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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-00309-5-6

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";

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 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 GMR-1 3G 1 41.201 [9].

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 GMR-1 3G 45.010 [6], and messages for timing and frequency control are defined in GMR-1 3G 44.008 [3].

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.

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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 (GMPRS); 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 43.022 (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".

[3] 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".

[4] GMR-1 3G 45.003 (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".

[5] 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".

[6] GMR-1 3G 45.010 (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".

[7] GMR-1 05.008 (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".

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

[8] 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".

[9] 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".

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 [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 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.

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

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

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

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

RADIO_LINK_TIMEOUT: 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.

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

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

SB_RESELECTION_TIMER: maximum time interval between consecutive spot beam reselection procedures

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 GMR-1 05.008 [7].

5 RF power control

Same as clause 5 in GMR-1 05.008 [7].

6 Radio link failure

Same as clause 6 in GMR-1 05.008 [7] for dedicated mode, with the following modifications for packet service in packet transfer mode:

- Link failure may occur as result of adverse channel conditions. The MES shall detect link failure by determining that the received E_s/N_o is below 2,5 dB for terminal type A and D and below 3,0 dB for terminal type C. The MES shall detect link failure by determining that the received E_s/N_o is below 2,5 dB for terminal type E and above. This determination may be based on Bit Error Rate estimation. The Bit Error Rate estimate may be based on known bits within the packet bursts, or on an examination of the Golay decoder outputs.
- This detection procedure shall be performed for each successive link failure measurement interval.
- The measurement interval is defined as LINK_FAILURE_MEASUREMENT_INTERVAL. The GS shall broadcast the value of LINK_FAILURE_MEASUREMENT_INTERVAL as part of system information in BCCH (see GMR-1 3G 44.008 [3]), and the default value is 10 seconds.
- In case of the radio link failure detection, the MES shall perform the procedure specified in GMR-1 3G 44.060 [8].

7 Idle mode tasks

Same as clause 7 in GMR-1 05.008 [7], with the following modifications :

- For terminals using FCCH3 bursts, clause 13 of the present document shall apply.