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ST7000 Product Information Manual

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European Union (EU) Waste of Electrical and Electronic Equipment (WEEE) directive



■ The European Union's WEEE directive requires that products sold into EU countries must have the crossed out trash bin label on the product (or the package in some cases).

As defined by the WEEE directive, this cross-out trash bin label means that customers and end-users in EU countries should not dispose of electronic and electrical equipment or accessories in household waste.

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

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Icon Conventions

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



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



WARNING: 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.

CAUTION: 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.



NOTICE: 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.

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Chapter 1

Product Overview

1.1

ST7000 Overview

The ST7000 is a compact and sophisticated TETRA radio, designed specifically for customer-facing staffs, executives, and senior officers.

Figure 1: ST7000



The radio combines elegant and discreet design with a simple user interface and high-quality audio to maintain the highest level of customer service. Driven by style and function, the ST7000 radio is a communications tool that delivers the ergonomics of a smartphone without the associated distractions. These intuitive features allow you to focus on the task at hand instead of on the radio, thus increasing productivity at work.

With a hybrid internal and external antenna system, the ST7000 radio fits easily in a pocket. The touch sensitive buttons, integrated Bluetooth® 4.0 wireless technology, a reversible USB-C™ connector for charging, and 3.5 mm audio connector make the ST7000 radio a flexible, modern TETRA radio. The ST7000 radio also provides uncompromising audio quality with low distortion, low audio power, and 1.8 W transmission power.

1.1.1

ST7000 Specifications

The following tables explain the specifications of the ST7000 radio.

Table 1: General Technical Specification

Parameter	Value
Dimensions H x W x D mm	107 x 60 x 19 122 x 60 x 19 (radio with 800 MHz antenna) 132 x 60 x 19 (radio with 380–430 MHz antenna)
Weight g	181 (radio with battery and antenna)
Battery	Removable 2200 mAh IMPRES Li-Ion battery
Battery performance	Duty Cycle 5/5/90 > 19 Hours Duty Cycle 5/35/60 > 14 Hours
Audio	Speech loudness at 30 cm: 94 Phon Audio output power at Rated/Max: 0.9 W Audio distortion at Rated: 1.0 %
Display	PMOLED 128 x 64 pixels, white
TMO Services	Full duplex TMO Private, PABX, PSTN, Emergency Half duplex TMO Private, Group, Emergency
DMO Services	Half duplex DMO Private, Group, Emergency
TMO Talkgroups	10,000 Unique TMO Talkgroups
DMO Talkgroups	2,000 Unique DMO Talkgroups
Country/Network Code Lists	100 Entries
Scan Lists	40 lists of up to 20 groups
Contact Lists	1,000 contacts with 6 numbers per contact (maximum of 2,000 unique numbers)

Table 2: RF Specification

Parameter	Value
Frequency Bands MHz	380–430 800
Transmitter RF W	1.8 W Power Class 3L and Class 4
Receiver Class	A and B
Receiver Static Sensitivity dBm	UHF: -116 (min); -118 (typical) 800 MHz: -114 (min); -116 (typical)
Receiver Dynamic Sensitivity dBm	UHF: -107 (min); -109 (typical) 800 MHz: -105 (min); -107 (typical)

Table 3: Environmental Specification

Parameter	Value
Operating Temperature °C	-20 to +55
Storage Temperature °C	-30 to +85
Humidity	ETS 300-019-1-7 Class 7.3E, MIL STD 810 D, E, F, G
Dust and Water Ingress Protection	IP54 (all connectors are rated IP67)
Shock, Drop, and Vibration	ETS 300-019 1-7 class 5M3; MIL-STD 810 D/E/F/G

Table 4: Bluetooth Audio and Data Services

Parameter	Value
Supported Versions	Bluetooth 2.1 +EDR, Bluetooth 4.0, and Bluetooth Smart (BTLE)
Security	Bluetooth 2.1 introduces mandatory encryption with Secure Simple Pairing (SSP), Easier Pairing and Preventing Sniffing/Hacking. Bluetooth 4.0 supports Security Manager (SM) Services with AES Encryption.
Audio	HeadSet Profile, Fast PTT with Motorola Solutions accessories
Data Services	Serial Port Profile, Dial Up Networking Profile, Discovery Mode, Generic Access Profile, Generic Attributes Profile (GATT), Heart Rate Profile, Battery Service Profile, and Devices Info Profile.

Table 5: Location Services

Parameter	Value
Supported Constellations	GPS, Beidou, and Glonass
Simultaneous Satellites	12 integrated external antenna
Tracking Sensitivity dBm	-163
Accuracy (measured at -130 dBm)	< 5 meter (50% probable)
Protocols	ETSI LIP and LRRP



NOTICE: This specification may be subject to change without further notice. All product features are subject to infrastructure support. Selected features are subject to optional software upgrade.

1.2

Ordering Options for Radios and Features

TETRA terminals are only available to accredited channel partners who are advised of the discount structure applied to these products.

Software options can be ordered and enabled in two ways:

- Enabled at the Distribution Center (DC).
- Enabled with a license in iTM.

1.3

Radio Ordering

Procedure:

- 1 Order the main radio model.
- 2 Order options from each of the following categories:
 - Software Selling Features
 - Customer Programming Software
 - Integrated Terminal Management
 - Accessories



NOTICE: Export controls apply when ordering encryption.

1.4

Customer Programming Software

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

Chapter 2

Services and Features

2.1

System Support

The 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.

The radio is designed to operate optimally on the Dimetra IP system. The radio operates properly on all SwMIs that comply with the following IOP TIP documents.

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 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

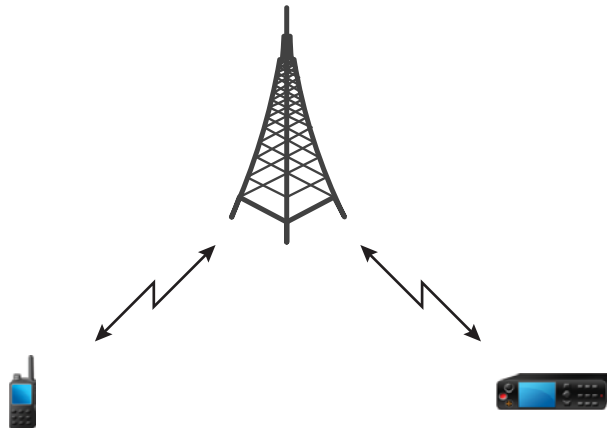
2.2

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, as well as access to the infrastructure-related features such as packet data.

Figure 2: Trunked Mode Operation

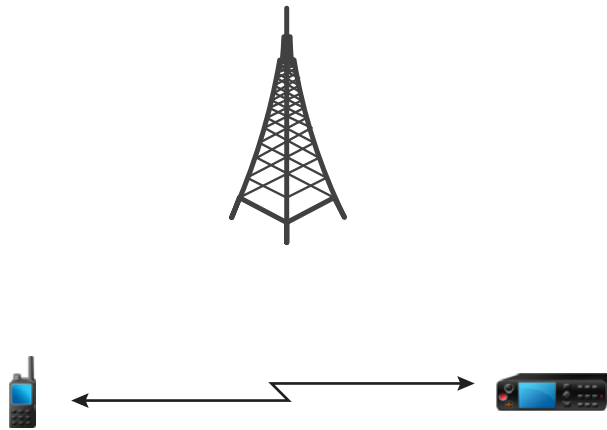


2.3

Direct Mode Operation

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

Figure 3: Direct Mode Operation



2.4

Numbering and Addressing

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

However, it is undesirable to require you to enter a long number to address another radio. To this end, a set of short number schemes can be used. Alternatively, the radio can be provisioned to treat a short number as a Short Subscriber Identity (SSI). This scheme can be refined to allow short dialing within a fleet by combining the ID entered with the radio own SSI.

If the radio is provisioned to treat a short number as a TETRA SSI, and the number entered is fewer than seven digits, the identity of the radio is combined with the number entered to produce the actual

Individual Short Subscriber Identity (ISSI). Using this scheme, an ISSI can comprise of a fleet number part and a member part.

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

- 1 The 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 you are provisioned with the capability of entering a real TETRA ISSI and you enter an ID of seven digits, the number is interpreted as a real TETRA ISSI regardless of the short addressing scheme used.

2.5

Dialing Methods

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

- Using predefined One-Touch Buttons.
- Dialing from the favorite folders.
- Dialing from the address book.

2.5.1

Individual Dialing

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

To make both simplex and duplex individual calls, contacts must be pre-configured in the CPS. The radio can still receive calls from other contacts which are not pre-defined in the CPS.

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

2.6

Unified Address Book

The radio offers an address book facility, where multiple numbers are associated with a single name tag. This facility presents an interface to the address book and provides a natural way to call an individual who can be contacted in different ways.

Each individual can have up to six associated numbers:

- Private (a TETRA ISSI)
- Home (phone number)
- Mobile (phone number)
- Work (phone number)

- PABX (local short number)
- Other (phone number)

The Contact List has a maximum capacity of 2000 Contacts, with up to 1000 associated Private and up to 1000 associated either Phone or PABX numbers distributed among the contacts.

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

2.7

Group Call

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

This service is available in both TMO and 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.

2.7.1

Programmable Talkgroups

The 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 the radio capabilities.

Talkgroups are configured separately for TMO and 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. The 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 CPS. In such a case a corresponding talkgroup is automatically selected during mode switching, regardless of the previously selected talkgroup.



NOTICE: Neither the group name nor the corresponding group address can be edited using the 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.

2.7.2

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
 - Placed at the root of the folder structure.
 - Can contain both level 2 folders and talkgroups at the same time.
 - Can contain any number of level 2 folders.
- Level 2 Folders

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


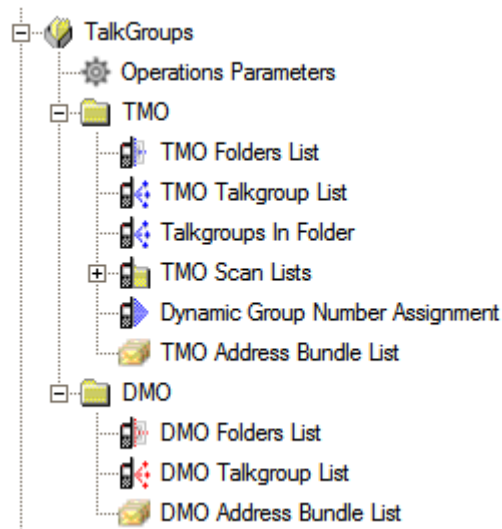

 **NOTICE:** The radio supports up to four levels of folders.

Figure 4: Talkgroup Tree



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

2.7.3

Talkgroup Selection

You can select a talkgroup when the display is turned off or turned on while in the idle screen using the **Talkgroup Selector** button.

Pressing the **Talkgroup Selector** button backward scrolls the talkgroup list vertically upward. On the contrary, pressing the button **Talkgroup Selector** button forward scrolls the talkgroup list vertically downward. The radio automatically attaches to the newly highlighted talkgroup after a timeout. The **Menu/Ok** icon and the **Back** icon on the **Touch User Interface** are inactive during scrolling and talkgroup attachment. The icons revert to active once talkgroup attachment is successful.

