



**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Digital Mobile Radio (DMR) Systems;  
Part 4: DMR trunking protocol**

*Full Standards Catalogue*  
*https://standards.iteh.ai/catalog/standards/sls/etsi-102-361-4-v1-9-1-2017-10*  
*46b3-b8be-1f48b2c01127/etsi-102-361-4-v1-9-1-2017-10*

---

**Reference**RTS/ERM-TGDMR-359

---

**Keywords**data, digital, MS, radio, signalling, trunking

---

**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

---

**Important notice**

---

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (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

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

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

<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

---

**Copyright Notification**

---

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2017.

All rights reserved.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.

**3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

**oneM2M** logo is protected for the benefit of its Members.

**GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

# Contents

Intellectual Property Rights .....	14
Foreword.....	14
Modal verbs terminology.....	14
1 Scope .....	15
2 References .....	15
2.1 Normative references .....	15
2.2 Informative references.....	16
3 Definitions, symbols and abbreviations .....	16
3.1 Definitions.....	16
3.2 Symbols.....	20
3.3 Abbreviations .....	20
4 Overview .....	23
4.0 Overview introduction.....	23
4.1 Protocol architecture.....	24
4.1.0 Protocol architecture - Introduction .....	24
4.1.1 Air Interface Physical Layer (layer 1).....	25
4.1.2 Air Interface Data Link Layer (layer 2).....	25
4.1.3 Air Interface Call Control Layer (layer 3) .....	26
4.2 Services and Facilities .....	27
4.3 Device Addresses .....	28
4.3.1 MS Addresses .....	28
4.3.2 Services and Gateway Addresses.....	28
4.4 Conventional/Trunked Systems.....	28
4.5 MS Location.....	28
4.6 Tier III Services.....	29
4.6.0 Tier III Services - Introduction .....	29
4.6.1 MS initiating calls.....	29
4.6.2 MS receiving calls .....	29
4.6.2.0 MS receiving calls - Introduction .....	29
4.6.2.1 MS receiving individual calls.....	30
4.6.2.1.0 MS receiving individual calls - Introduction .....	30
4.6.2.1.1 Off Air Call Set-Up (OACSU).....	30
4.6.2.1.2 Full Off Air Call Set-Up (FOACSU).....	30
4.6.2.2 MS receiving calls to talkgroups .....	30
4.6.2.3 MS receiving calls to All_MS.....	30
4.7 Physical Link Organization .....	30
4.7.0 Physical Link Organization - Introduction.....	30
4.7.1 Radio Frequency Allocation .....	31
4.7.2 Colour Code (CC).....	31
4.8 DMR TDMA burst and channel structure .....	31
4.9 TS Structure.....	33
4.9.0 Introduction to the TS Structure .....	33
4.9.1 An individual voice call example .....	33
4.9.1.1 Individual Call using OACSU.....	33
4.9.1.2 Individual Call using FOACSU .....	35
4.9.2 A talkgroup call example.....	36
4.10 Network architecture .....	37
4.10.0 Network architecture - Introduction.....	37
4.10.1 Network functions .....	37
4.10.1.0 Network functions - Introduction.....	37
4.10.1.1 Establishing service.....	37
4.10.1.2 Network Identifier.....	37
4.10.2 MS Location by Registration.....	38
4.11 Trunking methods.....	38

