



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

*Full standards catalogue available at
https://standards.iteh.ai/catalog/standards/sist/33a-6064-4adc-8340-608a77a5370b/etsi-ts-102-361-4-v1.10.1-2019-08*

Reference

RTS/ERM-TGDMR-374

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 prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

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 2019.

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 a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

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 Definition of terms, symbols and abbreviations.....	16
3.1 Terms.....	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	26
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	30
4.7.2 Colour Code (CC).....	31
4.8 DMR TDMA burst and channel structure	31
4.9 TS Structure.....	32
4.9.0 Introduction to the TS Structure	32
4.9.1 An individual voice call example	32
4.9.1.1 Individual Call using OACSU.....	32
4.9.1.2 Individual Call using FOACSU	34
4.9.2 A talkgroup call example	35
4.10 Network architecture	36
4.10.0 Network architecture - Introduction.....	36
4.10.1 Network functions	36
4.10.1.0 Network functions - Introduction.....	36
4.10.1.1 Establishing service.....	36
4.10.1.2 Network Identifier.....	36
4.10.2 MS Location by Registration	37
4.11 Trunking methods.....	37

4.11.0	Trunking methods - Introduction	37
4.11.1	Message trunking.....	37
4.11.2	Transmission trunking	37
4.11.3	Quasi-Transmission trunking.....	37
5	Trunking Control Channel Formats	38
5.0	Trunking Control Channel Formats - Introduction.....	38
5.1	The use of the CACH.....	38
5.1.0	System Identity Code Structure	38
5.1.1	C_SYS_Parms and P_SYS Parms - System Identity Code Subset	39
5.1.2	C_SYS_Parms - Reg.....	39
5.1.3	C_SYS_Parms - Common_Slot_Counter	39
5.2	Tier III signalling.....	39
5.3	Modes of control channel.....	39
5.3.0	Control channel modes - Introduction	39
5.3.1	Dedicated TSCC	40
5.3.2	Non-Dedicated TSCC.....	40
5.3.3	Operation in shared spectrum	40
5.4	CSBK/MBC/UDT/USBD Block Structure	40
5.4.0	CSBK/MBC/UDT/USBD Block Structure - Introduction	40
5.4.1	CSBK/MBC/UDT/USBD PDUs on the TSCC outbound channel	40
5.4.2	CSBK/MBC/UDT/USBD PDUs on the TSCC inbound channel	42
5.4.3	CSBK/MBC PDUs on the Payload Channel Outbound channel	42
5.4.4	CSBK PDUs on the Payload Channel Inbound channel.....	43
6	Trunking Procedures	44
6.1	Basic Structure	44
6.1.1	Channel Structure	44
6.1.1.1	Fully Regulated Structure	44
6.1.1.2	Shared Channel Unregulated Structure	44
6.1.1.3	TSCCAS Structure.....	45
6.1.2	Physical Channel Addressing	45
6.1.3	Sub-Division of the MS population.....	45
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.....	47
6.2.1.1.0	Random Access Control - Introduction.....	47
6.2.1.1.1	Sub dividing the MS population.....	47
6.2.1.1.2	Checking the Service-Function	48
6.2.1.1.3	Withdrawing slots from Random-Access.....	48
6.2.1.1.4	TSCC responses to Random Access attempts	49
6.2.1.1.5	Noting the response delay.....	49
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
