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Evropski digitalni celiļ ni telekomunikacijski sistem (faza 2) ï Radijsko oddajanje in sprejemanje (GSM 05.05)

European digital cellular telecommunications system (Phase 2); Radio transmission and reception (GSM 05.05)

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Special Mobile Group (SMG) Technical Committee (TC) of the European Telecommunications Standards Institute (ETSI).

This ETS defines the requirements for transceivers operating in the 900 MHz and 1800 MHz bands within the European digital cellular telecommunications system (Phase 2).

This ETS correspond to GSM technical specification, GSM 05.05 version 4.10.0.

The specification from which this ETS has been derived was originally based on CEPT documentation, hence the presentation of this ETS may not be entirely in accordance with the ETSI/PNE rules.

Reference is made within this ETS to GSM Technical Specifications (GSM-TSs) (NOTE).

NOTE: TC-SMG has produced documents which give the technical specifications for the implementation of the European digital cellular telecommunications system. Historically, these documents have been identified as GSM Technical Specifications (GSM-TSs). These TSs may have subsequently become I-ETSs (Phase 1), or ETSs (Phase 2), whilst others may become ETSI Technical Reports (ETRs). GSM-TSs are, for editorial reasons, still referred to in GSM ETSs.

Proposed transposition dates	
Date of adoption of this ETS:	30 July 1995
Date of latest announcement of this ETS (doa):	31 October 1995
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1.1 Scope

This standard defines the requirements for the transceiver of the pan-european digital mobile cellular and personal communication systems operating in the 900 MHz and 1800 MHz band (GSM 900 and DCS 1800).

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 transmission quality of the system.

This standard defines RF characteristics for the mobile station (MS) and base station system (BSS). The BSS will contain either base transceiver stations (BTS) or microcell base transceiver stations (micro-BTS). The precise measurement methods are specified in GSM 11.10 and 11.20.

Unless otherwise stated, the requirements defined in this standard apply to the full range of environmental conditions specified for the equipment (see Annex D).

In this standard some relaxations are introduced for GSM 900 mobile stations which fulfill the following conditions:

- pertain to power class 4 or 5 (see section 4.1.1);
- have a total weight less than 200 g (excluding battery);
- have a volume less than 500 cm^3 (excluding battery).

In this standard these mobile stations are referred to as "small MS".

The RF characteristics of repeaters are defined in Annex E of this standard. Annex D and E are the only sections of this standard applicable to repeaters. Annex E does not apply to the MS or BSS.

1.2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] GSM 01.04 (ETR 100): "European digital cellular telecommunication system (Phase 2); Definitions, abbreviations and acronyms".

[2] GSM 02.06 (ETS 300 504): "European digital cellular telecommunication system (Phase 2); Types of Mobile Stations (MS)".

[3] GSM 05.01 (ETS 300 573): "European digital cellular telecommunication system (Phase 2); Physical layer on the radio path General description".

[4] GSM 05.04 (ETS 300 576): "European digital cellular telecommunication system (Phase 2); Modulation".

[5] GSM 05.08 (ETS 300 578): "European digital cellular telecommunication system (Phase 2); Radio subsystem link control".

[6] GSM 05.10 (ETS 300 579): "European digital cellular telecommunication system (Phase 2); Radio subsystem synchronisation".

[7] GSM 11.10 (ETS 300 607): "European digital cellular telecommunication system (Phase 2); Mobile Station (MS) conformity specification".

[8] GSM 11.11 (ETS 300 608): "European digital cellular telecommunication system (Phase 2); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[9] CCITT Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".

[10] ETS 300 019-1-3: "Equipment engineering; Environmental conditions and Environmental tests for telecommunications equipment Part 1-3: Classification of Environmental conditions Stationary use at weather protected locations".

[11] ETS 300 019-1-4: "Equipment engineering; Environmental conditions and Environmental tests for telecommunications equipment Part 1-4: Classification of Environmental conditions Stationary use at non-weather protected locations".

1.3 Definitions and abbreviations

Definitions and abbreviations used in this specification are listed in GSM 01.04.