4.11.0	Trunking methods - Introduction .....	38
4.11.1	Message trunking.....	38
4.11.2	Transmission trunking .....	38
4.11.3	Quasi-Transmission trunking.....	38
5	Trunking Control Channel Formats .....	39
5.0	Trunking Control Channel Formats - Introduction.....	39
5.1	The use of the CACH.....	39
5.1.0	System Identity Code Structure .....	39
5.1.1	C_SYS_Parms and P_SYS Parms - System Identity Code Subset .....	40
5.1.2	C_SYS_Parms - Reg.....	40
5.1.3	C_SYS_Parms - Common_Slot_Counter .....	40
5.2	Tier III signalling.....	40
5.3	Modes of control channel .....	40
5.3.0	Control channel modes - Introduction .....	40
5.3.1	Dedicated TSCC .....	41
5.3.2	Non-Dedicated TSCC.....	41
5.3.3	Operation in shared spectrum .....	41
5.4	CSBK/MBC/UDT/USBD Block Structure .....	41
5.4.0	CSBK/MBC/UDT/USBD Block Structure - Introduction .....	41
5.4.1	CSBK/MBC/UDT/USBD PDUs on the TSCC outbound channel .....	41
5.4.2	CSBK/MBC/UDT/USBD PDUs on the TSCC inbound channel .....	43
5.4.3	CSBK/MBC PDUs on the Payload Channel Outbound channel .....	43
5.4.4	CSBK PDUs on the Payload Channel Inbound channel.....	44
6	Trunking Procedures .....	45
6.1	Basic Structure .....	45
6.1.1	Channel Structure .....	45
6.1.1.1	Fully Regulated Structure .....	45
6.1.1.2	Shared Channel Unregulated Structure .....	45
6.1.1.3	TSCCAS Structure.....	45
6.1.2	Physical Channel Addressing .....	46
6.1.3	Sub-Division of the MS population.....	46
6.2	Random Access Procedures .....	47
6.2.0	Random Access Procedures - Introduction.....	47
6.2.1	The Random Access Principle.....	47
6.2.1.0	Random Access Principle - Introduction.....	47
6.2.1.1	Random Access Control.....	48
6.2.1.1.0	Random Access Control - Introduction.....	48
6.2.1.1.1	Sub dividing the MS population.....	48
6.2.1.1.2	Checking the Service-Function .....	49
6.2.1.1.3	Withdrawing slots from Random-Access.....	49
6.2.1.1.4	TSCC responses to Random Access attempts .....	50
6.2.1.1.5	Noting the response delay.....	50
6.2.1.1.6	Random Backoff.....	50
6.2.1.1.7	Retry decision and time-outs .....	52
6.2.1.1.8	Random Access (non-emergency) SDL for an MS as defined in clause 6.2 .....	53
6.2.1.1.9	Random Access (emergency) SDL for an MS as defined in clause 6.2 .....	56
6.2.1.2	Action after receiving an acknowledgement .....	58
6.2.1.3	MS Arriving on a Control Channel .....	59
6.3	Control Channel Acquisition and Retention.....	59
6.3.0	Control Channel Acquisition and Retention - Introduction .....	59
6.3.1	MS Parameter Volatility .....	60
6.3.2	Control Channel Acquisition Procedures.....	61
6.3.2.0	Control Channel Acquisition Procedures - Introduction .....	61
6.3.2.1	Entry into TSCC Acquisition Procedures .....	61
6.3.2.2	Identifying a Candidate Control Channel.....	61
6.3.2.2.0	Identifying a Candidate Control Channel - Introduction .....	61
6.3.2.2.1	Checking the System Identity Code .....	62
6.3.2.2.2	TSCC Authorization Procedure.....	64
6.3.2.2.3	Checking the SYS_AREA information element .....	65
6.3.2.3	Confirmation - Monitoring the TSCC outbound channel signal quality .....	66

6.3.2.4	Reading the Colour Code .....	66
6.3.3	MS Leaving a Control Channel .....	67
6.3.3.1	Reasons for Leaving a Control Channel when active but idle .....	67
6.3.3.2	Leaving a Control Channel Whilst Waiting for Signalling .....	67
6.4	Registration, Power Save, and Authentication Procedures.....	67
6.4.0	Registration, Power Save, and Auth Procedures - Introduction.....	67
6.4.1	Registration .....	68
6.4.1.1	Introduction .....	68
6.4.1.2	The Principle .....	69
6.4.2	MS Parameter Volatility .....	70
6.4.3	Action on confirmation of a TSCC .....	70
6.4.4	Registration Procedures .....	70
6.4.4.0	Registration Procedures - Introduction.....	70
6.4.4.1	Registration by Random Access .....	71
6.4.4.1.0	Registration by Random Access - Introduction .....	71
6.4.4.1.1	Intermediate Acknowledgement.....	72
6.4.4.1.2	Registration accepted.....	72
6.4.4.1.3	Registration Refused .....	72
6.4.4.1.4	Registration Denied .....	72
6.4.4.1.5	Challenge and Response Authentication .....	72
6.4.4.1.6	Registration Attempt Times Out.....	73
6.4.4.1.7	Registration Demand Received During Random Access Registration.....	73
6.4.4.1.8	No answer response Received after the maximum number of random access attempts .....	73
6.4.4.1.9	Registration Action on Switch-on or equivalent.....	73
6.4.4.1.10	Registration scenario MSC .....	74
6.4.4.1.11	Registration with MS authentication .....	75
6.4.4.1.12	Acceptance of user initiated service requests .....	76
6.4.4.1.13	Talkgroup Subscription and Talkgroup Attachment.....	76
6.4.5	Mass re-registration .....	80
6.4.5.0	Mass re-registration - Introduction.....	80
6.4.5.1	Procedure for MS on receipt of Mass Re-registration Broadcast.....	80
6.4.6	De-registration .....	81
6.4.7	Power Save .....	81
6.4.7.1	Overview .....	81
6.4.7.2	Power Save Procedures .....	82
6.4.7.2.1	Basic Power Save Procedures.....	82
6.4.8	Authentication Procedures .....	84
6.4.8.0	Authentication Procedures - Introduction .....	84
6.4.8.1	Key Management .....	84
6.4.8.2	Authentication Procedures for the TSCC to authenticate an MS .....	85
6.4.8.3	Authentication Procedures for the MS .....	85
6.4.9	MS Stun/Revive .....	85
6.4.9.0	MS Stun/Revive - Introduction .....	85
6.4.9.1	MS Stun/Revive without authentication.....	86
6.4.9.1.0	MS Stun/Revive without authentication - Introduction .....	86
6.4.9.1.1	Stun/Revive procedures for the TSCC .....	86
6.4.9.1.2	Stun/Revive procedures for the MS.....	86
6.4.9.2	MS Stun/Revive with authentication.....	87
6.4.9.2.0	MS Stun/Revive with authentication - Introduction .....	87
6.4.9.2.1	Stun/Revive procedures with authentication for the TSCC .....	87
6.4.9.2.2	Stun/Revive procedures with authentication for the MS .....	88
6.4.10	MS Kill .....	88
6.4.10.0	MS Kill - Introduction.....	88
6.4.10.1	Kill procedures with authentication for the TSCC .....	89
6.4.10.2	Kill procedures with authentication for the MS .....	90
6.4.11	IP Connection Advice.....	91
6.4.11.0	IP Connection Advice - Introduction .....	91
6.4.11.1	IP Connection Advice procedures for the MS.....	91
6.4.11.1.0	IP Connection Advice procedures for the MS - Introduction .....	91
6.4.11.1.1	Registration Attempt Times Out.....	92
6.4.11.1.2	No answer response received after the maximum number of random access attempts .....	92
6.4.11.1.3	MS response to C_AHOY inviting the MS to send an IP address.....	92