6.4.11.2.0	IP Connection Advice procedures for the TSCC - Introduction	92
6.4.11.2.1	IP Bearer Service available at site	93
6.4.11.2.2	IP Bearer Service not available at site	93
6.4.11.2.3	Final acknowledgement to IP connection advice	93
6.4.12	Unsolicited MS Radio Check.....	94
6.4.13	Supplementary_User Data Service	95
6.4.13.0	Supplementary_User Data Service - Introduction.....	95
6.4.13.1	Supplementary data Inbound Phase	95
6.4.13.2	Supplementary Data Outbound Phase.....	96
6.4.14	MS Power Control and PTT De-key.....	99
6.4.14.0	MS Power Control and PTT De-key - Introduction	99
6.4.14.1	Reverse Channel	99
6.4.14.2	Procedures for Power Control	99
6.4.14.3	Procedures for PTT De-key.....	100
6.4.15	Transmit Interrupt.....	100
6.4.15.1	TSCC Initiated Interrupt	100
6.4.15.1.1	Call Termination for Emergency Calls.....	100
6.4.15.1.2	Call Termination when Call Timer Expires.....	100
6.4.15.2	Payload Interrupt Command	100
6.4.15.2.0	Payload Interrupt - Introduction	100
6.4.15.2.1	TSCC and TS Procedures for the Transmit Interrupt	101
6.4.15.2.2	MS Procedures for the Interrupting MS	102
6.4.15.2.3	MS Procedures for the MS being interrupted	102
6.4.15.3	Payload Interrupt Request	102
6.4.15.3.0	General	102
6.4.15.3.1	TSCC and TS Procedures for the Transmit Interrupt	103
6.4.15.3.2	MS Procedures for the Interrupting MS	103
6.4.15.3.3	MS Procedures for the MS being interrupted	104
6.5	Unified Data Transport Mechanism	104
6.5.0	Unified Data Transport Mechanism - Introduction.....	104
6.5.1	Format of the appended data.....	107
6.5.1.0	Format of the appended data - Introduction.....	107
6.5.1.1	UDT Block Structure	108
6.5.1.2	UDT Content for Services Carried on the Outbound channel.....	108
6.5.1.3	UDT Mechanism for the Inbound channel.....	109
6.6	Call procedures.....	110
6.6.0	Call procedures - Introduction.....	110
6.6.1	Procedures common to Voice calls and Packet Data Calls.....	112
6.6.1.1	MS Availability Checks	112
6.6.1.1.1	Availability of calling MS	112
6.6.1.1.2	Availability of called party as part of a call.....	112
6.6.1.1.3	General MS radio check	112
6.6.1.2	Call Cancellation.....	112
6.6.1.2.0	Call Cancellation - Introduction	112
6.6.1.2.1	Cancelling a OACSU Call.....	112
6.6.1.2.2	Cancelling a FOACSU Call.....	113
6.6.1.3	Acknowledgements sent to calling MS	113
6.6.1.4	Called Party Answering Mechanism.....	114
6.6.1.4.0	Called Party Answering Mechanism - Introduction	114
6.6.1.4.1	TSCC response to the Call Answer Random Access.....	114
6.6.1.4.2	Call Party Answer behaviour for the MS.....	115
6.6.1.5	Maintenance of call progress waiting timers.....	116
6.6.1.5.1	Call waiting timer for the calling MS	116
6.6.1.5.2	Call waiting timer for the called MS	116
6.6.1.6	Payload Channel Assignment to a Payload Channel.....	117
6.6.1.6.1	Payload Channel Assignment.....	117
6.6.1.6.2	Timing requirements for the allocation of a Payload Channel and PDUs that may be sent ..	118
6.6.1.7	Calls to ALLMSID, ALLMSIDL and ALLMSIDZ.....	119
6.6.2	Voice Call Procedures	119
6.6.2.0	Voice Call Procedures - Introduction.....	119