2.7.4

Favorite Folders

The radio supports two favorite folders. The **Favorite TGs** folder contains TMO and DMO talkgroups whereas the **My Contacts** folder contains private and phone contacts. By default, these folders are already enabled in the radio.

The favorite folders are static links to talkgroups and contacts. Hence to populate the favorite folders, talkgroups and contacts must be pre-configured in the Customer Programming Software (CPS). To access these folders, select either one of the folders from the radio menu. Selecting **Favorite TGs** enables scrolling within this folder. On the other hand, if **My Contacts** is selected, you can choose any contacts in the folder to initiate simplex or duplex calls for the contact. If a contact name has multiple contact numbers, then multiple entries must be configured in the contacts favorite with one entry per contact number type.

A favorite talkgroup range name replaces a talkgroup range name on the 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 the radio power cycle.

2.7.5

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. The radio allows you to receive calls, however, no call can be initiated to this talkgroup.

2.7.6

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. The radio user is not allowed to edit the scan list.

2.7.7

Transmission Timeout Timer

The 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.

2.7.8

Group Call Reception

In most situations, the radio receives group calls without any intervention. When the 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 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.

2.7.9

Talkgroup Scanning

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

To enable talkgroup scanning, select a pre-defined scan list. The available scan lists are configurable through the Customer Programming Software (CPS) only. 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, the 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.

The radio displays the scanned talkgroup ID when it receives a group call while talkgroup scanning is active. The display is turned off by default when the radio is transmitting. Pressing the **Power/Sleep/Wake** button turns on the display, showing the scanned talkgroup ID.

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

If talkgroups have been attached or are always attached, the 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).

2.7.10

Priority Monitor

While the radio is active in a group call, it may receive a group call setup for a different group. The 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, the 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.

The 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.

The 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.

2.7.11

Timed Talkgroup Change

This feature allows switching between the original and the predefined Trunked Mode Operation (TMO) or Direct Mode Operation (DMO) talkgroup by using the One-Touch Button.

The radio attaches to the selected, predefined talkgroup only for a specified amount of time (**Functional Timer**). After the timer expires, the radio returns to the previously attached, original talkgroup. Returning to the original talkgroup can also be assigned to the second press action of the button.

Example: A campus university combines four buildings: A, B, C, and D. A security procedure is to raise an internal alarm for the building and then notify the entire campus. The staff in each campus building configures radios with three types of talkgroups.

- 1 Internal Communication Talkgroups – regular talkgroups for the entire campus and individual buildings to communicate between staff members.
- 2 Internal Alarm Talkgroups – emergency talkgroups, individual for each building.
- 3 External Alarm Talkgroup – an emergency talkgroup to alert the entire campus.

The staff in individual buildings uses the dedicated Internal Communication Talkgroups for daily routines and the Internal Alarm Talkgroup for safety procedures. The campus staff in every building also scans the External Alarm Talkgroup.

The campus IT administrator assigned in Customer Programming Software (CPS) the **Timed Talkgroup Change** function to a One-Touch Button to switch between the original Internal Communication Talkgroup, and the Internal Alarm Talkgroup. This way the radio users can immediately switch to the emergency talkgroup and start an internal emergency call.

One of the staff members in building A is in an emergency situation. The person presses the One-Touch Button to switch to the Internal Alarm Talkgroup and starts the emergency call. The other staff members in building A hear the voice communication on the Internal Alarm Talkgroup. It turns out that the emergency is serious and one of the building administrators starts the global alarm for all campus buildings.

2.7.12

Broadcast Call

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

The 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.

2.7.13

PTT Double Push

The PTT double push (D-PTT) feature enables the radio to generate a specific tone sent to other radios in the talkgroup. You can send the tone by pressing **PTT** twice, or pressing the preconfigured One-Touch Button once.

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. D-PTT tone is not audible on sending radio.

To send the tone, you press the **PTT** twice in a period defined in Customer Programming Software (CPS). The D-PTT is triggered only when the radio is in idle or group call mode. The D-PTT tone is not played on the sending radio.

If the **PTT** is kept pressed after second press and the radio finishes sending the D-PTT tone it allows starting 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.



NOTICE: 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.

2.7.14

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.

2.7.15

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.

2.7.16

Call Ownership

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



NOTICE: The SwMI decides about the ownership of a call.

2.7.17

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**, the radio sends a message to the system withdrawing the request.

2.7.18

Call Restoration

If the radio roams to a new cell during a call, it attempts to continue the call on the new cell. Cell reselection and call restoration procedures are employed for this attempt.

If the radio roams while being the transmitting party in the call, an announced cell reselection, if possible, is carried out in the new cell.

If the radio is not the transmitting party, it employs an unannounced cell reselection, followed by the call restoration procedures.

2.7.19

Temporary Group Address

The radio supports the temporary group address assigned by the SwMI. The address is valid only for the lifetime of the call.

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

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

2.7.20

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, the radio automatically joins the call. Similarly, if the radio has been outside of the 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.



NOTICE: For Trunked Mode Operation (TMO), this feature must be configured on SwMI. Acknowledged late entry and late entry paging are not supported.

2.7.21

User Initiated Group Attachment

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

The 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, the radio initiates an attachment to the SwMI, detaching the old group and attaching to the new one.

All group attachments sent by the 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, the 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), the 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, the radio sends an attachment of the ATG as the selected group and as a scan group.

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

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

If the 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, the radio continues to scan all other groups, such as ATG associations.

2.8

Private Call

The Private Call, also called point-to-point, or individual call, enables calling between two individuals. No other radio can hear the conversation.

This call type can be carried out in two ways:

- Duplex call (if the system allows), in Trunked Mode Operation (TMO) Mode. Both parties can speak at the same time.
- Simplex call, in TMO or Direct Mode Operation (DMO) Mode. Only one party can speak at a time.

From your radio, a Private Call can be started using one of the following methods:

- By pressing predefined One Touch Button.

- By selecting a contact from the address book.
- By selecting a contact from the favorite folder.

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

2.8.1

Simplex Private Call

The radio is able to make and receive private calls to and from other TETRA radios with simplex speech capability. This call type uses TETRA individual call signaling.

All private calls are initiated using the on-off hook method. For incoming calls, the radio accepts both direct and on-off hook setup.

2.8.2

Duplex Private Call

The radio allows making and receiving private calls to and from other TETRA radios with duplex speech capability. Depending on the configuration, the radio may prohibit you from initiating duplex private calls.

The radio always initiates duplex private calls using on-off hook signaling with the traffic channel allocated by the SwMI only after the called party has answered the call. Therefore, the radio generates all progress tones during the call setup. In addition, the radio allows the SwMI to modify the call setup to direct. This modification enables the infrastructure to generate the progress tones.

2.8.3

Transmission Timeout Timer

In a simplex call, the 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.

2.8.4

Call Restoration in Private Call

If the radio roams while you are the transmitting party in a private call, the announced cell reselection is employed (if possible). Call restoration procedures are performed in the new cell.

If you are not the transmitting party, the radio employs an unannounced cell reselection, followed by the call restoration procedures.

2.8.5

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 the 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.
- The radio plays a special audio alert.



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

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

2.8.6

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, the radio accepts incoming calls with or without the presence check. If disabled, the radio only accepts private calls without the presence check.

2.8.7

DMO Individual Only Talkgroups

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

2.8.8

Private Calls through DMO Gateway

Private Calls through Direct Mode Operation (DMO) Gateway is a paid feature.

The DMO Gateway can relay clear and non-BSI 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 using Customer Programming Software (CPS), Integrated Terminal Management (iTM), Gateway MMI, or remotely using AT commands or TMO SDS Remote Control.

2.9

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 landline number) using a telephone switch. The 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.



NOTICE: The PSTN phone call is supported when PSTN/PABX feature is enabled in the codeplug and the SwMI supports this functionality. The PSTN/PABX gateway must be configured properly.

No more than one PSTN/PABX gateway ID and one PABX/PABX gateway ID are available in the radio.

2.9.1

Phone Call Initiation

The radio is able to initiate phone calls to a Public Switched Telephone Network (PSTN) or Private Automatic Branch Exchange (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, the radio generates all feedback tones internally. In addition, the 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.



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

2.9.2

Phone Call Reception

Incoming phone calls, from the land gateway to mobile, use on-off hook signaling. The radio extracts the gateway ID from the call setup signaling, to determine whether to start phone or Private Automatic Branch Exchange (PABX) call.

2.9.3

Call Restoration in Phone Call

If the radio roams while being in an active phone call, and the announced cell reselection is possible, then the announced cell reselection is employed. Also the call restoration procedures are performed.

2.10

Emergency Operations

Emergency Operations are used in critical situations. Your service provider can configure the **P1 Programmable** button as an **Emergency** button.

Pressing the programmed **Emergency** button activates one or more services, depending on the service provider setting:

- Sending Emergency Alarm
- Sending Short Data Service (SDS) Status
- Starting Hot Microphone operation

During Emergency Operations, the 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, the 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.

2.10.1

Emergency Group Call

The Emergency Group Call has the highest communication priority that means it is the 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**. The 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 shows that an emergency call has been received, and a special audio alert is played.

The Emergency Group Call Termination feature allows the radio user to attempt terminating an Emergency Group Call by pressing the **Back** touch icon. The ownership status of the radio determines the following termination conditions:

Call Owner

The radio sends a disconnection PDU to the SwMI. The SwMI responds by sending a release PDU response with an indication that the call has been disconnected.

Non-Call Owner

If a radio is programmed to terminate a call, the termination procedure is the same as for the call owner in an Emergency Group Call. Otherwise, the radio leaves the group call without informing the SwMI.

The SwMI may reject the termination request, in which case the radio stays in the group call.

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

- A non-tactical call is initiated on a talkgroup designated by the codeplug setting. When in non-tactical emergency mode, you cannot switch talkgroups.
- A tactical call is initiated on the currently selected talkgroup.

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

2.10.2

Non-Tactical Emergency

In Non-Tactical Emergency, the radio switches to a designated Emergency talkgroup when starting Emergency Operations. This talkgroup is used for the complete duration of the Emergency Operations and changing talkgroup is not allowed.

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

In Direct Mode Operation (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, the radio goes back to the previously selected talkgroup.

2.10.3

Emergency Alarm

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

Each time the 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 the radio is in Emergency Operation and on pressing the programmed **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).

2.10.4

Emergency SDS Status

Emergency Short Data Service (SDS) Status allows the radio to send a status message with a pre-programmed value to the destination address set up in the codeplug.

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

2.10.5

Emergency Hot Microphone

The Hot Microphone allows you to talk without pressing the **PTT** button during Emergency Operation. The transmission continues for a provisioned amount of time. 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 presses of the programmed **Emergency** button 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, the radio automatically attempts to get talk permit again.

Pressing the **Back** touch icon ends the Hot Microphone operation.

2.10.6

Alternating Hot Microphone

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.

