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Technical Specification

**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**

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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 with an identifying change of release date and an increase in version number as follows:

Version 3.m.n

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 3, sub-part 10 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":

Sub-part 1: "Network Functions";

Sub-part 2: "Network Architecture";

Sub-part 3: "Numbering, addressing and identification";

Sub-part 4: "Organization of Subscriber Data";

Sub-part 5: "Technical realization of Supplementary Services";

Sub-part 6: "Location Registration and Position Identification Procedures";

Sub-part 7: "Discontinuous Reception (DRX)";

Sub-part 8: "Support of Dual-Tone Multifrequency Signalling (DTMF)";

Sub-part 9: "Security related Network Functions";

Sub-part 10: "Functions related to Mobile Earth Station (MES) in idle mode";

Sub-part 11: "Technical realization of the Short Message Service (SMS) Point-to-Point (PP)";

Sub-part 12: "Technical realization of the Short Message Service Cell Broadcast (SMSCB)";

Sub-part 13: "Technical realization of group 3 facsimile using transparent mode of transmission";

- Sub-part 14: "Transmission Planning Aspects of the Speech Service in the GMR-1 system";
 - Sub-part 15: "Line Identification supplementary service - Stage 2";
 - Sub-part 16: "Call Barring (CB) supplementary services - Stage 2";
 - Sub-part 17: "Unstructured Supplementary Service Data (USSD) - Stage 2";
 - Sub-part 18: "Terminal-to-Terminal Call (TtT)";
 - Sub-part 19: "Optimal Routing technical realization";
 - Sub-part 20: "Technical realization of High-Penetration Alerting";
 - Sub-part 21: "Position Reporting services; Stage 2 Service description";
 - Sub-part 22: "Overall description of the GMPRS radio interface; Stage 2";
 - Sub-part 23: "Radio Access Network; Overall description - Stage 2";
- Part 4: "Radio interface protocol specifications";
 - Part 5: "Radio interface physical layer specifications";
 - 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 [2].

The clause numbering and the table numbering and figure numbering in the present document are aligned to the corresponding numbering of GMPRS-1 03.022 [15] as far as possible.

1 Scope

The present document gives an overview of the tasks undertaken by a GMR-1 Mobile Earth Station (MES) when in idle mode, that is, switched on but not having a dedicated channel allocated, e.g. not making or receiving a call. It also describes relevant network functions. The idle mode functions are also performed by a GMR-1 MES as long as no dedicated channel is allocated to the MES.

The present document outlines how the idle mode operation shall be implemented. Further details are given in GMR-1 3G 44.008 [4] and GMR-1 3G 45.008 [7].

Clause 4 of the present document gives a general description of the idle mode process. Clause 5 outlines the main requirements and technical solutions of those requirements. Clause 6 describes the processes used in idle mode.

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 (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 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".

- [3] GMR-1 03.299 (ETSI TS 101 376-3-21): "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 21: Position Reporting services; Stage 2 Service description".

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

- [4] 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".

- [5] 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".
- [6] 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".
- [7] 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".
- [8] 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".
- [9] 3GPP TS 43.022: "3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Functions related to Mobile Station (MS) in idle mode and group receive mode".
- [10] GSM 03.60 (ETSI TS 101 344): "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS) Service description; Stage 2 (Release 1997)".
- [11] 3GPP TS 23.122 (ETSI TS 123 122): "3rd Generation Partnership Project; Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode".
- [12] 3GPP TS 23.060 (ETSI TS 123 060): "3rd Generation Partnership Project; General Packet Radio Service (GPRS); Service description; Stage 2".
- [13] 3GPP TS 24.008 (ETSI TS 124 008): "3rd Generation Partnership Project; Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".
- [14] 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".
- [15] GMPRS-1 03.022 (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".

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

- [16] GMR-1 3G 44.160 (ETSI TS 101 376-4-14): "GEO Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 14: Mobile Earth Station (MES) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) 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.

