ETSI TS 101 376-5-2 V2.3.1 (2008-07)

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**

Reference

RTS/SES-00303-5-2

Keywords

GMPRS, GMR, GPRS, GSM, GSO, interface, MES, mobile, MSS, MUX, radio, satellite, S-PCN, TDMA

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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).

The contents of the present document are subject to continuing work within TC-SES and may change following formal TC-SES approval. Should TC-SES modify the contents of the present document it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

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where:

- 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 (Release 2) General Packet Radio Service, 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";

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

Sub-part 3: "Channel Coding";

Sub-part 4: "Modulation";

Sub-part 5: "Radio Transmission and Reception";

Sub-part 6: "Radio Subsystem Link Control";

Sub-part 7: "Radio Subsystem Synchronization";

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 document 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 GMPRS-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

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
    - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
    - for informative references.

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

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ETSI TS 101 376-1-1: "GEO-Mobile Radio Interface Specifications (Release 2) General Packet Radio Service; Part 1: General specifications; Sub-part 1: Abbreviations and acronyms; GMPRS-1 01.004".

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

[3] Void.

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

[4] Void.

[5] Void.

[6] Void.

[7] 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] 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] 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] 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] 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] 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] 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] 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] 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] ETSI TS 101 376-5-2: "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".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

Not applicable.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GMPRS-1 01.201 [2] apply.

3.2 Abbreviations

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

APSK	Amplitude Phase Shift Keying
LDPC	Low Density Parity Code
PDTCH2	Packet Data Traffic Channel 2
PNB2	Packet Normal Burst 2.

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 kbps or 4,8 kbps	11,70 kbps (= 46,8 / 8 x 2)
TCH9	User data: 9,6 kbps Fax: 2,4 kbps, 4,8 kbps, 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,16 APSK, or 32 APSK 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 used 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, PDTCH (m, 6), (m = 1, 2), where the burst duration is 10 ms, and PDTCH (m, 12), (m = 5), where the burst duration is 20 ms.

Table 5.2: Packet Traffic Data Channels

Channels	Direction (U: Uplink, D: Downlink)	Transmission symbol rate (ksps)	Channel Coding	Modulation	Peak payload transmission rate (without CRC) (kbps)	Peak payload transmission rate (with CRC) (kbps)
PDTCH(4,3)	U/D	93,6	Conv.	π/4-QPSK	113,6	116,8
PDTCH(5,3)	U/D	117,0	Conv.	π/4-QPSK	145,6	148,8
PDTCH(1,6)	U	23,4	Conv.	π/4-QPSK	27,2	28,8
PDTCH(2,6)	D	46,8	Conv.	π/4-QPSK	62,4	64,0
PDTCH2(5,12)	D	117,0	LDPC	π/4-QPSK	199,2	199,6
PDTCH2(5,12)	D	117,0	LDPC	16-APSK	354,8	355,2
PDTCH2(5,12)	D	117,0	LDPC	32-APSK	443,6	444,0
PDTCH2(5,12)	U	117,0	LDPC	π/4-QPSK	199,2	199,6
PDTCH2(5,12)	U	117,0	LDPC	16-APSK	399,2	399,6
PDTCH2(5,3)	U/D	117,0	LDPC	π/4-QPSK	169,6	171,2
PDTCH2(5,3)	U/D	117,0	LDPC	16-APSK	342,4	344,0
PDTCH2(5,3)	U/D	117,0	LDPC	32-APSK	380,8	382,4

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 for PDTCH(4,3) and PDTCH(5,3) and are achieved with rate 4/5 for PDTCH(1,6) and PDTCH(2,6). The peak rates of LDPC coded PDTCH(5,12) and LDPC coded PDTCH(5,3) are achieved for different modulation schemes with the following coding rate combinations:

- Downlink: 32 APSK Rate 4/5, 16 APSK Rate 4/5, π/4-QPSK Rate 9/10.
- Uplink: 16 APSK Rate 9/10, π/4-QPSK Rate 9/10.

NOTE: All the above coding rates are approximate rates. Refer to GMPRS-1 05.003 [9] for the exact coding rates.

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 [8]. System information parameters that are referenced in the present document are summarized in clause 10.

The network shall indicate to the MES via BCCH 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 normal 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

Same as clause 7.1 in GMR-1 05.002 [16], with the following additions.

The physical channel burst for PDCH(m,n) is denoted as a Packet Normal Burst, PNB(m,n) or PNB2(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: for m = 4 and 5, n = 3, for m = 1 and 2, n = 6, and for m = 5, n = 12.

The PNB(m,n) and PNB2(m,n) bursts may be n = 3, 6 or 12 timeslots long. The burst data is modulated either using π/4-QPSK, 16 APSK, or 32 APSK modulation, which maps two, four, and five bits to one symbol, respectively. For additional details concerning the modulation of PNB(m,n) and PNB2(m,n) bursts, see GMPRS-1 05.004 [10].

The physical channel burst for PRACH 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 present 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 packet normal bursts is defined as beginning with either HSN 5 *x m* or with HSN 5. Table 7.0a lists the useful duration for different packet normal bursts.