6.4.11.1.4	Final acknowledgment to IP connection advice received by the calling MS .....	92
6.4.11.2	IP Connection Advice procedures for the TSCC .....	92
6.4.12	Unsolicited MS Radio Check.....	93
6.4.13	Supplementary_User Data Service .....	94
6.4.13.0	Supplementary_User Data Service - Introduction.....	94
6.4.13.1	Supplementary data Inbound Phase .....	94
6.4.13.2	Supplementary Data Outbound Phase.....	95
6.4.14	MS Power Control and PTT De-key.....	98
6.4.14.0	MS Power Control and PTT De-key - Introduction .....	98
6.4.14.1	Reverse Channel .....	98
6.4.14.2	Procedures for Power Control.....	98
6.4.14.3	Procedures for PTT De-key.....	99
6.4.15	Transmit Interrupt.....	99
6.4.15.1	TSCC Initiated Interrupt .....	99
6.4.15.2	Payload Interrupt Command .....	99
6.4.15.2.0	Payload Interrupt - Introduction .....	99
6.4.15.2.1	TSCC and TS Procedures for the Transmit Interrupt .....	100
6.4.15.2.2	MS Procedures for the Interrupting MS .....	101
6.4.15.2.3	MS Procedures for the MS being interrupted .....	101
6.4.15.3	Payload Interrupt Request .....	101
6.4.15.3.0	General .....	101
6.4.15.3.1	TSCC and TS Procedures for the Transmit Interrupt .....	102
6.4.15.3.2	MS Procedures for the Interrupting MS .....	102
6.4.15.3.3	MS Procedures for the MS being interrupted.....	103
6.5	Unified Data Transport Mechanism .....	103
6.5.0	Unified Data Transport Mechanism - Introduction.....	103
6.5.1	Format of the appended data.....	106
6.5.1.0	Format of the appended data - Introduction .....	106
6.5.1.1	UDT Block Structure .....	107
6.5.1.2	UDT Content for Services Carried on the Outbound channel.....	107
6.5.1.3	UDT Mechanism for the Inbound channel.....	108
6.6	Call procedures.....	109
6.6.0	Call procedures - Introduction .....	109
6.6.1	Procedures common to Voice calls and Packet Data Calls.....	111
6.6.1.1	MS Availability Checks .....	111
6.6.1.1.1	Availability of calling MS .....	111
6.6.1.1.2	Availability of called party as part of a call.....	111
6.6.1.1.3	General MS radio check .....	111
6.6.1.2	Call Cancellation.....	111
6.6.1.2.0	Call Cancellation - Introduction .....	111
6.6.1.2.1	Cancelling a OACSU Call.....	111
6.6.1.2.2	Cancelling a FOACSU Call.....	112
6.6.1.3	Acknowledgements sent to calling MS.....	112
6.6.1.4	Called Party Answering Mechanism.....	113
6.6.1.4.0	Called Party Answering Mechanism - Introduction .....	113
6.6.1.4.1	TSCC response to the Call Answer Random Access.....	113
6.6.1.4.2	Call Party Answer behaviour for the MS.....	114
6.6.1.5	Maintenance of call progress waiting timers.....	115
6.6.1.5.1	Call waiting timer for the calling MS .....	115
6.6.1.5.2	Call waiting timer for the called MS .....	115
6.6.1.6	Payload Channel Assignment to a Payload Channel.....	116
6.6.1.6.1	Payload Channel Assignment .....	116
6.6.1.6.2	Timing requirements for the allocation of a Payload Channel and PDUs that may be sent ..	117
6.6.1.7	Calls to ALLMSID, ALLMSIDL and ALLMSIDZ.....	118
6.6.2	Voice Call Procedures .....	118
6.6.2.0	Voice Call Procedures - Introduction .....	118
6.6.2.1	Voice Call Procedures for the TSCC .....	119
6.6.2.1.0	Voice Call Procedures for the TSCC - Introduction.....	119
6.6.2.1.1	TSCC Response to single-part voice call set-up.....	119
6.6.2.1.2	TSCC Response to multi-part voice call set-up.....	120
6.6.2.1.3	Acknowledgements sent by the TSCC to the calling MS (voice).....	120
6.6.2.1.4	Voice Radio Check.....	121