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

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

- The radio exits the Emergency Mode.
- The Alternating Hot Microphone timer expires.
- The **PTT** button is pressed.
- The **Back** touch icon is pressed (only during the transmission timeslot).



NOTICE:

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

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

2.10.7

Invisible Emergency

It is possible for the service provider to disable visual and audible indications when performing Emergency Operation on the 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.

2.11

Security Services

The 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.

2.11.1

Terminal Equipment Identity

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

2.11.2

Authentication

Authentication establishes a level of a trust between a radio and 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 Centre (AuC) provides a single K for authentication, which is shared only with the radio. The SwMI always initiates Authentication. If set by the service provider, the radio can also authenticate the SwMI.

2.11.3

Radio Disable or Enable

A dispatcher can disable or enable the radio remotely.

When disabled, the radio does not participate in any voice call, Short Data Service (SDS), or packet data activity and ignores all supplementary services sent on the downlink. All visible and audible indications are disabled, and the radio appears to be turned off. All user inputs, such as key presses, are ignored, and the PEI interface is closed.

The radio continues to perform mobility management functions, such as roaming, to facilitate subsequent enabling or further disabling.

The radio stores the disabled or enabled state in the codeplug, so the unit remains in that state after turning on.

If the 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.

If the radio is in the equipment disabled state, and receives an appropriate TETRA signaling with the correct TEI, the radio restores to its normal operative state (if the subscription is also in the enabled state).

2.11.4

Radio Permanent Disable

Radio Permanent Disable and Radio Permanent Disable v2 are paid features that are mutually exclusive.

Permanent disabling is intended to protect a network from attack from a compromised or faulty radio. It can be used when the 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 the radio should be recovered and reprogrammed before being used again by the service provider.

When the radio is permanently disabled, it becomes inoperable.

- All its MMI interfaces on the radio are disabled.
- All its security key material, that is GCK, GSKO, DMO SCKs, Ks, DCK, CCK, 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 the 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 the 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, the radio could be assigned a new home zone that lies in a cluster where the K-REF association has not been deleted.

2.11.5

Radio Permanent Disable v2

Radio Permanent Disable and Radio Permanent Disable v2 are paid features that are mutually exclusive.

Similar to permanent disable, once the radio is disabled using the permanent disable v2, it cannot be recovered over the air. When the radio accepts the permanent disable command, and if the permanent disable v2 flag is enabled in the codeplug, the radio appears to be inoperable.

- All its MMI interfaces on the 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.
- The 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.



NOTICE: To restore a radio that is disabled using the permanent disable v2, see *TETRA Terminals CPS Start-up User Guide* (Motorola Solutions Part Number: 6802974C10).

2.11.6

High Assurance Boot

The radio has a facility that ensures that the code and data flashed in the 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. The radio is checking the signature of the code and data segments present in the radio using a public/private key mechanism.

If the HAB authentication of the flashed software fails, it does not allow the radio software to run.

2.12

Packet Data

In Trunked Mode Operation (TMO), the 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.

The radio operates on the single-slot packet data channel.

Packet data applications reside internally, over UDP, or in an externally connected device, connected using a USB cable port in the 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 \longleftrightarrow External Equipment (Terminal Equipment) (for example PC).
- External Equipment (Terminal Equipment) \longleftrightarrow Network (through radio).

The radio supports only IP version 4 packets. The radio routes datagrams independently of the protocol sitting on top of IP.

The radio supports an MTU of 1500 bytes.

The radio provides a best effort delivery service. If the delivery fails due to the radio environment, the 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. The 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.

The 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. The 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.



NOTICE: The cell re-selection is undeclared in a strict TETRA case. However, the SMDCP 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.

2.12.1

Voice and Data Support

The radio can alternate voice and packet data service. However, voice and data running in parallel are not supported. This behavior corresponds to Packet Data Type B - IP dual mode.

If the SwMI rejects the context activation due to `PD MS type not supported`, the 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.

The 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, the radio deactivates PD. The PEI operates in the local mode only (data transfer between TE and 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 the radio moves to the traffic channel due to the voice service, the radio terminates any active packet data transmission or reception. The data service is suspended. The data service resumes when the voice service ends.

The radio accepts any downlink Short Data Service (SDS) message received on the Packet Data Control Channel (PDCH). The radio can send uplink SDS messages on the PDCH.

The radio allows PEI, GNSS, and 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 GNSS and PEI PD applications are using the active PD context, the radio can filter the downlink IP packets based on their TCP/UDP port.

- UDP packets addressed to the GNSS port (configured in the codeplug) are routed to the GNSS internal application.



NOTICE: When activating another PD context on the radio, use the same settings in both PD contexts.

2.12.2

Packet Data IP Addressing

Table 6: 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 the 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: <ul style="list-style-type: none">• Request a Dynamic IP Address is set to Dynamic and the PD Application Type is the 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.

2.12.3

Packet Data User Authentication

The Packet Data (PD) user authentication is a method of authenticating the Terminal Equipment user before allowing the packet data link activation.

A PD Authentication server connected to the 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.



NOTICE: If the SwMI does not agree for the authentication method, for example PAP, the SwMI can reject it.

2.13

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 reports, software information, and battery state information. In addition, commands to access the radio configuration and storage parameters are available.

The radio supports TETRA standard packet data using the IP network layer protocol.

The radio operates on the single slot packet data channel.

Packet data applications reside internally, for example: GNSS reports, WAP, or in an external device connected to the 8-wire RS232 data port on the 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 \longleftrightarrow External Equipment (TE) (for example PC).
- External Equipment (TE) \longleftrightarrow Network (through radio).

The 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 the 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, the radio drops the wide mode connection, thus the PEI goes back to AT mode. Then the TNP1 client detects this change and reinitiates the PPP session in local mode.

The 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.

2.13.1

TETRA Network Protocol 1 IP Addressing

Table 7: TETRA Network Protocol 1 (TNP1) IP Addressing

Addressing Mode	Description
Wide Mode	All TNP1 services are available including packet data transfer towards the SwMI. The address used is the dynamic address MS 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 Addressing	The radio uses a fixed port address for reception and transmission of TNP1 packets. The port number is 4024.

2.14

Mobility Services

Terminal mobility indicates the ability of a terminal 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.

2.14.1

Main Control Channel Frequencies

The radio can find a wide range of main control channels. The radio maintains stored lists of carrier frequencies which are scanned in order.

- 1 A list of discrete entries of the last 32 control channels used by the radio.
- 2 A static list of up to 32 discrete frequencies specified by the operator that can be preprovisioned. The system operator can modify this list using the programming tool.

- 3 A frequency range specification, using a specific offset, that can be preprogrammed in the factory. The system operator can modify this range using the programming tool. Then the radio scans all frequencies in 25 kHz intervals in the specified range.
- 4 An extra frequency range specification. Having two separate range specifications allows for two non-contiguous blocks of frequencies or two different offsets.

The radio can use all four frequency lists to speed up registration process after a power cycle or loss of Trunked Mode Operation (TMO) coverage.

2.14.2

Control Channel Selection

Each TDMA frame on a given carrier comprises of 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.

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 the 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, the 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 the radio.

Secondary Control Channel (SCCH) is a paid feature.

2.14.3

Registration

On camping on a cell, the radio sends a registration request PDU to the SwMI, which includes a request to attach to the selected talkgroup.

If the registration and attachment succeed, the 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, the radio attempts to camp on a different cell.

If the SwMI denies the registration request due to the location area rejection, the radio does not attempt to register again at this cell until the next power-on. The 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 the radio or next Individual TETRA Subscriber Identity (ITSI) attach.

The radio does not send registration signaling when one of the following occurs:

- Roaming and registration fail before the radio receives the random access acknowledgment and the radio goes back to the last serving cell.
- The radio discovers a link failure on the serving cell, the link failure is shorter than the predefined timer and the radio is not in the transmit inhibit mode.
- The radio discovers a link failure on the serving cell and is in the transmit inhibit mode. In this case, the radio always goes back to the serving cell without registration and stays in the transmit inhibit mode until the mode is turned off.



NOTICE: When two or more scenarios occur at the same time, the radio registers with signaling.

If the radio discovers a link failure on the serving cell, a specific timer starts counting. If the link failure remains after the timer expires, then the radio acts as during a normal link failure. If the link failure ends before timer expires, then the 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 the radio does not register to go back in the range.

2.14.4

Call Roaming

The 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 the radio has lost the serving cell, the radio employs cell reselection procedures using the following methods:

- If not in a call - undeclared cell reselection.
- If in a call and not transmitting or link failure occurs - unannounced cell reselection.
- If transmitting in a call, and a neighbor has been scanned, and the cells are synchronized - announced type-1 or type-2 cell reselection.
- If transmitting in a call and no neighbor has been scanned or the cells are not synchronized - announced type-3 cell reselection.

For compatibility with systems that do not support type-1 or type-2 cell reselection, the radio can be provisioned to never perform these types of reselections.

The 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 Congestion level
- 5 Security Class
- 6 Subscriber Class
- 7 Home Location Area (Home Location area)
- 8 LA Boundary
- 9 Cell Load

The radio prefers a cell that has a higher service level to one with a lower service level. If the radio is operating on a serving cell that has a lower service level than a neighbor cell, the 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 the 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 PDUs to other cells. Link failures and other related scenarios are not randomized not to cause any unwanted delays in restoring the link.

2.14.5

Seamless Handover

Seamless handover eliminates voice interruption during calls by enabling the radio to roam faster between cells while transmitting.

Faster roaming is possible because the radio asks its serving cell to perform the reselection and the SwMI performs all the roaming signaling. The radio then moves straight to the traffic channel on the new cell and continues the call without call restoration.

2.14.6

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 Customer Programming Software (CPS).

2.14.7

Subscriber Class

When the radio powers up, or whenever it performs registration or roaming, it always uses its provisioned Subscriber Class (SC).

When the 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 the radio SC does not match the cell SC (the feature is configurable using the CPS), it either uses normal ranking procedures (see [Call Roaming on page 41](#)), or does not roam to the cell at all.

2.14.8

Subscriber Class by Talkgroup

Subscriber Class by Talkgroup is a paid feature.

You can configure up to 16 Subscriber Class by Groups in the Customer Programming Software (CPS) 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, the 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 SwMI, over the air, has a higher priority than Subscriber Class by Groups. If the 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.

2.14.9

RF Power Class Toggle

RF Power Class Toggle is a paid feature.

The RF power toggle is a radio-specific hardware feature enabling the radio to transmit with Class 3L (1.8 W) power. Using the Customer Programming Software (CPS) the power class can be set for the radio to transmit with Class 3L (1.8 W) or Class 4 (1 W).

The radio can be configured to switch automatically to Class 3L (1.8 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 a call. Such action may result in dropping the call, as the selected power class setting can be insufficient to sustain the transmission.

2.14.10

Local Site Trunking

Local Site Trunking (LST) is a feature enabling a Base Station to operate stand-alone. The Base Station may enter the mode when the link from the local cell to the central switch has gone down. The radio limits functionality when the cell is in this mode.



NOTICE: Whether a radio can register on cells in LST depends on the codeplug settings.

If system broadcasts indicate that system-wide services are not available (LST) on a cell, the radio registers on this cell only if there are no system-wide cells available.

