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Technical Specification

**Terrestrial Trunked Radio (TETRA);
Voice plus Data (V+D) and Direct Mode Operation (DMO);
Part 18: Air interface optimized applications;
Sub-part 3: Direct mode Over The Air Management
protocol (DOTAM)**

ETSI

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Terrestrial Trunked Radio (TETRA).

The present document is part 18, sub-part 3 of a multi-part deliverable covering the Terrestrial Trunked Radio (TETRA); the Voice plus Data (V+D), as identified below:

EN 300 392-1: "General network design";

EN 300 392-2: "Air Interface (AI)";

EN 300 392-3: "Interworking at the Inter-System Interface (ISI)";

ETS 300 392-4: "Gateways basic operation";

TS 100 392-5: "Peripheral Equipment Interface (PEI)";

TS 100 392-7: "Security";

EN 300 392-9: "General requirements for supplementary services";

EN 300 392-10: "Supplementary services stage 1";

TS 100 392-11: "Supplementary services stage 2";

TS 100 392-12: "Supplementary services stage 3";

ETS 300 392-13: "SDL model of the Air Interface (AI)";

ETS 300 392-14: "Protocol Implementation Conformance Statement (PICS) proforma specification";

TS 100 392-15: "TETRA frequency bands, duplex spacings and channel numbering";

TS 100 392-16: "Network Performance Metrics";

TR 100 392-17: "TETRA V+D and DMO specifications";

TS 100 392-18: "Air interface optimized applications".

　　Sub-part 1: "Location Information Protocol (LIP)";

　　Sub-part 2: "Net Assist Protocol (NAP)".

　　Sub-part 3: "Direct mode Over The Air Management protocol (DOTAM)".

NOTE: Part 10, sub-part 15 (Transfer of control), part 13 (SDL) and part 14 (PICS) of this multi-part deliverable are in status "historical" and are not maintained.

1 Scope

The present document defines the Direct mode operation Over The Air Management protocol for the TETRA V+D air interface. It defines the following services:

- Direct Mode Operation over the air management service.

- Interrogation of Direct Mode Operation groups and their status.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:

  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;

  - for informative references.

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 indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ETSI EN 300 392-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 1: General network design".

[2] ETSI EN 300 392-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".

[3] ETSI EN 300 392-9: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 9: General requirements for supplementary services".

[4] ETSI TS 100 392-15: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 15: TETRA frequency bands, duplex spacings and channel numbering".

[5] ETSI EN 300 396-3: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 3: Mobile Station to Mobile Station (MS-MS) Air Interface (AI) protocol".

[6] ETSI EN 300 396-6: "Terrestrial Trunked Radio (TETRA); Direct Mode Operation (DMO); Part 6: Security".

[7] ETSI EN 300 392-7: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 7: Security".

2.2   Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1]   ETSI TS 100 392-18-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D) and Direct Mode Operation (DMO); Part 18: Air interface optimized applications; Sub-part 1: Location Information Protocol (LIP)".

3   Definitions, symbols and abbreviations

3.1   Definitions

For the purposes of the present document, the terms and definitions given in EN 300 392-2 [2] and EN 300 396-3 [5] and the following apply:

assign: addition of group definition

assigned DMO group: DMO group with a valid parameter set, which has been assigned by a network operator

deassign: permanent removal of group definition

default DMO group: preferred DMO group which is selected when a mobile station switches from V+D to DMO

NOTE: A default DMO group is both, an assigned and a preferred DMO group.

DMO channel: Radio Frequency (RF) carrier for DMO usage

DMO group: DMO group defined by the parameter set: a TETRA group address, a mnemonic group name, a DMO channel, and a mnemonic DMO channel name

NOTE: DMO groups contain some additional parameters to the above list that is seen on the user's point of view.

management server: entity that manages DMO equipment

management source: originator of DMO management commands

preferred DMO group: assigned DMO group which has been assigned to a specific organisation for preferred usage

NOTE: There can be multiple preferred DMO groups defined at the same time.

selected DMO group: DMO group that MS user has selected

NOTE: A selected DMO group is a default, a preferred or an assigned DMO group.

Switching And Management Infrastructure (SwMI): all of the TETRA equipment for a Voice plus Data (V+D) network except for subscriber terminals

TETRA domain: all entities that are addressed using TETRA defined addresses

NOTE: This definition may cover entities that are not controlled by TETRA security features.

3.2 Symbols

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

ra   relationship between management server entity and managed DMO entity
rb   relationship between management source entity and management server entity
rc   relationship between management source entity and managed DMO entity
rd   relationship between communication management entity and management server entity
re   relationship between authentication entity and management server entity
rf   relationship between group number and radio resource management entity and management
          server entity
rg   relationship between communication management entity and authentication entity.

