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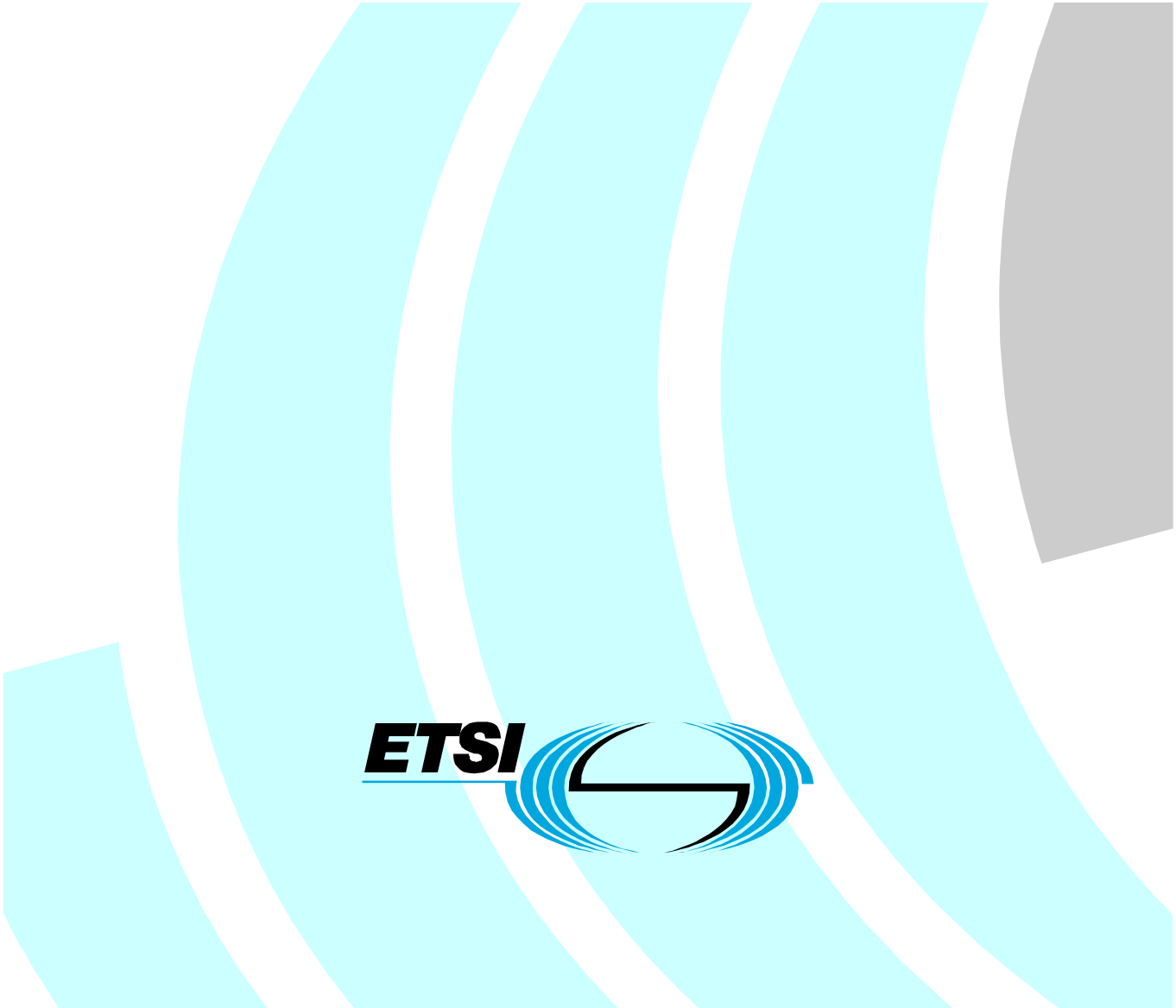
Technical Specification

GEO-Mobile Radio Interface Specifications (Release 2);
General Packet Radio Service;
Part 5: Radio interface physical layer specifications;
Sub-part 2: Multiplexing and Multiple Access;
Stage 2 Service Description;
GMPRS-1 05.002



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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

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- the third digit (n) is incremented when editorial only changes have been incorporated in the specification;
- the second digit (m) is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

The present document is part 5, sub-part 2 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications, as identified below:

Part 1: "General specifications";

Part 2: "Service specifications";

Part 3: "Network specifications";

Part 4: "Radio interface protocol specifications";

Part 5: "Radio interface physical layer specifications";

Sub-part 1: "Physical Layer on the Radio Path: General Description; GMR-1 05.001";

Sub-part 2: "Multiplexing and Multiple Access; Stage 2 Service Description; GMR-1 05.002";

Sub-part 3: "Channel Coding; GMR-1 05.003";

Sub-part 4: "Modulation; GMR-1 05.004";

Sub-part 5: "Radio Transmission and Reception; GMR-1 05.005";

Sub-part 6: "Radio Subsystem Link Control; GMR-1 05.008";

Sub-part 7: "Radio Subsystem Synchronization; GMR-1 05.010";

Part 6: "Speech coding specifications";

Part 7: "Terminal adaptor specifications".

Introduction

GMR stands for GEO (Geostationary Earth Orbit) Mobile Radio interface, which is used for mobile satellite services (MSS) utilizing geostationary satellite(s). GMR is derived from the terrestrial digital cellular standard GSM and supports access to GSM core networks.

The present specification is part of the GMR Release 2 specifications. Release 2 specifications are identified in the title and can also be identified by the version number:

- Release 1 specifications have a GMR-1 prefix in the title and a version number starting with "1" (V1.x.x.)
- Release 2 specifications have a GMPRS-1 prefix in the title and a version number starting with "2" (V2.x.x.)

The GMR release 1 specifications introduce the GEO-Mobile Radio interface specifications for circuit mode mobile satellite services (MSS) utilizing geostationary satellite(s). GMR release 1 is derived from the terrestrial digital cellular standard GSM (phase 2) and it supports access to GSM core networks.

