MOTOROLA SOLUTIONS

MXP600 Product Information Manual

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

Disclaimer

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

Safety Information

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

ATTENTION!

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

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

http://www.motorolasolutions.com

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

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

Read Me First

This manual covers information of features on your radio.

Notations Used in this Manual

The manual set is designed to give the reader more visual clues. The following graphic icons are used throughout the manual.

DANGER: The signal word DANGER with the associated safety icon implies information that, if disregarded, will result in death or serious injury.

: The signal word WARNING with the associated safety icon implies information that, if disregarded, could result in death or serious injury, or serious product damage.

CAUTION: The signal word CAUTION with the associated safety icon implies information that, if disregarded, may result in minor or moderate injury, or serious product damage.

ATTENTION: The signal word CAUTION may be used without the safety icon to state potential damage or injury that is not related to the product.

IMPORTANT: IMPORTANT statements contain information that is crucial to the discussion at hand, but is not CAUTION or WARNING. There is no warning level associated with the IMPORTANT statement.

NOTE: NOTICE contains information more important than the surrounding text, such as exceptions or preconditions. They also refer the reader elsewhere for additional information, remind the reader how to complete an action (when it is not part of the current procedure, for instance), or tell the reader where something is on the screen. There is no warning level associated with a notice.

Feature and Service Availability

This manual covers all available features and services for your radio. Your service provider can customize your radio to suit your individual needs. To find out the available features and services for your radio, check with your service provider.

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Chapter 1

Radio and Battery Care

Proper usage and care of your radio and battery ensure efficient operation and long life of the product.

1.1 Looking after Your Radio

Never leave your radio or battery in extreme temperatures, for example, behind a windscreen in direct sunlight. Your radio is submersible (compliant with the IP68 standard) – but only with the battery and the antenna attached. To clean your radio, use a moistened or antistatic cloth.

NOTE:

- Ensure that no contamination is on the Gore™ Port membrane, that is the area labeled as **VENT** on the back of your radio chassis.
- It is recommended to use Universal Connector Dust Cover (Motorola Solutions part number: PMHN4429_) if your radio is deployed near the seaside or salt water area, when it is without any audio accessory attached on it.

1.2 Troubleshooting

Your radio displays the following messages:

Table 1: Displayed Messages

Message	Message Description
`Attachment Failed`	Your radio could not perform talkgroup attachment. It keeps on trying. If it does not succeed, try another talkgroup.
`Authenticate Failure`	Your radio could not register on an authenticated system (for example, the Authentication Key is incorrect, or authentication is disabled).
`Call Barred`	The call is barred due to Barred Incoming Call or Barred Out-going Call Profile.
`Call Canceled`	You have canceled the call.
`Call Ended`	• Faulty channel. Please try later. • You have ended the call.
`Call Forwarding`	The radio you are trying to call is not available and the call is being forwarded to another radio.
`Call Modified`	The call you are participating in has been modified.
`Cert. not enrolled`	Check for Wi-Fi update triggered from Menu failed because the required certificate is not enrolled on your radio. Contact your service provider.
`Call Preempted`	Channel being used for priority.

Message	Message Description
Check for Updates Failed	Check for Wi-Fi update triggered from Menu failed. Contact your service provider.
Decryption Failed:	An error occurred while decrypting a message or call.
Emergency In Use Wait For Mic	The Hot Microphone feature is active, but the channel transmit grant has been given to another Emergency call on the same talkgroup. Your radio microphone is not active during this time, but it automatically tries to regain talk permit after a predetermined time.
Emgcy Mic Ended	The Hot Microphone timer automatically expired, or you pressed the **PTT** button to cancel the Hot Microphone feature.
Emergency Mic On	The Hot Microphone feature is active, and your radio is automatically transmitting hands free emergency audio.
Empty Entry	The speed number you dialed do not exist, or the number exists but the group is non-selectable.
Faulty Unit Error	Self-test failed. An operational fault has been detected with your radio. Record the error number. Turn your radio off and contact service.
File cannot be received, storage unavailable	The file cannot be received because the memory for its storage is inaccessible. See File Storage Not Available.
File Invalid	The picture you are trying to open is damage.
File Storage Not Available or No Picture Storage	Memory for file storage is inaccessible. Possible reasons: the microSD card is formatted incorrectly or is not installed at all, the internal radio memory is damaged, there is not enough available space to save a file, your radio is connected to a computer in the USB Mass Storage mode, or you try start the Picture Browser when the USB mode is set to **PEI**.
Gateway available	Your radio has connected to a gateway.
Gateway not available	Your radio cannot connect to a gateway, or connection has been lost.
Invalid Battery	The radio detects non-Motorola Solutions batteries and prompts you on battery authentication. This message is prompted upon power-up, with a tone.
Individual Calls Only	You can make only individual (private) calls.
Invalid ID	The entered number is not valid.
Limited Service	Emergency Calls, Emergency Alarms, and mobility operations (for example, group attachment) are allowed. All other incoming and outgoing call and data services are blocked.
List Empty	There are no programmed entries in the scrolling list. Type the entry.
List Not Attached	All talkgroups in the scan list are not attached.
List Partially Attached	The scan list is active, but not all talkgroups are attached to it.
Low Battery	The battery charge level is too low to perform the required operation.

Message	Message Description
Message Delivered	Indicates mail successfully delivered.
Message Failed	Indicates mail delivery failure.
My Groups Is Empty	You cannot view/delete groups when the **My Groups** folder is empty.
My Groups Is Full	You are not allowed to add a group to the **My Groups** folder as it already contains the maximum allowed number of groups.
Network Trouble	Network problems. Please try again later.
New Delivery Status	You have received a new Delivery Status.
No Service	Your radio is outside coverage. Return to coverage.
Not allowed in repeater mode	The service or feature is not available in the Repeater Mode.
No Answer	The called party does not answer.
No Entries	This message is displayed when accessing an empty list.
No Group	• Attachment failed. Your radio detached from current talkgroup. Please wait until it attaches again to the current talkgroup. • Displayed when you are out of the normal coverage area of your selected talkgroup. Please select a new talkgroup that is valid for your working location. • Indicates that a favorite group was removed from the **My Groups** folder.
No List	The network list is empty.
No New or Old Messages	Indicates that there are no new or old messages in the **Inbox**.
No Selected Scan List	You selected an empty network list.
No Service	Your radio is out of coverage.
Not Allowed To Initiate Call	You are not allowed to dial a number that is not in the address book.
Not Allowed To Transmit	Release the **PTT** button and try again later. You are not allowed to send a text message or a status message to a number that is not in the address book.
Overheating, Please Turn Radio Off	Your radio turns off. Keep it turned off for 5 minutes.
Party Busy	Called radio is busy.
Party Not Available	Called radio is out-of-range or turned off. Please try again later.
Please Try Again	You could not call.
Please Wait Connecting	A message during startup.
Radio Disabled	Check with your service provider.

Message	Message Description
Radio time not updated	Check for Wi-Fi update triggered from Menu failed because radio time is not set. Update your radio time to the current date and time. If error still occurs, contact service.
Registration Failure	Your radio could not register within the system. Please try again later.
Repeater available	Your radio has connected to a repeater.
Repeater not available	Your radio cannot connect to a repeater, or connection has been lost.
SD card is not available	The microSD card is damaged or missing (only applies to radios that support microSD cards).
Service Denied	Invalid number. Call your service provider.
Service Not Available	This service is not available on the current network.
Service Restricted	• This service or feature is restricted by your service provider, it has not been purchased, or it is not available. • Check for Wi-Fi update triggered from Menu failed because there is an in-progress LMR OTAP job. Complete the LMR OTAP job before trying again.
Single TalkGroup Only	There is only one programmed entry in the scrolling list.
TalkGrp ... cannot be deleted	Your service provider set this group so you cannot delete it from the favorite talkgroup folder.
This group already exists	The group you are attempting to add exists in the **My Groups** folder.
Try Again Later	The requested service is temporarily unavailable.
Unit is OK Warn:	Self-test error. A minor fault has been detected. Your radio is still fully operative. If this error recur, note the error code and contact service.
Unit Not Attached	Your radio could not attach to the system. The talkgroup may not be defined in the system. Please try another group.
Warning SD card not formatted correctly	The microSD card installed in your radio is not formatted correctly. To format it, contact your service provider.
Warning: Space for less than 10 picture signatures left!	Radio internal memory is running out of space and no more than 10 Digital Fingerprints can be saved.
Wi-Fi not connected	Check for Wi-Fi update triggered from Menu failed because radio is not connected to any Wi-Fi access point.
Not enough space to store picture signature!	Radio internal memory is full and no Digital Fingerprint can be saved.

1.3
Battery Storage

New Lithium-Ion batteries can be stored in ventilated, cool, and dry areas with some capacity loss in the life cycle.

Charge the battery if the battery is to be stored for a long period of time. Do not store a fully discharged battery.

Remove the battery pack from your radio if your radio is not to be used for a long period of time (few weeks).

1.4 Extending Battery Life

A battery is an expendable part and needs replacing during the life of your radio.

To ensure maximum service life of your radio, always replace the battery with a genuine Motorola Solutions replacement.

1.5 Battery Charging Temperature

The temperature range of battery operation is from 0°C to +45°C in charger mode. During charging, if the temperature is out of range, the battery might not be fully charged as the charging is temporarily stopped until the temperature becomes suitable.

1.6 Additional Battery Warnings/Cautions

- To prevent injury, do not allow metal objects to touch the battery contacts.
- Do not disassemble.
- Do not throw in fire.
- Do not dispose of battery in household waste.
- Keep battery away from children.
- Defective battery cannot be reused. In accordance with the national regulation, the defective battery must be disposed of in an environmentally friendly manner.

Chapter 2

MXP600 Radio Overview

Familiarize yourself with the buttons and functions on your radio.

The MXP600 radio specifications are available at https://www.motorolasolutions.com/mxp600radio.

Figure 1: MXP600 Front View

Table 2: Front View Description

Annotation	Name	Description
1	Display	Features a high resolution of 240 x 320 pixels and 65,536 colors. Supports scalable fonts and high colored images.
2	Top Microphone	Activated in Simplex and high-audio calls such as Group Calls.
3	Earpiece	The earpiece is active in low-audio Duplex calls. The earpiece allows you to hear voice from low-audio calls.

Annotation	Name	Description
4	Soft Key	The **Left** or **Right** soft key selects the option displayed above the key.
5	Menu Key	● From the home screen, press to enter the main menu. ● Used to enter context-sensitive menus.
6	Navigation Key	To navigate throughout the interface up, down, left, and right.
7	On/Off/End/Home Key	● Press and hold to turn on or off your radio. ● Press to end calls. ● Press to return to the home screen.
8	Send Key	● Press to initiate or answer Duplex calls, or send messages. ● From the home screen, press to enter Recent Dialed Calls.
9	Keypad	Enters alphanumeric characters for dialing, contact entries, and text messages. The keys (0–9, *, and #) support the One-Touch Button feature. Press and hold a key to activate a one-touch function assigned to it.
10	Bottom Microphone	Activated in Duplex and low-audio calls such as Private Calls.
11	Backlight Sensor	The backlight sensor measures ambient light intensity. When the display backlight is active and a low light condition is detected, the keypad is illuminated.
12	Speaker	The speaker is active in high-audio Simplex calls. The speaker allows you to hear voice from high-audio calls.

Figure 2: MXP600 Side and Back View

Table 3: Side and Back View Description

Annotation	Name	Description
13	Programmable Button	**Programmable** buttons support the One-Touch Button feature. **NOTE:** The required time to press and hold a button to activate a One-Touch Button feature is by default set to 0.1 second.
14	Near-Field Communication Tag	Near-Field Communication (NFC) key exchange allows your radio to seamlessly pair with approved Motorola Solutions Bluetooth accessories.
15	Push-To-Talk Button (PTT)	Press and hold to talk in Simplex calls. Release it to listen.
16	GCAI-Mini Connector	Provides connection with accessories. **NOTE:** Turn off your radio before connecting accessories.
17	Antenna	Transmits or receives Radio Frequency (RF) signals.
18	Rotary Knob	• Rotate to set the volume.

Annotation	Name	Description
		• Press and rotate to select a different talkgroup.
19	Back Microphone	Activated during Simplex and high-audio calls such as Group Calls. The back microphone allows optional noise cancellation.
20	Battery	Provides battery power for your radio.
21	Battery Latch	Locks or unlocks the battery.
22	RF Connector Dust Cover	Reduces the ingress of dust and dirt

Figure 3: MXP600 Top and Bottom View

Table 4: Top and Bottom View Description

	Name	Description
23	Emergency Button	Press and hold the **Emergency** button to start Emergency Operations. By default, when your radio is turned off, press and hold to power on in Emergency Operations.
24	LED Status Indicator	Shows the status of your radio. See LED Status Indication on page 49.
25	Bottom Connector	Used for charging and programming your radio, and connecting data transfer cables.

2.1
One-Touch Buttons

The One-Touch Button (OTB) feature allows you to activate a feature by a long key press of the programmable button.

NOTE:
You can also assign features to the option buttons of RSM accessories.

2.1.1
One-Touch Button Features

Table 5: One-Touch Button Features

Feature	Description
Activation of Covert Mode	Turns Covert Mode on or off.
Add Bluetooth Device	Activates scanning for Bluetooth devices.
Any Network	Selects any network.
Any Talkgroup Network	Selects any talkgroup network.
Bluetooth Smart Proximity Pairing	Activates scanning for Bluetooth Smart Proximity Pairing.
Change Audio Profile	Changes to the specific audio profile.
Change Talkgroup	Changes the talkgroup to the one programmed by your service provider.
Disconnect All Connected Bluetooth Devices	Disconnects all Bluetooth devices connected to your radio.
Display Bluetooth Generic Attribute Profile (GATT) Sensors Battery Levels	Displays the battery levels of all paired Bluetooth GATT-based sensor devices.
Display GATT Service Data	Displays the GATT-based sensor data.
Display Heart Rate	Displays the heart rate value received from the connected GATT-based heart rate sensor.
Display Operational-Tactical Address (OPTA)	Displays the OPTA.
DMO Pre-emptive Short Data Service (SDS)	Sends the next DMO SDS or status message with elevated priority.
Flip Display	Rotates the display by 180°. Flip Display is the default function for the upper **Side** button.
Home Only	Selects only home network.
Home Talkgroup on Home Network	Selects only home network and home talkgroup network.
Inactive One Touch Key 0	The one-touch function assigned to the **0** key remains inactive until you long press the button twice. **NOTE:** A single long press on the **0** button calls out the **+** symbol.
Initiate Call-Out Fallback	Sends a Call-Out Fallback Alert.

Feature	Description
Location Information Protocol (LIP) Report	Sends a message with the location of your radio to a dedicated address or Selected Talkgroup (DMO Only).
Lock to Current Network	Selects the current network only.
Phone and Private Automatic Branch Exchange (PABX) Call Setup	Initiates a PABX call to a predefined entry in the contact list.
Phone Call Setup	Initiates a phone call to a predefined entry in the contact list.
Prefer Talkgroup Network Shortcut	Displays the Prefer Talkgroup Network menu.
Private Call Setup	Initiates a simplex or duplex private call to a predefined entry in the contact list or to the last group call originator.
Reset to Default	Resets your radio to its default settings.
Radio Messaging System (RMS) Man-Machine Interface (MMI) Menu	Opens the RMS menu without activating RMS mode.
RMS Mode Activation or Deactivation	Toggles the RMS feature on or off.
Radio User Identity (RUI) Log On or Log Off	Toggles the RUI feature of your radio.
Scan for Bluetooth Devices	Activates scanning for Bluetooth devices after the OTB assigned to the Add Bluetooth Device function is pressed.
Select Talkgroup Network Shortcut	Displays the Select Talkgroup Network menu.
Selecting Audio Profiles	Changes the audio profile of your radio.
Send Double Push PTT Tone (D-PTT)	Sends the D-PTT tone to the currently used talkgroup.
Send Predefined Template (PDT)	Sends a predefined message to a dedicated address.
Send Status Message	Sends a dedicated status message to a dedicated address.
Send User-Defined Template (UDT)	Sends a user-defined message to a dedicated address.
Speaker Enable or Disable per Call	Enables or disables the loudspeaker for a duration of the ongoing call.
Switch to Previously Selected Talkgroup	Changes the talkgroup of your radio to the previously selected talkgroup (DMO or TMO).
SIM Card End-to-End Encryption	Enables or disables End-to-End Encryption on the SIM card.
Timed Talkgroup Change	Makes a predefined talkgroup the selected talkgroup for a specified amount of time. While you are using the predefined talkgroup, the second press of the One-Touch Button results in: ● your radio returns to the original talkgroup.

Feature	Description
	• your radio restarts the timer before returning to the previously selected talkgroup. • no action on your radio, depending on the configuration. After the timer expires, your radio returns to the previously selected talkgroup.
Toggle Backlight	Toggles the backlight on or off.
Toggle Backlight Intensity	Regulates the backlight intensity.
Toggle Bluetooth Discoverable Mode	Turns Discoverable Mode on or off.
Toggle Bluetooth GATT Sensor MMI Alerts	Toggles Bluetooth GATT Sensor MMI Alerts on or off.
Toggle BSI Encryption Enabled or Disabled	Enables or disables BSI encryption.
Toggle Call Forwarding	Toggles Call Forwarding on or off.
Toggle Car Kit Speaker Permanent On or Off	Permanently turns the Car Kit speaker on or off.
Toggle DMO or TMO	Toggles between TMO and DMO modes.
Toggle Extra Zoom	Turns Extra Zoom on or off.
Toggle Hi or Low Audio	Toggles audio between the external earpiece and the main speaker. Hi or Low Audio is the default function for the lower **Side** button. This feature is supported in emergency Full Duplex Private Calls (FDPC) mode. Press the One-Touch Button to toggle high or low audio state during incoming or outgoing emergency FDPC.
Toggle Horn and Lights	Toggles the horn and lights indication. Available only in Car Kit mode if the Horn and Light feature is enabled.
Toggle Howling Suppression	Enables or disables Howling Suppression.
Toggle Man Down (henceforth known as Fall Alert) On or Off	Turns the Man Down (Fall Alert) feature on or off.
Toggle RF Power Class	Toggles the RF Power Class between high and normal.
Toggle Remote Speaker Microphone (RSM) with Earpiece	Activates or deactivates the RSM earpiece.
Toggle Screen Saver	Activates or deactivates the Screen Saver feature.
Toggle Speaker During Call	Enables or disables the loudspeaker during a call. Available only in Car Kit mode.
Toggle Talkgroup Scan	Turns the Talkgroup Scan feature in TMO Mode on or off.
Toggle Transmit Inhibit Mode (TXI)	Turns TXI on or off.
Turn Bluetooth Indoor Location On or Off	Activates Bluetooth Indoor Location.
Turn Bluetooth On or Off	Turns Bluetooth on or off.

Feature	Description
Turn Repeater Mode On or Off	Turns Repeater Mode on or off.
Unassigned	Your radio displays `Unassigned Button` when no feature is assigned to this button.
Universal Time Display	Displays universal time on the home screen.
Volume Down	Decreases the volume by one level.
Volume Up	Increases the volume by one level.
Wi-Fi	Turns Wi-Fi connection on or off.

2.1.2
One-Touch Dial

The One-Touch Dial feature allows you to call by pressing and holding one of the numeric keys, **1**–**9**.

If you press an unassigned key, your radio displays a negative indication message.

NOTE:
If the One-Touch Button feature is disabled, One-Touch Dial is disabled as a consequence.

In RMS mode, the One-Touch Button feature is disabled.

2.2
Customer Programming Software

For information about Customer Programming Software, see the *TETRA Terminals CPS Plus Start-up User Guide*.

Chapter 3

Getting Started

Familiarize yourself with basic information on how to use your radio.

3.1
Attaching or Removing the Antenna

NOTE: Use only the antenna intended for your radio. Using other antennas can result in significant range loss due to poor Radio Frequency (RF) performance.

Attaching the Antenna

Procedure:

1. Insert the threaded base of the antenna into the antenna terminal on top of your radio.
2. Turn the antenna clockwise until tight.

Removing the Antenna

Procedure:

1. Turn the antenna anticlockwise.
2. Remove the antenna from your radio.

3.2
Installing or Uninstalling the MicroSD Card

NOTE: Applicable only for SD Card model.
The microSD card slot has a delicate construction. You must avoid installing or uninstalling the microSD card unnecessarily as this action can damage the mechanism of the reader. For copying files from your radio, you can use the USB Mass Storage Mode.

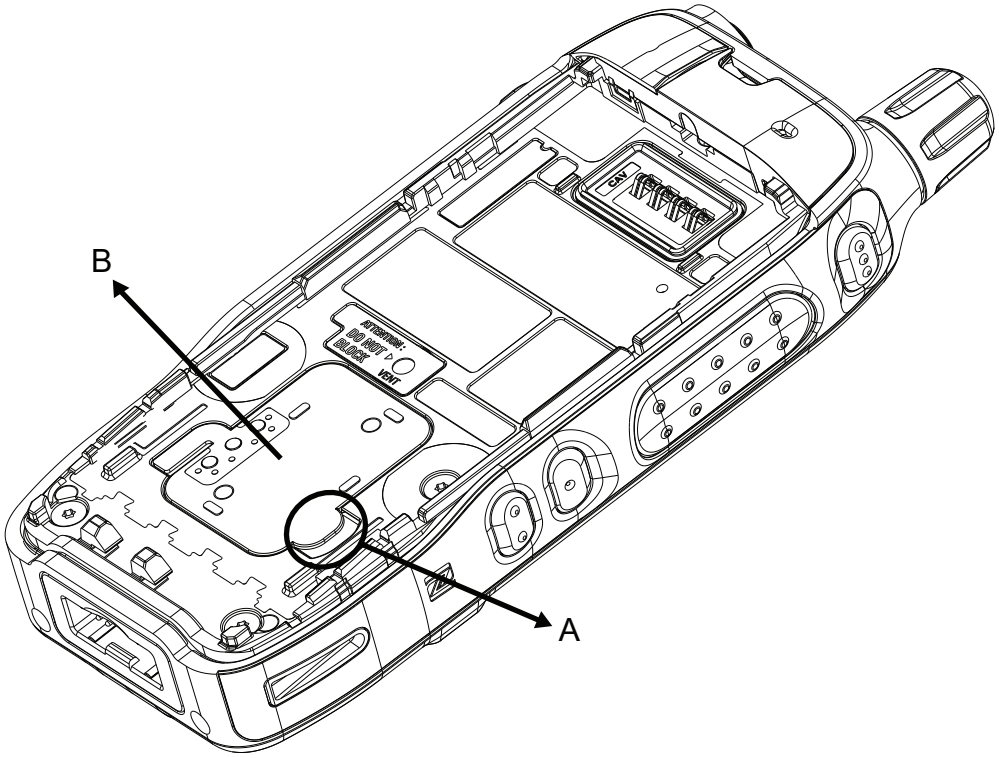
Installing the MicroSD Card

Prerequisites:
Your radio is equipped with a microSD card slot.

Procedure:

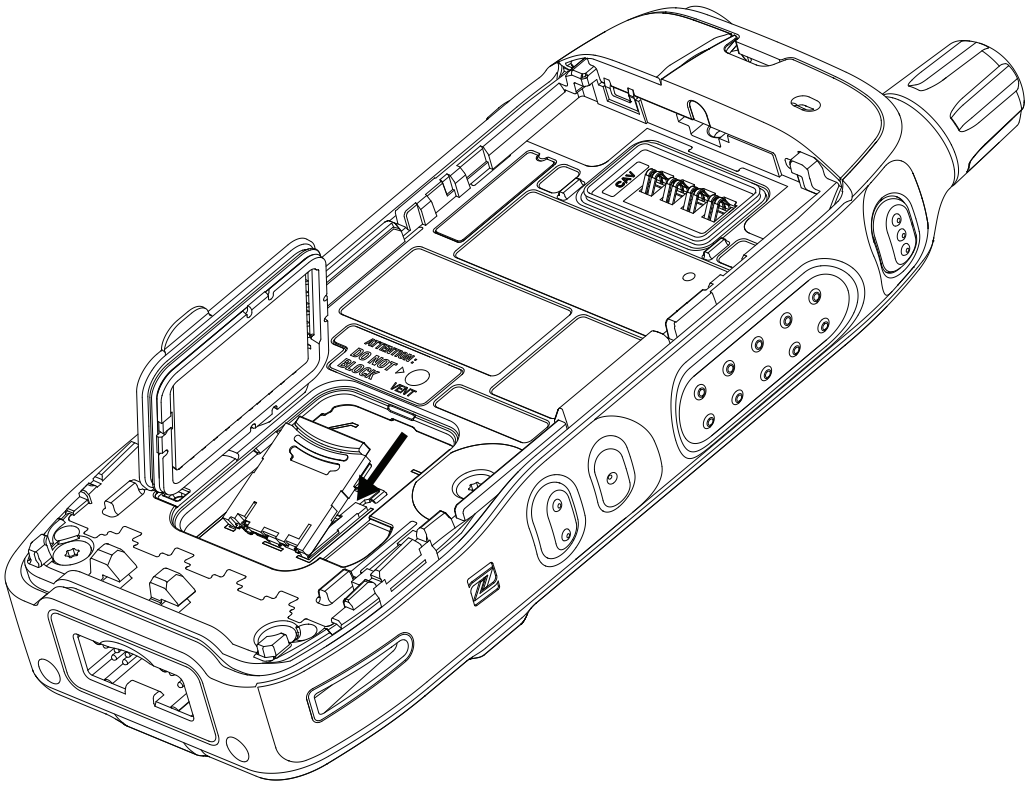
1. Remove the battery.
2. Flip open the plastic door from the finger scoop area.

   NOTE: Avoid pressing on the plastic door.

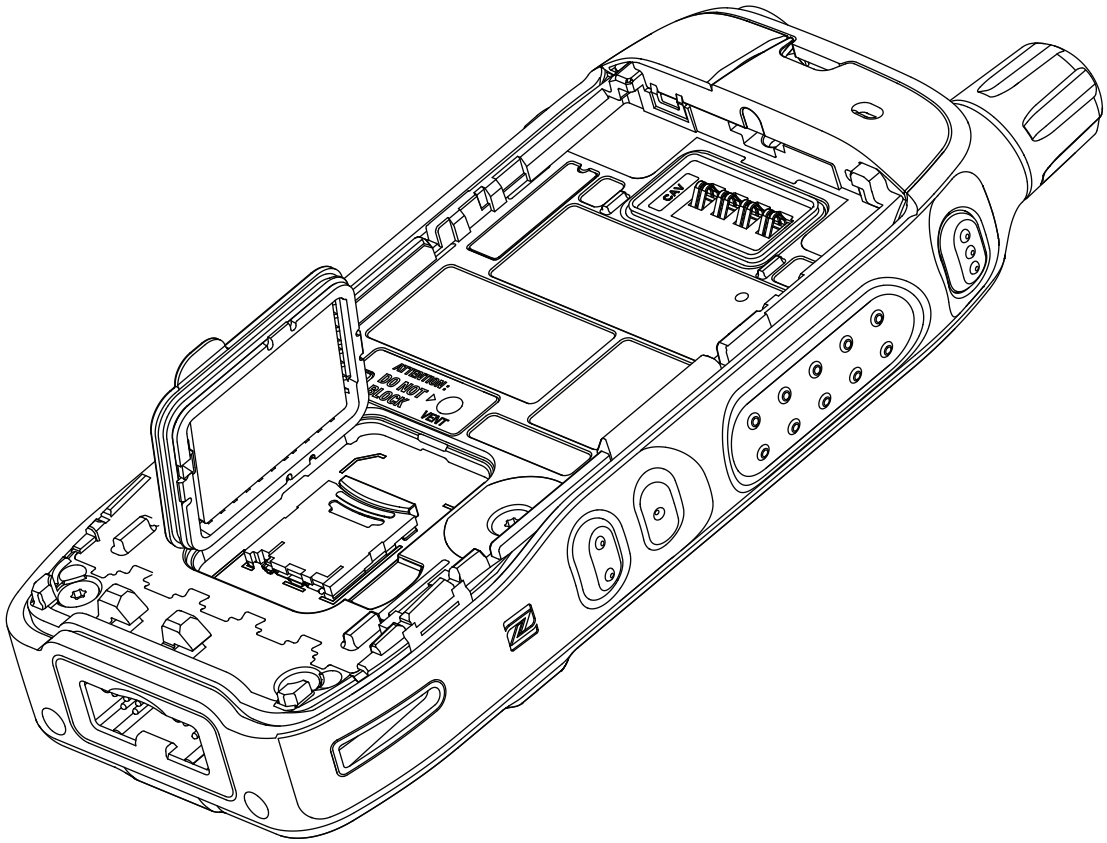


Annotation	Description
A	Finger Scoop Area
B	Plastic door

3. Flip open the microSD card holder.
4. Insert the microSD card into the microSD card holder ensuring that the gold contact area is facing down.



5. Close the microSD card holder and slide it to the lock position.



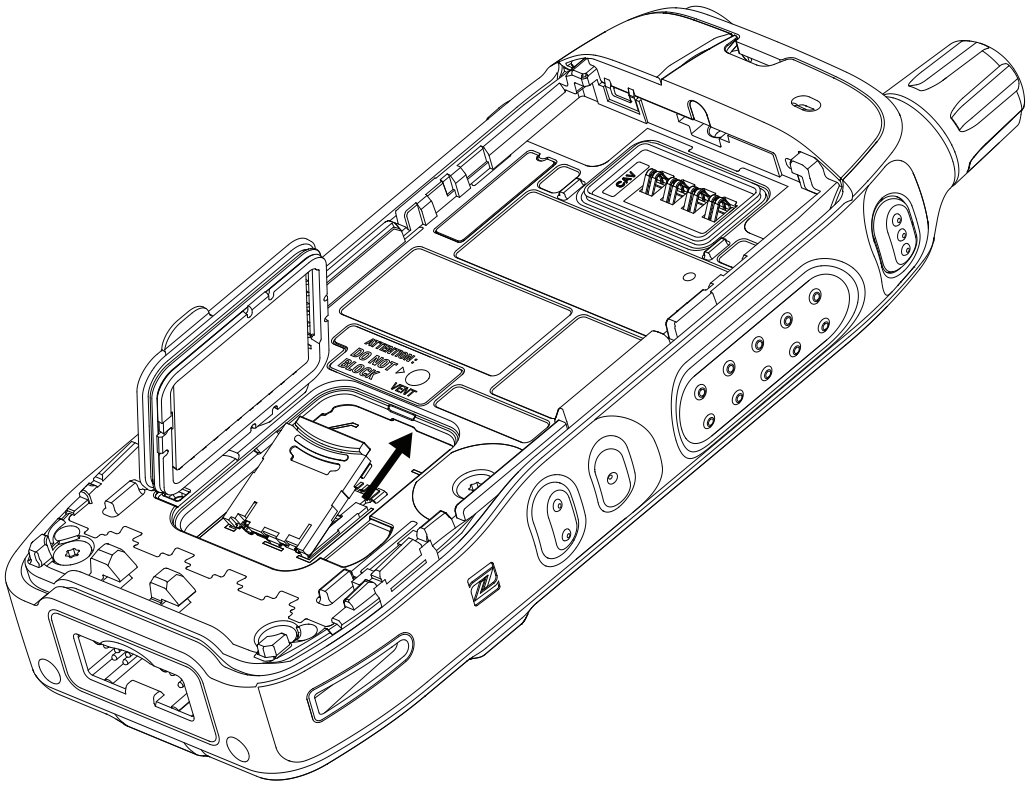
6. Close the plastic door.
7. Install the battery.

Uninstalling the MicroSD Card

Procedure:

1. Remove the battery.
2. Flip open the plastic door from the finger scoop area.

   NOTE: Avoid pressing on the plastic door.
3. Flip open the microSD card holder.
4. Remove the microSD card from the microSD card holder.



5. Close the microSD card holder and slide it to the lock position.
6. Close the plastic door.
7. Install the battery.

3.3

Installing or Uninstalling the SIM Card

NOTE: Applicable only for SIM Card model.
The SIM card slot has a delicate construction. You must avoid installing or uninstalling the SIM card unnecessarily as this action can damage the mechanism of the reader. For copying files from your radio, you can use the USB Mass Storage Mode.

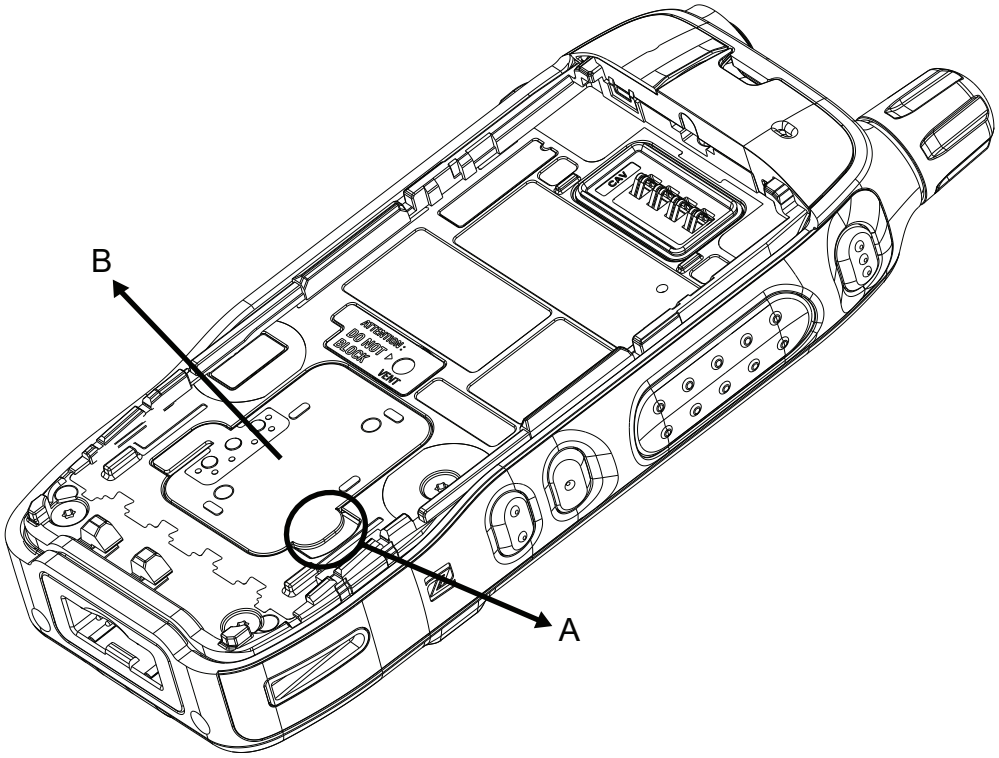
Installing the SIM Card

Prerequisites: Your radio is equipped with a SIM card slot.

Procedure:

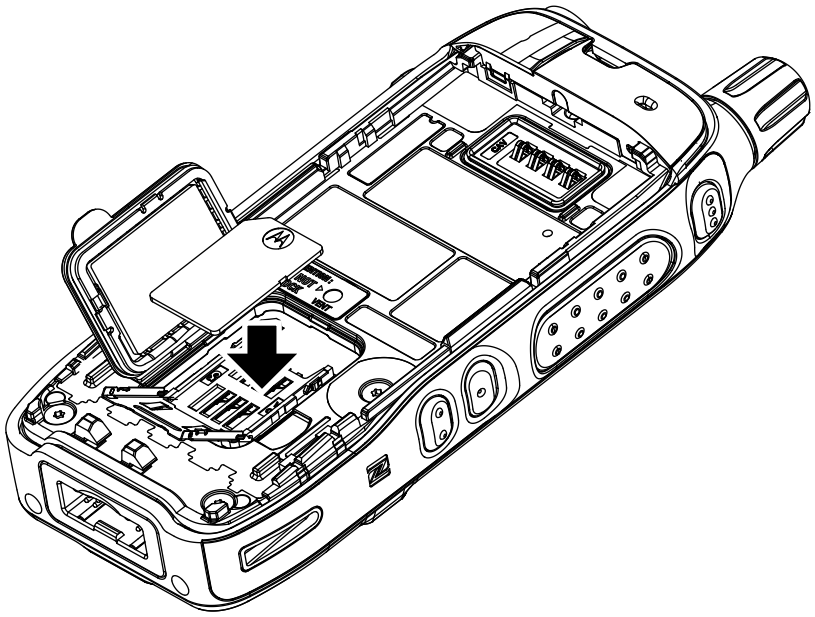
1. Remove the battery.
2. Flip open the plastic door from the finger scoop area.

   NOTE: Avoid pressing on the plastic door.

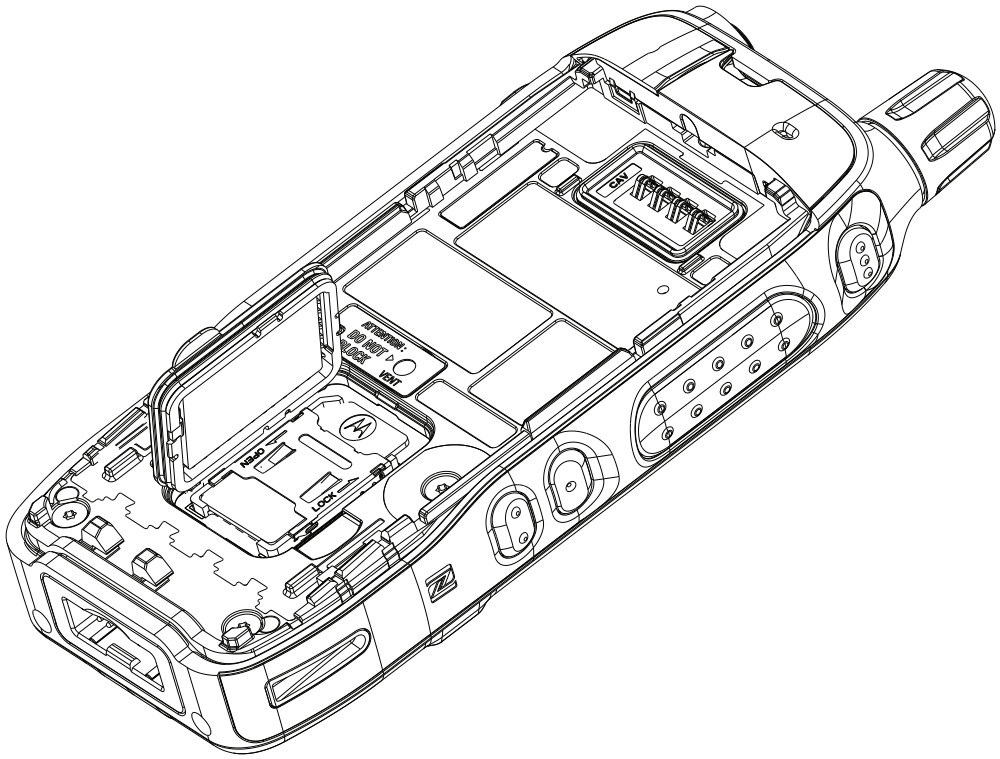


Annotation	Description
A	Finger Scoop Area
B	Plastic door

3. Flip open the SIM card holder.
4. Place the SIM card into the SIM card holder ensuring that the gold contact area is facing down.



