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**Prizemni snopovni radio (TETRA) - Tehnične zahteve za neposredni način delovanja (DMO) - 4. del: Radijski vmesnik tipa 1 za ponavljalnike (repetitorje)**

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

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# ETSI EN 300 396-4 V1.4.1 (2011-12)



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

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## Keywords

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# Contents

Intellectual Property Rights .....	9
Foreword.....	9
1 Scope .....	10
2 References .....	10
2.1 Normative references .....	10
2.2 Informative references.....	11
3 Definitions and abbreviations.....	11
3.1 Definitions.....	11
3.2 Abbreviations .....	14
4 Overview of protocol.....	15
4.1 General .....	15
4.2 The DM channel.....	17
4.3 DM call procedures for operation with a type 1 DM-REP .....	18
4.3.1 Constraints on the frame structure .....	19
4.3.2 Setting up a call .....	19
4.3.2.1 Call set-up without presence check.....	20
4.3.2.2 Call set-up with presence check.....	21
4.3.3 Changeover in a call .....	21
4.3.4 Pre-emption of a DM call .....	22
4.3.5 Terminating a call.....	23
4.3.6 DM short data call .....	23
4.3.6.1 Unacknowledged short data message.....	23
4.3.6.2 Acknowledged short data message .....	24
5 DM-MS layer 3 service description for operation with a type 1 DM-REP.....	25
5.1 Introduction .....	25
5.2 Services offered.....	25
5.3 Primitive description .....	25
5.4 Parameter description .....	25
5.5 States for DMCC-SAP .....	25
6 DM-MS layer 3 protocol for operation with a type 1 DM-REP.....	26
6.1 Introduction .....	26
6.1.1 DMCC protocol states .....	26
6.2 Circuit mode calls.....	26
6.2.1 Procedures for call set-up without presence check .....	26
6.2.1.1 Outgoing call.....	26
6.2.1.2 Incoming call.....	27
6.2.1.3 Temporary group address.....	27
6.2.2 Procedures for call set-up with presence check .....	27
6.2.2.1 Outgoing call.....	27
6.2.2.2 Incoming call.....	28
6.2.3 Usage of DM-OCCUPIED PDU .....	28
6.2.3.1 Sending of DM-OCCUPIED PDU by master DM-MS.....	28
6.2.3.2 Late entry by slave DM-MS.....	28
6.2.4 Procedures during occupation.....	28
6.2.4.1 Master DM-MS .....	28
6.2.4.2 Slave DM-MS .....	29
6.2.4.3 Transmitting Party Number Identification (TPNI).....	29
6.2.5 Procedures during reservation.....	29
6.2.5.1 Master DM-MS .....	29
6.2.5.2 Slave DM-MS .....	29
6.2.5.3 Pre-emption of short data sent as a transaction within a circuit mode call.....	29
6.2.6 Procedures to set up a new call by pre-emption.....	30
6.3 Short Data Service (SDS) procedures .....	30