The GMR release 2 specifications add packet mode services to GMR release 1. The GMR release 2 specifications introduce the GEO-Mobile Packet Radio Service (GMPRS). GMPRS is derived from the terrestrial digital cellular standard GPRS (included in GSM Phase 2+) and it supports access to GSM/GPRS core networks.

Due to the differences between terrestrial and satellite channels, some modifications to the GSM standard are necessary. Some GSM specifications are directly applicable, whereas others are applicable with modifications. Similarly, some GSM specifications do not apply, while some GMR specifications have no corresponding GSM specification.

Since GMR is derived from GSM, the organization of the GMR specifications closely follows that of GSM. The GMR numbers have been designed to correspond to the GSM numbering system. All GMR specifications are allocated a unique GMR number. This GMR number has a different prefix for Release 2 specifications as follows:

- Release 1: GMR-n xx.zyy
- Release 2: GMPRS-n xx.zyy

where:

- xx.0yy (z = 0) is used for GMR specifications that have a corresponding GSM specification. In this case, the numbers xx and yy correspond to the GSM numbering scheme.
- xx.2yy (z = 2) is used for GMR specifications that do not correspond to a GSM specification. In this case, only the number xx corresponds to the GSM numbering scheme and the number yy is allocated by GMR.
- n denotes the first (n = 1) or second (n = 2) family of GMR specifications.

A GMR system is defined by the combination of a family of GMR specifications and GSM specifications as follows:

- If a GMR specification exists it takes precedence over the corresponding GSM specification (if any). This precedence rule applies to any references in the corresponding GSM specifications.

NOTE: Any references to GSM specifications within the GMR specifications are not subject to this precedence rule. For example, a GMR specification may contain specific references to the corresponding GSM specification.

- If a GMR specification does not exist, the corresponding GSM specification may or may not apply. The applicability of the GSM specifications is defined in GMR-1 01.201 [2].

1 Scope

The present document defines the structure of the physical channels for the radio subsystem in the GMR-1 Mobile Satellite System. It describes the GMR-1 concept of logical channels and the timing concepts of TDMA frames, timeslots, and bursts. It defines the relationship between logical and physical channels, and defines the logical channels in terms of size, structure and timing relationships.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] GMR-1 01.004 (ETSI TS 101 376-1-1): "GEO-Mobile Radio Interface Specifications; Part 1: General specifications; Sub-part 1: Abbreviations and acronyms; GMR-1 01.004".

[2] GMPRS-1 01.201 (ETSI TS 101 376-1-2): "GEO-Mobile Radio Interface Specifications (Phase 2); General Packet Radio Service; Part 1: General specifications; Sub-part 2 : Introduction to the GMR-1 family; GMPRS-1 01.201".

[3] GMR-1 04.008 (ETSI TS 101 376-4-8) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 8: Mobile Radio Interface Layer 3 Specifications; GMR-1 04.008".

[4] GMR-1 05.003 (ETSI TS 101 376-5-3) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 3: Channel Coding; GMR-1 05.003".

[5] GMR-1 05.004 (ETSI TS 101 376-5-4) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 4: Modulation; GMR-1 05.004".

[6] GMR-1 05.010 (ETSI TS 101 376-5-7) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 7: Radio Subsystem Synchronization; GMR-1 05.010".

[7] GMPRS-1 03.022 (ETSI TS 101 376-3-10): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 3: Network specifications; Sub-part 10: Functions related to Mobile Earth Station (MES) in idle mode; GMPRS-1 03.022".

[8] GMPRS-1 04.008 (ETSI TS 101 376-4-8): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 4: Radio interface protocol specifications; Sub-part 8: Mobile Radio Interface Layer 3 Specifications; GMPRS-1 04.008".

[9] GMPRS-1 05.003 (ETSI TS 101 376-5-3): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 5: Radio interface physical layer specifications; Sub-part 3: Channel Coding; GMPRS-1 05.003".

[10] GMPRS-1 05.004 (ETSI TS 101 376-5-4): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 5: Radio interface physical layer specifications; Sub-part 4: Modulation; GMPRS-1 05.004".

[11] GMPRS-1 05.005 (ETSI TS 101 376-5-5): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception; GMPRS-1 05.005".

[12] GMPRS-1 05.008 (ETSI TS 101 376-5-6): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 5: Radio interface physical layer specifications; Sub-part 6: Radio Subsystem Link Control; GMPRS-1 05.008".

[13] GMPRS-1 05.010 (ETSI TS 101 376-5-7): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 5: Radio interface physical layer specifications; Sub-part 7: Radio Subsystem Synchronization; GMPRS-1 05.010".

[14] GMPRS-1 03.064 (ETSI TS 101 376-3-22): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 3: Network specifications; Sub-part 22: Overall description of the GMPRS radio interface; Stage 2; GMPRS-1 03.064".

[15] GMPRS-1 04.060 (ETSI TS 101 376-4-12): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 4: Radio interface protocol specifications; Sub-part 12: Mobile Earth Station (MES) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; GMPRS-1 04.060".

[16] GMR-1 05.002 (ETSI TS 101 376-5-2) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 2: Multiplexing and Multiple Access; Stage 2 Service Description; GMR-1 05.002".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GMR-1 01.004 [1] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations defined in GMR-1 01.004 [1] and the following apply:

CICH	Common Idle Channel
GMPRS	Geo-Mobile Pocket Radio Service
MAC	Medium Access Control
PAB	Packet Access Burst
PACCH	Packet Associated Control Channel
PAGCH	Packet Access Grant Channel
PCCCH	Packet common control channel
PDCH	Packet Data Channel
PDTCH	Packet data traffic channel
PKAB	Packet Keep-Alive Burst
PNB	Packet Normal Burst
PRACH	Packet Random Access Channel
PRI	Private Information
PTCCH/D	Packet Timing advance Control Channel/Downlink
PTCCH/U	Packet Timing advance Control Channel/Uplink
PUI	PUblic Information
SIRFN	System-Information-Relative Frame Number
TAI	Timing Advance Index
TFI	Temporary Frame Identifier
USF	Uplink Status Flag

4 General

Same as clause 4 in GMR-1 05.002 [16].