5. Close the SIM card holder and slide it to the lock position.



6. Close the plastic door.

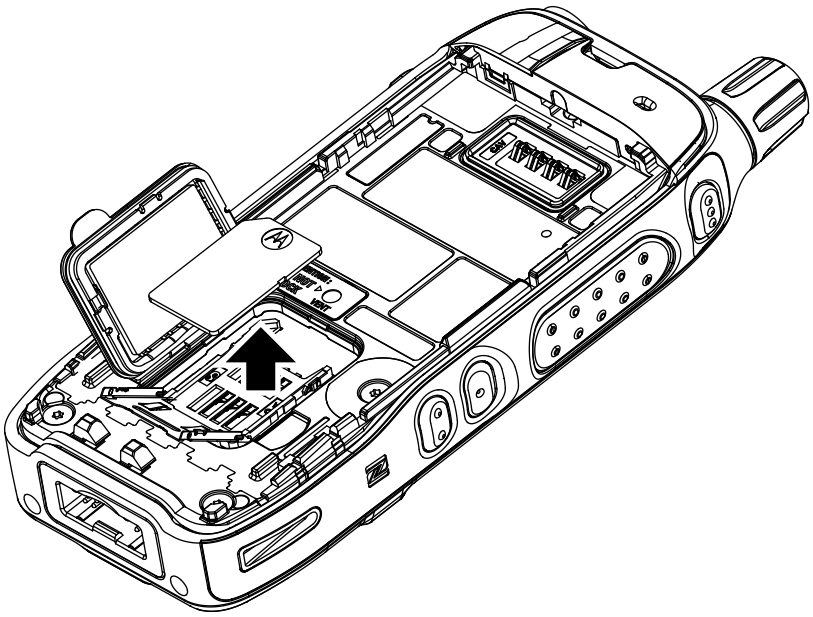
7. Install the battery.

Uninstalling the SIM Card

Procedure:

1. Remove the battery.
2. Flip open the plastic door from the finger scoop area.

   NOTE: Avoid pressing on the plastic door.
3. Flip open the SIM card holder.
4. Remove the SIM card from the SIM card holder.



5. Close the SIM card holder and slide it to the lock position.
6. Close the plastic door.
7. Install the battery.

3.4

Attaching or Removing the Battery

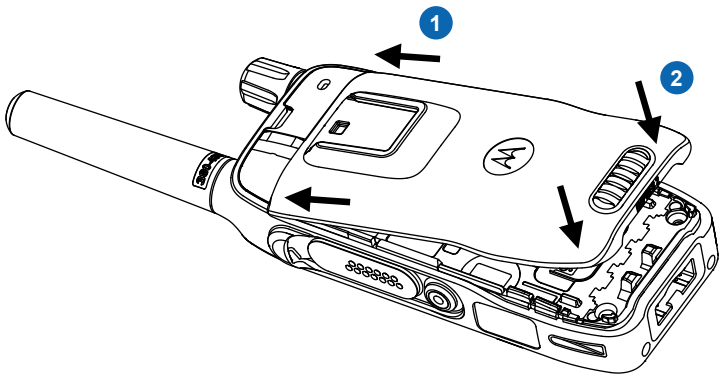
Familiarize yourself on attaching or removing the battery to or from your radio.

Attaching the Battery

Procedure:

1. Insert battery into the compartment until the contacts align and the battery hooks in place.

2. Press down the battery until it clicks in place.

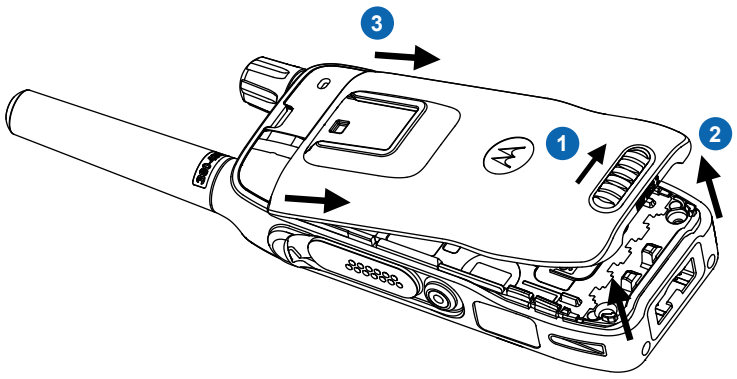


Removing the Battery

Prerequisites:
Turn off your radio.

Procedure:

1. Slide the **Battery Latch** to the right and hold it.
2. Lift the battery.
3. Remove the battery from the compartment.



NOTE: Pressing the latch while slide will cause battery hard to be removed.

3.5

Charging the Battery

IMPORTANT:
Use only Motorola Solutions-approved chargers, which provide optimal performance. Using other chargers may fail to fully charge, or can reduce the life of the battery.

Do not charge the battery in a hazardous area.

Do not connect a radio without a battery to the charger.

You can charge a battery separately or attached to your radio. Turn on your radio only if the radio is transmitting data wirelessly such as when using the Wi-Fi. Otherwise, your radio must be turned off.

Your radio is configurable to turn on automatically after you insert the battery. You can configure this functionality using the Customer Programming Software (CPS).

You can also configure your radio to turn on automatically after you disconnect it from the charger. This functionality is configurable using the CPS. When your radio is disconnected from the charging unit, it will automatically turn on.

NOTE: The **Auto-Power On** feature is not available for disconnection from the Car Kit.

Procedure:

1. Connect the charger to a power source according to the specification of the charger.

   NOTE: The charger must be connected to a power outlet that is nearby and easily accessed.

2. Depending on the type of charger, use one of the following options:

Option	Actions
Using desktop chargers or Multi-Unit chargers	**a.** Insert the battery or your radio with a battery into the slot of the charger. **b.** Ensure that the battery or radio is connected to the charger. **c.** When charging the battery only, ensure that the LED indication on the charger shows that charging is in progress. **d.** When charging the battery through a device, ensure that the LED indication on the device shows that charging is in progress.
Using travel or car chargers	**a.** Connect the charger to your radio with the battery attached. **b.** Ensure that your radio indicates that charging is in progress.

Figure 4: Desktop Charger

Figure 5: Car Charger

Figure 6: Travel Charger

NOTE: If the LED of a Multi-Unit Charger (MUC) blinks red when charging, you must reinsert your radio. If the LED still blinks red after several reconnections to MUC, the battery may be damaged or have reached end of life.

Postrequisites:
The battery can heat up when charging. After charging and before using your radio, ensure that the battery and your radio are in the operating temperature range.

3.6
Turning Your Radio On or Off

Familiarize yourself on how to turn on or turn off your radio.

Turning Your Radio On

Procedure:

Press and hold the **On** key.

Result:
Your radio performs a self-check and registration routine. After successful registration, your radio is in service.

NOTE: If Covert Mode is activated, your radio turns on without visible and audible notification.

Turning Your Radio Off

Procedure:

Press and hold the **Off** key.

3.7
Unlocking Your Radio

For radios with general PIN authentication, the PIN length is a fixed 4-digit code. For radios with BSI and SECTRA PIN authentication, the PIN length is configurable by your service provider up to a maximum

of an 8-digit code. The number of attempts for unlocking is three times for both BSI and SECTRA PIN Authentication.

Prerequisites: Your radio displays `Unit Locked Enter Code`.

Procedure:

Enter the PIN code at the prompt.

Result: Your radio enters the default home display.

NOTE: If you are unable to unlock your radio:

- For radios with general PIN authentication, you can only send or receive Emergency Calls and adjust the volume level with the **Rotary Knob**.
- For radios with BSI PIN authentication, you cannot take any action.
- The default value of the PIN is 0000.
- The number of attempts for unlocking is three times.

3.8 Unblocking Your Radio

If you have entered the incorrect PIN code for more than three times (by default), use the PIN Unblocking Key (PUK) to unblock your radio.

The PUK is a master code provided by your service provider. For radios with general PUK authentication, the PUK length is a fixed 8-digit code.

For radios with BSI and SECTRA PIN authentication, the PIN length is configurable by your service provider up to a maximum of an 8-digit code. The number of attempts for unblocking is 10 times for both BSI and SECTRA PIN Authentication.

Prerequisites: Your radio displays `Unit Blocked Enter PUK`.

Procedure:

1. Enter the PUK code at the prompt.

   Your radio displays the PIN code prompt.

2. Enter the PIN code at the prompt.

   If your service provider enables the PIN change option, you can change your PIN code. You must enter your new PIN code twice to change the PIN code.

   NOTE: For SECTRA Radio, once PIN is unblocked by providing the correct PUK, entering new PIN is required.

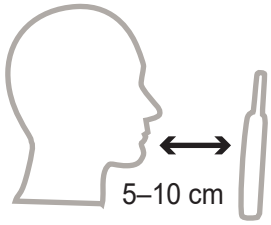
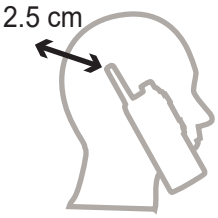
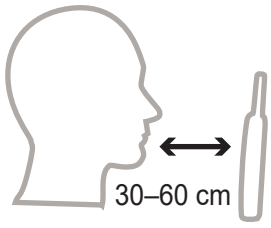
3.9

Holding Your Radio

Your radio has three microphones. The top microphone is for simplex dispatcher or private calls. The bottom microphone is for duplex calls. The third microphone is at the back of your radio for the optional noise cancellation feature.

Procedure:

Depending on the purpose, hold your radio accordingly to the following options:

Option	Actions
Simplex Calls 	• When using high audio, hold your radio vertically with the top microphone 5–10 cm away from your mouth. • Speak into the top microphone. • Listen through speaker. • Keep the antenna at least 2.5 cm from your head and body.
Duplex Calls 	• When using low audio, hold your radio as you would hold a phone. • Speak into the bottom microphone. • Listen through the earpiece. • Keep the antenna at least 2.5 cm from your head and body.
Lapel or Shoulder Use 	• For Group and Private Calls, turn your head towards your shoulder or lapel, and speak into the top microphone. • Listen through the speaker.
Speakerphone Use 	• Place your radio 30–60 cm away from you. • In a noisy environment, move the radio closer to you for better transmission.

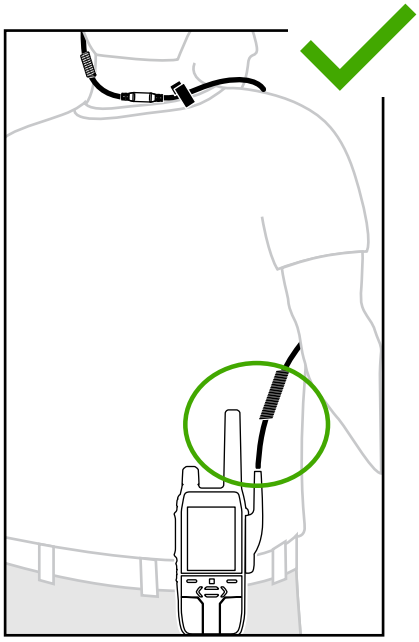
3.10

Recommended Wearing Position

If an accessory is attached to your radio, you can optimize the performance of the antenna by the way you wear your radio with the accessory.

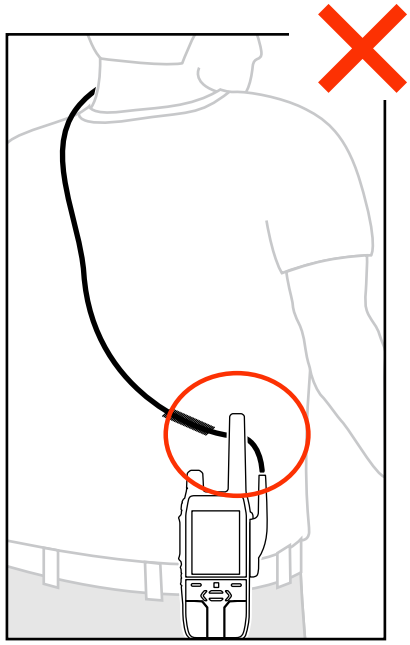
For optimized antenna performance, you must ensure that the accessory cable is away from the antenna of your radio.

Figure 7: Recommended Wearing Position



Avoid overlapping the accessory cable with the antenna of your radio.

Figure 8: Wearing Position to Avoid



3.11
Auto Power-On

Your radio is configurable to turn on automatically after inserting the battery. This functionality is configurable using the Customer Programming Software (CPS).

Battery Insertion

If the emergency mode was active before removing the battery, your radio enters this mode when the power-off period is shorter than approximately 3 seconds. This behavior applies to normal and silent emergency modes. The three-second period is approximate and determined by the discharge rate of capacitors in your radio. The period may last from 3 up to 6 seconds.

Charger Disconnection

Your radio can be configured to turn on automatically after disconnecting from the charger. When the radio is disconnected from the charging unit, the radio will auto power on. This functionality is configurable using the Customer Programming Software (CPS).

NOTE: This feature is not applicable to disconnection from the CarKit.

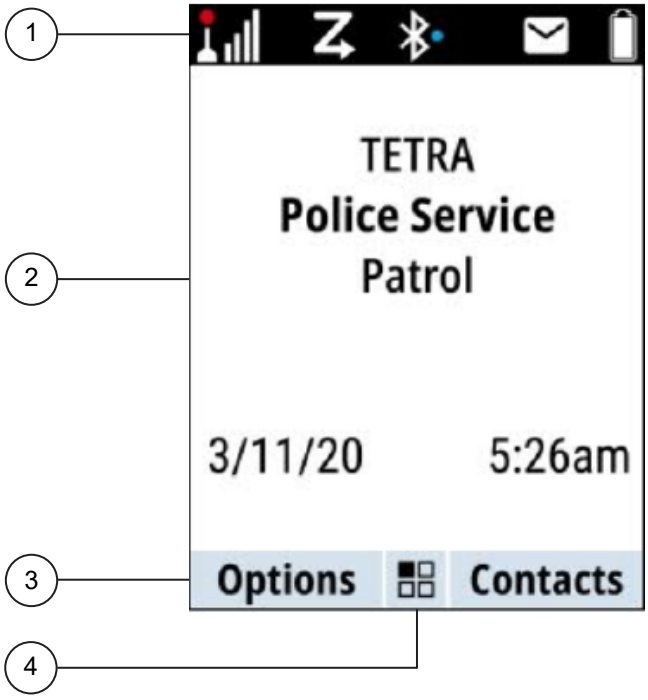
Chapter 4

Display and Keys

Familiarize yourself with the default home screen and keys elements of your radio.

4.1 Default Home Screen

Figure 9: Default Home Screen with Icons



Annotation	Description
1	Status icon area
2	Text display area
3	Soft key area
4	Menu/Context sensitive icon

4.2
Soft Key

Table 6: Colors of the Soft Key Area

The colors of the Soft key area change according to the mode the radio is in.

Color	Mode or State
Light Blue	Normal TMO and DMO Modes
Orange	Emergency Mode
Purple	Local Site Trunking Mode
Yellow	Call Out – Standby
Red	Call Out – Alert
Green	Call Out – Accepted
Pale Blue	Radio Messaging Service (RMS)
Gray	Radio User Identity (RUI) or Radio User Assignment (RUA)

Table 7: Soft Key Changes During a Call

During a call, label of the right Soft Key indicates the next possible change. Accessory default setup is:

Soft Key Label	Audio Setting
Spkr	Audio goes to the main speaker (`Speaker HIGH` is displayed)
Erpce	Audio goes to the earpiece (`Speaker LOW` is displayed)
PHF	Audio goes to the Personal Hands Free (`Speaker LOW` is displayed)

4.3
Configurable Idle Screen

Your service provider can configure the information that is displayed on the idle screen below the status icon area.

The displayed information depends on your radio configuration and services supported.

- Audio Profile Name
- BSI Registration Status
- Home Mode
- Individual Short Subscriber Identity (ISSI)
- International Talkgroup Link Alias
- Network (No Service, or Mobile Country Code (MCC)/Mobile Network Code (MNC), or Networks Alias)
- Operational-Tactical Address (OPTA)
- Radio Status
- Range
- RMS/FMS
- Scan List Alias
- Secondary Talkgroup Alias
- Talkgroup Alias
- Time and Date

Order and visibility of these items are also subject of the Configurable Idle Screen settings. Depending on the font size and icon bar, the idle screen displays three or four lines of information. By default, the information displayed on your idle screen are as follows:

Line 1
Network (No Service, or Mobile Country Code (MCC)/Mobile Network Code (MNC), or Networks Alias)

Line 2
Selected Group Folder

Line 3
Selected Group

Line 4, 5
Home Mode Display Text (if available)

4.4
Home Mode Display Text Message

Your radio is provided with a feature that allows your service provider to send special text messages to the display.

The message is limited to 24 characters. The message stays on the home screen until a new home mode display message is received. Power cycle your radio to replace the Home Display message to the predefined one.

4.5

Display Features

Your radio utilizes colors to highlight certain special situations:

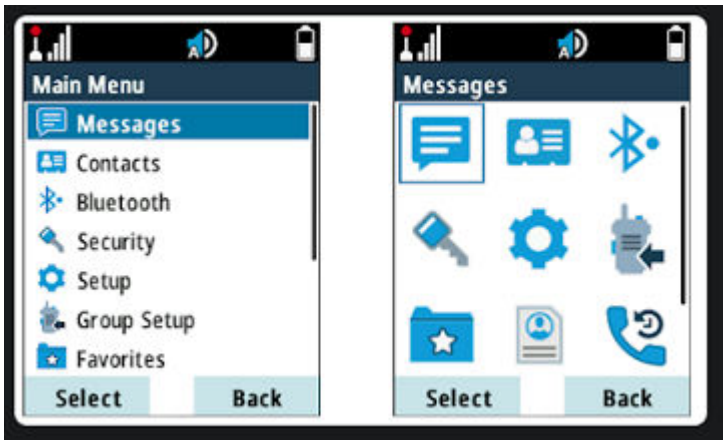
- When your radio is in an emergency mode/call.
- When in the call-out mode (alert received state, standby state, accept the state).
- In the Radio User Assignment (RUA)/Radio User Identity (RUI), when you are logged on or pseudo logged on.

If the display flip is provisioned, your radio can reverse the direction of the display. Hence, the display can be read when holding your radio upside down.

Your radio has three levels of font size that you can choose using the menu.

The Main Menu has two display formats. You can choose to view the Main Menu items in a list or in grid icons. Navigate through the Main Menu using the navigation keys (**Up**, **Down**, **Left**, and **Right** buttons). A handle scrollable bar appears when Main Menu items span the display view.

Figure 10: Grid view and list view of the Main Menu



Backlight on/off toggling setting applies according to your selected audio profile setting. The backlight can be provisioned to operate in one of the following modes:

Default
The backlight on/off state follows the generic configuration.

Semi-Auto
Pressing a provisioned One-Touch Button toggles the on/off state of the backlight. The backlight is also turned off automatically when the backlight timer runs out.

Auto
Pressing any key automatically turns on the backlight.

Disabled
The backlight is disabled for a dimmed display.

The backlight remains on until the backlight timer runs out, or if a provisioned One-Touch Button is pressed to turn it off. You can also toggle between the modes using the menu. The backlight modes are assigned using the configuration tool, and the setting is applied according to the user profile.

Your radio supports an option to display a screen saver when your radio has been idle for a set time, or when you explicitly activate it. The screen saver consists of an image, which can be provisioned from any GIF image, a text string which can also be provisioned, and the date and time. When the screen saver is being displayed, any key input or incoming service causes the screen saver to deactivate.

Chapter 5

Status Indications

Familiarize yourself with the status indications of your radio.

5.1 Battery Status Indication

Your radio indicates low battery level by playing an audible alert when the battery charge falls to a preset level. The low battery alert can be programmed to be 5, 10, or 20 % of remaining capacity by your service provider. The default setting is 5 %. The service provider also configures how frequently the alert repeats.

When your radio is charging, it displays the Charger Mode screen. The screen displays an appropriate Battery Charge Progress icon and charging progress expressed in percentage.

Figure 11: Charger Mode Screen

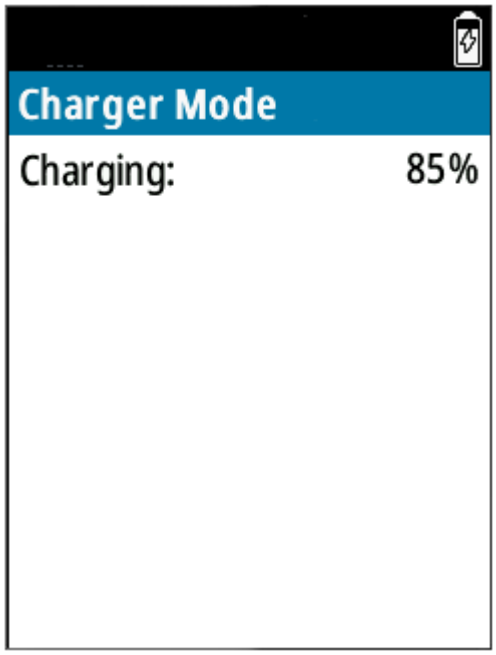


Table 8: Battery Icons

0%–5%	5%–15%	15%–25%	25%–40%	40%–60%	60%–80%	80%–100%
Battery Capacity						
						
Battery Charging						
						

5.2

LED Status Indication

Table 9: LED Status Indication

Indication	Status when Not Charging	Status when Charging
Solid green	• In use • Repeating call	Battery is fully charged
Blinking green	• In TMO service or idle • Switching modes from TMO to DMO	Battery is charged at 90%
Solid red	Out of service	Rapid charge
Blinking red	• Connecting to a network • Switching modes from DMO to TMO	Faulty or invalid battery
Solid orange	• Radio is powering on • Transmit inhibit mode in service • Channel busy in DMO • Radio interference in DMO	Not applicable
Blinking orange	Incoming private or phone call	Battery is on standby to rapid charge
No indication	• Radio powered off • Radio in Covert Mode	Not applicable

NOTE:
When you charge your radio in a multi-unit charger and the battery is at the 90–100% charge level, the LED indicators on your radio and on the multi-unit charger differs:

- LED on your radio – blinking green.
- LED on the multi-unit charger – solid green.

If you insert your radio with a deeply discharged battery into the multi-unit charger, the LED on your radio shows blinking red, indicating a charging error. Resolve this error by reinserting your radio.

Chapter 6

Icon Indications

Familiarize yourself with the icons on your radio.

6.1 Status Icons

Status icons appear when your radio is engaged in certain activities or when you have activated certain features.

Depending on your service provider settings, status icons can appear in normal or large size. By default, they are large on the home screen and normal when browsing though your radio menu.

Table 10: Trunked Mode Operation (TMO) Icons

Icon	Name	Description
	In Service	Transmission is available.
	No Service	Transmission is not available.
	Signal Strength	The more bars, the stronger the signal.
	RF Power	High Radio Frequency (RF) Power is enabled. The more bars, the stronger the signal.
	Migration	Your radio is registered to a foreign network.
	Broadcast Call	Your radio is in a Broadcast Call.
	Scan	Talkgroup scanning is activated on your radio.
	Packet Data or Multi-Slot Packet Data (MSPD)	The more blue sections on the icon, the faster the data transfer. • Four gray sections – Context activated and data idle. • One blue section – Packet Data is active. • Two blue sections – Multi-Slot Packet Data is active.

Table 11: Direct Mode Operation (DMO) Icons

Icon	Name	Description
	In Service	The connection status of your radio to a gateway. • Solid – Your radio is linked to a gateway. • Blinking – Your radio is not linked to a gateway.
	Direct Mode Call	Your radio is receiving a Direct Mode call. The more bars, the stronger the signal.
	High RF Power: receiving	The High RF Power option is enabled. Your radio is receiving a call.

Icon	Name	Description
	Direct Mode	Your radio is in Direct Mode, a radio-to-radio communication.
	Repeater Mode	Your radio is operating as a repeater in Repeater Mode. This icon blinks when the radio is in Repeater Background Mode.
	DMO Repeater Communication Mode	The **Repeater** option in DMO Mode is selected. • Solid – Your radio detects the repeater. For example, your radio receives a presence signal. • Blinking – Your radio does not detect the repeater yet or attachment is happening. • No icon – Radio-to-radio and gateway communication. The **GW + Rep** option in DMO Mode is selected. • Solid – Your radio detects the repeater and the repeater icon is solid. Your radio detects the gateway and the **In Service** icon is solid. For example, your radio receives a presence signal.
	Automatic DMO Mode Enabled	Indicates that Automatic DMO is enabled.
	Automatic DMO Mode Disabled	Indicates that Automatic DMO is disabled.

Table 12: General Icons

Icon	Name	Description
	All Ring Tones Off	• The volume is set to zero when **Volume Adj. Mode** is set to **Common**. • Both Simplex and Duplex ring volume is set to zero when **Volume Adj. Mode** is set to **Individual**.
	Simplex Ring Muted	• The Simplex ring volume is set to zero. • Duplex ring volume is set to more than zero.
	Duplex Ring Muted	• The Duplex ring volume is set to zero. • The Simplex ring volume is set to more than zero.
	Vibrate Only	To alert you of an incoming message, your radio vibrates.
	Vibrate then Ring	To alert you of an incoming message, your radio vibrates and then rings.
	Low Audio	The audio is set to a minimum level. **NOTE:** You can set different icons (A to E) for audio profiles.

Icon	Name	Description
	High Audio	The audio is set to a maximum level. **NOTE:** You can set different icons (A to E) for audio profiles.
	Permanent Disable in Car Kit.	Audio is disabled in the car kit.
	Earpiece Connected	An earpiece is connected to your radio.
	GNSS (Global Navigation Satellite Systems)	• Solid – Your radio detects a fixed location. • Blinking – Your radio is acquiring a fixed location. This feature is an optional setting and may not be enabled on your radio.
	RUI Pseudo Log On	You are in pseudo log on state.
	RUI Packet Data	You are in pseudo log on state when the Packet Data feature is activated and an active data session is in progress.
	RUI Packet Data	You are in pseudo logged on state when the Packet Data feature is activated and the external device sets up data connection with your radio.
	Battery Strength	The remaining power level of your battery.
	Battery Charging	The battery is charging.
	Emergency	Your radio is in Emergency Operation. • Solid – The Emergency Operation starts. • Blinking – Your radio is in emergency receiving state.
	Disaster Alert Call	Your radio is in a Disaster Alert Call.
	List Scrolling	The **Rotary Knob** is in list scrolling mode.
	New Message Has Arrived	Your radio receives a new message.
	New Message in Inbox	You have unread messages in your inbox.
	Unread WAP Message	A new page is loaded to the browser.
	Man Down (henceforth known as Fall Alert) Active	The Man Down (Fall Alert) feature is active on your radio.
	Man Down Alert (Fall Alert)	• Blinking – Your radio is in a Pre-Alert mode and signals Man Down (Fall Alert) conditions. • Solid – Your radio enters the Alert mode.
	Man Down (Fall Alert) Failure	The Man Down (Fall Alert) device failed.

Icon	Name	Description
	Call-Out	Indicates Call-Out alert.
	Call-Out Alert Arrived	Your radio receives a new Call-Out message.
	Call-Out Alert Unread	You have unread alerts in the **CO Box**.
	Indoor Location Enabled	Indicates that Indoor Location operation is enabled.
	Indoor Location Suspended	Indicates that Indoor Location operation is temporarily suspended.
	Secure Operation	Solid – Your radio is operating in a secure channel. Blinking – Your radio is receiving an encrypted voice call.
	Encryption Off	Blinking – SIM Card End-to-End Encryption is disabled in DMO and TMO.
	SIM End-to-End Encryption in TMO	SIM Card End-to-End Encryption is enabled in TMO.
	SIM End-to-End Encryption in DMO	SIM Card End-to-End Encryption is enabled in DMO. Numbers **1** and **2** indicate the selected type of DMO encryption keys.
	SDS End-to-End Encryption	A Short Data Service (SDS) message or message recipient address is encrypted. In High Security mode, when your radio only processes encrypted information. This icon is always visible when you are in the messages menu such as **Inbox**.
	Unread (New) WAP Message	You have not entered **WAP Box** since the last WAP message received. Blinking – The priority is high.
	Keys Locked	Indicates that keys are locked.
	Non-Secured Call in TMO	Blinking – Air encryption is not available when your radio is in TMO and attempts to connect to a gateway.
	Non-Secured Call in DMO	Blinking – Air Encryption is not available when your radio is in DMO. This icon appears after you press the **PTT** button.
	Non-formatted SD Card	• Solid – The microSD card is not formatted at all, formatted incorrectly, or damaged. • Blinking – The microSD card is being formatted.
	USB Connected	Your radio is connected to the computer through a USB cable. This icon is visible only in Mass Storage mode.
	Bluetooth Connected	Bluetooth is enabled and at least one device is connected to your radio.
	Bluetooth Disconnected	• Solid – Bluetooth is enabled but no devices are connected to your radio.

Icon	Name	Description
		• Blinking – Bluetooth is enabled and your radio is in the Discoverable Mode or connecting to a remote device.
	Remote Control	Your radio is being remotely controlled and some commands are being executed in the background. For example, your radio is being controlled by special SDS messages or triggered to send a GNSS location report.
	Wi-Fi Strength	The more bars, the stronger the Wi-Fi signal.
	OTAP over Wi-Fi Available	Indicates that there is an OTAP over Wi-Fi update available.

6.2

Talkgroup Icons Selection

Talkgroup icons are used to indicate that a talkgroup has a special function, show the status of network selection, and/or show the talkgroup properties. A talkgroup without an icon does not have a special function attached to it.

Talkgroup icons are displayed next to the talkgroup alias on idle display and when scrolling through the common or favorite folders.

NOTE: When in Direct Mode Operation (DMO), Trunked Mode Operation (TMO) talkgroups are not shown in common folders.

Table 13: TMO Talkgroup Icons

Icon	Talkgroup in Common Folders	Talkgroup in Favorites Folders	Instance when the Icon is Displayed
	Displayed in TMO	Displayed in TMO and DMO	When the selected talkgroup is a SIM TMO talkgroup, and is not registered to a SIM network. A single network is available.
	—	Displayed in DMO	When the selected talkgroup is a SIM TMO talkgroup. A single network is available.
	Not displayed	Displayed in TMO and DMO	When the selected talkgroup is a normal TMO talkgroup. A single network is available.
	Displayed in TMO	Displayed in TMO and DMO	Displayed when the selected talkgroup is an ISI or Any network TMO talkgroup. Multiple networks are available.
	Displayed in TMO	Displayed in TMO and DMO	Displayed when the selected TMO ISI talkgroup is not assigned to a home network. Multiple networks are available.
	Displayed in TMO	Displayed in TMO	Displayed when the selected normal TMO talkgroup is not assigned to the current network. A single network is available.

Table 14: DMO Talkgroup Icon and General Icons

Icon	Talkgoup in Common Folders and Favorite Folders
	Displayed when a DMO talkgroup is selected.
	Displayed when your radio is locked to a current single network. The selected ISI talkgroup or Any Net talkgroup allows multiple networks.

6.3
Menu Icons

Menu icons help you to identify the items in the menu at first glance. You can choose to view the Main Menu items in a list or in grid icons.

Table 15: Menu Icons

Icon	Name	Description
	Main Menu Items or Context Sensitive Menu	It is assigned to **Menu** when the main menu items/context-sensitive menu are active.
	Messages	Send status messages. Send text messages (free text or according to user defined or predefined templates). Received messages in **In-box**.
	Contacts	Add, search, edit, or erase entries in the contact list.
	Pictures	Allows you to browse and manage photos.
	Bluetooth	Allows you to manage Bluetooth settings.
	Browser	Starts the WAP browser.
	Man Down (hence-forth known as Fall Alert)	Allows you to activate the Man Down (Fall Alert) feature.
	Security	Lets you turn on/off and verify security features, and change pass-words.
	Setup	Allows you to customize your radio.
	Group Setup	Contains additional menu items for Scanning Talkgroups features.
	Individual Setup	Contains additional call settings for individual calls.
	Favorites	Contains shortcuts to frequently used talkgroups and contact num-bers.
	My Info	Displays information about your radio and its numbers.
	Recent Calls	Contains a list of recent calls.

Icon	Name	Description
	Shortcuts	Allows you to view and manage shortcuts to menu items.
	RUI	Allows you to log in and log out of your radio.
	Networks	Allows you to select a network.
	Location	Displays location of your radio.
	Packet Data	Allows you to send data from your radio to other devices.
	Crypto Menu	Allows you to manage SIM card based End-to-End Encryption. **NOTE:** Applicable only for SIM Card model.
	Services	Allows you to manage Broadcast, Assistance, and Disaster Calls.
	Wi-Fi	Allows you to manage the Wi-Fi functions to access a network.
	Wi-Fi OTAP	Allows you to manage Wi-Fi OTAP features.

6.4 Text Entry Icons

In the text entry screen, icons indicate the text entry mode and method that you are using. A character counter displayed on the text entry icon indicates the amount of characters that can be entered.

Press the **#** key to toggle through the text entry modes.

Table 16: Text Entry Mode Icons

Primary Icon	Secondary Icons	Description
		Indicates **all lower-case TAP** text entry method.
		Indicates **all upper-case TAP** text entry method.
		Indicates **first letter upper-case TAP** text entry method.
		Indicates **all lower-case iTAP** text entry method.
		Indicates **all upper-case iTAP** text entry method.
		Indicates **first letter upper-case iTAP** text entry method.

Table 17: Text Entry Method Icons

Icon	Description
	Latin alphabet – all lower-case
	Latin alphabet – first letter upper-case
	Latin alphabet – all upper-case
	Numeric
	Locks for numeric entry only
	Symbol
	Mandarin Phonetic Symbol
	Japanese Hiragana syllabary
	Korean alphabet
	Chinese Pinyin
	Chinese characters strokes

6.5 Messages Icons

Message icons are used as a description or quick indication of the message status.

6.5.1 Inbox Icons

The inbox folder contains up to 100 new or old incoming messages. The **Messages** sub-menu indicates the number of the messages. For example, the indication `2/4` means that two unread and four read messages are in the inbox.

Table 18: Inbox Icons

Icon	Description
Regular Messages	
	Message is unread.
	Message is read.
Protected Messages	
	Protected Message is unread.

Icon	Description
	Protected Message is read.
Secured Messages	
	Secured Message is unread.
	Secured Message is read.
Protected and Secured Messages	
	Protected and Secured Message is unread.
	Protected and Secured Message is read.
General	
	The sender's name and number is in the Message View.
	The date and time of message arrival is in the Message View.
	The delivery status for Store and Forward messages is received.

6.5.2
Outbox Icons

The outbox stores up to 100 sent messages that are arranged chronologically.

Table 19: Outbox Icons

Icon	Description
Regular Messages	
	Message delivery is in progress.
	Message delivery is accomplished.
	Message delivery failed.
	Outgoing message is successful.
	Outgoing message failed.
Protected Messages	
	Protected Message delivery is in progress.
	Protected Message delivery is accomplished.
	Protected Message delivery failed.

Icon	Description
	Outgoing Protected Message is successful.
	Outgoing Protected Message failed.
Secured Messages	
	Secured Message delivery is in progress.
	Secured Message delivery is accomplished.
	Secured Message delivery failed.
	Outgoing Secured Message is successful.
	Outgoing Secured Message failed.
Protected and Secured Messages	
	Protected and Secured Message delivery is in progress.
	Protected and Secured Message delivery is accomplished.
	Protected and Secured Message delivery failed.
	Outgoing Protected and Secured Message is successful.
	Outgoing Protected and Secured Message failed.

6.5.3
Call-Out Icons

Table 20: Call-Out Icons

Icon	Description
	Call-Out folder.
	Call-Out Message in the inbox is unread.
	Call-Out Message in the inbox is read.
	Protected Call-Out Message in the inbox is unread.
	Protected Call-Out Message in the inbox is read.
	Call-Out Message in the outbox is read.

Icon	Description
	Protected Call-Out Message in the outbox is read.

6.5.4
Radio Messaging System Icons

Table 21: Radio Messaging System (RMS) Icons

Icon	Description
	A new RMS status message is received.
	An RMS status message is sent.
	RMS Box Read Message
	RMS Box Unread Message

6.5.5
WAP Icon

Table 22: Wireless Application Protocol (WAP) Icon

Icon	Description
	WAP message.

6.6
Bluetooth Icons

These icons indicate the type of Bluetooth device paired with your radio, and when listed during discovery and radio scan.

Table 23: Bluetooth Icons

Icon	Description
	Bluetooth data
	Bluetooth earpiece
	Bluetooth accessory with PTT
	Bluetooth sensor

6.7
Wi-Fi Icons

Table 24: Wi-Fi Signal Strength Icons

Icon	Description
	Wi-Fi operation in progress.
Wi-Fi Signal Strength	
	Wi-Fi signal is excellent.
	Wi-Fi signal is good.
	Wi-Fi signal is average.
	Wi-Fi signal is poor.
	Wi-Fi signal is unavailable.
Wi-Fi Signal Strength for Secured Networks	
	Wi-Fi signal is excellent for secured networks.
	Wi-Fi signal is good for secured networks.
	Wi-Fi signal is average for secured networks.
	Wi-Fi signal is poor for secured networks.
	Wi-Fi signal is unavailable for secured networks.
Wi-Fi Signal Strength for Open Networks	
	Wi-Fi signal is excellent for open networks.
	Wi-Fi signal is good for open networks.