6.6.2.1.5	Availability Check for Voice Calls connected through Gateways .....	121
6.6.2.2	Voice Call Procedures for MS .....	122
6.6.2.2.0	Voice Call Procedures for MS - Introduction .....	122
6.6.2.2.1	Initiating a single-part voice call service .....	123
6.6.2.2.2	Response to the single-part voice service request.....	123
6.6.2.2.3	Initiating a multi-part voice call service .....	123
6.6.2.2.4	Response to the multi-part voice service request.....	123
6.6.2.2.5	Acknowledgements received by the calling MS (voice) .....	124
6.6.2.2.6	Availability Check to the called party (voice).....	125
6.6.2.2.7	Payload Channel Allocation .....	125
6.6.2.2.8	Calling MS in single part voice call setup SDL.....	126
6.6.2.2.9	Call set-up MSC that also transfers supplementary_user data.....	128
6.6.2.3	Procedures for the Voice Payload Channel.....	128
6.6.2.3.0	Procedures for the Voice Payload Channel - Introduction .....	128
6.6.2.3.1	TS Procedures for the Voice Payload Channel.....	129
6.6.2.3.2	MS Procedures for the Voice Payload Channel.....	133
6.6.2.4	Late Entry.....	135
6.6.2.4.1	The Principle .....	135
6.6.2.4.2	The Call Timer .....	135
6.6.3	Packet Data Call Procedures.....	136
6.6.3.0	Packet Data Call Procedures - Introduction .....	136
6.6.3.1	Packet Data Call Procedures for the TSCC.....	136
6.6.3.1.0	Packet Data Call Procedures for the TSCC - Introduction .....	136
6.6.3.1.1	TSCC Response to single-part packet data call set-up .....	136
6.6.3.1.2	TSCC Response to multi-part packet data call setup.....	137
6.6.3.1.3	Acknowledgements sent on the TSCC to the calling MS (packet).....	137
6.6.3.1.4	Radio Check for packet data.....	138
6.6.3.1.5	Availability Check for Packet Calls connected through Gateways .....	138
6.6.3.2	Packet Data Call Procedures for MS.....	138
6.6.3.2.0	Packet Data Call Procedures for MS - Introduction .....	138
6.6.3.2.1	Initiating a single-part packet data call service.....	139
6.6.3.2.2	Response to the single-part packet data service request .....	139
6.6.3.2.3	Initiating a multi-part packet data service.....	140
6.6.3.2.4	Response to the multi-part packet data service request .....	140
6.6.3.2.5	Acknowledgements received by the calling MS (packet data).....	140
6.6.3.2.6	Availability Check to the called MS (packet data) .....	141
6.6.3.2.7	Payload Channel Allocation .....	141
6.6.3.3	Procedures for the Packet Data Payload Channel .....	141
6.6.3.3.0	Procedures for the Packet Data Payload Channel - Introduction.....	141
6.6.3.3.1	TS Procedures for the Packet Data Payload Channel .....	142
6.6.3.3.2	MS Procedures for the Packet Data Payload Channel .....	144
6.6.3.4	Application Data Over IP Bearer Service .....	145
6.6.3.4.0	Application Data Over IP Bearer Service - Introduction.....	145
6.6.3.4.1	Text Messaging .....	145
6.6.3.4.2	Location.....	146
6.6.4	UDT Short Data Message Procedure.....	146
6.6.4.0	UDT Short Data Message Procedure - Introduction .....	146
6.6.4.1	UDT Short Data Procedures for the TSCC .....	148
6.6.4.1.0	UDT Short Data Procedures for the TSCC - Introduction.....	148
6.6.4.1.1	TSCC Response to a call to an individual MS or talkgroup (upload phase).....	149
6.6.4.1.2	TSCC Response to a call to an extended_address destination (upload phase) .....	149
6.6.4.1.3	Availability Check to the called MS (UDT Short Data).....	150
6.6.4.1.4	Sending the UDT Short Data to the Called Party (download phase).....	150
6.6.4.1.5	Final acknowledgement to the calling party .....	150
6.6.4.2	UDT Short Data Message procedures for MS.....	150
6.6.4.3	Initiating a UDT Short Data Message service.....	151
6.6.4.4	Response to a random access UDT Short Data message call service.....	151
6.6.4.5	Acknowledgements received by the calling MS .....	152
6.6.4.6	Timeout waiting for further signalling .....	152
6.6.4.7	MS receiving a UDT Short Data message.....	152
6.6.4.8	Short Data Message procedure MSC .....	153
6.6.5	UDT Short Data Polling Service.....	154

