

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**

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Reference

RTS/SES-00303-5-2

Keywords

GMPRS, GMR, GPRS, GSM, GSO, interface,
MES, mobile, MSS, MUX, radio, satellite, S-PCN,
TDMA**ETSI**650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

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

Siret N° 348 623 562 00017 - NAF 742 C
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Foreword

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where:

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- 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:
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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 $\pi/4$ -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, $m \times 31,25$ 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.	$\pi/4$ -QPSK	113,6	116,8
PDTCH(5,3)	U/D	117,0	Conv.	$\pi/4$ -QPSK	145,6	148,8
PDTCH(1,6)	U	23,4	Conv.	$\pi/4$ -QPSK	27,2	28,8
PDTCH(2,6)	D	46,8	Conv.	$\pi/4$ -QPSK	62,4	64,0
PDTCH2(5,12)	D	117,0	LDPC	$\pi/4$ -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	$\pi/4$ -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	$\pi/4$ -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, $\pi/4$ -QPSK Rate 9/10.
- Uplink: 16 APSK Rate 9/10, $\pi/4$ -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 MESSs, 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 MESSs. One PTCCH/D is paired with several PTCCH/Us.