- [i.1] 3GPP TS 25.413 (ETSI TS 125 413): "UTRAN Iu interface Radio Access Network Application Part (RANAP) signalling".

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 [2] and the following apply:

A-BCCH (A/Gb mode only): broadcast channel which:

- 1) uses an ARFCN on the BCCH_FULL_LIST for the serving satellite;
- 2) is illuminated permanently in a satellite system;
- 3) is always be transmitted with full BCCH power;
- 4) can be listed on a neighbour BCCH list; and
- 5) can be used for RSSI-based spot beam selection.

A/Gb mode: MES operating mode that applies with a Release 1 (GMR-1) or Release 2 (GMPRS-1) radio access network

NOTE: For the multi system case the mode is determined by the current serving radio access network.

BCCH carrier: frequency carrier which is used by either an FCCH or an FCCH3 multiplexed with a BCCH/CCCH

Dark Beam (A/Gb mode only): spot beam that is not activated and has no satellite resource allocated, or a spot beam that is activated but not illuminated

NOTE: To activate a beam is to allocate Subband and Frequency Slot resource, and perform routing over the satellite payload. To illuminate a beam is to start BCCH signal transmission using already activated satellite resource.

GMPRS-1 MES: MES capable of operating in A/Gb mode

GMR-1 3G MES: MES capable of operating in Iu mode

Iu mode: MES operating mode that applies with a Release 3 (GMR-1 3G) radio access network

NOTE: For the multi system case the mode is determined by the current serving radio access network.

Location Registration (LR): may be either the Location Updating procedure or the Routing Area Update procedure

NOTE 1: A MES that is IMSI attached to non-GMPRS services only performs location registration by the Location Updating procedure. A GMPRS-1 MES that is IMSI attached to GMPRS services or to GMPRS and non-GMPRS services performs location registration by the Routing Area Update procedure only when in a network of network operation mode I. A GMR-1 3G GPRS MES performs location registration by the Routing Area Update procedure (Iu mode) when in a network of network operation mode I or II.

NOTE 2: Both procedures are performed independently by the GMPRS-1 MES when it is IMSI attached to GMPRS and non-GMPRS services in a network of network operation mode II or III (see GSM 03.60 [10])

NOTE 3: Network operation modes I and II for GMR-1 3G Iu mode correspond to modes I and II for A/Gb mode, respectively. Mode III applies to A/Gb mode only, but not to Iu mode (see 3GPP TS 23.060 [12]).

Registration Area (RA): area in which mobile stations may roam without a need to perform location registration

NOTE: The registration area corresponds to the Location Area (LA) for performing location updating procedure, and it corresponds to the routing area for performing the routing area update procedure.

Routing Area Indicator (RAI): Routing Area Indicator has a similar format as the LAI and is similar in function to the LAI, except that the RAI is used for provision of data services

T-BCCH (A/Gb mode only): broadcast channel which:

- 1) can use any frequency, i.e. it may be assigned to an ARFCN not given in the BCCH_FULL_LIST for the serving satellite;
- 2) might not be illuminated or activated all the time;
- 3) might not be transmitted with full BCCH power;
- 4) is not listed in the neighbour BCCH list; and
- 5) is not used for RSSI-based spot beam selection.

spot beam: defined by its spot beam ID

NOTE: Several BCCH carriers may share the same spot beam ID. This indicates that the geographic coverage area of the BCCH carriers is coincident.

3.2 Abbreviations

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

4 General description

4.1 Comparison of GMR-1 and GMR-1 3G satellite systems with terrestrial cellular systems

A GMR-1 or GMR-1 3G satellite system differs from a terrestrial cellular system in several important respects but also incorporates a number of the same radio and network architecture features.

