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Technical Specification

**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**

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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:

Version 2.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 5, sub-part 5 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 [6].

1 Scope

The present document defines the performance requirements for the Mobile Earth Station (MES) radio transceiver for the GMR-1 Mobile Satellite System.

Requirements are defined for two categories of parameters:

- Those that are required to provide compatibility among the radio channels, connected either to separate or common antennas, which are used in the system. This category also includes parameters providing compatibility with existing systems in the same or adjacent frequency bands.
- Those that define the transmission quality of the system.

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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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 101 376-5-4: "GEO-Mobile Radio Interface Specifications (Release 2) General Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 4: Modulation; GMPRS-1 05.004".
- [3] 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".

- [4] ETSI EN 301 681 (V1.3.2): "Satellite Earth Stations and Systems (SES); Harmonized EN for Mobile Earth Stations (MESs) of Geostationary mobile satellite systems, including handheld earth stations, for Satellite Personal Communications Networks (S-PCN) in the 1,5/1,6 GHz bands under the Mobile Satellite Service (MSS) covering essential requirements under article 3.2 of the R&TTE Directive".
- [5] (ETSI TS 101 376-5-5) (V1.3.1): "GEO-Mobile Radio Interface Specifications (Release 1); Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception; GMR-1 05.005".

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

- [6] 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".
- [7] ETSI EN 301 444 (V1.1.1): "Satellite Earth Stations and Systems (SES); Harmonized EN for Land Mobile Earth Stations (LMES) operating in the 1,5 GHz and 1,6 GHz bands providing voice and/or data communications covering essential requirements under Article 3.2 of the R&TTE directive".

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, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GMPRS-1 01.201 [6] and the following apply:

active transmission: defined as the combination of the ramp-up, ramp-down, and active burst transmission periods

average EIRP: burst EIRP averaged over at least 200 bursts

burst EIRP: instantaneous EIRP measured over 90 % of the active portion of a burst

carrier-off state: an MES is in this state when it does not transmit any signal and it is more than 20 ms away from any active transmission (i.e. the carrier-off state excludes the carrier-standby state)

carrier-on state: an MES is in this state when it transmits a signal (i.e. the carrier-on state corresponds to an active transmission)

carrier-standby state: an MES is in this state when it does not transmit any signal but it is within 20 ms of the carrier-on state (i.e. the carrier-standby state occurs for up to 20 ms immediately before, and up to 20 ms immediately after the carrier-on state)

3.2 Symbols

For the purposes of the present document, the following symbols apply:

E_b	Average energy per bit in the wanted signal
E_s	Average energy per symbol in the wanted signal
N_o	Average channel noise (the noise power spectral density integrated over the channel bandwidth)

3.3 Abbreviations

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

4 Frequency bands and channel arrangement

4.1 Frequency bands and duplex method

Same as clause 4.1 in GMR-1 05.005 [5] for circuit switched operation.

Clause 4.1 in GMR-1 05.005 [5] is also applicable for packet switched operation, except that the FDM scheme may be operated in full duplex with any downlink (forward) RF carrier used with any uplink (return) RF carrier without necessarily having a fixed frequency offset between the two carriers.

4.2 RF carrier spacing and designation

The 34 MHz of the L-band spectrum is divided into 1 087 paired carriers, with carrier spacing of 31,250 kHz.

Carrier pairs, N , are numbered from 1 through 1 087 ($1 \leq N \leq 1\,087$) when operating in the L-band.

The centre frequency of the carriers in kHz corresponding to a carrier number is given by the expressions in table 4.1 for L-band.

Table 4.1: Carrier numbers for L-band

	Carrier centre frequencies (kHz)	Carrier number
Mobile earth station receive	$1\,525\,000,00 + 31,25 \times N$	$1 \leq N \leq 1\,087$
Mobile earth station transmit	$1\,626\,500,00 + 31,25 \times N$	$1 \leq N \leq 1\,087$

The carrier number and centre frequency of the carriers are given in table 4.2. The RF channels are spaced at 31,25 kHz intervals.