6.3.1	Sending short data.....	30
6.3.1.1	Sending short data on a free channel.....	30
6.3.1.1.1	Sending unacknowledged short data on a free channel .....	30
6.3.1.1.2	Sending acknowledged short data on a free channel .....	31
6.3.1.2	Sending short data by pre-emption.....	31
6.3.1.3	Sending short data during circuit mode transmission.....	31
6.3.1.4	Sending short data as a transaction within a circuit mode call .....	31
6.3.2	Receiving short data.....	31
6.3.2.1	Receiving unacknowledged short data.....	31
6.3.2.2	Receiving acknowledged short data.....	31
6.3.3	Additional addressing .....	31
6.3.4	Extended error protection .....	31
6.3.5	SDS-TL service in DMO .....	32
6.4	Usage of DMA-UNITDATA primitive.....	32
6.5	General procedures.....	32
6.5.1	Usage restriction type and validity time .....	32
7	DM-MS layer 2 service description for operation with a type 1 DM-REP .....	32
7.1	Introduction .....	32
7.2	Layer 2 architecture .....	33
7.3	Service descriptions.....	33
7.3.1	Services at the DMA-SAP .....	33
7.3.1.1	Services provided to layer 3.....	33
7.3.1.2	Service primitives at the DMA-SAP .....	34
7.3.2	Services at the DMC-SAP .....	34
7.3.2.1	Services provided to layer 3.....	34
7.3.2.2	Service primitives at the DMC-SAP .....	34
7.3.2.2.1	DMC-CONFIGURE primitive.....	34
7.3.2.2.2	DMC-REPORT primitive.....	34
7.3.3	Services at the DMD-SAP .....	34
7.3.3.1	Services provided to the U-plane application.....	34
7.3.3.2	Service primitives at the DMD-SAP .....	34
7.4	Parameter listing.....	34
8	DM-MS layer 2 protocol for operation with a type 1 DM-REP .....	35
8.1	Introduction .....	35
8.1.1	Functions of lower MAC .....	35
8.1.2	Functions of upper MAC .....	35
8.2	Interface between lower and upper MAC.....	35
8.2.1	Logical channels defined at the DMV-SAP.....	35
8.2.2	Service primitives at the DMV-SAP.....	35
8.2.3	PDU mapping of the logical channels at the DMV-SAP .....	36
8.2.4	Scrambling mechanism.....	36
8.2.5	PDU error detection.....	36
8.2.6	Modes of operation .....	36
8.3	Basic capabilities of the physical layer.....	37
8.3.1	DM-MS capabilities.....	37
8.3.1.1	DM only and dual mode capable MS operation.....	37
8.3.1.2	Dual watch capable MS operation .....	37
8.3.1.2.1	Full Dual Watch Mobile Station (F-DW-MS).....	37
8.3.1.2.2	Idle Dual Watch Mobile Station (I-DW-MS).....	37
8.4	Usage of DM channel with type 1 DM-REP .....	38
8.4.1	Definition of DM channel.....	38
8.4.1.1	DM channel arrangement.....	38
8.4.1.2	DM channel operation.....	38
8.4.2	DM-MAC states.....	39
8.4.2.1	DM-MAC state definitions .....	39
8.4.2.2	DM-MS channel surveillance procedures .....	40
8.4.2.2.1	Initial determination of DM channel state .....	40
8.4.2.2.2	Fast call set-up surveillance in idle mode.....	40
8.4.2.2.3	DM-MS channel surveillance at call set-up.....	40
8.4.2.3	Master DM-MS channel maintenance procedures during a call .....	41