Icon	Description
	Wi-Fi signal is average for open networks.
	Wi-Fi signal is poor for open networks.
	Wi-Fi signal is unavailable for open networks.

6.8

Contacts

The **Contacts** menu stores all your contact numbers.

Each contact entry requires the following information:

Name
If you store more than one number to one contact, this entry is required.

Type
Each contact must be assigned to one of the following types:

Table 25: Contact Types

Icon	Description
	**Private** Cannot have a speed dial number.
	**Mobile**
	**Home**
	**Work**
	**PABX**
	**Other**
	Pickers Indicate more than one number in a contact.

 # (number)
Each contact entry must contain a number.

Speed #
Shows the default Speed Dial number. You can accept or change it.

Simplex (Private only)
Shows the hook method for simplex calls.

Duplex (Private only)
Shows the hook method for duplex calls.

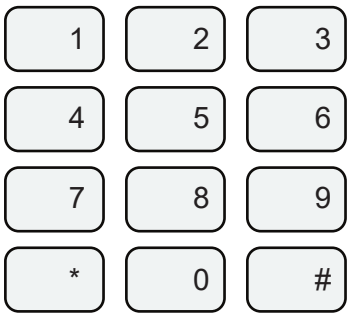
Chapter 7

Keypad Overview

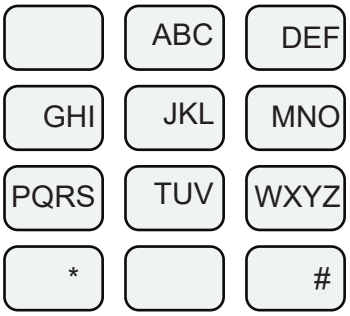
Familiarize yourself with the keys on your radio.

7.1 Alphanumeric and Symbol Keys

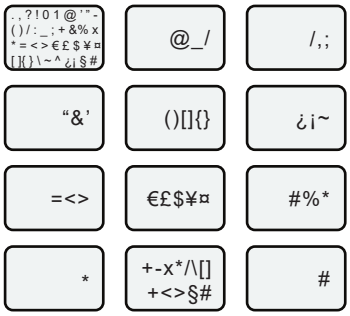
List of keys and characters in Alphanumeric Mode for TAP or iTAP.



Numeric Key View



Alphabetic Key View



Symbol Key View

Table 26: Alphanumeric and Symbol Keys

Numeric Keys	Alphabets	Symbols
1	Not applicable	. , ? ! 0 1 @ ’ ” - ( ) / : _ ; + & % × * = < > € £ $ ¥ ¤ [ ] { } \ ~ ^ ¿ ¡ § #
2	A B C a b c	@ _ \
3	D E F d e f	/ , ;
4	G H I g h i	” & ’
5	J K L j k l	( ) [ ] { }
6	M N O m n o	¿ ¡ ~
7	P Q R S p q r s	= < >
8	T U V t u v	€ £ $ ¥ ¤
9	W X Y Z w x y z	# % *
0	Not applicable	+ - × * / \ [ ] = < > § #

7.2
Other Key

Key	Description
Any numeric key	• In TAP press any key to reject word completion and continue with text entry A new completion will be displayed, if available, after the time-out for TAP expires. • Press and hold to enter Numeric mode from TAP or iTAP alphanumeric.
* key	• Press to insert a space. • In TAP press to dismiss a word completion and insert a space. • Enter a newly created word into the user dictionary. • Press and hold to enter a carriage return.
# key	• Press once to cycle through all entry modes (**Symbol**, **Numeric**, **Primary**, and **Secondary** (if configured). • Press and hold to return to the default entry mode.
Select	Press to select the highlighted choice and place it in the main text area.
Delete	• Press once to delete the last entered character. • Press and hold to clear the entire main text area.
Up Navigation key	• In TAP press to reject word completion and scroll up. • In TAP press to change previously entered small letter to capital.
Down Navigation key	• In TAP press to reject word completion and scroll within the text area. • In TAP press to change previously entered capital letter to small.
Left Navigation key	• Press to navigate to the left. Press and hold to repeat. • In TAP, if a word completion is available, press to reject the completion.
Right Navigation key	• Press to navigate to the right. Press and hold to repeat. • In TAP if a word completion is available, press to accept the word.
Menu	If a context-sensitive menu is active, opens the Context Sensitive Menu.

7.3
Idle Keys

From an idle display, you have easy access to stored target lists.

Table 27: Description of Idle Keys

Key	Description
Up Navigation	Press to access the Favorite Talkgroup list.
Down Navigation	Press to access the Recent Calls list.

Key	Description
Send	Press to access the Last Dialed Numbers list.
Contacts	Press to access the Address Book.

7.4

Browser Keys Usage

When the browser is active, the following usage described occurs inside or outside the editor.

Table 28: Browser Keys Interactions

Key Press	Action
0–**9** key	• In the editor: enters a digit and/or character depending on the text entry mode selected. • Outside the editor: in a numbered list, selects the required item list.
0–**9** key (hold)	• In the editor: standard use. • Outside the editor: hotkey for navigating to the numbered bookmark.
* key (press or hold)	In the editor, inserts a space.
# key (press or hold)	Brings up the Text Input pane, while in editor. Otherwise, sounds a wrong key press.
Left or **Right** Soft key	Selects the option that appears in the display directly above the left and right soft key (part of the page).
Up Navigation key	While in list of options, moves up one line.
Up Navigation key (hold)	Moves up on page.
Down Navigation key	While in list of options, moves down one line.
Down Navigation key (hold)	Moves down on page.
Left Navigation key	• Moves to the previous pane. • In the editor: moves left.
Left Navigation key (hold)	Functions as backward.
Right Navigation key	• Moves to the next pane. • In the editor: moves cursor to the right and inserts space if at the end of the word.
Right Navigation key (hold)	Functions as forward.
Center of Navigation keys (hold)	Auto-repeat.
Menu key	Brings up the browser menu.
End key	Press to deactivate the browser.
Send key	Disabled in browser active state.
Rotary Knob	Used for volume adjustment only.

Key Press	Action
Emergency button	Deactivates the browser. Your radio enters Emergency Mode.

7.5
Functions of Keys

Table 29: Functions of Keys

Key	Description
Menu	Press to open an active context-sensitive menu.
Select	Press to select the highlighted choice and place the selection in the main text area.
Delete	Press once to delete the last entered character. Press and hold to clear the entire main text area.
Up Navigation	In TAP, press to reject word completion and scroll up. In TAP, press to change the previous letter from lowercase to uppercase.
Down Navigation	In TAP, press to reject word completion and scroll in the text area. In TAP, press to change the previous letter from uppercase to lowercase.
Left Navigation	Press to navigate to the left. Press and hold to repeat. In TAP, if a word completion is available, press to reject the completion.
Right Navigation	Press to navigate to the right. Press and hold to repeat. In TAP, if a word completion is available, press to accept the word.
Send	Press to start calls or send messages. Disabled in browser active state.
End	Press to end calls. Press to deactivate the browser.
0 to **9**	In numeric mode, press to enter a digit at insertion point.
Any numeric key	Press and hold to enter TAP or iTAP alphanumeric mode. Press and hold to enter numeric mode. In TAP, press to reject word completion and continue entering text. A new word completion starts after TAP timeout.
0	Press to run through single shift, uppercase, and lowercase functions.
*	Press to insert a space. In TAP, press to reject word completion and insert a space. Press to enter a new word into the user dictionary.

Key	Description
	Press and hold to enter a carriage return.
#	Press once to run through **Symbol**, **Numeric**, **Primary**, and **Secondary** entry modes. Press and hold to return to the default entry mode.

Chapter 8

Services and Features

Motorola Solutions offers a wide range of services and features to meet the unique requirements of mission critical communications.

8.1 System Support

Your radio operates on the Dimetra IP 5.x, 6.x, 7.x and 8.x releases and Dimetra IP Compact. It also operates on previous versions of Dimetra; from Release 3.8 and on.

Your radio is designed to operate optimally on the Dimetra IP system. Your radio operates properly on all Switching and Management Infrastructure (SwMI) that comply with the below list of IOP features defined by the TETRA And Critical Communications Association (TANDCCA). Official IOP certificates can be downloaded from the TANDCCA web page at http://www.tandcca.com/interoperability/interoperability-certificates-and-test-reports/.

TMO TIP:

- TIP Core TTR 001-01, TIP – Part 1: Core
- TIP SDS TTR 001-02, TIP – Part 2: Short Data Service
- TIP DGNA TTR 001-03, TIP – Part 3: Dynamic Group Number Assignment
- TIP Auth TTR 001-04, TIP – Part 4: Authentication
- TIP PD TTR 001-05, TIP – Part 5: Packet Data
- TIP AI Migration TTR 001-06, TIP – Part 6: Air Interface Migration
- TIP FSSN TTR 001-07, TIP – Part 7: Fleet Specific Short Number
- TIP SS-AL TTR 001-09 TIP – Part 9: Ambience Listening
- TIP E2EE TTR 001-10, TIP – Part 10: End to End Encryption (Selling option)
- TIP AIE TTR 001-11 TIP – Part 11: Air Interface Encryption
- TIP SI TTR 001-12, TIP – Part 12: Service Interaction
- TIP Enable/Disable TTR 001-13 TIP – Part 13: Enable or Disable
- TIP LIP TTR 001-19, TIP – Part 19: Location Information Protocol
- TIP CF TTR 001-20, TIP – Part 20: Call Forwarding
- TIP Callout TTR 001-21, TIP – Part 21: Call Out

DMO TIP:

- TIP DCore TTR 002-01, DMO TIP – Part 1: DMO Core
- TIP DGate TTR 002-02, DMO TIP – Part 2: DMO Gateway
- TIP DRep TTR 002-03, DMO TIP – Part 3: DMO Repeater Type 1
- TIP DE2EE TTR 002-04, DMO TIP – Part 4: DMO End to End Encryption
- TIP DAIE TTR 002-05, DMO TIP – Part 5: DMO Air Interface Encryption

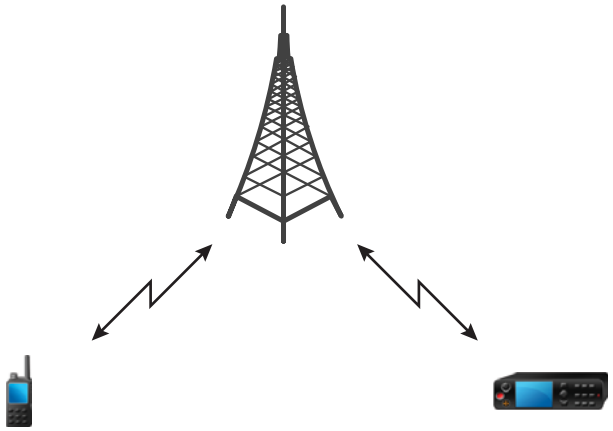
8.2

Trunked Mode Operation

Trunked Mode Operation (TMO) requires the switching and management infrastructure.

This operation mode enables various voice and data communication types, such as group calls and short data service messages, as well as access to the infrastructure-related features such as packet data.

Figure 12: Trunked Mode Operation



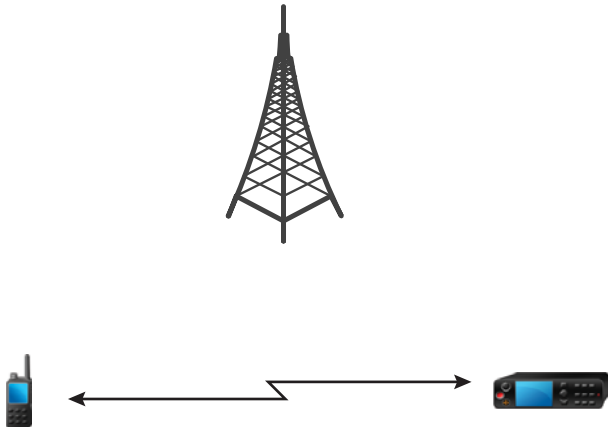
8.3

Direct Mode Operation

Direct Mode Operation (DMO) is a mode of simplex operation where radios communicate directly without the need of a network.

NOTE: For those who use DMO mode, you are recommended to apply DMO Static Cipher Keys (SCK) for data confidentiality.

Figure 13: Direct Mode Operation



8.3.1
Automatic DMO

NOTE: This is a Software Selling Feature.

When your radio detects the unavailability of TETRA control channel, your radio should automatically switch from TMO mode to Automatic DMO. If it senses the presence of a control channel, your radio switches back to TMO mode.

Enabling and disabling the Automatic DMO feature is configurable through the Radio MMI if enabled in the configuration tool.

When Automatic DMO is active, your radio supports the following operations:

- Your radio receives direct calls addressed to the selected DMO talkgroup, private DMO calls, and Short Data Service (SDS) messages.
- The group calls, private calls, and SDS messages initiated are configured in DMO.
- DMO Talkgroup change.
- Support all types of DMO communication mode change (for example, MS-MS, using Gateway, using Repeater, and using Gateway + Repeater)

NOTE:
The assigned Toggle DMO or TMO overwrites Automatic DMO when Automatic DMO is active and enters DMO mode once it is turned on.

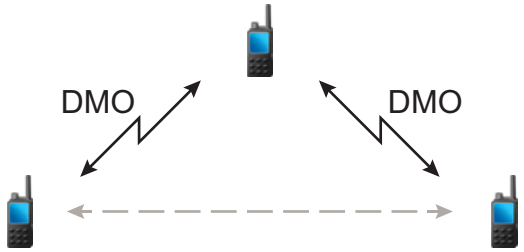
Private Calls are not supported when your radio enters Automatic DMO through a gateway.

8.4
Repeater Mode

NOTE: This is a Software Selling Feature.

The Repeater Mode provides repeater connectivity between radios operating in the DMO Mode. Only the radios on the same talkgroup can communicate with each other through the repeater. Also, only one repeater can be used in one setup. Chain repeaters are not allowed.

Figure 14: Repeater Mode Operation



A DMO repeater is used to extend the DMO range by retransmitting received information from one radio to another. It retransmits group calls, private calls, and data on a given frequency.

The repeater sends presence signal periodically on a free channel to allow other radios to synchronize on a given frequency.

The communication between radios and the DMO repeater is logically divided in two links. The term “master link” is used for all communication taking place between the Master radio and the DMO repeater.

The term “slave link” is used for all communication taking place between slave radio and the DMO repeater. The master is the radio initiating and transmitting the voice or data and the slave is the radio receiving the voice or data.

You can enable Call Monitoring of ongoing call to hear what is being transmitted. You can enable Interactive Repeater to hear and take part in the transmitted call.

Before entering Repeater Mode, the radio enters Repeater Background Mode and monitors the DMO channel for a predefined duration. This duration is configured in the Repeater Background Monitor Timer.

If the signal from other repeaters or gateways is detected, the radio displays `Repeater Detected` or `Gateway Detected` accordingly.

While in Repeater Background Mode, the radio does not send a signal to indicate presence. All operations are blocked except for the following:

- Entering Emergency Mode.
- Switching to another DMO channel.
- Switching to Trunked Mode Operation (TMO) by toggling the One-Touch Button (OTB).

You can manually exit Repeater Background Mode by pressing the **Cancel** softkey. The radio returns to the previous selected DMO mode.

The radio exits Repeater Background Mode and starts operating in Repeater Mode if the DMO channel is free when the Repeater Background Monitor Timer expires.

For more information, refer to DMO Gateway and Repeater Communication on page 73.

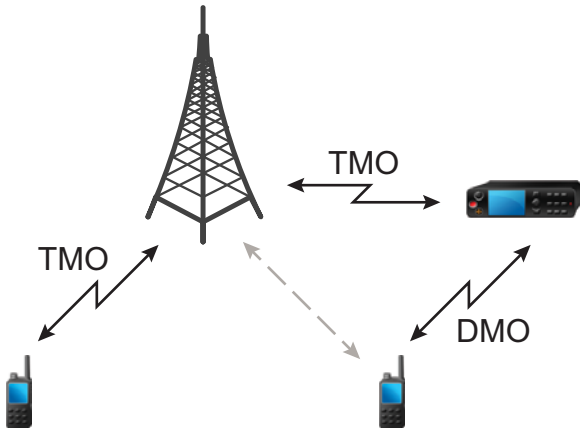
8.5 Gateway Mode

NOTE: This is a Software Selling Feature.

The Gateway Mode allows your radio to work as a gateway and thus provide connectivity among radios operating in DMO and TMO Modes.

NOTE: Only one gateway can be used in one setup. A gateway and a repeater cannot exist in the same setup.

Figure 15: Gateway Mode Operation



A DMO/TMO gateway is used to provide gateway connectivity between radio operation in the DMO and the TETRA TMO network. In other words, the gateway mode provides the interface between TETRA DMO and TMO modes.

The gateway has two air interfaces:

- On the connection to the TMO network, the gateway operates as normal TMO radio. It registers and authenticates to the SwMI using its own ITSI and own security keys when applicable. Similarly the gateway uses its own identity in all signaling exchanges with the SwMI in the same way as for a normal TMO radio.
- On the DMO side, the gateway uses the air interface specified in ETSI DMO Gateway Air Interface. On the DMO side, the gateway uses the frequency specified for currently selected DMO talkgroup. The gateway generates a Gateway Presence Signal after it has successfully registered and authenticated to the SwMI. This signal informs any DMO radio monitoring the RF carrier that the gateway is now present and available for service, and provides frame and slot numbering.

While in the gateway mode, individual and group calls are supported. When the gateway receives an individual or group call addressed to its current selected TMO talkgroup, it forwards the call on to the respective mapped DMO talkgroup. If the DMO channel is not free, and the incoming call has Emergency priority, then preemption request is sent.

When the gateway receives an individual or group call addressed to its current selected DMO talkgroup, it forwards the call on to the respective mapped TMO talkgroup. The DMO radio that initiated the call requires correct setup for gateway calls (otherwise the call is rejected).

The gateway enters Background Mode if it receives TETRA signaling that is not addressed to the gateway and that is stronger than the Gateway RSSI Threshold. While in Background Mode, the gateway does not send presence signal to the DMO channel or transfer traffic between channels.

To re-enter Gateway Mode, the gateway surveys the DMO channel for TETRA signals. If the gateway does not detect any signal that is stronger than the Gateway RSSI Threshold, it surveys the channel again for a period determined by the Gateway Background Survey Time before entering Gateway Mode.

At the same time, the gateway monitors TETRA transmissions on the DMO channel. If the gateway detects that a DMO transmission has ended, it monitors the channel again for a period determined by the Gateway Background Monitor Time before entering Gateway Mode.

Gateways roam between TMO sites. To prevent disconnecting an ongoing call due to roaming, the site switch is delayed until it is no longer in range of the given site.

For more information, refer to DMO Gateway and Repeater Communication on page 73.

NOTE: While in the gateway mode, individual and group calls cannot be initiated, also any active TMO scanning is suspended, including the scanning of supergroups.

8.6 DMO Gateway and Repeater Communication

Your radio provides the capability of communicating in Direct Mode Operation (DMO) with a Trunked Mode Operation (TMO) group through the Interoperability (IOP) certified gateways.

A DMO repeater re-transmits information received from one DMO radio to other DMO radios over the DMO air interface.

For each DMO talkgroup, the radio allows operating in one of the following modes:

Radio to radio only
Your radio initiates communication only on a talkgroup directly and not through a gateway or repeater.

Specific gateway
Your radio can initiate communication on a talkgroup directly or through a specific gateway address that is specified for a talkgroup. The gateway address can be edited through the radio MMI.

Auto gateway
Your radio can initiate communication on the selected talkgroup directly with another radio or through any available gateway that is detected as present.

Repeater
The talkgroup links to a DMO repeater.

Specific gateway and repeater
Your radio uses only the gateway with the specified gateway address for the talkgroup and/or a DMO repeater.

Automatic gateway and repeater
Your radio uses the first available gateway for a talkgroup and/or a DMO repeater. If either specific gateway or auto gateway mode is chosen, and a suitable gateway is found, all outgoing communication are placed through the gateway. If a suitable gateway is not found, or a communication setup through the gateway fails, the radio attempts to set up the communication directly.

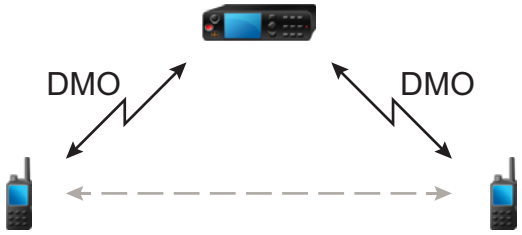
When operating on a gateway and/or repeater, the radio indicates the communication mode.

8.6.1

Communication through Repeaters

Radios that are out of range and cannot communicate directly with each other in Direct Mode Operation (DMO) can do it through a repeater. The repeater is a radio that repeats all communication on a chosen channel, and as a result increases radios DMO range.

Figure 16: Communication through Repeaters



When your radio connects to a gateway, it plays a tone, displays the `Gateway available` message, and shows an appropriate icon. When your radio loses connection with the gateway, it plays a tone, displays the `Gateway not available` message, and the gateway icon is blinking.

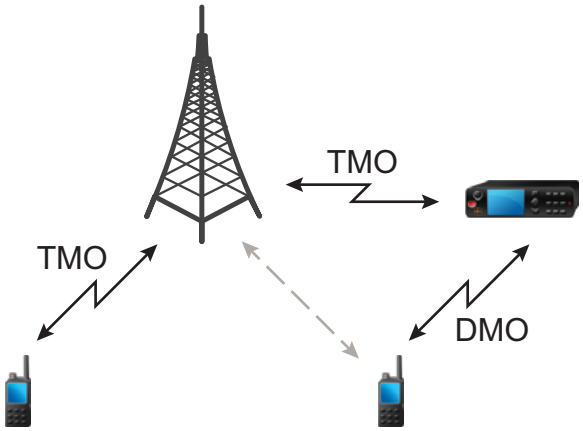
When the radio is on a Gateway mode, radio switches to Gateway mode from TMO if the radio enters emergency.

Powering off the radio or exiting the Gateway mode is restricted when gateway is forwarding emergency call.

8.6.2
Communication through Gateways

Gateway provides connectivity between radios operating in Direct Mode Operation (DMO) and the TETRA network, so that the DMO radios can communicate with the Trunked Mode Operation (TMO) radios.

Figure 17: Communication through Gateways



Radio behavior when radio detects a potential repeater signal:

- Radio sounds a tone sounds.
- Radio displays `Repeater available`.
- Radio displays an appropriate icon.

Radio behavior when radio loses connection with the repeater:

- Radio sounds a tone.
- Radio displays `Repeater not available`.
- Radio displays an appropriate icon.

Radio behavior when group call is in queue:

- Radio displays `Please Wait`.

Radio behavior when entering Local Site Trunking:

- Radio sounds a tone.
- Radio displays `Local Area Service`.

8.6.3
SDS through DMO Gateways or Repeaters

Radios operating in DMO can send the following message types to other radios through DMO Gateways or Repeaters:

- Short Data Service (SDS) Status
- SDS User-Defined Data Types 1, 2, 3
- SDS User-Defined Data Type 4 with or without SDS Transport Layer (SDS - TL)

- Global Navigation Satellite System (GNSS)/Global Positioning System (GPS) Local Information Protocol (LIP) messages

NOTE: The emergency trigger LIP report is sent to the currently selected talkgroup or to the configured destination. Applicable only for Direct Mode Operation (DMO) to Trunked Mode Operation (TMO) forwarding.

Both DMO Gateways and Repeaters can forward messages in Reservation and Idle mode. The supported forwarding directions are:

- DMO group address to TMO group address.
- TMO group address to DMO group address.
- DMO individual address to TMO group address.
- TMO individual address to DMO individual address.

8.6.4
Gateway and Repeater Synchronization

To communicate using gateways or repeaters, your radio requires synchronization with a gateway or a repeater.

A gateway or a repeater sends presence signals to radios. If your radio receives presence signals, it stays synchronized with the gateway or the repeater which sends the signals. If your radio fails to receive a presence signal it does not immediately lose synchronization. Your radio waits for another successful presence for a time defined by your service provider. This function ensures that communications are not dropped due to temporary reception issues.

If a gateway or a repeater is unavailable or your radio is not synchronized with a gateway or a repeater, depending on the setup configured by your service provider, the following scenarios apply:

- Your radio falls back to Direct Mode Operation (DMO).
- After pressing the **PTT** button, a prompt appears warning that the second press overrides the gateway or repeater operation mode.
- No direct DMO communications are permitted.

When your radio receives individual calls and group calls, and replying to individual calls is possible, replying to group calls is not possible.

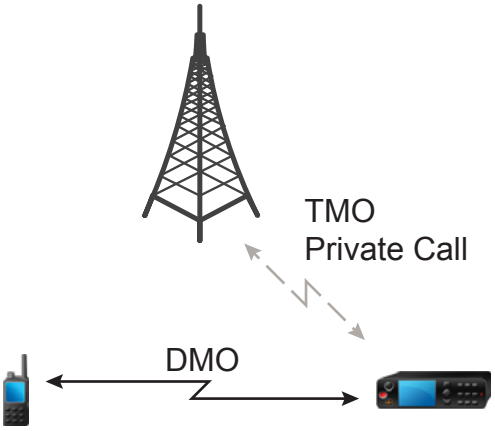
8.7
Network Monitor

NOTE: This is a Software Selling Feature.

This feature allows your radio to monitor for Trunked Mode Operation (TMO) individual calls while maintaining Direct Mode Operation (DMO) services.

When Network Monitor is active, your radio receives direct calls addressed to the selected DMO talkgroup, private DMO calls, Short Data Service (SDS) messages, and also private TMO calls.

The group calls, private calls, and SDS messages initiated are configured in DMO. Only responses to private TMO calls are sent in TMO.



8.8

Transmit Inhibit Mode

The Transmit Inhibit (TXI) Mode is a mode in which your radio sends no radio transmissions. Activate this mode in RF sensitive areas, for example hospitals, airplanes, where safety can be jeopardized due to transmission radiation.

To activate, select **Menu** → **Networks** → **TXI Mode** → **Activate**.

In this mode, your radio does not transmit under any circumstances except for the Emergency Calls. All the functions and keys which cause transmission, for example registration to the network, changing talkgroup or folder, sending Short Data Services (SDS) messages, or pressing the **PTT** button are disabled. While in TXI mode, trying to trigger a transmission would cause your radio to display `Not Allowed In TXI Mode` notification and to sound a tone.

In this mode, your radio does not transmit under any circumstances except for the Emergency Calls. All the functions and keys which cause transmission, for example registration to the network, changing talkgroup or folder, sending Short Data Services (SDS) messages, or pressing the **PTT** button are disabled. While in TXI mode, trying to trigger a transmission would cause your radio to display `TX Inhibit ON` notification and to sound a tone.

NOTE: When TXI mode is enabled, Airplane mode is also enabled. As a result, LTE, Bluetooth, and Wi-Fi are also turned off.

Your radio can still receive:

- Group calls
- Messages - stored in the **Inbox**
- Private call attempts - stored in the **Missed Calls** list, without the option to respond

When danger to safety no longer exists, for example, when you leave the RF sensitive area, you can deactivate the TXI Mode and your radio returns to standard operation.

You can deactivate the mode by selecting **Menu** → **Networks** → **TXI Mode** → **Deactivate**, pressing One-Touch Button, or implicitly when initiating an Emergency Call.

NOTE: RF Transmissions from your radio are prevented under the following conditions:

- TXI Mode is activated.
- Your radio is turned off.

When your radio is registered on a call, upon entering or exiting the TXI mode, it sends a special designated Short Data Service (SDS) status message. This SDS message indicates to the Switching and Management Infrastructure (SwMI) that your radio is entering or exiting TXI mode.

Mobility procedures that do not require your radio to send an uplink transmission are performed except for cell reselection.

In TXI mode, your radio joins group calls for any group that your radio is monitoring. Transmitting on that call is still prohibited.

Your radio also displays any incoming SDS messages to the user. The missed call feature is active in the TXI mode and allows checking what calls were missed. However, your radio attempts to prevent call setup retransmission from being recorded as separate calls.

If you initiate an emergency call, your radio immediately leaves TXI mode and attempts to start the emergency call if your radio is in service.

If your radio is turned off in the TXI mode, on turning on, your radio asks whether to exit the TXI mode. If you choose **No**, your radio turns off.

Chapter 9

Talkgroups

This section lists the features and functions available for talkgroups.

9.1 Programmable Talkgroups

Your radio offers a talkgroup list facility. Each talkgroup entry contains a TETRA group address and may be associated with a name tag. The talkgroups can be defined in the codeplug as per your radio capabilities.

Talkgroups are configured separately for Trunked Mode Operation (TMO) and Direct Mode Operation (DMO) modes. To program a talkgroup in TMO define its name and Group Short Subscriber Identity (GSSI). To program a talkgroup in DMO define its name, Group TETRA Subscriber Identity (GTSI) and frequency. Your radio operator can select a talkgroup which has an associated TMO or DMO frequency depending on the mode selected. When switching between the TMO and DMO modes the last active talkgroup is selected. However the required talkgroup can be mapped in configuration tool. In such a case a corresponding talkgroup is automatically selected during mode switching, regardless of the previously selected talkgroup.

NOTE: Neither the group name nor the corresponding group address can be edited using your radio MMI.

A talkgroup linked to several networks produces as many new unique talkgroups as the networks it associates with. For example, if the talkgroup has the same GSSI and network in several talkgroup folders, one unique talkgroup is created. Alternatively, if the talkgroup has the same GSSI but with different networks in several talkgroup folders, several unique talkgroups are created for each network.

The GTSI indicates the talkgroup uniqueness. It is a combination of the GSSI and the network associated to the talkgroup in the given talkgroup folder. The talkgroup folders do not determine the uniqueness of the new talkgroups.

9.2 Talkgroup Folders

The talkgroups are organized in folders. You can select a talkgroup by first choosing a folder and then the talkgroup in the folder. The size of each folder is flexible and can be defined through provisioning.

The talkgroup folders are organized in a tree-structure:

Level 1 Folders

Can contain any number of level 2 folders.

Placed at the root of the folder structure.

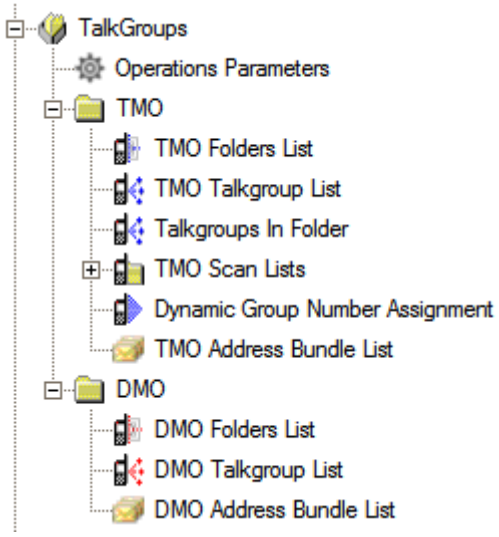
Can contain both level 2 folders and talkgroups at the same time.

Level 2 Folders

Placed in level 1 folders.

Any given level 2 folder can only be sub-folder to one level 1 folder.

Figure 18: Talkgroup Tree



NOTE: The folder definitions cannot be changed using your radio MMI. Any talkgroup folder or sub-folder which is either empty or does not contain any programmed talkgroups is hidden in the MMI.

9.3 Talkgroup Selection

Talkgroup selection from the stored talkgroups list in the idle mode can be performed by scrolling through the list using the scroll keys.

You can also scroll using the **Talkgroup Knob**. Talkgroup scrolling can be provisioned to scroll in a folder only, or continuously through the folders acting as one continuous list of groups. Your radio does not allow directly dialing a group Short Subscriber Identity (SSI).

9.4 Favorite Folders

You can add frequently used talkgroups and phone book contacts to the Favorite folder. You can add items from Favorites or Talkgroups and Contacts menu levels respectively.

This feature allows quick access to frequently used talkgroups by including the groups in up to three favorite talkgroups ranges. These ranges are separately stored in the data storage. The feature operates in both TMO and DMO modes. The favorite talkgroups ranges are shared for TMO and DMO talkgroups. Press the **Up** scroll key to select, view, and edit **My Groups** ranges. Once a group from the **My Groups** range is selected, you can select any of the favorite talkgroups in that range using normal procedure.

A favorite talkgroup range name replaces a talkgroup range name on your radio display whenever a favorite talkgroup is selected, or is in use for appropriate operation. The ranges of favorite talkgroups with their talkgroup assignments are kept through your radio power cycle.

9.5 Talkgroups Blind Operation

Your radio can be provisioned with a virtual scrolling end-stop option for use in blind operation.

When you have scrolled to the beginning or the end of the list, the first or the last talkgroup is displayed even if you continue to scroll. A tone is emitted when the upper or lower virtual end-stop is reached. To change

this setting for the **Rotary Knob**, you can select **Wrap around Rotary Knob Group Scrolling** option in the configuration tool. To change this setting for the **Talkgroup Selector** button, you can select **Wrap around Rotary Knob Group Scrolling** option in the configuration tool.

9.6 Receive-only Talkgroups

Talkgroups can be provisioned as receive-only talkgroups. This setting depends on the settings of the folder the talkgroup is in. Any talkgroup from the receive-only folder can be selected. Your radio allows you to receive calls, however, no call can be initiated to this talkgroup.

9.7 Non-Selectable Talkgroups

A talkgroup can be provisioned as a non-selectable talkgroup. Such talkgroups are not visible when scrolling through the talkgroup list, and thus cannot be selected.

The group name is displayed only upon receiving a call for the group, for instance, if it is an announcement talkgroup associated with the selected group, or if it is a scanned one. Your radio user is not allowed to edit the scan list.

9.8 Temporary Group Address

Your radio supports the temporary group address assigned by the Switching and Management Infrastructure (SwMI). The address is valid only for the lifetime of the call.

Your radio monitors signaling addressed to the temporary group, when your radio initiates a group call on the selected group, and the SwMI assigns the call to a temporary group.

Your radio supports assignment of an incoming group call to a temporary group address.

9.9 User Initiated Group Attachment

Your radio supports the temporary group address assigned by the Switching and Management Infrastructure (SwMI). The address is valid only for the lifetime of the call.

A radio must attach itself to a talkgroup to participate in a group call.

Your radio initiates a group attachment request to the SwMI during the following conditions:

- Radio powers up.
- Radio registers on a new site.
- User initiates a group change.
- User activates a scan list.

When a group change is requested, your radio initiates an attachment to the SwMI, detaching the old group and attaching to the new one.

All group attachments sent by your radio are sent with attachment mode of **Amendment** or **Detach all...** depending on which form causes sending fewer bits over the air interface.

When you turn on scanning and then select the scan list, your radio sends a group attachment request to attach the scan groups in addition to the selected group. Similarly, when you select an Announcement Talkgroup (ATG), your radio sends an attachment of the ATG as the selected group along with the attachment

of the associated groups as scan groups. If a group associated with an ATG is selected, your radio sends an attachment of the ATG as the selected group and as a scan group.

The TETRA TIP provides a facility by which your radio can send a status message to the SwMI to turn scanning off and on to save air interface signaling.

If your radio is provisioned with this option, when you turn scanning off, your radio sends an appropriate TETRA signaling. In this state, your radio does not monitor any groups other than the selected group. If you then turn scanning on, your radio sends an appropriate TETRA signaling and begins monitoring all scanned groups again.

If your radio is not provisioned with this option, you can only deselect the active scan list. However, you cannot turn off the scanning. Deselection of the user scan list causes a group detachment of the scan list groups sent to the SwMI. However, your radio continues to scan all other groups, such as ATG associations.

9.10
Announcement Talkgroups

Your radio supports a group hierarchy concept. An ATG is a talkgroup consisting of up to 20 talkgroups. One of the talkgroups is a master group. Only the master group can monitor the traffic of the ATG. Users of a subgroup cannot monitor the traffic of other subgroups.

Once you select an ATG, your radio monitors signals addressed to the ATG in addition to signals addressed to its selected talkgroup. Your radio does not support active scan list while attached to an ATG.

Depending on the codeplug settings, your radio can be provisioned to initiate an announcement call. If it is not provisioned to do so, your radio can still initiate an emergency call to the ATG.

A talkgroup can be associated to only one ATG. An ATG cannot be associated to another ATG. An ATG has a higher priority than other group calls within the same call priority.

It is possible to configure some or all DMO talkgroups to allow only individual calls. This configuration helps optimize frequency allocation in DMO.

Chapter 10

Talkgroup Scanning

Talkgroup scanning allows your radio to monitor signaling of a few talkgroups at the same time. In addition to monitoring signaling addressed to the selected talkgroup, your radio can monitor signaling addressed to multiple talkgroups.

To use the multiple group monitoring, define a scan list which is a user-activated scan list. Your radio can allow creating and editing the scan list using MMI. This list holds up to 20 talkgroups, which you monitor in addition to the selected group.

You can choose only one user-activated scan list at a time. When this list is activated, your radio begins to monitor traffic for these groups in addition to the traffic for the selected group. Up to 40 scan lists can be defined.

If the SwMI instructs a radio to detach one of the scanned groups, your radio stops monitoring the group, but the group remains in the scan list. Subsequent attachment of a group by the SwMI causes your radio to begin monitoring the group again.

The SwMI may also instruct a radio to attach groups from out of the scan list. If the group attachment is accepted, your radio monitors the group.

If talkgroups have been attached or are always attached, your radio may passively monitor the following talkgroups:

- Selected talkgroup.
- Announcement Talkgroup (ATG) associated with the selected talkgroup (if this talkgroup is not set as **Permanently detach**).
- Talkgroups associated with the selected ATG (if this talkgroup is not set as **Permanently detach**).
- Talkgroups in the user-activated scan list (if scanning is enabled and the SwMI-initiated detachment has not been performed on these groups).
- Talkgroups in the SwMI-controlled scan list (if scanning is enabled).
- Talkgroups with the class of usage set to **Always Scanned** (if supported).

Chapter 11

Dynamic Group Number Assignment

Dynamic Group Number Assignment (DGNA) allows the network operator to dynamically manage talkgroups on your radio over the air interface. Your radio responds to DGNA directed to it or to DGNA directed to a group your radio is attached to even if the talkgroup is not programmed in the codeplug.

