ETSI TS 101 376-5-6 V3.4.1 (2015-10)

TECHNICAL SPECIFICATION

**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;
GMR-1 3G 45.008**

Reference

RTS/SES-00374-5-6

Keywords

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Foreword

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The present document is part 5, sub-part 6 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; GMR-1 3G 45.001";

Sub-part 2: "Multiplexing and Multiple Access; Stage 2 Service Description; GMR-1 3G 45.002";

Sub-part 3: "Channel Coding; GMR-1 3G 45.003";

Sub-part 4: "Modulation; GMR-1 3G 45.004";

Sub-part 5: "Radio Transmission and Reception; GMR-1 3G 45.005";

Sub-part 6: "Radio Subsystem Link Control; GMR-1 3G 45.008";

Sub-part 7: "Radio Subsystem Synchronization; GMR-1 3G 45.010";

Part 6: "Speech coding specifications";

Part 7: "Terminal adaptor specifications".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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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 or 3GPP specifications are not subject to this precedence rule. For example, a GMR or 3GPP 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 ETSI TS 101 376-1-2 [9].

The clause numbering and the table numbering and figure numbering in the present document are aligned to the corresponding numbering of ETSI TS 101 376-5-6 (Release 1) [7] as far as possible. In several places, this means that the table numbering and figure numbering is non-continuous in the present document in order to maintain this alignment, the following rules apply:

- A table that uses the same table number replaces the corresponding table in ETSI TS 101 376-5-6 (Release 1) [7];

- A table that uses a different table number is a new additional table.

1 Scope

The present document specifies several control aspects for the radio link between the Mobile Earth Station (MES) and the Gateway Station (GS) in the GMR-1 3G Mobile Satellite System. It specifies the operation of power control and defines dead link detection. It makes requirements for DTX operation.

The present document also defines requirements for the MES for monitoring system information, as prerequisites to system access, and upon exit from dedicated mode. It makes requirements for spot beam selection and reselection. It defines the nature of the measurements that the MES uses to implement these processes.

Timing and frequency control aspects of link control are to be found in ETSI TS 101 376-5-7 [6], and messages for timing and frequency control are defined in ETSI TS 101 376-4-8 [3].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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.

The following referenced documents are necessary for the application of the present document.

In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in Release 7 or to the latest version of that document in the latest release less than 7.

In the case of a reference to a GMR-1 3G document, a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

[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".

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

[2] ETSI TS 101 376-3-10: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 3: Network specifications; Sub-part 10: Functions related to Mobile Earth Station (MES) in idle mode; GMR-1 3G 43.022".

[3] 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; GMR-1 3G 44.008".

[4] ETSI TS 101 376-5-3: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 3: Channel Coding; GMR-1 3G 45.003".

[5] 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; GMR-1 3G 45.005".

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

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

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

[8] 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; GMR-1 3G 44.060".

[9] 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; GMR-1 3G 41.201".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

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 [9] and the following apply:

Average Power Used (APU): at the beginning of each call, the MES will start a running power-averaged PAS setting, expressed in dB

NOTE: This parameter will be transmitted upon receipt of an INFORMATION REQUEST message from the network, with a power control request code.

BCCH_FULL_LIST: list of all the Broadcast Control CHannel (BCCH) numbers used by the network

BCCH_NEIGHBOR_LIST: list of the neighbouring spot beams' BCCH numbers, starting timeslots, and system information cycle offsets

Call Quality Metric (CQM): at the beginning of each call, the MES will start a running average of the percentage of post-FEC burst errors occurring for the call

NOTE: This parameter will be transmitted upon receipt of an INFORMATION REQUEST message from the network, with a power control request code.

criterion C1: used by the MES for detecting the presence of the frequency control channel (FCCH) and switching out of the frequency search state

link margin: difference (in dB) between the SQI at the receiver corresponding to the maximum transmit power level and the SQT

Link Quality Indication (LQI): amount of available link margin with respect to SQT, expressed in dB

NOTE: A positive value indicates the amount of additional link margin in reserve. A negative value indicates that power control is at saturation and that the SQT is not being met by the indicated value.

Open Loop Gain (Olgain): parameter Olgain is the loop gain for open loop control

Open Loop Threshold (Olthresh): parameter Olthresh is the threshold on the LQI estimate before activating open loop power control

Power Attenuation Notification (PAN): attenuation, in dB, used by the transmitter in the power control loop, relative to the maximum transmit power level

Power Attenuation Request (PAR): attenuation, in dB, requested by the receiver in the power control loop, relative to the maximum transmit power level

power control loop gain: number by which the difference between SQT and SQI is multiplied to derive the power correction value

NOTE 1: Two loop gains are defined:

- **GainDn:** used as the loop gain if the difference between SQT and SQI is negative;
- **GainUp:** used as the loop gain otherwise (i.e. if the difference between SQT and SQI is not negative).