3.3 Abbreviations

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

C   Conditional
DGNA   Dynamic Group Number Assignment
DMO   Direct Mode Operation
DOTAM   Direct mode operation Over The Air Management
FE   Functional Entity
GTSI   Group TETRA Subscriber Identity
ISDN   Integrated Services Digital Network
ISSI   Individual Short Subscriber Identity
ITSI   Individual TETRA Subscriber Identity
M   Mandatory
MNI   Mobile Network Identity
MS   Mobile Station
MS-ISDN   Mobile Station ISDN number
OTAK   Over The Air Keying
OTAR   Over The Air Re-keying
PDU   Protocol Data Unit
RF   Radio Frequency
SAP   Service Access Point
SCK   Static Cipher Key
SDS-TL   Short Data Service - Transport Layer
SS-DGNA   Supplementary Service Dynamic Group Number Assignment
SwMI   Switching And Management Infrastructure
V+D   Voice plus Data system

4 Direct mode operation over the air management protocol

4.1 General

The Direct mode operation Over The Air Management (DOTAM) is a TETRA air interface management protocol that could utilize various transport mechanisms.

The present document defines "control messages" to set and modify MS behaviour in DMO.

The management protocol can be used in various system configurations including:

- SwMI to MS communication.

- Management server to MS communication.

- MS to management server communication.

NOTE 1: Although DOTAM protocol can support direct MS to individual MS communication; the use of it may be limited to specific situations and is outside the scope of the present document.

NOTE 2: DOTAM does not preclude the usage of pre-configured group and/or frequency settings. It is outside the scope of the present document how DOTAM and pre-configured group and/or frequency settings may interact.

The DOTAM protocol may be a member of various other MS over the air management services such as:

- DGNA - V+D group management;

- Phonebook management - ISSI & MS-ISDN management;

- Remote programming of Status message mnemonics;

- Remote programming of technical parameters (timers, etc.);

- Remote software upgrade;

- OTAR/OTAK.

The first on the list is covered by SS-DGNA. The second is in relation to the first one and to the present document, but is outside the scope of the present document.

4.2 DOTAM protocol system architecture

The DOTAM protocol is used between various entities of the TETRA network. Physical entities identified for the purpose of the present document are:

- Mobile Station (MS).

- Management server.

- SwMI.

- Management source.

The management server details are outside the scope of the present document.

The management information exchange contains scenarios:

- Management server to managed MS in the TETRA V+D domain.

- Management source equipment to Management server.

- Management source MS to managed MS in DMO without any action in any other entities.

For the purposes of the present document, the TETRA domain consists of entities that are addressable using TETRA addressing and understand the binary format of the DOTAM protocol.

For the purposes of the present document protocol Functional Entities (FE) are used in some clauses instead of physical entities:

FE1: Managed entity.

FE2: Management server entity.

FE3: Management source entity.

The following relationships exit between these FEs:

ra: Relationship between management server entity and managed entity.

rb: Relationship between management source entity and management server entity.

rc: Relationship between management source entity and managed entity.

In figure 4.1 the management server FE2 acts as the source entity of management information and manages the FE1 entity.
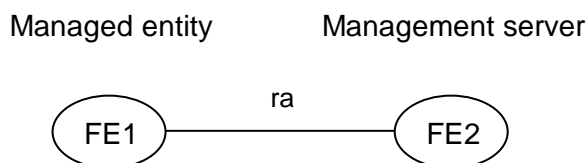
Managed entity   Management server

FE1 —— ra —— FE2

Figure 4.1: Management server and managed entity relationship

In figure 4.2 the management source FE3 defines DMO groups and DMO frequencies for the managed entity FE1.

Managed entity   Management server   Management source

FE1 —— ra —— FE2 —— rb —— FE3

Figure 4.2: Management source, management server, and managed entity relationship

In figure 4.3 a management source FE3 controls the managed entity FE1 without involvement of a management server.

NOTE: This optional arrangement may be used in special cases where a controlled end to end communication is arranged and the management source is authorised. This usage is outside the scope of the present document.

Managed entity   Management source
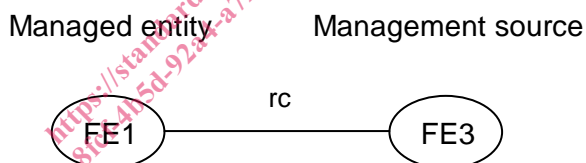
FE1 —— rc —— FE3

Figure 4.3: Management source and managed entity direct relationship

The management server entity can be sub-divided into sub-entities:

FE21:   Communication management entity.

FE22:   Management server entity.

FE23:   Authentication entity.

FE24:   Group number and radio resource management entity.

The following relationships exit between these FEs:

rd: Relationship between communication management entity and management server entity.

re: Relationship between authentication entity and management server entity.

rf: Relationship between group number and radio resource management entity and management
                     server entity.

rg: Relationship between communication management entity and authentication entity.

