



SLOVENSKI STANDARD

SIST EN 300 396-1 V1.2.1:2012

01-februar-2012

Prizemni snopovni radio (TETRA) - Tehnične zahteve za neposredni način delovanja (DMO) - 1. del: Splošna zasnova omrežja

Terrestrial Trunked Radio (TETRA) - Technical requirements for Direct Mode Operation (DMO) - Part 1: General network design

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Ta slovenski standard je istoveten z: **EN 300 396-1 Version 1.2.1**

SIST EN 300 396-1 V1.2.1:2012
<https://standards.iteh.ai/catalog/standards/sist/0f4a99e4-e2de-4667-9d8c-f7c4c67471a8/sist-en-300-396-1-v1-2-1-2012>

ICS:

33.070.10	Prizemni snopovni radio (TETRA)	Terrestrial Trunked Radio (TETRA)
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SIST EN 300 396-1 V1.2.1:2012	en
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ETSI EN 300 396-1 V1.2.1 (2011-12)



Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 1: General network design

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Reference

REN/TETRA-08196

Keywords

air interface, DMO, radio, TETRA**ETSI**

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Contents

Intellectual Property Rights	6
Foreword.....	6
1 Scope	7
2 References	7
2.1 Normative references	7
2.2 Informative references.....	8
3 Definitions, symbols and abbreviations	8
3.1 Definitions.....	8
3.2 Symbols.....	12
3.3 Abbreviations	12
4 DMO reference points	13
5 Protocol architecture for DMO.....	13
6 DM addressing and identities	13
6.1 Introduction	13
6.2 Mobile Network Identity (MNI).....	14
6.3 Subscriber identities	15
6.3.1 General.....	15
6.3.2 TETRA Subscriber Identity (TSI)	15
6.3.3 Short Subscriber Identity (SSI).....	16
6.3.3A Open identities	16
6.3.4 Installation of TSIs.....	16
6.3.5 Use of subscriber identities.....	16
6.4 DM repeater or gateway address	17
6.4.1 Contents of DM repeater or gateway address	17
6.4.2 Use of DM repeater or gateway address	17
6.5 TETRA Equipment Identity (TEI)	17
6.5.1 Contents of TEI.....	17
6.5.2 Allocation principles for TEI.....	17
6.6 Layer 2 addresses and labels	18
6.6.1 DM colour code	18
6.7 Use of TETRA addresses	19
6.7.1 Air interface addressing functions	19
6.7.2 Address placement in primitives and PDUs	19
6.7.2.1 Use of addresses at layer 2 for direct MS-MS operation.....	19
6.7.2.2 Use of TSI at layer 3 for direct MS-MS operation.....	20
6.7.2.3 Use of addresses for DM repeater operation.....	20
6.7.2.4 Use of addresses for DM gateway operation.....	20
6.7.3 Address and identity comparison.....	21
7 DM circuit mode teleservices and bearer services	21
8 DM intrinsic services.....	21
9 DM Short Data Service (SDS)	21
Annex A (informative): DMO reference points	22
A.1 Introduction	22
A.2 Reference configuration	22
A.2.1 Reference models	22
A.2.1.1 Direct mode mobile station (DM-MS).....	23
A.2.1.2 Dual watch mobile station (DW-MS)	23
A.2.1.3 Direct mode repeater (DM-REP)	24
A.2.1.4 Direct mode gateway (DM-GATE)	25

A.2.1.5	Direct mode repeater/gateway combination (DM-REP/GATE)	25
A.3	TETRA DM access	26
A.3.1	DM-MS access	26
A.3.2	MS functional groups	26
A.3.3	Reference points	27
Annex B (informative): Protocol architecture for DMO		28
B.1	Introduction	28
B.2	DM-MS protocol architecture	28
B.2.1	Overview	28
B.2.2	Air interface layer 1	29
B.2.3	Air interface layer 2	30
B.2.4	Air interface layer 3	31
B.2.4.1	Direct Mode Call Control (DMCC) entity	31
B.2.4.1.1	Intrinsic services control	31
B.2.4.1.2	Short Data Service (SDS)	31
B.2.4.1.3	SDS-TL service	31
B.2.4.2	DMMM entity (optional)	32
B.2.5	Security management	32
B.2.5.1	Identity management (authentication)	32
B.2.5.2	Key management	32
Annex C (informative): DM circuit mode teleservices and bearer services		33
C.1	Service definitions	33
C.1.1	Bearer service	33
C.1.2	Teleservice	33
C.1.3	Intrinsic service	33
C.2	Services offered in TETRA DMO	34
C.2.1	Direct Mode teleservices	34
C.2.1.1	Individual calls	34
C.2.1.2	Group call	35
C.2.1.3	SDS based teleservices	35
C.2.2	Direct Mode bearer services	35
C.2.2.1	Circuit mode unprotected bearer services	35
C.2.2.2	Circuit mode protected bearer services	35
C.2.2.3	Short Data Service (SDS)	35
C.2.2.4	SDS-TL service	36
C.2.3	Intrinsic services	37
C.2.3.1	DM late entry	37
C.2.3.2	Transmitting Party Number Identification (TPNI)	37
C.2.3.3	Emergency calls	37
Annex D (normative): TETRA type approval code information element		38
D.1	Encoding of the TAC information element	38
D.2	Application for the TAC value	38
Annex E (normative): TETRA final assembly code information element		41
E.1	Encoding of the FAC information element	41
E.2	Application for the FAC value	41
E.3	WEB page contents for FAC data base	41
Annex F (normative): TETRA electronic serial number information element		44
F.1	Encoding of the ESN information element	44
F.2	Usage of the ESN	44