NOTE 2: The loop gain is a unit less number with a default value of 1,0.

Power Control Topped-Out (PCTO): at the beginning of each call, the MES will start a running average of the percentage of messages for which the calculated PAS is less than PASmin

NOTE: This parameter will be transmitted upon receipt of an INFORMATION REQUEST message from the network, with a power control request code.

radio link failure counter S: counter whose value of zero determines the failure of the radio link

RADIO_LINK_TIMEOUT: system parameter for deriving the maximum value of the radio link failure counter S

Received Signal Strength Indication (RSSI): root mean squared (rms) value of the signal received at the receiver antenna

NOTE: The RSSI estimate is compensated for all the time-varying processes (such as automatic gain control) that affect the estimation procedure for obtaining a relative measure to use in comparing the strength of signals received at different times.

reserve link margin: difference (in dB) between the SQI corresponding to the maximum transmit power level and the actual SQI at the receiver

SB_RESELECT_HYSTERESIS: value in dB by which a nonserving beam's BCCH power measurement exceed the serving beam's BCCH power before the MES switches to the nonserving beam

SB_RESELECTION_TIMER: maximum time interval between consecutive spot beam reselection procedures

SB_SELECTION_POWER: during the spot beam selection and reselection, the MES selects only those BCCH carriers whose receive power is within SB_SELECTION_POWER dB of the strongest BCCH carrier

Signal Quality Indication (SQI) or Signal Quality Measurement (SQM): estimate of the ratio of signal power to the noise and the interference power S / (N + I) formed at the receiver in the power control loop

NOTE 1: The terms SQI and SQM are used interchangeably in the present document. The term SQI is used for the descriptions related to circuit-switched operation, whereas the term SQM is used for the packet-data-related descriptions in the present document.

NOTE 2: This estimate, averaged over one burst, is denoted here as SQIj or SQM_j (estimate for jth burst). For the power control algorithm in the circuit-switched operation, MES averages this estimate is averaged over six frames and the averaged estimate is denoted as $\overline{SQI6}$.

Signal Quality Target (SQT): desired receive signal quality, and it is defined as the targeted value for the ratio of the signal power to the noise and interference power

NOTE: The SQT is derived from a reference threshold and an allowance for fading and Doppler shift.

3.2 Abbreviations

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

APU	Average Power Used
CQM	Call Quality Metric
Olgain	Open Loop gain
Olthresh	Open Loop threshold
PCTO	Power Control Topped Out
SQIR	Signal Quality Indicator Report
SQISDR	Signal Quality Standard Deviation
TX	Transmit
UTLQR	UT Link Quality Report

4 General

Same as clause 4 in ETSI TS 101 376-5-6 (Release 1) [7].

5 RF power control

Same as clause 5 in ETSI TS 101 376-5-6 (Release 1) [7] with the exception of the following modification to clause 5.3.3:

5.3.3 Message coding

Same as clause 5.3.3 in ETSI TS 101 376-5-6 (Release 1) [7] with the following addition for PAN message coding for MES operating in Iu mode with PNB3(1,6)-2,6 kbps DACCH allocation in uplink direction in packet shared mode. In this mode the PAR transmitted by the GS towards to MES is a 6-bit integer word as defined in clause 5.3.3 in ETSI TS 101 376-5-6 (Release 1) [7] but the PAN as transmitted by the MES is a 5-bit integer word.

The MES shall quantize each of the PAN values to a 5-bit integer word in this mode only. The 5-bit field permits 32 codes. Codes 0 to 30 represent power levels (see table 5.1a), and the remaining code, 31, represents an escape sequence.

The quantization coding scheme is shown here, with the term "value" representing the unquantized PAN value.

If value < 0,0 dB, code = 0.

If value > 24,0 dB, code = 30.

If 0,0 ≤ value ≤ 24,0 dB, code = $\lfloor (\text{value}/0{,}8) \rfloor$,

where $\lfloor x \rfloor$ represents the largest integer less than or equal to *x*.

The decoding of the coded field shall be as follows:

Decoded value = 0,8 × code, where 0 ≤ code ≤ 30.

This is summarized in table 5.1a.

The MES shall transmit according to the resulting quantized PAN value (as decoded PAN value) and send the 5-bit PAN code over a single burst.