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Railway Telecommunications (RT);
GSM-R improved receiver parameters;
Part 1: Requirements for radio reception

Reference

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Keywords

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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Railway Telecommunications (RT).

The present document is part 1 of a multi-part deliverable covering the Railway Telecommunications (RT); GSM-R improved receiver parameters, as identified below:

Part 1: "Requirements for radio reception";

Part 2: "Radio conformance testing".

Modal verbs terminology

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

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Introduction

The present document is adding the requirements for the 2 Watt professional small mobile stations (OPH and OPS) for the pan-European digital cellular telecommunication system R-GSM/ER-GSM. The requirements already defined in the previous version 1.3.1 for the receiver of professional mobile station 8 Watt (cab radio and EDOR) are kept unchanged.

1 Scope

The present document defines the Radio Frequency requirements specific for the professional Mobile Station. The measurement methods are specified in ETSI TS 102 933-2 [5] and ETSI TS 100 607-1 [2].

Requirements are defined for two categories of parameters:

- Those that are required to provide compatibility between the radio channels, connected either to separate or common antennas, that 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 reception requirements for all types of professional MS.

MSs may operate on more than one of the frequency bands specified in clause 4. These MSs, defined in ETSI EN 300 919 [1], are referred to as "Multi band MSs" in the present document.

2 References

2.1 Normative references

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

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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

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

[1] ETSI EN 300 919: "Digital cellular telecommunications system (Phase 2+) (GSM); Types of Mobile Stations (MS) (GSM 02.06)".

[2] ETSI TS 100 607-1: "Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification (3GPP 11.10-1 Release 1999)".

[3] CENELEC EN 50155:2007: "Railway applications - Electronic equipment used on rolling stock".

[4] ETSI TS 100 910: "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (3GPP TS 05.05 Release 1999)".

[5] ETSI TS 102 933-2: "Railway Telecommunications (RT); GSM-R improved receiver parameters; Part 2: Radio conformance testing".

[6] UIC Project EIRENE (European Integrated Railway Radio Enhanced Network): "System Requirements Specification".

[7] ETSI TS 100 911: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (3GPP TS 05.08)".

[8] ETSI TS 101 349: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol (3GPP TS 04.60)".

[9] Void.

[10] ETSI TS 136 141: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing (3GPP TS 36.141)".

2.2 Informative references

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

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

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

[i.1] ETSI TR 101 748: "Digital cellular telecommunications system (Phase 2+) (GSM); Abbreviations and acronyms (GSM 01.04)".

3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TR 101 748 [i.1] and the following apply:

EDOR	ETCS Data Only Radio
ETCS	European Train Control System
OPH	Operational Purpose Handheld
OPS	Operational Purpose Handheld for Shunting

4 Frequency bands and channel arrangement

a) Railways GSM 900 Band, R-GSM (includes Standard and Extended GSM 900 Band):

- for Railways GSM 900 band, the system is required to operate in the following frequency band:
  - 876 MHz to 915 MHz: mobile transmit, base receive;
  - 921 MHz to 960 MHz: base transmit, mobile receive.

b) Extended Railways GSM 900 Band, ER-GSM (includes Standard and Extended GSM 900 Band):

- for Railways GSM 900 band, the system is required to operate in the following frequency band:
  - 873 MHz to 915 MHz: mobile transmit, base receive;
  - 918 MHz to 960 MHz: base transmit, mobile receive.

NOTE 1: The term GSM 900 is used for any GSM system, which operates in any 900 MHz band.

NOTE 2: The BTS may cover a complete band, or the BTS capabilities may be restricted to a subset only, depending on the operators needs.

The carrier spacing is 200 kHz.

The carrier frequency is designated by the absolute radio frequency channel number (ARFCN). For each carrier ARFCN, the corresponding frequency value in the lower band (Fl(n)) and in the upper band (Fu(n) are defined below.

Table 0

Band	Frequency value of the carrier ARFCN in the lower band	Frequency channel number (ARFCN)	Frequency value of the carrier ARFCN in the upper band
R-GSM 900	Fl(n) = 890 + 0,2 × n Fl(n) = 890 + 0,2 × (n - 1 024)	0 ≤ n ≤ 124 955 ≤ n ≤ 974	Fu(n) = Fl(n) + 45
ER-GSM 900	Fl(n) = 890 + 0,2 × n Fl(n) = 890 + 0,2 × (n - 1 024)	0 ≤ n ≤ 124 940 ≤ n ≤ 974	Fu(n) = Fl(n) + 45
NOTE: Frequencies are in MHz.			

5 Transmitter characteristics for 8 Watt mobiles

5.0 General provisions

Throughout this clause, unless otherwise stated, requirements are given in terms of power levels at the antenna connector of the equipment. For equipment with integral antenna only, a reference antenna with 0 dBi gain shall be assumed.

For GMSK modulation, the term output power refers to the measure of the power when averaged over the useful part of the burst.

For 8-PSK modulation, the term output power refers to a measure that, with sufficient accuracy, is equivalent to the long term average of the power when taken over the useful part of the burst for random data.

The term peak hold refers to a measurement where the maximum is taken over a sufficient time that the level would not significantly increase if the holding time were longer.

Unless otherwise specified, the common rules of ETSI TS 100 607-1 [2] shall be applied.

5.1 Output power

5.1.1 Mobile Station

The MS maximum output power and lowest power control level shall be, according to its class (as specified in ETSI EN 300 919 [1]), as defined in tables 1 and 2 .