6.6.5.0	UDT Short Data Polling Service - Introduction .....	154
6.6.5.1	UDT Short Data Polling Procedures for the TSCC .....	155
6.6.5.1.0	UDT Short Data Polling Procedures for the TSCC - Introduction .....	155
6.6.5.1.1	TSCC Response to a poll request from an MS .....	155
6.6.5.1.2	Availability Check to the called MS (UDT Short Data poll).....	156
6.6.5.1.3	Delivery of the polled data to the calling party .....	156
6.6.5.1.4	Final acknowledgement by the calling party to the TSCC .....	156
6.6.5.1.5	UDT Short Data Polling procedures from a TSCC gateway .....	156
6.6.5.2	UDT Short Data Polling Message procedures for MS .....	156
6.6.5.3	Initiating a UDT Short Data Polling service .....	157
6.6.5.4	Response to a random access UDT Short Data polling message .....	157
6.6.5.5	Final Acknowledgement transmitted by the calling MS .....	157
6.6.5.6	Timeout waiting for further signalling .....	157
6.6.5.7	MS receiving a C_AHOY poll for a short polling message .....	158
6.6.6	Status Call Service .....	158
6.6.6.0	Status Call Service - Introduction .....	158
6.6.6.1	Status Service Delivery Procedure .....	158
6.6.6.1.0	Status Service Delivery Procedure - Introduction .....	158
6.6.6.1.1	Status Service Delivery Procedures for the TSCC .....	159
6.6.6.1.2	Status Service Delivery Procedures for MS .....	161
6.6.6.2	Status Polling Service Procedure .....	164
6.6.6.2.0	Status Polling Service Procedure - Introduction .....	164
6.6.6.2.1	Status Service Polling Procedures for the TSCC .....	165
6.6.6.2.2	Status Polling Service Procedures for MS .....	166
6.6.6.3	Defined Status Values for Status Call Service .....	168
6.6.6.3.1	Emergency Alarm.....	168
6.6.6.3.2	Cancel Emergency Alarm.....	168
6.6.7	Call Diversion .....	168
6.6.7.1	Call Diversion Service .....	168
6.6.7.1.0	Call Diversion Service - Introduction .....	168
6.6.7.1.1	TSCC Procedures for the Call Diversion Service .....	169
6.6.7.1.2	MS Procedures for the Call Diversion Service .....	171
6.6.7.2	Diverting Calls .....	173
6.6.8	Dynamic Group Numbering Assignment Service .....	175
6.6.8.0	Dynamic Group Numbering Assignment Service - Introduction .....	175
6.6.8.1	Rules for the allocation of Dynamic Group Addresses .....	176
6.6.8.1.0	Allocation Rules - Introduction .....	176
6.6.8.1.1	DGNA_Address Mode .....	177
6.6.8.1.2	DGNA_Alias Mode .....	177
6.6.8.2	Dynamic Group Numbering Assignment Procedures for the TSCC .....	178
6.6.8.2.0	Dynamic Group Numbering Assignment Procedures for the TSCC - Introduction .....	178
6.6.8.2.1	TSCC Response to a call to an individual MS or talkgroup .....	178
6.6.8.2.2	UDT Outbound phase .....	178
6.6.8.2.3	Final acknowledgement to the calling party .....	179
6.6.8.3	Dynamic Group Numbering Assignment procedures for MS .....	179
6.6.8.3.0	DGNA Procedures for MS - Introduction .....	179
6.6.8.3.1	Initiating a Dynamic Group Numbering service .....	180
6.6.8.3.2	Response to a random access UDT Dynamic Group Numbering service .....	180
6.6.8.3.3	MS Response to the TSCC AHOY for the UDT Inbound .....	180
6.6.8.3.4	Acknowledgements received by the calling MS .....	181
6.6.8.3.5	Timeout waiting for further signalling .....	182
6.6.8.3.6	MS receiving a UDT Dynamic Group Numbering PDU .....	182
6.6.9	Full-Duplex MS to MS Voice Call Procedures .....	182
6.6.9.0	Full-Duplex MS to MS Voice Call Procedures - Introduction .....	182
6.6.9.1	Full-Duplex MS to MS Voice Call Procedures for the TSCC .....	182
6.6.9.1.0	Full-Duplex MS to MS Voice Call Procedures for the TSCC - Introduction .....	182
6.6.9.1.1	TSCC Response to single-part voice call set-up .....	182
6.6.9.1.2	TSCC Response to multi-part voice call set-up .....	183
6.6.9.1.3	Acknowledgements sent by the TSCC to the calling MS (voice) .....	183
6.6.9.1.4	Voice Radio Check .....	183
6.6.9.2	Full-Duplex MS to MS Voice Call Procedures for MS .....	183
6.6.9.2.0	Full-Duplex MS to MS Voice Call Procedures for MS - Introduction .....	183