8.4.2.4	Slave DM-MS channel maintenance procedures during a call.....	41
8.4.2.4.1	Slave MS channel maintenance during call transaction .....	41
8.4.2.4.2	Slave MS signal quality measurement during call transaction .....	41
8.4.2.4.3	Slave MS channel maintenance during reservation .....	42
8.4.3	Criteria for changing DM-MAC state .....	42
8.4.3.1	Criteria for changing DM-MAC state for master DM-MS.....	42
8.4.3.2	Criteria for changing DM-MAC state for slave DM-MS .....	42
8.4.3.3	Criteria for changing DM-MAC state for idle DM-MS .....	42
8.4.4	DM-MS channel monitoring procedures .....	42
8.4.4.1	DM channel during initial call set-up and new call transaction by current master MS .....	43
8.4.4.2	DM channel during call set-up with presence check.....	43
8.4.4.3	DM channel in occupation during a circuit mode call.....	43
8.4.4.4	DM channel in reservation during a circuit mode call .....	43
8.4.4.5	DM channel in occupation during an SDS call .....	44
8.4.4.6	DM channel usage during pre-emption signalling .....	44
8.4.4.7	DM channel usage during timing change request signalling.....	44
8.4.5	Transmission of layer 3 messages by DM-MAC.....	44
8.4.5.1	Transmission of C-plane messages by DM-MAC.....	44
8.4.5.2	Transmission of U-plane messages by DM-MAC .....	45
8.4.6	Transmission of layer 2 messages generated by DM-MAC .....	45
8.4.7	General DM-MAC procedures .....	45
8.4.7.1	DM-MAC repeat transmissions .....	45
8.4.7.2	DM-MAC frame countdown procedure.....	45
8.4.7.3	Use of timers .....	45
8.4.7.4	Linearization .....	46
8.4.7.5	Fragmentation .....	46
8.4.7.6	Fill bit indication .....	47
8.4.7.7	Selection of pseudo address .....	47
8.4.7.8	Slot flag indication .....	47
8.4.7.9	Requests bitmap .....	47
8.4.7.10	DM aspects of dual watch operation .....	47
8.4.7.10.1	Full and idle dual watch operation.....	47
8.4.7.10.2	DM aspects of full dual watch operation.....	47
8.4.7.10.3	DM aspects of idle dual watch operation.....	48
8.4.7.11	Air interface encryption .....	48
8.4.7.12	Channel A or B operation .....	48
8.4.7.13	Sending short data as a transaction within a circuit mode call.....	48
8.4.7.14	SDS time remaining .....	49
8.4.7.15	Timing change procedure.....	49
8.4.7.16	Timing change at changeover or pre-emption.....	49
8.5	MAC procedures for transfer of signalling messages.....	49
8.5.1	Formation of MAC PDU .....	49
8.5.2	Addressing .....	49
8.5.2.1	Transmission of message .....	50
8.5.2.1.1	Addressing in synchronization burst .....	50
8.5.2.1.2	Addressing in normal burst.....	50
8.5.2.2	Reception of message.....	50
8.5.3	Use of air interface encryption.....	51
8.5.4	Fragmentation and reconstruction.....	51
8.5.4.1	Fragmentation .....	51
8.5.4.2	Reconstruction .....	52
8.5.5	Fill bit addition and deletion .....	53
8.5.6	Transmission and reception of messages by layer 2 .....	53
8.5.6.1	Transmission of message .....	54
8.5.6.2	Reception of message.....	54
8.5.7	Random access protocol .....	56
8.5.7.1	Introduction.....	56
8.5.7.2	Procedures for master DM-MS .....	56
8.5.7.2.1	Indicating frames available for requests .....	56
8.5.7.2.2	Monitoring frames available for requests .....	57
8.5.7.2.3	Response to pre-emption or changeover request .....	57
8.5.7.2.4	Response to timing change request.....	57

8.5.7.3	Procedures for requesting DM-MS .....	58
8.5.7.3.1	Preparing for random access .....	58
8.5.7.3.2	First transmission of request .....	58
8.5.7.3.3	Valid access slots .....	58
8.5.7.3.4	Waiting for response .....	59
8.5.7.3.5	Subsequent transmission of request .....	59
8.5.7.3.6	Abandoning random access attempt .....	59
8.6	MAC procedures in traffic mode .....	59
8.6.1	Introduction .....	59
8.6.2	Criteria for transmission and reception of traffic .....	59
8.6.3	Change of U-plane mode .....	60
8.6.3.1	Call set-up without presence check .....	60
8.6.3.1.1	Outgoing call .....	60
8.6.3.1.2	Incoming call .....	60
8.6.3.2	Call set-up with presence check .....	60
8.6.3.2.1	Outgoing call .....	60
8.6.3.2.2	Incoming call .....	61
8.6.3.3	Late entry .....	61
8.6.3.4	End of traffic transmission .....	61
8.6.3.4.1	Master DM-MS .....	61
8.6.3.4.2	Slave DM-MS .....	61
8.6.4	Exchange of information at the DMD-SAP .....	61
8.6.5	Stealing from circuit mode capacity .....	61
9	DM-REP layer 2 protocol for a type 1 DM-REP .....	61
9.1	Introduction .....	61
9.1.1	Functions of lower MAC .....	62
9.1.2	Functions of upper MAC .....	62
9.2	Interface between lower and upper MAC .....	62
9.3	Basic capabilities of the DM-REP physical layer .....	63
9.4	Usage of DM channel .....	63
9.4.1	DM-REP operation .....	63
9.4.1.1	Channel structure .....	63
9.4.1.2	Channel synchronization .....	64
9.4.2	DM-REP states .....	64
9.4.2.1	DM-REP state definitions .....	64
9.4.2.2	DM-REP channel surveillance procedures .....	65
9.4.2.2.1	DM-REP channel surveillance when idle on a channel in unknown or free state (i.e. in state 0 or 1) .....	65
9.4.2.2.2	DM-REP channel surveillance when idle on a busy channel (i.e. in state 2) .....	65
9.4.2.2.3	DM-REP channel surveillance when idle at DM-MS call set-up .....	66
9.4.2.3	DM-REP channel maintenance when active during a call .....	66
9.4.3	Criteria for changing DM-REP state .....	67
9.4.3.1	Criteria for changing DM-REP state for active DM-REP .....	67
9.4.3.2	Criteria for changing DM-REP state for idle DM-REP .....	67
9.4.4	DM-REP channel monitoring procedures .....	68
9.4.4.1	DM channel during call set-up with presence check .....	69
9.4.4.2	DM channel in occupation during a circuit mode call .....	69
9.4.4.3	DM channel in reservation during a circuit mode call .....	69
9.4.4.4	DM channel in occupation during an SDS call .....	70
9.4.4.5	DM channel following pre-emption or changeover acceptance .....	70
9.4.4.6	DM channel following timing change announcement .....	71
9.4.5	DM-REP presence signal .....	71
9.4.5.1	Channel free .....	71
9.4.5.2	Channel in occupation .....	72
9.4.5.3	Channel in reservation .....	73
9.4.6	DM-REP linearization .....	73
9.5	DM-REP procedures for re-transmission of signalling messages .....	74
9.5.1	Re-transmission of signalling messages received from the master DM-MS .....	74
9.5.1.1	Re-transmission of master DM-MS signalling messages received in a DSB .....	74
9.5.1.1.1	General procedures .....	74
9.5.1.1.2	Re-transmission of DM-SETUP or DM-SETUP PRES message .....	75