Table 7.0a: Useful Duration For Different Packet Normal Burst Types

Burst	Direction	Beginning HSN	Useful Durations in Half-Symbol Periods
PNB(1,6)	U	5	458
PNB(2,6)	D	5	926
PNB(4,3)	U/D	5 x m	896
PNB(5,3)	U/D	5 x m	1 120
PNB2(5,3)	U/D	5 x m	1 120
PNB2(5,12)	U/D	5 x m	4 630

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 5 × m (if m = 4, 5) and 5 (if m = 1, 2) half-symbol periods before its useful duration, and a similar guard period with a duration of 5 × m *(*if m = 4, 5) and 5 (if m = 1, 2) 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].

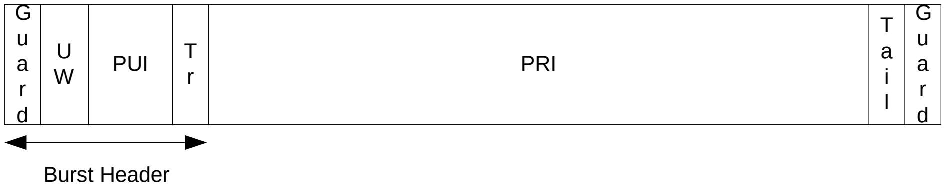
7.4.12 SDCCH burst

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

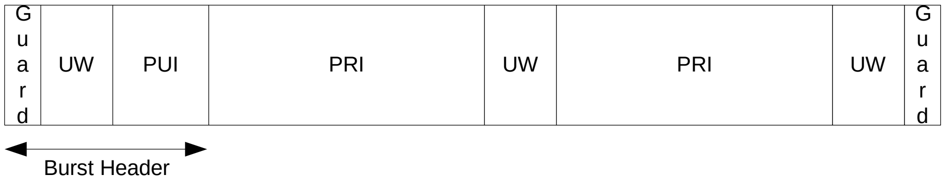
7.4.13 Packet Normal Bursts (PNB)

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

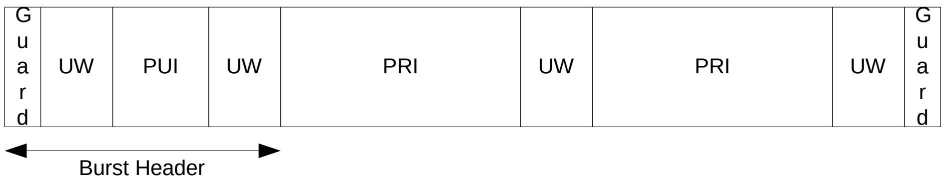
The first part, the burst header, is common to all PNBs that share the same suffix (m,n). The burst header comprises guard bits, a unique word, and encoded Public Information (PUI) field. The second part is the encoded Private Information (PRI). Pictorial description of the different PNB(m,n) is shown in figure 7.1. Refer to clauses 7.4.13.1 to 7.4.13.3 for a description on the different parts of PNB(m,n) shown in figure 7.1.



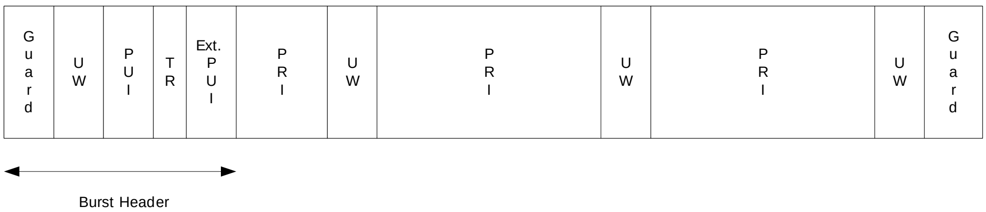
(a). Convolutionally coded PNB(4,3) and PNB(5,3) Downlink/Uplink



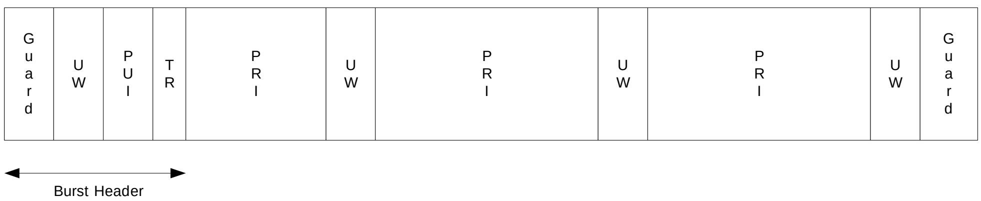
(b). PNB(1,6) Uplink



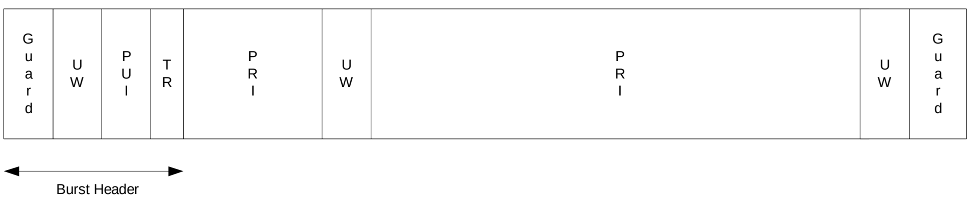
(c). PNB(2,6) Downlink



(d) LDPC coded PNB2(5,12) Downlink



(e) LDPC coded PNB2(5,12) Uplink



(f) LDPC coded PNB2(5,3) Downlink/Uplink

Figure 7.1: Burst header and PRI within PNB(m,n)