5 Logical channels

5.1 General

Same as clause 5.1 in GMR-1 05.002 [16].

5.2 Traffic channels

5.2.1 General

TCHs are intended to carry either encoded speech or user data. Three general types of traffic channels are defined:

1) TCH3: This channel carries data at a gross rate of 5,20 kbps.

2) TCH6: This channel carries data at a gross rate of 10,75 kbps.

3) TCH9: This channel carries data at a gross rate of 16,45 kbps.

The data gross rate is defined as the number of encoded bits in NT3, NT6 and NT9 burst, respectively, excluding the number of power control bits, divided by 40 ms frame time.

All traffic channels are bidirectional.

The types of traffic channels capable of speech and user data are identified in the following clauses.

5.2.2 Speech traffic channels

Same as clause 5.2.2 in GMR-1 05.002 [16].

5.2.3 Data traffic channels

Same as clause 5.2.3 in GMR-1 05.002 [16].

5.2.4 Summary of traffic channel characteristics

Table 5.1 summarizes the characteristics of traffic channels, where the gross transmission rate is the channel transmission bit rate (2 times channel transmission symbol rate) multiplied by the duty cycle of the channel.

Table 5.1: Summary of traffic channel characteristics

Channel Type	User Information Capability	Gross Transmission Rate
TCH3	Encoded speech	5,85 kbps (=46,8/8)
TCH6	User data: 4,8 kbps Fax: 2,4 or 4,8 kbps	11,70 kbps (=46,8/8 x 2)
TCH9	User data: 9,6 kbps Fax: 2,4, 4,8, or 9,6 kbps	17,55 kbps(=46,8/8 x 3)

5.2.5 Packet data traffic channels (PDTCH)

A PDTCH corresponds to the resource allocated to a single MES on one physical channel for user data transmission. Different logical channels may be dynamically multiplexed on to the same PDTCH. The PDTCH uses π/4-QPSK modulation. All packet data traffic channels are unidirectional, either uplink (PDTCH/U), for a mobile-originated packet transfer or downlink (PDTCH/D) for a mobile-terminated packet transfer.

PDTCHs are intended to carry packet data traffic. Different PDTCHs are defined by the suffix (m,n) where m indicates the bandwidth of the physical channel in which the PDTCH is mapped, m × 31,25 kHz, and n defines the number of timeslots allocated to this physical channel. Table 5.2 summarizes different types of packet traffic data channels, PDTCH(m,3), (m=4 and 5), where the burst duration is 5 ms for all the defined channels.

Table 5.2: Packet Traffic Data Channels

Channels	Transmission Symbol Rate (ksps)	Transmission Bandwidth (kHz)	Peak Payload Transmission Rate (without CRC) (kbps)	Peak Payload Transmission Rate (with CRC) (kbps)
PDTCH(4,3)	93,6	125,0	113,6	116,8
PDTCH(5,3)	117,0	156,25	145,6	148,8

The payload is the PRivate Information (PRI) delivered to the physical layer by the link layer. The PRI includes the MAC header and the other higher layer overhead. The peak payload transmission rate (without CRC) is defined as the maximum attainable PRI data rate with continuous transmission, i.e. using all 24 timeslots in a frame. The above peak-rates are achieved with rate 3/4 coding.

5.3 Control channels

5.3.1 General

Same as clause 5.3.1 in GMR-1 05.002 [16].

5.3.2 Broadcast channels

5.3.2.1 Frequency Correction CHannel (FCCH)

Same as clause 5.3.2.1 in GMR-1 05.002 [16].

5.3.2.2 GPS Broadcast control CHannel (GBCH)

Same as clause 5.3.2.2 in GMR-1 05.002 [16].

5.3.2.3 Broadcast Control CHannel (BCCH)

The BCCH broadcasts system information to the MESs, and is downlink only. The BCCH system information parameters are described in GMPRS-1 04.008 [3].System information parameters that are referenced in the present document are summarized in clause 10.

The BCCH shall indicate whether or not packet-switched traffic is supported.

5.3.3 Common Control CHannel (CCCH)

Same as clause 5.3.3 in GMR-1 05.002 [16].

5.3.4 Dedicated control channels

Same as clause 5.3.4 in GMR-1 05.002 [16].

5.3.5 Cell broadcast channel (CBCH)

Same as clause 5.3.5 in GMR-1 05.002 [16].

5.3.6 Packet Common Control CHannels (PCCCH)

If a PCCCH is not allocated, the information for packet-switched operation is transmitted on the CCCH. If a PCCCH is allocated, it may transmit information for the circuit-switched operation.

1) Packet Random Access Channel (PRACH): Uplink only, used to request allocation of one or several PDTCHs (for uplink or downlink direction).

2) Packet Access Grant Channel (PAGCH): Downlink only, used to allocate one or several PDTCHs.

5.3.7 Packet dedicated control channels

1) The Packet Associated Control Channel (PACCH): The PACCH is bidirectional. For description purposes PACCH/U is used for the uplink and PACCH/D for the downlink.

2) Packet Timing Advance Control Channel Uplink (PTCCH/U): Used to transmit packet access bursts to allow estimation of the timing advance for one MES in packet transfer mode.

3) Packet Timing Advance Control Channel Downlink (PTCCH/D): Used to transmit timing advance updates for several MESs. One PTCCH/D is paired with several PTCCH/Us.

6 The physical resource

6.1 General

Same as clause 6.1 in GMR-1 05.002 [16].

6.2 Radio frequency channels

6.2.1 Spot beam allocation

Same as clause 6.2.1 in GMR-1 05.002 [16].

6.2.2 Downlink and uplink

Same as clause 6.2.2 in GMR-1 05.002 [16].

6.3 Timeslots and TDMA frames

6.3.1 General

Same as clause 6.3.1 in GMR-1 05.002 [16].

