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Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 4: Type 1 repeater air interface

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Terrestrial Trunked Radio (TETRA).

The present document is part 4 of a multi-part deliverable covering the Technical Requirements for Direct Mode Operation (DMO), as identified below:

Part 1: "General network design";

Part 2: "Radio aspects";

Part 3: "Mobile Station to Mobile Station (MS-MS) Air Interface (AI) protocol";

Part 4: "Type 1 repeater air interface";

Part 5: "Gateway air interface";

Part 6: "Security";

Part 7: "Type 2 repeater air interface";

Part 8: "Protocol Implementation Conformance Statement (PICS) proforma specification";

Part 10: "Managed Direct Mode Operation (M-DMO)".

NOTE: Part 8 of this multi-part deliverable is of status "historical" and will not be updated according to this version of the standard.

National transposition dates	
Date of adoption of this EN:	28 April 2006
Date of latest announcement of this EN (doa):	31 July 2006
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 January 2007
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1 Scope

The multi-part deliverable EN 300 396 defines the TErrestrial Trunked RAdio (TETRA) Direct Mode Operation (DMO). It specifies the basic air interface, the inter-working between Direct Mode (DM) groups via repeaters, and inter-working with the TETRA Voice plus Data (V+D) system via gateways. It also specifies the security aspects in TETRA DMO, and the intrinsic services that are supported in addition to the basic bearer and teleservices.

This part applies to the TETRA DMO Repeater (DM-REP) air interface and contains the specifications of the physical, Data Link Layer (DLL) and the network layer according to the ISO model.

The specifications contained herein apply to a DM-REP as a stand-alone unit supporting a single call on the air interface (type 1 DM-REP). They also cover the operation of a Direct Mode Mobile Station (DM-MS) with a type 1 DM-REP.

NOTE 1: The specifications for a Direct Mode Repeater/Gateway (DM-REP/GATE) combined implementation are provided in EN 300 396-5 [5], together with the specifications for a Direct Mode Gateway (DM-GATE).

NOTE 2: The specifications for a DM-REP as a stand-alone unit supporting two calls on the air interface (type 2 DM-REP) are provided in EN 300 396-7 [7].

The protocol for a DM-MS operating with a type 1 DM-REP is specified in clauses 5 through 8, 10 and 11. Much of this protocol is defined in the form of a "delta document" relative to the specifications provided in EN 300 396-2 [2] and EN 300 396-3 [3] for direct MS-MS operation. These clauses define where the protocol in EN 300 396-2 [2] and EN 300 396-3 [3] applies without change, or where it applies with the specified amendments, replacements or additions. Where no reference to EN 300 396-2 [2] or EN 300 396-3 [3] exists, the clause should be regarded as independent.

The protocol for the DM-REP is specified in clauses 9 and 12.

The normative annex mainly specifies the parameter values used in the protocol.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- 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.
- For a non-specific reference, the latest version applies.

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

[1] ETSI ETS 300 396-1: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 1: General network design".

[2] ETSI EN 300 396-2: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 2: Radio aspects".

[3] 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".

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

[5] ETSI EN 300 396-5: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 5: Gateway air interface".

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

[7] ETSI EN 300 396-7: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 7: Type 2 repeater air interface".

[8] ETSI EN 300 396-10: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 10: Managed Direct Mode Operation (M-DMO)".

3 Definitions and abbreviations

3.1 Definitions

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

call: complete sequence of related call transactions between DM-MSs using the repeater protocol

NOTE: There are two types of call, individual call or group call. An individual call is a complete sequence of related call transactions between two DM-MSs. A group call is a complete sequence of related call transactions involving two or more DM-MSs. The number of participants in a group call is not fixed. Participants may join (late entry) and leave an ongoing call. For calls without presence check there is no guaranty that anyone is listening.

call transaction: all of the functions associated with a complete unidirectional transmission of information

NOTE: A call is made up of one or more sequential call transactions.

called user application: user application which receives an incoming call

calling user application: user application which initiates an outgoing call

changeover: within a call, the process of effecting a transfer of the master role (and hence transmitting MS) at the end of one call transaction so that another can commence

Direct Mode Operation (DMO): mode of simplex operation where mobile subscriber radio units may communicate using radio frequencies which may be monitored by, but which are outside the control of, the TETRA TMO network

NOTE: Direct Mode Operation is performed without intervention of any base station.