An MES of terminal type C shall be able to transmit an uplink PNB(1,6) immediately after RX-TX switching time (see GMPRS-1 05.005 [11]) from the reception of the last symbol of the burst header of downlink PNB(2,6). Consequently, an MES of terminal type C shall be capable of decoding and interpreting the burst header received prior to this transmission on uplink PNB(1,6). See also GMPRS-1 05.010 [13] and GMPRS-1 04.060 [15] for further description.

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

If m = 4 or m = 5, the PNB(m,n) has 5 × m guard bits at the beginning of the burst (as a part of the burst header) and 5 × m guard bits at the end of the burst.

If m = 1 or m = 2, the PNB(m,n) has 5 guard bits at the beginning of the burst (as a part of the burst header) and 5 guard bits at the end of the burst.

7.4.13.1.2 Unique Word (UW)

The burst header of PNB(1,6) has 14 bits of Unique Word (UW). There are additional 30 bits of UW within the PRI portion of PNB(1,6).

The burst header of PNB(2,6) has total of 36 bits of UW; 18 UW bits are located before the PUI and another 18 UW bits are located after the PUI. There are additional 32 bits of UW within the PRI portion of PNB(2,6).

The Unique Word (UW) size for the PNB(m,3), (m = 4, 5) is 10 × m bits. The entire UW is located within the burst header for convolutionally coded PNB(m,3), m = 4 or 5.

The burst header of PNB2(5,12) has total of 50 bits of UW. There are additional 82 bits of UW within the PRI portion of PNB2(5,12). The burst header of LDPC coded PNB2(5,3) has total of 50 bits of UW. There are additional 54 bits of UW within the PRI portion of LDPC coded PNB2(5,3).

The UW is modulated with π/4-QPSK or QPSK. For PNBs with payload modulated with 16 APSK and 32 APSK, the amplitude of all the UW will be equivalent to the amplitude of the outermost constellation of each payload modulation scheme. For the UW within the PRI portion of the PNB2(5,3) and PNB2(5,12), a constant π/4 phase shift is performed across QPSK modulated UW, instead of π/4 QPSK modulation. In the transmission of the π/4-QPSK PNB2(5,12) and PNB2(5,3) with rate 1/2 LDPC coded payload, the amplitude of the UW symbols will be 2,04 dB (i.e. amplitude of 1,2658) higher than the payload amplitude.

7.4.13.1.3 PUblic Information (PUI) field

The size of the uplink and the downlink PUI is 12 bits. The size of encoded PUI is 48 bits. Refer to GMPRS-1 04.060 [15] for detailed description of PUI. The detailed description of the PUI coding is in GMPRS-1 05.003 [9].

In addition to the PUI, the burst PNB2(5,12) in the down link has an extended PUI. The size of the downlink extended PUI is 30 bits. The size of encoded PUI is 96 bits. Refer to GMPRS-1 04.060 [15] for detailed description of PUI. The detailed description of the extended PUI coding is in GMPRS-1 05.003 [9].

The amplitude of both PUI and extended PUI will be equivalent to the amplitude of the outermost constellation of each payload modulation scheme. In the transmission of the π/4-QPSK PNB2(5,12) and PNB2(5,3) with rate ½ LDPC coded payload, the amplitude of PUI and extended PUI symbols will be 2,04 dB (i.e. amplitude of 1,2658) higher than the payload amplitude.

7.4.13.1.4 Transition symbols

Each PNB(m,n), except PNB(1,6) and PNB(2,6), has m symbols for transition between the two burst parts. There are no transition symbols for PNB(1,6) and PNB(2,6). PNB2(5,12) downlink has m symbols for transition between the PUI and the extended PUI.

The amplitude of transition symbols will be equivalent to the amplitude of the outermost constellation of each payload modulation scheme. In the transmission of the π/4-QPSK PNB2(5,12) and PNB2(5,3) with rate ½ LDPC coded payload, the amplitude of the transition symbols will be 2,04 dB (i.e. amplitude of 1,2658) higher than the payload amplitude.

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 either π/4-QPSK, 16 APSK,or 32 APSK.

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

The PRI in PNB(5,3) and PNB(4,3) is encoded using convolutional code with a constraint length of 7. The channel coding rate is variable, approximately 3/4, 5/8 or 1/2. The variable channel coding rate allows link margin control. The PRI in PNB(1,6) and PNB(2,6) is encoded using convolutional code with a constraint length of 9. The channel coding rate is variable, approximately 3/5, 7/10 or 4/5. The variable channel coding rate allows link margin control.

The PRI in PNB2(5,12) and PNB2(5,3) is encoded with LDPC. The channel coding rate is variable for each modulation scheme.