6.6.2.1	Voice Call Procedures for the TSCC	120
6.6.2.1.0	Voice Call Procedures for the TSCC - Introduction	120
6.6.2.1.1	TSCC Response to single-part voice call set-up	120
6.6.2.1.2	TSCC Response to multi-part voice call set-up	121
6.6.2.1.3	Acknowledgements sent by the TSCC to the calling MS (voice)	121
6.6.2.1.4	Voice Radio Check	122
6.6.2.1.5	Availability Check for Voice Calls connected through Gateways	122
6.6.2.2	Voice Call Procedures for MS	123
6.6.2.2.0	Voice Call Procedures for MS - Introduction	123
6.6.2.2.1	Initiating a single-part voice call service	124
6.6.2.2.2	Response to the single-part voice service request	124
6.6.2.2.3	Initiating a multi-part voice call service	124
6.6.2.2.4	Response to the multi-part voice service request	124
6.6.2.2.5	Acknowledgements received by the calling MS (voice)	125
6.6.2.2.6	Availability Check to the called party (voice)	126
6.6.2.2.7	Payload Channel Allocation	126
6.6.2.2.8	Calling MS in single part voice call setup SDL	127
6.6.2.2.9	Call set-up MSC that also transfers supplementary_user data	129
6.6.2.3	Procedures for the Voice Payload Channel	129
6.6.2.3.0	Procedures for the Voice Payload Channel - Introduction	129
6.6.2.3.1	TS Procedures for the Voice Payload Channel	130
6.6.2.3.2	MS Procedures for the Voice Payload Channel	134
6.6.2.4	Late Entry	136
6.6.2.4.1	The Principle	136
6.6.2.4.2	The Call Timer	136
6.6.2.5	Preferential Call Notification	137
6.6.2.5.1	The Principle	137
6.6.2.5.2	Announcing a new call on the payload channel	137
6.6.3	Packet Data Call Procedures	137
6.6.3.0	Packet Data Call Procedures - Introduction	137
6.6.3.1	Packet Data Call Procedures for the TSCC	137
6.6.3.1.0	Packet Data Call Procedures for the TSCC - Introduction	137
6.6.3.1.1	TSCC Response to single-part packet data call set-up	138
6.6.3.1.2	TSCC Response to multi-part packet data call setup	139
6.6.3.1.3	Acknowledgements sent on the TSCC to the calling MS (packet)	139
6.6.3.1.4	Radio Check for packet data	140
6.6.3.1.5	Availability Check for Packet Calls connected through Gateways	140
6.6.3.2	Packet Data Call Procedures for MS	140
6.6.3.2.0	Packet Data Call Procedures for MS - Introduction	140
6.6.3.2.1	Initiating a single-part packet data call service	140
6.6.3.2.2	Response to the single-part packet data service request	141
6.6.3.2.3	Initiating a multi-part packet data service	142
6.6.3.2.4	Response to the multi-part packet data service request	142
6.6.3.2.5	Acknowledgements received by the calling MS (packet data)	142
6.6.3.2.6	Availability Check to the called MS (packet data)	143
6.6.3.2.7	Payload Channel Allocation	143
6.6.3.3	Procedures for the Packet Data Payload Channel	143
6.6.3.3.0	Procedures for the Packet Data Payload Channel - Introduction	143
6.6.3.3.1	TS Procedures for the Packet Data Payload Channel	144
6.6.3.3.2	MS Procedures for the Packet Data Payload Channel	146
6.6.3.4	Application Data Over IP Bearer Service	147
6.6.3.4.0	Application Data Over IP Bearer Service - Introduction	147
6.6.3.4.1	Text Messaging	147
6.6.3.4.2	Location	148
6.6.4	UDT Short Data Message Procedure	148
6.6.4.0	UDT Short Data Message Procedure - Introduction	148
6.6.4.1	UDT Short Data Procedures for the TSCC	150
6.6.4.1.0	UDT Short Data Procedures for the TSCC - Introduction	150
6.6.4.1.1	TSCC Response to a call to an individual MS or talkgroup (upload phase)	151
6.6.4.1.2	TSCC Response to a call to an extended_address destination (upload phase)	151
6.6.4.1.3	Availability Check to the called MS (UDT Short Data)	152
6.6.4.1.4	Sending the UDT Short Data to the Called Party (download phase)	152