9.5.1.1.3	Re-transmission of DM-SDS DATA or DM-SDS UDATA message .....	75
9.5.1.1.4	Re-transmission of other messages in a DSB when not using multi-slot regeneration.....	76
9.5.1.1.5	Re-transmission of other messages in a DSB during traffic transmission with multi-slot regeneration .....	76
9.5.1.2	Re-transmission of master DM-MS signalling messages received in a DNB .....	77
9.5.1.2.1	Call transaction without multi-slot regeneration .....	77
9.5.1.2.2	Call transaction with multi-slot regeneration.....	77
9.5.1.3	Regeneration of missing repetitions on the slave link.....	78
9.5.2	Re-transmission of signalling messages received from a slave DM-MS .....	78
9.5.2.1	General procedures.....	78
9.5.2.2	Re-transmission of response messages from a slave DM-MS.....	79
9.5.2.3	Re-transmission of random access request.....	79
9.5.3	DM-REP signalling mechanisms .....	80
9.5.3.1	Frame countdown procedure .....	80
9.5.3.2	Fill bit addition and deletion .....	80
9.5.3.3	Null PDU .....	80
9.5.3.4	Air interface encryption .....	80
9.5.3.5	Timing change procedure.....	81
9.5.3.6	Random access procedures for DM-REP.....	81
9.6	DM-REP procedures in traffic mode.....	81
9.6.1	Introduction.....	81
9.6.2	Change of U-plane mode .....	82
9.6.2.1	Set-up without presence check.....	82
9.6.2.1.1	Switching into traffic mode .....	82
9.6.2.1.2	Link establishment failure .....	82
9.6.2.2	Set-up with presence check.....	82
9.6.2.3	End of traffic transmission .....	83
9.6.3	DM-REP traffic operation when active in traffic mode.....	83
9.6.3.1	Reception of TCH and STCH on the master link.....	83
9.6.3.2	Re-transmission of TCH and STCH on the slave link.....	84
9.6.3.2.1	Call transaction without multi-slot regeneration .....	84
9.6.3.2.2	Call transaction with multi-slot regeneration.....	84
10	PDU descriptions.....	85
10.1	Layer 2 PDUs sent in DSB .....	85
10.1.1	DMAC-SYNC PDU .....	85
10.1.2	DPRES-SYNC PDU .....	86
10.2	Layer 2 PDUs sent in DNB .....	87
10.3	Layer 2 information element coding .....	87
10.3.1	Addressing for URT = 0010 <sub>2</sub> or 1000 <sub>2</sub> .....	88
10.3.2	Addressing for URT = 0011 <sub>2</sub> or 1001 <sub>2</sub> .....	88
10.3.3	Addressing for URT = 0100 <sub>2</sub> or 0101 <sub>2</sub> .....	88
10.3.4	Addressing for URT = 0110 <sub>2</sub> .....	88
10.3.4A	Addressing for URT = 1010 <sub>2</sub> .....	88
10.3.4B	Addressing for URT = 1011 <sub>2</sub> .....	89
10.3.5	Channel state.....	89
10.3.6	Channel usage.....	89
10.3.7	Maximum DM-MS power class.....	89
10.3.8	M-DMO flag.....	90
10.3.9	MNI of DM-REP .....	90
10.3.10	Number of validity time units .....	90
10.3.11	Presence signal dual watch synchronization flag.....	90
10.3.12	Repeater operating modes.....	91
10.3.13	Spacing of uplink.....	91
10.3.14	Two-frequency repeater flag.....	92
10.3.15	Usage restriction type (URT).....	92
10.3.16	Validity time unit.....	93
10.3.17	Value of DT254 .....	93
10.3.18	Values of DN232 and DN233.....	93
10.4	Messages generated by layer 2 .....	94
10.5	Layer 3 PDUs.....	94
10.6	Message dependent elements coding.....	94