For further description of the modulation and channel coding schemes for the Public Information (PUI) field, the extended 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 to 19	20	Guard period in half symbols
20 to 59	40	Unique word
60 to 107	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
108 to 115	8	Burst transition (coded as all 1 bits)
116 to 907	792	Encoded bits e0 to e791
908 to 915	8	Tail (coded as all 1 bits)
916 to 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 bBits (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 1 170 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 to 24	25	Guard period in half symbols
25 to 74	50	Unique word
75 to 122	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
123 to 132	10	Burst transition (coded as all 1 bits)
133 to 1 134	1 002	Encoded bits e0 to e1 001
1 135 to 1 144	10	Tail (coded as all 1 bits)
1 145 to 1 169	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 PNB(1,6)

This burst has 234 symbols and 468 half symbols, which are transmitted in a six-timeslot (10 ms) duration. The channel transmission rate is 23,4 ksps (234 symbols / 10 ms). The transmission bandwidth is 31,25 kHz. The modulation is π/4-QPSK. See table 7.26.

Table 7.26: PNB(1,6) definition

HSN	Length of field in half symbols	Contents of field
0 to 4	5	Guard period
5 to 18	14	Unique word - UW1
19 to 66	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
67 to 226	160	PRI - Encoded bits e0 to e159
227 to 242	16	Unique word - UW2
243 to 448	206	PRI - Encoded bits e160 to e365
449 to 462	14	Unique word -UW3
463 to 467	5	Guard period

The unique word pattern for PNB(1,6) burst is shown in table 7.27.

Table 7.27: PNB(1,6) unique word definition for PDCH(1,6)

Unique word bits (HSN5, HSN6 …HSN18)
(00 01 11 01 00 10 00)
Unique word bits (HSN227, HSN228 …HSN242)
(00 01 11 01 00 10 00 10)
Unique word bits (HSN449, HSN450 …HSN462)
(00 01 11 01 00 10 00)

7.4.13.3.5 PNB(2,6)

This burst has 468 symbols and 936 half symbols, which are transmitted in a six to timeslot (10 ms) duration. The channel transmission rate is 46,8 ksps (468 symbols / 10 ms). The transmission bandwidth is 62,5 kHz. The modulation is π/4-QPSK. See table 7.28.

Table 7.28: PNB(2,6) definition

HSN	Length of field in half symbols	Contents of field
0 to 4	5	Guard period in half symbols
5 to 22	18	Unique word
23 to 70	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
71 to 88	18	Unique word
89 to 494	406	Encoded bits e0 to e405
495 to 510	16	Unique word
511 to 914	404	Encoded bits e406 to e809
915 to 930	16	Unique word
931 to 935	5	Guard period in half symbols

The unique word pattern for PNB(2,6) burst is shown in table 7.29.

Table 7.29: PNB(2,6) unique word definition for PDCH(2,6)

Unique word bits (HSN5, HSN6 …HSN22)
(00 01 11 01 00 10 00 10 00)
Unique word bits (HSN71, HSN72 …HSN88)
(00 01 11 01 00 10 00 10 00)
Unique word bits (HSN495, HSN496 …HSN510)
(00 01 11 01 00 10 00 10)
Unique word bits (HSN915, HSN916 …HSN930)
(00 01 11 01 00 10 00 10)

7.4.13.3.6 LDPC Coded PNB2(5,12)/Downlink

This burst has 2 340 symbols and 4 680 half symbols, which are transmitted in a twelve-timeslot (20 ms) duration. The channel transmission rate is 117 ksps (2 340 symbols / 20 ms). The transmission bandwidth is 156,25 kHz. The modulation is π/4-QPSK for the header including the first UW. The PRI is modulated with π/4-QPSK, 16 APSK, or 32 APSK. The second, third and fourth UW is modulated with QPSK with a constant π/4 phase shift. See table 7.29b

Table 7.29b: LDPC Coded PNB2(5,12)/Downlink definition

HSN	Length of field in half symbols	Contents of field
0 to 24	25	Guard period in half symbols
25 to 74	50	Unique word
75 to 122	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
123 to 132	10	Burst transition (coded as all 1 bits)
133 to 228	96	Encoded Extended public (PUI) field d0,…, d96
229 to 420	192	Encoded bits
421 to 448	28	Unique Word
449 to 2 524	2 076	Encoded bits
2 525 to 2 550	26	Unique Word
2 551 to 4 626	2 076	Encoded bits
4 627 to 4 654	28	Unique Word
4 655 to 4 679	25	Guard period in half symbols

The unique word pattern for PNB2(5,12) burst is shown in table 7.29c.

Table 7.29c: LDPC Coded PNB2(5,12) unique word definition for PDCH2(5,12)/Downlink

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)
Unique word bits (HSN421, HSN422 …HSN448)
(0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 1 1 1 1 0 1 1 1 0 1 1 0 1)
Unique word bits (HSN2525, HSN2526 …HSN2550)
(0 0 0 1 0 0 1 0 0 0 1 0 0 0 0 1 1 1 0 1 1 1 0 1 0 0)
Unique word bits (HSN4627, HSN4628 …HSN4654)
(0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 1 1 1 1 0 1 1 1 0 1 1 0 1)

7.4.13.3.7 LDPC Coded PNB2(5,12)/Uplink

This burst has 2 340 symbols and 4 680 half symbols, which are transmitted in a twelve-timeslot (20 ms) duration. The channel transmission rate is 117 ksps (2 340 symbols / 20 ms). The transmission bandwidth is 156,25 kHz. The modulation is π/4-QPSK for the header including the first UW. The PRI is modulated with π/4-QPSK or 16 APSK,. The second, third and fourth UW is modulated with QPSK with a constant π/4 phase shift. See table 7.29d.