6.6.4.1.5	Final acknowledgement to the calling party	152
6.6.4.2	UDT Short Data Message procedures for MS	153
6.6.4.3	Initiating a UDT Short Data Message service	153
6.6.4.4	Response to a random access UDT Short Data message call service.....	153
6.6.4.5	Acknowledgements received by the calling MS	154
6.6.4.6	Timeout waiting for further signalling	154
6.6.4.7	MS receiving a UDT Short Data message.....	154
6.6.4.8	Short Data Message procedure MSC	155
6.6.5	UDT Short Data Polling Service.....	156
6.6.5.0	UDT Short Data Polling Service - Introduction	156
6.6.5.1	UDT Short Data Polling Procedures for the TSCC.....	157
6.6.5.1.0	UDT Short Data Polling Procedures for the TSCC - Introduction	157
6.6.5.1.1	TSCC Response to a poll request from an MS	157
6.6.5.1.2	Availability Check to the called MS (UDT Short Data poll).....	158
6.6.5.1.3	Delivery of the polled data to the calling party	158
6.6.5.1.4	Final acknowledgement by the calling party to the TSCC	158
6.6.5.1.5	UDT Short Data Polling procedures from a TSCC gateway	158
6.6.5.2	UDT Short Data Polling Message procedures for MS	158
6.6.5.3	Initiating a UDT Short Data Polling service	159
6.6.5.4	Response to a random access UDT Short Data polling message	159
6.6.5.5	Final Acknowledgement transmitted by the calling MS	159
6.6.5.6	Timeout waiting for further signalling	159
6.6.5.7	MS receiving a C_AHOY poll for a short polling message	160
6.6.6	Status Call Service	160
6.6.6.0	Status Call Service - Introduction	160
6.6.6.1	Status Service Delivery Procedure.....	160
6.6.6.1.0	Status Service Delivery Procedure - Introduction	160
6.6.6.1.1	Status Service Delivery Procedures for the TSCC	161
6.6.6.1.2	Status Service Delivery Procedures for MS	163
6.6.6.2	Status Polling Service Procedure	166
6.6.6.2.0	Status Polling Service Procedure - Introduction	166
6.6.6.2.1	Status Service Polling Procedures for the TSCC	167
6.6.6.2.2	Status Polling Service Procedures for MS	168
6.6.6.3	Defined Status Values for Status Call Service	170
6.6.6.3.1	Emergency Alarm.....	170
6.6.6.3.2	Cancel Emergency Alarm.....	170
6.6.7	Call Diversion	170
6.6.7.1	Call Diversion Service	170
6.6.7.1.0	Call Diversion Service - Introduction.....	170
6.6.7.1.1	TSCC Procedures for the Call Diversion Service.....	171
6.6.7.1.2	MS Procedures for the Call Diversion Service	173
6.6.7.2	Diverting Calls	175
6.6.8	Dynamic Group Numbering Assignment Service.....	177
6.6.8.0	Dynamic Group Numbering Assignment Service - Introduction.....	177
6.6.8.1	Rules for the allocation of Dynamic Group Addresses	178
6.6.8.1.0	Allocation Rules - Introduction	178
6.6.8.1.1	DGNA_Address Mode	179
6.6.8.1.2	DGNA_Alias Mode.....	179
6.6.8.2	Dynamic Group Numbering Assignment Procedures for the TSCC.....	180
6.6.8.2.0	Dynamic Group Numbering Assignment Procedures for the TSCC - Introduction	180
6.6.8.2.1	TSCC Response to a call to an individual MS or talkgroup	180
6.6.8.2.2	UDT Outbound phase.....	180
6.6.8.2.3	Final acknowledgement to the calling party	181
6.6.8.3	Dynamic Group Numbering Assignment procedures for MS	181
6.6.8.3.0	DGNA Procedures for MS - Introduction.....	181
6.6.8.3.1	Initiating a Dynamic Group Numbering service.....	182
6.6.8.3.2	Response to a random access UDT Dynamic Group Numbering service	182
6.6.8.3.3	MS Response to the TSCC AHOY for the UDT Inbound.....	182
6.6.8.3.4	Acknowledgements received by the calling MS.....	183
6.6.8.3.5	Timeout waiting for further signalling	184
6.6.8.3.6	MS receiving a UDT Dynamic Group Numbering PDU.....	184
6.6.9	Full-Duplex MS to MS Voice Call Procedures.....	184

