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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**

Reference

RTS/SES-00303-5-5

Keywords

GMPRS, GMR, GPRS, GSM, GSO, interface, MES, mobile, MSS, radio, satellite, S-PCN

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Contents

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Foreword

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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 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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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 ($1 \le N \le 1\ 087$) 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 x N	$1 \le N \le 1\ 087$
Mobile earth station transmit	1 626 500,00 + 31,25 x N	$1 \le N \le 1\ 087$

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 ksps. 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 (ksps)
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 (µs)
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].

6 Transmitter characteristics

6.1 Power output characteristics and power class

Same as clause 6.1 in GMR-1 05.005 [5] with the additional specifications for new power classes for packet mode operation.

Table 6.1: Average EIRP for terminal types - extreme conditions

Power class	Minimum EIRP (dBW), PAS = 0 dB (see note 1)	Maximum EIRP (dBW), PAS = 0 dB (see note 1)	Examples
1	See GMR-1 05.005 [5]	See GMR-1 05.005 [5]	Data terminal type C
8	11,1	14,9	Data terminal type A
9	7	10,8	Data terminal type D
9 (see note 2)	14	17,8	Data terminal type D
NOTE 1: Power Attenuation Setting (PAS) is defined in GMPRS-1 05.008 [3]. NOTE 2: With external antenna.			

Table 6.2: Average EIRP for terminal types - normal conditions

Power class	Minimum EIRP (dBW), PAS = 0 dB (see note 1)	Maximum EIRP (dBW), PAS = 0 dB (see note 1)	Examples
1	See GMR-1 05.005 [5]	See GMR-1 05.005 [5]	Data terminal type C
8	12,1	14,9	Data terminal type A
9	8	10,8	Data terminal type D
9 (see note 2)	15,0	17,8	Data terminal type D
NOTE 1: PAS (Power Attenuation Setting) is defined in GMPRS-1 05.008 [3]. NOTE 2: With external antenna.			

In addition, the single burst EIRP shall satisfy the following:

a) Each of the bursts in the first five frames of each transmit activity that are not preceded in the past 60 seconds by a transmit activity of at least ten bursts long shall satisfy the limits in table 6.3.

NOTE: Each of these first five frames contains at least two bursts per frame (i.e. a total of at least ten burst in these first five frames).

b) Each of the remaining bursts shall satisfy the limits in table 6.4.

Requirements in tables 6.3 and 6.4 shall be met under the extreme environmental conditions defined in annex B.

Table 6.3: Single burst EIRP - each burst in the first 5 frames with at least 2 bursts per frame

Power class	EIRP range (dBW), with PAS = 0 dB	Examples
1	See GMR-1 05.005 [5]	Data terminal type C
8	9,1 to 14,9	Data terminal type A
9	5 to 10,8	Data terminal type D
9 (see note)	12 to 17,8	Data terminal type D
NOTE: With external antenna.		

Table 6.4: Single burst EIRP - frames 6 and on

Power class	EIRP range (dBW), with PAS = 0 dB	Examples
1	See GMR-1 05.005 [5]	Data terminal type C
8	10,1 to 14,9	Data terminal type A
9	6 to 10,8	Data terminal type D
9 (see note)	13 to 17,8	Data terminal type D
NOTE: With external antenna.		

In addition, the output power of an access burst for a packet mode terminal shall comply with the limits defined in table 6.5.

Table 6.5: Access burst EIRP

Burst types	EIRP range (dBW) for Data terminal type A	EIRP range (dBW) for Data terminal type C	EIRP range (dBW) for Data terminal type D	
			Internal Antenna	External Antenna
RACH	$5{,}0^{+6{,}8}_{-0{,}7}$ (see note 1)	Same as handheld MES. See GMR-1 05.005 [5]	$5{,}0^{+6{,}8}_{-0{,}7}$	$5{,}0^{+6{,}8}_{-0{,}7}$
PRACH	$12{,}1^{+2{,}8}_{-3}$ (see note 2)	Same as RACH used by handheld MES. See GMR-1 05.005 [5]	$8{,}0^{+2{,}8}_{-3}$	$15{,}0^{+2{,}8}_{-3}$
NOTE 1: RACH EIRP for Data terminal type A ranges from -0,7 dBW to +6,8 dBW around the nominal EIRP. NOTE 2: PRACH EIRP ranges from -3 dBW to +2,8 dBW around the nominal EIRP.				

6.2 Antenna radiation pattern

Same as clause 6.2 of GMR-1 05.005 [5] with the addition of the following text:

The antennas for the various packet terminals have the following gains when fully deployed with no conduction objects in the vicinity of the MES antenna.

Table 6.5a: Transmit Antenna Gain

Terminal type	Antenna gain
Data terminal type A	12,0 dBi
Data terminal type C	Same as handheld MES. See GMR-1 05.005 [5]
Data terminal type D	8,5 dBi
Data terminal type D (see note)	15,0 dBi
NOTE: With passive external antenna.	

For terminal types A and C, and terminal type D with passive external antenna, the axial ratio of radiated wave over the operational frequency range shall be better than 2 dB at boresight and better than 5 dB over the 3 dB coverage of the antenna.