Table 7.29d: LDPC Coded PNB2(5,12)/Uplink definition

HSN	Length of field in half symbols	Contents of field
0 to 24	25	Guard period in half symbols
25 to 74	50	Unique word
75 to 122	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
123 to 132	10	Burst transition (coded as all 1 bits)
133 to 420	288	Encoded bits
421 to 448	28	Unique Word
449 to 2 524	2 076	Encoded bits
2 525 to 2 550	26	Unique Word
2 551 to 4 626	2 076	Encoded bits
4 627 to 4 654	28	Unique Word
4 655 to 4 679	25	Guard period in half symbols

The unique word pattern for PNB(5,12) burst is shown in table 7.29e.

Table 7.29e: LDPC Coded PNB2(5,12) unique word definition for PDCH2(5,12)/Uplink

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)
Unique word bits (HSN421, HSN422 …HSN448)
(0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 1 1 1 1 0 1 1 1 0 1 1 0 1)
Unique word bits (HSN2525, HSN2526 …HSN2550)
(0 0 0 1 0 0 1 0 0 0 1 0 0 0 0 1 1 1 0 1 1 1 0 1 0 0)
Unique word bits (HSN4627, HSN4628 …HSN4654)
(0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 1 1 1 1 0 1 1 1 0 1 1 0 1)

7.4.13.3.8 LDPC Coded PNB2(5,3)/Downlink

This burst has 585 symbols and 1 170 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 for the header including the first UW. The PRI is modulated with π/4-QPSK, 16 APSK, or 32 APSK. The second, third and fourth UW is modulated with QPSK with a constant π/4 phase shift. See table 7.29f.

Table 7.29f: LDPC Coded PNB2(5,3) definition

HSN	Length of field in half symbols	Contents of field
0 to 24	25	Guard period in half symbols
25 to 74	50	Unique word
75 to 122	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
123 to 132	10	Burst transition (coded as all 1 bits)
133 to 420	288	Encoded bits
421 to 448	28	Unique Word
449 to 1 118	670	Encoded bits
1 119 to 1 144	26	Unique Word
1 145 to 1 169	25	Guard period in half symbols

The unique word pattern for LDPC coded PNB(5,3) burst is shown in table 7.29g.

Table 7.29g: LDPC Coded PNB2(5,3) unique word definition for PDCH2(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)
Unique word bits (HSN421, HSN422 …HSN448)
(0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 1 1 1 1 0 1 1 1 0 1 1 0 1)
Unique word bits (HSN1 119, HSN1 120 …HSN1 144)
(0 0 0 1 0 0 1 0 0 0 1 0 0 0 0 1 1 1 0 1 1 1 0 1 0 0)

7.4.13.3.9 LDPC Coded PNB2(5,3)/Uplink

This burst has 585 symbols and 1 170 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 for the header including the first UW. The PRI is modulated with π/4-QPSK or 16 APSK. The second, third and fourth UW is modulated with QPSK with a constant π/4 phase shift. See table 7.29h.

Table 7.29h: LDPC Coded PNB2(5,3)/Uplink definition

HSN	Length of field in half symbols	Contents of field
0 to 24	25	Guard period in half symbols
25 to 74	50	Unique word
75 to 122	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
123 to 132	10	Burst transition (coded as all 1 bits)
133 to 420	288	Encoded bits
421 to 448	28	Unique Word
449 to 1 118	670	Encoded bits
1 119 to 1 144	26	Unique Word
1 145 to 1 169	25	Guard period in half symbols

The unique word pattern for LDPC coded PNB2(5,3) burst is shown in table 7.29i.

Table 7.29i: LDPC Coded PNB2(5,3) unique word definition for PDCH2(5,3)/Uplink

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)
Unique word bits (HSN421, HSN422 …HSN448)
(0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 1 1 1 1 0 1 1 1 0 1 1 0 1)
Unique word bits (HSN1 119, HSN1 120 …HSN1 144)
(0 0 0 1 0 0 1 0 0 0 1 0 0 0 0 1 1 1 0 1 1 1 0 1 0 0)

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 7.30 for the PAB definition.

Table 7.30: PAB definition

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

The 12-bit Unique Word pattern is shown in table 7.31.

Table 7.31: 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 7.32 and 7.33 respectively.

Table 7.32: PKAB regarding PNB(4,3) definition

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

Table 7.33: PKAB regarding PNB(5,3) definition

HSN	Length of field in half symbols	Contents of field
0 to 24	25	Guard period in half symbols
25 to 74	50	Unique word
75 to 122	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
123 to 132	10	Burst transition (coded as all 1 bits)
133 to 1 134	1 002	No transmission
1 135 to 1 144	10	Tail (coded as all 1 bits)
1 145 to 1 169	25	Guard period in half symbols

The PKAB burst format corresponding to PNB(2,6) is shown in table 7.34. The PKAB burst corresponding to PNB(2,6) comprises of two unique words separated by encoded PUI as shown in table 7.34.