6.6.9.2.1	Initiating a single-part voice call service .....	184
6.6.9.2.2	Response to the single-part voice service request.....	184
6.6.9.2.3	Response to the multi-part voice service request.....	184
6.6.9.2.4	Acknowledgements received by the calling MS (voice) .....	185
6.6.9.2.5	Availability Check to the called party (voice) .....	185
6.6.9.2.6	Payload Channel Allocation .....	186
6.6.9.2.7	Calling MS in single part voice call setup SDL.....	186
6.6.9.2.8	Call set-up MSC that also transfers supplementary_user data.....	186
6.6.9.3	Timing requirements for the allocation of a Payload Channel.....	186
6.6.9.4	Procedures for the Voice Payload Channel.....	186
6.6.9.4.0	Procedures for the Voice Payload Channel - Introduction .....	186
6.6.9.4.1	TS Procedures for the Voice Payload Channel.....	187
6.6.9.4.2	MS Procedures for the Voice Payload Channel.....	187
6.6.10	Full-Duplex MS to MS Packet Data Call Procedures.....	187
6.6.10.0	Full-Duplex MS to MS Packet Data Call Procedures - Introduction .....	187
6.6.10.1	Full-Duplex MS to MS Packet Data Call Procedures for the TSCC .....	187
6.6.10.1.0	Full-Duplex MS to MS Packet Data Call Procedures for the TSCC - Introduction .....	187
6.6.10.1.1	TSCC Response to single-part packet call set-up.....	187
6.6.10.1.2	TSCC Response to multi-part packet call setup .....	187
6.6.10.1.3	Acknowledgements sent on the TSCC to the calling MS (packet).....	188
6.6.10.1.4	Radio Check for packet data.....	188
6.6.10.2	Full-Duplex MS to MS Packet Data Call Procedures for MS.....	188
6.6.10.2.0	Full-Duplex MS to MS Packet Data Call Procedures for MS - Introduction .....	188
6.6.10.2.1	Initiating a single-part packet data call service.....	189
6.6.10.2.2	Response to the single-part packet service request.....	189
6.6.10.2.3	Response to the multi-part packet data service request .....	189
6.6.10.2.4	Acknowledgements received by the calling MS (packet data).....	189
6.6.10.2.5	Availability Check to the called MS (packet data).....	190
6.6.10.2.6	Payload Channel Allocation .....	190
6.6.10.3	Procedures for the Packet Data Payload Channel.....	190
6.6.10.3.0	Procedures for the Packet Data Payload Channel - Introduction.....	190
6.6.10.3.1	TS Procedures for the Packet Data Payload Channel.....	191
6.6.10.3.2	MS Procedures for the Packet Data Payload Channel.....	191
6.6.11	Unified Single Block Data Polling Service.....	191
6.6.11.0	Unified Single Block Data Polling Service - Introduction.....	191
6.6.11.1	USB Polling Service Procedures for TSCC and TSCCAS.....	193
6.6.11.2	USB Polling Service Procedures for MS.....	193
6.6.11.3	Unified Single Block Data Polling Service - Location Information Protocol .....	193
6.6.11.3.0	General .....	193
6.6.11.3.1	USB Polling Service Poll Request PDU for LIP .....	194
6.6.11.3.2	USB Polling Service Poll Response PDU for LIP.....	195
6.6.11.3.3	Reason for Sending Information Element .....	195
6.7	System Management Procedures.....	195
6.7.1	Network System Announcements.....	195
6.7.1.0	Network System Announcements - Introduction .....	195
6.7.1.1	Announce/Withdraw TSCC .....	196
6.7.1.2	Specify Call Timer parameters.....	196
6.7.1.3	Vote now advice.....	196
6.7.1.4	Announce Local Time.....	197
6.7.1.5	Mass Registration.....	197
6.7.1.6	Announce a logical physical channel relationship .....	197
6.7.1.7	Adjacent Site Information .....	197
7	PDU description .....	198
7.0	PDU description - Introduction .....	198
7.1	Layer 3 PDUs.....	198
7.1.0	Layer 3 PDUs - Introduction.....	198
7.1.1	Control Signalling Block (CSBK/MBC/UDT) PDUs.....	199
7.1.1.0	Control Signalling Block (CSBK/MBC/UDT) PDUs - Introduction.....	199
7.1.1.1	TSCC Outbound channel CSBK/MBC/UDT .....	203
7.1.1.1.1	Channel Grant CSBK/MBC PDU .....	203
7.1.1.1.2	Channel Grant Absolute Parameters (CG_AP) appended MBC PDU .....	212