For terminal type D with internal antenna or active external antenna, the axial ratio of radiated wave over the operational frequency range shall be better than 4 dB at boresight and better than 5 dB over the 3 dB coverage of the antenna.

6.3 Transmit polarization

Same as clause 6.3 of GMR-1 05.005 [5].

6.4 Carrier-off conditions

Same as clause 6.4 of GMR-1 05.005 [5] with the following additional text:

The maximum EIRP from an MES in the carrier-off state shall be less than -30 dBm.

This requirement shall be met under the extreme environmental conditions defined in annex B.

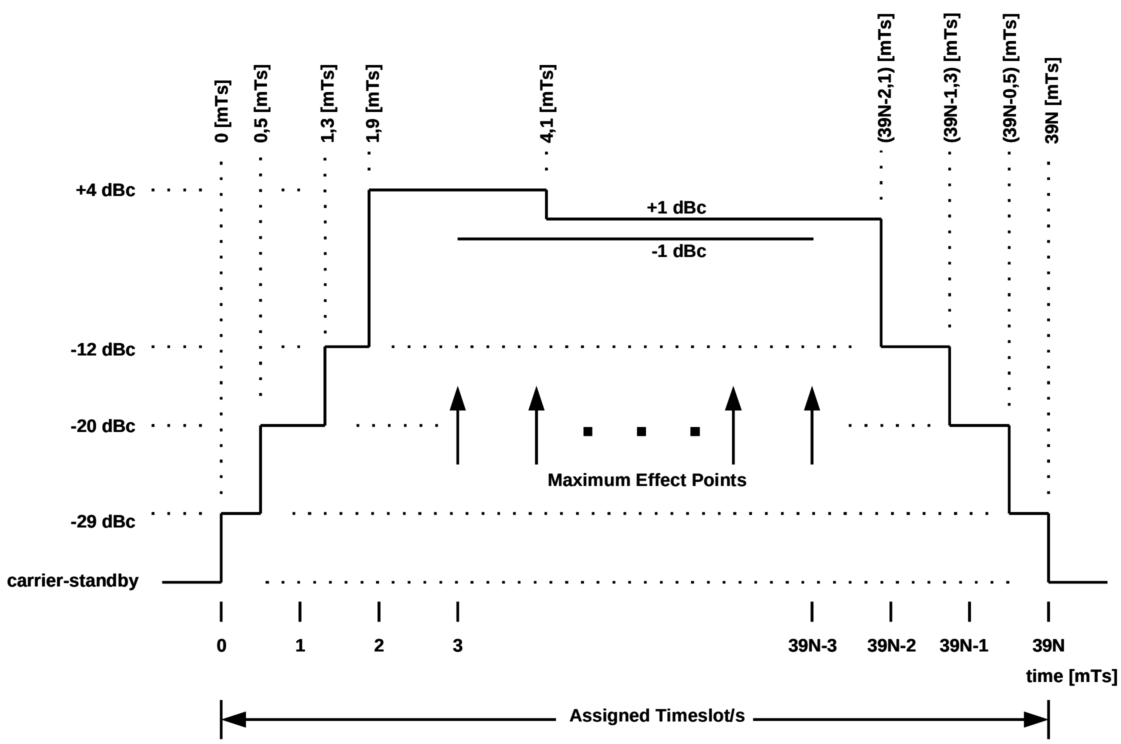
6.4a Carrier-standby conditions

The maximum EIRP from an MES in the carrier-standby state shall be less than -8 dBm.

This requirement shall be met under the extreme environmental conditions defined in annex B.

6.5 Ramp-up and ramp-down

The transition from the carrier-standby state to the active transmit state is the burst ramp-up, and the corresponding transition at the end of the burst is the burst ramp-down. The precise structure of the burst and the mapping of data bits into data symbols and transmit waveform is defined in GMPRS-1 05.004 [2]. The positions of the ramp-up and ramp-down periods relative to the slot boundaries and the maximum effect points of the transmitted symbols from the MES are shown in figure 6.1.



NOTE: T_S is the symbol period and is equal to 5/(117 x m) msec; i.e.(1/(23,4 x m)) ksps.

Figure 6.1: Ramp-up and ramp-down in relation to the rest of the burst

6.6 Power control range and accuracy

6.6.1 Approach

Same as clause 6.6.1 in GMR-1 05.005 [5].

6.6.2 Procedures and timing

Same as clause 6.6.2 in GMR-1 05.005 [5].

6.6.3 Range

Same as clause 6.6.3 in GMR-1 05.005 [5].

6.6.4 Accuracy

Same as clause 6.6.4 in GMR-1 05.005 [5].

6.6.5 Attenuation step size

Same as clause 6.6.5 in GMR-1 05.005 [5].

6.6.6 Monotonicity

Same as clause 6.6.6 in GMR-1 05.005 [5].

6.6.7 Initial power level P_{init}

The definition and the usage of the initial power level, P_{init}, is given in GMPRS-1 05.008 [3]. For MESs of type A, P_{init} is 12,1 dBW. For MESs of type C, P_{init} is 5,0 dBW. For MESs of type D, P_{init} is 8,0 dBW without an external antenna and 15,0 dBW with an external antenna.