Depending on the infrastructure settings, when the radio is operating on an LST cell, the radio may prevent you from invoking the following services:

- Private call
- Phone call

- Private Automatic Branch Exchange (PABX) call
- Packet data

Depending on the codeplug configuration, the 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, the radio temporarily ignores the LST/WST parameter when selecting a site. However, the radio still takes other parameters such as the Radio Signal Strength Indicator (RSSI) level of the cell into consideration when deciding on roaming.

Local Site Trunking Ignoring is a paid feature.

2.14.11

Cell Surveillance and Monitoring Threshold (Negative C)

The radio constantly calculates a normalized value that represents the signal strength of a cell. This value is used by the radios to determine if the cell is usable and when to leave the cell.

In the default case, when the radio is camped on a cell, it initiates link failure procedures, such as leave the cell, if this normalized signal strength value falls below zero. However via the Customer Programming Software (CPS) it is possible to configure the radio to allow this normalized value to be processed below zero; value can be set in 1db steps up to -5db. Reducing this value below zero allows the radio to maintain service on a weak cell where the radio is unable to roam to a better cell.

2.15

Supplementary Services

Following is the description of the TETRA Supplementary Services (SS) that the radio supports in the Trunked Mode Operation (TMO).

2.15.1

Dynamic Group Number Assignment

The radio supports dynamic addition and removal of talkgroups in its talkgroup list through TETRA Dynamic Group Number Assignment (DGNA) and De-assignment signaling (SS-DGNA).

The radio responds to DGNA directed to it or to DGNA directed to a group the radio is attached to even if the talkgroup is not programmed in the codeplug.

When a DGNA request to add a talkgroup is received, the radio adds the group in the first available spot in the talkgroup list in the codeplug. Then you can scroll to the talkgroup to select the group. The codeplug determines which DGNA operations are allowed for a group.

Depending on the group type, the following is allowed:

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

The groups can be assigned as not attached, attached as scanned or attached as selected. Assignment of the group through DGNA with attached as selected makes it the selected group of the radio. If the group is assigned with attached as scanned, if it is not already in the currently active scan

list, the radio adds this group to a SwMI Controlled scan list and begins monitoring downlink signaling addressed to this group. The SwMI controlled list holds up to ten groups, and the radio monitors these groups as well as groups in the user scan list.

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

When a talkgroup de-assignment is received, depending on the codeplug settings (DGNA Operations field in the Talkgroup List) the radio behavior is as follows:

- If the DGNA Operations field is set to Static or Semi-Static, the radio;
 - leaves the talkgroup and the parameters assignments to folders unchanged.
 - sends an acknowledgment PDU with notification the group definition has been removed.
- If the DGNA Operations field is set to Dynamic or if the group is not in the talkgroup list, the radio;
 - removes the talkgroup from the talkgroup list, if the talkgroup is in the list.
 - removes all the occurrences of the talkgroup from the folder list.
 - sends an acknowledgment PDU with notification the group definition has been removed (also if the talkgroup has been deleted, or the talkgroup does not exist in the radio).

Even if the talkgroup is de-assigned, the radio can receive group calls or emergency group calls for any assigned scan list.

If the de-assignment is for a group in the scan list, the group remains in the list. However, it is not monitored.

If the de-assignment is for a group in the SwMI controlled list, the group is removed from the list.

If the de-assignment is for the selected group, depending on the service provider settings, the radio;

- notifies that there is no group attached, when in the group mode, and does not attach to another talkgroup automatically.
- attaches to the previously selected talkgroup, which is the talkgroup it was attached to before the DGNA being assigned. If the previous selected group is not present then the radio shows that there is no group attached and displays `No Group`.
- attaches to a default talkgroup configured by the service provider. If the default talkgroup is unavailable (it was deleted), the radio enters the `No Group` state.

At each talkgroup change, an appropriate notification is shown on the display.

If the de-assignment is for an announcement group, the talkgroup is removed from the talkgroup list. Also, all the groups that are associated with this announcement group do not have an associated announcement group. If the currently selected talkgroup is associated with this announcement group, the radio stops scanning the associated announcement group.

If DGNA user notification is provisioned, the user is notified once the DGNA operation is successful. For example, when a group is added or deleted. The notification is displayed until you confirm the operation. In case you receive a call, the message continues displaying until you confirm it.

The radio supports the reception of a DGNA Assignment that is addressed to its selected talkgroup as a supergroup of the selected group. All signaling addressed to the supergroup is monitored in addition to signaling addressed to the selected group, any announcement or associated groups, and groups in the active scan lists.

When the selected group is unselected, the radio ceases processing signaling to the supergroup that was associated with that selected group.

The radio receives the lifetime of the supergroup as part of the assignment signaling. If a subsequent assignment to the same group is not received within that lifetime, the radio ceases monitoring that supergroup.

The radio also supports supergroups of scanned groups, such that a group addressed DGNA assignment received on one of the user scan group addresses causes the 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.

The following DGNA functions are not supported:

- Call-related DGNA.
- Functionality of the authorized user.
- Network authentication before accepting DGNA.

2.15.2

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 the radio receives a call setup message with an AL call, the radio accepts the call. Then the 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.

The radio imposes no time limit on the transmission. The radio continues to transmit until the 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, the radio disconnects the call and initiates the requested service. The 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, the 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 the radio in the active AL call, the radio enters Pseudo Power-Off state.

2.15.3

Pseudo Power-Off

If you attempt to power down the radio in the active Ambience Listening (AL) call, the radio appears to turn off. However, it remains fully operational from Layer-3 and below. The radio has a blank screen, and all LEDs are turned off.

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

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

2.15.4

Preemptive Priority Call

If during a call, a call setup is received for a call with higher priority than the present call, and the new call priority is Preemptive Priority 3 (value 14 in the codeplug) or Preemptive Priority 4 – Emergency (value 15 in the codeplug), the radio disconnects from the present call and joins the new high priority call.

If the call priority of the new call is Preemptive Priority 1 (12) or Preemptive Priority 2 (13), depending on configuration, the radio either accepts or rejects the new call.

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.

2.15.5

Transmit Inhibit Mode

The Transmit Inhibit (TXI) Mode is a mode in which the 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/OK** → **Networks** → **TXI Mode** → **Activate**.

In this mode, the 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, or pressing the **PTT** button are disabled. Any transmission trial causes the radio to display `Not Allowed In TXI Mode` notification and to play a tone. Your radio can still receive group calls.

When no danger to safety exists anymore, for example, when you leave the RF sensitive area, you can deactivate the Tx-I Mode and the radio returns to standard operation.

You can deactivate the mode by selecting **Menu/OK** → **Networks** → **TXI Mode** → **Deactivate**, or implicitly when initiating an Emergency Call.



NOTICE:

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

- TXI Mode is activated.
- Battery is removed.
- The radio is turned off.

On entering or exiting the TXI mode, when the radio is camped on a cell, it sends a specially designated Short Data Service (SDS) status message. This SDS message indicates to the SwMI that the radio is entering or exiting TXI mode.

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

In TXI mode, the radio joins group calls for any group that the radio is monitoring, but the transmitting on that call is still prohibited.

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

If the radio is turned off in the transmit inhibit mode, on turning on the radio asks whether to exit the transmit inhibit mode. If you press the **Back** touch icon, the radio turns off.

2.15.6

Calling Line Identification Presentation

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



NOTICE: The number sent by the 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.

2.15.7

Universal Time Display

The radio can present time information to the user. The time is derived from an internal clock. The radio maintains the clock both when the radio is powered on and powered off.



NOTICE: 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:

- The 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 the radio using the Customer Programming Software (CPS) or radio MMI.

The 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, date, and offset information through the 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 SwMI. The radio provides user indications upon crossing to another time zone, when a new Mobile Country Code (MCC) broadcast received.

2.16

DMO Gateway and Repeater Communication

The radio provides the capability of communicating in Direct Mode Operation (DMO) with a Trunked Mode Operation (TMO) group via 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

The radio initiates calls only on a talkgroup directly and not through a gateway or repeater.

Auto gateway

The radio can initiate calls 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

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

Automatic gateway and repeater

The 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 calls are placed through the gateway. If a suitable gateway is not found, or a call setup through the gateway fails, the radio attempts to set up the call directly.

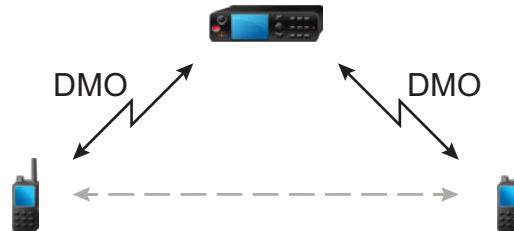
When operating on a gateway and/or repeater, the radio indicates the communication mode.

2.16.1

Communication through Repeaters

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

Figure 5: Communication through Repeaters



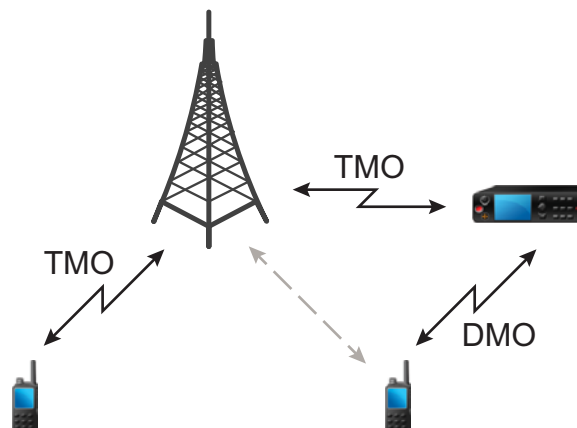
When the radio connects to a repeater, it plays a tone, displays the `Repeater available` message, and shows an appropriate icon. When the radio loses connection with the repeater, it plays a tone, displays the `Repeater not available` message, and the repeater icon is blinking.

2.16.2

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 6: Communication through Gateways



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

2.16.3

Gateway and Repeater Synchronization

To communicate via gateways or repeaters, the radio requires synchronization with a gateway or a repeater.

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

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

- The 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 calls are permitted.

In the second scenario, while the radio receives individual calls and group calls, and replying to individual calls is possible, replying to group calls is not possible.

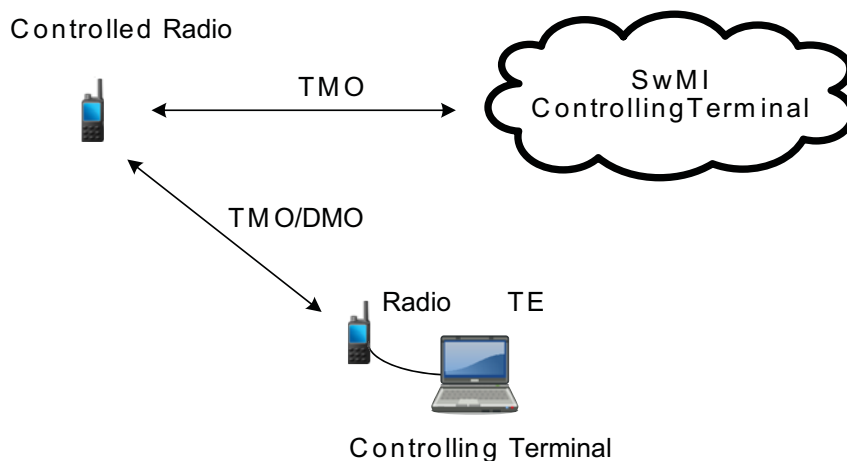
2.17

SDS Remote Control

Short Data Service (SDS) Remote Control is a paid feature.