7.1.1.1.3	Move TSCC (C_MOVE) CSBK/MBC PDU.....	213
7.1.1.1.4	Aloha (C_ALOHA) CSBK PDU.....	214
7.1.1.1.5	Announcements (C_BCAST) CSBK/MBC PDU.....	216
7.1.1.1.6	Ahoy (AHOY) CSBK PDU.....	217
7.1.1.1.7	Acknowledgement (C_ACKD) TSCC Response CSBK PDU.....	218
7.1.1.1.8	Unified Data Transport Outbound Header (C_UDTHD) UDT PDU.....	220
7.1.1.2	TSCC Inbound channel CSBKs/UDTs transmitted by MS.....	221
7.1.1.2.1	Random Access Request (C_RAND) PDU.....	221
7.1.1.2.2	C_Ackvitation (C_ACKVIT) CSBK PDU.....	222
7.1.1.2.3	C_Acknowledge (C_ACKU) MS Response CSBK PDU.....	223
7.1.1.2.4	Unified Data Transport Inbound channel Header (C_UDTHU) UDT PDU.....	224
7.1.1.3	Outbound channel CSBKs transmitted on a Payload Channel by a TS.....	226
7.1.1.3.1	Channel Grant (P_GRANT) CSBK/MBC PDU.....	226
7.1.1.3.2	Clear (P_CLEAR) CSBK PDU.....	227
7.1.1.3.3	Protect (P_PROTECT) CSBK PDU.....	228
7.1.1.3.4	Ahoy (P_AHOY) CSBK PDU.....	228
7.1.1.3.5	P_Acknowledgement response.....	229
7.1.1.4	Inbound channel CSBKs transmitted on a Payload Channel by MS(s).....	229
7.1.1.4.1	Random Access Request PDU.....	229
7.1.1.4.2	P_ACK Acknowledgements.....	230
7.1.1.4.3	P_MAINT Maintenance PDUs.....	230
7.1.2	Short Link Control PDUs.....	231
7.1.2.1	Control Channel System Parameters.....	231
7.1.2.2	Payload Channel System Parameters.....	231
7.2	Layer 3 information element coding.....	232
7.2.0	Layer 3 information element coding - Introduction.....	232
7.2.1	Mask.....	232
7.2.2	Service Function.....	233
7.2.3	NRand_Wait.....	233
7.2.4	Reg.....	233
7.2.5	Backoff.....	234
7.2.6	System Identity Code.....	234
7.2.7	Response_Info.....	234
7.2.8	Reason.....	235
7.2.8.0	Reason - Introduction.....	235
7.2.8.1	Acknowledgements C_ACK.....	235
7.2.8.2	Acknowledgements C_NACK.....	236
7.2.8.3	Acknowledgements C_QACK, C_WACK.....	239
7.2.9	Digits.....	240
7.2.10	Active_Connection.....	240
7.2.11	HI_RATE.....	240
7.2.12	Service_Kind.....	241
7.2.12.0	Service_Kind - Introduction.....	241
7.2.12.1	Service_Kind_Flag.....	241
7.2.12.2	UDT_Option_Flag.....	242
7.2.13	Service_Options.....	243
7.2.13.0	Service Options - Introduction.....	243
7.2.13.1	Service_Options for a Voice Service Request.....	243
7.2.13.2	Service_Options for a Packet Data Service Request.....	243
7.2.13.3	Service_Options for a Call Diversion Service Request.....	244
7.2.13.4	Service_Options for a Registration Service Request.....	244
7.2.13.5	Service_Options for an Include Call Service Request.....	245
7.2.13.6	Service_Options for a Status Transport Request.....	245
7.2.13.7	Service_Options for the UDT Short Data Service.....	245
7.2.13.8	Service_Options for the Supplementary Data Service.....	246
7.2.13.9	Service_Options for a UDT Short Data Polling Request.....	246
7.2.14	Service_Options_Mirror.....	246
7.2.14.0	Service_Options_Mirror - Introduction.....	246
7.2.14.1	Service_Options_Mirror for MS Authentication.....	246
7.2.14.2	Service_Options_Mirror for MS Stun/Revive.....	247
7.2.14.3	Service_Options_Mirror for MS Kill.....	247
7.2.15	Proxy Flag.....	247

7.2.16	POL_FMT.....	248
7.2.17	Appended_Block .....	248
7.2.18	Opcode.....	249
7.2.19	Announcement type .....	249
7.2.19.0	Announcement type - Introduction .....	249
7.2.19.1	Announce/Withdraw TSCC (Ann-WD_TSCC) .....	249
7.2.19.2	Specify Call Timer Parameters (CallTimer_Parms).....	250
7.2.19.3	Vote Now Advice (Vote_Now).....	250
7.2.19.3.0	Vote Now - Introduction.....	250
7.2.19.3.1	Vote Now Absolute Parameters (VN_AP) appended MBC PDU .....	250
7.2.19.4	Broadcast Local Time (Local_Time) .....	251
7.2.19.4.0	Broadcast Local Time - Introduction.....	251
7.2.19.4.1	Broadcast Local Time - Month (B_MONTH).....	252
7.2.19.4.2	Broadcast Local Time - Day of Week (DAYSOFF_WEEK) .....	252
7.2.19.5	Broadcast Mass Registration (MassReg) .....	252
7.2.19.5.0	Broadcast Mass Registration - Introduction .....	252
7.2.19.5.1	Reg_Window .....	253
7.2.19.6	Broadcast Adjacent Site information .....	253
7.2.19.7	CdefParms absolute frequency relationship .....	253
7.2.19.8	Broadcast General Site Parameters information.....	254
7.2.20	Individual/Group G/I .....	254
7.2.21	Protect_Kind .....	254
7.2.22	Maint_Kind.....	255
7.2.23	Response expected (A) .....	255
7.2.24	Data Packet Format.....	255
7.2.25	SAP Identifier .....	256
7.2.26	Pad Nibble (PN).....	256
7.2.27	UDT Format.....	257
7.2.28	Offset .....	257
7.2.29	Protect Flag (PF).....	257
7.2.30	Privacy .....	258
7.2.31	STATUS .....	258
7.2.32	Version.....	258
7.2.33	Target Address Contents.....	258
7.2.34	Payload Channel Type .....	259
7.2.35	Site Timeslot Synchronization.....	259
7.2.36	One Key format flag (OK).....	259
7.2.37	Single Item Multi-Item(SIMI) data.....	259
<b>Annex A (normative): Timers, constants levels and addresses.....</b>		<b>260</b>
A.0	Timers, constants levels and addresses - Introduction .....	260
A.1	Layer 3 timers.....	260
A.2	Layer 3 constants.....	262
A.3	Layer 3 levels .....	262
A.4	Tier III Gateways/Identifiers .....	263
<b>Annex B (normative): Opcode Reference Lists.....</b>		<b>264</b>
B.1	CSBK/MBC/UDT Opcode List.....	264
B.2	Short Link Control Opcode List.....	265
B.3	Appended Data Information Elements .....	265
B.3.0	Appended Data Information Elements - Introduction .....	265
B.3.1	Appended Data Binary Format.....	265
B.3.2	Appended Data Addressing Format .....	267
B.3.3	Appended Data BCD Format .....	268
B.3.4	Appended Data ISO 7 bit character set Format.....	270
B.3.5	Appended Data ISO 8 bit Character Format.....	272
B.3.6	Appended Data NMEA (IEC 61162-1) format .....	274

