

ETSI TS 101 376-5-7 V3.1.1 (2009-07)

Technical Specification

**GEO-Mobile Radio Interface Specifications (Release 3);
Third Generation Satellite Packet Radio Service;
Part 5: Radio interface physical layer specifications;
Sub part 7: Radio Subsystem Synchronization;
GMR-1 3G 45.010**

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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 3); Third Generation Satellite 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 3 specifications. Release 3 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).
- Release 3 specifications have a GMR-1 3G prefix in the title and a version number starting with "3" (V3.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.

The GMR release 3 specifications evolve packet mode services of GMR release 2 to 3rd generation UMTS compatible services. The GMR release 3 specifications introduce the GEO-Mobile Radio-Third Generation (GMR-1 3G) service. Where applicable, GMR-1 3G is derived from the terrestrial digital cellular standard 3GPP and it supports access to 3GPP core networks.

Due to the differences between terrestrial and satellite channels, some modifications to the GSM or 3GPP standard are necessary. Some GSM and 3GPP specifications are directly applicable, whereas others are applicable with modifications. Similarly, some GSM and 3GPP specifications do not apply, while some GMR specifications have no corresponding GSM or 3GPP specification.

Since GMR is derived from GSM and 3GPP, the organization of the GMR specifications closely follows that of GSM or 3GPP as appropriate. The GMR numbers have been designed to correspond to the GSM and 3GPP numbering system. All GMR specifications are allocated a unique GMR number. This GMR number has a different prefix for Release 2 and Release 3 specifications as follows:

- Release 1: GMR n xx.zyy.
- Release 2: GMPRS n xx.zyy.
- Release 3: GMR-1 3G xx.zyy

where:

xx.0yy ($z = 0$) is used for GMR specifications that have a corresponding GSM or 3GPP specification. In this case, the numbers xx and yy correspond to the GSM or 3GPP numbering scheme.

xx.2yy ($z = 2$) is used for GMR specifications that do not correspond to a GSM or 3GPP specification. In this case, only the number xx corresponds to the GSM or 3GPP 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 and 3GPP specifications as follows:

- If a GMR specification exists it takes precedence over the corresponding GSM or 3GPP specification (if any). This precedence rule applies to any references in the corresponding GSM or 3GPP specifications.

NOTE: Any references to GSM or 3GPP 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 or 3GPP specification.

- If a GMR specification does not exist, the corresponding GSM or 3GPP specification may or may not apply. The applicability of the GSM and 3GPP specifications is defined in GMR 1 3G 41.201 [8].

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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 3G 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>.

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] GMPRS-1 01.004 (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".

NOTE: This is a reference to a GMR-1 Release 2 specification. See the introduction for more details.

- [2] GMR-1 3G 44.008 (ETSI TS 101 376-4-8): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 8: Mobile Radio Interface Layer 3 Specifications".
- [3] GMR-1 3G 45.002 (ETSI TS 101 376-5-2): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 2: Multiplexing and Multiple Access; Stage 2 Service Description".
- [4] GMR-1 3G 45.005 (ETSI TS 101 376-5-5): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception".
- [5] GMR-1 3G 45.008 (ETSI TS 101 376-5-6): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 6: Radio Subsystem Link Control".
- [6] GMR-1 05.010 (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".

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

- [7] GMR-1 3G 44.060 (ETSI TS 101 376-4-12): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite 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".
- [8] GMR-1 3G 41.201 (ETSI TS 101 376-1-2): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 1: General specifications; Sub-part 2: Introduction to the GMR-1 family".
- [9] GMR-1 3G 44.118 (ETSI TS 101 376-4-13): "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 13: Radio Resource Control (RRC) protocol; Iu Mode".

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 GMR-1 3G 41.201 [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: a 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 centre 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 centre, measured in number of timeslots

SB_SYMBOL_OFFSET: additional offset between downlink frame N and uplink frame N + 7 at the spot beam centre, 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 defined in GMPRS-1 01.004 [1] apply.

4 General description of synchronization system

Same as clause 4 in GMR-1 05.010 [6], with addition of following at the end of the first paragraph.

The description above also applies to S-band.

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 GMR-1 3G 45.005 [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.