The 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.

Figure 7: SDS Remote Control Overview



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).

You can use the feature only after a successful authorization, which requires entering a valid remote control PIN number.

The remote control messages can be sent to a group or individual 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 the radio authorized ISSI list, the radio executes received command and sends a response.

If configured by service provider upon the reception of SDS Remote Control Service (AT command) request, the radio gives an audio-visual notification.

The service provider has two options: **Limited SDS RC** and **Full SDS RC** modes.

The SDS remote control in the **Limited SDS RC** enables the following:

- Switching between TMO or DMO modes (read, change, notify) for individual radio and group using the +CTOM AT command.
- Selecting a talkgroup (read, change, notify) for individual radio and group using the +CTGS AT command.
- Reading and setting the scanning state using the +CTSCAN AT command.
- Collecting Network Information from individual radio - Network Registration Status and Cell Signal Quality using respectively the +CREG and +CSQ AT commands.
- Reading individual radio GPS position using the +GPSPOS AT command.
- Setting volume level for individual MT using the +CLVL AT command.
- Rebooting the radio using the R AT command.
- Terminating a call using the H AT command.
- Call forwarding using the +MCCFWD AT command.

The SDS remote control in the Full SDS RC enables the radio to use most of the AT Commands. To see which AT Commands are not supported, refer to the *AT Commands Programmer's Guide*.

2.18

Status Remote Control

Status Remote Control is a feature that provides limited control of the radio, unlike Short Data Service (SDS) Remote Control.



NOTICE: Only one type of remote control can be active on a radio; either SDS or Status.

The following tasks can be assigned remotely to a radio:

Play loud tone until user interaction

The radio plays a loud tone until you unlock the **Touch User Interface** (if needed) and press the **Back** touch icon. The tone is played through the speaker even if an accessory is attached.



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

- In a call.
- Temporarily disabled.
- Pseudo Off Mode.
- Ambience Listening Mode.
- Tx-I Mode.
- Emergency Mode.

Send firmware version and TEI

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



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

2.19

Global Navigation Satellite System (GNSS) Location Service

The Global Navigation Satellite System (GNSS) Location Service feature uses information from satellites orbiting the Earth to determine the geographical location of your radio. GNSS uses satellites from the GPS, GLONASS, Galileo, and BeiDou systems. GNSS Location Service is a paid feature.

The GNSS Location Service availability, accuracy, and the position calculation time vary depending on the environment in which you use the radio. The GNSS 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.

The radio supports the following system combinations depending on its hardware and configuration:

- Global Positioning System (GPS)
- Global Navigation Satellite System (GLONASS)
- BeiDou Navigation Satellite System (BDS)
- GPS + GLONASS
- GPS + BeiDou

The radio can send the location information over-the-air to your dispatcher to display it in the control center. Check your radio configuration details with your service provider.



IMPORTANT: Where the signals from satellites are not available, the GNSS 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 GNSS 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 GNSS Location Service feature provides a location, most probably near to your actual location.

The 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).
- Packet Data - Trunked Mode Operation (TMO) only.

Packet Data must be enabled on the network to send Location Reports using Packet Data. If the Location Reports are sent over the Packet Data, a Packet Data icon is displayed when the message is being sent.

If the Location Reports are sent via SDS with User-Defined Data Type-4 as a Transport Layer (SDS - TL), either the European Telecommunications Standards Institute (ETSI) Location Information Protocol (LIP) or Motorola Solutions Location Request/Response Protocol (LRRP) GPS Location Protocol is used. The LRRP GPS protocol either use SDS - TL (for added reliability) or Simple GPS with no SDS - TL (for saving air interface resources). GPS Protocol Identifiers are:

- LRRP SDS TL = 131
- LRRP Simple GPS = 3
- LIP GPS = 10

Location reports are sent in TMO. Your service provider can also provision location reports to be sent in Direct Mode Operation (DMO). If the radio is provisioned to provide user indications, the feature operational status is indicated on the radio display. Also, if configured by service provider, the radio gives an audio-visual notification upon reception of LIP command.

The GNSS Location Service feature can be enabled or disabled as a whole using the Customer Programming Software (CPS). It is possible to configure the feature parameters using the CPS, or over the air. The CPS configuration provides a default profile. The commands received over the air may overwrite the default profile configuration. The profile assigned to the 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.



NOTICE:

The Current GPS Cycle ends between 6th and 7th April 2019 at midnight Coordinated Universal Time (UTC). After this date, your service provider must reconfigure the Current GPS Cycle codeplug value to avoid malfunctions in GPS location reporting.

Ensure that the application receiving location messages uses valid addresses which are set up on radio as an authorized ISSI range. Otherwise the radio rejects all system position requests.

You can enable or disable the GNSS Location Service through the radio interface. If this feature is disabled, the Location Service Configuration can be programmed to the following parameters:

Receiver

GNSS Receiver is disabled. The radio responds to location requests by informing that location reporting is disabled.

Receiver and Location Protocol

GNSS Receiver and Location Protocol are disabled. The radio does not respond to any location requests.

Once the GNSS Location Service is re-enabled, the radio restores its location service.

The radio supports GNSS triggers functions, using LIP or LRRP, to report GNSS positions when the radio meets a set of criteria. Your service provider can set up the following triggers, together with their specific parameters:

Table 8: GNSS Triggers

Trigger Type	Trigger Event
Power-up	Radio powers up in TMO.
Power-down	Radio powers down in TMO.

Table continued...

Trigger Type	Trigger Event
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 (the radio checks the movement from the last known position at an interval).
TMO ON	Successful registration on entering TMO from DMO.
DMO ON	Before TMO deregistration, and before entering DMO.
Transmit Inhibit Mode ON	Radio is about to enter Tx-I.
Transmit Inhibit Mode OFF	Radio has successfully registered after leaving Tx-I.
Low battery	Radio detects its battery level has reached or fallen below the level specified by service provider.
Loss of GNSS	Radio detects a loss of GNSS for a minimum duration defined by service provider.
Recovery of GNSS	Radio detects a recovery of GNSS signal for a minimum duration defined by service provider.
Status entered	Radio sends a status defined in the codeplug for location reporting by pre-programming.
GNSS ON	Positioning device has been switched ON.
GNSS OFF	Positioning device in the radio is switched OFF.
Emergency Periodic Profile (LRRP only)	Radio is in emergency operation and given time interval after the last location report expires.

The GNSS icon is displayed in the status area when GNSS has a location fix. Optionally, your service provider may configure the radio to always display the GNSS icon, even outside of GNSS coverage or before the radio has acquired a location fix, that is, right after being powered on. In this configuration, the GNSS icon blinks until a location fix is acquired.

2.19.1

Global Navigation Satellite System (GNSS) over Packet Data

This feature enables a radio to use the Global Navigation Satellite System (GNSS) Location Service over Packet Data instead of standard Short Data Services (SDS).

When the GNSS Location Service feature is enabled and the GNSS services have been turned on using the radio interface, the radio requests for Packet Data context activation.

With turning off the GNSS using the radio interface, Packet Data service deactivates. The ongoing Packet Data session deregisters. For the GNSS over Packet Data, triggers and location information are sent or received while Packet Data is activated. It is carried out similarly to the standard GNSS over SDS.

When the GNSS 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 GNSS data.

2.19.2

Global Navigation Satellite System (GNSS) Accuracy

The Global Navigation Satellite System (GNSS) Location Service accuracy depends on the GNSS coverage and the selected accuracy mode.

In good GNSS 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.



NOTICE:

The presented values depend on variety of factors, for example the view on the sky. To optimize the GNSS performance the radio should have the clearest possible view of the open sky.

2.19.3

Location Report Backlog

The radio can record location track when it is out of service, when in DMO, or when in TXI mode.

The location reports generated during this time is stored, and all location report backlog recordings are uploaded once the 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)

The radio starts recording location reports when radio is out of service in TMO Mode.

The radio resumes latest location reporting when TMO coverage is regained.

Location Backlog Recording in Direct Mode Operation (DMO)

The radio starts recording location reports in DMO Mode.

The radio resumes latest location reporting when it switches back to TMO mode.



NOTICE: This feature is only available when enabled by your service provider.

Location Backlog Recording in Transmit Inhibit Mode (TXI)

When the radio is in TXI mode, location reports are generated and recorded but not sent out.

Once the radio exits TXI mode and is within TMO coverage, the location reports are uploaded to the server.

2.20

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.

The usable range may be reduced when you connect the radio with devices that support more limited ranges or if physical obstacles such as walls appear between devices. There are five separate Bluetooth features available:

- Bluetooth Audio - includes Bluetooth Audio, Fast Push-to-Talk (PTT), and Indoor Location

- Bluetooth Connectivity - includes Bluetooth Dial Up Networking (DUN) and Bluetooth Serial Port Profile (SPP)
- Bluetooth Radio Control - includes Bluetooth Radio Control via AT commands, Bluetooth Generic Attribute Profiles (GATT) Sensors
- Bluetooth Smart Proximity Pairing
- Bluetooth Smart Ready - includes Bluetooth Low Energy Heart Rate Profile and Bluetooth Generic Attribute Profiles (GATT) Sensors

You can use Bluetooth to:

- Connect the 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 the radio.
- Make your radio discoverable indoors to Bluetooth beacons.
- Allow radio collaboration with various Bluetooth sensors or data capture devices for example, biometric sensor, bar code scanner, or firearm device.
- Increase connectivity with secure packet data services between the radio and a Data device or a Smartphone running appropriate applications.
- Enable radio control via a Data device.

The radio supports Bluetooth 2.1 + EDR, Bluetooth 4.0, and Bluetooth Smart (BTLE). Secure Simple Pairing, one of its features, ensures high level of security while pairing devices and thus protects you against recording and passive eavesdropping.

One radio can be connected with up to seven devices at the same time.



NOTICE: Bluetooth Audio, Bluetooth Connectivity, Bluetooth Radio Control, Bluetooth Smart Proximity Pairing, and Bluetooth Smart Ready are paid features.

2.20.1

Bluetooth Interactions

The Bluetooth feature interacts differently with other features and situations of the radio.

The following features and situations limit the use of Bluetooth:

Transmit Inhibit Mode (Tx-I)

Bluetooth does not work in the Transmit Inhibit Mode. When the radio enters the Tx-I Mode while Bluetooth is enabled, all remote devices are disconnected and Bluetooth is disabled. After leaving the Tx-I 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 the radio, it disconnects the Bluetooth audio device. When a wired audio device is already connected to the radio, scanning for Bluetooth audio devices is disabled.

2.20.2

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.