F.3 Usage of check sum of the equipment identity	44
Annex G (informative): Bibliography	45
History	46

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Foreword

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

The present document is part 1 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"; (Historical)

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

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

NOTE: Part 7, part 8 and part 10 of this multi-part deliverable are of status "historical" and will not be updated according to this version of the standard.

National transposition dates

Date of adoption of this EN:	22 December 2011
Date of latest announcement of this EN (doa):	31 March 2012
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 September 2012
Date of withdrawal of any conflicting National Standard (dow):	30 September 2012

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 services and teleservices.

The present document applies to the general network design of TETRA DMO as follows:

- it defines and specifies the circuit mode reference points for the Mobile Station (MS), repeater and gateway to the Switching and Management Infrastructure (SwMI);
- it defines and specifies models of the air interface protocol stack where the different functions of layers and sub-layers are listed;
- it defines and specifies the TETRA DMO addressing and identities and their organization in groups corresponding to the different functions;
- it defines and specifies the functions provided by the circuit mode teleservices used for speech and basic services used for data transfer;
- it defines and specifies the intrinsic services that extend the capabilities of the circuit mode bearer services and teleservices;
- it defines and specifies the functions related to the transport of short data messages.

NOTE: If a discrepancy occurs between the present document and any other part of the EN 300 396 multi-part deliverable, then the other part will take precedence. This part will be updated at a frequency consistent with maintaining the integrity of the present document as a whole.

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.

- [1] ETSI EN 300 392-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".
- [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 300 396-4: "Terrestrial Trunked Radio (TETRA); Technical Requirements for Direct Mode Operation (DMO); Part 4: Type 1 repeater air interface".

- [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); Technical Requirements for Direct Mode Operation (DMO); Part 6: Security".
- [7] ETSI EN 300 395-2: "Terrestrial Trunked Radio (TETRA); Speech codec for full-rate traffic channel; Part 2: TETRA codec".
- [8] ITU-T Recommendation E.218: "Management of the allocation of terrestrial trunk radio Mobile Country Codes".

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 Directives: "ETSI Statutes; ETSI Rules of Procedure; ETSI Board Working Procedures; Powers and Functions of the Board; Terms of Reference of the Operational Co-ordination Group (OCG); ETSI Technical Working Procedures; ETSI Drafting rules".
- [i.2] ETSI EN 300 392-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 1: General network design".
- [i.3] Void.
- [i.4] ETSI TR 102 300-5: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Designers' guide; Part 5: Guidance on numbering and addressing".
- [i.5] ETSI EG 202 118: "Services and Protocols for Advanced Networks (SPAN); The structure of the TETRA numbering resource, interworking and high level policy for administration".
- [i.6] ITU-T Recommendation E.411 (1993): "ISDN user-network interfaces - Reference configurations".
<https://standards.iteh.ai/catalog/standards/sist/0f4a99e4-e2de-4b67-9d8c-7e4c677fab/sist-en-300-396-1-v1-2-1-2012>
- [i.7] ETSI EN 300 392-5: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D) and Direct Mode Operation (DMO); Part 5: Peripheral Equipment Interface (PEI)".
- [i.8] 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)".
- [i.9] ETSI EN 300 396-7: "Terrestrial Trunked Radio (TETRA); Technical Requirements for Direct Mode Operation (DMO); Part 7: Type 2 repeater air interface". (Historical).

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the ETSI Directives [i.1] and the following apply:

Bit Error Ratio (BER): ratio of the bits wrongly received to all bits received in a given logical channel

call: complete sequence of related call transactions between DM-MSs

NOTE 1: 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.

NOTE 2: 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

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

Direct Mode GATEway (DM-GATE): device that provides gateway connectivity between a 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 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:

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

NOTE: 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 [i.9] operates on a pair of duplex-spaced RF carriers.

DM channel: specific grouping of timeslots in the DM multiplex structure related to a particular DM RF carrier (i.e. DM frequency)

NOTE: The grouping may not always be fixed, but in DMO when operating in frequency efficient mode as an example, there are two DM channels, identified by the letters A and B.