6.6.9.0	Full-Duplex MS to MS Voice Call Procedures - Introduction	184
6.6.9.1	Full-Duplex MS to MS Voice Call Procedures for the TSCC	184
6.6.9.1.0	Full-Duplex MS to MS Voice Call Procedures for the TSCC - Introduction	184
6.6.9.1.1	TSCC Response to single-part voice call set-up	184
6.6.9.1.2	TSCC Response to multi-part voice call set-up	185
6.6.9.1.3	Acknowledgements sent by the TSCC to the calling MS (voice)	185
6.6.9.1.4	Voice Radio Check	185
6.6.9.2	Full-Duplex MS to MS Voice Call Procedures for MS	185
6.6.9.2.0	Full-Duplex MS to MS Voice Call Procedures for MS - Introduction	185
6.6.9.2.1	Initiating a single-part voice call service	186
6.6.9.2.2	Response to the single-part voice service request	186
6.6.9.2.3	Response to the multi-part voice service request	186
6.6.9.2.4	Acknowledgements received by the calling MS (voice)	187
6.6.9.2.5	Availability Check to the called party (voice)	187
6.6.9.2.6	Payload Channel Allocation	188
6.6.9.2.7	Calling MS in single part voice call setup SDL	188
6.6.9.2.8	Call set-up MSC that also transfers supplementary_user data	188
6.6.9.3	Timing requirements for the allocation of a Payload Channel	188
6.6.9.4	Procedures for the Voice Payload Channel	188
6.6.9.4.0	Procedures for the Voice Payload Channel - Introduction	188
6.6.9.4.1	TS Procedures for the Voice Payload Channel	189
6.6.9.4.2	MS Procedures for the Voice Payload Channel	189
6.6.10	Full-Duplex MS to MS Packet Data Call Procedures	189
6.6.10.0	Full-Duplex MS to MS Packet Data Call Procedures - Introduction	189
6.6.10.1	Full-Duplex MS to MS Packet Data Call Procedures for the TSCC	189
6.6.10.1.0	Full-Duplex MS to MS Packet Data Call Procedures for the TSCC - Introduction	189
6.6.10.1.1	TSCC Response to single-part packet call set-up	189
6.6.10.1.2	TSCC Response to multi-part packet call setup	189
6.6.10.1.3	Acknowledgements sent on the TSCC to the calling MS (packet)	190
6.6.10.1.4	Radio Check for packet data	190
6.6.10.2	Full-Duplex MS to MS Packet Data Call Procedures for MS	190
6.6.10.2.0	Full-Duplex MS to MS Packet Data Call Procedures for MS - Introduction	190
6.6.10.2.1	Initiating a single-part packet data call service	191
6.6.10.2.2	Response to the single-part packet service request	191
6.6.10.2.3	Response to the multi-part packet data service request	191
6.6.10.2.4	Acknowledgements received by the calling MS (packet data)	191
6.6.10.2.5	Availability Check to the called MS (packet data)	192
6.6.10.2.6	Payload Channel Allocation	192
6.6.10.3	Procedures for the Packet Data Payload Channel	192
6.6.10.3.0	Procedures for the Packet Data Payload Channel - Introduction	192
6.6.10.3.1	TS Procedures for the Packet Data Payload Channel	193
6.6.10.3.2	MS Procedures for the Packet Data Payload Channel	193
6.6.11	Unified Single Block Data Polling Service	193
6.6.11.0	Unified Single Block Data Polling Service - Introduction	193
6.6.11.1	USBD Polling Service Procedures for TSCC and TSCCAS	195
6.6.11.2	USBD Polling Service Procedures for MS	195
6.6.11.3	Unified Single Block Data Polling Service - Location Information Protocol	195
6.6.11.3.0	General	195
6.6.11.3.1	USBD Polling Service Poll Request PDU for LIP	196
6.6.11.3.2	USBD Polling Service Poll Response PDU for LIP	197
6.6.11.3.3	Reason for Sending Information Element	197
6.7	System Management Procedures	197
6.7.1	Network System Announcements	197
6.7.1.0	Network System Announcements - Introduction	197
6.7.1.1	Announce/Withdraw TSCC	198
6.7.1.2	Specify Call Timer parameters	198
6.7.1.3	Vote now advice	198
6.7.1.4	Announce Local Time	199
6.7.1.5	Mass Registration	199
6.7.1.6	Announce a logical physical channel relationship	199
6.7.1.7	Adjacent Site Information	200
6.7.1.8	General Site Parameters	200