- It is only possible to have one Object Push Profile (OPP) enabled device connected at a time.
- It is only possible to have one Bluetooth Dial Up Networking (DUN) enabled device connected at a time.
- It is possible to have up to seven Serial Port Profile (SPP) sensor devices connected at a time given that the total number of connected devices does not exceed seven.

In summary, it is possible to have one Motorola Solutions PTT device, one BT audio device, one OPP device, one DUN device, and three SPP devices connected at the same time.



NOTICE: The recommended size of the file to be sent is 2 GB.

2.20.3

Bluetooth Sensor Data

Your service provider can configure the details of the sensor information the radio displays.

Depending on the type of sensor connected to the 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 the radio displays.

Sensor Battery Information

The 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 the 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 the radio user by making the user more aware of their surroundings. If the collected values exceed limits set by your service provider, the 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.

2.20.4

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 the radio can be paired with via Bluetooth, for example gas or heart rate sensors.

To pair the radio with a sensor, move the radio close to a sensor and press and hold the **One-Touch Button**. A tone indicates successful pairing and connection. After the connection, the radio collects information from the sensor.

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Chapter 3

Man-Machine Interface

3.1

LED Indications



NOTICE: LED Coverage Indicator and LED Power Indicator are differentiated on the radio. See [Controls and Indicators on page 60](#) for the positions of the two LED.

Table 9: LED Status Indications

Indication	Status
Solid green	<ul style="list-style-type: none"> In use. Repeating call.
Blinking green	<ul style="list-style-type: none"> In service or idle.
Solid red	<ul style="list-style-type: none"> Out of service. Switching between modes, for example, DMO to TMO.
Blinking red	<ul style="list-style-type: none"> Connecting to the network. Entering DMO.
Solid orange	<ul style="list-style-type: none"> Radio is powering up. Transmit inhibit in service. Channel busy in DMO. Radio interference in DMO.
Blinking orange	<ul style="list-style-type: none"> Incoming call.
No indication	<ul style="list-style-type: none"> Radio powered down. Radio in Covert Mode.

Table 10: Battery Charging LED Indications

Indication	Status
Solid green	Battery fully charged
Blinking green	Battery charged at 90%
Solid red	Rapid or trickle charge
Blinking red	Faulty or invalid battery
Blinking orange	Battery is waiting to charge



NOTICE:

When you charge your radio in a multi-unit charger, the LED Power Indicator of the radio indicates the charge status of the battery.

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

3.2

Battery Charging Indications

When the radio is turned on while charging, it displays an appropriate Battery Charge Progress icon at the status icon area.

When the radio is turned off while charging, it displays the Charger Mode screen. The screen displays the charging progress expressed in percentage.



NOTICE: The Charger Mode screen does not remain on. To easily identify the charging status, check the LED Power Indicator. See [LED Indications on page 59](#).

Figure 8: Charger Mode Screen

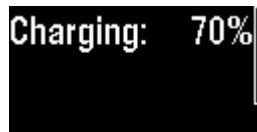


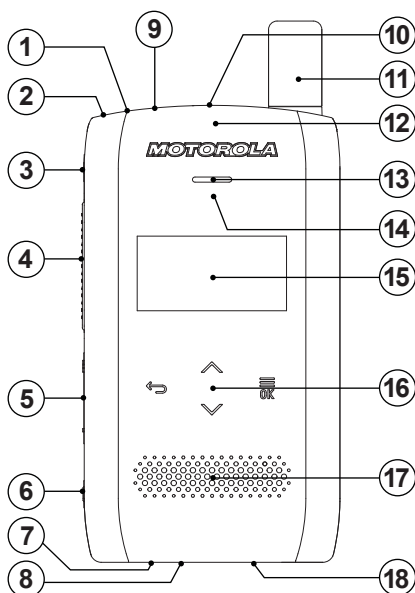
Table 11: Battery Icons

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

Battery Charge Progress						
0%–5%	5%–15%	15%–25%	25%–40%	40%–60%	60%–80%	80%–100%

3.3

Controls and Indicators









Annotation	Description
1	<p>Power/Sleep/Wake button</p> <ul style="list-style-type: none"> • Press and hold to turn on/off the radio. • Press to turn display on/off.
2	<p>LED Power Indicator</p> <p>Shows the battery status when the radio is charging.</p>
3	<p>P1 Programmable button</p> <p>Supports the One-Touch Button feature or the Emergency Operations feature.</p>
4	<p>Push-to-Talk (PTT) button</p> <p>Press and hold to initiate a simplex call, release it to listen.</p> <p> NOTICE: Pressing PTT activates the backlight for 3 seconds.</p>
5	<p>Volume button</p> <ul style="list-style-type: none"> • Press + to increase the volume. • Press - to decrease the volume.
6	<p>P2 Programmable button</p> <p>Supports the One-Touch Button feature.</p>
7	<p>Audio Connector</p> <p>The 3.5 mm audio connector supports headset audio and microphone, as well as PTT on Motorola accessories.</p>
8	<p>USB Connector</p> <p>The USB Type-C™ connector supports charging and programming.</p>
9	<p>Top Microphone</p> <p>The Top Microphone is activated during high-audio simplex calls.</p>

Table continued...

Annotation	Description
10	Talkgroup Selector Allows user to scroll through the talkgroups of the current selected folder on Idle screen.
11	Hybrid Antenna
12	LED Coverage Indicator Shows the coverage status while transmitting and receiving over the network.
13	Earpiece The Earpiece is active during low-audio simplex or duplex calls.
14	Proximity Sensor Disables the display and Touch User Interface during full duplex calls to avoid unintended presses on the touch buttons.
15	PMOLED Display The 1.54-inch screen features a monochrome display with a resolution of 128 x 64 pixels. The screen consists of a two-line display area with the top line showing radio icons and the bottom line showing text display.
16	<p>Touch User Interface The four touch sensitive menu icons allow access to menu navigation.</p> <ul style="list-style-type: none"> To navigate within the menu hierarchy, press the Up  or Down  menu icon. To return to the previous menu, press the Back  menu icon. To select or to enter context-sensitive menus, press the Menu/OK  menu icon. <p> NOTICE: To turn on the Touch User Interface, press the Power/Sleep/Wake button. The available navigation icons light up depending on the context or menu that is displayed.</p>
17	Speaker Provides good quality high audio during simplex calls.
18	Bottom Microphone Activated during low-audio duplex calls.

3.4

One-Touch Buttons

The One-Touch Button feature allows you to activate a feature by a long key press of the programmable button. If an unassigned button is pressed, the radio displays `Unassigned Button`.

Table 12: One-Touch Button Features

Feature	Description
Add Bluetooth Device	Activates scanning for Bluetooth devices.
Bluetooth Smart Proximity Pairing	Turns Proximity Pairing on or off.

Table continued...

Feature	Description
Change Talkgroup	Changes the talkgroup to the one programmed by your service provider.
Disconnect All Connected Bluetooth Devices	Disconnects all Bluetooth devices connected to the radio.
Display Heart Rate	Displays the heart rate value received from the connected GATT-based heart rate sensor.
LIP Report	Sends a message with the location of the radio to a dedicated address.
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.
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 the radio to its default settings.
Send Double Push PTT Tone (D-PTT)	Sends the D-PTT tone to the currently used talkgroup.
Switch to Previously Selected Talkgroup	Changes the talkgroup of the radio to the previously selected talkgroup (DMO or TMO).
Timed Talkgroup Change	<p>Makes a predefined talkgroup the selected talkgroup for a specified amount of time. While using the predefined talkgroup, the second press of the One-Touch Button results in:</p> <ul style="list-style-type: none"> • the radio returning to the previously selected talkgroup, • the radio restarting the predefined time, or • no action on the radio, depending on the configuration <p>After the timer expires, the radio returns to the previously selected talkgroup.</p>
Toggle Bluetooth Discoverable Mode	Turns Discoverable Mode on or off.
Toggle DMO or TMO	Toggles between TMO and DMO modes.
Toggle Hi or Low Audio	Toggles audio high or low.
Toggle Howling Suppression	Enables or disables Howling Suppression.
Toggle Talkgroup Scan	Turns the Talkgroup Scan feature in TMO Mode on or off.
Turn Bluetooth On or Off	Turns Bluetooth on or off.
Unassigned	No feature assigned to this button.
Universal Time Display	Displays universal time on the home screen.

3.5

Display

This section presents the default home screen elements of the radio.

Figure 9: Default Home Screen with Icons



Table 13: Display

Annotation	Description
1	Status icon area
2	Text display area

3.5.1

Status Icons

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

Table 14: Trunked Mode Operation (TMO) Icons









Icon	Description
	In Service
	No Service
	Signal Strength The more bars, the stronger the signal.
	Migration Radio is registered to a foreign network.
	Scan Talkgroup scanning is activated in the radio.

Table 15: Direct Mode Operation (DMO) Icons

Icon	Description
	Direct Mode Call Radio is receiving a Direct Mode call. The more bars, the stronger the signal.
	Direct Mode Radio is in Direct Mode, radio-to-radio communication.
	DMO Gateway Communication Mode Indicates that the gateway is selected. This icon has the following states: <ul style="list-style-type: none"> • Solid - when the radio is synchronized with the gateway. • Blinking - when the radio is not synchronized or during attachment. • No icon - during a radio-to-radio and repeater call.
	DMO Repeater Communication Mode

Icon	Description
	<p>Indicates that the Repeater or GW + Rep option in DMO mode is selected. This icon has the following states:</p> <ul style="list-style-type: none"> • Solid - when the radio has detected the repeater, for example, when the radio receives a presence signal. • Blinking - when the radio has not detected the repeater or during attachment. • No icon - during a radio-to-radio and gateway call.

Table 16: General Icons

Icon	Description
	<p>Low Audio Audio mode is changed to low.</p>
	<p>High Audio Audio mode is changed to high.</p>
	<p>Earpiece Connected Earpiece is connected.</p>
	<p>Battery Strength Indicates the charge of the battery.</p>
	<p>Battery Charging Indicates that the battery is charging.</p>
	<p>Emergency Radio is in Emergency Operation.</p>
	<p>Bluetooth Connected Bluetooth is enabled and at least one device is connected.</p>
	<p>Bluetooth Disconnected This icon has the following states:</p> <ul style="list-style-type: none"> • Solid - Bluetooth is enabled but no device is connected. • Blinking - Bluetooth is enabled and the radio is in Discoverable Mode or connection with a remote device is being established.

3.5.2

Idle Display

The terminals provide access to all services from the main idle display.

Your service provider can configure the idle display. The idle display can show the following:

- Icons on the status area (top line):
 - Status icons in Trunked Mode Operation (TMO) signal level icon.
 - Battery level displayed at all times.



NOTICE: The terminal periodically repeats the audible and visible indication of low battery.

- Displays a single line of text which can comprise of multiple information. The content of this information depends on the Configurable Idle Screen settings.

- Selected Group.
- Current Scanlist.
- Time and Date.



NOTICE: If there is more than one line of text available on the idle screen, you can use the **Touch User Interface** to scroll through multiple text lines.