6.7 Adjacent channel interference

Same as clause 6.7 in GMR-1 05.005 [5].

6.7.1 Interference due to modulation

Terminals with Maximum EIRP less than or equal to 15 dBW shall meet the following requirements:

Same as clause 6.7.1 in GMR-1 05.005 [5] with the following additional text:

A factor "m" defines the transmitted signal symbol rate. "m" is equal to the ratio of the signal's transmit symbol rate to 23 400 symbols/sec. The interference shall be less than the levels given in table 6.6 as seen by a matched filter with a bandwidth of m × 23,4 kHz. The channel centres for measurement are also scaled by the factor "m", as given in table 6.6.

Table 6.6: Adjacent channel interference due to modulation

Power class	1st Adjacent channels, ± m x 31,25 kHz	2nd Adjacent channels, ± m x 62,5 kHz	3rd Adjacent channels, ± m x 93,75 kHz	4th Adjacent channels and Beyond (see note 1)	Examples
1	-25 dBc	-40 dBc	-53 dBc	-60 dBc	Data terminal type C
8	-25 dBc	-40 dBc	-53 dBc	-60 dBc	Data terminal type A
9	-25 dBc	-40 dBc	-53 dBc	-60 dBc	Data terminal type D
NOTE 1: This requirement applies to all adjacent channels that are integrally contained in the band that extends from 2 MHz below the lower end of the transmit band to 2 MHz above the upper end of the transmit band. NOTE 2: The total energy in any first adjacent carrier bandwidth (23,4 kHz) due to terminal type D connected to an external antenna capable of 15 dBW EIRP shall be at most -35 dBc. The first adjacent 23,4 ksps carrier will be located at ± (m+1) x 15,625 kHz.					

The transmitter shall also meet the spectral requirements defined in clause 4.2.2 of EN 301 681 [4]. In the event of any conflict the more stringent limit shall apply.

Terminals with Maximum EIRP greater than 15 dBW shall meet the following requirements:

The unwanted emissions within the band 1 626,5 MHz to 1 660,5 MHz band shall not exceed the carrier-on limits defined in clause 4.2.2.2 of EN 301 444 [7].

6.7.2 Interference due to switching transients

Same as clause 6.7.2 in GMR-1 05.005 [5] with the following additional text:

Table 6.7: Adjacent channel interference due to switching transients

Power class	1st Adjacent channels, ± m x 31,25 kHz	2nd Adjacent channels, ± m x 62,5 kHz	3rd Adjacent channels, ± m x 93,75 kHz	4th Adjacent channels and beyond (see note)	Examples
1	-18 dBc	-33 dBc	-46 dBc	-53 dBc	Data terminal type C
8	-18 dBc	-33 dBc	-46 dBc	-53 dBc	Data terminal type A
9	-18 dBc	-33 dBc	-46 dBc	-53 dBc	Data terminal type D
NOTE: This requirement applies to all adjacent channels that are integrally contained in the band that extends from 2 MHz below the lower end of the transmit band to 2 MHz above the upper end of the transmit band.					

6.8 Unwanted emissions

6.8.1 Unwanted emissions in the carrier-on state and carrier-standby state

Terminals with Maximum EIRP less than or equal to 15 dBW shall meet the following requirements:

For an MES in the carrier-on state, or in the carrier-standby state, the maximum EIRP density of the unwanted emissions from the MES outside the band 1 626,5 MHz to 1 660,5 MHz shall not exceed the carrier-on limits defined in table 3 of EN 301 681 [4].

Terminals with Maximum EIRP greater than 15 dBW shall meet the following requirements:

For an MES in the carrier-on state, or in the carrier-standby state, the maximum EIRP density of the unwanted emissions from the MES outside the band 1 626,5 MHz to 1 660,5 MHz shall not exceed the carrier-on limits defined in table 2b of EN 301 444 [7].

6.8.2 Unwanted emissions in the carrier-off state

Terminals with Maximum EIRP less than or equal to 15 dBW shall meet the following requirements:

For an MES in the carrier-off state, the maximum EIRP density of the unwanted emissions from the MES shall not exceed the carrier-off limits defined in table 5 of EN 301 681 [4].

Terminals with Maximum EIRP greater than 15 dBW shall meet the following requirements:

For an MES in the carrier-off state, the maximum EIRP density of the unwanted emissions from the MES shall not exceed the carrier-off limits defined in table 2b of EN 301 444 [7]. In addition, the EIRP in any 3 kHz band within the 1 626,5 MHz to 1 660,5 MHz band shall not exceed -63 dBW.

7 Receiver characteristics

7.1 Receive antenna pattern

Same as clause 7.1 in GMR-1 05.005 [5] with the following addition:

The antennas for the various packet terminals have the following gains when fully deployed and with no conduction objects in the vicinity of the MES antenna:

Table 7.1: Receive Antenna Gain

Terminal type	Antenna gain
Data terminal type A	12,0 dBi
Data terminal type C	Same as handheld MES. See GMR-1 05.005 [5].
Data terminal type D	8,5 dBi
Data terminal type D (see note)	15,0 dBi
NOTE: With passive external antenna.	