Using DGNA, the network operator can:

- Assignment – An assignment of a new talkgroup in the talkgroup list
- Reassignment – An assignment of a talkgroup that already exists in the talkgroup list
- De-assignment – Removal of a talkgroup from the talkgroup list
- Selection – Attach or select newly added talkgroups

All the above operations are performed by transmitting data to your radio.

Your radio also supports supergroups of scanned groups, such that a group addressed DGNA assignment received on one of the user scan group addresses causes your radio to monitor all signaling addressed to that supergroup as long as the scan group is being monitored, and as long as the supergroup lifetime lasts.

DGNA Operation

There are three DGNA Group Type:-

- Static – only selection is allowed.
- Semi-Static – selection and reassignment are allowed.
- Dynamic – selection, de-assignment, and reassignment are allowed.

The group type configured will determine which DGNA Operation is applicable.

DGNA Operations	Talkgroup Selection	Talkgroup Reassign-ment	Talkgroup Deassign-ment
Static	Applicable	Not Applicable	Not Applicable
Semi-Static	Applicable	Applicable	Not Applicable
Dynamic	Applicable	Applicable	Applicable

Assignment

When your service provider adds (assigns) a new talkgroup, depending on the settings, your radio can perform one of the following actions:

- Attached as scanned – If the group is assigned with attached as scanned, if it is not already in the currently active scan list, your radio adds this group to a Switching and Management Infrastructure (SwMI) Controlled scan list and begins monitoring downlink signaling addressed to this group. The SwMI controlled list holds up to ten groups, and your radio monitors these groups as well as groups in the user scan list.
- Attached as selected – Assignment of the group through DGNA with attached as selected makes it the selected group of your radio. If the DGNA Auto Select is configured, radio will automatically attach to and automatically select the assigned talkgroup.

If the talkgroup list is full when adding a group, your radio rejects the assignment operation. If the SwMI controlled list is full and the assignment is with attached as scanned, the attachment is rejected.

Deassigment

When your service provider deletes (de-assigns) the currently selected talkgroup, depending on the settings, your radio can perform one of the following actions:

- Enter the `No Group` state – your radio does not attach to any talkgroup automatically.
- Attach to the last selected TMO talkgroup - If the last selected TMO talkgroup is not available (it was deleted), your radio enters the `No Group` state.
- Attach to a default talkgroup configured by your service provider - If the default talkgroup is not available (it was deleted), your radio enters the `No Group` state.
- At each talkgroup change, an appropriate notification is shown on the display.
- If the DGNA message is received to delete all talkgroups, your radio displays `All Talkgroups Deleted`.

Chapter 12

Types of Radio Calls

Your radio is able to make calls in Trunked Mode Operation (TMO), Direct Mode Operation (DMO), or both. This section talks about the types of calls available.

12.1 Group Call

The group call service enables your radio to communicate with a group of other TETRA radios using point to multi-point operation.

This service is available in both Trunked Mode Operation (TMO) and Direct Mode Operation (DMO). You can initiate a new group call to the selected talkgroup or talk back to the existing group call by pressing the PTT button.

Functions available in group call service are as listed:

Group Call Reception

In most situations, your radio receives group calls without any intervention. When your radio receives an incoming group call, you are alerted with a short alert tone. Depending on the configuration, the tone can be disabled. Then the speech follows.

To clear a call ended by the call owner, normally by the Switching and Management Infrastructure (SwMI), you do not need to do anything. However, you can leave a group call. Then the call continues for other radios, even though your radio does not participate in the call anymore.

PTT Queue

PTT Queue allows you to configure the response to releasing **PTT** of the call originating radio. This feature also determines how to cancel waiting for the call when the infrastructure is busy and your call is queued.

Talking Party Identification

Radios engaged in a group call receives an ID of the transmitting party. The identification presentation functionality is supported mostly using the information found in the call setup messages.

Call Ownership

Your radio can be given the call ownership of a talkgroup call. When your radio is the call owner, it sends an appropriate TETRA signaling to end the call.

NOTE: The SwMI decides the ownership of a call.

Transmission During Group Call

While receiving a group call, and the **PTT during received Group Call** is enabled, you may request to transmit by pressing and holding the **PTT**. The system registers this action and informs you that the request has been queued.

If you release the **PTT**, your radio sends a message to the system withdrawing the request.

Late Entry

A radio can join a group call even if it does not participate in it from the beginning.

For example, if you turn on your TETRA terminal and select a talkgroup with an ongoing group call, your radio automatically joins the call. Similarly, if your radio has been outside of your radio coverage, for example in a tunnel, the control channel continues to divert the terminal to a talkgroup call, assuming a call is already in progress.

NOTE: For TMO, this feature must be configured on SwMI. Acknowledged late entry and late entry paging are not supported.

Transmission Timeout Timer for Group Call

Your radio limits the time you can continuously talk in a group call without interruption, according to a provisioned value. You are warned a short time before the talk time expires. The timer is provisioned per talkgroup folder.

D-PTT Tone

The PTT double push (D-PTT) feature enables your radio to generate a specific tone sent to other radios in the talkgroup.

NOTE: Your radio can only support either D-PTT Tone feature or D-PTT Preempt Group Call feature at a time.

To send the tone, you can press the preconfigured One-Touch Button once or **PTT** twice in a period defined in configuration tool. The D-PTT is triggered only when your radio is in idle or group call mode. The D-PTT tone is not played on the sending radio.

After the D-PTT tone is played, you can press and hold the **PTT** once again to get the permission to talk. Otherwise if you press the **PTT** while the D-PTT tone is played, it is ignored. The D-PTT tone is not audible on the sending radio.

If you hold the **PTT** after the second press and your radio finishes sending the D-PTT tone, you can start a group call. You are notified of the behavior by the permission to talk tone after D-PTT tone ends. If **PTT** is released after the second press, only the D-PTT tone is sent.

NOTE: The D-PTT tone is sent as voice, hence the receiving radio plays the sound no matter whether the feature is enabled on it.

You can adjust the D-PTT tone volume level in the speaker or earpiece of the sourcing radio. Disabling all the tones does not affect the sent tone volume. From the MMI, you can change the D-PTT tone to be single, double, or triple. The tone type can also be changed in the codeplug.

D-PTT Preempt Group Call

NOTE: This is a Software Selling Feature.

The D-PTT Preempt Group Call allows superiors to take over and speak in an ongoing group call by making preemptive priority calls.

NOTE: Your radio can only support either the D-PTT Tone feature or D-PTT Preempt Group Call feature at a time.

By pressing the PTT (Push-To-Talk) button twice, you make a preemptive request to temporarily interrupt an ongoing group call and gain permission to speak.

If your group call is preempted and you are still pressing the **PTT** button, your radio displays the `PTT Denied` prompt.

If your service provider enables the visual notification, your radio displays the `PTT Interrupted` prompt throughout the group call preemption, even if you no longer hold the **PTT** button.

If your service provider enables the audio notification, your radio plays the PTT Denied Tone until you no longer hold the **PTT** button.

12.1.1
PTT Queue

PTT Queue allows you to configure the response to releasing **PTT** of the call originating radio. This feature also determines how to cancel waiting for the call when the infrastructure is busy and your call is queued.

When you press and hold the PTT button to transmit while in a call and transmission is not granted, your radio plays a PTT queuing tone. You can stop playing the PTT queuing tone by releasing the PTT button.

12.2
Private Call

Private call, also called point-to-point call, enables communication between two individuals. No other radio can hear the conversation.

This call type can be carried out in two ways:

Duplex Call
This call type is only allowed in Trunked Mode Operation (TMO). During this call, both parties can speak at the same time.

Simplex Call
Available in TMO or Direct Mode Operation (DMO). Only one party can speak at a time.

In TMO, you can answer a private call in the following methods:

Hook (default)
When this method is selected, you must answer the call to begin transmission.

Direct
When this method is selected, the call is automatically answered without any keypress and transmission begins immediately. Therefore, ensure that the incoming call notification is configured properly to indicate the incoming call.

As Received
When this method is selected, the call is answered according to the call answering setup determined by the transmitting party.

If configured, your radio can block outgoing private calls. The following are private calls that needs to be blocked in TMO:

- Half Duplex
- Full Duplex
- PSTN (Telephony)
- PABX

The following are private calls that needs to be blocked in DMO:

- Calls between Motorola Solutions radios
- Calls using Repeater
- Calls using Repeater

Table 30: Call Answering Rules

The following table illustrates the dependencies between the call answering setup and the call receiving method. The setup on the receiving radio takes precedence over the setup of the transmitting radio.

Call Answering Setup		Call Answering Method
Transmitting Radio	Receiving Radio	
Hook	Hook	User answer
Hook	Direct	Auto answer
Hook	As Received	User answer
Direct	Hook	User answer
Direct	Direct	Auto answer
Direct	As Received	Auto answer

NOTE: The Direct hook method for duplex calls is supported from Dimetra 9.0.2 onwards.

When a DMO private call takes place, the radios not involved in this call receive the channel busy indication. The radios are identified using their radio numbers.

Functions available in private call service are as listed:

Transmission Timeout Timer for Private Call

In a simplex call, your radio limits the time you can continuously talk in a group call without interruption, according to a provisioned value. You are warned shortly before the talk time expires.

Assistance Call

Assistance Call feature helps you to call for assistance during normal and non-critical situations. Starting an Assistance Call means to start a private call on a configured ISSI number. Assistance Call destination address and priority can be configured in the codeplug. This feature is only supported in TMO mode and on GMOI network.

Assistance Call can be a simplex or duplex call depending upon your service provider settings. An Assistance Call is full-duplex when you type the number and press **Send**. An Assistance Call is half-duplex when you type the number and press **PTT**.

You can initiate Assistance Call to five different target addresses using one of the following methods:

- Dialing ISSI number or speed dial on idle screen.
- Selecting ISSI number from recent call list.
- Selecting contact from address book.
- Selecting contact from the Assistance Call Menu Using Remote Control feature.
- Pressing predefined One Touch Button.

Individual Call Supplementary Services

The Individual Call supplementary service feature in Trunked Mode Operation (TMO) provides similar functions which are available in the telephony network. The subfeatures available are Call Hold, Call Transfer, Call Waiting, and Call Forwarding.

Table 31: Individual Call Supplementary Service Subfeatures

Subfeatures	Description
Call Hold	A console operator can interrupt an individual call by putting it on hold. When a call is on hold, the console operator can perform other actions such as searching for information. During this time, voice communication stops instead of being terminated. Voice communication resumes when the call is no longer on hold.
Call Transfer	Call Transfer allows a console operator to transfer an active individual call to another new party. Call transfer is required, for example when the caller cannot directly dial or does not have the number to do so. The caller is put on hold while the console operator initiates an individual call with the new party. Then, the console operator transfers the call, connecting both parties in a new individual call.
Call Waiting	Call Waiting allows your radio engaged in a call to acknowledge an incoming individual call. Your radio can choose to **Accept**, **Reject**, or **Ignore** the waiting call. **Accept** The ongoing call ends immediately, and your radio connects to the new call. **Reject** Your radio rejects the waiting call and the ongoing call resumes. **Ignore** The **Waiting Call Ignoring Duration** timer starts and your radio must end the ongoing call before this timer expires to connect to the new call. If the timer expires, your radio rejects the call.
Call Forwarding	Call Forwarding allows the Switching and Management Infrastructure (SwMI) to redirect an individual call to another destination. The redirection is according to one or more combinations of the following pre-configurations: **Call Forwarding Unconditional (CFU)** The call is forwarded to the specified destination regardless of the state of the recipient. **Call Forwarding on Busy (CFB)** The call is forwarded to the specified destination if the recipient is busy in another call. **Call Forwarding on No Reply (CFNRy)** The call is forwarded to the specified destination if the recipient does not answer the call. **Call Forwarding on Not Reachable (CFNRc)** The call is forwarded to the specified destination if your radio is not reachable, for example, if it is switched off or out of range.

DMO Individual Call Presence Check

If the other party is listening, the Presence Check feature allows the user making a Direct Mode Operation (DMO) private call to have a confirmation. This confirmation is important in situations where it is crucial that the message gets through.

If the other party does not answer the call, a radio with Presence Check enabled displays the `Party not available` message. Both radios must support this feature to use it.

In addition, radios can be configured to Accept DMO Individual Calls with Presence Check. If enabled, your radio accepts incoming calls with or without the presence check. If disabled, your radio only accepts private calls without the presence check.

Private Calls through DMO Gateway

NOTE: This is a Software Selling Feature.

The DMO Gateway can relay clear, non-BSI, and non-SECTRA encrypted private calls from a radio in Trunked Mode Operation (TMO) to another radio in DMO, and the other way around.

A DMO radio can directly establish a private call with another TMO radio through its Individual Short Subscriber Identity (ISSI).

A TMO radio initiating a private call with another DMO radio first establishes a private call with a DMO Gateway. Then the DMO Gateway establishes a private call with the target address of the DMO radio, which is already predefined in the Gateway. The DMO forwarding address is configurable. Contact your service provider for more information.

12.3 Phone Call

The phone call service enables a radio in Trunked Mode Operation (TMO) to communicate in a one-on-one simplex or duplex conversation with a phone (for example, a phone call-enabled TETRA radio or landlines number) using a telephone switch. Your radio supports individual call service to an external identity.

Two phone call types are available:

- A full phone number Public Switched Telephone Network (PSTN) call is addressed to the defined PSTN gateway address.
- An internal Private Automatic Branch Exchange (PABX) call is addressed to the defined PABX gateway address.

NOTE: The PSTN phone call is supported when PSTN/PABX feature is enabled in the codeplug and the Switching and Management Infrastructure (SwMI) supports this functionality. The PSTN/PABX gateway must be configured properly.

If configured, your radio can block outgoing private calls. The following are private calls that needs to be blocked in TMO:

- Half Duplex
- Full Duplex
- PSTN (Telephony)
- PABX

The following are private calls that needs to be blocked in DMO:

- Calls between Motorola Solutions radios
- Calls using Repeater
- Calls using Gateway

Only one PSTN/PABX gateway ID and one PABX/PABX gateway ID are available in your radio.

Functions available in phone call service are as listed:

Phone Call Initiation

Your radio is able to initiate phone calls to a PSTN or PABX with duplex speech capability. This call type uses TETRA individual call signaling using single stage dialing and hook setup for outgoing calls.

Using the hook signaling for phone calls, implies that until a traffic channel is allocated, your radio generates all feedback tones internally. In addition, your radio accepts SwMI modification of the call setup to direct, enabling the infrastructure to generate the progress tones.

Phone calls can also be made between TETRA radios using the Mobile Station International Subscriber Directory Number (MSISDN) number as the called party number. MSISDN calls share the same gateway as phone calls, that is, PSTN gateway configured in the codeplug. If an MSISDN call is placed, two radios can have a simplex or duplex call based on the assigned ISDN number.

NOTE: The Dimetra Infrastructure does not support private calls and Short Data Service (SDS) through MSISDN.

Phone Call Reception

Incoming phone calls, from the land gateway to mobile, use on-off hook signaling. Your radio extracts the gateway ID from the call setup signaling, to determine whether to start phone or PABX call.

12.4
Preemptive Priority Call

During a call, if a call setup is received from a call with higher priority than the present call, your radio disconnects from the present call and joins the new high priority call.

Your radio behaviors depends on the configured priorities. Available priorities that can be configured are as follow:

- Priority 1 or 2 (12 or 13) – Interrupts (preempts) ongoing calls of lower priority, depending on configuration, your radio either accepts or rejects the new call.
- Prority 3 or 4 (14 or 15) – Interrupts (preempts) ongoing non-emergency calls and join Emergency call that is with higher priority.

When the new call is accepted, a special tone is played, and you are notified of the high priority call.

When you initiate a private call and you receive a rejection with the reason `Called party busy`, you have the option to interrupt the existing call or initiate a new call. However, this time the call is initiated with the preemptive priority.

Priority Monitor During Group Call

While your radio is active in a group call, it may receive a group call setup for a different group. Your radio decides whether to ignore the new call or accept it basing on the call priority. If the new call has the higher priority than the current one, the new call may be joined and the current call is dropped.

The following priority types are applicable to calls:

- Call priority indicated in the call setup signaling.
- Priority of the group indicated by the Class of Usage (CoU) negotiated upon attachment.

If the old call and new call have different call priorities, your radio follows the call with the higher call priority. If the calls have the same call priority, the CoU priority of the group decides.

If a radio is in a group call, but is not currently the talking party, and detects a call setup for a different group with the same priority, it joins the call if a CoU priority is higher.

Your radio can be set up not to immediately join the new higher priority call but to present the new call to the user before joining it. If so provisioned, you are given a choice of following the new higher priority call or staying with the present call.

Your radio can be set up to treat a selected group call as a higher priority than a scan group call. This behavior occurs regardless of the priority of the calls or the groups.

12.5 Broadcast Call

Broadcast Call enables the dispatcher to transmit to all radios in the specific area. This call is only available on GMOI network.

Your radio joins calls received with a communication type broadcast and displays a notification that this call is a broadcast call. Typically, this call type is addressed to the broadcast address (ISSI).

A broadcast call takes precedence over any other call that has the same or lower call priority.

NOTE: Your radio cannot initiate a broadcast call, however, your radio is able to initiate the "broadcast-type" call restricted to the particular talkgroup using the Announcement Call feature.

In TMO mode, broadcast call can be forwarded from the Gateway to a DMO open talkgroup or Attached DMO Talkgroup if configured.

Announcement Call

This feature allows you to make a Broadcast Call from your radio initiated on the predefined talkgroup. The alias (message) displayed during Broadcast Call, as well as the call priority and destination address (talkgroup), can be configured in codeplug. This feature can only be used in TMO mode and on the GMOI network.

During Announcement Call, other features are impacted:

- No other services except emergency are allowed (same as in emergency mode)
- Hot Mic functionality cannot be used.
- When Announcement Call begins, any other ongoing services are terminated.

If the BSI or the SECTRA feature (radio with a SIM Card) defines the type of encryption, the Broadcast Call is always clear. Otherwise if your radio uses other encryption service the type of the encryption used for that call is up to the encryption settings of that service.

Not all infrastructures support this feature. Consult your service provider before enabling it.

12.6 Call Modification

Call Modification is a feature that allows your service provider to modify the call to optimize it and adjust to a current situation.

Modification can cover:

Call priority
Modified during call setup.

Call type
Modified during call setup.

Call encryption
Modified during an ongoing call, but not in the transmission phase.

When the call is modified, your radio displays `Call Modified` message.

When a recently modified call requires the **PTT** button to transmit, your radio displays `Call Modified Use PTT`.

All modifications are made by your service provider and your radio only follows them. You have no influence on ongoing call modifications.

When call priority is changed to emergency:

- The display indicates that an Emergency Group Call has been received.
- Your radio plays a special audio alert.

NOTE: If a Group Call is modified into an Emergency Group Call, no emergency-related features are triggered.

If your radio cannot follow a call modification requested by the service provider, due to its settings, your radio rejects it and displays `Service Not Available` message.

12.7 Ambience Listening

The Ambience Listening (AL) feature allows a console operator or dispatcher to monitor audio activity near a specific radio without giving any indication to the affected radio.

When your radio receives a call setup message with an AL call, your radio accepts the call. Then your radio opens the microphone, and begins transmitting without showing any indication of the call. Call acceptance and rejection while active in another call follows the PPC rules.

Your radio imposes no time limit on the transmission. Your radio continues to transmit until the Switching and Management Infrastructure (SwMI) ends the call or when you perform an action that releases the call. If you attempt to start a service while the AL call is in progress, your radio disconnects the call and initiates the requested service. Your radio allows performing actions that can be performed without releasing the AL call. These actions include access of most menu items, activating, deactivating scan lists, and changing talkgroups. When changing talkgroups, your radio appears as if it is performing an attachment. The attachment appears to be successful, but the actual attachment signaling is performed only after the AL call terminates. When performing the attachment after the call, no indication is shown to the user unless the attachment fails. If you attempt to power down your radio in the active AL call, your radio enters Pseudo Power-Off state.

Pseudo Power-Off

Powering off your radio in an active Ambience Listening (AL) call causes your radio to enter a Pseudo Power-Off state.

In Pseudo Power-Off state, your radio appears to turn off, have a blank screen, and all LEDs are turned off. However, your radio is fully operational.

When the AL call ends in this pseudo power-off state, your radio automatically turns off.

If you attempt to power up your radio from the pseudo power-off state, your radio acts as if it is really powering up.

Chapter 13

Dialing Methods

Your radio supports multiple methods of selecting a number for an outgoing call.

Your radio supports the following dialing methods:

- Using predefined One-Touch Buttons
- Dialing from the favorite folders
- Dialing from the address book
- Dialing from the Recent Calls list
- Direct dialing
- Dialing from the embedded numbers in Short Data Service messages
- Speed dialing
- Talkgroup dialing by index

13.1 Talkgroup Dialing by Index

Talkgroup dialing by index allows a radio to make group calls using the talkgroup speed dial number, or in other words, the Talkgroup ID, or Index. If configured, talkgroup dialing by index also includes user-defined speed numbers.

With the talkgroup dialing by index option enabled, you can use the keypad and press the talkgroup speed dial number followed by the ***** key. For example, to call a talkgroup whose ID is 19, press **1**, **9**, and ***** from the keypad and then select the **Attach** soft key when viewing the offered talkgroup information. To start the group call, press the **PTT** button.

13.2 Individual Dialing

The Individual Call feature consists of the Telephone Interconnect feature and the Private Call feature.

The Phone or Private Automatic Branch Exchange (PABX) feature allows you to make a phone or PABX call by dialing a shortened number of up to three digits instead of the full number. The Phone or PABX speed dial number is assigned when the dialed number is added to the contact list.

You can re-dial numbers from the call history list by pressing the down scroll key.

The private ID number is a number of up to 16 digits. If you enter fewer than 16 digits, the Individual Short Subscriber Identity (ISSI) part is added to the full Individual TETRA Subscriber Identity (ITSI) with leading zeros. The private ID number consists of the following items with their respective dialing scheme:

- Mobile Country Code (MCC) 15–13
- Mobile Network Code (MNC) 12–9
- ISSI 8–1

NOTE: For the MNC of a private ID (digits 12-9), values from 0000 through 9999 are accepted.

The Migration mode supports three types of relative dialing and whichever Mobile Network Identity (MNI) is assumed when your radio dials an ISSI:

- Relative to Switching and Management Infrastructure (SwMI) – your radio uses the MNI of the current SwMI.
- Relative to radio MNI – your radio uses its home MNI.
- Relative to current MNI – your radio uses its home MNI when it migrates to another network or the MNI of the SwMI when your radio has ITSI attached to another network.

Two dialing options are given to the user:

Fixed
Provides up to 16 digits which include the MCC, MNC, and ISSI numbers. If you enter fewer than 16 digits, then the rest is filled with the digits that are set in the codeplug.

Automatic
Provides up to eight digits. If you provide more, it switches to fixed mode. If you enter fewer than eight digits, your radio fills the rest of the number with its own ITSI.

If you enter more than 16 digits, you receive a prompt informing you of an incorrect input.

If the One-Touch Button is provisioned, you can call an individual by pressing and holding down one of the programmable buttons.

Chapter 14

Unified Address Book

Your radio offers an address book feature. Each contact entry corresponds to an alias (name) and ID (number) that you use to initiate a call.

Contacts from your radio can placed into up to 100 folders inside your address book. The folder name can be edited when creating the folder or when adding or editing a new contact (if configured).

NOTE: You can enter a maximum of 15 characters when naming the folder.

The following details are required for each contact entry:

 # (number)
Each contact entry must contain a number.

Speed #
Shows the default Speed Dial number. You can accept or change it.

Simplex (Private only)
Shows the hook method for simplex calls.

Duplex (Private only)
Shows the hook method for duplex calls.

Each contact entry can have up to six numbers:

- Private, a TETRA Individual Short Subscriber Identity (ISSI) or Individual TETRA Subscriber Identity (ITSI)
- Home phone number
- Mobile phone number
- Work phone number
- PABX, local short number
- Other phone number

The Contact List has a maximum capacity of 2,000 Contacts. Up to 1,000 Private numbers and 1,000 Phone or PABX numbers are distributed among the contacts.

You can edit the address book by adding or deleting entries. Your radio also allows you to view the number of used or free address book entries.

The address book is accessible through PEI. Using the PEI enables you to read, write, and modify contact list entries using AT commands.

The contacts menu supports contacts folder. Contacts folder has the following features:

- Supports up to a maximum of 100 folders in the contacts menu.
- Maximum length of the folder name is15 characters.

  NOTE: If your radio screen is not able to display all the characters of the folder name, the folder name will be truncated with the symbol "…", example `WWWWWWWW...`
- Supports same contact in multiple folders.
- Folder name is editable when adding a new contact or when editing contact if configured.

Chapter 15

Call History

The Call History stack holds the recent call activities.

A call history list consists of the following items:

- Last dialed numbers
- Missed call numbers
- Answered (Received) call numbers

Additionally, the time a call is established and all call durations are available. To view call history, press the down scroll key.

The Call History stack holds private TETRA IDs for:

- Private Call
- Phone Call
- PABX Call

Numbers from the Call History stack are available for the following actions:

- View
- Select and Call
- Store (new or existing entry)
- Delete

NOTE: Outgoing duplex calls from Recent Calls list display in DMO are not allowed.

When you scroll through the lists, the entries appear in the opposite order (the most recent entry is shown first). When a call is made to a number that exists in the last dialed list, this number is not duplicated in the list and is moved to the beginning of the list. However, a missed call and received entries are duplicated in the corresponding call list. Additionally, the time when the calls are established and duration of the calls are also available.

The call history lists are available after next power-up.

Chapter 16

Calling Line Identification Presentation

If your radio is provisioned with the Calling Line Identification Presentation (CLIP), the calling party number is transported as part of the incoming call setup signaling.

Also the calling party number is shown on your radio display. If the calling party ID is programmed in your radio with a corresponding name, the name is displayed in addition to the number.

NOTE: The number sent by the Switching and Management Infrastructure (SwMI) is expected to be in a form that can be used to call back the calling party at any other time. Thus, for instance, the number can be stored in the address book.

If the calling party number is not present in the incoming call setup signaling, a blank line is displayed in its place.

Chapter 17

DTMF Overdial

This supplementary service allows your radio to send Dual-Tone Multi-Frequency (DTMF) tones to both internal and the external network during the call (conversation). It is only possible to send DTMFs when in a full duplex call.

This feature allows you to communicate with an automated answering device (for example, the voice mail or answering machine) during an on-going private, phone or Private Automatic Branch Exchange (PABX) call.

While in an on-going private, phone or PABX call, press the DTMF keys (0-9, *, #). When pressed, the DTMF key sounds a tone and the entered digit is displayed on the screen.

This feature can be disabled in the codeplug (enabled by default).

Chapter 18

Emergency Operations

Emergency Operations are used in critical situations.

Pressing the **Emergency** button or entering Emergency number and pressing the **Send** key, activates one or more services, depending on the service provider setting.

NOTE: It is possible to power up your radio by pressing the Emergency Button. Depending on the service provider settings, your radio can start Emergency Operations automatically. If your radio is PIN-protected, except for SIM PIN, Emergency Operations bypass the PIN lock during the Emergency Operations.

During Emergency Operations, your radio automatically rejects phone, Private Automatic Branch Exchange (PABX), and private calls, and does not monitor the talkgroups in the selected scan list. However, if an Announcement Talkgroup (ATG) is the selected group, your radio monitors the sub-groups associated with the ATG.

When entering Emergency Operation, any ongoing voice call is aborted or cleared down. Any packet data transfer in progress is aborted. However, the session is kept open.

18.1 Emergency Alarm

The emergency alarm is a special status message sent to the infrastructure while starting the Emergency Operations. Your radio may wait for infrastructure acknowledgment for this alarm and attempts retries.

Each time your radio enters the Emergency Operation, it sends an emergency alarm. When an emergency alarm is sent successfully, the respective audible tone sounds.

In addition, once your radio is in Emergency Operation and on pressing the **Emergency** button, an extra emergency alarm is sent. The only exception of this condition is during Hot Microphone transmission.

The message can be dispatched both in Trunked Mode Operation (TMO) and Direct Mode Operation (DMO).

NOTE: Emergency Alarm in DMO mode can be configured to send in all DMO modes or when your radio is synced through Gateway.

18.2 Emergency Group Call

The Emergency Group Call has the highest communication priority, which makes it a pre-emptive call. Emergency Group Call is available in both Trunked Mode Operation (TMO) and Direct Mode Operation (DMO) modes.

During Emergency Operations, Emergency Group Call can be started by pressing **PTT**. Your radio may also support Hot Microphone operation, which allows the Emergency Call to be conducted without pressing **PTT**. If a radio receives an incoming group call with emergency priority, the display changes to red with a red triangle icon on display, and a special audio alert is played.

An emergency group call can be configured as tactical or non-tactical:

Tactical Group Call

Your radio sends an emergency alarm and/or makes an Emergency Call on the current channel.

Non-Tactical Group Call

Your radio reverts to the preprogrammed emergency channel to send an alarm and/or make an Emergency Call. This talkgroup is used for the entire duration of the Emergency Operations and changing talkgroup is not allowed.

In TMO, it is possible to configure your radio to make Emergency Non-Tactical Group Calls without sending attachment. If set, your radio assumes implicit attachment after receiving a temporary address.

In DMO, the Non-Tactical Emergency proceeds on the same frequency as the previously selected talkgroup. The service provider can designate any Individual TETRA Subscriber Identity (ITSI) address to be used for Emergency Operations and this ITSI can be an Open Group - broadcast address.

After exiting from Non-Tactical Emergency, your radio goes back to the previously selected talkgroup.

Pressing the **Emergency** button during an ongoing emergency broadcast call has no effect. No new call is started and no emergency alert is sent.

The Emergency Group Call Termination feature allows you to attempt terminating an Emergency Group Call by pressing the **End** key. The ownership status of your radio determines the following termination conditions:

Call Owner

Your radio either stays in Emergency Mode, or returns to TMO.

Non-Call Owner

Your radio always returns to TMO mode.

The Switching and Management Infrastructure (SwMI) may reject the termination request, in which case your radio stays in the group call.

In TMO, if your radio enters emergency operations while the emergency broadcast call is active your radio continues on the call without initiating any calls and sends an emergency alarm.

18.3 Emergency Individual Calls (Private or MSISDN)

The Emergency Individual Calls are simplex or duplex calls with emergency priority.

On pressing the **Emergency** button, your radio initiates an individual call to a provisioned private or Mobile Station Integrated Services Digital Network (MSISDN) address.

This feature also supports the direct or hook dialing method on simplex and duplex calls. For full duplex Emergency Individual Calls initiated to an MSISDN address, the default dialing method is configured to hook and it cannot be modified.

During an emergency individual call, your radio rejects all incoming individual calls with non-emergency priority. These rejected calls are shown as missed calls after the emergency individual call has ended.

Emergency Full Duplex Private Calls (FDPC) supports high/low audio state. The audio state is configurable. You are able to select the audio state during incoming/outgoing emergency FDPC by toggling hi/low audio during active Emergency FDPC.

18.4 SDS in Emergency Mode

Short Data Service (SDS) in Emergency Mode enables Status and/or SDS functionality during emergency mode or an Emergency call.

If SDS in Emergency Mode is enabled, the **Message** menu is accessible for composing, sending, and viewing Status and/or SDS messages during emergency mode.

18.5
Emergency SDS Status

Emergency Short Data Service (SDS) Status allows your radio to send a status message with a programmed value to the destination address set up by your service provider.

This feature is available in Trunked Mode Operation (TMO) only. If no status acknowledgment or negative acknowledgment is received, your radio retries sending the message. If Emergency Alarm or Hot Microphone is configured, status is not sent.

18.6
Hot Mic Operation

The Hot Microphone feature allows you to talk without pressing the **PTT** button during Emergency Operation. The transmission continues for a provisioned amount of time. The Alternating Hot Microphone is an enhancement of the Hot Microphone feature. It allows you to have the Hot Microphone switched on and off alternately.

Emergency Hot Microphone

If configured, pressing the **PTT** button before the Hot Microphone time expires ends the Hot Microphone operation. Then normal PTT operation in Emergency group call takes over whereby the transmission is ongoing for the time the **PTT** button is held.

Subsequent **Emergency** button presses during the Emergency Operation restart the Hot Microphone transmission.

If a talk permit is granted to another member of the group, the Emergency Call received tone is played. If configured, your radio automatically attempts to get talk permit again.

Pressing **End** soft key or **End** key ends the Hot Microphone operation.

Alternating Hot Microphone

If this feature is enabled, you can initiate the Alternating Hot Microphone by pressing the **Emergency** button. After activation, your radio alternately enters transmission phases (your microphone is active) and reception phases (you can only listen) for an amount of time precisely determined by your service provider.

The Alternating Hot Microphone terminates when one of the following conditions is met:

- Your radio exits the Emergency Mode.
- The Alternating Hot Microphone timer expires.
- The **PTT** button is pressed (if configured).
- The right **Soft** key is pressed (only during the transmission time-slot).

To skip your transmission time-slot and jump to a receiving time-slot, press the **End** key.

NOTE:
When your radio goes out of the service, it enters the receiving mode and the Alternating Hot Microphone is on hold. When your radio is back to the service, the Hot Microphone transmission and the Alternating Hot Microphone resume.

When your radio is in the Emergency Mode, pressing the **Emergency** button restarts the Alternating Hot Microphone.

If this feature is enabled, you can initiate the Alternating Hot Microphone by pressing the **Emergency** button.

The Alternating Hot Microphone terminates when one of the following conditions is met:

- Your radio exits the Emergency Mode.

- The Alternating Hot Microphone timer expires.
- The **PTT** button is pressed.
- The right **Soft** key is pressed (only during the transmission time-slot).

To skip your transmission time-slot and jump to a receiving time-slot, press the **End** key.

NOTE:
When your radio goes out of the service, it enters the receiving mode and the Alternating Hot Microphone is on hold. When your radio is back to the service, the Hot Microphone transmission and the Alternating Hot Microphone resume.

When your radio is in the Emergency Mode, pressing the **Emergency** button restarts the Alternating Hot Microphone.

18.7 Silent Emergency Mode

The Silent Emergency Mode is similar to Emergency Mode, except that in Silent Emergency your radio provides no audiovisual indications and no keypad tones while entering emergency. All the display indications are as in the idle mode.

If the Silent Emergency feature is enabled, your radio enters Silent Emergency mode on pressing the `Emergency` button. After entering the Silent Emergency mode, your radio guarantees itself to be in TMO mode. Your radio stays in TMO mode or switches to it, depending on the actual state. Once in TMO mode, your radio sends Silent Emergency alarm. The Silent Emergency can be either terminated by the control room or you can manually exit from your radio.

This feature is specifically designed for situation where it is critical to raise emergency alarm without showing any indications in radio.

For example: A night bus driver is threatened by some anti-social elements to divert the bus route. In this situation, the bus driver raises Silent Emergency alert by pushing a hidden switch without showing any sign. As a result, rescue team tracks the bus and brings situation under control.

This field allows you to set the silent emergency in the following state:

- **Disabled** — by default Silent Emergency Mode is disabled.
- **Enabled** — enables Silent Emergency Mode.

When Silent Emergency is enabled, your radio cannot use any services except for:

- Receiving Ambience Listening
- Sending Silent Emergency Alarms
- Sending GPS location reports

NOTE: If your radio is in a private or group call, your radio waits until the call ends, and then enters the Silent Emergency Mode.

Your radio exits the Silent Emergency Mode, under the following conditions:

- Press **Menu** simultaneously with the **Right** Navigation key.
- No success in sending the Silent Emergency Alarm and the maximum number of retries has been reached.
- The control room terminates the Silent Ambience Listening.
- The Ambience Listening is disconnected due to another reason.

If you turn off your radio in the Silent Emergency Mode, your radio switches to pseudo power off state. In this state, your radio appears to be turned off. However, your radio is still on and in the Silent Emergency Mode.

On turning your radio on during the pseudo power off state, your radio acts as during turning on and still is in the Silent Emergency Mode.

NOTE:

- If you try to activate any other feature, it is blocked and radio will display service unavailable message.
- The Silent Emergency Mode and Emergency Mode are mutually exclusive and only one mode can be enabled at one time.

18.8 Invisible Emergency

It is possible for the service provider to disable visual and audible indications when performing Emergency Operation on your radio, known as Invisible Emergency. Invisible Emergency provides an extra layer of safety when using Emergency Operation in a critical situation, for example during a direct attack on the user.

18.9 Disaster Alert

Disaster Alert call is a broadcast emergency call initiated by your radio, with emergency pre-emptive priority that everyone in a broadcast area can hear.

This feature is designed for catastrophic situations, such as earthquakes, and has the highest priority over other calls. All radios under Disaster Alert display emergency notification on their screens. The alert message, its duration, and destination talkgroup can be configured in the codeplug.

To initiate Disaster Alert, switch your radio to Disaster Alert mode and press **PTT** button. When the call ends, your radio exits the Disaster Alert state.

During Disaster Alert, other functionality is impacted:

- When Disaster Alert begins, any other ongoing services are terminated.
- No other services can interrupt this type of call.
- Hot Mic functionality cannot be used.
- Speech can only be in Clear mode, even if any of the encryption services are enabled. The only exception is E2E Encryption.

NOTE: Not all infrastructures support this feature. Consult service provider before enabling this feature.

18.10 Emergency Alert

NOTE: This is a Software Selling Feature.

This feature allows your radio to send emergency alerts to other radios within its Direct Mode Operation (DMO) coverage by pressing the **Emergency** button.

Even in Trunked Mode Operation (TMO), your radio monitors a special DMO emergency frequency for possible emergency alerts and responds to them by automatically joining the emergency call.

To initiate the emergency alert, your radio must be in MS-MS DMO mode or out of coverage in TMO mode. The alert is not sent to the dispatch console.

To receive the emergency alert, your radio must be in DMO or TMO, within RF range of the initiating radio, and must not be in a call. When your radio receives the emergency alert, it joins the call automatically.

