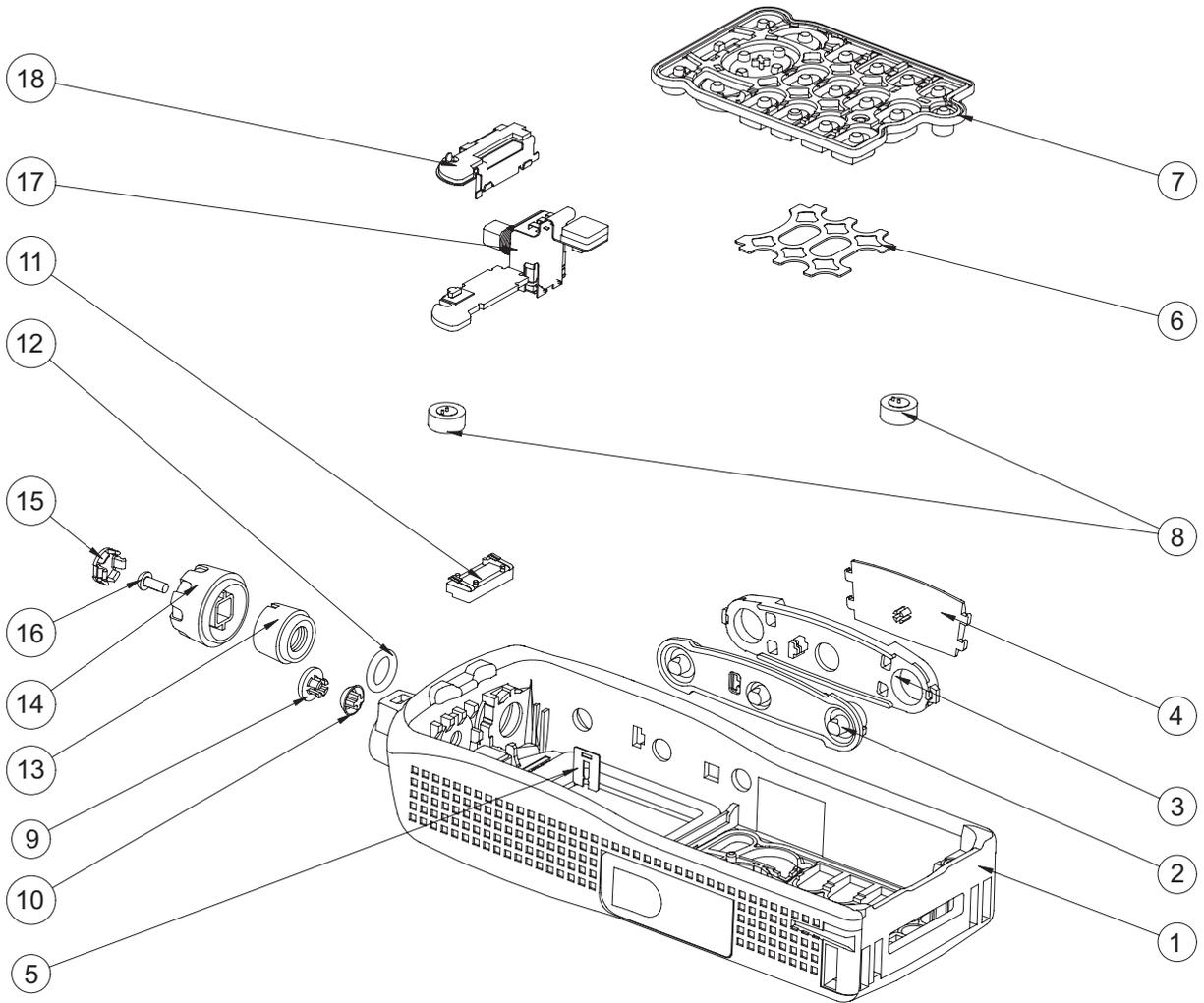


Figure 21 Exploded View 1

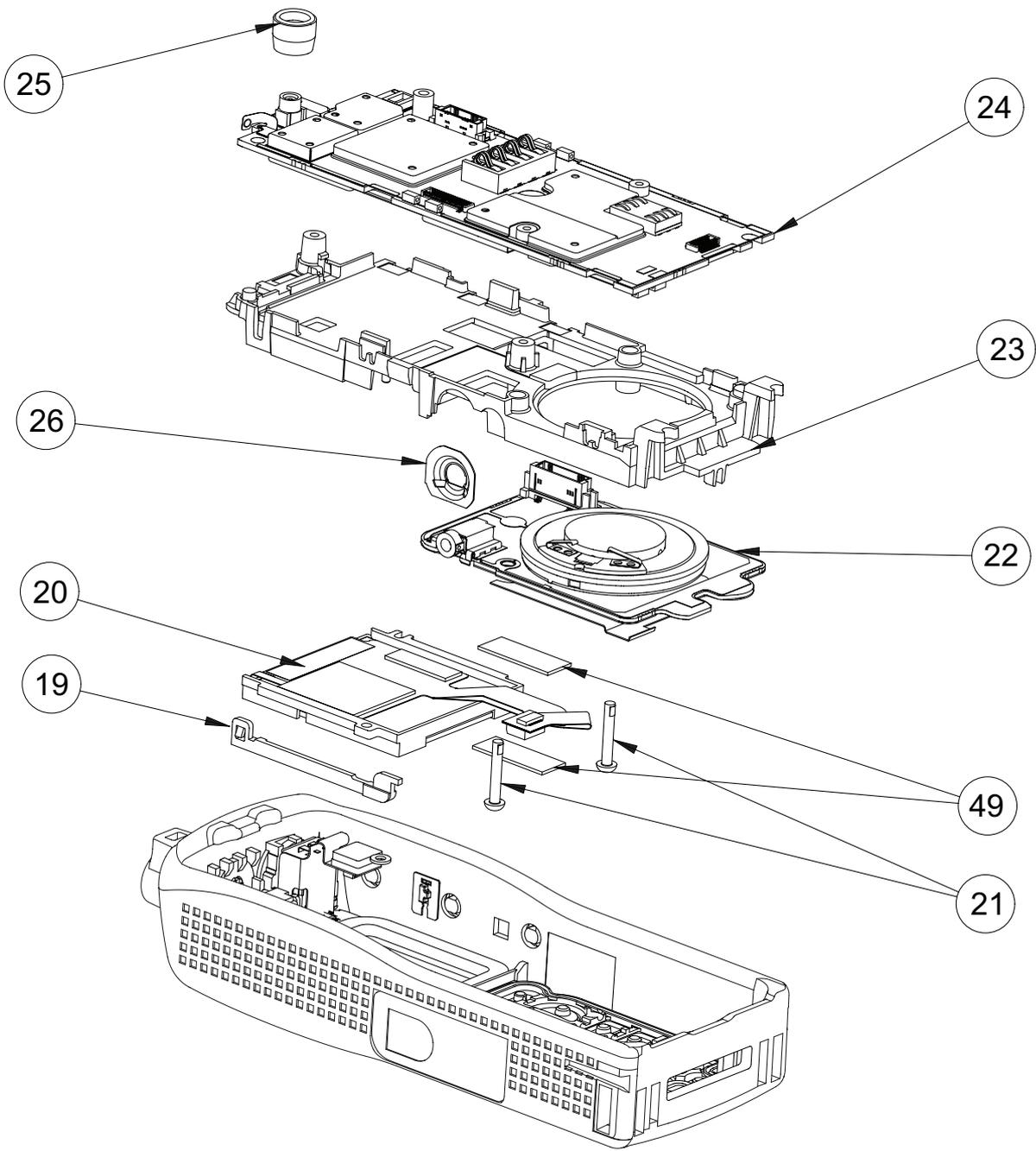


Figure 22 Exploded View 2

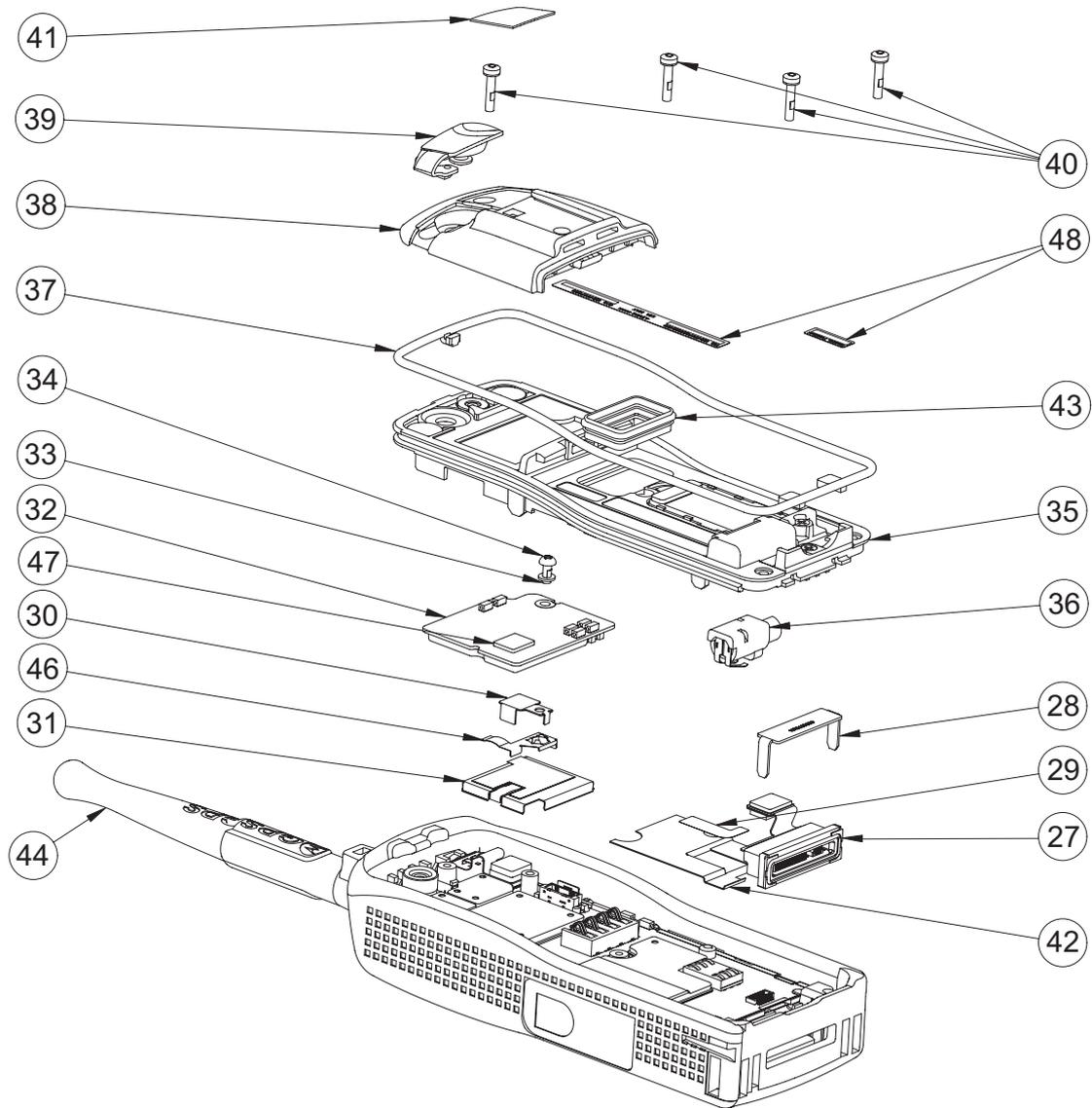


Figure 23 Exploded View 3

Torque List

| Description | Part/Kit | Quantity | Torque |
|--------------------|------------|----------|-------------------------------|
| Selector screw | 0387839V01 | 1 | 2.0±0.5 in-lb (0.23±0.058 Nm) |
| Selector nut | 0287571V09 | 1 | 5±0.5 in-lb (0.58±0.058 Nm) |
| UCM Screw | 0387839V01 | 1 | 2.0±0.5 in-lb (0.23±0.058 Nm) |
| Simcard screw | 0387839V62 | 2 | 2.0±0.5 in-lb (0.34±0.058 Nm) |
| External screw | 0187506V83 | 4 | 3.0±0.5 in-lb (0.23±0.058 Nm) |
| Keypad board screw | 0387839V57 | 2 | 3.0±0.5 in-lb (0.23±0.058 Nm) |

Replacement Parts

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

The first column of the radio replacement parts list provides you with the call out number of the components as marked in Figure 21 on page 6-25, Figure 22 on page 6-26 and Figure 23 on page 6-27.

Radio Replacement Parts List

| No. from exploded view | Part/Kit Number | Description | Remark |
|------------------------|-----------------|---------------------------|--------------|
| 1 | 0187959V09 | Front housing assembly | |
| 2 | 7587835V05 | Keypad PTT | |
| 3 | 1388526V01 | Bezel PTT | |
| 4 | 3887998U03 | Paddle PTT | |
| 5 | 4287531V09 | Clip PTT | Retainer PTT |
| 6 | 3587514V19 | Keypad Felt | |
| 7 | 7587835V06 | Keypad assembly, English | |
| | 7587835V17 | Keypad assembly, Chinese | |