For GMSK modulation:

Table 1

Power class	ER-GSM/R-GSM Nominal Maximum output	Tolerance (dB) for conditions	
	Power	Normal	Extreme
2	8 W (39 dBm)	±2	±2,5

For 8-PSK modulation (optional):

Table 2

Power class	ER-GSM/R-GSM Nominal Maximum output	ER-GSM/R-GSM Tolerance (dB) for conditions	
	Power	Normal	Extreme
E1	33 dBm	±2	±2,5

Maximum output power for 8-PSK in any one band is always equal to or less than GMSK maximum output power for the same equipment in the same band.

The different power control levels as defined in ETSI TS 100 911 [7] needed for adaptive power control shall have the nominal output power as defined in table 3, starting from the power control level for the lowest nominal output power up to the power control level for the maximum nominal output power corresponding to the class of the particular MS as defined in tables 1 and 2. Whenever a power control level commands the MS to use a nominal output power equal to or greater than the maximum nominal output power for the power class of the MS, the nominal output power transmitted shall be the maximum nominal output power for the MS class, and the tolerance specified for that class (see tables 1 and 2) shall apply.

Table 3

ER-GSM/R-GSM			
Power control level	Nominal Output power (dBm)	Tolerance (dB) for conditions	
		Normal	Extreme
0 to 2	39	±2	±2,5
3	37	±3	±4
4	35	±3	±4
5	33	±3	±4
6	31	±3	±4
7	29	±3	±4
8	27	±3	±4
9	25	±3	±4
10	23	±3	±4
11	21	±3	±4
12	19	±3	±4
13	17	±3	±4
14	15	±3	±4
15	13	±3	±4
16	11	±5	±6
17	9	±5	±6
18	7	±5	±6
19 to 31	5	±5	±6

Furthermore, the difference in output power actually transmitted by the MS between two power control levels where the difference in nominal output power indicates an increase of 2 dB (taking into account the restrictions due to power class), shall be +2 ± 1,5 dB. Similarly, if the difference in output power actually transmitted by the MS between two power control levels where the difference in nominal output power indicates an decrease of 2 dB (taking into account the restrictions due to power class), shall be -2 ± 1,5 dB.

NOTE: A 2 dB nominal difference in output power can exist for non-adjacent power control levels e.g. power control levels 18 and 22.

A change from any power control level to any power control level may be required by the base transmitter. The maximum time to execute this change is specified in ETSI TS 100 911 [7].

In order to manage mobile terminal heat dissipation resulting from transmission on multiple uplink timeslots, the mobile station shall reduce its maximum output power by the following values on a per-assignment basis.

Table 4

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power, (dB)
1	0
2	0 to 3,0
3	1,8 to 4,8
4	3,0 to 6,0

The supported maximum output power for each number of uplink timeslots shall form a monotonic sequence. The maximum reduction of maximum output power from an allocation of n uplink timeslots to an allocation of n+1 uplink timeslots shall be equal to the difference of maximum permissible nominal reduction of maximum output power for the corresponding number of timeslots, as defined in table 4.

As an exception, in case of a multislot uplink assignment, the first power control step down from the maximum output power is allowed to be in the range 0 dB to 2 dB.

In case the MS transmits on more uplink slots than assigned (e.g. due to a polling response) MS may reduce uplink power as above for a multislot uplink configuration but as a function of the number of active uplink slots on a TDMA frame basis as specified in ETSI TS 101 349 [8].

6 Transmitter characteristics for 2 Watt mobiles

6.0 General provisions

Throughout this clause, unless otherwise stated, requirements are given in terms of power levels at the antenna connector of the equipment. For equipment with integral antenna only, a reference antenna with 0 dBi gain shall be assumed.

For GMSK modulation, the term output power refers to the measure of the power when averaged over the useful part of the burst.

For 8-PSK modulation, the term output power refers to a measure that, with sufficient accuracy, is equivalent to the long term average of the power when taken over the useful part of the burst for random data.

The term peak hold refers to a measurement where the maximum is taken over a sufficient time that the level would not significantly increase if the holding time were longer.

Unless otherwise specified, the common rules of ETSI TS 100 607-1 [2] shall be applied.

6.1 Output power

6.1.1 Mobile Station

The MS maximum output power and lowest power control level shall be, according to its class (as specified in ETSI EN 300 919 [1]), as defined in tables 5 and 6.

For GMSK modulation:

Table 5

Power class	ER-GSM/R-GSM Nominal Maximum output	Tolerance (dB) for conditions	
	Power	Normal	Extreme
4	2 W (33 dBm)	±2	±2,5

For 8-PSK modulation (optional):

Table 6

Power class	ER-GSM/R-GSM Nominal Maximum output	ER-GSM/R-GSM Tolerance (dB) for conditions	
	Power	Normal	Extreme
E2	27 dBm	±3	±4

Due to the 8-PSK modulation scheme and its resulting high peak-to-average ratio the maximum output power for the 8-PSK in any one band shall be always less than the GMSK maximum output power for the same equipment in the same band.

The different power control levels as defined in ETSI TS 100 911 [7] needed for adaptive power control shall have the nominal output power as defined in table 7, starting from the power control level for the lowest nominal output power up to the power control level for the maximum nominal output power corresponding to the class of the particular MS as defined in tables 5 and 6. Whenever a power control level commands the MS to use a nominal output power equal to or greater than the maximum nominal output power for the power class of the MS, the nominal output power transmitted shall be the maximum nominal output power for the MS class, and the tolerance specified for that class (see tables 5 and 6) shall apply.