2 Frequency bands and channel arrangement

For GSM 900, the system is required to operate, at least, in the following frequency band (primary band P-GSM 900):

890 - 915 MHz : mobile transmit, base receive
935 - 960 MHz : base transmit, mobile receive

For DCS 1800, the system is required to operate in the following frequency band:

1710 - 1785 MHz : mobile transmit, base receive
1805 - 1880 MHz : base transmit, mobile receive

Furthermore, in some countries, GSM 900 is allowed to operate in part of all of the following extension band G1:

880 - 890 MHz : mobile transmit, base receive
925 - 935 MHz : base transmit, mobile receive

The carrier spacing is 200 kHz.

NOTE: The term GSM 900 is used for any GSM system which operates in any 900 MHz band. P-GSM 900 band is the primary band for GSM 900. E-GSM 900 band includes the primary band (P-GSM 900) and the extension band (G1).

The carrier frequency is designated by the absolute radio frequency channel number (ARFCN). If we call Fl(n) the frequency value of the carrier n in the lower band, and Fu(n) the corresponding frequency value in the upper band, we have:

P-GSM 900	Fl(n) = 890 + 0.2*n	$1 \leq n \leq 124$	Fu(n) = Fl(n) + 45
E-GSM 900	Fl(n) = 890 + 0.2*n Fl(n) = 890 + 0.2*(n-1024)	$0 \leq n \leq 124$ $975 \leq n \leq 1023$	Fu(n) = Fl(n) + 45
DCS 1800	Fl(n) = 1710.2 + 0.2*(n-512)	$512 \leq n \leq 885$	Fu(n) = Fl(n) + 95

Frequencies are in MHz

3 Reference configuration

The reference configuration for the radio subsystem is described in GSM 05.01.

The micro-BTS is different from a normal BTS in two ways. Firstly, the range requirements are much reduced whilst the close proximity requirements are more stringent. Secondly, the micro-BTS is required to be small and cheap to allow external street deployment in large numbers. Because of these differences the micro-BTS needs a different set of RF parameters to be specified. Where the RF parameters are not different for the micro-BTS the normal BTS parameters shall apply.

4 Transmitter characteristics

Throughout this section, 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.

The term output power refers to the measure of the power when averaged over the useful part of the burst (see Annex B).

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.

4.1 Output power

4.1.1 Mobile station

The mobile station maximum output power and lowest power control level shall be, according to its class, as defined in the following table (see also GSM 02.06).

Power class	GSM 900 Maximum output power	DCS 1800 Maximum output power	Tolerance (dB) for conditions normal	extreme
1		1 W (30 dBm)	± 2	± 2.5
2	8 W (39 dBm)	0.25 W (24 dBm)	± 2	± 2.5
3	5 W (37 dBm)		± 2	± 2.5
4	2 W (33 dBm)		± 2	± 2.5
5	0.8 W (29 dBm)		± 2	± 2.5

NOTE: The lowest power control level for all classes of GSM 900 MS is 19 and for all classes of DCS 1800 MS is 15.

The different power levels needed for adaptive power control (see GSM 05.08) shall have the nominal output power as defined in the table below, starting from the lowest power control level up to the maximum output power corresponding to the class of the particular mobile station. Whenever a power control level corresponds to the power class of the MS, the tolerance of ±2 or 2.5 dB (see above) shall apply.

GSM 900

Power control level	Output power (dBm)	Tolerance (dB) for conditions normal	extreme
0	-	- -	- -
1	-	- -	- -
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	5	± 5	± 6

DCS 1800

Power control level	Output power (dBm)	Tolerance (dB) for conditions normal	extreme
29	36	± 2	± 2.5
30	34	± 3	± 4
31	32	± 3	± 4
0	30	± 3	± 4
1	28	± 3	± 4
2	26	± 3	± 4
3	24	± 3	± 4
4	22	± 3	± 4
5	20	± 3	± 4
6	18	± 3	± 4
7	16	± 3	± 4
8	14	± 3	± 4
9	12	± 4	± 5
10	10	± 4	± 5
11	8	± 4	± 5
12	6	± 4	± 5
13	4	± 4	± 5
14	2	± 5	± 6
15	0	± 5	± 6

Furthermore the output power actually transmitted by the MS at each of the power control levels shall form a monotonic sequence, and the interval between power steps shall be 2 ± 1.5 dB.