6.3.2 Timeslot number

Same as clause 6.3.2 in GMR-1 05.002 [16].

6.3.3 TDMA frame number

Same as clause 6.3.3 in GMR-1 05.002 [16].

7 Bursts

7.1 General

A physical channel uses time division multiplexing and is defined as a sequence of timeslots on a single Radio Frequency (RF) channel. The transmissions within these timeslots are known as bursts.

A burst is a single unit of transmission on the radio path defined in terms of RF channel, RF power profile, and modulation symbols. Bursts are sent in a defined time and frequency window where the time window is defined by a range of contiguous timeslot numbers and the frequency window is defined by the carrier number. Therefore, a burst represents the physical content of one or more contiguous timeslots.

The physical channel burst for PDCH(m,n) is denoted as a Packet Normal Burst, PNB(m,n). Here, the bandwidth factor, m, refers to the integer multiple of the bandwidth, 31,25 kHz, of the basic channel, and the time factor, n, refers to the number of timeslots. The ranges of these two variables are as follows: m = 4 and 5, and n = 3.

The PNB(m,n) bursts are n = 3 timeslots long. The burst data is modulated using π/4-QPSK modulation, which maps two bits to one symbol. For additional details concerning the modulation of PNB(m,n) bursts, see GMR-1 05.002 [10].

The physical channel burst for PRACH and PTCCH is denoted as Packet Access Burst (PAB). The PAB is transmitted in the basic channel bandwidth 31,25 kHz. It occupies 4.3 ms in a 5 ms time-slot, which results in ±0,35 ms guard-time.

7.2 Timing

7.2.1 Half-symbol period

The fundamental unit of burst timing is the half-symbol period. The half-symbol period is a function of the bandwidth factor, m. A timeslot consists of (78 x *m*) half-symbol periods, each of $\frac{5}{234\ x\ m}$ ms duration. A particular half-symbol period within a burst is referenced by a half-symbol number (HSN), with the first half-symbol period numbered 0. In the following clauses, the transmission timing of a burst is defined in terms of half-symbol numbers. The half symbol with the lowest half-symbol number is transmitted first.

7.2.2 Useful duration

Different types of bursts exist in the system. One characteristic of a burst is its useful duration. The useful duration of a burst for circuit service is defined as beginning with HSN5. This document defines bursts with useful durations of 146, 224, 458, 614, and 692 half-symbol periods, based on total durations of 2, 3, 6, 8, and 9 timeslots.

The useful duration for bursts for packet service is defined as beginning with HSN 5 *m*. The present document defines bursts with useful durations of 448, 896, 1120, and 1344 half-symbol periods, based on a total duration of three timeslots and total bandwidths of four and five times the basic bandwidth of 31,25 kHz.

7.2.3 Guard period

The period between the useful durations of successive bursts is termed the guard period. Each burst has a guard period with a duration of five m half-symbol periods before its useful duration, and a similar guard period with a duration of five m half-symbol periods after its useful duration, which has the effect of centering a burst's useful duration within its timeslot(s).

7.3 Multiple unique word patterns in bursts

Many bursts contain a pattern of bits known as a unique word pattern, used to resolve phase ambiguities inherent in the modulation. The NT3, NT6, and NT9 bursts, described later, allow multiple patterns for the unique word to distinguish bursts that contain signalling (FACCH) from those that contain user information (speech/data). The SDCCH bursts use multiple unique word patterns to identify a subchannel associated with each SDCCH burst. Additional details concerning SDCCH subchannels use of multiple unique word patterns are in clause 8.5.4.

7.4 Types of bursts

Same as clause 7.4 in GMR-1 05.002 [16].

7.4.1 BACH burst

Same as clause 7.4.1 in GMR-1 05.002 [16].

7.4.2 BCCH burst

Same as clause 7.4.2 in GMR-1 05.002 [16].

7.4.3 CICH burst

Same as clause 7.4.3 in GMR-1 05.002 [16].

7.4.4 DC2 burst

Same as clause 7.4.4 in GMR-1 05.002 [16].

7.4.5 DC6 burst

Same as clause 7.4.5 in GMR-1 05.002 [16].

7.4.6 DKAB bursts

Same as clause 7.4.6 in GMR-1 05.002 [16].

7.4.7 FCCH burst

Same as clause 7.4.7 in GMR-1 05.002 [16].

7.4.8 NT3 burst

Same as clause 7.4.8 in GMR-1 05.002 [16].

7.4.8.1 NT3 burst for encoded speech

Same as clause 7.4.8.1 in GMR-1 05.002 [16].

7.4.8.2 NT3 burst for FACCH

Same as clause 7.4.8.2 in GMR-1 05.002 [16].

7.4.9 NT6 burst

Same as clause 7.4.9 in GMR-1 05.002 [16].

7.4.10 NT9 burst

Same as clause 7.4.10 in GMR-1 05.002 [16].

7.4.11 RACH burst

Same as clause 7.4.11 in GMR-1 05.002 [16].

7.4.12 SDCCH burst

Same as clause 7.4.12 in GMR-1 05.002 [16].

7.4.13 Packet normal bursts (PNB)

The Packet Normal Bursts (PNB) comprises of two parts.

The first part, the burst header, is common to all PNBs that share the same suffix (m,n). The burst header comprises guard bits, a unique word, and encoded PUblic Information (PUI) field. The second part is the encoded PRivate Information (PRI).

7.4.13.1 Burst header

The burst header of the PNB(m,n) is modulated using π/4-QPSK. The various fields of the burst header are described below.

7.4.13.1.1 Guard bits

The PNB(m,n) has 5 x m guard bits at the beginning of the burst (as a part of the burst header) and 5 x m guard bits at the end of the burst.

7.4.13.1.2 Unique word (UW)

The Unique Word (UW) size is 10 x m bits.

7.4.13.1.3 Public information (PUI) field

The PUblic Information (PUI) of the downlink PDCH has a field (Uplink Status Flag or USF) that carries assignment for the next uplink PDCH transmission, a field to identify modulation and coding scheme, and one bit to indicate presence or absence of the PRI.