Dual mode switchable Mobile Station (DU-MS): MS that is capable to operate 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 TMO channels 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).

Functional group: set of functions which may be needed in TETRA DMO access arrangements

NOTE 1: In a particular access arrangement, specific functions in a function group may but need not be present.

NOTE 2: Specific functions in a functional group may be performed in one or more pieces of equipment.

frequency efficient mode: mode of operation where two independent DM communications are supported on a single RF carrier

NOTE: In frequency efficient mode the two DM channels are identified as channel A and channel B.

Full Dual Watch Mobile Station (F-DW-MS): MS that is capable of both TETRA DMO and TETRA TMO and capable to monitor 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 to periodically monitor 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.

Message Erasure Rate (MER): ratio of the messages detected as wrong by the receiver to all messages received in a given logical channel

normal mode: mode of operation where only one DM communication is supported on a RF carrier

occupation: time where a call transaction is in progress on a channel

Open MNI (O-MNI): open network address used for all DM networks on the selected frequency

NOTE: O-MNI consists of all binary ones (11...11₂). The O-MNI is used in combination with the O-SSI or the network specific SSI.

Open SSI (O-SSI): short subscriber identity used in order to obtain openness within a given MNI

NOTE: O-SSI consists of all binary ones (11...11₂). The O-SSI is used in combination with the O-MNI or the network specific MNI.

Open TSI (O-TSI): open TETRA subscriber identity, which is a combination of O-MNI + O-SSI

NOTE: O-TSI consists of all binary ones (11...11₂).

pre-emption: transfer of the master role to the requested DM-MS

NOTE: This process may occur within a call during occupation or to set-up a new call during either occupation or reservation.

Radio Frequency carrier (RF carrier): radio frequency channel

NOTE: This is a specified portion of the RF spectrum. In DMO, the RF carrier separation is 25 kHz.

random access: request permission from the current master to use the DM channel or to change the ongoing call timing

NOTE: The request of the DM channel usage may be issued by any DM-MS that wishes to transmit traffic or short data either during occupation or reservation period. The request of changing the ongoing call timing may be issued by any DW-MS involved in the call as a slave either during occupation or reservation period.

R0: reference point within the Mobile Terminating unit (MT) that corresponds to the top of the mobile radio not including the routing

NOTE: R0 acts as the network service boundary and exists in all MTs.

R1: reference point between Terminal Equipment (TE2) and the Mobile Termination (MT2)

NOTE: There may be several alternative interface protocols at R1, including existing standards.

R2: reference point at the TETRA air interface

recent user: DM-MS that was master of the call transaction immediately prior to the current master's call transaction in a call

recent user priority: service which gives the recent user a preferred access to request transmission when the current master is ceasing its call transaction in a group call

NOTE: This service is controlled by the current master.

reference configuration: conceptual configuration useful in identifying various possible physical access arrangements to TETRA DMO

NOTE 1: Two concepts are used in defining reference configurations:

- reference points; and
- functional groups.

NOTE 2: Physical interfaces that do not correspond to a reference point will not be described in the TETRA deliverables.

reference point: conceptual point dividing functional groups

NOTE: In a specific access arrangement, a reference point may correspond to a physical interface between pieces of equipment, or there need not be any physical interface corresponding to the reference point. Physical interfaces that do not correspond to a reference point will not be the subject of TETRA DMO interface recommendations.

reservation: time where a "channel reservation" signal is present on the channel

short data service: data service providing both user-defined short messages and predefined 16-bit messages

simplex: mode of working in which information can be transferred in both directions but not at the same time

Trunked Mode Operation (TMO): mode of operation where MSs communicate via the TETRA V+D air interface which is controlled by the TETRA Switching and Management Infrastructure (SwMI)

NOTE: This is also called V+D operation. The abbreviation "TMO" is used in the present document to pair with the abbreviation "DMO" instead of the abbreviation "V+D". "TMO" abbreviation is not used in EN 300 392-1 [i.2] and EN 300 392-2 [1].

Type 1 DM-REP: DM repeater that supports a single call on the air interface

NOTE: There are two varieties of type 1 DM-REP. A type 1A DM-REP operates on a single RF carrier. A type 1B DM-REP operates on a pair of duplex-spaced RF carriers, one used as the "uplink" from DM-MSs to the DM-REP and the other used as the "downlink" from the DM-REP to DM-MSs.

Type 2 DM-REP: DM repeater that is capable of supporting two simultaneous calls on the air interface

NOTE: A type 2 DM-REP operates on a pair of duplex-spaced RF carriers, one used as the "uplink" from DM-MSs to the DM-REP and the other used as the "downlink" from the DM-REP to DM-MSs.

V+D operation: mode of operation for communication via the TETRA V+D air interface which is controlled by the TETRA Switching and Management Infrastructure (SwMI)

NOTE: This is also called Trunked Mode Operation (TMO).