Table 7.34: PKAB regarding PNB(2,6) definition

HSN	Length of field in half symbols	Contents of Field
0 to 4	5	Guard period in half symbols
5 to 22	18	Unique word
23 to 70	48	Encoded public information (PUI) field c0,…,c23, c0,…, c23
71 to 88	18	Unique word
89 to 930	842	No transmission
931 to 935	5	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]). Figure 8.14 indicates the numbering of consecutive frames for the entire multiframe.

Figures 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 or D-MAC-slots in a multiframe is defined GMPRS-1 03.064 [14]. Each MAC-slot or a D-MAC-slot carries a single RLC block.

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. When the network transmits on a PDTCH(2,6) carrier, it will do so on D-MAC slots 0,1, 2 and 3. As a result, an MES listening to a PDTCH(2,6) will receive the USF on D-MAC slots 0, 1, 2 and 3. When the network transmits on a PDTCH(4,3) and PDTCH(5,3) it will do so on all the MAC slots, and the MES listening to a PDTCH(4,3) or PDTCH(5,3) will receive the USF on all MAC slots. 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 relationship between the downlink D-MAC-slot in which the block containing the USF is transmitted and the uplink D-MAC-slot to which it applies is described in GMPRS-1 05.010 [13]. The MES may transmit on any of the uplink MAC-slots allocated to the MES. The MES shall transmit on every D-MAC-slot 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 signals 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)

When an MES transmits a PTCCH/U on the same carrier as a PDTCH(4,3) or a PDTCH(5,3), the PTCCH/U shall be mapped to one of the MAC-slots 0, 2, 4, or 6 for an even numbered multiframe and slots 1, 3, 5, 7 in an odd numbered multiframe. When an MES transmits a PTCCH/U on the same carrier as a PDTCH(1,6), the PTCCH/U shall be mapped to one of the D-MAC-slots 0, 1, 2, or 3. 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.

Similarly, the PRACH may be dynamically allocated on individual PDCH D-MAC-slots. If an MES, which is receiving PDTCH(2,6) on downlink, detects a USF value equal to USF_FREE in a D-MAC-slot k (k = 0, 1, 2 or 3) beginning at timeslot T (T = 0, 1, 2 …, or 23) of a downlink frame F, the MES may transmit the PRACH either on timeslots T, T + 1, T + 2 or on timeslots T + 3, T +4, T + 5, where timeslot T is in the uplink frame F + USF_DELAY and the timeslot numbers T + 1 to T + 5 are modulo 24 (see GMPRS-1 05.010 [13]). The MES shall randomly select either timeslot T or timeslot T + 3 as the start of the PRACH transmission.

Fixed PRACH opportunities may be statically allocated on individual PDCH D-MAC-slots on the paired 31,25 kHz carrier as described in annex B.

For a PDTCH(4,3) or a PDTCH(5,3), multiple PRACHs, of up to a maximum of m (where m = 4 or 5), 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. Number of overlaid channels supported by the network is indicated by BCCH system information parameters PRACH Overlay and Uplink PRACH Channels, see GMPRS-1 04.008 [8]. The MES shall randomly select one of the overlaid PRACH frequencies for transmission, see GMPRS-1 03.064 [14].

Table 8.1 shows valid PRACH frequencies when multiple PRACHs are overlaid on the same PDCH MAC-slot. Uplink frequency is derived from frequency parameters as specified in GMPRS-1 05.005 [11].

Table 8.1: Overlaid PRACH frequencies

Bandwidth	PRACH frequency
m = 4	PRACH1 = Uplink frequency - 48,875 kHz
	PRACH2 = Uplink frequency - 15,625 kHz
	PRACH3 = Uplink frequency + 15,625 kHz
	PRACH4 = Uplink frequency + 48,875 kHz
m = 5	PRACH1 = Uplink frequency - 62,50 kHz
	PRACH2 = Uplink frequency - 31,25 kHz
	PRACH3 = Uplink frequency
	PRACH4 = Uplink frequency + 31,25 kHz
	PRACH5 = Uplink frequency + 62,50 kHz

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 messages on these channels shall address the MES by the TFI (see GMPRS-1 04.060 [15]).

PDTCH/D or PACCH/D mapped to either PDCH(4,3) or PDCH(5,3) is carried on a MAC-slot (i.e. MAC-slot 0, 1, 2 …, or 7). PDTCH/D or PACCH/D mapped to PDCH(2,6) is carried on a D-MAC-slot (i.e. D-MAC-slot 0, 1, 2 or 3).

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 mapped to downlink PDCH(4,3) or downlink PDCH(5,3) is always carried in a fixed frame B9 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.