In terrestrial cellular system, a cell is always wholly contained within a single LA. In a GMR-1 or GMR-1 3G satellite system, each BCCH carrier shall be associated with a single LAI. Multiple BCCH channels may be provided in the same spot beam with identical coincident geographic coverage or with overlapping geographic coverage where the individual BCCH carrier LAIs may be associated with the same or different PLMNs.

In a cellular system, a cell always provides access to only one base station and only one MSC or SGSN Core Network (CN) elements. In GMR-1 or GMR-1 3G, a BCCH carrier within a spot beam shall provide access to one GS and to one CN element. Multiple BCCH carriers within coincident or overlapping spot beams may provide access to different GS and different CN elements. The gateways may have the same or different PLMN.

In a terrestrial cellular system, PLMN selection has priority over cell selection, and any suitable cell of a selected PLMN can be selected even if there are other stronger cells belonging to other PLMNs. In GMR-1 or GMR-1 3G, only the strongest or next to the strongest spot beam from a particular satellite should be camped on, and the PLMN should be selected from the BCCHs of these spot beams.

Having coverage from more than one satellite of a single system operator is also a distinct attribute of a GMR-1 or GMR-1 3G system, with no comparable situation in a terrestrial cellular system.

In a terrestrial cellular system, the position of the MS is indicated by cell selection and, optionally, by additional functionality provided by GPS or some other technique. In a GMR-1 or GMR-1 3G system, if the MES supports GPS capability the MES is required to perform GPS position determination, use that position as part of spot beam selection, and report its position to the network during the system access. If the MES does not support GPS capability, spot beam selection is based on power measurements. In a GMR-1 3G system, spot beam selection may include Gateway selection where suitable or equivalent coverage is provided by spot beams associated with different Gateways.

In a terrestrial cellular system, any detectable signal can be a potential candidate for camp-on. However, due to link margins for the satellite frequency correction and broadcast channels (FCCH and BCCH) and the beamforming properties of the satellite antenna, it is possible to receive a signal that is not from the spot beam associated with the MES's location. The MES scan procedure shall avoid camping on these spurious signals.

In a terrestrial cellular system, registration is permitted on any network for which a minimally acceptable signal can be detected. In a GMR-1 or GMR-1 3G system, and assuming that the spurious signals described above have been rejected, registration is not always allowed on detectable networks. Registration may be position based, as will be described later. In this regard, the GS may participate in the PLMN and RA selection process, which is never the case in a cellular system. However, a GMR-1 or GMR-1 3G system may or may not require MES position reporting.

The GMR-1 or GMR-1 3G system has different service levels: Normal Service, Alerting Service, Limited Service, and No Service. Alerting service is optional for both the network and the MES.

The GMR-1 or GMR-1 3G system in A/Gb mode may use Dark Beams to manage the assignment of resources to spot beams or to minimize unnecessary power consumption on the satellite. A spot beam may not have satellite frequency or timeslot resources allocated, or may have resources allocated but may not be transmitting a BCCH signal. In either case the spot beam is called a Dark Beam.

4.2 Idle mode

The GMR-1 idle mode can be subdivided into four processes:

- Spot beam selection and reselection.
- PLMN selection.
- GPS position determination (for suitably equipped MESs).
- Location registration.

The GMR-1 3G idle mode includes all of these GMR-1 idle mode processes plus one additional process:

- Gateway selection.

The next clause introduces the issues to be accommodated by idle mode, and describes at a general level how the idle mode processes shall specifically solve them.

The functional aspects of the idle mode process are described in the following clause. The relationship between these processes is illustrated in figures 6.1 and 6.1a (for GMR-1 3G). The internal states and state transitions within each process are shown in figures 6.2 to 6.5.

5 Requirements and technical solutions

The following clauses list the main requirements of idle mode operation and give an outline of the technical solution.

5.1 Service capabilities

The MES shall provide three levels of service: Normal Service, Limited Service, and No Service. The MES may provide two additional levels of service: Position-Restricted Service (A/Gb mode only) and Alerting Service. The service levels are shown schematically in figure 5.1.