For terminal types A and C, and terminal type D with passive external antenna, the axial ratio of radiated wave over the operational frequency range shall be better than 2 dB at boresight and better than 5 dB over the 3 dB coverage of the antenna.

For terminal type D with internal antenna or active external antenna, the axial ratio of radiated wave over the operational frequency range shall be better than 4 dB at boresight and better than 5 dB over the 3 dB coverage of the antenna.

7.2 Receive polarization

Same as clause 7.2 in GMR-1 05.005 [5].

7.3 Receiver figure of merit

Same as clause 7.3 in GMR-1 05.005 [5] with the following additional text:

The Gain/Temperature (G/T) ratio of the various packet data terminals in the direction of the peak antenna gain under clear sky conditions, with the antenna fully deployed and with no conducting objects in the vicinity of the unit, at 20 °C, will exceed the following G/T values at elevations over 20 degrees.

Table 7.2: Gain/Temperature (G/T) ratio

Terminal type	G/T
Data terminal type A	-16,2 dB/K
Data terminal type C	Same as handheld MES. See GMR-1 05.005 [5]
Data terminal type D	-18,0 dB/K
Data terminal type D (see note)	-18,0 dB/K
NOTE: With external antenna.	

7.4 Receiver sensitivity

Same as clause 7.4 in GMR-1 05.005 [5] with the following additional text:

The receiver sensitivity is defined for the various transmission rates used for the packet services as the maximum power required at the antenna connector to provide the required performance with the nominal antenna.

7.4.1 Receiver BER in static conditions

Same as clause 7.4.1 of GMR-1 05.005 [5] with the following additional text:

Table 7.3a: BER in static conditions

Power Class	C/No at antenna connector (dB/Hz)	G/T (dB/K) (see note 1)	BER	User data rate (kbps) (see note 2)	Convolutional coding constraint length	Coding rate	Examples
1	53,1	-24	$1,0 \times 10^{-6}$	47,2	9	3/5	Data terminal type C, PNB(2,6)
1	54,2	-24	$1,0 \times 10^{-6}$	56,0	9	7/10	Data terminal type C, PNB(2,6)
1	55,4	-24	$1,0 \times 10^{-6}$	64,0	9	4/5	Data terminal type C, PNB(2,6)
8	58,8	-16,2	$1,0 \times 10^{-6}$	116,8	7	3/4	Data terminal type A, PNB(4,3)
8	57,8	-16,2	$1,0 \times 10^{-6}$	97,6	7	5/8	Data terminal type A PNB(4,3)
8	56,2	-16,2	$1,0 \times 10^{-6}$	78,4	7	1/2	Data terminal type A PNB(4,3)
8	59,8	-16,2	$1,0 \times 10^{-6}$	148,8	7	3/4	Data terminal type A PNB(5,3)
8	58,8	-16,2	$1,0 \times 10^{-6}$	124,8	7	5/8	Data terminal type A PNB(5,3)
8	57,2	-16,2	$1,0 \times 10^{-6}$	99,2	7	1/2	Data terminal type A PNB(5,3)
NOTE 1: This G/T value applies for elevations over 20 °. NOTE 2: This includes 16 bits of CRC.							

Table 7.3b: FER in static conditions

Power Class	C/No at antenna connector (dB/Hz)	G/T (dB/K) (see notes 1 and 2)	FER	User data rate (kbps) (see note 3)	FEC/ Modulation	Coding rate	Examples
9	67,06	-18	$1,0 \times 10^{-4}$	444,0	LDPC/ 32 APSK	0,818	Data terminal type D PNB2(5,12)
9	66,13	-18	$1,0 \times 10^{-4}$	415,6	LDPC/ 32 APSK	0,765	Data terminal type D PNB2(5,12)
9	63,96	-18	$1,0 \times 10^{-4}$	355,2	LDPC/ 16 APSK	0,818	Data terminal type D PNB2(5,12)
9	61,75	-18	$1,0 \times 10^{-4}$	296,0	LDPC/ 16 APSK	0,681	Data terminal type D PNB2(5,12)
9	58,68	-18	$1,0 \times 10^{-4}$	199,6	LDPC/ π/4-QPSK	0,919	Data terminal type D PNB2(5,12)
9	56,78	-18	$1,0 \times 10^{-4}$	177,6	LDPC/ π/4-QPSK	0,818	Data terminal type D PNB2(5,12)
9	55,04	-18	$1,0 \times 10^{-4}$	148,0	LDPC/ π/4-CQPSK	0,681	Data terminal type D PNB2(5,12)
9	53,21	-18	$1,0 \times 10^{-4}$	110,4	LDPC/ π/4-CQPSK	0,508	Data terminal type D PNB2(5,12)
9	67,28	-18	$1,0 \times 10^{-4}$	382,4	LDPC/ 32 APSK	0,798	Data terminal type D PNB2(5,3)
9	66,46	-18	$1,0 \times 10^{-4}$	358,4	LDPC/ 32 APSK	0,748	Data terminal type D PNB2(5,3)
9	64,18	-18	$1,0 \times 10^{-4}$	305,6	LDPC/ 16 APSK	0,797	Data terminal type D PNB2(5,3)
9	62,13	-18	$1,0 \times 10^{-4}$	254,4	LDPC/ 16 APSK	0,664	Data terminal type D PNB2(5,3)
9	59,10	-18	$1,0 \times 10^{-4}$	171,2	LDPC/ π/4-QPSK	0,894	Data terminal type D PNB2(5,3)
9	57,28	-18	$1,0 \times 10^{-4}$	152,0	LDPC/ π/4-QPSK	0,793	Data terminal type D PNB2(5,3)
9	55,58	-18	$1,0 \times 10^{-4}$	126,4	LDPC/ π/4-CQPSK	0,660	Data terminal type D PNB2(5,3)
9	53,93	-18	$1,0 \times 10^{-4}$	97,6	LDPC/ π/4-CQPSK	0,509	Data terminal type D PNB2(5,3)