3.5.3

Languages Supported

Table 17: Languages Supported

Language	ST7000
English	Yes
Arabic	Yes
Chinese (traditional)	Yes
Croatian	Yes
Danish	Yes
Dutch	Yes
Finnish	Yes
French	Yes
German	Yes
Hungarian	Yes
Italian	Yes
Japanese	Yes
Korean	Yes
Norwegian	Yes
Polish	Yes
Russian	Yes
European Portuguese	Yes
Latin American Portuguese	Yes
European Spanish	Yes
Latin American Spanish	Yes
Swedish	Yes

3.6

Tones




NOTICE: The radio has two tone packs which are the default Classic Tones and New Tones. Your service provider decides which tone pack is enabled. To listen to the audio signal tones samples, click .

Table 18: Radio Tones







































New Tone	Classic Tone	Tone Description
		Default Beep – Played when pressing a key.
		Invalid Action Examples: <ul style="list-style-type: none"> Pressing an invalid key. Dialing an invalid number. Talk prohibit.
		System Notification Examples: <ul style="list-style-type: none"> The radio changes its status from out-of-range to in service. The radio returns to the home network. Toggleing between TMO and DMO modes.
		System Error Examples: <ul style="list-style-type: none"> The radio changes its status from in service to out-of-range. Call disconnected.
		General Notification Examples: <ul style="list-style-type: none"> Entering Local Site Trunking. Entering Transmit Inhibit Mode.
		Talk Permit – The radio user is allowed to transmit after pressing the PTT button.
		Emergency – Emergency Call received.
		Emergency 2 – Emergency Call received (optional tone).
		Low Battery – Battery charge level is low.
		Phone Busy – The called radio is busy.
		Phone Ring Back – Played on the initiating phone when Phone Call is being set up.
		Private Ring Back – Played on the initiating phone when Private Call is being set up.

Table continued...

New Tone	Classic Tone	Tone Description
		Ringtone 1.
		Ringtone 2.
		Ringtone 3.
		Ringtone 4.
		Ringtone 5.
		Simplex Volume Set – Played when adjusting simplex volume.
		Duplex Volume Set – Played when adjusting duplex volume.

3.7

Description of Tones

Motorola Solutions TETRA terminal supports audible user notification, tones.

Tones for events are divided into five categories:

- Keypad – for events triggered by key-press.
- Alert – for events triggered by an application.
- Ring – for events triggered by incoming/outgoing call.
- Callout – 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 the 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 Customer Programming Software (CPS) 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).

3.8

Dual Microphones

Each radio has two microphones. One at the top of the unit for dispatch (simplex) operation, and another at the bottom of the unit for duplex calls.

While the ambience listening is active or while being in the covert mode, you cannot switch to the high audio mode by pressing the speaker control key.

3.9

Audio Toggle

You can control audio routing between the speaker and earpiece for any private or group call through the dedicated **One-Touch Button**. The default setting for this feature is configurable in the Customer Programming Software (CPS).

3.10

Volume Adjustment Mode

The Volume Control Mode is configurable using the Customer Programming Software (CPS).



NOTICE: When a volume control capable Bluetooth device is connected, the radio always uses the Common setting.

The max volume offset (dB) and the volume range (dB) are configurable through CPS (**Audio Settings** → **User Profile**). The volume control in the 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.

3.11

Accessory Setup

You can connect CORE or Other accessories to the audio connector at the bottom of the radio.

If you connect a CORE or Other (for example, a third-party accessory) accessory, the 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 the radio that defines the audio settings, such as gains and filters settings, for each accessory.



NOTICE: To ensure proper connection of the audio accessory, fully insert the audio connector into the audio port of the radio. To resolve connection issues caused by partial insertion, remove and reinsert the audio connector.

3.12

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.

3.12.1

Audio Profile

The radio supports an audio profile which is configurable using the Customer Programming Software (CPS).

The following parameters can be configured for the audio profile:

- Mic Gain offsets.
- Howling Gains.
- AGC, Echo Cancellor, and RX/TX Noise suppressor.
- Voice offsets and ranges for different audio devices.

- Tone offset and ranges.

3.13

Test Page


Only authorized persons can use the Test Page option and this option must be enabled in the codeplug.




NOTICE: 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/OK** → **Up** → **Down** → **Back**.

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.
 - **Antenna Frequency Band**
 - **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**
-  **NOTICE:** You can exit KVL Mode by power cycle.
- **E2E Key Del**


- **MS Logging**
- **CE Monitor** – Crypto-Engine Monitor.
- **Key Info** – Key Information allows the 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 MSs 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 the radio, that is SCKN and SCK-VN attributes (SCK version number).
 **NOTICE:** When checking for SDMO key information in the radio, the SDMO KAG (SDMO Key Association Group) range in the AuC (Authentication Center) is from 0 to 9 and the range in the radio is from 1 to 10.
 - For the GCK:
 - + **Full GCK-VN** – current Full GCK-VN. (GCK version number).
 - + **GCK List** – list all GCKs stored in the radio, that is GCKN and GCK-VN attributes.

3.14

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
 **NOTICE:** 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) – the ISSI which is in use.
- TETRA Equipment Identity (TEI) – the TEI is displayed as a hexadecimal number.
- Serial number – Motorola Solutions serial number is displayed only on radios distributed under Motorola Solutions trademark.

3.15

Hardware Test

This mode allows performing basic hardware tests and share the results immediately on the display.

 **NOTICE:** The hardware test mode is only for use by authorized persons.

Use the following key combinations to access the hardware test: simultaneously press and hold the **P2 Programmable** button, **PTT** button, and the **Power/Sleep/Wake** button.

Appendix A

Service Information – EIA

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 GmbH, European Systems Component Center, Am Borsigturm 130, 13507 Berlin, Germany

E-mail: escc.admin@motorolasolutions.com.

Telephone: +49 (0)30 6686 1404

Mon – Fri, 08:00 am – 06:00 pm (CET)

Table 19: Service Information — Telephone Numbers to EIA Integrated Call Center

Country	Telephone Number
Austria	1206091087
Denmark	43682114
France	157323434
Germany	6950070204
Italy	291483230
Lithuania	880030828
Netherlands	202061404
Norway	24159815
Portugal	800552277
Russia	810800228 41044 (Alternative 8108001201011)
South Africa	800981900
Spain	912754787

Table continued...

Country	Telephone Number
United Kingdom	2030277499
Other Countries	+42 0533336946

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 <http://emeaonline.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 or see <http://emeaonline.motorolasolutions.com>.

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 <http://emeaonline.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: esc.admin@motorolasolutions.com.

Appendix B

Service Information – AME

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 20: 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: Mareen Phua E-mail: mareen@azure.com.sg Enquiry: Tay Yong Hock E-mail: yonghock.tay@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

Table continued...

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, Hung Hom, 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.

Table continued...

Country	Telephone Number	Address
		8F, No. 9, Songgao Rd., 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 Motorola Solutions local distribution organization or via Motorola Solutions Online (Extranet).

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Appendix C

Service Information – 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 21: Service Information – Telephone Numbers and Addresses of Latin America Radio Support Centers

Country	Telephone Number	Address
Colombia	571- 376-6990	MOTOROLA DE COLOMBIA SERVICE CENTRE Torre Banco Ganadero Carrera 7 No. 71-52 Torre B piso 13 Oficina 1301 Bogota
Mexico	5252576700	MOTOROLA DE MEXICO 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 22: Service Information – Telephone Numbers and Addresses of Latin America Motorola Solutions Centers

Country	Telephone Number	Address
Argentina	5411-4317-5300	MOTOROLA DE ARGENTINA Ave. del Libertador 1855 B1638BGE, Vicente Lopez Buenos Aires
Brasil	5511-3847-668	MOTOROLA DO BRASIL LTDA. Av. Chedid Jafet

Table continued...

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 CHILE Ave. Nueva Tajamar 481 Edif. World Trade Center Of. 1702, Torre Norte Las Condes Santiago
Colombia	571-376-6990	MOTOROLA DE COLOMBIA, LTDA. Carrera 7 #71-52 Torre A, Oficina 1301 Bogotá
Costa Rica	506-201-1480	MOTOROLA 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 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 DE MEXICO, S.A. Calle Bosques de Alisos #125 Col. Bosques de Las Lomas 05120 México D.F.
Peru	511-211-0700	MOTOROLA DEL PERU, S.A. 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 DE LOS ANDES C.A. Ave. Francisco de Miranda Centro Lido, Torre A Piso 15, El Rosal Caracas, 1060

Glossary

Air Interface Encryption (AIE) The Dimetra IP System supports Over-the-Air Standard Encryption of radios and Base Stations using the standard TETRA algorithms TEA1, TEA2 and TEA3.

| See also: [Encryption](#)

Base Station A fixed RF transceiver used in wireless voice and data communications.

| See also: [Base Transceiver Subsystem](#)

Base Transceiver Subsystem (BTS) A Base Station serving as the Radio Frequency (RF) interface between the radios and the system infrastructure.

Control Channel A dedicated channel at a site on which radios send and receive instructions for call processing.

Central Network Equipment The equipment located at the Master Site or Mobile Switching Office.

Customer Programming Software (CPS) Computer-based software which allows the programming of the radio's characteristics (for example, frequency, DPL codes, and alias).

Direct Mode Operation (DMO) Direct communications between two or more radios without the use of any infrastructure.

Encryption Using ciphers to alter information before it is transmitted over a network. Encryption ensures, to the greatest extent possible, that messages cannot be read or altered during transmission.

Local Site Trunking (LST) When a system fails or many of the sites lose connection to the CNE, the sites are designed to go into a fall back situation known as Local Site Trunking (LST). When the sites are forced to go into LST, the radios (users) are randomly distributed across all the sites and communication between

radios is dependant on at which site they are registered. Only radios registered at a particular site can communicate to each other.

| See also: [Central Network Equipment](#)

Dynamic Group Number Assignment (DGNA) DGNA is a possibility to provision talkgroups into the radio over the Air Interface.

| See also: [Talkgroup](#)

Push-to-Talk A method by which a radio user initiates or joins a call. When the user presses the PTT button (also known as keying up), the radio sends data to the network infrastructure to request call services.

Motorola Telephone Interconnect Gateway (MTIG) The MTIG acts as a gateway in the TI architecture and provides transcoding of voice between the external PBX and the Dimetra IP network.

| See also: [Private Automatic Branch Exchange, Telephone Interconnect](#)

Mobile Network Code Allocated by the national authority that allocates frequency assignments in a country and should be requested from that authority at the same time as frequency allocations are requested. The MCC and MNC together form a unique TETRA system identifier that is broadcast by a Dimetra system over the air interface.

| See also: [Mobile Country Code](#)

Mobile Country Code The 3 digit (12 bits) Mobile Country Code identifies uniquely the country of the mobile subscriber. Within an IMSI, the first 3-digit contains the MCC information. A mobile country code (MCC) is used in combination with a mobile network code (MNC) to uniquely identify a mobile network operator (carrier) using the GSM (including GSM-R), UMTS, TETRA, and LTE public land mobile networks.

| See also: [Mobile Network Code](#)

Radio A two-way communication device used for voice and data.