10.7	DM-SDU elements coding .....	95
<b>Annex A (normative):</b>	<b>Timers and constants in DM-MS and DM-REP .....</b>	<b>96</b>
A.1	Layer 3 timers in DM-MS .....	96
A.2	Layer 3 constants in DM-MS .....	96
A.3	Layer 2 timers in DM-MS .....	97
A.4	Layer 2 constants in DM-MS .....	97
A.5	Maximum number of frame transmissions by DM-MAC .....	99
A.6	Layer 2 timers in DM-REP .....	99
A.7	Layer 2 constants in DM-REP .....	100
<b>Annex B (normative):</b>	<b>SDS-TL use in DMO .....</b>	<b>101</b>
<b>Annex C (informative):</b>	<b>Change requests .....</b>	<b>102</b>
History .....		103

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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 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"; (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.

<b>National transposition dates</b>	
Date of adoption of this EN:	22 December 2011
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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 [i.3].

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.

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## 2 References

SIST EN 300 396-4 V1.4.1:2012

[https://standards.iteh.ai/catalog/standards/sist/d43553b0-2934-40e8-a01e-](https://standards.iteh.ai/catalog/standards/sist/d43553b0-2934-40e8-a01e-031059428d20/sist-en-300-396-4-v1-4-1-2012)

[031059428d20/sist-en-300-396-4-v1-4-1-2012](https://standards.iteh.ai/catalog/standards/sist/d43553b0-2934-40e8-a01e-031059428d20/sist-en-300-396-4-v1-4-1-2012)

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 300 396-1: "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".

## 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] ETSI EN 300 396-7: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 7: Type 2 repeater air interface". (Historical).
- [i.4] ETSI EN 300 396-10: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 10: Managed Direct Mode Operation (M-DMO)". (Historical).

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## 3 Definitions 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:

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

**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.

**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 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 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 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

**Medium Access Control (MAC) block:** unit of information transferred between the upper MAC and lower MAC for a particular logical channel

NOTE: Logical channels are e.g. SCH/F or STCH. The lower MAC performs channel coding for insertion into the appropriate physical slot or half slot.

**normal mode:** mode of operation where only one DM communication is supported on an RF carrier or a pair of duplex-spaced RF carriers for operation with a type 1B DM-REP or type 1B DM-REP/GATE

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

**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.

**presence signal:** message transmitted by a DM-REP or a gateway in order to indicate its presence on an RF carrier

**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:** procedure used to avoid clashes when requesting permission from the current master to use the DM channel

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.

**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.

**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

**slave link:** communication link used for transmissions between the DM-REP and slave or idle DM-MSs

**surveillance:** process of determining the current state of the DM RF carrier when in idle mode

**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 [4].