Direct Mode Call Control (DMCC): layer 3 entity responsible for setting up and maintaining a call in DMO

DM channel: specific grouping of timeslots in the DM multiplex structure related to a particular DM RF carrier (i.e. DM frequency) or to a pair of duplex-spaced RF carriers

NOTE: Duplex-spaced RF carriers are used for operation with a type 1B or type 2 DM-REP or a type 1B DM-REP/GATE.

Direct Mode Mobile Station (DM-MS): physical grouping that contains all of the mobile equipment that is used to obtain TETRA DM services

NOTE: A DM-MS may have one of three roles in the present document:

- **master:** if the DM-MS is either active in a call transaction transmitting traffic or control data, or is reserving the channel by means of channel reservation signalling;
- **slave:** if the DM-MS is receiving traffic and/or signalling in a call;
- **idle:** if the DM-MS is not in a call.

Direct Mode GATEway (DM-GATE): device that provides gateway connectivity between DM-MS(s) and the TETRA TMO network

NOTE: The gateway provides the interface between TETRA DMO and TETRA TMO. A gateway may provide only the gateway function (DM-GATE) or may provide the functions of both a DM repeater and a DM gateway during a call (DM-REP/GATE).

Direct Mode REPeater (DM-REP): device that operates in TETRA DMO and provides a repeater function to enable two or more DM-MSs to extend their coverage range

NOTE 1: It may be either a type 1 DM-REP, capable of supporting only a single call on the air interface, or a type 2 DM-REP, capable of supporting two calls on the air interface. A type 1 DM-REP may operate on either a single RF carrier (type 1A DM-REP) or a pair of duplex-spaced RF carriers (type 1B DM-REP). A type 2 DM-REP operates on a pair of duplex-spaced RF carriers.

NOTE 2: A repeater may have one of two roles:

- **active:** if the repeater is active in a call transaction receiving and transmitting traffic and/or signalling messages.
- **idle:** if the repeater is not in a call.

DUal Mode switchable Mobile Station (DU-MS): MS that is capable of operating in TETRA DMO or in TETRA TMO one mode at a time

NOTE: Only one mode can be selected at any given time and the MS is not capable of monitoring a DM RF carrier while in TMO or a TMO channel while in DMO.

Dual Watch Mobile Station (DW-MS): MS that is either full dual watch MS (F-DW-MS) or idle dual watch MS (I-DW-MS)

NOTE: When idle, the MS periodically monitors both the DM RF carrier and the TMO control channel. If the MS is performing full dual watch, it is also capable of periodically monitoring the TMO control channel while in a DM call and a DM RF carrier while in a TMO call. Alternatively the MS may perform idle dual watch, in which case it need not be capable of monitoring the TMO control channel while involved in a DM activity (e.g. call) or a DM RF carrier while involved in a TMO activity (e.g. call).

frequency efficient mode: mode of operation where two independent DM communications are supported on a single RF carrier or a pair of duplex-spaced RF carriers for operation with a type 2 DM-REP

NOTE: Frequency efficient mode is not applicable to transactions through a type 1 DM-REP.

Full Dual Watch Mobile Station (F-DW-MS): MS that is capable of both TETRA DMO and TETRA TMO and capable of monitoring the DM RF carrier while in a TMO service and a TMO control channel while in a DM service

NOTE: When idle, the MS periodically monitors both the DM RF carrier and the TMO control channel. The MS is also capable of periodically monitoring the TMO control channel while in a DM call and a DM RF carrier while in a TMO call.

gateway: DM-GATE or DM-REP/GATE

NOTE: Generic term which describes either a pure DM-GATE or a combined implementation with a repeater (DM-REP/GATE).

Idle Dual Watch Mobile Station (I-DW-MS): MS that is capable of both TETRA DMO and TETRA TMO and when idle capable of periodically monitoring both modes

NOTE: When idle, the MS periodically monitors both the DM RF carrier and the TMO control channel. The MS need not be capable of monitoring the TMO control channel while involved in a DM activity (e.g. call) or a DM RF carrier while involved in a TMO activity (e.g. call).

logical channel: any distinct data path

NOTE: Logical channels are considered to operate between logical endpoints.

master link: communication link used for transmissions between master DM-MS and DM-REP