7	PDU description	200
7.0	PDU description - Introduction	200
7.1	Layer 3 PDUs	200
7.1.0	Layer 3 PDUs - Introduction.....	200
7.1.1	Control Signalling Block (CSBK/MBC/UDT) PDUs.....	201
7.1.1.0	Control Signalling Block (CSBK/MBC/UDT) PDUs - Introduction	201
7.1.1.1	TSCC Outbound channel CSBK/MBC/UDT.....	206
7.1.1.1.1	Channel Grant CSBK/MBC PDU	206
7.1.1.1.2	Channel Grant Absolute Parameters (CG_AP) appended MBC PDU	215
7.1.1.1.3	Move TSCC (C_MOVE) CSBK/MBC PDU.....	215
7.1.1.1.4	Aloha (C_ALOHA) CSBK PDU.....	217
7.1.1.1.5	Announcements (C_BCAST) CSBK/MBC PDU.....	218
7.1.1.1.6	Ahoy (C_AHOY) CSBK PDU	220
7.1.1.1.7	Acknowledgement (C_ACKD) TSCC Response CSBK PDU.....	221
7.1.1.1.8	Unified Data Transport Outbound Header (C_UDTHD) UDT PDU	223
7.1.1.2	TSCC Inbound channel CSBKs/UDTs transmitted by MS.....	224
7.1.1.2.1	Random Access Request (C_RAND) PDU	224
7.1.1.2.2	C_Ackvitation (C_ACKVIT) CSBK PDU	225
7.1.1.2.3	C_Acknowledge (C_ACKU) MS Response CSBK PDU	226
7.1.1.2.4	Unified Data Transport Inbound channel Header (C_UDTHU) UDT PDU.....	227
7.1.1.3	Outbound channel CSBKs transmitted on a Payload Channel by a TS	229
7.1.1.3.1	Channel Grant (P_GRANT) CSBK/MBC PDU.....	229
7.1.1.3.2	Clear (P_CLEAR) CSBK PDU	230
7.1.1.3.3	Protect (P_PROTECT) CSBK PDU	231
7.1.1.3.4	Ahoy (P_AHOY) CSBK PDU	231
7.1.1.3.5	P_Acknowledgement response.....	232
7.1.1.4	Inbound channel CSBKs transmitted on a Payload Channel by MS(s).....	232
7.1.1.4.1	Random Access Request PDU	232
7.1.1.4.2	P_ACK Acknowledgements	233
7.1.1.4.3	P_MAINT Maintenance PDUs.....	233
7.1.2	Short Link Control PDUs	234
7.1.2.1	Control Channel System Parameters	234
7.1.2.2	Payload Channel System Parameters	234
7.2	Layer 3 information element coding	235
7.2.0	Layer 3 information element coding - Introduction.....	235
7.2.1	Mask	235
7.2.2	Service Function	235
7.2.3	NRand_Wait	235
7.2.4	Reg.....	236
7.2.5	Backoff	236
7.2.6	System Identity Code.....	236
7.2.7	Response_Info	237
7.2.8	Reason	237
7.2.8.0	Reason - Introduction.....	237
7.2.8.1	Acknowledgements C_ACK.....	237
7.2.8.2	Acknowledgements C_NACK	238
7.2.8.3	Acknowledgements C_QACK, C_WACK	242
7.2.9	Digits	243
7.2.10	Active_Connection	243
7.2.11	HI_RATE.....	243
7.2.12	Service_Kind	244
7.2.12.0	Service_Kind - Introduction.....	244
7.2.12.1	Service_Kind_Flag.....	244
7.2.12.2	UDT_Option_Flag	245
7.2.13	Service_Options.....	246
7.2.13.0	Service Options - Introduction	246
7.2.13.1	Service_Options for a Voice Service Request.....	246
7.2.13.2	Service_Options for a Packet Data Service Request.....	246
7.2.13.3	Service_Options for a Call Diversion Service Request.....	247
7.2.13.4	Service_Options for a Registration Service Request.....	247
7.2.13.5	Service_Options for an Include Call Service Request	248
7.2.13.6	Service_Options for a Status Transport Request.....	248