| | 7587835V16 | Keypad assembly, Korean | |
| | 7587835V25 | Keypad assembly, BoPoMoFo | |
| | 7587835V23 | Keypad assembly, Arabic | |
| | 7587835V26 | Keypad assembly, Cyrillic | |
| 8 | 5086346J05 | Microphone | |
| 9 | 3887998U04 | Key emergency | |
| 10 | 3287533V62 | Seal emergency | |
| 11 | 5089574N01 | Earpiece | |
| 12 | 3287842V25 | Seal rotary | |
| 13 | 0287571V09 | Selector nut | |
| 14 | 3687537V09 | Selector knob | |
| 15 | 3687537V10 | Selector knob cover | |
| 16 | 0387839V01 | Selector screw (M2) | |

| No. from exploded view | Part/Kit Number | Description | Remark |
|------------------------|----------------------|--|--|
| 17 | 0188176V27 | Flex rotary-acoustics assembly | For 800MHZ |
| | 0188176V33 | Flex rotary-acoustics assembly | For 380MHz |
| 18 | 0187506V93 | Retainer earpiece assembly | |
| 19 | 0788394V17 | Display holder | clip LCD |
| 20 | 7287507V03 | Display | |
| 21 | 0387839V57 | Screw M2x13 Torx Pan Patch | |
| 22 | PMTN4119_ | Keypad board assembly | Including loudspeaker |
| 23 | 0189968V08 | Internal frame assembly | For UHF |
| | 0188809V60 | Internal frame assembly | For 800 MHz |
| 24 | PMLE4589_ | Main board kit for UHF (1W radio) | Main boards are shipped with new serial and TEI numbers |
| | PMLF4051_ | Main board kit for 800 MHz | |
| | PMUE3319_W | Main board kit for UHF (1.8W radio) | |
| | PMUE3376_W | Main board kit for UHF (1.8W radio) - TEA1 | |
| | PMUE3376_W | Main board kit for UHF (1.8W radio) - TEA2 | |
| | PMUE3388_W | Main board kit for UHF (1.8W radio) - TEA3 | |