Alias Short Subscriber Identity (ASSI)

The Tetra address corresponds to the Individual Tetra Subscriber Identity (ITSI). It includes in addition to the Mobile Country Code (MCC), the Mobile Network Code (MNC) nor the 7- or 8-digit subscriber short identifier, Short Subscriber Code (SSI), the allocation of mobile radio equipment to a private or public service produces.

| See also: [Short Subscriber Identity](#)

European Telecommunications

Standards Institute (ETSI) ETSI has been active in the smart card field, building European standards where there are gaps in the ISO standards. ETSI card standards work is based on ISO standards where published.

| See also: [TETRA](#)

Short Data Service (SDS) A flexible bearer service that transfers information from one interface to another.

Main Control Channel (MCCH) The main control channel at a site. The channel is used by radios to register on the system and to request and setup speech calls with other radios.

| See also: [Control Channel](#)

Over-The-Air-Rekeying protocol

(OTAR) Used in connection with Air Interface Encryption.

| See also: [Air Interface Encryption](#)

Downlink The radio frequency communications path from the BTS to the radio. Also referred to as the BTS transmit path.

| See also: [Base Transceiver Subsystem](#)

Switching and Management

Infrastructure (SwMI) All the system components excluding the mobile equipment that is the CNE and all the remote site equipment.

| **Synonym:** Fixed Network Equipment
| See also: [Central Network Equipment](#)

Private Call A PTT call in which a user on one endpoint/device directly initiates a direct,

private, audio conversation with another user on another endpoint/device. Available in PTT Pro.

Individual Short Subscriber Identity (ISSI) TETRA term for a unique, individual ID assigned for each radio.

| See also: [Short Subscriber Identity](#)

Talkgroup A uniquely named group of radios that can share calls and messages. A talkgroup's normal communications do not require interfacing with other talkgroups. Typically, the majority of a radio user's communications are within their own talkgroup.

Public Switched Telephone Network (PSTN) The telephone network, traditionally the wired network, that requires the public user to address or dial the destination using a "telephone number" for a temporary connection.

Group Short Subscriber Identity (GSSI) TETRA term, in Dimetra called Group ID or Talkgroup ID.

| See also: [Short Subscriber Identity](#)

Derived Cipher Key (DCK) Used to encrypt all uplink signaling (from radios to infrastructure) and individually addressed downlink signaling (from infrastructure to a radio).

| See also: [Encryption](#)

Common Cipher Key (CCK) Used to encrypt group and broadcast addressed downlink signaling (from infrastructure to a radio). Also used to protect ISSI identities.

| See also: [Encryption](#), [Individual Short Subscriber Identity](#)

Static Cipher Key (SCK) Key used for encryption between radios and BTS in Class 2 systems with corresponding algorithm.

| See also: [Encryption](#), [Base Transceiver Subsystem](#)

TETRA Acronym for TERrestrial Trunked RAdio. The digital trunked radio standard produced by ETSI providing detailed telecommunications specifications to which Base Stations and radios should adhere.

| See also: [Base Station](#), [European Telecommunications Standards Institute](#), [Radio](#)

Man Machine Interface (MMI) MMI commands are the input from a service computer entered to communicate with the Site Controller at the system level.

| See also:

Radio User Assignment (RUA) Part of RUA/RUI feature.

| See also: [Radio User Assignment/Radio User Identity](#)

Radio User Identity (RUI) Part of RUA/RUI feature

| See also: [Radio User Assignment/Radio User Identity](#)

Radio User Assignment/Radio User Identity (RUA/RUI) This feature allows to assign alphanumeric user names to radio users, and to authenticate the radio users in a login process.

| See also: [Radio User Assignment](#), [Radio User Identity](#)

TETRA Equipment Identity (TEI) An electronic serial number that is permanently embedded in the TETRA equipment, like radios.

Telephone Interconnect (TI) Most 2-way radio systems can be enhanced by a telephone interconnect option. Telephone interconnect allows the mobile or portable radio user to place and receive standard landline telephone calls via the 2-way radio system. In a conventional system, telephone interconnect requires a special piece of equipment called a patch or interconnect device. In trunked systems, a telephone interconnect terminal is connected to the central controller.

| See also: [Motorola Telephone Interconnect Gateway](#), [Public Switched Telephone Network](#)

Short Subscriber Identity (SSI) The network specific portion of a TETRA Subscriber Identity. An SSI is only unique within one TETRA subdomain (one TETRA network).

Radio Signal Strength Indicator (RSSI) Determines radiation patterns of transmitters antennas.

Private Automatic Branch Exchange Private Branch eXchange (PABX) A telephone switch that is operated privately within a confined setting, instead of publicly. Most large offices have a PBX to handle intraoffice calls and to connect calls to and from the Public Switched Telephone Network (PSTN).

Individual TETRA Subscriber Identity (ITSI) Consists of ISSI plus MCC and MNC codes.

| See also: [Individual Short Subscriber Identity](#), [Mobile Country Code](#), [Mobile Network Code](#)

Announced Cell Reselection Cell reselection where radio Mobile Link Entity (MLE) informs the Switching and Management Infrastructure (SwMI) both in the serving cell and in the new cell that cell change is performed.

| See also: [Switching and Management Infrastructure](#), [Cell](#), [Mobile Link Entity](#)

Mobile Link Entity (MLE) Responsible for the control of lower layer radio functions.

| See also: [Announced Cell Reselection](#)

Group Cipher Key (GCK) Predetermined cipher key used to provide confidentiality in Class 3 system with corresponding algorithm. Used to generate MGCK.

| See also: [Modified Group Cipher Key](#), [Class 3](#)

Modified Group Cipher Key Used to encrypt group addressed downlink signaling.

| See also: [Downlink](#), [Encryption](#)

Clear Not encrypted.

Audio Device Descriptors (ADD) A structure which provides hardware information about a particular audio accessory (for both IMPRESS and core accessories). Files with ADD have an extension .add.

Asia Pacific region (APAC) Asia Pacific region

Calibration values A set of important and unique, factory-defined values (such as

frequency tuning) assigned to radios. Also known as Sensitive data.

Class 3 DCK encryption, ESI with CCK, authentication.

| **See also:** [Common Cipher Key](#), [Derived Cipher Key](#)

Dual Tone Multi-Frequency (DTMF)

Tone-based signaling scheme which combines two of a set of standard frequencies. The result is a third or beat frequency (signal) which is the desired or usable signal. DTMF signaling is used as tone-dialing in the common telephone.

Encryption Secure communications systems are designed to provide coded (“encrypted”) signals between some or all links in the system. In order to do this, each device involved in secure communications is loaded with a multi-digit encryption variable (called a key). This key is used by an encryption algorithm built into the device to encrypt voice or data as needed. Only devices in the system with the same algorithm and encryption key can decode the encrypted signals.

Encrypted Short Identity (ESI)

Encrypted Short Identity

EA Solutions Support Center (ESSC)

EA Solutions Support Center

Firmware Computer instructions that reside as read-only software on a radio's flash memory.

Flash A storage chip integrated in to radio hardware, that can be erased and reprogrammed.

Flashing Writing a software image file to a radio.

Group Cipher Key Key Association Range (GCK KAR) Group Cipher Key Key Association Range

General Programmable Input Output (GPIO) A method of transferring data between the CPU and a peripheral, such as a network adapter or an ATA storage device.

Group Call A call addressed to talkgroups or multigroups.

| **See also:** [Talkgroup](#)

Home Location Address Area within radio coverage of a base station or group of base stations within which a radio is allowed to operate.

| **See also:** [Base Station](#)

Key A piece of data, which when used with a particular cryptographic algorithm, allows unencrypted information to be encrypted and encrypted information to be decrypted.

| **See also:** [Encryption](#)

Location Information Protocol (LIP)

Location Information Protocol

Location Request Response Protocol (LRRP)

This protocol allows for a single and efficient format of passing location information (requests and responses).

Motorola Advanced Crypto Engine

(MACE) Processors responsible for encrypting and decrypting audio in the Voice Processor Module (VPM) hardware.

Next Generation Control Head (NGCH)

Next Generation Control Head

PABX Gateway A device that provides connectivity from a TETRA user to a PABX subscriber and the other way around.

| **See also:** [Private Automatic Branch Exchange](#)

Permanent Disable Version 2 (PDV2)

You can restore a disabled radio using CPS Plus.

Peripheral Equipment Interface (PEI)

Personal Hands-Free kit (PHF) In other words an earpiece or a handset.

Private Duplex Call A private call between two radios that resembles a telephone conversation. The two individuals can talk and listen at the same time without pressing PTT.

| [See also: Private Call, Push-to-Talk](#)

Private Number Also called Private ID.

PSTN Gateway A device that provides connectivity from a TETRA user to a PSTN subscriber and the other way around. Additionally, for the duration of the call, the PSTN gateway allows TETRA signaling information to be passed from TETRA Switching and Management Infrastructure to the external network user and from the external network user to the TETRA SwMI in accordance with the TETRA Call Control (CC) procedures.

| [See also: Public Switched Telephone Network, Switching and Management Infrastructure](#)

Point-to-Point Call (PTPC) Point-to-Point Call

| [See also: Private Call](#)

Push-to-Talk button Push-to-Talk button

| **Abbreviation:** PTT Button

Remote Control Unit (RCU) A small device attached to a covert radio over a thin wire, used for operating the radio.

Remote flashing Programming the transceiver via the control head.

Remote Speaker Microphone (RSM)
Remote Speaker Microphone

Secure Direct Mode Operation Key Association Group (SDMO KAG)
Secure Direct Mode Operation Key Association Group

Selling Feature Requires a USB dongle with purchased licenses.

Semi-Duplex Private Call Also called Private Call or Express Connect Call. In this type of one-way call, the user presses and holds the PTT while talking, and releases the PTT while listening.

| [See also: Private Call, Push-to-Talk](#)

Sensitive Data A set of important and unique, factory-defined values (such as frequency tuning) assigned to radios.

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

Software Image A collection of files distinguished by individual releases. It contains firmware, codeplug, and audio template files dedicated to specific radio models.

Status ID A feature that makes it possible for a subscriber to send status messages to other subscribers. The user can enter a status message for each ID in a Status ID list. When a subscriber sends a status message, the ID of the subscriber's unit is sent along with the status message.

Trunked Radio Communications (Trunked) A computer controlled communications system that allocates speech channels on demand selecting on a random basis from the group of channels available.

Upgrade To replace radio firmware with a newer version and preserve User and Sensitive Data.

User Data A set of codeplug nodes and values, that can be edited and replicated to other codeplugs or radios.

Visiting Alias Short Subscriber Identity ((V)ASSI) An identity by which foreign subscribers are known to operators for subscribed services. It is assigned by a TETRA system to a foreign device to facilitate short addressing within that visited system.

Digital Car Kit (DCK) Accessories that allow you to use your phone in the car without requiring use of your hands.

Base Transceiver Station (BTS) Base Transceiver Station

Dynamic Site Assignment This feature allows the Dimetra system to assign voice channels only at the sites where radio users are registered to complete calls.

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