NOTE 1: This G/T value applies for elevations over 20 °.
NOTE 2: With external antenna the G/T is -11 dB/K.
NOTE 3: This includes 8 bits of CRC.

7.4.2 Receiver BER in Rician fading

Same as clause 7.4.2 in GMR-1 05.005 [5].

7.4.3 FER of logical channels

Same as clause 7.4.3 in GMR-1 05.005 [5].

7.4.4 FER of PUI

The Frame Error Rate (FER) of the PUI and extended PUI shall not exceed the values specified in table 7.4 for the given E_s/N_0 values in a static channel. A PUI and extended PUI frame shall be considered to be in error if there are any decoded PUI and extended PUI bits in error. All tests shall be conducted in the steady-state operational conditions (OC_1), defined in clause 5.1 of GMR-1 05.005 [5] under normal environmental conditions. The E_s/N_0 values may be mapped into power levels into the antenna port for each type of MES using the formulas in annex A of GMR-1 05.005 [5].

Table 7.4: PUI and Extended PUI FER Requirement

Power Class	Max. FER Allowed	E_s/N_0 (dB) at input of baseband demodulator
1	0,01 %	3,5
8	0,01 %	3,5
9	0,01 %	2,8

7.5 Receiver selectivity

Receiver selectivity is a measure of a receiver's ability to operate in the presence of a single modulated interferer at some power level and at some defined frequency spacing from the received signal. The interferer will be modulated as defined in GMR-05.004 [2] with random data, and a symbol rate of 23,4 ksym/sec.

Under the interference conditions in table 7.5, the receiver performs as defined in the static sensitivity requirement with 0,5 dB greater signal power.

Table 7.5: Receiver Selectivity Interference Conditions

Case	Interference level relative to sensitivity	Interference frequency offset
1	+ 15 dB	m x 31,25 kHz
2	+ 25 dB	m x 93,75 kHz
3	+ 45 dB	> 500 kHz

where "m" defines the bandwidth of the received signal in units of 31,25 kHz channels.

7.6 Receiver intermodulation

Same as clause 7.6 in GMR-1 05.005 [5].

7.7 Receiver blocking characteristics

Same as clause 7.7 in GMR-1 05.005 [5].

7.8 Receive signal strength

Same as clause 7.8 in GMR-1 05.005 [5].

7.9 Erroneous frame Indication Performance

For an MES receiving a valid PDCH signal with a random USF not equal to an allocated USF, the probability of the MES detecting USF equal to the allocated USF shall not be more than 1e-05. This requirement shall be met for all input Es/No levels up to 3,5 dB.

8 GPS receiver characteristics

Same as clause 8 in GMR-1 05.005 [5].

Annex A (informative): Antenna factor equation

Same as annex A in GMR-1 05.005 [5].

Annex B (normative): Environmental conditions

Same as annex B in GMR-1 05.005 [5].

Annex C (normative): Channel model

Same as annex C in GMR-1 05.005 [5].

Annex D (informative): Derivation of receiver sensitivity specifications

D.1 Introduction

This annex describes the derivation of the sensitivity specifications used elsewhere in the present document. The purpose is to clearly define the meaning of the specification and the calculations used in the derivation.

The system requirements define transmissions at two symbol rates (one for PNB(4,3) and one for PNB(5,3), PNB2(5,3), and PNB2(5,12)) and different coding rates which provide a specification for the E_b/N_o at the input to the demodulator that is required to achieve a Bit Error Rate specification. Calculations have been provided for all combinations of symbol and coding rates.

D.2 Definitions

Three definitions of the receiver sensitivity are defined as follows.

D.2.1 Integral sensitivity

The integral sensitivity is the conducted power collected by the receiver antenna that achieves the desired BER assuming the antenna remains connected to the receiver. The integral sensitivity is specified in dBm.

The integral sensitivity may be considered to be that conducted power incident at the input of the receiver that has been collected by the antenna at the radiated sensitivity specification, considering the performance parameters of the antenna.