| 25 | 3287842V30 | RF switch internal seal | Seal RF switch |
| 26 | 1587949V14 | Cover audio connector | Cover audio jack |
| 27 | 0188809V36 | Accessory connector assembly | |
| 28 | 4286372U14 | Retainer accessory connector | |
| 29 | 5488700V14 | Tamper label | Only when UCM is equipped |
| 30 | 4286372U15 | Retainer rotary connector | |
| 31 | 0188809V24 | Retainer UCM | Only when UCM is equipped |
| 32 | CLN8527_ CLN8353_ | UCM assembly | The UCM Board can only be replaced by Motorola Service Centre or Motorola Service Depot. |
| 33 | 0480378L02 | Lock washer | Only when UCM is NOT used |
| 34 | 0387839V01 | UCM screw | |
| 35 | 0187506V84 | Back housing assembly | For UHF |
| | 0171122L01 | Back housing assembly | For 800 MHz |
| 36 | 0104023J32 | Vibrator assembly | |
| 37 | 3287842V56 | Seal main | O-Ring (purple) |

| No. from exploded view | Part/Kit Number | Description | Remark |
|------------------------|-----------------|-------------------------------------|---------------------------|
| 38 | 1587508V69 | Top cover, belt clip | |
| 39 | 3887998U07 | Seal RF switch, for belt clip cover | |
| 40 | 0187506V83 | Screw and Washer, External | |
| 41 | 3387921U12 | Motorola Logo Label | |
| 42 | 0104026J08 | Cover Sim | |
| 43 | 3287533V46 | Seal contact battery | |
| 44, 45 | * | Antenna | |
| 46 | 4286372U24 | Retainer | Only when UCM is equipped |
| 47 | 7587509V77 | Pad, Connector ACC | Only when UCM is equipped |
| 48 | 5416360H01 | Twin FFC labels | |
| 49 | 75012032001 | RF Absorber | |