The following table illustrates the dependencies between the current radio mode and the type of emergency operation:

Table 32: Emergency Operation Dependencies

Radio Mode	Initiate Emergency	Emergency Alert Received (Yes/No)
DMO, MS-MS, idle	Emergency Alert	Yes
DMO, Repeater, idle	Standard DMO Emergency	Yes
DMO, Gateway, idle	Standard DMO Emergency	Yes
DMO, in call	Per communication mode	No
TMO, no coverage	Emergency Alert	Yes
TMO, in coverage, idle	Standard TMO Emergency	Yes
TMO, in coverage, in call	Standard TMO Emergency	No
Network Monitor, MS-MS	Emergency Alert	No
Network Monitor, Repeater	Standard DMO Emergency	No
Gateway operation, in coverage	Standard TMO Emergency	No
Repeater operation	Standard DMO Emergency	No

18.11 Emergency Destination in Local Site Trunking

NOTE: This is a Software Selling Feature.

The Emergency Destination in Local Site Trunking feature allows your radio to send emergency requests to a different destination while in local site trunking mode.

The supported emergency services are:

- Emergency Alarm
- Emergency Call
- Emergency Short Data Services (SDS) Status
- Location Information Protocol reports

Chapter 19

Short Data Services

Short data service (SDS) features supports transfer of short data messages and pre-coded status transfer called Status Transfer Service (STS).

Short Data Service (SDS) message types	Functionality	DATA Type	
SDS Status	You can send a predefined Status message that can be associated with text string. The Status messages can be used by the system to send to your radio user Status information.	—	—
SDS User Defined Data Types 1, 2, 3	You can send or receive SDS fixed length messages.	SDS Type 1	16 bit value
		SDS Type 2	32 bit value
		SDS Type 3	64 bit value
SDS User Defined Data Type 4 with or without SDS Transport Layer (SDS - TL).	• You can send or receive SDS variable length message. • Can be sent directly to the end user or using Service Center if provided by the infrastructure. • Can be sent with or without acknowledgment request. There will be end-to-end acknowledgments, delivery report, and message numbering for messages that are sent with acknowledgment request.	SDS Type 4	

The feature supports the following addressing modes:

- Radio to radio
- Radio to talkgroup
- Radio to external subscriber number (gateway address)
- Internal/External Application or Service Center to radio

19.1
Text Messages

The messages feature allows you to send, receive, and store and forward text messages. Messages can be protected from being deleted or being overwritten.

19.1.1
Type of Short Data Service and Functionality

Type of Short Data Service	Description	Typical Maximum Character
Short Text Message	Radio is able to send, receive, and store and forward text messages.	140 char
Long Text Message	Radio is able to send and receive Long Text Message with the SwMi or individual (ISSI or MS-ISDN). Sending long text messages to groups is not possible. This feature allows sending long text messages up to 1000 characters. Messages that are longer than 140 characters are divided and sent separately one after another. Your radio can reconstruct a long text message consisting of up to ten short messages. The maximum length of the message is 141-1000, what can be defined in the codeplug. Your radio recombines the text segments independently of the order they have been received to the correct order of the original message. The message can be combined only if all their message reference number are correct and the segmented receiver timer is still valid. When a recipient receives all the parts of the message, it displays as one on the screen.	1000 char

Following are the actions you are able to perform with Messages:

Option	Action
Send	You can compose, edit, and send a message up to 1000 characters, depending on the setting.
	Messages can be sent to Group, Individual, and to External Subscriber Number.
	Messages can be sent with a request for a received delivery report.
Receive	Incoming messages are identified with notification and quick access to read the message is provided.

Option	Action
	The incoming message can contain up to 1000 characters, depending on the setting.

19.1.2
MS-ISDN SDS

MS-ISDN is an ISDN number assigned to a TETRA radio.

With this feature enabled, users can choose between MS-ISDN and ISSI when addressing SDS to another TETRA radio.

The MS shall support text message and status based on MS-ISDN. MS-ISDN SDS will be sent to a PSTN gateway ISSI. MS-ISDN shall share the same icon as phone.

19.1.3
Timestamp

Your radio puts on each received and accepted text and status message a time stamp with receiving time taken from radio internal time clock.

This time stamp is displayed when the user reads the text message. Time stamp is only available for messages.

19.1.4
Encoding Scheme Support

The encoding schemes supported in text messages are:

ISO 8859-1 (Latin-1)
American Standard Code for Information Interchange (ASCII) encoding scheme which includes letters and special characters needed for Western European languages.

2-byte Universal Character Set (UCS-2)
Unicode standard which defines a consistent method of encoding and decoding multilingual text such as Chinese and Korean characters.

Table 33: Maximum SDS Character with Encryption

Encoding Scheme	Without OPTA and E2EE	Without OPTA and with E2EE[1]	With OPTA and without E2EE	With OPTA and E2EE[1]
7-bit	160	124 (121)	136	100 (97)
8-bit	140	109 (106)	116	85 (82)
16-bit	70	54 (53)	46	30 (29)

19.1.5
Messages and Storage Capacity

Store for messages:

[1] In E2EE SDS, a timestamp reduces the maximum size of the user data. See values in parentheses.

Inbox

Incoming messages and Delivery reports are stored in the Inbox.

For delivery reports, the associated message is stored in Outbox. The report is deleted from the Inbox automatically after viewing it.

Outbox

Outgoing text messages are stored in Outbox (when store and forward mechanism is not in place.)

Overwritten Delivery Status shall be moved to the associated message status in Outbox

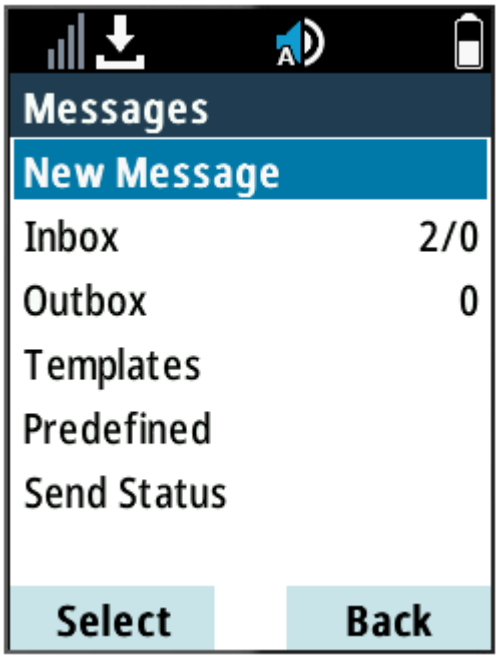
Message storage capacity:

- Total capacity for both Inbox and outbox is 100 short messages or 20 full-size long message.
- Inbox and outbox share the memory area, hence the capacity depends on the combination of short and long text messages in each of these folders.

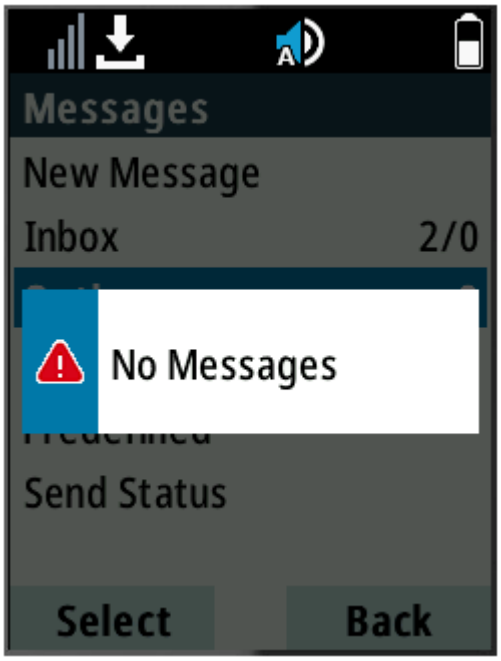
Example:

Types of Messages	Inbox	Outbox
Short Messages	0	100
	100	0
	50	50
Long Text Message	0	20
	10	0

When you enter the Messages sub-menu, the number on the right side of Inbox and Outbox is indicating the number of the messages stored.



If the Outbox is empty, then your radio displays `No Messages` notification.



19.1.6

Buffer Full Overwrite Policy

Buffer Full Overwrite Policy allows you to define how your radio handles received messages when the inbox is full.

Upon receiving a new Short Data Services (SDS) message and the buffer of the received messages is full, your radio acts according to the Buffer full overwrite policy. The options are:

None
Your radio does not overwrite messages in the buffer; puts a message in the buffer only in free place (free place is the case when no message is written to it or message is deleted).

Overwrite Old + New
First your radio tries to overwrite old messages. If all the messages are new and unread, overwrite the oldest unread message with the new one.

Overwrite Only Old
If the buffer contains at least one old message then new received SDS message shall overwrite the oldest read message in the buffer.

NOTE: Messages that are protected will not be overwritten

Chapter 20

Home Mode Display Text Message

Your radio is provided with a feature that allows your service provider to send special text messages to the display.

The message is limited to 24 characters. The message stays on the home screen until a new home mode display message is received. Power cycle your radio to replace the Home Display message to the predefined one.

Figure 19: Example of Home Mode Display Text Message

Chapter 21

Collaborative Messaging

This feature allows external device to send/receive message when your radio application is enabled. It is mutually exclusive with Secure SDS Storage feature and EtE High Security Mode Feature.

The external device can be connected to your radio using either Bluetooth connection or wired cable connection. It includes the following functions:

- Inbox/Outbox synchronization.
- Notification on message status, or user action synchronization between the external device and your radio.

NOTE: This feature does not support Call Out/RMS/Home Display.

Chapter 22

SDS Air Interface Aspects

Delivery report types are available as standard report and short form report. Your radio can be provisioned to send a short-form SDS - TL receive report when the originator of the message allows short-form report.

The short form report uses a specially designated 16-bit SDS status value instead of SDS-REPORT. Your radio can respond to a delivery response request automatically or manually although selection of report types through radio MMI is available only in manual response.

Your radio supports SwMIs that employ store and forward service as indicated in the cell broadcast information. Your radio supports use of a service center, which address is set in your radio. The store and forward operation is supported. However, your radio notifies you only on successful sending of the message. Your radio does not wait for the report from the service center.

Downlink SDS messages types 1, 2, and 3 are always routed to the PEI when an AT application is registered. If no external application is registered, the message is discarded.

NOTE: The DMO SDS does not support type 1, 2, and 3 user-defined short messages.

Chapter 23

SDS Encryption

Short data messages stored in a radio are protected against any unauthorized access. The stored data includes messages in the Inbox, Outbox, and stored call out messages.

The required protection against any unauthorized access through the MMI, PEI, or unintentional access by other means is carried out through the special mechanisms. The encryption of stored messages preventing from accessing the memory directly and the user authentication, protect SDS messages. Protected messages cannot be read on your radio MMI unless valid authentication occurs. For the user authentication, the existing radio PIN is used.

SDS messages received by your radio are encrypted before being stored in the Inbox. Store and Forward messages are encrypted before being saved in the Outbox.

Received call out messages are encrypted before being stored in the CO Box.

If the feature is enabled, then your radio prompts you to enter the PIN if any of the following menu items are selected from the MMI.

- **Messages → Inbox**.
- **Messages → Outbox**.
- **Messages → CO Box**.

Following successful PIN entry and access to the required messages, your radio does not require further PIN entries to access messages unless one of the following conditions has been met.

- Exiting from your radio menu.
- Turning off your radio.
- Changing the PIN from the MMI.

If you disable the PIN lock through the MMI or change the PIN, the protected messages are deleted. Before deleting the messages, you are prompted to ensure that the operation should proceed. If the PIN lock is changed through the PEI, all the protected messages stored in the Inbox, Outbox, and CO Box are deleted. On enabling your radio permanent disable, the access to the protected messages is lost.

Chapter 24

SDS End-to-End Encryption

NOTE: This is a Software Selling Feature.

End-to-end Encryption (E2EE) provides customers with a higher degree of confidentiality than existing TETRA air interface data encryption.

The TETRA standard supports the air interface security that provides protection of the air interface. The information flow inside the infrastructure is not secured. When you require data protection for your data going through the infrastructure, you need your entire transport path to be encrypted.

This entire path encryption is called E2EE. The source and the destinations are supplied with the mechanism for encrypting and decrypting.

NOTE: The 260–275 MHz radios do not support the SDS end-to-end encryption.

In air interface encryption, the receiving Base Station decrypts data which travels clear within the system domain. For E2EE, the transmitting radio encrypts the data and the receiving radio or an E2E terminator located in the infrastructure decrypts the data.

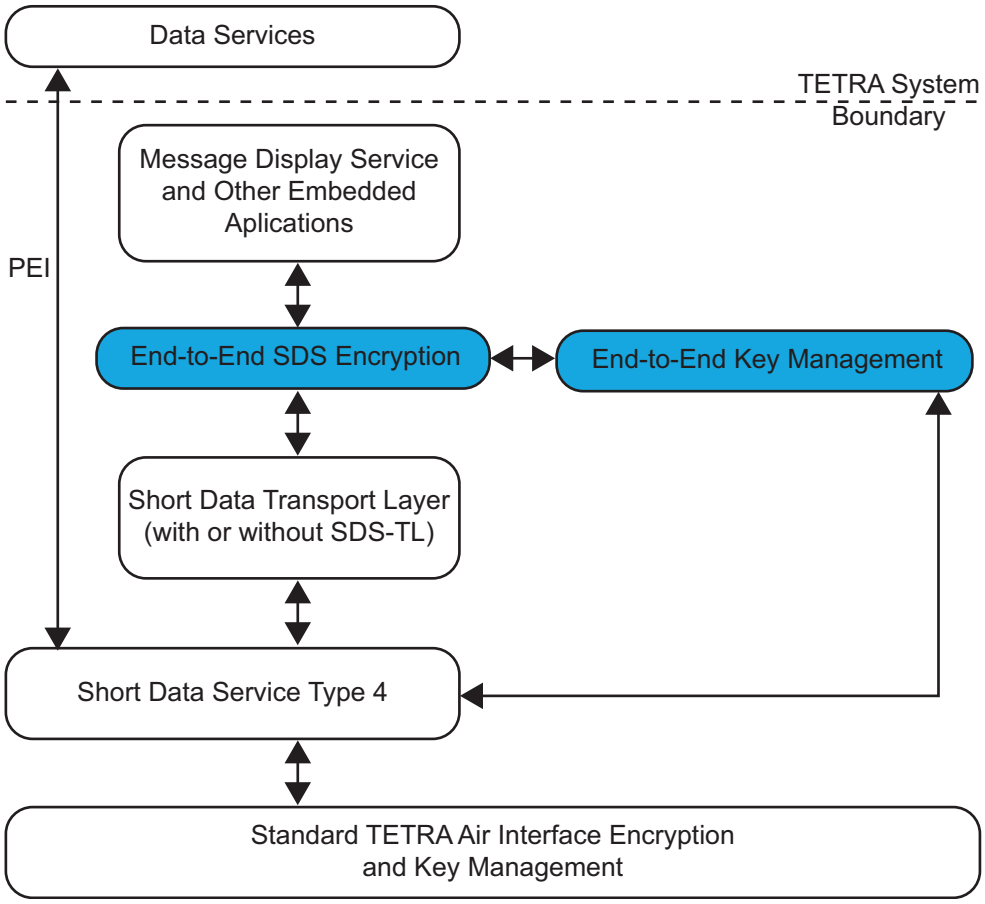
E2EE protects the SDS/SDS-TL data services both in TMO and DMO. The following TETRA data types are protected.

- SDS type 4 with SDS-TL, with or without acknowledgment request
- SDS type 4 without TL, with or without acknowledgment request

For short data applications, the source data may come from an external application or from a task internal to your radio, such as text messages or GPS. Your radio passes only the internal text messages and GPS data for encryption by its crypto-engine.

The encrypted short data service is established between two end points. One end point is terminated in your radio, and the other end point is terminated in a Short Data Encryption Gateway (SDEG) or another radio. The destination address specifies the encryption type, that is, whether the packets are transmitted as encrypted, clear, or dropped.

Figure 20: SDS End-to-End Encryption



NOTE: Key Management Facility (KMF) can manage and support only one short data association and a key at the same time.

Your radio selects the E2EE mode for the outgoing text message in accordance to the address association and requirements for the E2EE High Security Mode. Depending on codeplug settings, you can override the address association and select using the MMI menu whether an SDS is sent to clear or encrypted contact (Group or Private Number).

Your radio support the high security mode configurable using the configuration tool. In this mode, the association that binds the address to a given cryptogroup is always mandatory.

If no cryptogroup associations exist, this condition means that the keys are not loaded. In such situation, your radio discards any outgoing or incoming message that is encrypted. You are alerted when this situation occurs.

This feature can only be disabled using the Key Variable Loader (KVL).

SDS Receive Failure Notification

When a radio fails to decrypt a received SDS message, it displays a notification including the ISSI of sender and reason for failure.

Chapter 25

SDS and Status Remote Control

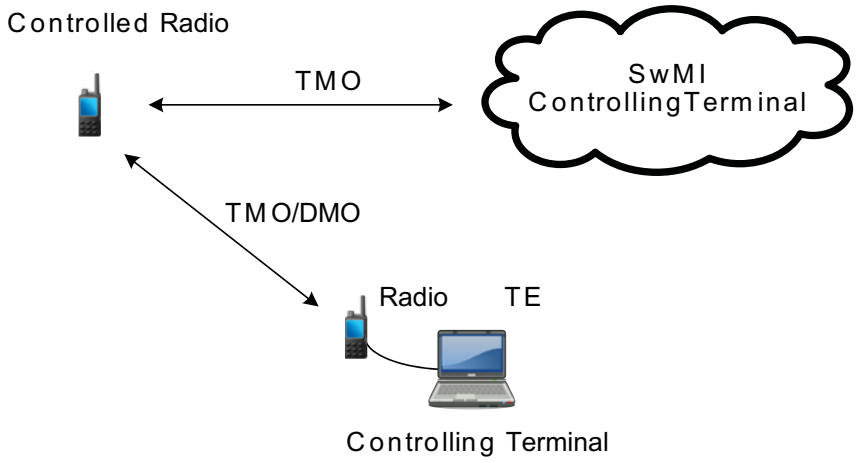
The SDS Remote Control is a feature that enables remote control and configuration of the radio using special SDS messages. The Status Remote Control is a feature that provides limited control of the radio. Only one type of remote control can be active on a radio; either SDS or Status.

SDS Remote Control

NOTE: This is a Software Selling Feature. You can use the feature only after a successful authorization, which requires entering a valid remote control PIN number.

The Short Data Service (SDS) remote control feature enables controlling a radio through Air Interface using SDS - TL bearer service. A controlling terminal, for instance, a controlling radio or SwMI controlling terminal, sends the SDS remote control messages with AT commands to a radio for its execution. The SDS remote control functionality works in both Trunked Mode Operation (TMO) and Direct Mode Operation (DMO) and the remote control PDUs are sent using Terminal Equipment (TE).

Figure 21: SDS Remote Control Overview



The remote control messages can be sent to a group or individual radios. The messages can be sent both in TMO and DMO (including the Repeater Mode) by any radio capable of controlling other radios. A controlled radio receives over the air control information using SDS type 4 with Transport Layer (TL) on the specific PID number defined in the codeplug. If the received control message is originated from one of the Individual Short Subscriber Identities (ISSI) present on your radio authorized ISSI list, your radio executes received command and sends a response. If configured by service provider, upon the reception of SDS Remote Control Service (AT command) request, your radio gives an audio-visual notification.

Your service provider has two modes which can be configured for your radio:

- Limited SDS Remote Control
- Full SDS Remote Control

Check with your service provider for more information on these modes.

Status Remote Control

Status Remote Control provides limited control of your radio, unlike SDS Remote Control. The following tasks can be assigned remotely to a radio:

Play loud tone until user interaction

Your radio plays a loud tone as in the Man Down (henceforth known as Fall Alert) feature until you unlock the keypad (if needed) and press the appropriate soft key labeled **Exit**. The tone is played through the speaker even if an accessory is attached.

The tone is not emitted when your radio is in one of the following states:

- In a call
- Temporarily disabled
- Pseudo Off Mode
- Ambience Listening Mode
- Transmit Inhibit Mode (TXI)
- Emergency Mode
- Silent Emergency Mode
- Covert Mode

Send firmware version and TEI

Your radio sends back an SDS message with its firmware version and TEI.

NOTE: If the sending Individual Short Subscriber Identity (ISSI) is not on the Allowed ISSIs list, the receiving radio ignores the task.

Chapter 26

DMO SDS Transmit Traffic Stealing

The Traffic Stealing feature enables your radio to send status or Short Data Services (SDS) in a voice call transmission. Your radio replaces the audio frame with the status or SDS payload.

Audio is impacted when traffic is stolen for sending status or SDS. The receiving radio can decode the status or SDS from the traffic and indicate it to the user.

Chapter 27

Numbering and Addressing

Each radio has an Individual TETRA Subscriber Identity (ITSI). ITSI is used for addressing your radio over the air interface.

Instead of entering a long number to address another radio, you can use a short number scheme. You can program your radio to treat a short number as a Short Subscriber Identity (SSI). The short number must have fewer than seven digits. This scheme allows short dialing within a fleet by combining the ID entered with your radio SSI.

The identity of your radio is combined with the number entered to produce an Individual Short Subscriber Identity (ISSI). Using this scheme, an ISSI can comprise a fleet number part and a member part.

The ISSI of your radio is used to determine the leading digits for the digits omitted as in the following scenario:

1. Your radio has the following ID: 1234567
2. You enter: `890`
3. The SSI sent is: 1234890

The following services can use the short SSI for identification of both the called and the calling parties:

- Duplex private call
- Simplex private call
- Group call
- Mobile status
- Short data bearer service
- Text message service

If your radio has the short addressing scheme but you enter a seven-digit ID, the number is also interpreted as a TETRA ISSI.

Chapter 28

Shadow Groups (Address Bundles)

NOTE: This is a Software Selling Feature.

The Shadow Groups feature offers a way of sending statuses to multiple destinations or recipients simultaneously. Each radio can store up to 255 Address Bundles.

Four types of Address Bundles are supported:

- Status Addressing (including emergency alarm)
- GNSS/GPS Local Information Protocol (LIP) Addressing
- RMS/FMS Addressing
- Bluetooth Sensor Addressing

Shadow Groups in TMO

Each Address Bundle may contain up to four target addresses (ISSI or GSSI). Each talkgroup may be configured to send statuses, GNSS/GPS LIP reports or RMS/FMS messages to a specific Address Bundle.

Additional Address

The Additional Address feature allows your radio to send RMS messages, and LIP reports to additionally defined recipients.

Your service provider defines the default addresses where your radio sends RMS messages and LIP reports. If an Additional Address is selected and enabled, RMS messages and LIP reports are also sent to the recipient defined in the Additional Address.

You can create, edit, and delete Additional Addresses using your radio menu. If your service provider configures an Additional Address, the service provider can disable edition and deletion of the address using your radio menu.

You can define up to 30 Additional Addresses.

Shadow Groups in DMO

In DMO the Address Bundle contains one target address (ISSI or GSSI). Each talkgroup may be configured to send statuses or GNSS/GPS LIP reports to a specific Address Bundle.

The Shadow Groups feature may affect Emergency Calls setup time to be slightly elongated.

Shadow Groups (Address Bundle) is not supported via gateway.

Chapter 29

Call-Out

NOTE: This is a Software Selling Feature.
For those who use DMO mode, you are recommended to apply DMO SCK for data confidentiality.

A Call-Out is an alert sent to one or many recipients when an incident requires immediate attention. The Call-Out message can include an instruction to use a different talkgroup during the Call-Out or remain on the attached talkgroup.

The types of Call-Out alerts are:

Normal
An alert message sent by a dispatcher either to a single radio or to a group of radios.

Storm Plan
An alert message sent by a dispatcher to a group of radios. To raise its reliability, it is sent several times. You are not able to respond to the Call-Out alert and any key press takes you to the information phase. You can configure the storm plan severity to either Severity 0 or Severity 15.

The Call-Out mode is ended when the acknowledgment timer runs out, or when you press any key or softkeys (**Messages** and **Exit**), except for the **EMERGENCY** button, or the rotary knob.

Simple Call-Out
An alert with the functionality similar to full Call-Out but without the information phase. There are two types of Simple Call-Out:
With user receipt
The Call-Out mode is ended when the acknowledgment timer runs out, or when you select **Accept**, **Reject**, **Standby**, or reply with a text message.

Without user receipt
The Call-Out mode is ended when the acknowledgment timer runs out, or when you press any key or softkeys (**Messages** and **Exit**), except for the **EMERGENCY** button, or the rotary knob.

Fallback Mode
An alert message that is limited only to voice communication. To initiate this type of Call-Out, press a One-Touch Button predefined by your service provider. It can be cleared manually.

NOTE: Fallback is only possible when your radio is in Local Site Trunking.

Test Call-Out
A special Call-Out alert sent by the dispatcher to test this feature. On receiving the Test Call-Out, your radio plays a tone and displays **Test Call-Out**. To respond and clear the alert, select **Test OK**. After responding, the display returns to the previous mode.

Only the emergency mode has higher priority than the Call-Out. However, if your service provider configures Emergency Calls to be ignored during Call-Out mode, your radio rejects them with no notification. When you receive the alert, the following responses are available.

- **Accept** – additional information from the dispatcher is displayed.
- **Reject** – display returns to the home display and the talkgroup is set to the one before the Call-Out.

You can address a Call-Out alert by:

- Individual Short Subscriber Identity (ISSI) – to an individual radio.
- Group short Subscriber Identity (GSSI) – to a group of recipients.

Your radio plays a Call-Out tone according to the configured indication profile. The indication profile is configured based on the severity level of a matching Group Short Subscriber Identity (GSSI) and Sub-Address Group Call-Out.

All incoming and outgoing Call-Out messages are stored in **CO Box** (Call-Out Box) and can be managed through the Man-Machine Interface (MMI). You can protect Call-Out messages from being deleted or from the overwriting policy of your radio. The overwrite policy deletes the oldest one upon receipt of a new Call-Out message. When a new Call-Out arrives, the new Call-Out overrides the old Call-Out, even if it has not been responded. An ongoing Call-Out overrides the old one in any phase of the Call-Out alert. Also, the overwrite policy deletes unprotected Call-Out messages first before deleting protected ones.

There is a two-level structure for the alerts. First level is the main alert list, and the second one are all the messages associated with the alerts. Both lists are displayed chronologically with the newest on top. The capacity of the **CO Box** is 100 Call-Out alerts and 100 messages (incoming/outgoing).

In normal mode, you can browse the **CO Box** and read all the Call-Out messages. In the Call-Out mode, you can only read the ongoing Call-Out messages.

The Call-Out service functions in two main phases:

Alert Phase

You receive the alert with the associated messages that you can respond to. These messages provide all the important information about an incident. A special tone is played when the alert is coming in. The tone volume range is configured in the codeplug and cannot be adjusted through the MMI. The conditions for stopping this tone are configured in the codeplug (for example, upon pressing any key). Also, an ongoing alert tone is paused on incoming Call-Out group call. This alert is resumed once the call ends (if not stopped before). The time-stamp on the Call-Out alert indicates the time and date when the Call-Out is received.

Information Phase

You are in the Call-Out mode and you may receive more messages about the incident with the text or voice. You can also query for more information using the voice group call or the Call-Out text function which enables you to send a text message to the dispatcher host application. Depending on the settings configured by your service provider, you are able to respond to a Call-Out in one of the following ways:

- Free text – type a response.
- Call-Out template – select from a list of predefined replies.

The voice message can be sent with the high priority as a group call. You can answer back to the group or to the dispatcher using the voice group call. You may receive more information about the incident either through subsequent text or voice messages.

Call-Out Authorized ISSI

This is a Software Selling Feature.

When you enable the Call-Out Authorized ISSI feature, your radio accepts Call-Out from authorized calling party and discards any unauthorized Call-Out. There is no indication displays if your radio discards unauthorized Call-Out. Your radio can accept up to 2000 Authorized ISSI list which includes Call-Out types such as Alert, Test, Information, Clear, and Availability Request. You may export and import the list in configuration tool.

29.1 Call-Out Interactions

When you receive a Call-Out alert while being in the emergency mode, the message is ignored.

In the transmit inhibit mode, you can receive Call-Out messages. The Call-Out alert message is displayed on the screen. You have the option to exit TXI Mode or exit the Call-Out prompt. In exiting TXI mode, your radio prompts you to accept or reject the Call-Out message. To continue in TXI mode, exit the Call-Out prompt instead.

In the fallback mode (that is, when you are in the local site trunking) you can receive a Call-Out call. In such case, the receiving radio enters the Call-Out fallback mode, which only includes voice communication. You can only clear the fallback mode manually.

Chapter 30

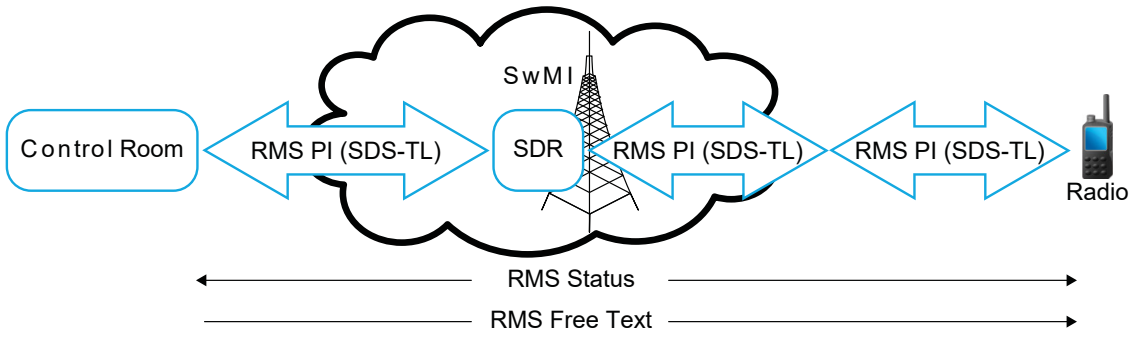
Radio Messaging System

NOTE: This is a Software Selling Feature.

There are two types of Radio Messaging System (RMS) messages, RMS Status and RMS Free Text.

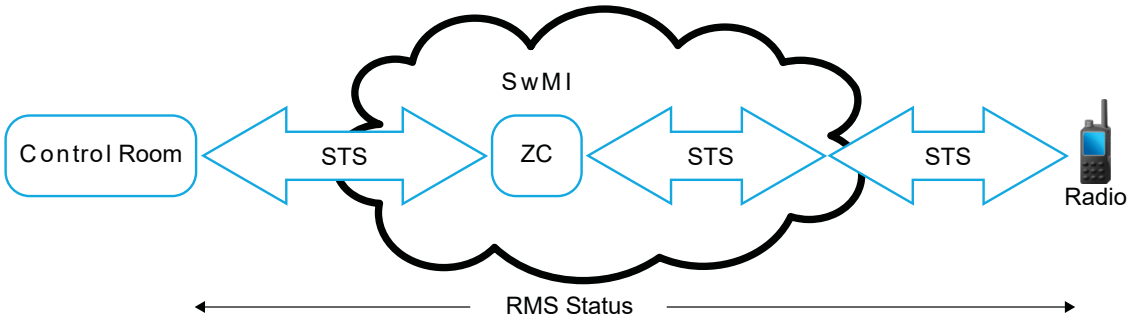
The RMS feature enables radios to receive and send RMS messages through the TETRA network using the Short Data Service (SDS) or Status Data Service (STS) Transport Layer (TL).

Figure 22: RMS Flow Model with SDS TL



A Short Data Router (SDR) provides TETRA short data services between host applications connected to Dimetra Mobile Stations or between a host application connected to a Dimetra Mobile Station and a host application connected through the Dimetra Master Site. Furthermore the SDR provides TETRA short data services directly between two Dimetra Mobile Stations or directly between a Dimetra Mobile Station and a host application connected through the Dimetra Master Site.

Figure 23: RMS Flow Model with STS TL



Your radio is able to receive and send RMS messages, using statuses by the Zone Controller (ZC).

To receive and send RMS messages, ensure that the RMS feature is enabled in the codeplug. Your radio accepts RMS messages only from the transmitting party address defined in the codeplug. Any outgoing RMS status is sent to the RMS status target address defined in the codeplug.

The RMS status is a bidirectional message (from the control room to a radio and conversely). Sending an RMS status is possible, where the RMS mode is enabled in the radio. In such case, you can send one of 100 predefined RMS statuses to an address predefined in the codeplug. You can select the particular RMS status using assigned One-Touch Buttons. A received RMS status is displayed in blue color on the idle display. The latest received or sent RMS status is kept on the idle display until the next power cycle.

The RMS free text is a unidirectional message (from the control room to a radio). Received RMS free texts are displayed in blue color on the idle display. The latest RMS free text is kept on the display (idle display) until the next power cycle.

Upon receiving the request, your radio sends the latest sent RMS status to the control room without any user interaction or notification.

Incoming and outgoing RMS statuses and RMS free text messages, with the exception for RMS status sent, are stored in the **RMS Box**. The **RMS Box** has a maximum capacity of 50 entries for incoming and outgoing RMS messages. If the **RMS Box** is full, storing any new incoming or outgoing RMS message overwrites the oldest message (received or sent) in the **RMS Box**.

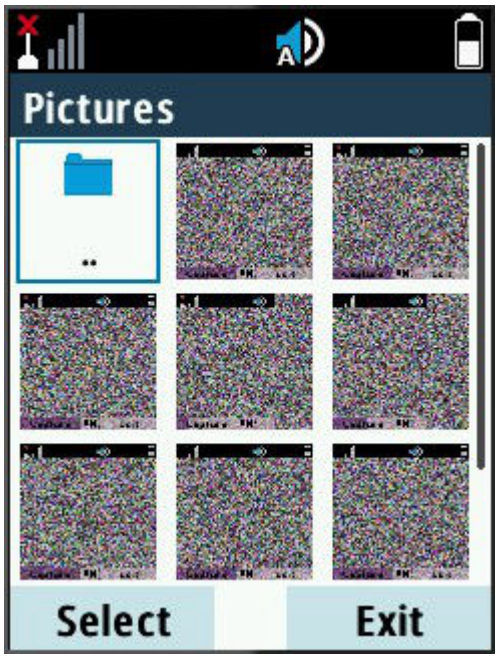
Chapter 31

Pictures

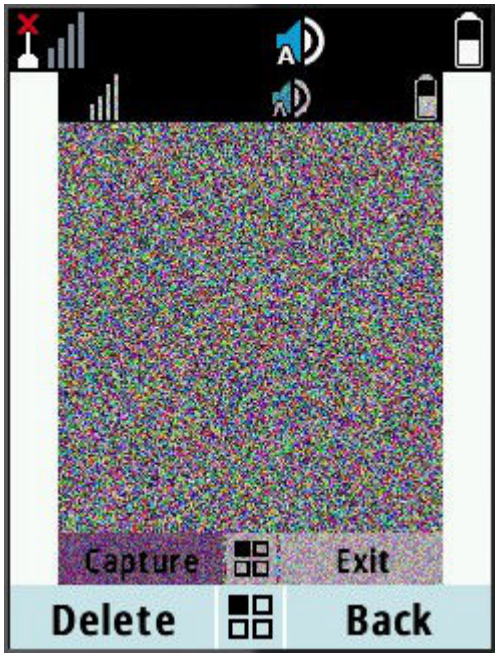
The Picture Browser allows you to browse through pictures saved on the microSD card or in the internal radio memory and send them to other devices using Bluetooth.

The Picture Browser navigates through memory content and views pictures in three modes:

- Picture Browser Grid View – a view consisting of thumbnails of pictures and folders



- Picture View – a view where a whole picture is visible on your screen



- Zoom mode – a view where a picture will be zoomed accordingly.
  - 1st – Actual view of picture (no zoom)
  - 2nd – Picture enlarged x2 (in reference to actual view)
  - 3rd – Picture enlarged x4 (in reference to actual view)
  - 4th – Picture enlarged x8 (in reference to actual view)
  - 5th – 1:1 scale view

NOTE: Pictures with size bigger than 2 Mpix is decompressed with resolution divided by two (example, a 3000x2000 pix is decompossed to 1500x1000 pix). Only the smaller resolution picture is available for zooming. Original picture is not modified in any other way.

In browser mode, Picture Browser stores pictures and allows navigation through the following location or folder:

- SD Card
- Extended flash reserved for mass storage in the radio not equipped with SD Card slot.

NOTE: If your radio is equipped with SD Card reader and SD card is not available, your radio displays `File Storage Not Available` and Picture Browser will not be started.

Items in your Picture Browser are first sorted by file system date, and for items with the same system date, they are then sorted based on the name. Items are listed in the following order:

1. Folders
2. Pictures

Picture Browser displays pictures only in the JPEG format, that is files with .jpg and .jpeg extensions. Also, the browser does not open pictures which size exceeds 10 MB – `File too large` message is displayed.

If a picture file is corrupted, the following happens:

- In Grid view, the default picture icon is displayed unless there is a proper small thumbnail available for the corrupted file.
- In Picture view, as soon as your radio detects the corrupted file, your radio displays `File Invalid` and the preview of the picture is black.

NOTE: Your radio is allowed to display a thumbnail (if available) for a short period of time before your radio detects a picture itself is corrupted.

A corrupted file is not able to go into Zoom mode. If you attempt to go into Zoom mode, your radio plays an invalid tone and displays `File Invalid`.

Chapter 32

Man Down (Fall Alert)

NOTE: This is a Software Selling Feature.

Man Down (henceforth known as Fall Alert) alerts when no movement occurs for a set time or your radio stays at an angle of tilt below a defined value.

The Man Down (Fall Alert) feature is based on a sensor with low-power current consumption. When Man Down (Fall Alert) is enabled the sensor performs a self-test during powering on your radio. If the test fails or when the Man Down (Fall Alert) device detects a failure during the activation of the feature, your radio notifies with a specific audio tone and status icon. If the feature is deactivated using radio MMI after the sensor failure is detected, the Man Down (Fall Alert) icon disappears and the tone is no longer played.

Your radio alerts you when:

- Its tilt exceeds a predefined angle value.
- No movement is detected in a predefined time interval.

In case any of the conditions are met, your radio alerts you with a Man Down (Fall Alert) pre-alert. If you do not disable the pre-alert condition, your radio switches to the Emergency Operation.