The PUI of the uplink PDCH has a field to identify the modulation and coding schemes.

Refer to GMPRS-1 04.060 [15] for detailed description of PUI.

The size of the uplink and the downlink PUI is 12 bits. The size of encoded PUI is 48 bits. The detailed description of the PUI coding is in GMPRS-1 05.003 [9].

7.4.13.1.4 Transition symbols

Each PNB(m,n) has m symbols for transition between the two burst parts.

7.4.13.2 Encoded private information (PRI)

The second part of the burst carries the PRivate Information (PRI) delivered to the physical layer. The PRI is modulated using π/4-QPSK.

The PRI includes the MAC layer header. Refer to GMPRS-1 04.060 [15] for detailed description of PRI content.

The PRI is encoded using convolutional code with a constraint length of 7. The channel coding rate is a variable, approximately 3/4, 5/8, or 1/2. The variable channel coding rate allows link margin control.

For further description of the modulation and channel coding schemes for the PUblic Information (PUI) field and the PRivate Information (PRI) bits, refer to GMPRS-1 05.004 [10] and GMPRS-1 05.003 [9], respectively.

7.4.13.3 Formats of packet normal burst

This clause specifies different PNB(m,n) formats.

7.4.13.3.1 Void

7.4.13.3.2 PNB(4,3)

This burst has 468 symbols and 936 half symbols, which are transmitted in a three-timeslot (5 ms) duration. The channel transmission rate is 93,6 ksps (468 symbols/5 ms). The transmission bandwidth is 125 kHz. The modulation is π/4-QPSK. See table 7.22.

Table 7.1 to 7.21: Void

Table 7.22: PNB(4,3) definition

HSN	Length of Field in Half Symbols	Contents of Field
0-19	20	Guard period in half symbols
20-59	40	Unique word
60-107	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
108-115	8	Burst transition (coded as all 1 bits)
116-907	792	Encoded bits e0 to e791
908-915	8	Tail (coded as all 1 bits)
916-935	20	Guard period in half symbols

The Unique Word pattern for PNB(4,3) burst is shown in table 7.23.

Table 7.23: PNB(4,3) unique word definition for PDCH(4,3)

Unique Word Bits (HSN20, HSN21 …HSN59)
(00-01-00-01-00-01-11-10-11-01-00-10-11-10-11-01-11-01-11-01)

7.4.13.3.3 PNB(5,3)

This burst has 585 symbols and 1170 half symbols, which are transmitted in a three-timeslot (5 ms) duration. The channel transmission rate is 117 ksps (585 symbols/5 ms). The transmission bandwidth is 156,25 kHz. The modulation is π/4-QPSK. See table 7.24.

Table 7.24: PNB(5,3) definition

HSN	Length of Field in Half Symbols	Contents of Field
0-24	25	Guard period in half symbols
25-74	50	Unique word
75-122	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
123-132	10	Burst transition (coded as all 1 bits)
133-1134	1002	Encoded bits e0 to e1001
1135-1144	10	Tail (coded as all 1 bits)
1145-1169	25	Guard period in half symbols

The unique word pattern for PNB(5,3) burst is shown in table 7.25.

Table 7.25: PNB(5,3) unique word definition for PDCH(5,3)

Unique Word Bits (HSN25, HSN26 …HSN74)
(00-01-11-10-00-10-11-01-00-01-00-01-00-01-00-01-00-10-11-01-11-10-00-10-00)

7.4.13.3.4 Void

7.4.14 Packet Access Burst (PAB)

The PAB has an 8-byte information field (64 bits). The information field is encoded to 106 bits. The encoded bits, the CW, the UW bits and the guard bits form a total of 234 bits. The PAB uses π/4–QPSK modulation, in which two bits are mapped to one symbol. Thus, the PAB has 117 symbols transmitted at 23,4 ksps (117 symbols/5 ms). The transmission bandwidth is 31,25 kHz.

For additional details concerning the coding and the modulation of the PAB, see GMPRS-1 05.003 [9] and GMPRS-1 05.004 [10], respectively. See table 7.28 for the PAB definition.

Table 7.26 to 7.27: Void

Table 7.28: PAB definition

HSN	Length of Field in Half Symbols	Contents of Field
0-15	16	Guard period in half symbols
16-47	32	CW (coded as all 1 bits)
48-59	12	Unique word
60-111	52	Encoded bits e0 to e51
112-143	32	CW (coded as all 1 bits)
144-155	12	Unique word
156-209	54	Encoded bits e52 to e105
210-217	8	CW (coded as all 1 bits)
218-233	16	Guard period in half symbols

The 12-bit Unique Word pattern is shown in table 7.29.

Table 7.29: PAB unique word definition

Unique Word Bits (HSN48, HSN49,…,HSN59)
Unique Word Bits (HSN144, HSN145,…,HSN155)
(00-00-11-00-11-10)

7.4.15 Packet Keep-Alive Burst (PKAB)

The PKAB burst formats are the same as PNB(m,n) formats, except the PRI portion is not transmitted (no power). The PKAB burst formats corresponding to PNB(4,3) and PNB(5,3) are shown in tables 7.31 and 7.32 respectively.

Table 7.30: Void

Table 7.31: PKAB regarding PNB(4,3) definition

HSN	Length of Field in Half Symbols	Contents of Field
0-19	20	Guard period in half symbols
20-59	40	Unique word
60-107	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
108-115	8	Burst transition (coded as all 1 bits)
116-907	792	No transmission
908-915	8	Tail (coded as all 1 bits)
916-935	20	Guard period in half symbols

Table 7.32: PKAB regarding PNB(5,3) definition

HSN	Length of Field in Half Symbols	Contents of Field
0-24	25	Guard period in half symbols
25-74	50	Unique word
75-122	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
123-132	10	Burst transition (coded as all 1 bits)
133-1134	1002	No transmission
1 135-1 144	10	Tail (coded as all 1 bits)
1 145-1 169	25	Guard period in half symbols

8 Logical-physical channel mapping

8.1 General

Same as clause 8.1 in GMR-1 05.002 [16].