7.2.13.7	Service_Options for the UDT Short Data Service	248
7.2.13.8	Service Options for the Supplementary Data Service	249
7.2.13.9	Service Options for a UDT Short Data Polling Request	249
7.2.14	Service_Options_Mirror	249
7.2.14.0	Service_Options_Mirror - Introduction.....	249
7.2.14.1	Service_Options_Mirror for MS Authentication.....	249
7.2.14.2	Service_Options_Mirror for MS Stun/Revive.....	250
7.2.14.3	Service_Options_Mirror for MS Kill	250
7.2.15	Proxy Flag.....	250
7.2.16	POL_FMT.....	251
7.2.17	Appended_Block	251
7.2.18	Opcode.....	252
7.2.19	Announcement_type	252
7.2.19.0	Announcement_type - Introduction	252
7.2.19.1	Announce/Withdraw TSCC (Ann_WD_TSCC)	252
7.2.19.2	Specify Call Timer Parameters (CallTimer_Parms).....	253
7.2.19.3	Vote Now Advice (Vote_Now).....	253
7.2.19.3.0	Vote Now - Introduction.....	253
7.2.19.3.1	Vote Now Absolute Parameters (VN_AP) appended MBC PDU	254
7.2.19.4	Broadcast Local Time (Local_Time)	254
7.2.19.4.0	Broadcast Local Time - Introduction.....	254
7.2.19.4.1	Broadcast Local Time - Month (B_MONTH).....	255
7.2.19.4.2	Broadcast Local Time - Day of Week (DAYSOFF_WEEK)	255
7.2.19.5	Broadcast Mass Registration (MassReg)	255
7.2.19.5.0	Broadcast Mass Registration - Introduction	255
7.2.19.5.1	Reg_Window	256
7.2.19.6	Broadcast Adjacent Site information	256
7.2.19.6a	Broadcast a Logical Channel/Frequency Relationship.....	256
7.2.19.7	CdefParms absolute frequency relationship	257
7.2.19.8	Broadcast General Site Parameters information	257
7.2.20	Individual/Group G/I	257
7.2.21	Protect_Kind	258
7.2.22	Maint_Kind	258
7.2.23	Response expected (A)	258
7.2.24	Data Packet Format.....	258
7.2.25	SAP Identifier	259
7.2.26	Pad Nibble (PN).....	259
7.2.27	UDT Format.....	260
7.2.28	Offset	260
7.2.29	Protect Flag (PF).....	260
7.2.30	Privacy	261
7.2.31	STATUS	261
7.2.32	Version.....	261
7.2.33	Target Address Contents.....	261
7.2.34	Payload Channel Type	262
7.2.35	Site Timeslot Synchronization.....	262
7.2.36	One Key format flag (OK).....	262
7.2.37	Single Item Multi-Item(SIMI) data.....	262
7.2.38	Response Delay (RD)	263
7.2.39	Payload Contents (PC).....	263
7.2.40	Current (confirmed) Site Information	263
7.2.41	Network Information	263
Annex A (normative): Timers, constants levels and addresses		265
A.0	Timers, constants levels and addresses - Introduction	265
A.1	Layer 3 timers.....	265
A.2	Layer 3 constants.....	267
A.3	Layer 3 levels	267
A.4	Tier III Gateways/Identifiers	268