For easier localization of your radio, visual and audible indications are started until they are deactivated. If the Emergency Hot Microphone is on, the additional audio indication is not played.

Operation

Man Down (Fall Alert) can be disabled or enabled from the menu or by One-Touch Button (OTB).

If the Man Down (Fall Alert) feature is deactivated with a OTB, your radio plays an audio tone once. If the feature is deactivated using the menu, your radio does not play the tone.

To exit Man Down (Fall Alert), exit the Emergency Mode by pressing and holding the **Exit Soft** key, or press the **PTT** button.

Chapter 33

Security Services

Your radio provides TETRA security features as described in the TETRA Security ETS 300 392-7 standard, TTR 001-11 TIP, and TTR 001-13 TIP.

33.1 Terminal Equipment Identity

The Terminal Equipment Identity (TEI) is unique identification number programmed in your radio at the factory and cannot be later modified.

33.2 PIN/PUK User Authentication

In order to authenticate yourself, your radio supports a Personal Identification Number (PIN) and PIN Unblocking Key (PUK) mechanisms. These mechanisms prevent unauthorized access to your radio. The PIN/PUK operations are available from both MMI, PEI (using AT commands), and configuration tool.

For the authentication purpose, your radio prompts you to enter a valid 4-digit PIN, before your radio allows you to access all the available services. When your radio is PIN locked, you have no or limited access to your radio services.

If the maximum number of consecutive failed attempts is reached, your radio is blocked and remains in this state until it is unblocked. The blocked status is sustained regardless of turning off or battery removal. Your radio is unblocked either by entering the a valid 8 digit PUK.

User Authentication Type	Digits to Enter
Radio PIN	4
Radio PUK	8
SIM PIN	can be 1 till 8
SIM PUK	can be 1 till 8

User Authentication Type	Ways to unlock
PIN	Enter the code using MMI or PEI
PUK	Enter the code using MMI or PEI from the configuration tool

BSI PIN/PUK Authentication

When your radio has determined that BSI PIN/PUK is required, your radio prompts you to enter a valid BSI PIN before your radio allows you to access all the available services. The BSI PIN/PUK length is configurable by your service provider up to a maximum of 8-digit code.

The permissible number of consecutive failed attempts for BSI PIN is defined in by your service provider. When your radio is BSI PIN locked or BSI PUK blocked, you have no access to your radio services. As the

BSI PIN and BSI PUK code is defined by your service provider, you are unable to change the BSI PIN/PUK code.

NOTE: Your radio is only able to support either PIN/PUK mechanism, BSI PIN/PUK mechanism, or SECTRA PIN/PUK mechanism at a time.

SECTRA PIN/PUK Authentication

When your radio has determined that SECTRA PIN/PUK is required, your radio prompts you to enter a valid SECTRA PIN before your radio allows you to access all the available services. The SECTRA PIN/PUK length is configurable by your service provider up to a maximum of 8-digit code.

The permissible number of consecutive failed attempts is three times for SECTRA PIN and 10 times for SECTRA PUK, and is defined in by your service provider. When your radio is SECTRA PIN locked or SECTRA PUK blocked, you have no access to your radio services. Unlike the BSI SIM PIN/PUK, you are able to change the SECTRA PIN/PUK code. A new PIN is required especially after your radio is unblocked using PUK.

NOTE: Your radio is only able to support either PIN/PUK mechanism, BSI PIN/PUK mechanism, or SECTRA PIN/PUK mechanism at a time.

33.3 Keypad Lock

The keypad lock feature allows you to lock the keypad to avoid accidentally pressing a key.

By default, while the keypad is locked, all keys are inoperative except for the **Power** and **Emergency** buttons. When an incoming emergency call is received, the **PTT** button automatically unlocks for the call duration.

Keypad lock and automatic keypad lock are disabled while the camera is active.

When the keypad is locked, your radio displays one of the following:

- **Nothing** - no notification is displayed.
- **Notification Only** - `Keys Locked` is displayed.
- **Notification and Instruction** - `Press Menu and * to Unlock` is displayed.

You can set the display option in the codeplug. By default, it is set to **Notification and Instruction**.

Your service provider can determine which of the following elements are also inoperative while the keypad is locked:

- PTT button (also on accessories)

  NOTE:
  Your service provider can set the **PTT** button behavior in the codeplug to the following options:

  - **Disable**: disables Lock PTT feature on all **PTT** buttons.
  - **Enable - All**: locks all **PTTs**.
  - **Enable - Radio with RSM**: locks radio **PTT** only, specifically when a Remote Speaker Microphone (RSM) is connected.
  - **Enable - Accessories Only**: locks RSM **PTT** only.

    NOTE: Selecting **Enable - Accessories Only** does not lock or affect the Bluetooth **PTT**.

- Volume Control
- Talkgroup Selection
- Side buttons

- Lock on Start-Up
- The Power-Off button
- Accessory Dot Option buttons[2]

Automatic Keypad Lock

The automatic keypad lock is a feature enabling your radio to lock its keypad automatically after a defined period. Your radio allows activating or deactivating the feature using the MMI.

If the feature is enabled, after a defined time of inactivity the keypad locks automatically. Any user activity restarts the Automatic Keypad Lock timer. When the keypad locks automatically, your radio displays `Keypad auto locked`. You can change the time value required for the automatic lock through the MMI.

33.4 Authentication

Authentication establishes a level of a trust between a radio and Switching and Management Infrastructure (SwMI). It is a challenge-response result protocol between two parties based on their common knowledge of a secret key (K) to verify the identity of each party.

The SwMI Authentication Center (AuC) provides a single K for authentication, which is shared only with your radio. The SwMI always initiates Authentication. If set by the service provider, your radio can also authenticate the SwMI.

33.5 Air Interface Encryption

NOTE: This is a Software Selling Feature.

Air Encryption is a feature that enables encryption of entire communication between your radio and infrastructure, which results in increased security of calls, messages, and data.

Enhanced Security consists of Trunked Mode Operation (TMO) Air Interface Encryption class 3G and DMO class 2.

Your radio supports TETRA Air Interface Encryption (AIE) using the standard TETRA public encryption algorithms, as defined in TETRA Security ETS 300 392-7, TEA1, TEA2, and TEA3. The focus of cryptography in TETRA is the encryption key. TETRA AIE provides $12\,000^8$ key combinations.

TETRA TMO has three classes of encryption:

- Class 1 – clear (none)
- Class 2 – Static Cipher Key (SCK) encryption
- Class 3 – Derived Cipher Key (DCK) encryption, sometimes called the dynamic key, the Common Cipher Key (CCK), and the Group Cipher Key (GCK)

TETRA Direct Mode Operation (DMO) has two classes of encryption: Class 1 and Class 2.

The security features supported in your radio depend on the security mode.

[2] Accessory Dot Option buttons are programmable buttons available on your accessory. Note that only selected accessories have this function. Check with your service provider for more information.

Table 34: Security Features Required Per Security Class

Security Feature	Mode			
	Security Class 1	Security Class 2	Security Class 3	Security Class 3G
Radio Initiated Authentication	Not Allowed	Not Allowed	Not Allowed	Not Allowed
SwMI Initiated Authentication	Optional	Optional	Mandatory	Mandatory
Mutual Authentication	Optional	Optional	Optional	Optional
Over the Air Re-keying (OTAR)	N/A	Optional	Mandatory	Mandatory
SCK AIE	N/A	Mandatory	N/A	N/A
DCK AIE	N/A	N/A	Mandatory	Mandatory
GCK AIE	N/A	N/A	N/A	Mandatory

NOTE:
In the current release, your radio does not support the following security features:

- Radio initiated authentication.
- Support for TEA4.
- Explicit authentication during Dynamic Group Number Assignment (DGNA).
- OTAR in foreign network.
- GCK AIE in foreign network.

33.5.1
Clear Radios (Class 1)

Your radio can be configured as a clear radio. In such case, your radio identifies itself in registration as a Security Class 1 radio and does not support encryption. A Security Class 1 radio does not contain any encryption algorithms in its software.

33.5.2
Static Cipher Key Encryption (Class 2)

Your radio supports static Air Interface Encryption (AIE) using a set of up to 32 Static Cipher Keys (SCK) shared by the Switching and Management Infrastructure (SwMI) and all authorized radios.

Your radio then determines which static keys to use based on the SCK Number (SCKN) and SCK version number (SCK-VN) broadcast by the SwMI. A radio can be configured to support static key encryption. In such case, it identifies itself in registration as a Security Class 2 radio, and attempts to negotiate Security Class 2 encryption. Each radio then uses either the TEA1 or the TEA2 (TEA 3 for Asia and Pacific) Key Stream Generator (KSG) algorithm. Each radio contains only one of those algorithms in its software.

When Security Class 2 Encryption has been negotiated, encrypted PDUs are encrypted using SCK.

In Direct Mode Operation (DMO), the system manager may choose the SCK and the key may be distributed from the Trunked Mode Operation (TMO) SwMI using the Over-the-Air Re-keying (OTAR) mechanism or provided manually using Key Variable Loader (KVL).

33.5.3

Derived Cipher Key and Common Cipher Keys Encryption (Class 3)

Derived Cipher Key and Common Cipher Keys Encryption (DCK/CCK) are required to prevent over-exposure of key material. Existing encryption systems use Static Cipher Keys (SCK), where one key is used for all radios and all communications.

Key material is often exposed and SCK logistics of changing keys consist in programming all radios and Base Stations. DCK is used for individually addressed TM-SDU (Service Data Unit). DCK/CCK encryption provides Derived Cipher Key (DCK) for uplink (from the radio to the BTS) communication and Common Cipher Key (CCK) for downlink (from the BTS to the radios) group communication. The DCK is derived from either the one way or mutual authentication process and the CCK is received during registry.

The radios supporting the dynamic key encryption identify themselves to the system as Class 3 radios during registry and attempt to negotiate Class 3 encryption. A Class 3 radio supports group addressed signaling and group communication traffic encryption using CCKs as well as encryption of uplink and down link individually addressed signaling messages and individual call traffic (private or phone) using its DCKs. The radios support Over the Air Re-keying (OTAR) of the CCK by the system.

A clear radio can transmit and receive from encrypted radios. The system informs the encrypted radios that the communication is with a clear radio and they switch to clear operation. Class 2 and 3 radios can only act as described if they are allowed to operate in a lower class.

33.5.4

Group Cipher Keys Encryption (Class 3G)

For the Security Class 3G the system allows grouping addressed signaling and dedicated group call traffic encryption using Group Cipher Keys (GCK) to cryptographically isolate talkgroups.

The downlink signaling is encrypted using Modified Group Cipher Key (MGCK) that is cryptographically derived from the Common Cipher Key (CCK) associated with the serving cell and the GCK associated with a given talkgroup. The Switching and Management Infrastructure (SwMI) does not change GCK and CCK simultaneously. Whenever a GCK change occurs, CCK changes are frozen for this time period.

The Derived Cipher Key (DCK) is derived from either the one way or mutual authentication process and the CCK is received during registry, whereas the GCK is received through Over-the-Air Re-keying (OTAR) mechanism only.

Your radio supports over-the-air and manual provisioning of key associations that link a GCK to one or more Trunked Mode Operation (TMO) talkgroups, and manual provisioning of Key Association Group (KAG) to one or more Direct Mode Operation (DMO) talkgroups.

The system can provide the ability for the operator to group contiguous ranges of TMO Short Subscriber Identity (SSI). This case occurs where any talkgroup residing within the address range is assigned using the same GCK association. These ranges, referred to as Key Association Ranges (KAR), are used to convey the TMO talkgroup and GCK relationships to the relevant SwMI and radios responsible for GCK functions.

33.5.5

Over the Air Re-keying

Over The Air Re-keying (OTAR) is a feature that allows operators to centrally manage and distribute the encryption keys used by the subscriber radios for voice and data encryption. With OTAR, you are able to plan, generate, store, track, and maintain all encryption keys for the entire radio network using one central system. OTAR also allows you to change encryption keys frequently which enhances the security.

TETRA systems support Group Cipher Keys (GCK) encryption for specific talkgroups:

- Group OTAR of GCK.
- Group OTAR of fallback TM-SCK.
- Group OTAR of DM-SCK, including management of the cryptographic schedule of DM-SCKs.

The group OTAR mechanisms require a use of the Group Session Key for OTAR (GSKO). The GSKO is delivered to your radio only by using individual OTAR and the Session Key for OTAR (KSO).

For the systems utilizing group OTAR, the fundamental system operation (regarding Static Cipher Keys (SCK) /GCK OTAR) relies on the sites regular transmission. In other words, the sites are regularly broadcasting information regarding which security class and associated keys are in use. The sites transmit future versions of the respective keys to groups of radios belonging to the same Cryptographic Management Group (CMG). Your radio acquires the keys before the Switching and Management Infrastructure (SwMI) activates them. Then the air interface encryption service uses the keys. The sites also broadcast the current key that is in use which can be sent using OTAR mechanism to your radio on request.

NOTE: When a radio has not received a new key before activation by the SwMI, your radio requests the missing keys.

Some systems adopt only individual OTAR methods for delivery of SCK and GCK to your radio. In such cases GSKO is not used. Some systems employ a mix of individual and group OTAR methods. Your radio supports the complement to functionality required for supporting the superset of different SwMI behaviors, for example:

- Individual OTAR (using KSO) of SCK and GCK.
- Group OTAR (using GSKO) of SCK and GCK.
- Individual OTAR (using KSO) of GSKO.
- Secure DMO Key Management (using SwMI).
- Crypto Management Group.
- Storage of 10 KAG (equivalent to 30 DM-SCK).
- Storage of 16 GCK (includes current/future versions).
- Storage of 2 TM-SCK.
- Storage of Group Association attribute per Talkgroup.
- GCK Air Interface Encryption.
- Seamless key changes of GCK.
- Seamless security class changes to SC3G.

The SwMI can support the group OTAR feature. Where supported, the SwMI groups radios that share the same set of cryptographic key material into a specific CMG. Any radio belonging to the same CMG is addressed using a CMG GTSI. The primary purpose of the addressing is to transmit group OTAR messages conveying TM-SCK, DM-SCK and/or GCK. Any radio that supports TM-SCK group OTAR, DM-SCK group OTAR, or GCK group OTAR is assigned to a specific CMG.

Each CMG has a designated specific GSKO. The system deploys over the air a CMG GSKO (and CMG GTSI) to each radio belonging to the CMG. The GSKO is used as the sealing key for TM-SCK, DM-SCK, and GCK, when sent across the air interface. The SwMI can perform scheduled transmissions of the future TM-SCK addressed to each CMG. Your radio requesting a TM-SCK triggers the site to schedule additional transmissions of the requested TM-SCKs. These transmissions are addressed to either the CMG GTSI that your radio belongs to or its ITSI.

The SwMI can perform scheduled background transmissions of the future GCKs addressed to each CMG. Your radio requesting for a given GCK triggers the site to schedule additional transmissions of the current and the future versions associated of the requested GCK. These transmissions are addressed to either the CMG GTSI that your radio belongs to or its ITSI.

The SwMI can perform scheduled background transmissions of the current and the future DM-SCK addressed to each CMG. Your radio requesting for a DM-SCK triggers the site to schedule additional transmissions of the requested DM-SCK. These transmissions are addressed to either the CMG GTSI that your radio belongs to or its ITSI.

33.5.6
Encryption Mobility

A Class 2 or Class 3 radio can operate on a lower class Switching and Management Infrastructure (depending on configuration). A radio that is provisioned not to allow operation on a lower class Switching and Management Infrastructure (SwMI), does not register on such a cell.

A Class 2 or Class 3 radio moves to a cell that supports a Static Cipher Keys (SCK)/Common Cipher Keys (CCK)/Group Cipher Keys (GCK) that your radio possesses, applies Air Interface Encryption (AIE) to the registration Protocol Data Unit (PDU). If no acknowledgment is received, your radio sends the registration in clear.

33.5.7
Encryption MMI

A Class 2 or Class 3 radio that is involved in a clear communication provides a visual and an audible indication informing that the communication is not encrypted (if enabled by the service provider).

If configured by your service provider, your radio plays a sound and displays `Call & Data Not Encrypted` when encryption is on and you receive a clear call (unencrypted). This feature provides service confidentiality between you and the system.

In the TMO Mode, when Air Encryption is enabled on your radio but cannot be supported due to an infrastructure failure, the following icon appears on the display:  . When encryption is not available in the DMO Mode, your radio displays  .

33.5.8
Air Interface Encryption Key Storage

Your radio stores all the keys, Static Cipher Keys (SCK)/Common Cipher Key (CCK)/Derived Cipher Key (DCK)/Group Cipher Keys (GCK), in a sealed manner in non-volatile memory of your radio. However, they are not stored in the codeplug.

Your radio supports loading of the SCK keys manually using the Key Variable Loader (KVL). By using a special key combination, you can delete the cipher keys in your radio. Depending on configuration, you may erase either all keys or only the short-term keys.

33.6
Secure DMO

The Secure Direct Mode Operation (DMO) feature guarantees key ciphered transmission in the DMO.

When DM-SCKs are provided by OTAR, you are informed in case your radio does not contain the complete set of SDMO keys. Whenever your radio enters DMO and your radio does not possess past and present DM-SCKs for all provisioned KAG and/or it has not yet successfully received SCK Subset Grouping Type, SCK Subset Number, and SCK-VN information from the SwMI, then your radio:

- plays a special reject tone.
- prompts a message indicating **OTAR incomplete**.

Your radio provides SDMO status information to the user from the MMI **DMOSCK Validity** submenu inside the **Security** menu (present only when configured in the codeplug):

- **DMO SCK is Valid** if DMO SCK OTAR is disabled and all DM-SCKs are provided using the KVL.
- **DMO SCK is Valid** if DMO SCK OTAR is enabled and your radio knows the current SCK information and has all the corresponding past and present DM-SCKs.
- **DMO SCK is Invalid** in all other cases.

Your radio supports system management of SDMO keys. The SDMO operated device radio includes the configuration of the DM-SCKs used by SDMO, the current active SCK Subset Number, and the Version Number information to organize key schedules. Your radio considers the last received variant of this information PDU as the most accurate indication of SDMO key configuration.

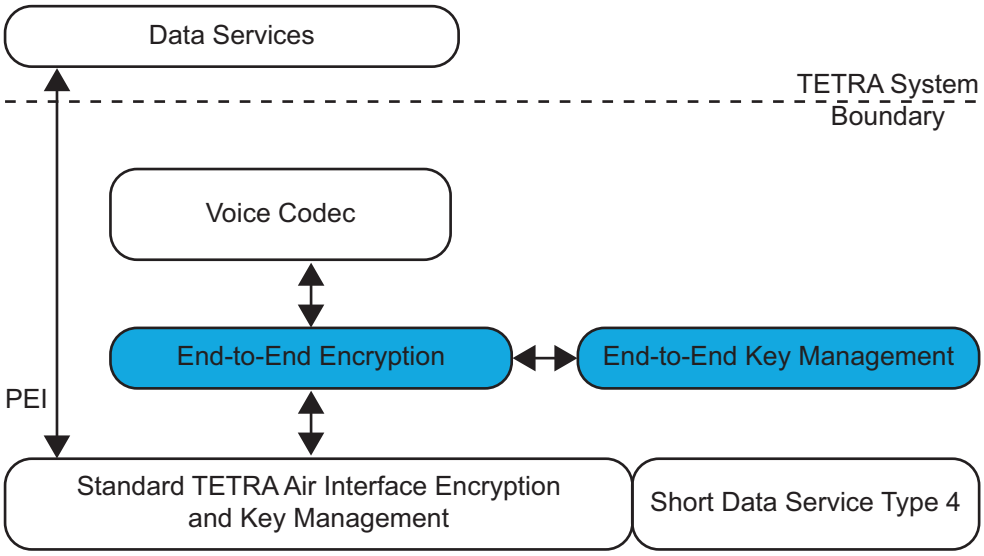
DMO SCK can only be used if Enhanced Security feature is purchased.

33.7 End-to-End Encryption

The TETRA standard supports air encryption.

Your radio creates the PDU (Protocol Data Unit) and the PDU is encrypted before transmission. The Base Station receives this PDU and must decrypt it, to know what to do with it and where to send it. Thus, if a PDU contains voice information, the voice part of the message has been decrypted and is now unprotected, until it is transmitted out to the caller.

Figure 24: Voice and Data End to End Encryption



The End-to-End Encryption (E2EE) feature resolves this issue by encrypting the voice information before it is packed into the PDU. This message is also encrypted according to the over-the-air encryption of the TETRA standard. Thus, when the Base Station decrypts the PDU containing voice information, the voice part remains protected by encryption until the called radio receives the voice and decrypts it.

The Motorola Advanced Crypto Engine (MACE),CRYPTR Micro or Micro HSM, BSI encryption, and SECTRA encryption carry out voice encryption. CRYPTR Micro or Micro HSM is an SD-card size device located in your radio. The crypto engine takes the voice stream and encrypts this stream using a set of keys. Likewise, the crypto engine takes encrypted voice stream and using the same keys decrypts back into clear voice.

The encryption of voice and data can be carried out using a dedicated SIM card reader.

In the end-to-end encryption feature, your radio notifies and informs whether the call, being made or received, is voice-encrypted. Your radio also provides with means to select a different key, delete keys, request new keys and change the encryption mode of non-defined private calls.

Your radio supports BSI and SECTRA encryption in full duplex calls.

This feature is relevant for group calls and private calls in TMO and DMO.

33.8 SIM Security

The SIM is an integrated circuit card that holds a filing system and an application.

There are two types of SIM security features:

- BSI SIM is only available on the GMOI network
- SECTRA SIM

The security of the SIM card is ensured by the means of the following security functionality groups:

Security Functionality Groups	BSI	SECTRA
Voice End-to-End Encryption (E2EE) and related key management	Yes	Yes
Network access parameters and authentication	Yes	Not Applicable
Key management for Air Interface Encryption (AIE)	Yes	Not Applicable
Operational Tactical Address (OPTA), modification, encryption, and transfer	Yes	OPTA Not Applicable
AES for E2EE of SIM Interface and SIM-Terminal Authentication	Yes	Yes

The application performs the following actions:

Actions	BSI	SECTRA
Generation of Key Stream Segments (KSS)	Yes	Yes
Synchronization for E2EE	Yes	Yes
TETRA authentication algorithm based on K key on the SIM	Yes	Yes
Key management for E2EE keys	Yes	Yes
SIM interface encryption and authentication using the AES	Yes	Yes

The filing system holds the following items:

Items	BSI	SECTRA
Network access parameters as Individual Tetra Subscriber Identity (ITSI)	Yes	Not Applicable
Security class definition and authentication definition	Yes	Yes
Integrated circuit card identifier	Yes	Yes
SIM version number	Yes	Yes

Items	BSI	SECTRA
OPTA	Yes	Not Applicable

The E2EE keys are also kept on the SIM. However, they are accessible for the SIM application only, thus E2EE key management is transparent to your radio.

The keys for AIE remain on your radio. The SIM application handles AIE key management. SECTRA SIM does not support handling AIE key management.

33.9 Radio Disable or Enable

A dispatcher can disable or enable your radio remotely.

When disabled, your radio does not participate in any voice call, Short Data Service (SDS), or packet data activity and ignores all supplementary services sent on the down link. All visible and audible indications are disabled, and your radio appears to be turned off. All user inputs, such as key presses, are ignored, and the PEI interface is closed.

Your radio continues to perform mobility management functions, such as roaming, to facilitate subsequent enabling or further disabling.

Your radio stores the disabled or enabled state in the codeplug, so the unit remains in that state after turning on.

If your radio is in the disabled state, and receives an appropriate TETRA signaling for subscription enablement with the correct Short Subscriber Identity (SSI) and Mobile Network Identity (MNI), it restores to its normal operative state.

The TEI Query feature provides TEI information to the infrastructure during registration. This allows the dispatcher to disable radio by sending an appropriate TETRA signaling for equipment disable with the correct TEI for this radio. Replacing the SIM card does not activate your radio. TEI Query feature is only available on GMOI network.

If your radio is in the equipment disabled state, and receives an appropriate TETRA signaling with the correct TEI, your radio restores to its normal operative state (if the subscription is also in the enabled state).

33.10 Radio Permanent Disable

NOTE: This is a Software Selling Feature.

Radio Permanent Disable and Radio Permanent Disable v2 are features that are mutually exclusive.

Permanent disabling is intended to protect a network from being attack from a compromised or faulty radio. It can be used when your radio has been compromised, or has been suspected of compromise for a long time. It is a one-way function and no equivalent enable is available. Then your radio should be recovered and reprogrammed before being used again by the service provider.

When your radio is permanently disabled, it becomes inoperable.

- All its MMI interfaces on your radio are disabled.
- All its security key material, that is GCK, GSKO, DMO SCKs, Ks, DCK, CCK, and TMO SCKs are deleted.
- All its codeplug is deleted.
- All its software is deleted.

The permanent disable should be invoked when it has been determined that a radio is unrecoverable. When a radio has been lost or stolen, the first step always is to stun your radio using temporary disable.

The permanent disable should be used with the deletion of the user radio record in the User Configuration Server and the deletion of the K-REF association of the disabled radio in the Provisioning Center and the Authentication Center. This deletion ensures that subscriber information is not downloaded into the Home Location Register if a restore of the UCS is performed.

The system operator has to also ensure that your radio K-REF association is also removed from the other Authentication Centers in the network, in cases where the K-REF pairs are duplicated across the network.

If this association is not removed, your radio could be assigned a new home zone that lies in a cluster where the K-REF association has not been deleted.

33.11 Radio Permanent Disable v2

NOTE: This is a Software Selling Feature.

Radio Permanent Disable and Radio Permanent Disable v2 are features that are mutually exclusive.

Similar to permanent disable, once your radio is disabled using the permanent disable v2, it cannot be recovered over the air. When your radio accepts the permanent disable command, and if the permanent disable v2 flag is enabled in the codeplug, your radio appears to be inoperable.

- All its MMI interfaces on your radio appear to be disabled.
- All its security key material that is GCK, GSKO, DMO SCKs, Ks, DCK, CCK, TMO SCKs, and End-to-End key material are deleted.
- Your radio automatically enters programming mode upon powering attempts.
- The permanent disable flag is set in the codeplug.

Unlike in the permanent disable, a permanent disabled v2 radio can be re-enabled using the software selling dongle. If you have the software selling dongle, you can read the codeplug and clear the permanent disable flag.

NOTE: The configuration tool can restore a radio that is disabled using the permanent disable v2.

33.12 High Assurance Boot

Your radio has a facility that ensures that the code and data flashed in your radio is authentic and has not been altered.

The hardware forces the High Assurance Boot (HAB) module to run at boot time. The module checks if all software comes from a trusted source. Your radio is checking the signature of the code and data segments present in your radio using a public/private key mechanism.

If the HAB authentication of the flashed software fails, it does not allow your radio software to run.

33.13 Covert Mode

NOTE: This is a Software Selling Feature.

This feature enables you to completely shut down all visible and audible alerts and notifications, making your radio unnoticeable even in a silent and dark environment.

All audio activities are suppressed to the built-in speaker and mic, and the audio is routed to and from the accessory only.

When your radio is in the Covert Mode, you cannot enter the following menu items of the Setup menu.

- **Vibrate**.
- **Set Volume**
- **Tones**
- **Backlight** (in Display menu item)

When the Covert Mode is turned on:

- All tones are set to **Off** (corresponding to All Tones menu entry).
- Group audio is set to **Spkr Cntrl** (corresponding to Audio Toggle menu entry).
- The private speaker is set to **Off** (this setting causes all the calls are routed through the earpiece).
- Backlight is set to **Disabled** (corresponding to Backlight menu entry).
- All LED indicators are switched off.
- Using flashlight as a torch is disabled.

Your radio powers up in the mode set before turning off. If Covert Mode is enabled before turning off, your radio turns on in Covert Mode.

When Covert Mode is turned off, all the changed settings are reverted to the previous state.

This feature can be used as a One-Touch Button.

Chapter 34

User Indication

This section contains information about user indication from your radio.

34.1 Vibrate Mode

The vibrate menu allows you to determine if your radio vibrates, rings, or vibrates, and then rings when receiving a call.

Five vibration patterns can be assigned using the configuration tool, and you apply the setting according to the user profile.

34.2 Ring Style

The ring style menu allows you to set ring style for incoming calls.

You can set individual ring tones for all duplex calls, simplex calls, and DMO simplex calls.

34.3 Volume Control

Volume Control Mode is used to control the volume levels.

It is configurable in the configuration tool. If enabled, the Volume Control mode is selectable using your radio MMI. There are two options for Volume Control Mode:

Individually Controlled

This is the default setting where you can adjust the following volumes individually as per your preference.

- Voice – voice volume
- Duplex – alerting volume at an incoming phone/PABX or duplex private call
- Simplex – alerting volume at an incoming simplex private call
- Keypad – keypad tones volume
- Tones – alert tones volume
- Call-Out – Call-Out tone volume (if enabled)

The adjustments are made for the volumes within the ranges defined in the audio mode. Simplex and duplex calls use the same range. All other volumes are fixed for each audio mode.

Commonly Controlled

You can adjust one volume level for all volume settings.

When the rotary knob is in the volume mode, your radio adjusts the value of the commonly controlled volume along with the audio volume.

NOTE: When a volume control capable Bluetooth device is connected, your radio always uses the Common setting.

The max volume offset (dB) and the volume range (dB) are configurable through configuration tool. The volume control in your radio is divided into 13 steps, from 0 to 14. If, for example, the **vol. range** is set to 39, each step on the volume indication bar is 3 dB.

34.4 Languages Supported

Table 35: Languages Supported

Language
Arabic
Chinese (simplified)
Chinese (traditional)
Croatian
Danish
Dutch
English
European Spanish
Finnish
French
German
Greek
Hebrew
Hungarian
Icelandic
Italian
Japanese
Korean
Latin American Spanish
Lithuanian
Macedonian
Mongolian
Norwegian
Polish
Portuguese
Russian
Swedish
User defined

34.5
Audio Features

Different audio quality and adaptive audio parameters can be configured according to the working environment.

There are many situations where the demand of audio quality changes according to the working environment. For example, an airport worker, who works partly in the field where there is lots of noise coming from the surrounding environment and partly inside the airport where there is relatively less noise, may experience different audio quality.

34.5.1
Adaptive Multi-Microphone Beam-Forming Noise Suppression

NOTE: This is a Software Selling Feature.

This feature optimizes the speech level of the user while minimizing background noise.

Users can talk to your radio in any direction and advanced algorithms automatically adjust to optimal noise suppression.

34.5.2
Adaptive Wind Noise Mitigation

NOTE: This is a Software Selling Feature.

This feature keeps communications clear and intelligible even under windy conditions.

When your radio senses wind noise, it automatically uses the loudspeaker as a microphone. Speaker grill eliminates wind turbulence to the speaker and greatly reduces the effect of wind noise, which helps to enhance the clarity of the transmitted speech.

34.5.3
Adaptive Acoustic Feedback Suppression

NOTE: This is a Software Selling Feature.

This feature enables the radio to automatically adjust the volume of the speaker to prevent the negative effects of acoustic feedback.

Users do not need to manually lower the audio volume or changing feedback suppression settings manually when shifting between environments.

34.5.4
Audio Profiles

Audio profiles can be used to adjust the audio settings of your radio to fit different operating environments.

You can select the corresponding audio profiles. It is possible to enable and customize up to ten audio profiles using the configuration tool . The following parameters can be configured:

- Mic Gain offsets

- Howling Gains
- AGC, Echo Canceler, and RX/TX Noise suppressor
- Voice offsets and ranges for different audio devices
- Individual Toner per profile basis.
- Category Tone per profile basis.
- Volume level adjustment (offset) for each of the event per profile basis.
- Backlight Toggling.
- LED light indication.

NOTE: Audio Profile names in your radio MMI correspond to the Profile Alias/Name parameter value for the corresponding User Profile in configuration tool.

Using the configuration tool you can create an audio profile using the ten User Profiles. You can also enable/disable an audio profile in the codeplug and give an alias/name to a particular profile configured in the codeplug.

You can configure Backlight Toggling, LED Indication and, Individual Toner Per Profile Basis.

The audio profiles are created and maintained independent of each other. Creating or modifying one audio profile does not have any impact on the others.

Your radio enables toggling audio profiles using the menu or using the One-Touch Button.

You can change the audio profile during an active call.

34.5.5
Transmit Automatic Gain Control

The Transmit Automatic Gain Control (TX-AGC) provides flexibility in terms of operating environment.

The TX-AGC allows you to transmit from a radio both indoor and outdoor without having to change a profile. The TX-AGC provides normalized sound levels to the receiving party.

34.5.6
Howling Suppression

The howling suppression is a mode increasing the stability of the acoustic feedback loop. Your radio eliminates howling caused by the feedback loop from the receiving radios to the sending radio in simplex calls.

To enable this anti-howling function, use the menu or the corresponding One-Touch Button.

When the howling suppression is enabled, Microphone and Speaker gain reduction values corresponding to the active audio profile are taken into use. You can toggle the howling suppression during an active call.

34.5.7
Audio Toggle

You can control audio routing between the speaker and earpiece for any private or group call through the dedicated **Speaker Control** key. You can also define through the menu to have all group calls in high audio or controlled by the **Speaker Control** key.

The toggling options are:

- **Always Loud** – directs the audio to the speaker for the call duration and the soft key to change this setting is not visible.

- **Spkr Cntrl** – directs the audio to the earpiece for the call duration and the soft key to change this setting is visible.

34.6 Description of Tones

Motorola Solutions TETRA terminal supports audible user notification tones.

Tones for events are divided into five categories:

Table 36: Tone Categories

Category	Event
Keypad	For events triggered by key-press.
Alert	For events triggered by an application.
Ring	For events triggered by incoming/outgoing call.
Call-out	For events triggered by Call-Out alert.
Voice	For the event triggered by voice volume set.

A category may have many or few associated events.

The number of tones is limited; a specific tone may be used for indicating several different events. The generated tone may be mixed with the received speech signal, replace it, or be played while your radio is in idle (when there is no received or transmitted speech) dependent on its category and the features interaction.

The ‘right’ tone or event loudness is an objective matter. Motorola Solutions TETRA terminal tones architecture is highly flexible and allows you to adjust the level of every tone-event (such as valid key-press) individually and at the same time to adjust the level of all events associated with a tone-category.

Using the configuration tool, it is possible to set the level of each event compare with the nominal speech level (-20 dBm0); that means, for a given volume setting, a tone may be louder, softer, or at speech level. This option is available both for in idle (when there is no received or transmitted speech) and in-call (during received or transmitted speech).

34.7 Universal Time Display

Your radio can present time information to the user. The time is derived from an internal clock. Your radio maintains the clock both when your radio is powered on and powered off.

NOTE: If the power is lost, for example due to the flat battery, the internal clock is not maintained.

To ensure the time displayed is accurate, the time is displayed only if within the last 48 hours either of the following events have occurred:

- Your radio has received a network time update from the system.
- You have manually updated the time.

Also, as the internal clock is not maintained after a power loss event, the time is not displayed until either these events occur.

The feature is enabled or disabled and the default configuration can be set for your radio using the configuration tool or radio MMI.

Your radio display supports the following:

- Twenty-four-hour and twelve-hour formats.
- DD/MM/YY, MM/DD/YY, DD-MON-YY, and YY/MM/DD date formats.

You can change the time and configuration information through your radio MMI, depending on the codeplug settings. Depending on configuration, system broadcast information can have higher priority than data entered manually. Thus time, date, and offset information entered from the MMI is overwritten, when data is received from the Switching and Management Infrastructure (SwMI). Your radio provides user indications upon crossing to another time zone, when a new Mobile Country Code (MCC) broadcast received.

Chapter 35

Energy Economy

Energy Economy (EE) is a mode of operation to save battery life. Your radio does not monitor all downlink time slots of the Main Control Channel. If your radio is in the charger, Energy Economy mode is not needed.

When in Energy Economy mode, your radio monitors one frame of the Control Channel and sleeps in one or several subsequent frames. You can select the Energy Economy mode through the configuration tool, with the options of either **EG1** or **EG5**. Each Economy Group (EG) determines the number of frames that sleep. Your radio communicates the selected Energy Economy mode to the Switching and Management Infrastructure (SwMI).

Chapter 36

Bluetooth

Bluetooth is a wireless technology used to create personal networks operating in the 2.4 GHz unlicensed band with a range of up to 10 m.

Bluetooth feature allows your radio to interact with standard or commercial Motorola Solutions and third party audio accessories, wireless PTT, and wireless data services.

By default, Bluetooth is activated on your radio. Your radio supports the Headset Profile (HSP).

Secure Connection feature offer encrypted communication between radio and accessory, encrypted with AES encryptions. Your radio support level 4 Secure Connection.

Your radio supports Bluetooth 5.0.

The Secure Simple Pairing feature ensures a high level of security while pairing devices, thus protecting you against recording and passive eavesdropping. One radio can be connected with six data connections and one audio connection.

Your radio supports Bluetooth 5.0. The Secure Simple Pairing feature ensures a high level of security while pairing devices, thus protecting you against recording and passive eavesdropping.

One radio can be connected with up to seven devices at the same time.

The usable range may be reduced when you connect your radio with devices that support more limited ranges or if physical obstacles such as walls appear between devices. Five separate Bluetooth features available:

- Bluetooth Audio – includes Bluetooth Audio and Fast Push-to-Talk (PTT)
- Bluetooth Radio Control – includes Bluetooth Radio Control using AT commands and Bluetooth Generic Attribute Profiles (GATT) Sensors
- Bluetooth Smart Proximity Pairing
- Bluetooth Smart Ready includes:
  - Bluetooth Low Energy Indoor Location,
  - Bluetooth Low Energy Heart Rate Profile
  - Bluetooth Generic Attribute Profiles (GATT) Sensors

NOTE: Bluetooth Audio, Bluetooth Radio Control, Bluetooth Smart Proximity Pairing, and Bluetooth Smart Ready are Software Selling Features.

You can use Bluetooth to:

- Connect your radio with wireless accessories, for example, a headset, which gives you a greater freedom of movement and increases your work comfort. Also, wireless accessories allow performing the same activities in several ways. For example, you can change the volume level either in the headset or on your radio.
- Allow your radio to detect BTLE iBeacons.
- Increase connectivity with secure packet data services between your radio and a data device or a smartphone running appropriate applications.
- Enable radio control through a data device.