B.3.6.0	Appended Data NMEA - Introduction.....	274
B.3.6.1	Short NMEA (IEC 61162-1) format .....	275
B.3.6.2	Long NMEA (IEC 61162-1) format specified .....	275
B.3.6.3	Long NMEA (IEC 61162-1) format unspecified .....	275
B.3.7	UDT DMR IP format .....	276
B.3.8	Appended Data Unicode 16 bit UTF-16BE Character Format.....	277
B.3.9	Appended Data Mixed Format .....	279

## **Annex C (informative): Physical Channel Plan.....281**

C.1	Transmission and Reception .....	281
C.1.1	RF carriers .....	281
C.1.1.1	Nominal carriers frequencies .....	281
C.1.1.2	Fixed Channel Plan.....	281
C.1.1.3	Flexible Channel Plan.....	283
C.1.1.4	Determination of Transmitter and Receiver frequency from CdefParms .....	283

## **Annex D (informative): Control Channel Hunting Procedures .....284**

D.1	Control Channel Hunting Procedures.....	284
D.1.0	Introduction .....	284
D.1.1	Resuming a TSCC hunt channel.....	286
D.1.2	Commanded TSCC hunt channel .....	286
D.1.2.1	Conditions to enter a Commanded TSCC hunt.....	286
D.1.2.2	Nominated Channel for the Single Channel Hunt.....	287
D.1.2.3	Short Hunt Sequence .....	287
D.1.2.3.0	Short Hunt Sequence - Introduction.....	287
D.1.2.3.1	Conditions to enter a Short Channel Hunt.....	287
D.1.2.4	Comprehensive Hunt Sequence .....	288
D.1.2.4.0	Comprehensive Hunt Sequence - Introduction.....	288
D.1.2.4.1	Conditions to enter a Comprehensive Channel Hunt .....	288
D.1.2.5	Receiver Sensitivity During Control Channel Acquisition .....	288

## **Annex E (informative): Fleet numbering and dialling plan .....289**

E.1	Introduction .....	289
E.2	Subscriber mapping.....	290
E.2.0	Subscriber mapping - Introduction .....	290
E.2.1	User Interface - Air Interface .....	290
E.3	Numbering Plan.....	291
E.3.0	Numbering Plan - Introduction.....	291
E.3.1	Definition of User Number and Address .....	292
E.3.1.0	User Number - Introduction.....	292
E.3.1.1	Definition of Air Interface User Address.....	292
E.3.1.2	Relationship between NAI and Air Interface MS Address .....	293
E.3.1.3	Individual Number .....	293
E.3.1.3.1	Short Subscriber Identity (SSI) .....	293
E.3.1.3.2	Fleet Individual Identity .....	293
E.3.1.3.3	Algorithm to convert an Individual Number to an AI Address .....	293
E.3.1.4	Group Number .....	293
E.3.1.4.1	Group Identity .....	293
E.3.1.4.2	Fleet Group Identity .....	294
E.3.1.4.3	Algorithm to convert a Group Number to an AI Address .....	294
E.3.2	Dispatcher.....	294
E.3.3	Short Dispatcher Dialling .....	294
E.3.4	All Call Dialed Strings .....	295
E.3.4.0	All Call Dialed Strings Introduction .....	295
E.3.4.1	Dialed Strings for Local All Calls .....	295
E.3.4.2	Dialed Strings used to address all MS in a subset of the system's radio sites as a talkgroup.....	295
E.3.4.3	Dialed Strings used to address all MS in the System as a talkgroup .....	296
E.3.5	Call Modifiers .....	296
E.3.6	Dialed Function Strings.....	297

E.3.7	Calls to Line Connected Destinations .....	297
E.3.7.1	Calls to the PABX and PSTN .....	297
E.3.7.1.0	Calls to the PABX and PSTN - Introduction .....	297
E.3.7.1.1	Calls to the PSTN.....	297
E.3.7.1.2	Calls to the PABX.....	297
<b>Annex F (informative):</b>	<b>Use of MSC and SDL diagrams.....</b>	<b>298</b>
F.1	Introduction .....	298
F.2	Principle .....	298
F.3	Notation.....	298
<b>Annex G (informative):</b>	<b>Bibliography.....</b>	<b>299</b>
History .....		300

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)

Full standard:  
<https://standards.iteh.ai/catalog/standards/sist/61c0e3d1-28ba-46b3-b8be-1f48b2e01127/etsi-ts-102-361-4-v1.9.1-2017-10>