The integral sensitivity may be calculated from the definition and specification of G/T. The system noise temperature of the receiver may be calculated from the following formula expressed in logarithmic form:

$$G/T = G - 10\log(T_S)$$

where G/T is specified,

G = Antenna Gain (dBi)

T_s = System Noise Temperature (referred to the antenna connector)

The integral sensitivity is defined as the product of the system noise floor (kT_s) and the required C/N_o.

$$Integral\ Sensitivity = 10\log(kT_S) + (C/N_0)$$

where k is the Boltzman constant (1,38 x 10^{-23} J/K) and (C/N_o) is expressed in logs. The (C/N_o) may then be expanded to give:

$$Integral\ Sensitivity = 10\log(kT_S) + (E_b/N_0) + 10\log(R_b)$$

$$Integral\ Sensitivity = 10\log(kT_S R_b) + (E_b/N_0)$$

where R_b is the bit rate and (E_b/N_o) is expressed in logs.

D.2.2 Radiated sensitivity

The radiated sensitivity is the radiated power flux density incident at the receiver antenna that achieves the desired BER. The radiated sensitivity is specified in dBm/m^2.

The radiated sensitivity is calculated from the integral sensitivity and including the effective area of the receive antenna as follows:

$$Radiated\ Sensitivity = Integral\ Sensitivity - 10\log(A_e)$$

Where A_e is the effective antenna area.

Using the definition of effective antenna area:

$$A_e = \frac{G_l \lambda^2}{4\pi}$$

where G_l is the gain of the antenna relative to an isotropic radiator in linear form, and the formula for integral sensitivity derived above, the Radiated Sensitivity can be expressed as follows:

$$Radiated\ Sensitivity = 10\log\left(\frac{4\pi k T_s R_b}{\lambda^2}\right) + (E_b / N_0) - G$$

where λ is the free space wavelength and G is the gain G_l expressed in logarithmic form (dBi).

D.2.3 Conducted sensitivity

The conducted sensitivity is the conducted power incident at the receiver connector, with the receive antenna disconnected, assuming a signal source at the ambient temperature has been impedance matched (to 50 Ω) to the receiver. The conducted sensitivity is specified in dBm.

The calculation of conducted sensitivity is similar to the integral sensitivity, with a noise temperature that considers the signal source, such that:

$$T_{cond} = T_S - T_{ant} + T_{amb}$$

where, T_{cond} = Noise Temperature of Conducted System (referred to the connector):

T_{ant} = Noise Temperature of Antenna

T_{amb} = Ambient Temperature (e.g. 290 K)

T_s = System Noise Temperature (referred to the antenna connector)

All temperatures are expressed in Kelvin (K).

$$\therefore Conducted\ Sensitivity = 10\log(k T_{cond} R_b) + (E_b / N_0)$$

D.3 Calculated parameters

Table D.3.1 shows the parameters used in the calculations that are common to all modulation rates and coding schemes for terminal type A.

Table D.3.1: Common parameters for terminal type A

Parameter	Symbol	Value	Derivation
G/T	G/T	-16,2 dB/K	The present document
Antenna Gain	G	12 dBi	The present document
Boltzmann Constant	k	1,38 x 10^{-23} J/K	Physical Constant
Free Space Wavelength	λ	0,194m	Calculated using frequency at the centre of the Rx band
Effective Antenna Area	A_e	-13,22 dB m^2	Calculated from antenna gain and wavelength
Antenna Noise Temperature	T_{ant}	150 K	Antenna Specification
System Noise Temperature	T_s	660,7 K	Calculated from G/T and antenna gain
System Noise Floor	$10\log(kT_s)$	-170,4 dBm/Hz	Calculated
Conducted Noise Temperature	T_{cond}	800,7K	Calculated with Tamb at 290 K
Conducted Noise Floor	$10\log(kT_{cond})$	-169,6 dBm/Hz	Calculated

Table D.3.1a shows the parameters used in the calculations that are common to all modulation rates and coding schemes for terminal type C.

Table D.3.1a: Common parameters for terminal type C

Parameter	Symbol	Value	Derivation
G/T	G/T	-24 dB/K	The present document
Antenna Gain	G	3,5 dBi	Antenna Specifications
Boltzmann Constant	k	1,38 x 10^{-23} J/K	Physical Constant
Free Space Wavelength	λ	0,194 m	Calculated using frequency at the centre of the Rx band
Effective Antenna Area	A_e	-21,72 dB m^2	Calculated from antenna gain and wavelength
Antenna Noise Temperature	T_{ant}	150 K	Antenna Specification
System Noise Temperature	T_s	562,34 K	Calculated from G/T and antenna gain
System Noise Floor	$10\log(kT_s)$	-171,1 dBm/Hz	Calculated
Conducted Noise Temperature	T_{cond}	702,34 K	Calculated with T_{amb} at 290 K
Conducted Noise Floor	$10\log(kT_{cond})$	-170,14 dBm/Hz	Calculated

Tables D.3.1b and D.3.1c show the parameters used in the calculations that are common to all modulation rates and coding schemes for terminal type D.

