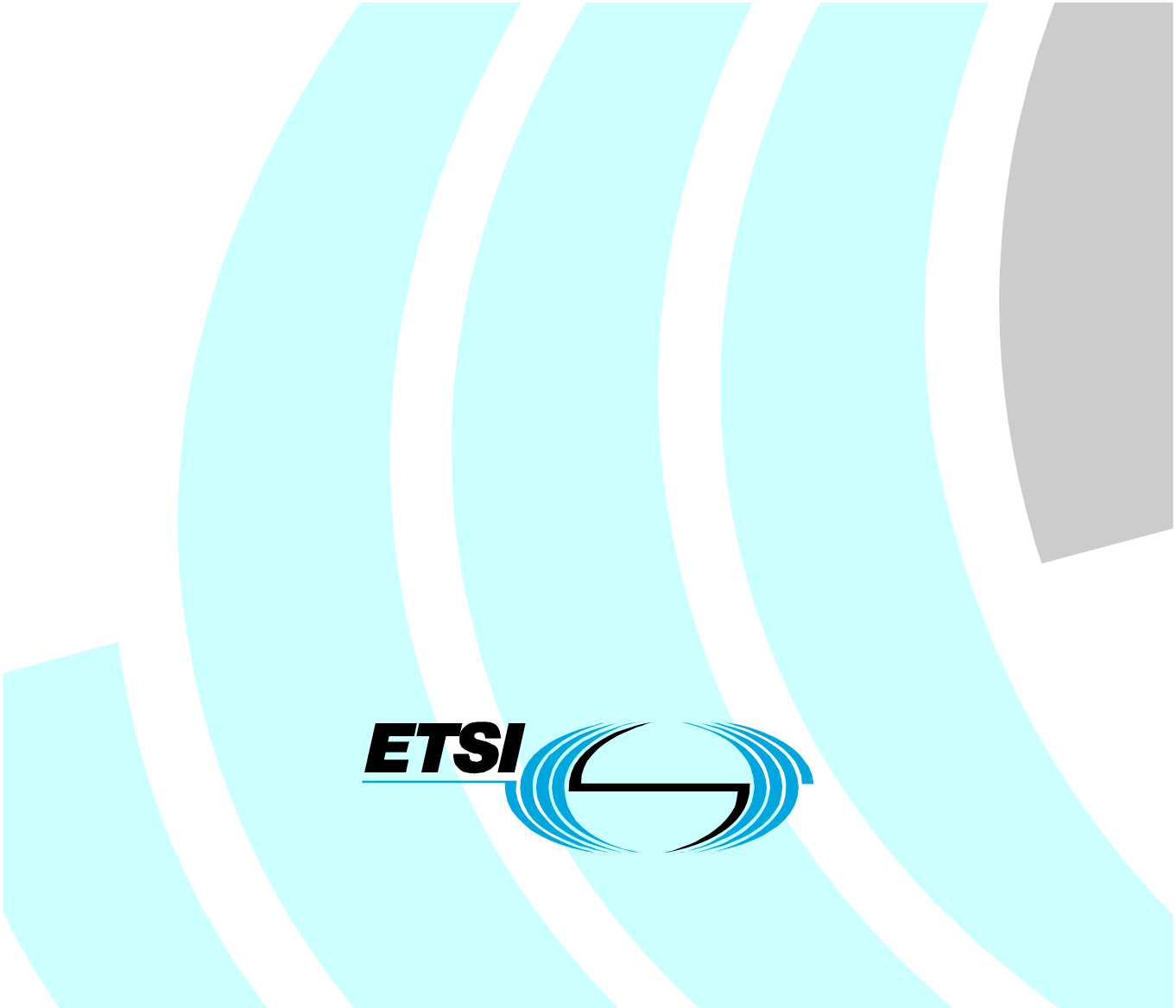
ETSI TR 102 021-11 V1.1.1 (2011-07)

Technical Report

Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2.1; Part 11: Over The Air Management



Reference
DTR/TETRA-01198

Keywords
radio, TETRA, user

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Terrestrial Trunked Radio (TETRA).

The present document is part 11 of a multi-part deliverable covering the User Requirement Specifications (URSs) TETRA Release 2 and Release 2.1, as identified below:

Part 1: "General overview" (Release 2.1);

Part 2: "High Speed Data" (Release 2.1);

Part 3: "Codec" (Release 2);

Part 4: "Air Interface Enhancements" (Release 2.1);

Part 5: "Interworking and Roaming" (Release 2.1);

Part 6: "Subscriber Identity Module (SIM)" (Release 2.1);

Part 7: "Security" (Release 2.1);

Part 8: "Air - Ground - Air services" (Release 2);

Part 9: "Peripheral Equipment Interface" (Release 2.1);

Part 10: "Local Mode Broadband" (Release 2.1);

Part 11: "Over The Air Management" (Release 2.1);

Part 12: "Direct Mode Operation" (Release 2.1).