Table 4.2: Carrier numbers and frequencies

MES-RX centre frequency (kHz)	MES-TX centre frequency (kHz)	Carrier numbers (N)
1 525 031,25	1 626 531,25	1
1 525 062,50	1 626 562,50	2
1 529 937,50	1 631 437,50	158
1 529 968,75	1 631 468,75	159
1 530 000,00	1 631 500,00	160
1 530 031,25	1 631 531,25	161
1 532 937,50	1 634 437,50	254
1 532 968,75	1 634 468,75	255
1 533 000,00	1 634 500,00	256
1 543 968,75	1 645 468,75	607
1 544 000,00	1 645 500,00	608
1 544 968,75	1 646 468,75	639
1 545 000,00	1 646 500,00	640
1 554 968,75	1 656 468,75	959
1 555 000,00	1 656 500,00	960
1 558 968,75	1 660 468,75	1 087

The packet services use nominal transmission bandwidths that are multiples of the 31,25 kHz basic transmission bandwidth. These different transmission bandwidths defined over the subbands are used to support transmission symbol rates that are multiples of the basic transmission symbol rate of 23,4 kbps. A 3-bit bandwidth suffix is added to the AFRCN to indicate the bandwidth and transmission rate of the modulated carrier. The association of transmission bandwidths to transmission symbol rates is given in table 4.3.

If the transmission bandwidth is an even multiple of 31,25 kHz, then the carrier frequency shall be shifted by +15,625 kHz.

Table 4.3: Transmission bandwidth and associated transmission symbol rates

Bandwidth suffix	Transmission bandwidth (kHz)	Transmission Symbol rate (kps)
000	reserved	Reserved
001	31,25	23,4
010	62,50	46,8
011	reserved	Reserved
100	125,00	93,6
101	156,25	117,0
110	reserved	Reserved
111	reserved	Reserved

4.3 RF carrier used for synchronization and spot beam selection

Same as clause 4.3 in GMR-1 05.005 [5].

4.4 Frequency assignment to spot beams

Same as clause 4.4 in GMR-1 05.005 [5].

5 Stability requirements

5.1 Frequency and symbol timing stability

Same as clause 5.1 in GMR-1 05.005 [5].

5.1.1 Definition of operating conditions

Same as clause 5.1.1 in GMR-1 05.005 [5].

5.1.2 Frequency and timing stability requirement

Same as clause 5.1.2 in GMR-1 05.005 [5].

5.1.3 Frequency and timing stability requirements for packet data mode

In the tests of this clause, the MES shall be receiving the logical channel specified in table 5.1 and shall be transmitting a PDCH logical channel. In all test cases, AWGN shall be used.

The rms frequency and symbol timing error of the transmitted signal from the MES shall not exceed the values given in table 5.1 when the unit is receiving the logical channels given in the table E_s/N_o values listed in the table.

Table 5.1: Frequency and timing stability requirements

Received logical channel	Operational condition (see note)	E_s/N_o (dB)	RMS Frequency Error (Hz)	RMS timing error (μ s)
PDCH (at 46,8 ksps)	Steady state	5	10	0,9
PDCH (at 93,6 ksps)	Steady state	5	10	0,9
PDCH (at 117,0 ksps)	Steady state	5	10	0,9

NOTE: The Steady State operational condition is defined in GMR-1 05.005.

5.2 Frequency switching time

Same as clause 5.2 in GMR-1 05.005 [5] with the following additional text.

For full duplex operation, the transmit (receive) to receive (transmit) frequency switching time is not applicable. In addition, the MES shall be capable of switching from any transmit frequency to any other transmit frequency with the same specification as the receiver frequency switching.

5.3 MES time alignment accuracy

Same as clause 5.3 in GMR-1 05.005 [5].