8.1.1 Frequency-domain description

Same as clause 8.1.1 in GMR-1 05.002 [16].

8.1.2 Time-domain description

8.1.2.1 Physical channels

Same as clause 8.1.2.1 in GMR-1 05.002 [16].

8.1.2.2 Logical channels

Same as clause 8.1.2.2 in GMR-1 05.002 [16].

8.2 Physical Channel (PC) types and names

Same as clause 8.2 in GMR-1 05.002 [16].

8.3 Logical channel parameters

Same as clause 8.3 in GMR-1 05.002 [16].

8.4 Permitted channel configurations

Same as clause 8.4 in GMR-1 05.002 [16].

8.5 Logical channel frame sequencing concepts

Same as clause 8.5 in GMR-1 05.002 [16].

8.5.1 Simple frame sequence

Same as clause 8.5.1 in GMR-1 05.002 [16].

8.5.1.1 Simple frame sequence subchannels

Same as clause 8.5.1.1 in GMR-1 05.002 [16].

8.5.2 Simple paired-frame sequence

Same as clause 8.5.2 in GMR-1 05.002 [16].

8.5.2.1 Simple paired-frame sequence subchannels

Same as clause 8.5.2.1 in GMR-1 05.002 [16].

8.5.3 Configured paired-frame sequence

Same as clause 8.5.3 in GMR-1 05.002 [16].

8.5.3.1 CBCH configuration

Same as clause 8.5.3.1 in GMR-1 05.002 [16].

8.5.4 Statistically multiplexed paired-frame sequence

Same as clause 8.5.4 in GMR-1 05.002 [16].

8.5.4.1 Pool size

Same as clause 8.5.4.1 in GMR-1 05.002 [16].

8.5.4.2 Statistically multiplexed paired-frame sequence subchannels

Same as clause 8.5.4.2 in GMR-1 05.002 [16].

8.5.4.3 Example using SDCCH

Same as clause 8.5.4.3 in GMR-1 05.002 [16].

8.5.5 System information cycle sequencing

Same as clause 8.5.5 in GMR-1 05.002 [16].

8.5.5.1 Physical-Channel-Relative Timeslot Number (PCRTN)

Same as clause 8.5.5.1 in GMR-1 05.002 [16].

8.5.5.2 System-Information-Relative Frame Number (SIRFN)

Same as clause 8.5.5.2 in GMR-1 05.002 [16].

8.5.5.3 Graphical representation of system information cycle timeslots

Same as clause 8.5.5.3 in GMR-1 05.002 [16].

8.6 Mapping of logical channels to BCCH/CCCH

Same as clause 8.6 in GMR-1 05.002 [16].

8.6.1 Fixed reserved-slot logical channels

Same as clause 8.6.1 in GMR-1 05.002 [16].

8.6.1.1 FCCH

Same as clause 8.6.1.1 in GMR-1 05.002 [16].

8.6.1.2 CICH

Same as clause 8.6.1.2 in GMR-1 05.002 [16].

8.6.1.3 BCCH

Same as clause 8.6.1.3 in GMR-1 05.002 [16].

8.6.2 Optional reserved-slot logical channels

Same as clause 8.6.2 in GMR-1 05.002 [16].

8.6.2.1 PCH

Same as clause 8.6.2.1 in GMR-1 05.002 [16].

8.6.2.2 BACH

Same as clause 8.6.2.2 in GMR-1 05.002 [16].

8.6.3 Unreserved-slot logical channels

Same as clause 8.6.3 in GMR-1 05.002 [16].

8.7 Mapping of logical channels to normal CCCH

Same as clause 8.7 in GMR-1 05.002 [16].

8.8 Mapping in time of packet logical channels onto physical channels

8.8.1 General

A physical channel allocated to carry packet logical channels is called a Packet Data Channel (PDCH). A PDCH shall carry packet logical channels only. A PDCH is of size (m,n), where m is the bandwidth index and n is the number of timeslots. The logical channels PACCH and PDTCH use the PNB(m,n) associated with the physical channel PDCH(m,n) onto which they are mapped.

Packet-switched logical channels are mapped dynamically onto a 16-multiframe.

A multiframe consists of 16 consecutive frames, (see GMPRS-1 05.010 [13] and GMPRS-1 03.064 [14]). The type of logical channel may vary on a frame-by-frame basis. Each MAC-slot carries a single RLC block. Figure 8.14 indicates the numbering of consecutive frames for the entire multiframe.

Figure 8.1 to 8.13: Void

B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15

Figure 8.14: Multiframe structure for PDCH

The mapping of logical channels onto the successive MAC-slots in a multiframe is defined GMPRS-1 03.064 [14].

In the downlink direction, the logical channel type is indicated by the message type.

In the uplink part for channels other than PRACH, the logical channel type shall be indicated by the message type. For the PRACH case the logical channel type is indicated by the USF (GMPRS-1 04.060 [15]), set on the corresponding block on the downlink on a frame-by-frame basis.

8.8.2 Mapping of the uplink channels

8.8.2.1 Mapping of uplink packet traffic channel (PDTCH/U) and PACCH/U

The PDCHs where the MES may expect occurrence of its PDTCH/U(s) or PACCH/U for a mobile-originated transfer is indicated in resource allocation messages (see GMPRS-1 04.060 [15]). PACCH/U shall be allocated respecting the resources allocated to the MES and the MES multislot class. A single USF (6 bits), is allocated to the MES for all the PDCHs that it has been allocated. Some of the PDCHs allocated in extended dynamic mode may not be associated with the allocated USF. See GMPRS-1 03.064 [14] for further details.