* Refer to the following Accessories Replacement Parts List

Accessories Replacement Parts List

| Kit Number | Description |
|---------------------------------------|---|
| Batteries | |
| FTN6573 | Standard capacity battery, 950 mAh, Lilon |
| FTN6574 | Ultra high capacity battery, 1850 mAh, Lilon |
| Chargers and Vehicle Solutions | |
| FTN6575 | Dual pocket desktop charger base (requires travel charger /power supply NNTN4250 and specific plug or travel kit) |
| NNTN4250 | Travel Charger (power supply unit) US plug, just add country specific adapter (SYN7456 - Euro, SYN7455 - UK, SYN8127 - Australia/New Zealand) |
| WALN4092 | Travel charger kit (includes UK and Euro adapters) |
| NPN6443 | Travel charger kit (includes Korea adapter) |
| NNTN5842 | Travel charger kit (includes Argentina adapter) |
| FLN9469 | Vehicle Cigarette Lighter Charger |
| Carrying Options | |
| NTN5243 | Shoulder Strap |
| RLN5717 | Belt worn hard leather case with swivel belt loop |
| RLN5718 | Belt worn nylon holster with fixed 3" belt loop |
| RLN5719 | Belt worn soft leather carry case with swivel 3" belt loop |

| Kit Number | Description |
|----------------------------------|--|
| RLN5720 | Belt worn soft leather carry case with integrated belt clip |
| RLN5722 | Replacement swivel belt loop |
| RLN5889 | Replacement T-strap |
| HLN9767 | Wrist Strap |
| HLN9844 | Belt Clip (short, 1.5") for use with radio top cover |
| HLN9714 | Belt Clip (long, 2.5") for use with radio top cover |
| Audio Accessories | |
| FTN6596 | Earpiece receive only with coiled cord, suitable for shoulder worn terminals |
| FTN6582 | Breeze headset with boom microphone and in-line Push-To-Talk |
| FTN6583 | Personal Hands free kit (ear bud with in-line microphone and Push-To-Talk) |
| FTN6595 | Surveillance kit - 3 wire earpiece with separate microphone and Push-To-Talk |
| FTN6707 | Surveillance kit - 2 wire earpiece with combined microphone and Push-To-Talk |
| PMLN4605 | Acoustic Tube for use with 2 wire kit FTN6707 |
| For use with FTN6595 and FTN6596 | |
| NTN8370 | Acoustic Voicetube with foam plug for extreme noise environments |
| NTN8371 | Acoustic Voicetube with rubber ear tips for low noise environments |
| WADN4223 | Earshell - large with grommet insert |
| WADN4224 | Earshell - small with grommet insert |
| Antennas | |
| 8586381J11 | Whip Antenna 380–430 MHz, 1575.4M |
| 8587526V14 | Stub Antenna 380–430 MHz, 1575.4M |
| 8587526V08 | Helical Antenna 800–870 MHz with integrated GPS antenna |
| 8587526V09 | Whip Antenna 800–870 MHz with integrated GPS antenna |
| Cables | |
| PMKN4025A | RS-232 Data cable |
| FLN9636 | Programming cable |
| PMKN4026A | USB Cable |

Notes

APPENDIX A

SERVICE INFORMATION

Servicing MTP850 Handportable Terminals

Service for the mobile units is based on the substitution method; a faulty part is replaced by a working one, providing quicker service to the customer. For example, if the controller board is faulty, it is replaced. If the mobile requires more complete testing or servicing than that is available at field level, it is sent to the European Radio Service Centre; where it is serviced, and returned to the Regional Service Centre.

Level 1 and Level 2 Maintenance

This manual covers Level 1 and Level 2 Maintenance: at Level 1 maintenance you replace the transceiver and/or accessories and send the faulty transceiver and/or accessories to higher level of maintenance; at level 2 maintenance a transceiver board is replaced.

The MTP850 Terminals are programmed at the factory. They cannot be tuned at the field service level.

Level 3 Maintenance

Level 3 maintenance can only be done at the Motorola Service Centre/Depot. To find out more about Motorola Service Centre, please visit

<http://www.motorola.com/governmentandenterprise>

Replacement Parts

Damaged parts should be replaced with identical replacement parts. For complete information on ordering required parts and kits, contact your local customer service representative (see following pages).

SERVICE INFORMATION

Europe, Middle East and Africa Region

European Radio Support Centre (ERSC)

Motorola European Radio Support Centre is available at:

Motorola European Radio Support Centre ERSC
Tel.: +49 (0)30 6686 1555
Fax: +49 (0)30 6686 1579
Am Borsigturm 130
13507 Berlin
Germany

EMEA Systems Support Centre (ESSC)

The Systems Support Centre is available at:

Telephone: +44 (0) 1256 484448
E-mail: ESSC@motorola.com

Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola Radio Aftermarket and Accessory Division (AAD). If no part number is assigned, the part is not normally available from Motorola. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

Note on this digital Tetra Radio: **The CPS has no capability to tune the radio. Tuning the radio can only be performed at the factory or at the appropriate Motorola Repair Centre. Components replacement can affect the radio tuning and must only be performed by the appropriate Motorola Repair Centre.**

Parts identification and ordering

Request for help in identification of non-referenced spare parts should be directed to the Customer Care Organization of Motorola's local area representation. Orders for replacement parts, kits and assemblies should be placed directly on Motorola's local distribution organization or via the Extranet site Motorola Online at:
<http://www.motorola.com/emeaonline>.

However, export-controlled products or spare parts (e.g TEA-related boards) cannot be ordered via Motorola Online. Please send an order form with actual end-customer details via e-mail to your customer care team.

EMEA Test Equipment Support

Information related to support and service of Motorola Test Equipment is available by calling the Motorola Test Equipment Service in Germany at +49 (0) 6128 702179, Telefax +49 (0) 6128 951046, through the Customer Care Organization of Motorola's local area representation, or via the Internet at: <http://www.gd-decisionssystem.com/cte/>.