Introduction

The Terms of Reference for TC TETRA approved at ETSI Board meeting #69, November 2008 is to produce ETSI deliverables (and maintenance thereafter) in accordance with the following requirements:

The Terms of Reference for TC TETRA are to produce ETSI deliverables (and maintenance thereafter) in accordance with the following requirements:

a) The provision of user driven services, facilities and functionality as required by traditional Professional Mobile Radio (PMR) user organizations such as the Emergency Services, Government, Military, Transportation, Utility and Industrial organizations as well as Public Access Mobile Radio (PAMR) Operators.

b) The evolution and enhancement of TETRA as required by the market with the provision of new services, facilities and functionality made possible by new technology innovations and standards.

c) Further enhancements of the TETRA standard in order to provide increased benefits and optimization in terms of spectrum efficiency, network capacity, system performance, quality of service, security and other relevant parameters.

d) The backward compatibility and integration of the new services, facilities and functionality with existing TETRA standards in order to future-proof the existing and future investments of TETRA users.

Technical Objective

TETRA is one of a number of digital wireless communication technologies standardized by ETSI.

ETSI TC TETRA produces standards and/or adapts existing standards for efficient digital PMR and PAMR voice and data services, including broadband evolution.

The present document provides the User Requirement Specifications for the TETRA Over The Air Management.

The URS is required by TC TETRA to guide the enhancement of the current TETRA standard, mainly the introduction of advanced Over The Air Management features.

1 Scope

The present document provides the User Requirement Specifications for the TETRA "Over The Air management".

The present document describes the functionalities which are most needed by the users to manage Over The Air.

The present document is applicable to the specification of TETRA Release 2.1 equipment.

The user requirements contained in the present document are described in non-technical terms and are based on discussions in TC TETRA WG1 and on an analysis of the results for air interface enhancements from the 2001 TETRA Release 2 Market Questionnaire and the 2007 Future of TETRA workshop [i.1].

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TR 102 621: "Terrestrial Trunked Radio (TETRA); TWC2007 Future of TETRA workshop report".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

TETRA Release 2: Work Programme within ETSI Project TETRA to enhance the services and facilities of TETRA in order to meet new user requirements, utilize new technology and increase the longevity of TETRA within the traditional market domains of PMR and PAMR

TETRA Release 2.1: Work Programme within TC TETRA to enhance the services and facilities of TETRA in order to meet new user requirements, utilize new technology and increase the longevity of TETRA within the traditional market domains of PMR and PAMR

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CCK	Common Cipher Key
DM-GATE	Direct Mode Gateway
DMO	Direct Mode of Operation
DM-REP	Direct Mode Repeater
DOTAM	Direct mode operation Over The Air Management
ETSI	European Telecommunications Standards Institute
FOTA	Firmware Over The Air
GCK	Group Cipher Key
GPS	Global Positioning System
ISSI	Individual Short Subscriber Identity
LIP	Location Information Protocol
MMI	Man Machine Interface
MNI	Mobile Network Identity
MS	Mobile Station
OTAM	Over The Air Management
OTAP	Over The Air Programming
OTAR	Over The Air Re-keying
PABX	Private Analogique Branch eXchange
PMR	Private Mobile Radio
PSS	Public Safety System
PSTN	Public Switch Telephone Network
SCK	Static Cipher Key
SDS	Short Data Service
SDSC	Short Data Service Centre
SwMI	Switching and Management Infrastructure
TETRA	TErrestrial Trunked RAdio
TR	Technical Report
URS	User Requirement Specification
V+D	Voice and Data

4 Over The Air Management

4.1 General

As MSs accumulate new applications and become more advanced, OTAM configuration has become increasingly important as new updates and services come on stream. OTAM optimises the configuration data updates in MSs and enables the distribution of new software updates to MSs with the necessary settings. OTAM messaging provides remote control of MSs for service and subscription activation, personalization and programming of a new service or feature.

Over-the-air management (OTAM) may refer to:

- over-the-air programming (OTAP):
  - TMO over the air group management;
  - DMO group and frequency management (DOTAM);
  - Over the air phonebook management;
  - Over the Air management of Parameters and Settings.
- methods of distributing new software updates to MSs ("Firmware Over The Air", FOTA);
- Over the air management of encryption keys.

Mechanisms for Over-the-air management should be safe, secure and fault tolerant.