36.1
Bluetooth Interactions

The Bluetooth feature interacts differently with other features and situations of your radio.

The following features and situations limit the use of Bluetooth:

Car Kit
Car Kit affects Bluetooth headsets - when Car Kit is used, audio is routed only to/from accessories connected to the Car Kit. The audio is not routed to Bluetooth headsets.

Covert Mode
The radio cannot enter Discoverable Mode while in the Covert Mode as Covert Mode has a higher priority.

Transmit Inhibit Mode (TXI), Repeater Mode
Bluetooth does not work in the Transmit Inhibit Mode nor in the Repeater Mode. When your radio enters one of those modes while Bluetooth is enabled, all remote devices are disconnected and Bluetooth is disabled. After leaving the TXI or the Repeater Mode, Bluetooth is enabled again (if it was previously turned on).

Wired Audio Accessories
Wired audio accessories have a higher priority than Bluetooth audio accessories. If both types of devices are connected to your radio, it disconnects the Bluetooth audio device. When a wired audio device is already connected to your radio, scanning for Bluetooth audio devices is disabled.

36.2
Bluetooth Restrictions

TETRA Radios support simultaneous connection with up to seven remote devices.

The following restrictions on combinations of connected remote devices apply:

- It is only possible to connect one Motorola Solutions Push-to-Talk (PTT) device connected at a time.
- It is only possible to connect one Bluetooth (BT) audio device at a time.

In summary, it is possible to have three SPP devices connected at the same time.

36.3
Bluetooth Sensor Data

Your service provider can configure the details of the sensor information your radio displays.

Depending on the type of sensor connected to your radio and the setup configured by your service provider, various types of information are displayed. The following sections contain information on the most significant, pre-determined data your radio displays.

Sensor Battery Information
Your radio displays the percentage of the remaining battery power of the connected sensors.

Heart Rate Sensor
If a heart rate sensor with the Energy Expended feature is paired and connected to your radio, two values are displayed:

- Heart Rate in bpm
- Energy Expended in kJ

Sensor Alarm
A radio paired with appropriate sensors increases the security of your radio user by making the user more aware of their surroundings. If the collected values exceed limits set by your service provider, your radio

plays an alarm tone, light the LED, and display a warning message. The alarm concerns, for example, low battery, high toxicity, or low/high heart rate.

The alarm is active for a pre-defined time or until you discard it.

36.4
Bluetooth Smart Proximity Pairing

With the use of Proximity Pairing, you can instantly connect your radio with Bluetooth Low Energy (BTLE) devices.

BTLE devices are various types of sensors your radio can be paired with using Bluetooth, for example gas or heart rate sensors.

To pair your radio with a sensor, move your radio close to a sensor and press and hold the One-Touch Button. A tone indicates successful pairing and connection. After the connection, your radio collects information from the sensor.

36.5
Bluetooth Low Energy Indoor Location

Your radio supports Indoor Location feature with the use of Bluetooth Low Energy (BTLE) iBeacons. Indoor Location is used to track radio location while indoors. This feature is only supported on radio models with BTLE hardware. This feature is only available when enabled by your service provider.

Your radio receives information from beacons that are within range, and transmits the information in a Location Information Protocol message over the TETRA network. A mapping application then decodes the information to calculate your radio location. This allows the supported console operator to know the location of your radio and ensure fast response when an incident occurs.

Indoor Location feature supports the following operation modes:

Enabled
Indoor Location is activated.

Disabled
Indoor Location is deactivated.

Suspended
Indoor Location is temporarily halted.

This feature is only supported in Trunked Mode Operation (TMO). If Indoor Location is enabled and your radio enters Direct Mode Operation (DMO), the Indoor Location is disabled automatically. When your radio switches back to TMO, the Indoor Location re-enables if it was previously enabled before entering DMO.

Your radio also supports Outdoor Global Positioning System and Indoor Location concurrently, configurable through the configuration tool. This configuration allows you to move between indoors and outdoors without losing location data.

NOTE: Indoor Location is suspended when you initiate Bluetooth Smart Proximity Pairing, and resumes when the pairing is completed.

Chapter 37

Wireless Application Protocol (WAP)

NOTE: This is a Software Selling Feature.

Wireless Application Protocol (WAP) is a standard for application layer network communications in a wireless communication environment such as TETRA network. The protocol is used to access the mobile web from a radio through a WAP browser.

37.1 WAP Browser

The Openwave Mobile Browser is a Wireless Application Protocol (WAP)-compliant user agent. The WAP browser, available only in Trunked Mode Operation (TMO) mode and on a network with Packet Data enabled, provides all the basic services of a computer web browser.

Depending on the configuration tool configuration, the display can return to the browser session automatically after an interruption by the preemptive display. The WAP browser does not support right-to-left languages (as Arabic and Hebrew); English is used instead. The characters of right-to-left scripts are not displayed.

NOTE: Depending on your radio configuration and the network conditions, the WAP browser may not display images properly (or may display them with a delay).

37.2 WAP Push

NOTE: This is a Software Selling Feature.

Wireless Application Protocol (WAP) Push allows WAP content to be pushed to a radio.

This push is carried out by sending a specially formatted (Push Access Protocol) XML document to the Push Proxy Gateway, that in turn forwards the document to your radio.

A WAP push message is an encoded message including a link to a WAP address. When receiving a WAP push, a WAP enabled radio automatically gives the option to access the WAP content. The implemented WAP push is compliant with WAP 2.0 standard.

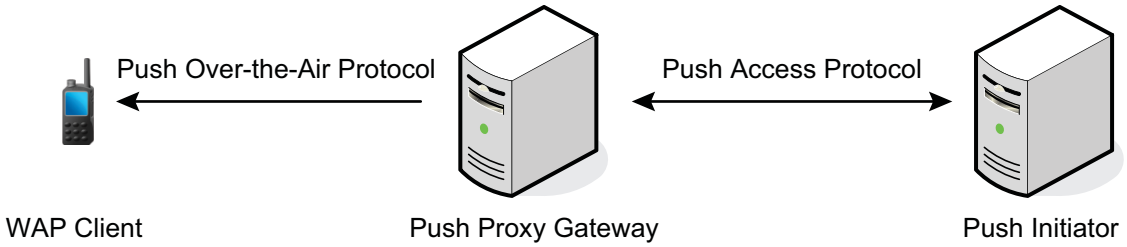
Your radio supports WAP 2.0 through a proxy only. Proxy-less connections are not supported.

37.2.1 WAP Push Framework

A push operation in Wireless Application Protocol (WAP) is carried out by allowing a Push Initiator (PI) to transmit push content and delivery instructions to a Push Proxy Gateway (PPG). The PPG delivers the push content to your radio as per to the delivery instructions.

The PI is an application running on a web server and communicating with the PPG using the Push Access Protocol (PAP). The PPG uses the Push Over-The-Air (OTA) Protocol to deliver the push content to your radio.

Figure 25: Push Framework



37.2.2
WAP Push Service Indication

The service indication (SI) presents a notification and an associated URL with a prompt to enter the URL on your radio display. The notification is then stored in the Wireless Application Protocol (WAP) box for subsequent presentation.

The SI can be valid only for a certain amount of time. After the specified time elapses, the SI indicates void content. The author of an SI can set the expiration date and time, that is, when the SI is automatically deleted from your radio.

The service provider can remotely delete SIs that became invalid. The removal is carried out through sending a special SI to delete the invalid entity.

A new SI is indicated with a respective status icon, tone, and a pop-up. The pop-up occurrence depends on the SI priority (high and medium) and your radio conditions (for instance, if your radio is in a call the pop-up does not appear). Depending on the periodic alert feature availability, a notification of an unread SI can be indicated with periodic notification, similarly to an SDS message.

37.2.3
WAP Push Service Load

Service Loads (SL) differ from the Service Indications (SI) by the fact they do not prompt to enter the URL. Instead, the browser is automatically activated. The SL contains a URL indicating what service to load.

A new SL is indicated with a respective status icon, tone, and browser activation. The browser activation depends on the SL priority (high) and your radio conditions (for instance, if your radio is in a call, the browser does not display).

SL messages sent with urgency cache can be not indicated directly to the user. Such SL messages load content and store it in the cache (the process works in the background, only the PD icon is visible to the user).

Chapter 38

Radio Info

Depending on the codeplug configuration the manufacturer, type, and serial number information is available. The information is available through the service page accessible from the MMI.

The Radio Info provides the following data:

- Manufacturer
- Model Number

  NOTE: The manufacturer and model number information is displayed only on radios distributed under Motorola Solutions trademark.
- Release Name – the version of radio software.
- Individual Short Subscriber Identity (ISSI) – individual ID assigned for each radio. Followed with current content. The ISSI which is in use. If a SIM Card is present, the ISSI is read from the card, otherwise it is taken from the codeplug.
- TETRA Equipment Identity (TEI) – unique identification number programmed in your radio at the factory and cannot be later modified. The TEI is displayed as a hexadecimal number.
- Serial number – Motorola Solutions serial number is displayed only on radios distributed under Motorola Solutions trademark.

Chapter 39

Radio Mass Storage

Radio Mass Storage enables support of Micro SD/SDHC Card or extended flash memory in your radio as a medium for storage for applications.

Your radio supports the following microSD cards:

- Micro Secure Digital Card (a standard microSD card) with capacity up to 2 GB
- Micro Secure Digital High Capacity Card (MicroSDHC card) with capacity from 4 GB to 32 GB

NOTE: Use only Motorola Solutions-approved cards that meet the ATEX requirement. For a list of Motorola Solutions-approved cards, refer to the *Safety Leaflet*.

Your radio only supports the following characters in the filenames:

- Numeric digits
- English alphabetic characters
- Space
- Non-alphabetic characters such as ! # $ % & ' ( ) - @ ^ _ ` { } ~.

Ensure that the computer system supports non-alphabetic characters before using them.

The SD Card or radio extended flash memory is accessible by the USB interface at the bottom connector. The following operations are available to applications:

- Read file
- Write file
- Create file
- Delete file
- Create directory
- Delete directory

If your radio supports an SD card, then the SD card is used as message storage device, radio extended flash memory is not accessible.

If your radio supports SD card, as part of Permanent Disable, your radio formats the SD card. This action applies to both Permanent Disable and Permanent Disable v2.

Chapter 40

Radio User Assignment and Radio User Identity

NOTE: This is a Software Selling Feature.

Radio User Assignment (RUA) and Radio User Identity (RUI) enables authentication for providing full access to the infrastructure and the physical radio.

RUA and RUI feature is first enabled. On logging on to your radio you enter your User ID with the PIN to check your identity. After successful RUA/RUI authentication, you are logged on to the physical radio. Thus, you can still be reached at your radio number. A log on failure results in limited service.

You can differentiate the RUA/RUI state by the interface color. Blue for logged on and gray for logged off. No additional icon indicates whether you are logged on.

Besides the logged on off states, your radio can also be in the pseudo log on state indicated by the relevant icon.

The User ID is stored in the RUI List. To verify who is logged on to your radio, see the second line in the RUI list (the first line is **New User ID**).

NOTE: Your radio does not enter programming mode using AT Commands in Limited Service, when PEI is disabled on Limited Service Feature List (in configuration tool). It is especially important when using Integrated Terminal Management (iTM) for remote programming.

40.1 RUA/RUI Log On

You can log on yourself or the dispatcher can log you on. The feature must be enabled in the codeplug, by your service provider.

After turning on your radio, the infrastructure verifies a request from your radio and checks if it supports the Radio User Assignment (RUA)/Radio User Identity (RUI). When the infrastructure accepts RUA request, you are asked for RUI and RU-PIN. After providing correct information, a successful log on occurs and full access is granted for specified time.

When a RUI and/or RU-PIN are incorrect, a log on failure occurs. The infrastructure sends the RUA reject signal to your radio. If enabled in the codeplug, limited service access is granted.

When the dispatcher is sending the RUA accept signal to your radio with the time period that the full service is granted, then the successful book on occurs.

40.2 RUA/RUI Radio Behavior

When your radio is logged off and receives Radio User Assignment (RUA) accept from the infrastructure without sending log on information, it indicates book on with an assigned log on period timer.

Your radio sends automatically book on response according to the terminal settings:

Book on Reject
Your radio rejects all the book on.

Book on Accept
Your radio accepts all the book on.

To log off, use your radio menu. The dispatcher has also the option to log you off using **Force Off** setting.

The pseudo log on is a state which occurs when the RUA/Radio User Identify (RUI) authenticated radio goes to Local Site Trunking (LST), or infrastructure accepts the log on with the empty granted assignment period. In this state, your radio has the full functionality available except some services as forwarding calls. This state is signalized with a specific icon.

The RUA/RUI feature is specified with the following timers:

Log On Process Timer
Defines the amount of time during which your radio awaits log on response from infrastructure.

Time Out Warning Timer
Defines the amount of time after which your radio displays the warning.

Log On Period Timer
Defines the amount of time during which your radio is logged on.

40.3 RUA/RUI Interactions

When you switch from Trunked Mode Operations (TMO) to Direct Mode Operations (DMO), the terminal logs off (depending on the codeplug settings). When you switch from DMO to TMO, your radio initiates the log on process.

You may be Radio User Identity (RUI)-authenticated when out of coverage. In this situation, your radio is in pseudo logged on status. All the timers are the same as for the logged on user with the coverage. You may also be logged off when out of coverage. In this situation, your radio is provided with the limited service access. In both cases, if your radio is back in the coverage area and receives Radio User Assignment (RUA) request from Switching and Management Infrastructure (SwMI), it prompts you to log on.

If during the emergency operations you receive the force-off, it logs you off without exiting the emergency operations. As long as your radio is in the emergency operations, your radio display does not indicate any change.

When your radio turns on in the Local Site Trunking (LST), it prompts for the PIN. If the correct PIN is entered, your radio switches to the pseudo logged on state. When you move to the LST, your radio switches to pseudo logged on state. However, no prompt for the PIN occurs.

When you change to a different physical terminal, the store and forward report is routed to your radio where you are currently logged on. When your radio receives store and forward report, it does not display the report, as the reports have to match the sent Short Data Services (SDS). If an SDS consumer report is requested, it is recommended that the receiver sends an explicit separate SDS message to confirm that the message has been received and read. The report is stored together with the sent SDS in the **Outbox**, because of that when you log off, delete the messages from the **Outbox**. When you change to different physical radio, the previous permanent radio does not receive the report. The status of store and forward message in the **Outbox** cannot be updated.

Chapter 41

Mobility Services

Terminal mobility indicates the ability of your radio to acquire, register, and operate on an appropriate TETRA network and also to change cells when the conditions require it with a minimum interruption of services.

Main Mobility requirements include:

Initial Cell Selection
The procedure which your radio applies in order to find a suitable cell on which to register and obtain service when no neighbors are known or available. For this procedure, your radio uses a set of provisioned or known frequencies.

Registration
A signaling exchange that your radio employs to notify the Switching and Management Infrastructure (SwMI) that it has arrived at a cell. The registration exchange may include secure key authentication. The SwMI may also request your radio to register to verify your radio location or to force authentication.

Migration and Multi-Network Operation
The terminal will have a set of provisioned parameters which will indicate on which Mobile Network Identity (MNI) the terminal can operate

Control Channel Selection
In TETRA, each TDMA frame on a given carrier is comprised of 4 time slots, each of which can be used as a “physical” channel

Surveillance, Monitoring, and Scanning

Surveillance
A procedure that your radio continuously performs to evaluate the continued suitability of the serving cell based on the broadcast cell parameters and the measured signal strength.

Monitoring
A procedure that your radio employs to evaluate the suitability of a neighbor cell based on signal strength measurements of the cell, and parameters of that cell provided by the serving cell.

Scanning
A procedure that your radio employs to evaluate the suitability of a neighbor cell based on signal strength measurements of the cell and parameters received directly from that cell.

Cell Ranking
The procedure your radio performs to sort the neighbor cells in order of most desirable for cell reselection to least desirable for cell reselection.

Cell Reselection
The procedure used by your radio to move from the serving cell to a cell that the serving cell has identified as a neighbor cell, and whose conditions are sufficiently better that the serving cell.

Cell Restoration
A procedure initiated by your radio following cell reselection to resume an ongoing circuit mode call upon arriving at a new cell.

41.1
Networks

Your radio holds a list of 101 allowed network identities (including 1 home network and 100 foreign networks) with a combination of Mobile Country Code (MCC) and Mobile Network Code (MNC).

The first network in this list must be your radio home network. Each network can have an associated name that can indicate to the user which network it is. Your radio can perform initial cell selection and registration on these networks. The same ISSI is used on all networks. You can limit registration to the home network only, or to a selected network only, and to ignore the other allowed networks.

Registration on any of these networks is performed using your radio Individual Short Subscriber Identity (ISSI) and without migration signaling.

Your radio selects the network registration method based on the following configurations in the configuration tool:

Migration Signaling
If the network supports migration, your radio registers to the network using migration signaling.

ITSI Attach
Your radio registers to the network using regular Individual TETRA Subscriber Identity (ITSI) attachment.

Automatic
Your radio uses migration signaling or ITSI attachment to register to the network, depending on the capabilities of the network.

Your radio operates in all networks similar to its operation in the home network, with some behavior configurable using the configuration tool. All group calls are placed using Short Subscriber Identity (SSI) addresses. It is the responsibility of the Switching and Management Infrastructure (SwMI) to reject calls for groups that the local system cannot reach, or connect the calls to another foreign system. Individual calls are placed using SSI addresses for intra-network calls, or TETRA Subscriber Identity (TSI) for inter-network calls.

If the registration method is ITSI Attach or if the Migration Encryption feature is enabled, the following features are configurable in the configuration tool for the foreign network:

- Authentication
- Air Interface Encryption (AIE)
- Encryption

NOTE: The telephone gateway interprets telephone numbers with the country code of the local country. For example, if you dial the number 01256-48-4566 in the UK, the system treats as if you dial +44-1256-48-4566.

41.1.1
Migration

NOTE: This is a Software Selling Feature.

The Migration feature enables your radio to migrate and register to a foreign network using migration signaling. This condition allows your radio to attach to talkgroups in the foreign network.

This feature consists of the following key functions:

- If you change talkgroup to one on a different network, your radio automatically migrates to this network or to one of the available networks. If the talkgroup is an Inter-System Interface (ISI) talkgroup, the talkgroup supports multiple networks connected through the ISI interface. Your radio can automatically migrate to an available network in the region. It is useful if the signal is lost as your radio attempts to establish communication with any available network. Your service provider must preconfigure the codeplug with the network before assigning it to talkgroups.

- The service provider can set the registration method to individual networks. Also, the service provider can set an automatic registration method, depending on the network broadcast.

The Migration feature supports individual call, group call, and individually addressed Short Data Service (SDS) or Status messages. To receive group calls or group-addressed Short Data Service (SDS) or Status messages from a group of the current network, your radio has to attach to the nominated group. To receive group calls or group-addressed SDS or Status messages from other networks, the attached talkgroup must be configured in the Switching and Management Infrastructure (SwMI) as an ISI talkgroup.

Your radio cannot migrate to a foreign network while it is in an active call.

41.1.2
Network Selection

In case the Migration is not supported, you can select one or multiple preprogrammed networks to register your radio to.

The following network options are only available when your radio is in Trunked Mode Operation (TMO) or Gateway mode:

Network Sel
In this option, you can select the network to which your radio is allowed to register.

Home Only
Your radio registers only to its home network, even if it finds a foreign network that is in range first.

Select Net
This option allows you to manually select a preferred network from a list of configured networks. As a result, your radio registers only to this selected network, even if it finds another network that is in range first.

Any Network
In this option, if the home network is not available, your radio selects the network automatically. Your radio registers to any network that is already configured into its codeplug list of networks. This option does not require manual selection. Network selection to another network is only performed at initial cell selection following a link failure and then only if the home network is not available.

TG Net Sel
This option is only available when the selected talkgroup is an Any Net or Inter-System Interface (ISI) talkgroup. You can select one or multiple networks determined by the selected talkgroup of your radio, or define the searching and registration priority of the network.

Home Only
Your radio registers only to its home network, even if it finds a foreign network that is in range first.

Select TG Net
Selecting this option displays the available networks of a selected talkgroup. If your radio is attached to an Any Net talkgroup, it displays the allowed multiple networks of the Any Net talkgroup that you can register to. If your radio is attached to an Inter-System Interface (ISI), it displays multiple linked networks that you can register to.

Prefer TG Net
Selecting this option displays the available networks of a selected talkgroup. If your radio is attached to an Any Net talkgroup, it displays the allowed multiple networks of the Any Net talkgroup that you can register to. If your radio is attached to an Inter-System Interface (ISI), it displays multiple linked networks that you can register to. The selected network has the first priority during network searching and registration.

Any TG Net
This option indicates that your radio can register to any available networks of a selected talkgroup. If your radio is attached to an Any Net talkgroup, it can register to networks allowed by the Any Net talkgroup. If

your radio is attached to an Inter-System Interface (ISI) talkgroup, it can register to any available linked network.

If your radio selects a network different from the current one, your radio may force initial cell selection to find a cell that belongs to the home or the selected network. In the selected network option, your radio displays a list of network names where each network name corresponds to one of the Mobile Network Identities (MNI) in the list. The network names are configured in your radio as part of the configuration of the MNI list.

41.1.3
Multi-System Operation

Your radio holds a list of up to 100 allowed network identities – Mobile Country Code (MCC) and Mobile Network Code (MNC) combinations, that are considered friendly networks. The first network in this list must be your radio home network.

Each network can have an associated name that can indicate to the user which network it is. Your radio can perform initial cell selection and registration on these networks. Registration on any of these networks is performed using your radio Individual Short Subscriber Identity (ISSI) and without migration signaling. The same ISSI is used on all networks. You can limit registration to the home network only, or to a selected network only, and to ignore the other allowed networks.

In case the Base Transceiver Station (BTS) does not support the migration defined by European Telecommunications Standards Institute (ETSI) standard, multi-system operation is only supported as follows:

You can change the network mode using the MMI. A top-level menu item called **Networks Sel** allows choosing between **Home Only**, **Select Net**, and **Any Net**. If your radio chooses a network different from the current one, your radio forces initial cell selection to find a cell that belongs to the home or the selected network. In the selected network option, a list of network names, where each network name corresponds to one of the MNIs in the list, is displayed. The network names are provisioned in your radio as part of provisioning of the MNI list. The network alias or MNI of the current network is displayed on the first line of the idle display.

Home Only
In this mode your radio recognizes only the first system in the allowed list. As a result, your radio registers only on its home network, even if a foreign network is in range and is found first.

Select Network (Select Net)
In this mode your radio recognizes only the system you selected in the list of allowed systems. As the result, your radio registers only on this selected network, even if another network is in range and is found first.

Any Network (Any Net)
In this mode radio selects the network automatically where the home network is not available. Your radio registers to any network that it finds that is already programmed into its codeplug list of networks, whereby no user manual selection is required. Network selection to another network is only performed at initial cell selection following a link fail and then only if the home network is not available. Your radio uses its own ISSI.

Your radio operates in all networks as it does in its home network. All communications are placed using SSI addresses, and it is the Switching and Management Infrastructure (SwMI) responsibility to reject communications for subscribers or groups that cannot be reached in the local system.

NOTE: The telephony gateway interprets telephone numbers with the country code of the local country. For example, if you dial the number 01256-48-4566 in the UK, it is treated as if you dialed +44-1256-48-4566.

For description of other BTS supported migrating modes used, refer to Air Interface Migration and Dynamic Air Interface Migration sections.

41.2

Frequency List Type

Your radio can find a wide range of main control channels. Your radio maintains stored lists of carrier frequencies which are scanned in order. The use of these lists is designed in such a way as to minimize the time it takes to find a valid cell.

There are four types of frequently list. Your radio can use all four frequency lists to speed up registration process after a power cycle or loss of Trunked Mode Operation (TMO) coverage.

No.	Type	Description
1	Last Known Frequencies List	A list of discrete entries of up to the last 32 frequencies stored in the configuration tool or in the SIM Card. This is a dynamic list which shall be populated and maintained by your radio only. The purpose of this list is to hold the frequencies of the last serving cell and its neighbors. Scanning this list first will allow the terminal to quickly find the last cell it was on, or one of its neighbors. The first frequency from that list is the frequency of last serving cell.
2	Discrete Frequencies List	A second list of discrete entries of up to 32 frequencies specified and programmed by the operator. This list can be used to hold frequencies most likely to be encountered by your radio, or frequencies that are preferred over others. This list is not available on the SIM card, radios that use a SIM card shall obtain this list from the codeplug.
3 and 4	2 Frequency Ranges	A pair of frequency range specifications which will each cover one range of frequencies to be scanned. Each range is specified by a start frequency, then your radio scans all frequencies in 25 kHz intervals in the specified range. Having two separate range specifications allows for two non-contiguous blocks of frequencies or two different offsets. This list is not available on the SIM card, radios that use a SIM card shall obtain this list from the codeplug.

NOTE: The discrete frequencies list and the frequency ranges are programmed in the factory, or by the system/network operator using the Configuration tool. They are not modified by the radio software.

41.3

Initial Cell-Reselection

Upon power up, link failure or anytime no valid neighbors have been identified, the terminal will be capable of finding any TETRA system. This will be done by maintaining lists of frequencies which are candidates for TETRA operation.

The use of these lists is designed in such a way as to minimize the time it takes to find a valid cell. A carrier shall be considered a candidate for selection, if the average RSSI is greater than or equal to a minimum signal strength threshold provisioned.

Upon selection of a cell, cell acquisition is started by first scan for a TETRA signal if the cell is not synchronized.

41.4
Registration

On camping on a cell, your radio sends a registration request Protocol Data Unit (PDU) to the Switching and Management Infrastructure (SwMI), which includes a request to attach to the selected talkgroup.

If the registration and attachment succeed, your radio begins normal operation on the cell. If the registration attempt times out, or the SwMI rejects the registration for a temporary reason, another registration attempt is made. If both attempts fail, your radio attempts to camp on a different cell.

If the SwMI denies the registration request due to the location area rejection, your radio does not attempt to register again at this cell until the next power-on. Your radio supports the modification of its subscriber class on receipt of a new subscriber class from the SwMI in the registration acknowledgment PDU. This subscriber class is used until turning off your radio or next Individual TETRA Subscriber Identity (ITSI) attach.

Your radio does not send registration signaling when one of the following occurs:

- Roaming and registration fail before your radio receives the random access acknowledgment and your radio goes back to the last serving cell.
- Your radio discovers a link failure on the serving cell, the link failure is shorter than the predefined timer and your radio is not in the transmit inhibit mode.
- Your radio discovers a link failure on the serving cell and is in the transmit inhibit mode. In this case, your radio always goes back to the serving cell without registration and stays in the transmit inhibit mode until the mode is turned off.

NOTE: When two or more scenarios occur at the same time, your radio registers with signaling.

If your radio discovers a link failure on the serving cell, a specific timer starts counting. If the link failure remains after the timer expires, then your radio acts as during a normal link failure. If the link failure ends before timer expires, then your radio goes back to the serving cell without registration. This mechanism ensures that unnecessary registration is avoided.

When a radio is out of the serving cell range for a period shorter than configured in the codeplug, then your radio does not register to go back in the range.

41.5
Cell Roaming

Your radio continually monitors neighbor cells and scans the highest ranked neighbor cell.

When the state of the highest ranked neighbor cell is sufficiently better than the serving cell, or when your radio has lost the serving cell, your radio employs cell reselection procedures using the following methods:

- Undeclared cell reselection – if not in a call.
- Unannounced cell reselection – if in a call and not transmitting or link failure occurs.
- Announced type-3 cell reselection – If transmitting in a call and no neighbor has been scanned or the cells are not synchronized.
- Announced type-2 cell reselection – If transmitting in a call, and a neighbor has been scanned, and the cells are synchronized.
- Announced type-1 cell reselection – It is also known as seamless handover. If a radio is transmitting in a call and asks its serving cell to perform the reselection, the Switching and Management Infrastructure (SwMI) performs all the roaming signaling. Your radio then moves straight to the traffic channel on the new cell and continues the call without call restoration. Seamless handover enables radio to roam faster between cells while transmitting and eliminates voice interruption during calls.

For compatibility with systems that do not support type-1 or type-2 cell reselection, your radio can be provisioned to never perform these types of reselection.

Your radio decides on the need for cell reselection, based on comparison of the signal strength and the service level between the serving cell and neighbor cells. The service level criteria are based on the following criteria listed in priority order:

1. System Wide Services available (Local or Wide Trunking)
2. Valid or Invalid Subscriber Class
3. Relinquishing criteria
4. Preferred MNI criteria
5. Congestion level
6. Security Class
7. Subscriber Class
8. Quadrature Amplitude Modulation (QAM) availability
9. Home Location Area (Home Location area)
10. Location Area (LA) Boundary
11. Cell Load
12. Local Site Trunking (LST) Services

Your radio prefers a cell that has a higher service level to one with a lower service level. If your radio is operating on a serving cell that has a lower service level than a neighbor cell, your radio roams to the neighbor, even during a call.

During network reconfiguration, a significant number of radios registered on one cell may roam. This roaming can cause major congestion on specific cells. To avoid the congestion on control channels for the specific cells, the specified radios roaming should be distributed in time.

As the operation cannot be performed immediately for all your radios, some of the radios must wait longer to roam. The time cannot be programmed not to cause any of the radios to have inferior roaming capabilities. Thus the roaming time for the radios is randomized.

The randomization means that after roaming scenario starts, a radio is not sending registration parameters to other cells at once but waits random time before sending registration Protocol Data Unit (PDU) to other cells. To avoid unwanted delays in restoring the link, link failures and other related scenarios are not randomized.

41.6 Channel Selection

Each TDMA frame on a given carrier comprises four time slots, which any slot can be used as a physical channel.

The following types of physical channels are available:

- Traffic physical (TP) channel - used primarily for circuit call traffic.
- Control physical (CP) channel - dedicated only for signaling.
- Packed Data Control (PDCH) channel - dedicated for Packet Data traffic.
- Unallocated physical (UP) channel.

The following types of control channels are available:

- Main Control Channel (MCCH) - occupies the first slot of the main carrier.

- Secondary Control Channel (SCCH) - can be used to extend Control Channel capacity.

  NOTE: This is a Software Selling Feature.

The following types of SCCH are available:

- Common SCCH
- Assigned SCCH

In addition to the MCCH, a cell can have up to three common SCCHs, which could occupy slots 2, 3, and 4 in the main carrier. This solution allows your radio to distribute its population among up to four channels and so to increase Control Channel capacity at the expense of traffic channel capacity.

Until having received a specific parameter on a cell, your radio uses the MCCH. When the signal is received, each radio maps itself to a particular common SCCH, and that SCCH operates as the MCCH for your radio.

41.7 Call Restoration

Call restoration allows your radio roams to a new cell during a call, to resume the on going call upon arriving at the new cell. Cell reselection and call restoration procedures are employed for this attempt.

If your radio is a transmitting party in the call, the announced cell reselection is employed (if possible). Call restoration procedures are performed in the new cell.

If your radio is a receiving party in the call, your radio employs an unannounced cell reselection, followed by the call restoration procedures.

Call restoration is applicable for:

- Group call
- Private call
- Phone call

41.8 Mobility Service Level

Terminal mobility indicates the ability of a terminal to acquire, register, and operate on an appropriate TETRA network. The terminal is also able to change cells when the conditions require it with a minimum interruption of services.

For each neighbor cell, your radio determines the service level based on the cell's parameters as compared with the serving cell. Neighbors are not compared between each other. Each neighbor cell shall be scored as follows:

- The serving cell is Better than this neighbor cell.
- The serving cell is the Same as the neighbor cell.
- The serving cell is Worse than the neighbor cell.

To validate if serving is better/same/worse than checked neighbor, your radio shall use the service level criteria.

If the serving cell is found to be Better or Worse than the neighbor cell for a given criterion then the service level of the neighbor has been determined, and the subsequent criteria shall not be evaluated.

If all criteria for a neighbor cell are the same as the serving cell, then the serving cell shall be considered the same as the neighbor cell.

41.8.1
Operating Mode

There are two types of operating mode in a cell, Wide Mode and Local Site Trunking.

- Wide Mode - System-Wide services supported
- Local Site Trunking - System-Wide service temporary not supported. If system broadcasts indicate that system-wide services are not available (LST) on a cell, your radio registers on this cell only if there are no system-wide cells available.

Depending on the infrastructure settings, when your radio is operating on an LST cell, your radio may prevent you from invoking the following services:

- Private call
- Phone call
- Private Automatic Branch Exchange (PABX) call
- Packet data
- Short Data Service (SDS) data

Depending on the codeplug configuration, your radio may indicate entering the LST with the following notifications:

- Visible and audible
- Visible
- Audible
- None

To avoid unnecessary roaming and reduce congestion, Local Site Trunking Ignoring feature can be enabled. When Local Site Trunking Ignoring feature is enabled, your radio temporarily ignores the LST/WST parameter when selecting a site. However, your radio still takes other parameters such as the Radio Signal Strength Indicator (RSSI) level of the cell into consideration when deciding on roaming.

The system wide services evaluation is split in two sub-criteria:

- The System-Wide criteria, which will discourage your radio from going from a wide area service cell to a local service cell, as well as encourage your radio to go from a local service cell to a wide area cell – with the rationale that wide area service is always better than local service.
- The LST criteria, which will discourage your radio from going from one local service cell to another local service cell – with the rationale that such roaming may improve RF conditions, but will destroy any ongoing communication.

The reason for this split is to allow other criteria to be evaluated when on a local service cell. The home location area criteria will thus work also between two LST cells.

41.8.2
Congested Cell Handling

This feature is used only during initial registration and when roaming between sites. It is not used when camped on a site that has become busy or congested due to no free traffic channel to make or receive calls.

When the cell that the terminal is trying to register is congested, a special level-based algorithm is in the place. Depending on the level of congestion, the terminal is waiting for the registration or is rejected on that cell.

The terminal recognizes whether the cell is congested (Control Channel Congestion). The terminal tries to roam to not congested cells first, ranking congested ones as secondary. The cell congestion is one of the service level criteria.

The following cells are never marked as congested.

- Last suitable cell - if there are no other suitable cells during roaming or initial cell selection.
- Serving cell.

The feature is configurable using the configuration tool.

41.8.3
Subscriber Class

When your radio powers up, or whenever it performs registration or roaming, it always uses its provisioned Subscriber Class (SC).

When your radio registers on a cell that does not support any of its SCs, it is active only in services that have the emergency priority.

Whenever your radio SC does not match the cell SC (the feature is configurable using the configuration tool), it either uses normal ranking procedures (see Cell Roaming on page 164), or does not roam to the cell at all.

41.8.4
Subscriber Class by Talkgroup

NOTE: This is a Software Selling Feature.

You can configure up to 16 Subscriber Class by Groups in the configuration tool by assigning talkgroups to Subscriber Classes. The talkgroups can be assigned to more than one Subscriber Class according to the Group Short Subscriber Identity (GSSI) or by the folder of the talkgroup, except for the Favorite folder. If a talkgroup is assigned to more than one Subscriber Class, your radio uses the first assigned Subscriber Class.

A radio Subscriber Class changes when the user changes to a talkgroup with a different Subscriber Class. A Subscriber Class received from the Switching and Management Infrastructure (SwMI), over the air, has a higher priority than Subscriber Class by Groups. If your radio is not already using this Subscriber Class, it automatically changes to it.

The Subscriber Class by Talkgroup feature is useful in the following examples:

Preserving traffic channel capacity.
Two cells with the same coverage are placed together to multiply traffic capacity. Radios attached to Talkgroup 1 are registering on these two cells. As a result, traffic channel capacity is reduced as two channels are being used. The Subscriber Class by Talkgroup feature directs radios registered on the second cell to roam to the first cell, thus increasing traffic channel capacity.

Distributing radios across cells and prohibiting them from roaming to mismatched cells.
When there are many radios in a small area with multiple Base Transceiver Station (BTS), congestion occurs because of high roaming traffic. The Subscriber Class by Talkgroup feature directs radios attached to the same talkgroup to roam to a matching Subscriber Class cell. Also, it does not allow radios to roam to a mismatched Subscriber Class cell.

The Subscriber Class by Talkgroup feature does not apply to supergroups as they are regarded as scanned groups.

41.8.5

RF Power Class Toggle

NOTE: This is a Software Selling Feature.

The RF power toggle is a radio-specific hardware feature enabling your radio to change the transmit power from Class 4 to Class 3L, or Class 4 to Class 3.

Depending on the codeplug settings, you can toggle through the interface, between high power (Class 3L or Class 3) and normal RF power (Class 4).

The radio can be configured to switch automatically to Class 3L (1.8 W) or Class 3 (2.8 W) on entering Direct Mode Operation (DMO) and to automatically switch to Class 4 (1 W) on entering Trunked Mode Operation (TMO).

Changing RF power class is performed immediately. The change can be done, for example, during an active communication. Such action may result in dropping the communication, as the selected power class setting can be insufficient to sustain the transmission.

Chapter 42

Location Service

The location service feature uses information from GPS satellites orbiting the Earth to determine the approximate geographical location of your radio.

Your radio supports the following navigation constellation:

- All navigation satellite systems
- Global Navigation Satellite System (GLONASS)
- Galileo
- BeiDou Navigation Satellite System (BDS)
- Satellite-Based Augmentation System (SBAS)

The GPS Location Service availability, accuracy, and the position calculation time vary depending on the environment in which you use your radio. The GPS Location Service can assist your dispatcher or colleagues in many ways such as more efficient deployment of resources or locating your radio when you trigger your emergency service.

Your radio can display the location information directly on the screen or send it over-the-air to your dispatcher to display it in the control center. Check your radio configuration details with your service provider.

The GPS icon is displayed in the status area when GPS has a location fix. Optionally, your service provider may configure your radio to always display the GPS icon, even outside of GPS coverage or before your radio has acquired a location fix, that is, right after being powered on. In this configuration, the GPS icon blinks until a location fix is acquired.