PTCCH/D mapped to downlink PDCH(2,6) is always carried in a fixed frame B9 of PDCH on D-MAC-slot 0 (refer to Figure 8.14). The location of D-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 on PDCH(4,3) and PDCH(5,3).

i) PAGCH + PDTCH/D + PACCH/D + PTCCH/D on downlink.

ii) PDTCH/U + PACCH/U + PTCCH/U on uplink.

Similarly, the following combinations of packet logical channels are permitted on PDCH(1,6) and PDCH(2,6).

i) PAGCH + PDTCH/D + PACCH/D + PTCCH/D on PDCH(2,6) on downlink.

ii) PDTCH/U + PACCH/U + PTCCH/U on PDCH(1,6) on uplink.

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 PDCH(4,3) or PDCH(5,3) per frame. Similarly, the multislot configuration occupies up to four PDCH(2,6) or PDCH(1,6) per frame. The physical channels in a multislot configuration are with different Timeslots Numbers (TN) but with the same Absolute Radio Frequency Channel Number (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 to 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 in table A.1.

Table A.1: Multislot class

Multislot class	Number of slots			Minimum number of slots				MES Type
	Rx	Tx	Sum	T_{ta}	T_{tb}	T_{ra}	T_{rb}	
1	24 (max)	24 (max)	NA	NA	0	6	0	A, D
2	24 (max)	9 (avg) (see note 1)	NA	NA	0	0	0	C
3	24 (max)	8 (avg) (see note 2)	NA	NA	0	0	0	C
4	24 (max)	12(max) (see note 3)	NA	NA	0	0	0	C
5								reserved
6								reserved
7								reserved
8								reserved
NOTE 1: Average of 3 DMAC slots out of 8 DMAC slots yields an average of 9 transmit slots (slot = 1,667 ms) out of 24 slots. NOTE 2: For example, 1-ON, 2-OFF (implying 1 DMAC slot ON followed by 2 DMAC slots OFF) transmission pattern yields an average of 8 transmit slots (slot = 1,667 ms) out of 24 slots. NOTE 3: For example, 2-ON, 2-OFF (implying 2 DMAC slot ON followed by 2 DMAC slots OFF) transmission pattern yields 12 transmit slots (slot = 1,667 ms) out of 24 slots.								

Type A MESs are required to be able to transmit and receive at the same time.

Type C MESs are not required to transmit and receive at the same time.

Rx Rx describes the maximum number of receive timeslots that the MES can use per TDMA frame (see table A.1). 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. For type C MES, the receive timeslots shall be allocated within window of size Rx. The network shall take into account the terminal multi-slot class and transmission capabilities into account while allocating Rx timeslots to MES (Refer to annex C).

Tx Tx describes the number of transmit timeslots that the MES can use per TDMA frame (see table A.1). 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.. The network shall take into account the terminal multi-slot class and transmission capabilities into account while allocating Tx timeslots to MES (Refer to annex C).

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 spot-beam signal level measurement and get ready to transmit.

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 spot-beam 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 spot-beam 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 spot-beam 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): Asymmetrical pairing of PDCH/D(2,m) with PDCH/U(1,m)

The downlink 62,5 kHz PDCH carrier (carrying PDCH(2,m)) is coupled with two uplink 31,25 kHz carriers; one carrying PDCH(1,6) and the other carrying PRACH. This is shown in the following diagram. Refer to GMPRS-1 03.064 [14] and GMPRS-1 04.008 [8] for description on how the network conveys the information to the MES regarding its assignment of the one downlink 62,5 kHz channel and the corresponding two 31,25 kHz uplink channels.

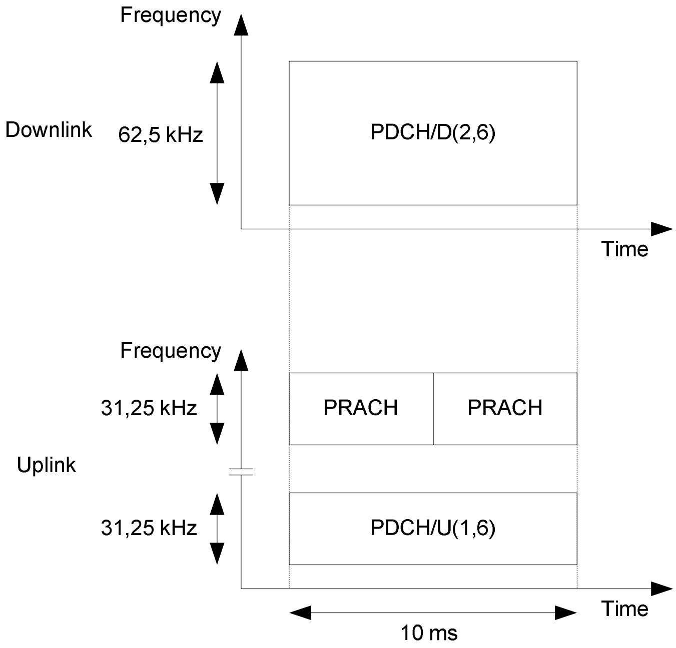


Figure B.1: Asymmetrical Pairing of PDCH/D(2,6) with PDCH/U(1,6)

Annex C (normative): GMPRS Terminal Types

GMPRS supports multiple terminal types. The terminal type is determined based on the following MES attributes:

- MES RF power capability.
- MES multislot class.
- Types of physical channels supported.
- Transmission capability.
- Mode of use.
- Use with a specific network infrastructure.