Asia Pacific Region

Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola Radio Aftermarket and Accessory Division (AAD). If no part number is assigned, the part is not normally available from Motorola. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

Note on this digital TETRA Radio: **The CPS has no capability to tune the radio. Tuning the radio can only be performed at the factory or at the appropriate Motorola Repair Center. Component replacement can affect the radio tuning and must only be performed by the appropriate Motorola Repair Center.**

All orders for parts/information should include the complete Motorola identification number. All part orders should be directed to your local AAD office. Please refer to your latest price pages.

Technical Support

Technical support is available to assist the dealer/distributor in resolving any malfunction which may be encountered. Initial contact should be by telephone wherever possible. When contacting Motorola Technical Support, be prepared to provide the product model number and the unit's serial number.

Further Assistance From Motorola

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

Latin America Region

Latin America Radio Support Centres

The Customer Support is available through the following service centres:

Warranty and Repairs:

MOTOROLA DE COLOMBIA SERVICE CENTRE

Torre Banco Ganadero
Carrera 7 No. 71-52
Torre B piso 13
Oficina 1301
Bogota- Colombia
(571) 376-6990

MOTOROLA DE MEXICO SERVICE CENTRE

Bosques de Alisos #125
Col. Bosques de las Lomas
CP 05120 Mexico DF
5252576700

Piece Parts:

To order parts in Latin America and the Caribbean contact your local Motorola GEMS representative.

MOTOROLA, INC.

Latin American Countries Region
789 International Parkway
Sunrise, FL 33325
USA 954-723-8959

MOTOROLA DE ARGENTINA

Ave. del Libertador 1855
B1638BGE, Vicente Lopez
Buenos Aires, Argentina
5411-4317-5300

MOTOROLA DE LOS ANDES C.A.

Ave. Francisco de Miranda
Centro Lido, Torre A
Piso 15, El Rosal
Caracas, 1060 Venezuela
58212-901-4600

MOTOROLA DO BRASIL LTDA.

Av. Chedid Jafet
222 Bloco D Conjuntos 11,12,21,22 E 41
Condominio Millennium Office Park
04551-065- Vila Olimpia, Sao Paulo
Brasil
5511-3847-668

MOTOROLA CHILE

Ave. Nueva Tajamar 481
Edif. World Trade Center
Of. 1702, Torre Norte
Las Condes
Santiago, Chile
562-338-9000

MOTOROLA DE COLOMBIA, LTDA.

Torre Banco Ganadero
Carrera 7 #71-52
Torre A, Oficina 1301
Bogotá, Colombia
571-376-6990

MOTOROLA DE COSTA RICA

Parque Empresarial Plaza Roble
Edificio El Portico, 1er Piso
Centro de Negocios Internacional
Guachepelin, Escazu
San Jose, Costa Rica
506-201-1480

MOTOROLA DEL ECUADOR

Autopist Gral. Rumiñahui, Puente 2
Conjunto Puerta del Sol Este-Ciudad Jardin
Pasa E, Casa 65
Quito, Ecuador
5932-264-1627

MOTOROLA DE MEXICO, S.A.

Calle Bosques de Alisos #125
Col. Bosques de Las Lomas
05120 México D.F.
México
52-555-257-6700

MOTOROLA DEL PERU, S.A.

Ave. República de Panama 3535
Piso 11, San Isidro
Lima 27, Peru
511-211-0700

Technical Support:

<http://www.motorola.com/businessonline>, go to **Contact Us** to request technical support

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola. If no part number is assigned, the part is not normally available from Motorola. If the part number is appended with an asterisk, the part is serviceable by Motorola Depot only. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

Recommended Programming Equipment

| Name | Part Number |
|--|-------------|
| MTP850 Customer GPS | |
| RS-232 Programming cable (set cable switch to FLASH) | PMKN4025_ |
| USB Programming cable | PMKN4026_ |

Service Replacement Kit Matrix

| Sales Model | Description | Service Tanapa | Description |
|---------------------------|-------------|---------------------------|------------------------------------|
| MTP850 806–870 MHz | | FUE1081BS | MTP850 KOREA W/O UCM-CLEAR |
| | | FUE1082BS | MTP850 KOREA W/O UCM -TEA1 |
| | | FUE1144BS | MTP850 KOREA W UCM-CLEAR |
| | | FUE1086BS | MTP850 KOREA W GPS W UCM-TEA1 |
| | | FUE1142CS | MTP850 CHINESE W/O UCM-CLEAR |
| | | FUE1102BS | MTP850 CHINESE W/O UCM-TEA1 |
| | | FUE1101BS | MTP850 CHINESE W UCM-CLEAR |
| | | FUE1106BS | MTP850 CHINESE W UCM-TEA1 |
| | | FUE1107CS | MTP850 ENGLISH W/O UCM-CLEAR |
| | | FUE1110BS | MTP850 ENGLISH W UCM-CLEAR |
| | | FUE1111BS | MTP850 ENGLISH W/O UCM-TEA1 |
| | | FUE1114BS | MTP850 ENGLISH W UCM-TEA1 |
| | | FUE1115BS | MTP850 KOREA W/O GPS W/O UCM -TEA3 |
| | | FUE1117BS | MTP850 KOREA W UCM -TEA3 |
| | | FUE1119BS | MTP850 CHINESE W/O UCM-TEA3 |
| | | FUE1123BS | MTP850 CHINESE W UCM-TEA3 |
| | | FUE1124BS | MTP850 ENGLISH W/O UCM-TEA3 |
| | FUE1127BS | MTP850 ENGLISH W UCM-TEA3 | |
| MTP850 380–430 MHz | | FUE1153CS | MTP850 380 CLR ENG W/O UCM |
| | | FUE1157BS | MTP850 380 CLR ARB W/O UCM |
| | | FUE1189CS | MTP850 380 CLR CYR W/O UCM |
| | | FUE1158BS | MTP850 380 ENG W/UCM AES128 |
| | | FUE1162BS | MTP850 380 ARB W/UCM AES128 |
| | | FUE1190BS | MTP850 380 CYR W/UCM AES128 |
| | | FUE1178CS | MTP850 380 TEA1 ENG W/O UCM |
| | | FUE1167BS | MTP850 380 TEA1 ARB W/O UCM |
| | | FUE1191BS | MTP850 380 TEA1 CYR W/O UCM |
| | | FUE1168BS | MTP850 380 TEA1 ENG W/UCM AES128 |
| | | FUE1172BS | MTP850 380 TEA1 ARB W/UCM AES128 |
| | | FUE1193BS | MTP850 380 TEA1 CYR W/UCM AES128 |
| | | FUE1173CS | MTP850 380 TEA2 ENG W/O UCM |
| | | FUE1174BS | MTP850 380 TEA2 ENG W/UCM AES128 |