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 GSM 05.08.

4.1.2 Base station

The base station transmitter maximum output power, measured at the input of the BSS Tx combiner, shall be, according to its class, as defined in the following table:

GSM 900

TRX power class	Maximum output power
1	320 - (<640) W
2	160 - (<320) W
3	80 - (<160) W
4	40 - (<80) W
5	20 - (<40) W
6	10 - (<20) W
7	5 - (<10) W
8	2.5 - (<5) W

DCS 1800

TRX power class	Maximum output power
1	20 - (<40) W
2	10 - (<20) W
3	5 - (<10) W
4	2.5 - (<5) W

The micro-BTS maximum output power per carrier measured at the antenna connector after all stages of combining shall be, according to its class, defined in the following table.

GSM 900 micro-BTS			DCS 1800 micro-BTS		
TRX power class	Maximum output power		TRX power class	Maximum output power	
M1	(>19) - 24 dBm	((>0.08) - 0.25 W)	M1	(>27) - 32 dBm	((>0.5) - 1.6 W)
M2	(>14) - 19 dBm	((>0.03) - 0.08 W)	M2	(>22) - 27 dBm	((>0.16) - 0.5 W)
M3	(>9) - 14 dBm	((>0.01) - 0.03 W)	M3	(>17) - 22 dBm	((>0.05) - 0.16 W)

The tolerance of the actual maximum output power of the BTS shall be ±2 dB under normal conditions and ±2.5 dB under extreme conditions. Settings shall be provided to allow the output power to be reduced from its maximum level in at least six steps of nominally 2 dB with an accuracy of ±1 dB to allow a fine adjustment of the coverage by the network operator. In addition, the actual absolute output power at each static RF power step (N) shall be 2*N dB below the absolute output power at static RF power step 0 with a tolerance of ±3 dB under normal conditions and ±4dB under extreme conditions. The static RF power step 0 shall be the actual output power according to the TRX power class.

As an option the BSS can utilise downlink RF power control. In addition to the static RF power steps described above, the BSS may then utilise up to 15 steps of power control levels with a step size of 2 dB ±1.5 dB, in addition the actual absolute output power at each power control level (N) shall be 2*N dB below the absolute output power at power control level 0 with a tolerance of ±3 dB under normal conditions and ±4 dB under extreme conditions. The power control level 0 shall be the set output power according to the TRX power class and the six power settings defined above.

Network operators may also specify the BTS output power including any Tx combiner, according to their needs.

4.2 Output RF spectrum

The specifications contained in this section apply to both BTS and MS, in frequency hopping as well as in non frequency hopping mode, except that beyond 1800 kHz offset from the carrier the BTS is not tested in frequency hopping mode.

Due to the bursty nature of the signal, the output RF spectrum results from two effects:

- the modulation process;

- the power ramping up and down (switching transients).

The two effects are specified separately; the measurement method used to analyze separately those two effects is specified in GSM 11.10 and 11.20. It is based on the "ringing effect" during the transients, and is a measurement in the time domain, at each point in frequency.

The limits specified hereunder are based on a 5-pole synchronously tuned measurement filter.

Unless otherwise stated, for the BTS, only one transmitter is active for the tests of this section.

4.2.1 Spectrum due to the modulation and wide band noise

The output RF modulation spectrum is specified in the following table. A mask representation of this specification is shown in annex A. This mask applies for all RF channels mentioned in section 2.

The specification applies to the entire of the relevant transmit band and up to 2 MHz either side.

The figures in the table below, at the listed frequencies from the carrier (kHz), are the maximum level (dB) relative to a measurement in 30 kHz on the carrier.