
**Elektromagnetna združljivost (EMC) in zadeve v zvezi z radijskim spektrom (ERM) -
Elektromagnetna združljivost (EMC) evropskih digitalnih celičnih
telekomunikacijskih sistemov (GSM 900 MHz in DCS 1 800 MHz) - 1. del: Mobilna in
prenosna radijska in pomožna oprema**

Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) for
European digitalcellular telecommunications system (GSM 900 MHz and DCS 1 800
MHz); Part 1: Mobile and portable radio and ancillary equipment

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ETSI

Postal address

F-06921 Sophia Antipolis Cedex - FRANCE

Office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE

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

Siret N° 348 623 562 00017 - NAF 742 C

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Internet

secretariat@etsi.fr

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document has been produced by ETSI in response to a mandate from the European Commission issued under the Council Directive 98/34/EC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulation.

The present document is intended to become a Harmonized EMC Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility (the "EMC Directive" 89/336/EEC [22] as amended).

Technical specifications relevant to the EMC Directive are given in annex A.

The present document is part 1 of a multi-part EN covering Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) for European digital cellular radio telecommunications systems (GSM 900 MHz and DCS 1 800 MHz), as identified below:

- Part 1: "Mobile and portable radio and ancillary equipment";**
- Part 2: "Base station radio and ancillary equipment" (ETS 300 342-2 [24]);
- Part 3: "Base station radio and ancillary equipment and repeaters meeting Phase 2 GSM requirements" (ETS 300 342-3 [25]).

The present document is based upon the Generic Standards EN 50081-1 [1] and EN 50082-1 [2] and other standards, where appropriate, to meet the essential requirements of Council Directive 89/336/EEC [22].

For equipment which can be connected to the AC main supply, the requirements of EN 61000-3-2 [17] and EN 61000-3-3 [18] apply where appropriate from 2001-1-1.

Proposed national transposition dates

Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	36 months after doa

1 Scope

The present document covers the assessment of radio communications and ancillary equipment in respect of Electromagnetic Compatibility (EMC).

Technical specifications related to the antenna port and emissions from the enclosure port of radio equipment are found in the related product standards for the effective use of the radio spectrum.

The present document specifies the applicable EMC tests, the methods of measurement, the frequency range, the limits and the minimum performance criteria for Phase 1, Phase 2, and Phase 2+ GSM 900 MHz and DCS 1 800 MHz digital cellular mobile and portable radio equipment, transmitting and receiving speech and/or data, and the associated ancillary equipment.

Base station equipment operating within network infrastructure is outside the scope of the present document. However, the present document does cover mobile and portable equipment that is intended to be operated in a fixed location while connected to the AC mains.

The environment classification used in the present document refers to the environment classification used in the Generic Standards EN 50081-1 [1], EN 50082-1 [2], except the vehicular environment class which refers to ISO 7637-1 [3] and ISO 7637-2 [4].

The EMC requirements have been selected to ensure an adequate level of compatibility for apparatus in residential, commercial, light industrial and vehicular environments. The levels however, do not cover extreme cases which may occur in any location but with low probability of occurrence.

The present document may not cover those cases where a potential source of interference which is producing individually repeated transient phenomena, or a continuous phenomena, is permanently present, e.g. a radar or broadcast site in the near vicinity. In such a case it may be necessary to use special protection applied to either the source of interference or the interfered part or both.

Compliance of radio equipment to the requirements of the present document does not signify compliance to any requirement related to the use of the equipment (i.e. licensing requirements).

Compliance to the requirements of the present document does not signify compliance to any safety requirement. However, it is the responsibility of the assessor of the equipment that any observation regarding the equipment becoming dangerous or unsafe as a result of the application of the tests called for in the present document should be recorded in the test report.

The present document is based on the considerations and guidance given in ETR 238 [21].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] EN 50081-1 (1992): "Electromagnetic compatibility - Generic emission standard. Part 1: Residential, commercial and light industry".

[2] EN 50082-1 (1997): "Electromagnetic compatibility - Generic immunity standard. Part 1: Residential, commercial and light industry".