Table D.3.1b: Common parameters for terminal type D (with internal antenna)

Parameter	Symbol	Value	Derivation
G/T	G/T	-18,00 dB/K	The present document
Antenna Gain	G	8,50 dBi	Antenna Specifications
Boltzmann Constant	k	1,38 x 10^{-23} J/K	Physical Constant
Free Space Wavelength	λ	0,194 m	Calculated using frequency at the centre of the Rx band
Effective Antenna Area	A_e	-16,74 dB m^2	Calculated from antenna gain and wavelength
Antenna Noise Temperature	T_{ant}	120,00 K	Antenna Specification
System Noise Temperature	T_s	446,68 K	Calculated from G/T and antenna gain
System Noise Floor	$10log(kT_s)$	-172,10 dBm/Hz	Calculated
Conducted Noise Temperature	T_{cond}	616,68 K	Calculated with T_{amb} at 290 K
Conducted Noise Floor	$10log(kT_{cond})$	-170,70 dBm/Hz	Calculated

Table D.3.1c: Common parameters for terminal type D (with external antenna)

Parameter	Symbol	Value	Derivation
G/T	G/T	-11,00 dB/K	The present document
Antenna Gain	G	15,50 dBi	Antenna Specifications
Boltzmann Constant	k	1,38 x 10^{-23} J/K	Physical Constant
Free Space Wavelength	λ	0,194 m	Calculated using frequency at the centre of the Rx band
Effective Antenna Area	A_e	-9,74 dB m^2	Calculated from antenna gain and wavelength
Antenna Noise Temperature	T_{ant}	120,00 K	Antenna Specification
System Noise Temperature	T_s	446,68 K	Calculated from G/T and antenna gain
System Noise Floor	$10log(kT_s)$	-172,10 dBm/Hz	Calculated
Conducted Noise Temperature	T_{cond}	616,68 K	Calculated with T_{amb} at 290 K
Conducted Noise Floor	$10log(kT_{cond})$	-170,70 dBm/Hz	Calculated

The following tables present the specifications for each transmitted symbol rate in turn.

Table D.3.2: Void

Table D.3.3: PNB(2,6)

Number of channels	2		
Transmission Symbol Rate (sps)	46 800		
Coding Rate (K = 9)	4/5	7/10	3/5
Target E_b/N_o for 10^{-6} BER (dB)	5,7	4,5	3,4
C/N_0 (dB)	55,4	54,2	53,1
Integral Sensitivity (dBm)	-115,7	-116,9	-118,0
Radiated Sensitivity (dBm/m^2)	-94,0	-95,2	-96,3
Conducted Sensitivity (dBm)	-114,8	-116,0	-117,1

Table D.3.4: Void

Table D.3.5: PNB(4,3)

Number Of Channels	4		
Transmission Symbol Rate (sps)	93 600		
Coding Rate (K = 7)	3/4	5/8	1/2
Target E_b/N_o for 10^{-6} BER (dB)	6,1	5,1	3,5
C/N_0 (dB)	58,8	57,8	56,2
Integral Sensitivity (dBm)	-111,6	-112,6	-114,2
Radiated Sensitivity (dBm/m^2)	-98,4	-99,4	-101,0
Conducted Sensitivity (dBm)	-110,7	-111,7	-113,3

Table D.3.6: PNB(5,3)

Number Of Channels	5		
Transmission Symbol Rate (sps)	117 000		
Coding Rate (K = 7)	3/4	5/8	1/2
Target E_b/N_o for 10^{-6} BER (dB)	6,1	5,1	3,5
C/N_0 (dB)	59,8	58,8	57,2
Integral Sensitivity (dBm)	-110,6	-111,6	-113,2
Radiated Sensitivity (dBm/m^2)	-97,4	-98,4	-100,0
Conducted Sensitivity (dBm)	-109,8	-110,8	-112,4

Table D.3.7a: PNB2(5,12) - π/4-QPSK, with internal antenna

Number Of Channels	5			
Transmission Symbol Rate (sps)	117 000			
Coding Rate	0,919	0,818	0,681	0,508
Target E_b/N_o for 10^{-4} FER (dB)	4,99	3,09	1,35	-0,48
C/N_0 (dB)	58,68	56,78	55,04	53,21
Integral Sensitivity (dBm)	-113,42	-115,32	-117,06	-118,89
Radiated Sensitivity (dBm/m^2)	-96,68	-98,58	-100,32	-102,15
Conducted Sensitivity (dBm)	-112,02	-113,92	-115,66	-117,49

Table D.3.7b: PNB2(5,12) - π/4-QPSK, with external antenna

Number Of Channels	5			
Transmission Symbol Rate (sps)	117 000			
Coding Rate	0,919	0,818	0,681	0,508
Target E_b/N_o for 10^{-4} FER (dB)	4,99	3,09	1,35	-0,48
C/N_0 (dB)	58,68	56,78	55,04	53,21
Integral Sensitivity (dBm)	-113,42	-115,32	-117,06	-118,89
Radiated Sensitivity (dBm/m^2)	-89,68	-91,58	-93,32	-95,15
Conducted Sensitivity (dBm)	-112,02	-113,92	-115,66	-117,49

Table D.3.8a: PNB2(5,12) - 16APSK, with internal antenna

Number Of Channels	5	
Transmission Symbol Rate (sps)	117 000	
Coding Rate	0,818	0,681
Target E_b/N_o for 10^{-4} FER (dB)	7,26	5,04
C/N_0 (dB)	63,96	61,74
Integral Sensitivity (dBm)	-108,14	-110,36
Radiated Sensitivity (dBm/m^2)	-91,40	-93,62
Conducted Sensitivity (dBm)	-106,74	-108,96