The occurrence of the PDTCH/U and/or the PACCH/U for a given MES on a given PDCH shall be indicated by the value of the USF contained in the header of the block transmitted in the downlink MAC-slot of the same PDCH. The relationship between the downlink MAC-slot in which the block containing the USF is transmitted and the uplink MAC-slot to which it applies is described in GMPRS-1 05.010 [13]. The MES may transmit a PDTCH block or a PACCH block on any of the uplink MAC-slots allocated to the MES. The occurrence of the PACCH/U associated to a PDTCH/D shall be indicated by the network by polling the MES (see GMPRS-1 04.060 [15]).

NOTE: This clause specifies how the network shall signal that the MES is allowed to use the uplink. The operation of the MES is specified in GMPRS-1 04.060 [15]. In particular cases of fixed allocation or extended dynamic allocation, the MES may not need to monitor the USF on all allocated PDCHs.

8.8.2.2 Mapping of the packet timing advance control channel (PTCCH/U)

PTCCH/U shall be mapped to one of the MAC-slots 0,2,4,6 for an even numbered multiframe and slots 1, 3, 5, 7 in an odd numbered multiframe. PTCCH/U shall be allocated respecting the resources allocated to the MES and the MES multislot class. An MES shall be allocated a subchannel of the PTCCH/U, where the subchannel number is derived from the Timing Advance Index (TAI), indicated in the uplink/downlink assignment or immediate assignment message (see GMPRS-1 04.060 [15] and GMPRS-1 03.064 [14]). See GMPRS-1 05.010 [13] for details regarding deriving the PTCCH/U slot from the Timing Advance Index.

8.8.2.3 Mapping of the uplink PCCCH, i.e. PRACH

The PRACH is dynamically allocated on individual PDCH MAC-slots. The occurrence of a PRACH opportunity on the uplink is indicated by USF=USF_FREE in the PUI of the block which is received in the corresponding MAC-slot on the downlink.

Multiple PRACH slots, of up to a maximum of m, may be overlaid on the same PDCH MAC-slot where m x 31,25 kHz is the PDCH bandwidth (m=4 and 5). This is possible because the PRACH uses bandwidth of 31,25 kHz only, whereas the PDCH bandwidth is an integral multiple of 31,25 kHz. The multiple PRACH bursts overlaid on a singe MAC-slot use different carrier frequencies that are spaced 31,25 kHz apart. Refer to GMPRS-1 03.064 [14].

8.8.3 Mapping of the downlink channels

8.8.3.1 Mapping of the (PDTCH/D) and PACCH/D

The PDCH where the MES may expect occurrence of its PDTCH/D(s) for a mobile-terminated transfer, or its PACCH/D for both mobile-originated and mobile-terminated transfers, are indicated in resource allocation messages (see GMPRS-1 04.060 [15]). The logical channel type shall be indicated in the message header. The mobile owner of the PDTCH/D or PACCH/D shall be indicated by the TFI (Temporary Frame Identifier) (see GMPRS-1 04.060 [15]).

8.8.3.2 Mapping of the PTCCH/D

The PTCCH/D carries signalling messages containing timing advance and frequency correction information for MESs sharing the PTCCH/U on the same PDCH. PTCCH/D is always carried in a fixed frame B8 of PDCH on MAC-slot 0. The location of MAC-slot 0 with respect to the downlink frame boundary is defined using the parameter MAC_FORWARD_TS_OFFSET in the system information.

8.8.3.3 Mapping of the PBCCH

The use of the PBCCH is currently not defined for the GMR-1 packet data service.

8.8.3.4 Mapping of the PCCCH

The PCCCH and its different logical channels (PAGCH) and the PDTCH and PACCH can be mapped dynamically and are identified by the message header.

8.8.4 Mapping of PBCCH data

The use of the PBCCH is currently not defined for GMR-1.

8.8.5 Permitted combination of packet data channels

The following combinations of packet logical channels are permitted in a PDCH(m,n)

i) PCCCH + PDTCH + PACCH + PTCCH

ii) PDTCH + PACCH + PTCCH

where PCCCH = PRACH + PAGCH.

8.9 Multislot configurations

A multislot configuration consists of multiple circuit or packet-switched traffic channels together with associated control channels, allocated to the same MES. The multislot configuration occupies up to eight basic physical channels, with different Timeslots Numbers (TN) but with the same frequency parameters (ARFCN).

8.9.1 Multislot configurations for circuit switched connections

The use of multislot configurations for circuit-switched connections is not currently supported by GMR-1.

8.9.2 Multislot configurations for packet switched connections

An MES may be allocated several PDTCH/Us or PDTCH/Ds for one mobile-originated or one mobile-terminated communication, respectively. In this context, allocation refers to the list of PDCH that may dynamically carry the PDTCHs for that specific MES. The PACCH may be mapped onto any of the allocated PDCHs.

The occupied physical channels shall consist of a combination of configurations i and ii, as defined in clause 8.8.5. The network shall leave a gap of at least one radio block between the old and the new configurations when the allocation is changed and the PDCHs with the lowest numbered timeslot are not the same in the old and new configurations.

9 Operation of channels

Same as clause 9 in GMR-1 05.002 [16].

9.1 PC6d and PC12u pairing

Same as clause 9.1 in GMR-1 05.002 [16].

9.2 Bidirectional channel timeslot assignments

Same as clause 9.2 in GMR-1 05.002 [16].

9.3 GBCH

Same as clause 9.3 in GMR-1 05.002 [16].

9.4 DKABs

Same as clause 9.4 in GMR-1 05.002 [16].

9.5 FCCH and CICH

Same as clause 9.5 in GMR-1 05.002 [16].

9.6 TACCH/2

Same as clause 9.6 in GMR-1 05.002 [16].

9.7 MES monitoring of paging and alerting groups

Same as clause 9.7 in GMR-1 05.002 [16].

9.7.1 Determination of assigned CCCH

Same as clause 9.7.1 in GMR-1 05.002 [16].

9.7.2 Determination of assigned paging group

Same as clause 9.7.2 in GMR-1 05.002 [16].

9.7.3 Determination of alerting group

Same as clause 9.7.3 in GMR-1 05.002 [16].