- [3] ISO 7637-1 (1990): "Road vehicles - Electrical disturbance by conduction and coupling - Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage - Electrical transient conduction along supply lines only".
- [4] ISO 7637-2 (1990): "Road vehicles - Electrical disturbance by conduction and coupling - Part 2: Commercial vehicles with nominal 24 V supply voltage - Electrical transient conduction along supply lines only".
- [5] I-ETS 300 034-1: "European digital cellular telecommunications system (Phase 1); Radio subsystem link control (GSM 05.08)".
- [6] I-ETS 300 034-2: "European digital cellular telecommunications system (Phase 1); Radio subsystem link control; Part 2: DCS extension (GSM 05.08-DCS)".
- [7] ETS 300 578: "Digital cellular telecommunications system (Phase 2); Radio subsystem link control (GSM 05.08)".
- [8] EN 55022 : "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".
- [9] CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus".
- [10] EN 61000-4-3: "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurements techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test".
- [11] EN 61000-4-2: "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurements techniques - Section 2: Electrostatic discharge immunity test. Basic EMC publication".
- [12] EN 61000-4-4: "Electromagnetic Compatibility (EMC); Part 4: Testing and measurements techniques - Section 4: Electrical fast transient/burst immunity test. Basic EMC publication".
- [13] EN 61000-4-6: "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurements techniques - Section 6: Immunity to conducted disturbances induced by radio-frequency fields".
- [14] EN 61000-4-11: "Electromagnetic Compatibility (EMC); Part 4: Testing and measurements techniques - Section 11: Voltage dips, short interruptions and voltage variations immunity tests".
- [15] EN 61000-4-5: "Electromagnetic Compatibility (EMC) - Part 4: Testing and measurements techniques - Section 5: Surge immunity test".
- [16] ITU-T Recommendation P.64: "Telephone transmission quality, Telephone installations, Local line networks, Objective electro-acoustical measurements. Determination of sensitivity/frequency characteristics of local telephone systems".
- [17] EN 61000-3-2 (1995): "Electromagnetic compatibility (EMC) - Part 3: Limits - Section 2: Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase)".
- [18] EN 61000-3-3 (1994): "Electromagnetic compatibility (EMC) - Part 3: Limits - Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current less than or equal to 16 A".
- [19] ETS 300 911: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (GSM 05.08 version 5.9.0 Release 1996)".
- [20] ITU-T Recommendation P.76: "Telephone transmission quality, Measurements related to speech loudness, Determination of loudness ratings; Fundamental principles, Annex A".
- [21] ETR 238: "ETSI/CENELEC standardization programme for the development of Harmonized Standards related to Electro-Magnetic Compatibility (EMC) in the field of telecommunications".
- [22] 89/336/EEC: "Council Directive on the approximation of laws of the Member States relating to Electromagnetic Compatibility".

- [23] TS 100 910 (V6.2): "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (GSM 05.05 version 6.2.0, Release 1997)".
- [24] ETS 300 342-2: "Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) for European digital cellular telecommunications system (GSM 900 MHz and DCS 1 800 MHz); Part 2: Base station radio and ancillary equipment".
- [25] ETS 300 342-3: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) for European digital cellular telecommunications system (GSM 900 MHz and DCS 1 800 MHz); Part 3: Base station radio and ancillary equipment and repeaters meeting Phase 2 GSM requirements".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

ancillary equipment: equipment (apparatus), used in connection with a receiver, transmitter or transceiver, is considered as an ancillary equipment (apparatus) if:

- the equipment is intended for use in conjunction with a receiver, transmitter or transceiver to provide additional operational and/or control features to the radio equipment (e.g. to extend control to another position or location); and
- the equipment cannot be used on a stand alone basis to provide user functions independently of a receiver, transmitter or transceiver; and
- the receiver, transmitter or transceiver to which it is connected, is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions).

base station equipment: mobile or portable equipment that is also intended to operate in a fixed location and powered from the AC mains.

idle mode: mode of operation of a receiver or a transceiver, where the Equipment Under Test (EUT) is powered, available for service and available to respond to a request to set up a call.

integral antenna equipment: equipment fitted with an antenna designed to be connected to the equipment without the use of an external connector and considered to be part of the equipment. An integral antenna may be fitted internally or externally to the equipment.

mobile equipment: receiver, transmitter or transmitter/receiver (transceiver) that is intended for installation and use in a vehicle, and powered by the main battery of the vehicle.

portable equipment: stand alone receiver, transmitter or transmitter/receiver (transceiver) powered by its own integral battery.

port: particular interface of the specified equipment (apparatus) with the electromagnetic environment.

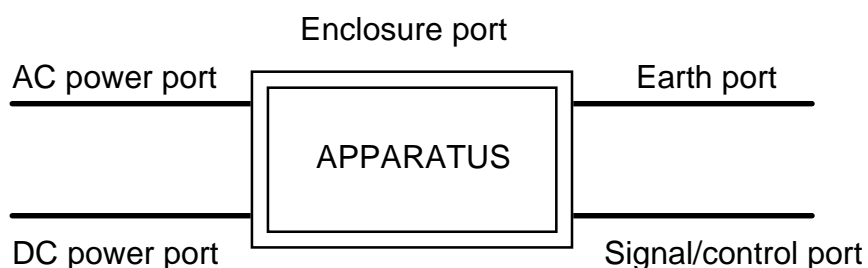


Figure 1: Examples of ports

radio communications equipment: apparatus which includes one or more transmitters and/or receivers and/or parts thereof. This type of equipment (apparatus) can be used in a fixed, mobile or a portable application.

RXQUAL: measure of the received signal quality, which is generated by the mobile or portable equipment, for use as a criterion in the Radio Frequency (RF) power control and handover processes. For more information see:

- I-ETS 300 034-1 [5] subclause 8.2 for Phase 1 GSM 900 equipment;
- I-ETS 300 034-2 [6] subclause 8.2 for Phase 1 DCS 1800 equipment; or
- ETS 300 578 [7] subclause 8.2 for Phase 2 GSM 900 or Phase 2 DCS 1800 equipment;
- ETS 300 911 [19] subclause 8.2 for Phase 2+ GSM 900 or Phase 2+ DCS 1800 equipment.