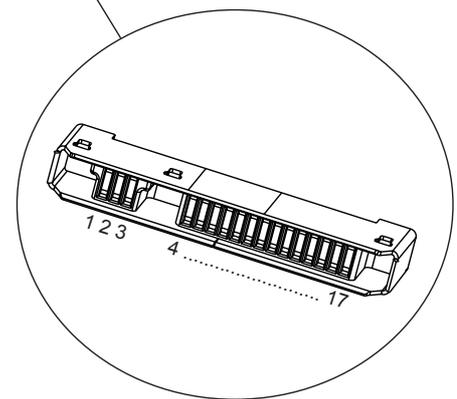
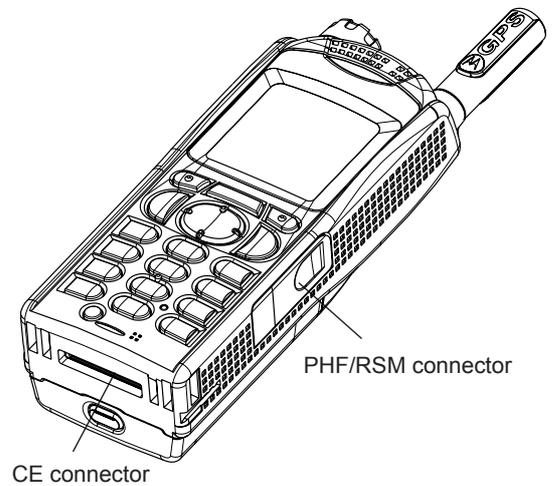
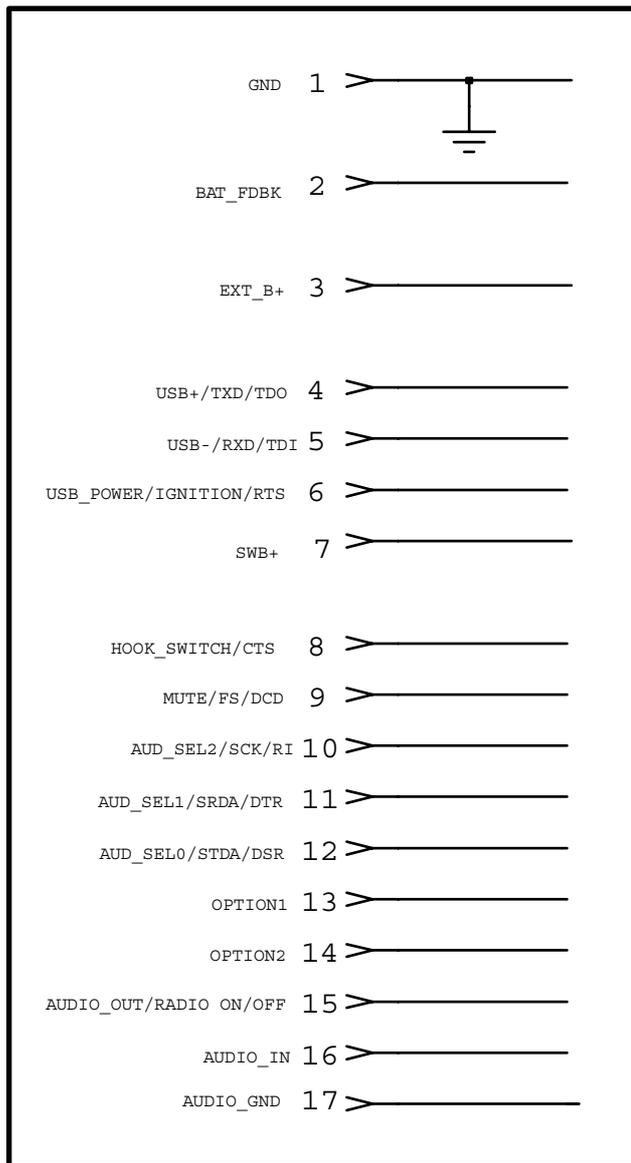
| Sales Model | Description | Service Tanapa | Description |
|-------------|-------------|----------------|-----------------------------------|
| | | FUE1224CS | MTP850 380 TEA3 ENG W/O UCM |
| | | FUE1228BS | MTP850 380 TEA3 ARB W/O UCM |
| | | FUE1229BS | MTP850 380 TEA3 CYR W/O UCM |
| | | FUE1230BS | MTP850 380 TEA3 ENG W/UCM AES128 |
| | | FUE1234BS | MTP850 380 TEA3 ARB W/UCM AES128 |
| | | FUE1235BS | MTP850 380 TEA3 CYR W/UCM AES128 |
| | | FUE1244BS | MTP850 380 TEA2 ENG W/O UCM W/A |
| | | PMUE2914BS | MTP850 380 ENG UCM-M AES128 |
| | | PMUE2915BS | MTP850 380 ARB UCM-M AES128 |
| | | PMUE2916BS | MTP850 380 CYR UCM-M AES128 |
| | | PMUE2917BS | MTP850 380 ENG TEA1 UCM-M AES128 |
| | | PMUE2918BS | MTP850 380 ARB TEA1 UCM-M AES128 |
| | | PMUE2919BS | MTP850 380 CYR TEA1 UCM-M AES128 |
| | | PMUE2920BS | MTP850 380 TEA2 ENG UCM-M AES128 |
| | | PMUE2921BS | MTP850 380 TEA3 ENG UCM-M AES128 |
| | | PMUE2922BS | MTP850 380 ARB TEA3 UCM-M AES128 |
| | | PMUE2923BS | MTP850 380 CYR TEA3 UCM-M AES128 |
| | | PMUE3319AS | MTP850 380 CLR ROM |
| | | PMUE3318AS | MTP850 380 CLR ROM UCM-AES128 |
| | | PMUE3350AS | MTP850 380 CLR ROM UCM-AES256 |
| | | PMUE3370AS | MTP850 380R CLR ARB |
| | | PMUE3371AS | MTP850 380R CLR ARB UCM-M AES128 |
| | | PMUE3372AS | MTP850 380R CLR ARB UCM-M AES256 |
| | | PMUE3373AS | MTP850 380R CLR CYR |
| | | PMUE3374AS | MTP850 380R CLR CYR UCM-M AES128 |
| | | PMUE3375AS | MTP850 380R CLR CYR UCM-M AES256 |
| | | PMUE3376AS | MTP850 380R TEA1 ROM |
| | | PMUE3377AS | MTP850 380R TEA1 ROM UCM-M AES128 |
| | | PMUE3378AS | MTP850 380R TEA1 ROM UCM-M AES256 |
| | | PMUE3379AS | MTP850 380R TEA1 ARB |
| | | PMUE3380AS | MTP850 380R TEA1 ARB UCM-M AES128 |
| | | PMUE3381AS | MTP850 380R TEA1 ARB UCM-M AES256 |
| | | PMUE3382AS | MTP850 380R TEA1 CYR |
| | | PMUE3383AS | MTP850 380R TEA1 CYR UCM-M AES128 |
| | | PMUE3384AS | MTP850 380R TEA1 CYR UCM-M AES256 |
| | | PMUE3385AS | MTP850 380R TEA2 ROM |
| | | PMUE3386AS | MTP850 380R TEA2 ROM UCM-M AES128 |
| | | PMUE3387AS | MTP850 380R TEA2 ROM UCM-M AES256 |
| | | PMUE3388AS | MTP850 380R TEA3 ROM |
| | | PMUE3389AS | MTP850 380R TEA3 ROM UCM-M AES128 |
| | | PMUE3390AS | MTP850 380R TEA3 ROM UCM-M AES256 |
| | | PMUE3391AS | MTP850 380R TEA3 ARB |
| | | PMUE3392AS | MTP850 380R TEA3 ARB UCM-M AES128 |
| | | PMUE3393AS | MTP850 380R TEA3 ARB UCM-M AES256 |

