

ETSI TS 101 376-5-7 V2.3.1 (2008-08)

Technical Specification

**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**

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Reference

RTS/SES-00303-5-7

Keywords

GMPRS, GMR, GPRS, GSM, GSO, interface,
MES, mobile, MSS, radio, satellite, S-PCN,
synchronization, terminal

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

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

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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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 7 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 [8].

The clause numbering and the table and figure numbering in the present document are aligned to the numbering of the corresponding Release 1 specification GMR-1 05.010 [6] as far as possible. The table and figure numbering in the present document has been adjusted in order to maintain this alignment as follows:

- A table that uses the same table number replaces the corresponding table in GMR-1 05.010 [6];
- A table that uses a different table number is a new additional table.

1 Scope

The present document presents the requirements for synchronizing timing and frequency between the MES and the Gateway Station (GS) in the GMR-1 Mobile Satellite System for circuit switch and packet switch modes of operation.

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 101 376-4-8: "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".
- [3] ETSI TS 101 376-5-2: "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".
- [4] 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".
- [5] 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".

- [6] ETSI TS 101 376-5-7 (V1.3.1): "GEO-Mobile Radio Interface Specifications (Release 1); Part 5: Radio interface physical layer specifications; Sub-part 7: Radio Subsystem Synchronization; GMR-1 05.010".

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

- [7] 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".
- [8] 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".

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 [8] and the following apply:

Frequency Correction (FC): in-call frequency correction sent over FACCH channel

frequency offset: frequency correction sent over AGCH channel

guard time violation: message to indicate the violation of Rx/Tx burst guard time

MAC_FORWARD_TS_OFFSET: offset in number of timeslots of MAC-slot 0 or D-MAC-slot 0 relative to the start of the downlink frame

MAC_RETURN_TS_OFFSET: offset in number of timeslots of MAC-slot 0 or D-MAC-slot 0 relative to the start of the uplink frame

Pre-correction Indication (PI): timing delay pre-compensated by the MES in the RACH transmission

RACH_TS_OFFSET: RACH window offset relative to the start of BCCH window within the same frame, measured in number of timeslots

RACH_SYMBOL_OFFSET: RACH timing offset in symbols

NOTE: The offset between RACH window and the start of the reference frame seen from the MES. Measured in number of symbols.

SA_BCCH_STN: BCCH window offset relative to the start of the frame, in number of timeslots

SA_FREQ_OFFSET: twice of the downlink beam center Doppler due to satellite motion only

SA_SIRFN_DELAY: within each multiframe, the first FCCH channel frame number relative to the start of the multiframe

SB_FRAME_TS_OFFSET: offset between downlink frame N and uplink frame N + 7 at the spot-beam center, measured in number of timeslots

SB_SYMBOL_OFFSET: additional offset between downlink frame N and uplink frame N + 7 at the spot beam center, measured in number of symbols

Timing Correction (TC): in-call timing correction sent over FACCH channel

timing offset: timing correction sent over AGCH channel

USF Delay Value: if an MES receives a USF in its receive downlink frame N, it applies the USF (i.e. transmits corresponding to the received USF grant) on the uplink frame numbered (N + USF Delay Value)

NOTE: USF Delay Value is decoded from USF_DELAY and USF_DELAY Adjustment parameters in BCCH System Information, and it can take values of 6, 7, 8, 9 or 10.

3.2 Abbreviations

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

4 General description of synchronization system

Same as clause 4 in GMR-1 05.010 [6].

4.1 System timing structure

Same as clause 4.1 in GMR-1 05.010 [6].

4.2 Timebase counter

Same as clause 4.2 in GMR-1 05.010 [6].

4.3 General requirement

4.3.1 Timing and frequency reference point

Same as clause 4.3.1 in GMR-1 05.010 [6].

4.3.2 MES requirement

Same as clause 4.3.2 in GMR-1 05.010 [6], with the addition of the following:

MES receiver's time and frequency search ranges (apertures) shall be large enough to accommodate the variations (specified in clause 4.3.3) in the network transmit time and frequency in addition to the satellite-MES relative motion induced time and frequency shifts (see annex A for an informative description), MES oscillator drifts, etc. The MES receiver, operating with such values of time and frequency apertures, shall achieve the performance requirements (i.e. BER, FER, time and frequency estimation accuracies, etc.) specified in GMPRS-1 05.005 [4].

4.3.3 Network requirement

Same as clause 4.3.3 in GMR-1 05.010 [6], with the addition of the following:

The network shall ensure that the maximum variation between the transmit time of a CCCH burst and the transmit time of a PDCH burst does not exceed 12 μ s. Similarly, the maximum burst-to-burst variation in the PDCH transmit time shall not exceed 4 μ s. Burst-to-burst variations in the network transmit frequency shall not exceed 10 Hz.

4.3.4 Measurement conditions

Same as clause 4.3.4 in GMR-1 05.010 [6].

5 Timing synchronization, TtG/GtT call

Same as clause 5 in GMR-1 05.010 [6], except for the addition of the next paragraph, which follows the second paragraph.

For the case in which the MES operates in the packet mode, receive timing shall be corrected by monitoring BCCH, PCH or PDCH and transmission timing shall be corrected with factors provided by the Gateway Station (GS). The GS provides correction factors via AGCH or PACCH based on the MES mode and situation, which is explained here.

5.1 General description

Same as clause 5.1 in GMR-1 05.010 [6], except for the addition of the next paragraph, which follows the fifth paragraph.

If packet transfer mode is initiated via the RACH then the procedure is identical to that described for circuit switched service in clause 5.3.1. Packet switched time and frequency synchronization for the PDCH and the PRACH is described in clause 5.6.

5.2 Timing of forward link common channels

Same as clause 5.2 in GMR-1 05.010 [6].

5.2.1 FCCH/BCCH timing

Same as clause 5.2.1 in GMR-1 05.010 [6].

5.2.2 CCCH timing

Same as clause 5.2.2 in GMR-1 05.010 [6].

5.3 Idle mode timing synchronization

5.3.1 Initial timing acquisition

Same as clause 5.3.1 in GMR-1 05.010 [6].

5.3.2 Paging mode

Same as clause 5.3.2 in GMR-1 05.010 [6].

5.3.3 Alerting mode

Same as clause 5.3.3 in GMR-1 05.010 [6].

5.4 Synchronization at initial access

5.4.1 Synchronization process

Same as clause 5.4.1 in GMR-1 05.010 [6].