3.2 Abbreviations

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

AC	Alternating Current
ARFCN	Absolute Radio Frequency Channel Number *)
BCCCH	Broadcast Control Channel *)
BS	Base Station
CCCH	Common Control Channel *)
CR	Continuous phenomena applied to Receivers (subclause 6.3)
CT	Continuous phenomena applied to Transmitters (subclause 6.1)
DC	Direct Current
DTX	Discontinuous Transmission *)
EMC	Electromagnetic Compatibility
ERP	Ear Reference Point (artificial head)
EUT	Equipment Under Test
LISN	Line Impedance Stabilizing Network
MRP	Mouth Reference Point (artificial head)
RF	Radio Frequency
rms	root mean square
RXQUAL	Receiver Quality *)
SPL	Sound Pressure Level
TR	Transient phenomena applied to Receivers (subclause 6.4)
TT	Transient phenomena applied to Transmitters (subclause 6.2)

*) refer to GSM standards for further details.

4 Test conditions

4.1 General

The equipment shall be tested under normal test conditions according to the relevant product and basic standards or to the information accompanying the equipment, which are within the manufacturers declared range of humidity, temperature and supply voltage. The test conditions shall be recorded in the test report.

The test configuration shall be as close to normal intended use as possible and shall be recorded in the test report. Whenever the Equipment Under Test (EUT) is provided with a detachable antenna, the EUT shall be tested with the antenna fitted in a manner typical of normal intended use, unless specified otherwise.

For immunity tests the test modulation, test arrangements, etc., as specified in the present document, subclauses 4.2 to 4.10, shall apply and the conditions shall be as follows:

4.2 Arrangements for establishing a communication link

The wanted RF input signal nominal frequency shall be selected by setting the Absolute Radio Frequency Channel Number (ARFCN) to an appropriate number, e.g. in the case of GSM 900 MHz this is 60 to 65, and in the case of GSM 1800 MHz this is 690 to 706.

A communication link shall be set up with a suitable base station simulator (hereafter called "the test system").

When the EUT is required to be in the transmit/receive mode, the following conditions shall be met:

- the EUT shall be commanded to operate at maximum transmit power;
- the downlink RXQUAL shall be monitored.

4.2.1 Calibration of audio levels

For the portable the audio calibration is performed as follows:

Set the EUT volume to provide the nominal audio level if specified by the manufacturer. If no such level is specified, the centre volume step shall be used.

Prior to the test sequence, the reference level of the speech output signal on both the downlink and uplink shall be recorded on the test instrumentation, as shown in figure 3. The reference level shall be equivalent to the SPL of 0 dBPa at 1 kHz at the Ear Reference Point (ERP) defined in ITU-T Recommendation P.64 [16] for the downlink, and -5 dBPa at 1 kHz at the Mouth Reference Point (MRP) defined in ITU-T Recommendation P.64 [16] for the uplink.

NOTE 1: The ERP and MRP are both defined with respect to an artificial head defined in ITU-T Recommendation P.76 [20]. The handset shall be mounted on the artificial head such that the ear piece is centred at the artificial ear.

NOTE 2: If the equipment does not include acoustical transducers (e.g. a microphone or loudspeaker) the equivalent electrical reference levels shall be specified by the manufacturer.

The voice processor may often apply noise and echo cancellation algorithms which attempt to eliminate or reduce steady state audio signals as e.g. the 1 kHz calibration signals. These algorithms may be disabled during the calibration procedure. Specialized test software may be required. If the algorithms can not be disabled then the reference level shall be measured using a max-hold detection on the audio level meter in order to determine the level before the noise and echo cancellation algorithms become effective.

In handsfree applications an external loudspeaker is used. The SPL from the external loudspeaker is normally much higher than from the ear piece of the portable in order to overcome a high ambient noise level. The downlink reference level shall be increased in order to compensate for the difference. Alternatively, the distance between the loudspeaker and the measuring microphone shall be adjusted during the measurement procedure in accordance with the manufacturer's specification. It is important that the dynamic range of the test instrumentation is not exceeded.

Normally no corrections are made to the uplink reference level. In case it is not possible to perform the above calibration (e.g., a PC card with headset) the manufacturer shall specify the distance between the MRP and the microphone.

4.2.2 Measurement of audio levels

When the audio levels are measured during testing the EUT software shall be configured for voice applications. If the algorithms for noise and echo cancellation are not disabled, then the level shall be measured using a max-hold detection on the audio level meter in order to determine the level before the noise and echo cancellation algorithms become effective.

The level of the output signal from the downlink speech channel of the EUT at the mobile or portable's ear piece shall be assessed by measuring the Sound Pressure Level (SPL) as shown in figure 2. When an external loudspeaker is used the acoustical coupler shall be fixed to the loudspeaker in the position used during the calibration. The level of the decoded output signal from the uplink speech channel of the EUT at the analogue output of the test system shall be measured. Pick up of extraneous background noise by the microphone of the EUT shall be minimized.