Table D.3.8b: PNB2(5,12) - 16APSK, with external antenna

Number Of Channels	5	
Transmission Symbol Rate (sps)	117 000	
Coding Rate	0,818	0,681
Target E_b/N_o for 10^{-4} FER (dB)	7,26	5,04
C/N_0 (dB)	63,96	61,74
Integral Sensitivity (dBm)	-108,14	-110,36
Radiated Sensitivity (dBm/m^2)	-84,40	-86,62
Conducted Sensitivity (dBm)	-106,74	-108,96

Table D.3.9a: PNB2(5,12) - 32APSK, with internal antenna

Number Of Channels	5	
Transmission Symbol Rate (sps)	117 000	
Coding Rate	0,818	0,765
Target E_b/N_o for 10^{-4} FER (dB)	7,26	5,04
C/N_0 (dB)	63,96	61,74
Integral Sensitivity (dBm)	-108,14	-110,36
Radiated Sensitivity (dBm/m^2)	-91,40	-93,62
Conducted Sensitivity (dBm)	-106,74	-108,96

Table D.3.9b: PNB2(5,12) - 32APSK, with external antenna

Number Of Channels	5	
Transmission Symbol Rate (sps)	117 000	
Coding Rate	0,818	0,765
Target E_b/N_o for 10^{-4} FER (dB)	9,39	8,46
C/N_0 (dB)	67,06	66,13
Integral Sensitivity (dBm)	-105,0	-105,97
Radiated Sensitivity (dBm/m^2)	-81,30	-82,23
Conducted Sensitivity (dBm)	-103,64	-104,57

Table D.3.10a: PNB2(5,3) - π/4-QPSK, with internal antenna

Number Of Channels	5			
Transmission Symbol Rate (sps)	117 000			
Coding Rate	0,894	0,793	0,660	0,509
Target E_b/N_o for 10^{-4} FER (dB)	5,41	3,59	1,89	0,24
C/N_0 (dB)	59,10	57,28	55,58	53,93
Integral Sensitivity (dBm)	-113,00	-114,82	-116,52	-118,17
Radiated Sensitivity (dBm/m^2)	-96,26	-98,08	-99,78	-101,43
Conducted Sensitivity (dBm)	-111,60	-113,42	-115,12	-116,77

Table D.3.10b: PNB2(5,3) - π/4-QPSK, with external antenna

Number Of Channels	5			
Transmission Symbol Rate (sps)	117 000			
Coding Rate	0,894	0,793	0,660	0,509
Target E_b/N_o for 10^{-4} FER (dB)	5,41	3,59	1,89	0,24
C/N_0 (dB)	59,10	57,28	55,58	53,93
Integral Sensitivity (dBm)	-113,00	-114,82	-116,52	-118,17
Radiated Sensitivity (dBm/m^2)	-89,26	-91,08	-92,78	-94,43
Conducted Sensitivity (dBm)	-111,60	-113,42	-115,12	-116,77

Table D.3.11a: PNB2(5,3) - 16APSK, with internal antenna

Number Of Channels	5	
Transmission Symbol Rate (sps)	117 000	
Coding Rate	0,797	0,664
Target E_b/N_o for 10^{-4} FER (dB)	7,48	8,44
C/N_0 (dB)	64,18	65,14
Integral Sensitivity (dBm)	-107,92	-106,96
Radiated Sensitivity (dBm/m^2)	-91,18	-90,22
Conducted Sensitivity (dBm)	-106,52	-105,56

Table D.3.11b: PNB2(5,3) - 16APSK, with external antenna

Number Of Channels	5	
Transmission Symbol Rate (sps)	117 000	
Coding Rate	0,797	0,664
Target E_b/N_o for 10^{-4} FER (dB)	7,48	8,44
C/N_0 (dB)	64,18	65,14
Integral Sensitivity (dBm)	-107,92	-106,96
Radiated Sensitivity (dBm/m^2)	-84,18	-83,22
Conducted Sensitivity (dBm)	-106,52	-105,56

Table D.3.12a: PNB2(5,3) - 32APSK, with internal antenna

Number Of Channels	5	
Transmission Symbol Rate (sps)	117 000	
Coding Rate	0,798	0,748
Target E_b/N_o for 10^{-4} FER (dB)	9,61	8,79
C/N_0 (dB)	67,28	66,46
Integral Sensitivity (dBm)	-104,82	-105,64
Radiated Sensitivity (dBm/m^2)	-88,08	-88,90
Conducted Sensitivity (dBm)	-103,42	-104,24

Table D.3.12b: PNB2(5,3) - 32APSK, with external antenna

Number Of Channels	5	
Transmission Symbol Rate (sps)	117 000	
Coding Rate	0,798	0,748
Target E_b/N_o for 10^{-4} FER (dB)	9,61	8,79
C/N_0 (dB)	67,28	66,46
Integral Sensitivity (dBm)	-104,82	-105,64
Radiated Sensitivity (dBm/m^2)	-81,08	-81,90
Conducted Sensitivity (dBm)	-103,42	-104,24

Annex E (informative): Bibliography

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