IMPORTANT: Where the signals from satellites are not available, the GPS Location Service does not work. This situation usually happens when your radio cannot establish a view of a wide area of open sky, for example, when your GPS antenna is covered or facing the ground. Such situations include being:

- In underground locations
- Inside buildings, trains, or other covered vehicles
- Under any other metal or concrete roof or structure
- Near a powerful radio or television tower
- In extreme temperature outside the operating limits of your radio

Even if your location information can be calculated in such situations, it may take longer to do so. Therefore, in any emergency situation, always report your location to your dispatcher. Where adequate signals from multiple satellites are available, your GPS Location Service feature provides a location, most probably near to your actual location.

Enhance GPS Performance

When the GPS feature is unable to complete a location calculation successfully, you hear an audible tone indicating that your radio cannot see the satellites. To maximize the ability of your radio to determine a location fix, please note the following guidelines:

Stay in the open

The GPS feature works best where there is nothing between your radio and a large amount of open sky. If possible, go outside, away from tall buildings and foliage. While the performance in a building is improved by moving closer to windows, glass with certain sun shielding films may block satellite signals.

Position your radio to enhance reception

Signals from GPS satellites are transmitted to your GPS antenna, which is in your radio antenna. Hold your radio away from your body, giving the antenna clear access to satellite signals. Do not cover the antenna area with your fingers or anything else.

Stand still

If possible, stand still until your radio is finished determining your location. Moving your radio at a walking pace while your radio is calculating your approximate location may substantially decrease GPS performance.

This feature works best where there is nothing between your radio and a large amount of open sky. To maximize the ability of your radio to determine a location fix, avoid closed space, tall buildings, and foliage. If possible, do not use this feature in underground parking lots, tunnels, under bridges, and close to high buildings.

Your radio supports viewing your radio position and the status of the visible satellites is available. The position may consist of longitude and latitude, UK, or Irish grid coordinates.

Use the following two methods to configure the GPS feature parameters:

Configuration tool

The configuration tool provides a default profile.

Over-the-air

The commands received over the air may overwrite the default profile configuration.

The profile assigned to your radio determines when to send location data, what data to send with what accuracy and to what address.

All data requests and configuration commands received over the air are checked to confirm that they have come from a trusted source.

Location reports are accepted only from authorized Individual Short Subscriber Identities (ISSI) or IPs, depending on the configured transport layer of SDS or Packet Data.

You can enable or disable the GPS Location Service through your radio interface. If this feature is disabled, the Location Service Configuration can be programmed to the following parameters:

- Receiver – GPS Receiver is disabled. Your radio responds to location requests by informing that location reporting is disabled.
- Receiver and Location Protocol – GPS Receiver and Location Protocol are disabled. Your radio does not respond to any location requests.

Once the GPS Location Service is re-enabled, your radio restores its location service.

Your radio supports GNSS triggers functions to report GNSS positions when your radio meets a set of criteria. Your service provider can set up the following triggers, together with their specific parameters:

Table 37: GPS Triggers

LIP Triggers can be configured for TMO only, DMO only, or both modes at the same time.

Trigger Type	Trigger Event
Power-up	Radio powers up in TMO.
Power-down	Radio powers down in TMO.
Emergency condition	Radio enters emergency operations.
Periodic	Given time interval after the last location report expires.
Moved	Radio position has changed by at least the distance defined (your radio checks the movement from the last known position at an interval).

Trigger Type	Trigger Event
TMO ON	Successful registration on entering TMO from DMO.
DMO ON	Before TMO de-registration, and before entering DMO.
Transmit Inhibit Mode (TXI) ON	Radio is about to enter TXI.
Transmit Inhibit Mode (TXI) OFF	Radio has successfully registered after leaving TXI.
Low battery	Radio detects its battery level has reached or fallen below the level specified by service provider.
Loss of GPS	Radio detects a loss of GPS for a minimum duration defined by service provider.
Recovery of GPS	Radio detects a recovery of GPS signal for a minimum duration defined by service provider.
Status entered (Status and RMS Status)	Radio sends a status defined in the codeplug for location reporting by pre-programming.
Car Kit Connected	Radio detects that a Car Kit has been connected.
Car Kit Disconnected	Radio detects that a connected Car Kit has now been disconnected.
GPS ON	Positioning device has been switched ON.
GPS OFF	Positioning device in your radio is switched OFF.
Emergency Periodic Profile (LRRP only)	Radio is in emergency operation and given time interval after the last location report expires.

42.1

Location Service over Packet Data

This feature enables a radio to use the Location Service over Packet Data instead of standard Short Data Services (SDS).

When the Location Service feature is enabled and the GPS services have been turned on using the radio interface, the radio requests for Packet Data context activation.

With turning off the GPS using the radio interface, Packet Data service deactivates. The ongoing Packet Data session deregisters. For the GPS over Packet Data, triggers and location information are sent or received while Packet Data is activated. It is carried out similarly to the standard GPS over SDS.

When the GPS over Packet Data is enabled, sending, or receiving triggers and location information during Direct Mode Operation (DMO) or Emergency Mode is not possible.

If a Packet Data connection cannot be established, the radio is not able to send or receive GPS data.

42.2

Different Location Displays

Table 38: Different Location Displays

Latitude/Longitude	UK Coordinates	Irish Coordinates	UTM Coordinates	MGRS Coordinates
Time	Time	Time	Time	Time

Latitude/Longitude	UK Coordinates	Irish Coordinates	UTM Coordinates	MGRS Coordinates
Latitude	2-Letter Code	1-Letter Code	3-Letter Code	3-Letter Code and 2-Letter Code
Longitude	Easting and Northing Coordinate	Easting and Northing Coordinate	Easting and Northing Coordinate	Easting and Northing Coordinate
Altitude	Altitude	Altitude	Altitude	Altitude
Satellites	Satellites	Satellites	Satellites	Satellites

- Time – Indicates when the last time the location was calculated. The time is provided in Universal Time Coordinated.
- Letter Code – Grid zone or square on the map for different coordinate standard.
- Latitude – Expressed in degrees, minutes, and seconds.
- Longitude – Expressed in degrees, minutes, and seconds.
- Number of satellites – Used to calculate the location. In general, more satellites provide better accuracy. The maximum is 12 satellites.
- Easting – Refers to the eastward-measured distance expressed in meters.
- Northing – Refers to the northward-measured distance expressed in meters.

NOTE: Skipping each digit of easting and northing coordinates decreases the accuracy by the factor of 10.

42.3 GPS Accuracy

The GPS Location Service accuracy depends on the GPS coverage and the selected accuracy mode.

In good GPS coverage (at least -137 dBm or in open sky), the location accuracy presents as follows:

- In high accuracy mode, the accuracy is:
  - 5 m for 50% of location reports.
  - 10 m for 95% of location reports.
- In power optimized or normal mode, the accuracy is:
  - 20 m for 50% of location reports.
  - 50 m for 95% of location reports.

NOTE:
The presented values depend on variety of factors, for example the view on the sky. To optimize the GPS performance your radio should have the clearest possible view of the open sky.

The use of the high capacity battery is recommended, especially when high accuracy mode is used.

42.4 Location Report

Your radio can record location track when it is out of service, when in Direct Mode Operation (DMO), or when in Transmit Inhibit (TXI) mode.

Your radio can be triggered to send Location Reports in various circumstances, for example:

- Upon a request
- Entering Emergency Mode
- At specified time intervals
- At specified distance intervals

The Location Reports can be sent in two ways using:

Short Data Service (SDS)

The Location Reports are sent using SDS with User-Defined Data Type-4 as a Transport Layer (SDS - TL), using one of the methods below:

- European Telecommunications Standards Institute (ETSI) Location Information Protocol (LIP)
- Motorola Solutions Location Request/Response Protocol (LRRP) GPS Location Protocol, which uses either:
  - SDS - TL (for added reliability)
  - Simple GPS with no SDS - TL (for saving air interface resources)

Packet Data (Trunked Mode Operation (TMO) only)

Packet Data must be enabled on the network to send Location Reports using Packet Data. When this feature is enabled, your radio requests for Packet Data context activation. Triggers and location information sent or received are carried out similarly to the SDS. Sending or receiving triggers and location information during Direct Mode Operation (DMO) or Emergency Mode is not possible.

Disabling this feature using your radio interface deactivates the Packet Data service and the ongoing Packet Data session deregisters.

If the Location Reports are sent over the Packet Data, a Packet Data icon is displayed when the message is being sent. If a Packet Data connection cannot be established, your radio is not able to send or receive GPS data.

Location reports are sent in TMO. Your service provider can also provision location reports to be sent in Direct Mode Operation (DMO). If configured, Location Information Protocol (LIP) sends the emergency trigger LIP report in emergency priority when the radio is in emergency mode or emergency call. If your radio is provisioned to provide user indications, the feature operational status is indicated on your radio display. Also, if configured by service provider, your radio gives an audio-visual notification upon reception of LIP command.

Location Report Backlog

The location reports generated during this time is stored, and all location report backlog recordings are uploaded once your radio is back in service. Your radio can save up to maximum 180 location reports. The location report backlog function differently when in different mode:

Location Backlog Recording in Trunked Mode Operation (TMO)

Your radio starts recording location reports when radio is out of service in TMO Mode.

Your radio resumes latest location reporting when TMO coverage is regained.

Location Backlog Recording in Direct Mode Operation (DMO)

Your radio starts recording location reports in DMO Mode.

Your radio resumes latest location reporting when it switches back to TMO mode.

NOTE: This feature is only available when enabled by your service provider.

Location Backlog Recording in Transmit Inhibit Mode (TXI)

When your radio is in TXI mode, location reports are generated and recorded but not sent out.

Once your radio exits TXI mode and is within TMO coverage, the location reports are uploaded to the server.

42.5

Military Grid Reference System

NOTE: This is a Software Selling Feature.

The Military Grid Reference System (MGRS) is the geo-coordinate standard used by the military for locating points on Earth. The MGRS attempts to represent the entire surface of Earth on a worldwide grid. The grid is based on the UTM (Universe Transverse Mercator) between 80° S and 84° N latitudes and UPS (Universal Polar Stereographic) systems.

The UTM area is divided into 60 longitudinal strips, each 6° wide. The strips are numbered 1–60 beginning at the 180°–174° W (Zone 1) and increase to the East. Each strip (or Zone) is then divided (horizontally) into 8° latitude bands.

NOTE: An example of an MGRS coordinate would be **19TDJ3858897366**, which consists of:

- **19** is the UTM Zone Number
- **T** is the corresponding UTM latitude band letter
- **DJ** is the MGRS Grid Reference used to define the 100 km square within the UTM/UPS block. The columns A-Z (excluding "I" and "O"), like UTM, start at 180° and increase towards the East. Every three columns, the pattern repeats. Letters designating rows, increase towards the North. The letters cycle backwards through the alphabet in the southern hemisphere (towards the South):
  - **D** is the MGRS column letter
  - **J** is the MGRS row letter
- **38588** is the 5-digit MGRS Easting value. It represents the number of meters East of the origin (that is, southwest corner) of the 100 km square in which it is contained.
- **97366** is the 5-digit MGRS Northing value. It represents the number of meters North of the origin (that is, southwest corner) of the 100 km square in which it is contained.

MGRS Support feature can be programmed in configuration tool. You can choose to display the GNSS/GPS coordinates in MGRS format.

Chapter 43

Packet Data

In Trunked Mode Operation (TMO), your radio provides a TETRA bearer service for applications that use the IP protocol. This service is available to external applications by connecting using the PEI.

Your radio operates on the single-slot packet data channel by default or the multi-slot packet data channel. The multi-slot packet data channel is a Software Selling Feature.

Your radio supports TETRA standard multi-slot packet data using the IP network layer protocol through Point-to-Point Protocol (PPP), and TETRA SNDCP protocol. The IP connection is established between Terminal Equipment and Mobile Terminal, allowing external applications to communicate with Terminal Equipment using predefined IP addresses.

NOTE: This IP connection is referred as the local link. The link between your radio and the Switching and Management Infrastructure (SwMI) is referred as the wide link. When a wide link is established, your radio is in the wide mode.

Packet data applications reside internally, over UDP, or in an externally connected device, connected using a USB cable port in your radio.

Communication to external radio is initialized using AT commands. Once connection is established, the external application requests and operates in Point-to-Point Protocol (PPP) mode until data connection terminates.

The system provides Point-to-Point IP connectivity allowing the following datagram exchanges.

- Radio ←→ External Equipment (Terminal Equipment) (for example PC).
- External Equipment (Terminal Equipment) ←→ Network (through radio).

Your radio supports only IP version 4 packets. Your radio routes datagrams independently of the protocol sitting on top of IP.

Your radio supports an MTU of 1500 bytes.

Your radio provides a best effort delivery service. If the delivery fails due to your radio environment, your radio generates ICMP messages addressed to the Terminal Equipment. Delivery may fail due to the following reasons:

- No radio coverage.
- Failed transmission.
- Service interaction.

The packet data service Packet Data Channel (PDCH) access signaling has the same priority as a circuit mode setup-related signaling. Your radio uses advanced link for packet data transmission and supports advanced link flow control. If the link does not disconnect between cells, advanced link roaming is supported.

Your radio does not support data compression. Application attempts to negotiate data compression during context activation is rejected. If the SwMI sends a data compressed IP packet, it is silently discarded.
Your radio supports IP header compression negotiation received from Terminal Equipment during Packet Data Protocol (PDP) context activation and transparently transfers IP packets with the header compression between Terminal Equipment and the SwMI.

The packet data service employs the TETRA standard cell selection and re-selection. The packet data service suspends while the re-selection is occurring, and resumes when the cell re-selection procedure completes.

NOTE: The cell re-selection is undeclared in a strict TETRA case. However, the SNDCP protocol defines a procedure for reconnecting the packet data service on the new cell. In this case, the cell re-selection procedure resembles the unannounced cell re-selection procedure.

43.1 Voice and Data Support

Your radio can alternate voice and packet data service. However, voice and data running in parallel are not supported. This behavior corresponds to Packet Data (PD) Type B - IP dual mode.

If the Switching and Management Infrastructure (SwMI) rejects the context activation due to `PD MS type not supported`, your radio re-initiates context activation indicating that supports Type C. It is done to accommodate legacy SwMIs that uses an older definition of these types.

Your radio supports transmitting and receiving Short Data Services (SDS) on the Packet Data Channel (PDCH). Thus, these services may be conducted in parallel.

Your radio can operate in one of the voice-data interaction modes.

Voice Only Mode

You can select **Voice Only mode**, in which PD service is disabled. If an external application attempts to start up in this mode, PD registration for a wide link is rejected. If the PD service is active when this mode is selected, your radio deactivates PD. The PEI operates in the local mode only (data transfer between Terminal Equipment (TE) and Mobile Terminated (MT)).

Data Only Mode

You can select **Data only mode**, in which normal voice calls are not permitted. Incoming non-emergency voice calls are rejected, and you cannot initiate non-emergency voice calls. Incoming and outgoing emergency calls are allowed.

Voice and Data Mode

In **Voice and Data mode** any voice call activity that occurs during a data session takes priority over the PD. Once a voice call has interrupted the data session, the PD session is suspended, until the voice activity has ended. Then the session is resumed. Voice priority mode is the default mode.

You can choose one of the interaction modes. The choice of interaction mode is stored in non-volatile memory and remembered at power-up.

In **Voice and Data mode**, if your radio moves to the traffic channel due to the voice service, your radio terminates any active packet data transmission or reception. The data service is suspended. The data service resumes when the voice service ends.

Your radio accepts any downlink SDS message received on the PDCH. Your radio can send uplink SDS messages on the PDCH.

Your radio allows PEI, GNSS/GPS, and WAP packet data applications to activate and use the packet data context simultaneously. The first application initiates PD context activation. The next PD context activation from another PD application results in sending a reply indicating that the PD context is active. When WAP, GNSS/GPS, and PEI PD applications are using the active PD context, your radio can filter the downlink IP packets based on their TCP/UDP port. UDP packets addressed to the WAP port (configured in the codeplug) are routed to the WAP internal application.

- UDP packets addressed to the GNSS/GPS port (configured in the codeplug) are routed to the GNSS/GPS internal application. UDP packets not addressed to the WAP nor the GNSS/GPS ports are routed to the PEI, using Point-to-Point Protocol (PPP).

NOTE: When activating another PD context on your radio, use the same settings in both PD contexts.

43.2
Packet Data IP Addressing

Table 39: Packet Data IP Addressing

Addressing Mode	Description
Wide IP Address	An IP address may be assigned to the terminal by the SwMI during the Packet Data (PD) context activation. When assigned, both Terminal Equipment and Mobile Terminal applications use this address as the source address in IP packets delivered to the infrastructure.
Local IP Address	By default both Terminal Equipment and your radio have their own IP addresses. Terminal Equipment and Mobile Terminal use these addresses for local datagram transmissions between Terminal Equipment and Mobile Terminal only and are not passed to the SwMI.
Static or Dynamic IP Address Assignment	The terminals support static and dynamic IP address assignment. The dynamic support is requested in the following situations: • **Request a Dynamic IP Address** is set to **Dynamic** and the PD Application Type is your radio internal PD application. • **Request a Dynamic IP Address** is set to **Dynamic** and the PD Application Type is a PEI PD application requesting dynamic IP address.

43.3
Packet Data User Authentication

The Packet Data (PD) user authentication is a method of authenticating the Terminal Equipment (TE) user before allowing the packet data link activation.

A PD Authentication server connected to the Switching and Management Infrastructure (SwMI) authenticates the Terminal Equipment user. The terminal only sends the messages between the Terminal Equipment and the SwMI. In the wide mode, the terminal offers Point-to-Point Protocol (PPP) user authentication between Mobile Terminal and Terminal Equipment using Password Authentication Protocol (PAP) or Challenge Handshake Authentication Protocol (CHAP), before the IP link is established. The terminal always attempts to negotiate usage of the CHAP method. However, the radio agrees to use PAP, when the Terminal Equipment application insists. If the terminal does not require PD user authentication, it operates without any user authentication. However, if the terminal requires the PD user authentication, it rejects the Packet Data Protocol (PDP) context activation.

NOTE: If the SwMI does not agree for the authentication method, for example PAP, the SwMI can reject it.

Chapter 44

TETRA Network Protocol 1

TETRA Network Protocol type 1 (TNP1) is a bridge protocol based on the TETRA layer 3 over the air protocol. The TNP1 supports all TETRA dispatch functionality.

In the Trunked Mode Operation (TMO), the TNP1 specifies a protocol for use over the PEI, that allows Terminal Equipment (TE) to have control over the TETRA services: mobility management, call control, short data service, and supplementary services: send GNSS/GPS reports, software information, and battery state information. In addition, commands to access your radio configuration and storage parameters are available.

Your radio supports TETRA standard packet data using the IP network layer protocol.

Your radio can operate both on the single slot packet data channel and the multi-slot packet data channel.

Packet data applications reside internally, for example: GNSS/GPS reports, WAP, or in an external device connected to the 8–wire RS232 data port on your radio. Communication to the external device is initialized using AT commands.

The system provides point-to-point IP connectivity allowing the following datagram exchanges:

- Radio ←→ External Equipment (TE) (for example PC).
- External Equipment (TE) ←→ Network (through radio).

Your radio supports IP version 4 packet.

TNP1 services can use one of two Point-to-Point Protocol (PPP) methods to connect from the terminal equipment to your radio, local mode, and wide mode. The TNP1 should be used in wide-mode wherever possible, to allow the parallel operation of TNP1-SDS services and packet data services over a common PPP link.

If the transmit inhibit is entered, your radio drops the wide mode connection, thus the PEI goes back to AT mode. Then the TNP1 client detects this change and re-initiates the PPP session in local mode.

Your radio disables the TNP1 session while being in the Direct Mode Operation (DMO).

AT commands are used to initiate the PPP service for TNP1 to operate. Once the PPP session is running all AT commands are blocked. When the PPP session is closed, AT commands are available.

44.1 TETRA Network Protocol 1 IP Addressing

Table 40: TETRA Network Protocol 1 (TNP1) IP Addressing

Addressing Mode	Description
Wide Mode	All TNP1 services are available including packet data transfer towards the Switching and Management Infrastructure (SwMI). The address used is the dynamic address radio IP or configured statically.
Local Mode	All TNP1 services are available except packet data transfer. The addresses used are the two static addresses TE IP: 10.0.0.101 and MT IP: 10.0.0.100.
Port Address-ing	Your radio uses a fixed port address for reception and transmission of TNP1 packets. The port number is 4024.

Chapter 45

Wi-Fi

IMPORTANT: When the **Wi-Fi** function is enabled, and **Active Scanning** is constantly turned on, an attacker can use the Wi-Fi signal to identify and monitor the location of your radio. When a Wi-Fi feature is required for Active Scan, you are recommended to enable the **Wi-Fi Auto Off** feature to minimize your risk.

Wi-Fi features enable your radio to connect to a network wirelessly. You can set up and connect Wi-Fi network to update your radio firmware and codeplug.

Your radio supports WPA, WPA2-PSK, and 802.1x EAP-TLS.

Frequency Bands

IEEE 802.11n supports both 2.4 GHz and 5 GHz unlicensed frequency bands. These unlicensed bands enforce strict transmission power limits to prevent interference among devices.

Operation Modes

The operation mode supported is Wi-Fi Client.

Network Security, 802.11i

The supported security types include the following items:

Wi-Fi Protected Access (WPA) and WPA2

WPA/WPA2-PSK (Pre-Shared Key) requires a passphrase between 8 to 63 characters. The authentication protocols are Advanced Encryption Standard (AES).

WPA/WPA2-Enterprise or 802.1x EAP-TLS, provides more security than WPA-PSK. 802.1x EAP-TLS offers individualized and centralized control over access to the Wi-Fi network. When trying to connect to the network, the radio will use the MSI certificate as credentials to authenticate with RADIUS.

Chapter 46

Over The Air Programming

NOTE: This is a Software Selling Feature.

Over The Air Programming (OTAP) enables remote radio reconfiguration over TETRA network and Wi-Fi network.

46.1 LMR OTAP

NOTE: This is a Software Selling Feature.

LMR Over The Air Programming (OTAP) enables remote radio reconfiguration over TETRA network.

LMR OTAP mitigates the need of having your radio grounded or sending it to the service center for update. Radio LMR OTAP tool enables operator to create and prepare an update package before sending it over to the destination radio. Upon receiving the package, the recipient radio prompts for configuration update acceptance. Accepting the prompt enables the radio to update with the new configuration as received over LMR OTAP. During the configuration update progress, visible indication guidance and update status are provided.

In the event of update failure, radio self-recovery is available without user intervention. Contact your radio administrator or service provider for support if the new configuration is not working.

NOTE: LMR OTAP operates on Trunked Mode Operation (TMO) only.

46.2 Wi-Fi OTAP

NOTE: This is a Software Selling Feature..

Wi-Fi Over-the-Air Programming (OTAP) allows your radio to upgrade the radio software and configuration wirelessly over a Wi-Fi connection. Your radio pulls updated files from the Integrated Terminal Management (iTM) instead of having those files pushed out by the programmer.

For each update, your radio uploads the device inventory to iTM. Your radio then gets a job descriptor from iTM. The job descriptor indicates pending jobs and files to download or upload.

OTAP over Wi-Fi includes the following jobs:

- Updating firmware
- Updating configuration
- Updating languages
- Reading the codeplug

If the Wi-Fi Auto-On or Off feature is enabled while your radio Wi-Fi connection is turned off, the Wi-Fi turns on automatically during the power-up cycle. This is to allow your radio to check for updates and send programming status update to the iTM. Your radio Wi-Fi connection reverts back to off mode when one of the following conditions is fulfilled:

- When **Check for Updates** returns negative result, a 30-seconds timer starts to turn off the Wi-Fi. Occurrence of a negative result may due to one of the following reasons:
  - No Wi-Fi connection.
  - iTM server is not available.
  - No OTAP updates available.
- When there is a **Mandatory Update** available:
  1. Your radios download the update, performs the upgrade, and reboots.
  2. After rebooting, your radio sends the programming status update to the iTM.
  3. Starts the 30-seconds timer to turn off the Wi-Fi.
- When there is a **Non-Mandatory Update** available:
  1. Your radio downloads the update, and starts the 30-seconds timer to turn off the Wi-Fi once download completes.
  2. Your radio reboots after installing the update.
  3. After rebooting, your radio sends the programming status update to the iTM.
  4. Starts the 30-seconds timer to turn off the Wi-Fi.

NOTE:

- The 30-seconds timer is run at the background of your radio. Once the timer expires, the Wi-Fi connection is automatically turned off without any notification statuses.
- The Wi-Fi status changes automatically if Wi-Fi Auto-On or Off feature is enabled.

Chapter 47

Accessory (Accry) Setup

You can connect to IMPRES, CORE, Other, 3rd party authenticated, or Secondary Accessories to the radio side connector or using Bluetooth.

If you connect an IMPRES accessory, your radio detects and recognizes the accessory automatically. If you connect a CORE, Other (for example, a third-party accessory), or Secondary accessory (for example, an earpiece connected to an RSM), your radio may detect the connection but manual selection is required at the **Accry Setup** menu.

The **Accry Setup** menu contains the supported accessories, represented by their Model Number as defined by the related Audio Device Descriptor (ADD). ADD is a set of parameters in your radio that defines the audio settings, such as gains and filters settings, for each accessory.

IMPORTANT: Do not connect RSMs to both connectors at the same time. To ensure correct connection, do not press any RSM buttons when connecting the RSM to your radio.

47.1 Car Kit

NOTE: This is a Software Selling Feature.

The Car Kit allows better operating convenience when using your radio in a car by providing hands-free capability by the use of visor microphone and external speakers.

Other accessories such as handset, external PTT, or external emergency button can also be connected to the Car Kit. An external TETRA/GPS antenna connected to the cradle provides improved signal reception. The Horn and Lights feature provides additional notifications of incoming calls.

Chapter 48

Test Page

Only authorized persons can use the Test Page option and this option must be enabled in the codeplug.

NOTE: If Test Page option is not enabled in the codeplug, you can only access the Key Variable Loader (KVL) mode option. When using a KVL device (a portable device used to load encryption keys to a secure entity), set the baud rate to 19200 bits/second.

Use the following key sequence to access the test page: ***** → **#** → **Menu** → **Right**.

The following information is available in the test page:

- **Ver Info** – Version Information – displays software or hardware version information.
  - **Build Date** – software build (a compiled version of software).
  - **CP Ver** – Codeplug version.
  - **DSP Ver** – Signaling Processor Software version.
  - **Host Ver** – Application Software version.
  - **HardwareID** – hardware identification number.
  - **EquipID** – TETRA Equipment Identity (TEI).
  - **LLS version** – Local Language Package version.
- **Addresses**
  - **Home MNI** – country identification code, network code.
  - **Group ID** – number of the currently selected talkgroup.
  - **Own ISSI** – Own Individual Short Subscriber Identity.
  - **ASSI** – Alias Short Subscriber Identity.
- **Err Logs** – Error Logs – displays information about software errors.
- **Cells Info** – Cell Information – displays information about the foreground and background cells (BTS sites). This menu displays the RSSI levels of the cells.
- **Cell Lists** – Displays frequency lists.
  - Frequency **List1** (32 variable frequencies)
  - Frequency **List2** (32 fixed frequencies)
  - Frequency **List3** (comprehensive hunt)
  - Frequency **List4** (comprehensive hunt)
- **Data Svc** – Data Services – allows access to the air tracer enable, the conformance tests, and the KVL mode.
  - **Air Tracer**
  - **Conf Test** – Conform test.
  - **KVL Mode**

    NOTE: You can exit KVL Mode by power cycle.
  - **E2E Key Del**
  - **MS Logging**

- **CE Monitor** – Circulator Eliminator Monitor.
- **Key Info** – Key Information allows your radio to display security information for the following conditions:
  - For the serving cell:
    - **Curr Cell SC** – Security class of the serving cell, that is Security Class 1, Security Class 2, Security Class 3, Security Class 3 with Group Cipher Key (GCK).
  - For the group OTAR:
    - **CMG GSSI** – Crypto-Management Group (CMG) group of radios with common key material
  - For SDMO and TM-SCK OTAR:
    - **SCK SubsGrType** – SDMO SCK Subset Grouping Type.
    - **Curr Subs Info** – current SDMO SCK Subset Number and SCK-VN.
    - **Fallback TMSCK** – current Fallback TMO SCK, that is SCKN and SCK-VN attributes.
    - **SCK List** – list all SCKs stored in your radio, that is SCKN and SCK-VN attributes.

      NOTE: When checking for SDMO key information in your radio, the SDMO KAG range in the AuC is from 0 to 9 and the range in your radio is from 1 to 10.
  - For the GCK:
    - **Full GCK-VN** – current Full GCK-VN.
    - **GCK List** – list all GCKs stored in your radio, that is GCKN and GCK-VN attributes.
- **DMO info** – Direct Mode Operation information (RSSI and Frequency)

Chapter 49

Hardware Test

This mode allows performing basic hardware tests and share the results immediately on the display.

NOTE: The hardware test mode is only for use by authorized persons.

Use the following key combinations to access the hardware test: **1**, **2**, **3** (hold all simultaneously) and then press **On/Off** key.

Appendix A

Service Information – EMEA

Service orders are dealt with by two centres: European Radio Support Centre (ERSC) and European Systems and Components Centre (ESCC). This section contains contact details to service centers in Europe, Middle East, and Africa.

European Radio Support Centre (ERSC)

ERSC provides a remote Technical Support Service to help customers resolve technical issues and quickly restore their systems. The centre handles service orders for subscribers and accessories. This team of highly skilled professionals is available to the customers that have current ERSC service agreements in place. For further information and to verify whether your current service agreement entitles you to benefit from this service, contact your local customer support.

To contact ERSC, use the following EIA Integrated Call Center details:

E-mail: ersc@motorolasolutions.com.

Telephone: +49 (0)30 6686 1555

European Systems and Components Centre (ESCC)

ESCC provides a repair service for infrastructure equipment. Customers requiring a repair service should contact the Customer Information Desk and obtain a Return Material Authorization number. Unless advised otherwise, the equipment should then be shipped to the following address:

Motorola Solutions Systems Polska Sp.z o.o ul. Czerwone Maki 82, 30-392 Krakow, Poland.

E-mail: escc.admin@motorolasolutions.com.

Telephone: +49 (0)30 6686 1404

Monday to Friday, 08:00am–06:00pm (CET)

Parts Identification and Ordering

To get help in identification of non-referenced spare parts, contact your local Motorola Solutions Customer Care Organization.

To request replacement parts, kits and assemblies, place orders directly through your Motorola Solutions local distribution organization or through https://shop-business.motorolasolutions.com/.

EIA Test Equipment Support

For information related to support and service of Motorola Solutions Test Equipment, contact your local Motorola Solutions Customer Care Organization.

For customers in Germany, contact the Equipment Service Group in Germany:

Telephone: +49 (0) 6128 702179

Fax: +49 (0) 6128 951046

Latest Versions of Manuals

To download the latest versions of technical manuals, see https://learning.motorolasolutions.com/.

Submit Your Comments

If you have any comments or would like to report a problem regarding Motorola Solutions publications, send an e-mail to: escc.admin@motorolasolutions.com.

Appendix B

Service Information for APAC

This topic contains contact details to service centers in Asia and Pacific region.

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 Solutions Technical Support, be prepared to provide the product model number and the serial number.

Further Assistance from Motorola Solutions

You can also contact the Customer Help Desk through the website: http://www.motorolasolutions.com/en_xp/products. If a unit requires further complete testing, knowledge and/or details of component level troubleshooting or service than is customarily performed at the basic level, send the radio to a Motorola Solutions Service Center as listed in the following table:

Table 41: Service Information – Telephone Numbers and Addresses of the Asia and Pacific Motorola Solutions Centers

Country	Telephone Number	Address
Singapore	+65-6352-6383	**Motorola Solutions Singapore Pte. Ltd,** c/o Azure Engineering, 49 Jalan Pemimpin, #03-11 APS Industrial Building, Singapore 577203 Contact: Alvin Tan E-mail: alvin.tan@motorolasolutions.com Contact: Gan Saw See E-mail: gan.sawsee@motorolasolutions.com
Malaysia	+603-7809-0000	**Motorola Solutions Sdn. Bhd.** Level 14, Persoft Tower, No. 68, Pesiaran Tropicana, 47410 Petaling Jaya, Selangor Darul Ehsan, Malaysia Contact: Koh Tiong Eng E-mail: A21001@motorolasolutions.com
Indonesia	+62-21-3043-5239	**PT. Motorola Solutions Indonesia** 30th Floor, Gedung BRI II, Suite 3001, Jl. Jend. Sudirman Kav. 44-46, Jakarta 10210, Indonesia Contact: Eko Haryanto E-mail: Eko.Haryanto@motorolasolutions.com

Country	Telephone Number	Address
Thailand	Tel: +662-653-220 Fax: +668-254-5922	**Motorola Solutions (Thailand) Ltd.** 142 Two Pacific Place Suite 2201, 3220 Sukhumvit Road, Klongtoey, Bangkok 10110 Contact: Nitas Vatanasupapon E-mail: Nitas@motorolasolutions.com
India	+91-9844218850	**Motorola Solutions India Pvt. Ltd.** C/o Communication Test Design India Private Limited, #4, 5 Maruthi Industrial Estate, Rajapalya, Hoodi Village, Bangalore - 560048, India Contact: K. Umamaheswari E-mail: umamaheshwari@motorolasolutions.com
China	+86-10-8473-5128	**Motorola Solutions (China) Co. Ltd.** No. 1 Wang Jing East Road, Chao Yang District, Beijing, 100102, P.R. China Contact: Sophy Wang E-mail: C18170@motorolasolutions.com
Hong Kong	852-2966-4823	**Motorola Solutions Asia Pacific Ltd.** Unit 1807-1812, 18/F, Two Harbourfront, 22 Tak Fung Street, Hunghom, Kowloon, Hong Kong Contact: Judy Leung E-mail: Judy.Leung@motorolasolutions.com
Philippines	Tel: +632 858-7500 Fax: +632 841-0681	**Motorola Communications Philippines, Inc.** Unit 2102, One Global Place Building, 5th Ave., Bonifacio Global City, Taguig, Philippines 1634. Contact: Arthur Nieves E-mail: Arthur.Nieves@motorolasolutions.com
Korea	+822-3497-3649	**Motorola Solutions Korea, Inc.** 9th Floor, Hibrand Building, 215, Yangjae-Dong, Seocho-Gu, Seoul, 137-924, Korea. Contact: KS Kwak E-mail: r45321@motorolasolutions.com
Taiwan	+886-2-8729 8000	**Motorola Solutions Taiwan, Ltd.** 8F, No. 9, Songgao Rd.,

Country	Telephone Number	Address
		Taipei 110, Taiwan (R.O.C.) Contact: Michael Chou E-mail: ftpe239@motorolasolutions.com
Australia	+613-9847-7725	**Motorola Solutions Australia Pty. Ltd.** 10 Wesley Court, Tally Ho Business Park, East Burwood Victoria 3151, Australia. E-mail: servicecentre.au@motorolasolutions.com

Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola Solutions part number is assigned to the part, it is available from Motorola Solutions Service Organization. If no part number is assigned, the part is not normally available from Motorola Solutions. If a list of parts is not included, that means that no user-serviceable parts are available for that kit or assembly.

Customer Programming Software has no capability to tune the radio. Tuning the radio can only be performed at the factory or at the appropriate Motorola Solutions Repair Center. Component replacement can affect the radio tuning and must only be performed by the appropriate Motorola Solutions Repair Center.

All orders for parts/information should include the complete Motorola Solutions identification number. All part orders should be directed to your local Motorola Solutions Service Organization. See your latest price pages.

Parts Identification and Ordering

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

Appendix C

Service Information for Americas

This topic contains contact details to service centers in Latin America and Caribbean region.

Technical Support

To request technical support, go to https://businessonline.motorolasolutions.com, **Contact Us**.

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

Warranty and Repairs

Table 42: Service Information – Telephone Numbers and Addresses of Latin America Radio Support Centers

Country	Telephone Number	Address
Colombia	571- 376-6990	Motorola Solutions de Colombia Service Centre Torre Banco Ganadero Carrera 7 No. 71-52 Torre B piso 13 Oficina 1301 Bogota
Mexico	5252576700	Motorola Solutions de México Service Centre Bosques de Alisos #125 Col. Bosques de las Lomas CP 05120 Mexico DF

Piece Parts

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

Table 43: Service Information – Telephone Numbers and Addresses of Latin America Motorola Solutions Centers

Country	Telephone Number	Address
Argentina	5411-4317-5300	Motorola Solutions Argentina Ave. del Libertador 1855 B1638BGE, Vicente Lopez Buenos Aires
Brasil	5511-3847-668	Motorola Solutions Ltda Av. Chedid Jafet

Country	Telephone Number	Address
		222 Bloco D Conjuntos 11,12,21,22 E 41 Condominio Millennium Office Park 04551-065- Vila Olimpia, Sao Paulo
Chile	562-338-9000	Motorola Solutions Chile S.A. Av. Nueva Tajamar 481 Edif. World Trade Center Of. 1702, Torre Norte Las Condes Santiago
Colombia	571-376-6990	Motorola Solutions Colombia LTDA. Carrera 7 #71-52 Torre A, Oficina 1301 Bogotá
Costa Rica	506-201-1480	Motorola Solutions de Costa Rica Parque Empresarial Plaza Roble Edificio El Portico, 1er Piso Centro de Negocios Internacional Guachepelin, Escazu San Jose
Ecuador	5932-264-1627	Motorola Solutions del Ecuador Autopist Gral. Rumiñahui, Puente 2 Conjunto Puerta del Sol Este-Ciudad Jardin Pasa E, Casa 65 Quito
Mexico	52-555-257-6700	Motorola Solutions de México, S.A. Calle Bosques de Alisos #125 Col. Bosques de Las Lomas 05120 México D.F.
Peru	511-211-0700	Motorola Solutions del Peru Ave. República de Panama 3535 Piso 11, San Isidro Lima 27
USA	954-723-8959	Motorola Solutions, Inc. Latin American Countries Region 789 International Parkway Sunrise, FL 33325
Venezuela	58212-901-4600	Motorola Solutions de Los Andes C.A. Ave. Francisco de Miranda Centro Lido, Torre A Piso 15, El Rosal Caracas, 1060