4.2 Over the Air Programming

Currently every MS has to be connected to a programming tool to change features. E.g. cars have to be taken out of service and have to be moved to a Service centre to have the reprogramming done. Such a reprogramming procedure requires careful planning and logistics. During the reprogramming procedure dispatchers may have to deal with different and operationally conflicting group lists.

Over-the-Air Programming (OTAP) provides an easy, fast and more economical alternative to the cumbersome programming procedure described above. OTAP is a mechanism to read and write MS configuration over the air.

In an advanced OTAP enabled TETRA system a new MS only programmed with an ISSI and encryption keys can be provided with the operational configuration parameters and settings at first log-on.

4.2.1 TMO over the air Group Management

TMO over the air Group Management enables a dispatcher to send one or more (dynamic) groups to MSs and optionally instruct the MSs to switch to one of the new groups. TMO over the air Group Management also enables the dispatcher to remove one or more groups from MSs.

Use cases:

- In PSS operations, a dispatcher can assign a dynamic group to a specific operational task, which is sent to all MSs of the people assigned to the task. In the group assignment the MSs are instructed to switch to the new group. After completion of the operational task the dispatcher will de-assign the dynamic group after which the MSs will delete the group and return to their original group. This allows temporarily allocation of a Public Safety group to MSs belonging to other Public Safety and even non-Public Safety users on the same system.

- TMO over the air Group Management can also be used to apply small fleet map changes to many MSs with little effort. For example, in a countrywide system, an MS that will be used in a different part of the country can have its group plans dynamically adjusted to adapt to the local conditions. On returning to its original jurisdiction, the MS can be changed back to its home settings just as easily as it was adjusted for use elsewhere.

  In this way TMO over the air Group management can promote operational interoperability.

- Another use-case for TMO over the air Group Management is to not to program groups into MSs at all. The dynamic model allows flexible deployment of MS to the users. When starting their shift the users log on to the system and (only) receive all the necessary groups (typically less than 10 groups) to perform their tasks. At the end of the shift users log off and the groups are removed from their MSs.

  An MS supporting TMO over the air Group Management can be shared via a pool and a single MS can carry multiple roles. In this way the organisation can optimize the MS investment.

  Another advantage is for the MS user. Because the MS only has the necessary groups the chance of selecting a wrong group is small.

4.2.2 DMO Group and Frequency Management

In national TETRA networks for public safety services (PSS) the users also need to communicate independently of the network via DMO. For this purpose, PSS network operators identify frequency channels for DMO usage and assign these frequency channels to dedicated PSS. This assignment depends on the respective PSS and/or the geographical region the PSS operates in and can change when PSS users move to different geographical regions or when a PSS network operator shifts already identified DMO frequency channels from one PSS to another one.

DMO over-the-air group and frequency management avoids mass re-programming of MSs whenever a change occurs.

There are at least two types of over-the-air management needs related to DMO groups.

- Use case 1 - Location based activation/deactivation

- Use case 2 - Changing the DMO frequency

4.2.3 Over the Air Phonebook Management

The phonebook of an MS is used to show the alias of the talking parties in a group call or to start an individual or telephone call.

It is more than desirable to enable users to enjoy access to their contacts in their MS, without needing to re-input them for any new MS they acquire.

With OTA Phonebook Management it should be possible to update the phone book in the MS. Only changes to the existing phone book will be updated.

The MS communicates with a central address database to verify that the phone book contains all the required numbers (ISSIs and phone numbers) and contact information for the specific organization and owner of the MS. If necessary, new or changed ISSIs or telephone numbers and contact information are downloaded from the central address database to the MS phone book.

A typical use case may be updating a phonebook at the start of a shift.

Depending on the settings in the MS it is allowed for the user to make changes in the received Phonebook.

4.2.4 Over the Air management of Parameters and Settings

OTAP should provide a standard mechanism for remote management of selected sets of MS settings and parameters. All customisation parameters need to be accessible via OTAP but in general only certain parameters will need updating. The mechanism will need to be one that only allows authorised entities to make changes.

OTAP will be used to update some parameters in the MS after a change in an operational procedure. The parameters involved can be technical, audio or MMI related parameters. For management reasons it is necessary to have an up to date overview of the actual setting of parameters in the MS. With OTAP it possible to query or download parameters from the MS.