| Sales Model | Description | Service Tanapa | Description |
|-------------|-------------|----------------|-----------------------------------|
| | | PMUE3394AS | MTP850 380R TEA3 CYR |
| | | PMUE3395AS | MTP850 380R TEA3 CYR UCM-M AES128 |
| | | PMUE3396AS | MTP850 380R TEA3 CYR UCM-M AES256 |

Note: All models listed in the Service Tanapa Column are not field replaceable for Latin America.

APPENDIX B CONNECTOR PIN FUNCTIONS

CE Bottom Connector



17 pin CE Connector

Mode Select (Option1 and Option2):

The following logic levels can be used to select the requested CE Bus mode:

| MODE | OPTION_1 | OPTION_2 | USB_PWR | AUDIO_IN |
|-----------------------------------|--|----------|---------|----------|
| NORMAL (no accessory) | 1 | 1 | 0 | X |
| USB Accessory/Computer | 1 | 1 | >4.0V | 1 |
| USB accessory / RS232 (6 wire) | 1 | 1 | >4.0V | 0 |
| Dumb Accessory | 1 | 0 | X | 1 |
| USB OTG | 1 | 0 | X | 0 |
| RS-232 (8 wire)/IDB Smart Cable | 0 | 1 | X | 1 |
| Bluetooth (RS-232 (4 wire) / SSI) | 0 | 1 | X | 0 |
| PTT | 0 | 0 | X | X |
| SB9600 |  Diode connected from Option 2 to 1 | | X | X |