Functional entity FE2 and its sub-entities FE21, FE22, FE23 and FE24 are presented in figure 4.4.
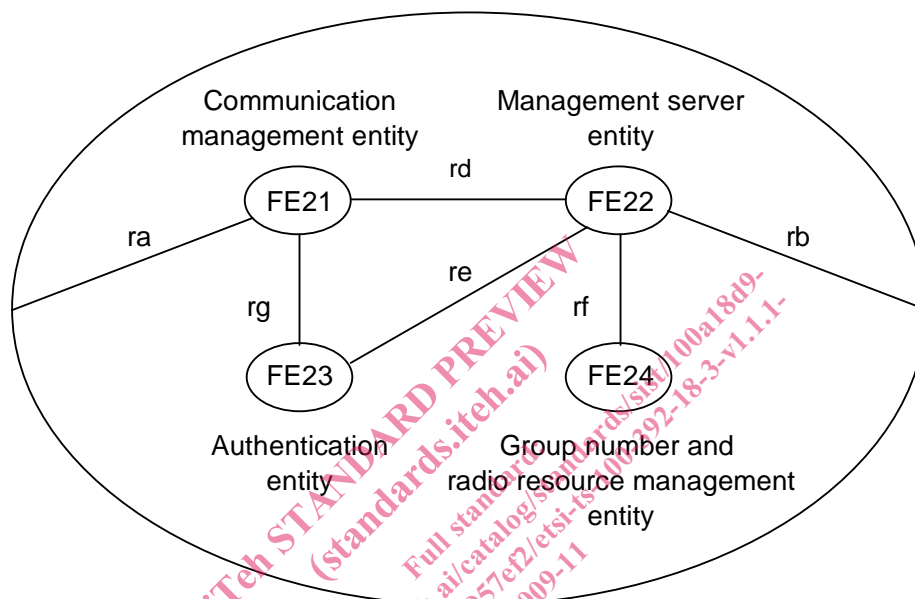

Figure 4.4: Management server sub-entities relationships

4.3   DOTAM protocol service description

4.3.1   General on DOTAM services

The DOTAM protocol can support multiple services. Typical services are:

- Assignment of DMO group definition (addition of a DMO group and/or DMO frequency).

- Deassignment of DMO group definition (removal of a group).

- Allocation or status change of a DMO group.

- Interrogation of DMO group definitions.

4.3.2   Services available at the DOTAM-SAP

DOTAM-SAP at the management server offers services to the DOTAM manager entity and is accessible to the human users. The man machine interface is outside the scope of the present document.

DOTAM-SAP at the MS is a conceptual service access point and is not intended to be accessible by human users.

4.3.3 Service primitives at the DOTAM-SAP

Service primitives at the DOTAM-SAP define service access at management source:

DOTAM-Assign response: this primitive is used to acknowledge assignments.

DOTAM-Assign indication: this primitive is used to receive assignments.

DOTAM-Define confirmation: this primitive is used to receive acknowledgements to the DMO group and frequency definition requests.

DOTAM-Define request: this primitive is used to send DMO group and frequency definition requests.

DOTAM-Interrogate confirmation: this primitive is used to receive DMO group interrogation results.

DOTAM-Interrogate indication: this primitive is used to receive DMO group interrogation requests.

DOTAM-Interrogate request: this primitive is used to send DMO group interrogation requests.

DOTAM-Interrogate response: this primitive is used to send DMO group interrogation results.

DOTAM-Remove confirmation: this primitive is used to receive DMO group removal results.

DOTAM-Remove indication: this primitive is used to receive DMO group removal requests.

DOTAM-Remove request: this primitive is used to send DMO group removal requests.

DOTAM-Remove response: this primitive is used to send DMO group removal responses.

DOTAM-Status request: this primitive is used to send DMO group status change requests.

DOTAM-Status indication: this primitive is used to receive DMO group status change requests.

DOTAM-Status response: this primitive is used to send response to the DMO group status change requests.

DOTAM-Status confirmation: this primitive is used to receive response to the DMO group status change requests.

4.3.4 Service primitive parameters at the DOTAM-SAP

As the present document does not define a physical access to the DOTAM-SAP, the description of the conceptual service primitives is minimized and the service primitive parameters are implied by the information elements in the PDUs, refer to clause 6.2.

4.3.5 State description

The location information protocol uses a single state at the FEs that does not link request and response together. At that state DOTAM sends and receives all the service primitives and PDUs.

5 DOTAM protocol description

5.1 Description of information elements

5.1.1 Acknowledgement request

Acknowledgement request shall define whether a confirmation is expected for the message.

NOTE 1: Acknowledgement request in a "request" control message means that confirmation of receipt is requested using the corresponding "response" control message.

NOTE 2: Behaviour on failure to receive a requested confirmation is not defined.