Annex B (normative):	Opcode Reference Lists	269
B.1	CSBK/MBC/UDT Opcode List.....	269
B.2	Short Link Control Opcode List.....	270
B.3	Appended Data Information Elements.....	270
B.3.0	Appended Data Information Elements - Introduction.....	270
B.3.1	Appended Data Binary Format.....	270
B.3.2	Appended Data Addressing Format.....	272
B.3.3	Appended Data BCD Format.....	273
B.3.4	Appended Data ISO 7 bit character set Format.....	275
B.3.5	Appended Data ISO 8 bit Character Format.....	277
B.3.6	Appended Data NMEA (IEC 61162-1) format.....	279
B.3.6.0	Appended Data NMEA - Introduction.....	279
B.3.6.1	Short NMEA (IEC 61162-1) format.....	280
B.3.6.2	Long NMEA (IEC 61162-1) format specified.....	280
B.3.6.3	Long NMEA (IEC 61162-1) format unspecified.....	280
B.3.7	UDT DMR IP format.....	281
B.3.8	Appended Data Unicode 16 bit UTF-16BE Character Format.....	282
B.3.9	Appended Data Mixed Format.....	284
Annex C (informative):	Physical Channel Plan	286
C.1	Transmission and Reception.....	286
C.1.1	RF carriers.....	286
C.1.1.1	Nominal carriers frequencies.....	286
C.1.1.2	Fixed Channel Plan.....	286
C.1.1.3	Flexible Channel Plan.....	288
C.1.1.4	Determination of Transmitter and Receiver frequency from CdefParms.....	288
Annex D (informative):	Control Channel Hunting Procedures	289
D.1	Control Channel Hunting Procedures.....	289
D.1.0	Introduction.....	289
D.1.1	Resuming a TSCC hunt channel.....	291
D.1.2	Commanded TSCC hunt channel.....	291
D.1.2.1	Conditions to enter a Commanded TSCC hunt.....	291
D.1.2.2	Nominated Channel for the Single Channel Hunt.....	292
D.1.2.3	Short Hunt Sequence.....	292
D.1.2.3.0	Short Hunt Sequence - Introduction.....	292
D.1.2.3.1	Conditions to enter a Short Channel Hunt.....	292
D.1.2.4	Comprehensive Hunt Sequence.....	293
D.1.2.4.0	Comprehensive Hunt Sequence - Introduction.....	293
D.1.2.4.1	Conditions to enter a Comprehensive Channel Hunt.....	293
D.1.2.5	Receiver Sensitivity During Control Channel Acquisition.....	293
Annex E (informative):	Fleet numbering and dialling plan	294
E.1	Introduction.....	294
E.2	Subscriber mapping.....	295
E.2.0	Subscriber mapping - Introduction.....	295
E.2.1	User Interface - Air Interface.....	295
E.3	Numbering Plan.....	296
E.3.0	Numbering Plan - Introduction.....	296
E.3.1	Definition of User Number and Address.....	297
E.3.1.0	User Number - Introduction.....	297
E.3.1.1	Definition of Air Interface User Address.....	297
E.3.1.2	Network Prefix (NP).....	298
E.3.1.3	Individual Number.....	298
E.3.1.3.1	Short Subscriber Identity (SSI).....	298
E.3.1.3.2	Fleet Individual Identity.....	298
E.3.1.3.3	Algorithm to convert an Individual Number to an AI Address.....	298

E.3.1.4	Group Number	299
E.3.1.4.1	Group Identity	299
E.3.1.4.2	Fleet Group Identity	299
E.3.1.4.3	Algorithm to convert a Group Number to an CAI Address	299
E.3.2	Dispatcher.....	299
E.3.3	Short Dispatcher Dialling	300
E.3.4	All Call Dialed Strings	300
E.3.4.0	All Call Dialed Strings Introduction	300
E.3.4.1	Dialed Strings for Local All Calls	300
E.3.4.2	Dialed Strings used to address all MS in a subset of the system's radio sites as a talkgroup.....	301
E.3.4.3	Dialed Strings used to address all MS in the System as a talkgroup	301
E.3.5	Call Modifiers	301
E.3.6	Dialed Function Strings.....	302
E.3.7	Calls to Line Connected Destinations	303
E.3.7.1	Calls to the PABX and PSTN	303
E.3.7.1.0	Calls to the PABX and PSTN - Introduction	303
E.3.7.1.1	Calls to the PSTN.....	303
E.3.7.1.2	Calls to the PABX.....	303
Annex F (informative): Use of MSC and SDL diagrams.....		304
F.1	Introduction	304
F.2	Principle	304
F.3	Notation.....	304
Annex G (normative): MS Native Addressing Plan		305
G.1	Introduction	305
Annex H (informative): Bibliography.....		306
History		307