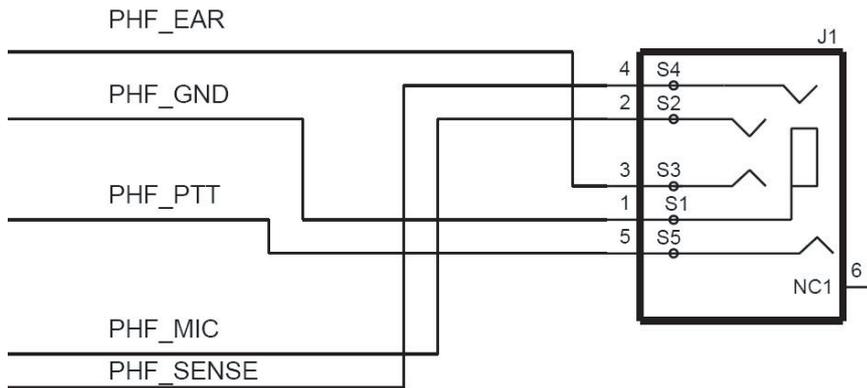
Accessory Connector Pin-Outs

| Pin No. | Signal Name (Short Form) | Power/ Default States | USB | USB OTG | Bluetooth (RS232/ SSI) | RS232 (8 wire) | USB/ RS232 (6 wire) | JTAG |
|---------|---|------------------------|------------------------|------------------------|------------------------|----------------|----------------------|------------------------|
| 1 | Power Ground (GND) | GND | GND | GND | GND | GND | GND | GND |
| 2 | Battery Feedback (BATT_FDBK) | BATT_FDBK ⁻ | BATT_FDBK ⁻ | BATT_FDBK ⁻ | BATT_FDBK ⁻ | BATT_FDBK | RTS | BATT_FDBK ⁻ |
| 3 | External Power (EXTB+) | EXTB+ | EXTB+ | EXTB+ | EXTB+ | EXTB+ | EXTB+ | EXTB+ |
| 4 | USB+/TXD (D+) | | D+ | D+ | TXD | TXD | D+ | TDO |
| 5 | USB-/RXD (D-) | | D- | D- | RXD | RXD | D- | TDI |
| 6 | USB Power/Ignition/Send/End / RTS (USB_PWR) | | USB_PWR | USB_PWR | RTS | RTS | USB_PWR ⁻ | RESET_IN |
| 7 | Switched Battery (SWB+) | SWB+ | SWB+ | SWB+ | SWB+ | SWB+ | SWB+ | SWB+ |
| 8 | Hook Switch / FM_DATA / CTS (HKSW) | | HKSW | | CTS | CTS | CTS | Mcu_DE |
| 9 | MUTE/FS/DCD (MUTE) | | | | FS | DCD | DCD | Dsp_DE |
| 10 | DUMB_SEL2/SCK/RI (DSEL2) | DSCEN | DSCEN | | SCK | RI | TXD | TCK |
| 11 | DUMB_SEL1 / FM_CLOCK /SRDA / DTR (DSEL1) | | | CABLE_ID | SRDA | DTR | DTR | TMS |
| 12 | DUMB_SEL0 / FM_EN / STDA/ DSR (DSEL0) | | | DONGLE | STDA | DSR | RXD | TRST |
| 13 | Option 1 (OPT1) | UPLink | UPLink | | OPT1 | OPT1 | OPT1 | OPT1 |
| 14 | Option 2 (OPT2) | DNLink | DNLink | | OPT2 | OPT2 | OPT2 | OPT2 |
| 15 | Audio Out On/Off (AUDIO_OUT) | AUDIO_OUT | AUDIO_OUT | AUDIO_OUT | AUDIO_OUT | AUDIO_OUT | AUDIO_OUT | AUDIO_OUT |
| 16 | Audio In (AUDIO_IN) | AUDIO_IN | AUDIO_IN | AUDIO_IN | AUDIO_IN | AUDIO_IN | AUDIO_IN | AUDIO_IN |
| 17 | Audio Ground (AUDIO_GND) | AUDIO_GND | AUDIO_GND | AUDIO_GND | AUDIO_GND | AUDIO_GND | AUDIO_GND | AUDIO_GND |

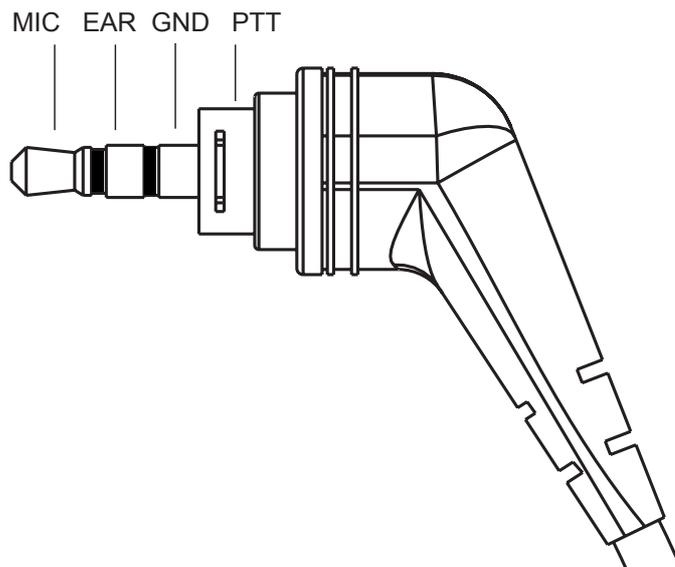
Note: For additional information refer to the detailed service manual chapter: Theory of Operation.

AUDIO Side Connector

PHF/RSM Connector



PHF/RSM Plug



RSM Modes of Operation

| MODE | OPTION SELECT 1 (PIN #13) | OPTION SELECT 2 (PIN #14) | AUDIO IN (PIN #16) | DUMB SEL 0 (PIN #12) | DUMB SEL 2 (PIN #10) | MUTE (PIN #9) TERMIAL OUTPUT |
|---|---------------------------------|---------------------------------|-----------------------|----------------------------|----------------------------|---------------------------------------|
| ACCESSORY ATTACHED (SPEAKER AND MICROPHONE ARE OFF) | 1 | 0 | 1 | 0 | 0 | 0 |
| PTT SIMPLEX (SPEAKER IS OFF MICROPHONE IS ACTIVE, TERMINAL IS IN SIMPLEX MODE) | 0 | 0 | 1 | 0 | 0 | 0 |
| PTT TIC (SPEAKER IS SWITCHED OFF, MICROPHONE IS ACTIVE, TERMINAL IS IN TELEPHONE INTERCONNECT MODE) | 0 | 0 | 1 | 0 | 0 | 1 |
| EMERGENCY SW (SPEAKER IS OFF MICROPHONE COULD BE ON OR OFF) | 0 | 0 | 0 | 0 | 0 | 0 |
| SPEAKER OFF (MICROPHONE COULD BE ON OR OFF) | X | 0 | X | 0 | 0 | 0 |
| SPEAKER ON (MICROPHONE OFF) | 1 | 0 | 1 | 0 | 0 | 1 |

Note: For additional information refer to the detailed service manual chapter: Theory of Operation.

Notes