9.7.4 Determination of PCCCH_GROUP and PAGING_GROUP for MES in GMPRS attached mode

In the absence of PCCCH, CCCH shall be used in the GMPRS-attached mode for paging and access. If the determination of the specific paging multiframe and paging block index, as specified in this clause, are not supported on CCCH by both the MES and the BTS, the method defined in clauses 9.7.1 and 9.7.2 shall be used. This is negotiated at GMPRS attach.

9.8 MES selection of PC12U

Same as clause 9.8 in GMR-1 05.002 [16].

9.9 SDCCH vs. CBCH

Same as clause 9.9 in GMR-1 05.002 [16].

9.10 MES monitors paired CCCH for AGCH

Same as clause 9.10 in GMR-1 05.002 [16].

9.11 Additional air interface constraints

Same as clause 9.11 in GMR-1 05.002 [16].

10 BCCH parameters

Same as clause 10 in GMR-1 05.002 [16].

10.1 Types of BCCH parameters

Same as clause 10.1 in GMR-1 05.002 [16].

10.2 Information used to obtain synchronization

Same as clause 10.2 in GMR-1 05.002 [16].

10.3 Channel meta-information

SA_CCCH_CHANS (5 bits) Gives the total number of normal CCCHs + BCCH/CCCHs. The value can range from a minimum of 1 in very low traffic spot beams to a maximum value of 31 in the most highly congested spot beams.

SA_AGCH_CHANS (5 bits) The number of additional AGCH/CCCHs in the spot beam. The value can range from 0-31.

SA_PCCCH_CHANS (5 bits) This indicates the total number of PCCCHs of a supported bandwidth category and may occur more than once in a system information cycle if different bandwidths are supported.

10.4 Beam-configurable multichannel information

Same as clause 10.4 in GMR-1 05.002 [16].

10.5 Information specific to one instance of a channel

Same as clause 10.5 in GMR-1 05.002 [16].

Annex A (normative): Multislot capability

A.1 MES classes for multislot capability

When an MES supports the use of multiple timeslots it shall belong to a multislot class as defined below:

Table A.1

Multislot class	Maximum number of slots			Minimum number of slots				Type
	Rx	Tx	Sum	T_{ta}	T_{tb}	T_{ra}	T_{rb}	
1	24	24	NA	NA	0	6	0	A, B
2								reserved
3								reserved
4								reserved
5								reserved
6								reserved
7								reserved
8								reserved

Rx:

Rx describes the maximum number of receive timeslots that the MES can use per TDMA frame. The MES must be able to support all integer values of receive TS from 0 to Rx (depending on the services supported by the MES). The receive TS need not be contiguous.

Tx:

Tx describes the maximum number of transmit timeslots that the MES can use per TDMA frame. The MES must be able to support all integer values of transmit TS from 0 to Tx (depending on the services supported by the MES). The transmit TS need not be contiguous.

Sum:

Sum is the total number of uplink and downlink TS that can actually be used by the MES per TDMA frame. The MES must be able to support all combinations integer values of Rx and Tx TS where $1 \leq Rx + Tx \leq Sum$ (depending on the services supported by the MES). Sum is not applicable to all classes.

T_{ta}:

T_{ta} relates to the time needed for the MES to perform adjacent cell signal level measurement and get ready to transmit.

For circuit switched multislot configurations as defined in clause 6.4.2.1, T_{ta} is not applicable.

T_{tb}:

T_{tb} relates to the time needed for the MES to get ready to transmit. This minimum requirement will only be used when adjacent cell power measurements are not required by the service selected.

It is the minimum number of timeslots that will be allowed between the end of the last transmit burst in a TDMA frame and the first transmit burst in the next TDMA frame.

T_{ra}:

T_{ra} relates to the time needed for the MES to perform adjacent cell signal level measurement and get ready to receive.

It is the minimum number of timeslots that will be allowed between the end of the last receive burst in a TDMA frame and the first receive burst in the next TDMA frame.

T_{rb}:

T_{rb} relates to the time needed for the MES to get ready to receive. This minimum requirement will only be used when adjacent cell power measurements are not required by the service selected.

It is the minimum number of timeslots that will be allowed between the end of the last receive burst in a TDMA frame and the first receive burst in the next TDMA frame.

A.2 Constraints imposed by the service selected

The service selected will impose certain restrictions on the allowed combinations of transmit and receive timeslots. Such restrictions are not imposed by this annex but should be derived from the description of the services. For example, in the case of circuit switched data the TS numbers used in the uplink will be a subset of those used in the downlink.

The service selected will determine whether or not adjacent cell power measurements are required and therefore whether T_{ra} or T_{rb} is allowed for.

A.3 Network requirements for supporting MES multislot classes

The multislot class of the MES will limit the combinations and configurations allowed when supporting multislot communication.

It is necessary for the network to decide whether requested or current multislot configuration can be supported by distant MES. If actual TA is great enough it may be necessary for network to downgrade requested resources or it may be necessary for network to downgrade current resources.

It is necessary for the network to decide whether the MES needs to perform adjacent cell power measurement for the type of multislot communication intended and whether the service imposes any other constraints before the full restrictions on TS assignments can be resolved.

Annex B (informative): Bibliography

- GMR-1 03.022 (ETSI TS 101 376-3-10) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 10: Functions related to Mobile Earth station (MES) in idle mode; GMR-1 03.022".
- GMR-1 04.003 (ETSI TS 101 376-4-3): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 3: Channel Structures and Access Capabilities; GMR-1 04.003".
- GMR-1 04.006 (ETSI TS 101 376-4-6) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 6: Mobile earth Station-Gateway Station Interface Data Link Layer Specifications; GMR-1 04.006".
- GMR-1 05.005 (ETSI TS 101 376-5-5) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception; GMR-1 05.005".
- GMR-1 05.008 (ETSI TS 101 376-5-6) (V1.2.1): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 6: Radio Subsystem Link Control; GMR-1 05.008".

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