EXAMPLE 1:

Modify and query MS related parameters:

- Query MS information e.g. information about manufacturer, model, serial number, hardware version, firmware version, dataset version, maximum power, supported features:
  - Query of hardware version of the MS:
    - With this information there is a clear view of the amount of different MS hardware versions in the total fleet of MSs;
    - MS Hardware versions which are not certified can easily be found.
  - Query of Firmware version of the MS:
    - To get an up-to-date overview of the Firmware status of the MS. With this information there is a clear view of the amount of different MS Firmware versions in the total fleet of MSs;
    - MS Firmware versions which are not certified can easily be found.
- Query MS status e.g. mode of operation (V+D, DMO, DM-GATE), battery charge, error reports.
- Modify and query MMI configuration e.g. configuration of shortcuts/function keys, audio configuration, display configuration, configuration of available menus, configuration of physical interfaces (PEI, external keys, alarm contact, accessories:
  - To assign or change a function to one or more keys on the keypad, e.g. assign the function TMO - DMO switch to key number "3" on the keypad.
- Change of audio parameters after selection of a new audio accessory.

  If the user organisation selects a new audio accessory to be connected to the MS OTAP will be used to set the audio parameters to the desired values.

EXAMPLE 2:

Modify and query network related parameters:

- Modify and query channel parameters e.g. list of preferred channels or frequency range for initial cell selection, use of common secondary control channels.
- Modify and query SwMI addresses e.g. address of PSTN gateway, PABX gateway, Short Data Service Centre (SDSC).
- Modify and query Mobility Management parameters e.g. allowed networks (MNI), preferred location areas, subscriber classes, behaviour in cells with subscriber class mismatch.
- Modify and query security parameters e.g. provisioning of static cipher keys (SCK), mutual authentication, change of security class in DMO.
- Modify and query emergency call parameters e.g. destination address for emergency call and/or emergency status, call type, configuration of automatic transmission cycles after call setup.
- Modify and query parameters for short messages (SDS and Status) e.g. assignment of status text to status value, use of short-/standard report, text coding scheme.
- Modify and query Packet Data parameters e.g. access point name, protocol configuration options, authentication, static IP address.
- Modify and query Location Information parameters e.g. configuration of GPS receiver, provisioning of GPS almanac data, configuration of LIP trigger, destination address for LIP messages:
  - Activation and configuration of a new feature, e.g. the use of LIP.

    OTAP will be used to activate this functionality in the MS and to set the related parameters.

EXAMPLE 3: Modify and query DM-GATE parameters e.g. control of DM-GATE functionality, change of DMO channel, change of DMO MNI, configuration of accepted ISSI, configuration of address translation.

EXAMPLE 4: Modify and query Direct Mode related parameters e.g. configuration of DMO groups, channels, key assignment, emergency call, DM timer, use of DM-REP or DM-GATE.

4.3 Firmware Over The Air (FOTA)

Firmware Over The Air (FOTA) provides a way to update or patch the firmware of an MS remotely. FOTA updating technology can be used to deliver new features and services to customers and/or to solve problems in the field caused by a bug in the old firmware. The essence of FOTA is the ability to update the firmware on the MS in a safe, secure and fault tolerant way.

Due to bandwidth limitations, it is important to send just the updated, changed or added code; not the entire firmware package. There is no degradation in operational use when a firmware download occurs, the MS is fully operational. During installation of the update the MS is maybe out of service for a maximum of a few minutes.

FOTA allows for MS firmware updates when the MS is already in customers hands. FOTA reduces support costs and increases consumer satisfaction by introducing a convenient method to distribute software improvements and new functionality.

Key features that should always be present in a FOTA solution are:

- The ability to suspend and resume an update.
- Package encryption.
- Package compression.
- Updates can be scheduled to non-busy hours to minimize user impact.

- The MS user decides when the update will be installed.
- Once a firmware update has been installed, the MS should return to a usable state.
- The MS user and the FOTA server should receive a confirmation if the update has successfully completed.

The list of features above is not a complete list but represents a list of examples.

4.4 Over the air management of encryption keys

To distribute or update CCKs, GCKs and SCKs in TETRA the Over The Air Re-keying (OTAR) mechanism is an already existing management tool. This mechanism makes it possible to send in a secure way air interface encryption keys from the SwMI over the air directly to an MS and can be applied as long as an authentication key K is available for the MS. The OTAR messages to an MS are encrypted using session encryption keys that are derived from the authentication key for this MS.

The OTAR mechanism can be used for both an individual MS and for groups of MSs.

A mechanism similar to OTAR is also available for the management of end-to-end encryption keys.

Key management in a two-way radio system can be a challenging and time consuming task, especially in large systems. Over the Air Key Management (OTAR) is an effective method of maintaining and updating encryption keys in a two-way radio system. As with any task, there is a continued desire to improve the efficiency of the key management process. This is especially true when there is a large number of radios or end devices that are key managed in a two-way radio system. It is desirable for key management to be as unobtrusive as possible to other services offered in a two-way radio system. The more efficient the key management service is, the better the performance of the two-way radio system for key management and other services.

History

Document history		
V1.1.1	July 2011	Publication