



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

Document Preview

[ETSI EN 300 396-4 V1.4.1 \(2011-12\)](https://standards.iteh.ai/catalog/standards/etsi/072100c9-d367-4dc9-bffb-cf0c7373dabf/etsi-en-300-396-4-v1-4-1-2011-12)

<https://standards.iteh.ai/catalog/standards/etsi/072100c9-d367-4dc9-bffb-cf0c7373dabf/etsi-en-300-396-4-v1-4-1-2011-12>

Reference

REN/TETRA-08194

KeywordsTETRA, DMO, repeater, protocol, radio, air
interface**ETSI**650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

iteh Standards
(<https://standards.iteh.ai>)
Document Preview

Important notice

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, please send your comment to one of the following services:

http://portal.etsi.org/chaicor/ETSI_support.asp

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2011.
All rights reserved.

DECTTM, PLUGTESTSTM, UMTSTM and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.
3GPPTM and LTETM are Trade Marks of ETSI registered for the benefit of its Members and
of the 3GPP Organizational Partners.
GSM[®] and the GSM logo are Trade Marks registered and owned by the GSM Association.

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	56
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	57
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.....	58
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	63
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.....	72
9.4.6	DM-REP linearization	73
9.5	DM-REP procedures for re-transmission of signalling messages	73
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	81
9.6.2.1	Set-up without presence check.....	81
9.6.2.1.1	Switching into traffic mode	81
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	82
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.....	83
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 ₂ or 1000 ₂	88
10.3.2	Addressing for URT = 0011 ₂ or 1001 ₂	88
10.3.3	Addressing for URT = 0100 ₂ or 0101 ₂	88
10.3.4	Addressing for URT = 0110 ₂	88
10.3.4A	Addressing for URT = 1010 ₂	88
10.3.4B	Addressing for URT = 1011 ₂	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