This information is conveyed to the network in CHANNEL REQUEST TYPE-1, CHANNEL REQUEST TYPE-2 or PACKET CHANNEL REQUEST message.

Assignment of GMPRS terminal type identifier to a MES is the responsibility of the network operator.

Table C.1: GMPRS Terminal Type Identifier

GMPRS terminal type identifier (in binary) $B_7b_6b_5b_4b_3b_2b_1$	GMPRS multislot class (See annex A)	Power class (See GMPRS-1 05.005 [11])	Supported channel type(s) (See clause 5)	Transmission capability	Mode of use	Types of services supported	Antenna Type	Packet service availability indicator (See GMPRS-1 04.008 [8] and GMPRS-1 03.022 [7])
1 0 0 0 0 0 0	1	8 (Terminal type A)	PDCH(5,3) PDCH(4,3) PRACH CCCH	Full duplex	Fixed	144 kbps GMPRS packet switched services only	Internal	CELL_BAR_ACCESS_EXTENSION shall be used with CELL_BAR_ACCESS
1 0 0 1 0 0 0	1	8 (Terminal type A)	PDCH(5,3) PDCH(4,3) PRACH CCCH	Full duplex	Fixed	144 kbps GMPRS packet switched services only	Internal	CELL_BAR_ACCESS_EXTENSION2
0 0 0 1 0 0 1	2	1 (Terminal type C)	PDCH(2,6) PDCH(1,6) PRACH CCCH TCH3/6/9 FACCH3/6/9 SACCH6/9	Half duplex	Handheld	GMR Circuit switched services and 60 kbps GMPRS packet switched services.	Internal	CELL_BAR_ACCESS_EXTENSION2
0 0 0 1 0 1 0	3	1 (Terminal type C)	PDCH(2,6) PDCH(1,6) PRACH CCCH TCH3/6/9 FACCH3/6/9 SACCH6/9	Half duplex with partial burst decoding capability (see clause 7.4.13)	Handheld	GMR Circuit switched services and 60 kbps GMPRS packet switched services.	Internal	CELL_BAR_ACCESS_EXTENSION2
0 0 0 1 0 1 1	4	1 (Terminal type C)	PDCH(2,6) PDCH(1,6) PRACH CCCH TCH3/6/9 FACCH3/6/9 SACCH6/9	Half duplex	Handheld	GMR Circuit switched services and 60 kbps GMPRS packet switched services.	Internal	CELL_BAR_ACCESS_EXTENSION2
0 0 0 1 1 0 0	1	1 (Terminal type C)	PDCH(2,6) PDCH(1,6) PRACH CCCH TCH3/6/9 FACCH3/6/9 SACCH6/9	Full duplex	Handheld	GMR Circuit switched services and 60 kbps GMPRS packet switched services.	Internal	CELL_BAR_ACCESS_EXTENSION2

GMPRS terminal type identifier (in binary) $B_7b_6b_5b_4b_3b_2b_1$	GMPRS multislot class (See annex A)	Power class (See GMPRS-1 05.005 [11])	Supported channel type(s) (See clause 5)	Transmission capability	Mode of use	Types of services supported	Antenna Type	Packet service availability indicator (See GMPRS-1 04.008 [8] and GMPRS-1 03.022 [7])
0 0 0 1 1 0 1	1	9 (Terminal type D)	PDCH(5,3) PDCH2(5,3) PDCH2(5,12) PRACH CCCH	Full duplex	Fixed	444 kbps GMPRS packet switched services in downlink; 202 kbps GMPRS packet switched services in uplink	Internal	CELL_BAR_ACCESS_EXTENSION2
0 0 0 1 1 1 0	1	9 (Terminal type D)	PDCH(5,3) PDCH2(5,3) PDCH2(5,12) PRACH CCCH	Full duplex	Fixed	444 kbps GMPRS packet switched services in downlink; 384 kbps GMPRS packet switched services in uplink	Passive external	CELL_BAR_ACCESS_EXTENSION2
0 0 0 1 1 1 1	1	9 (Terminal type D)	PDCH(5,3) PDCH2(5,3) PDCH2(5,12) PRACH CCCH	Full duplex	Fixed	444 kbps GMPRS packet switched services in downlink; 384 kbps GMPRS packet switched services in uplink	Active external	CELL_BAR_ACCESS_EXTENSION2
All other values are reserved	N/A	N/A	N/A	N/A	N/A	N/A		N/A

Annex D (informative): Bibliography

- GMR-1 03.022 (ETSI TS 101 376-3-10): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 10: Functions related to Mobile Earth station (MES) in idle mode".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- 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".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- GMR-1 04.006 (ETSI TS 101 376-4-6): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 6: Mobile earth Station-Gateway Station Interface Data Link Layer Specifications".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- GMR-1 05.005 (ETSI TS 101 376-5-5): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- GMR-1 05.008 (ETSI TS 101 376-5-6): "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 6: Radio Subsystem Link Control".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

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

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

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

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

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

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

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