

Draft **ETSI EN 300 342-3** V1.2.1 (1999-12)

Candidate Harmonized European Standard (Telecommunications series)

**Electromagnetic compatibility and
Radio Spectrum Matters (ERM);
ElectroMagnetic Compatibility (EMC) for 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 and Phase 2+ GSM requirements**



Reference

REN/ERM-EMC-208

Keywords

DCS, EMC, GSM, radio, testing

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
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Internet

secretariat@etsi.fr
Individual copies of this ETSI deliverable
can be downloaded from
<http://www.etsi.org>
If you find errors in the present document, send your
comment to: editor@etsi.fr

Important notice

This ETSI deliverable may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

Contents

Intellectual Property Rights	6
Foreword	6
1 Scope	7
2 References	8
3 Definitions and abbreviations	9
3.1 Definitions	9
3.2 Abbreviations	11
4 General test conditions	11
4.1 Test conditions	11
4.2 General test configuration	11
4.3 Test conditions for immunity tests	12
4.4 Normal test modulation for base Stations	12
4.5 Arrangements for test signals at the input of the transmitter and the output of the receiver	13
4.6 Arrangements for test signals at the output of the transmitter	13
4.7 Arrangements for test signals at the input of the receiver	13
4.8 Base station receiver exclusion band	13
4.9 Base station transmitter exclusion band	13
4.10 Narrow band responses in receiver immunity tests	14
4.11 Repeater and ancillary RF amplifier exclusion band	14
4.12 Arrangements for testing of equipment with an integral antenna	14
5 Performance assessment	15
5.1 General	15
5.2 Assessment of BER at the output of a transmitter	15
5.2.1 Assessment of BER using static layer 1 functions	15
5.2.2 Assessment of BER using RXQUAL	16
5.3 Assessment of BER at the output of a receiver	16
5.3.1 Assessment of BER using RXQUAL	16
5.3.2 Assessment of BER using reported BER	16
5.4 Performance assessment of repeaters and ancillary RF amplifiers	16
6 Performance criteria	16
6.1 Performance criteria for Continuous phenomena applied to Transmitters (CT)	17
6.2 Performance criteria for Transient phenomena applied to Transmitters (TT)	17
6.3 Performance criteria for Continuous phenomena applied to Receivers (CRx)	17
6.4 Performance criteria for Transient phenomena applied to Receivers (TRx)	17
6.5 Performance criteria for Continuous phenomena applied to Repeaters and Ancillary RF Amplifiers (CRptr)	18
6.6 Performance criteria for Transient phenomena applied to Repeaters and Ancillary RF Amplifiers (TRptr)	18
7 Applicability overview tables	19
7.1 Emission	19
7.2 Immunity	20
7.3 Applicability of tests for ancillary RF amplifiers	21
7.3.1 Independent ancillary RF amplifiers	21
7.3.2 Ancillary RF amplifiers tested in conjunction with a BTS	21
8 Test methods and limits for emission tests of base stations, repeaters, ancillary RF amplifiers and/or ancillary equipment	22
8.1 Enclosure port, ancillary equipment	22
8.1.1 Definition	22
8.1.2 Test method	22
8.1.3 Test limits	22

8.2	DC power input/output port.....	22
8.2.1	Definition.....	22
8.2.2	Test method.....	22
8.2.3	Test limits.....	23
8.3	AC mains power input/output ports.....	23
8.3.1	Definition.....	23
8.3.2	Test method.....	23
8.3.3	Test limits.....	23
8.4	Antenna port, ancillary RF amplifiers.....	24
8.4.1	Definition.....	24
8.4.2	Test method.....	24
8.4.3	Test limits.....	24
8.5	Enclosure, ancillary RF amplifiers.....	24
8.5.1	Definition.....	24
8.5.2	Test method.....	24
8.5.3	Test limits.....	25
8.6	Harmonic current emissions (AC mains input port).....	25
8.7	Voltage fluctuations and flicker (AC mains input port).....	25
9	Test methods and levels for immunity tests of base stations, repeaters, ancillary RF amplifiers and/or ancillary equipment.....	25
9.1	RF electromagnetic field (80 MHz to 1 000 MHz).....	25
9.1.1	Definition.....	25
9.1.2	Test method and level.....	26
9.1.3	Performance criteria.....	26
9.2	Electrostatic discharge.....	26
9.2.1	Definition.....	26
9.2.2	Test method and levels.....	26
9.2.3	Performance criteria.....	27
9.3	Fast transients common mode.....	27
9.3.1	Definition.....	27
9.3.2	Test method and levels.....	27
9.3.3	Performance criteria.....	28
9.4	RF common mode, 0,15 MHz to 80 MHz.....	28
9.4.1	Definition.....	28
9.4.2	Test method and level.....	28
9.4.3	Performance criteria.....	29
9.5	Voltage dips and interruptions.....	29
9.5.1	Definition.....	29
9.5.2	Test method and levels.....	29
9.5.3	Performance criteria.....	29
9.6	Surges, common and differential mode.....	30
9.6.1	Definition.....	30
9.6.2	Test method and level.....	30
9.6.3	Performance criteria.....	30
9.7	RF conducted immunity, ancillary RF amplifiers.....	31
9.7.1	Definition.....	31
9.7.2	Test method.....	31
9.7.3	Performance criteria.....	31

Annex A (normative):	Subclauses of the present document relevant for compliance with the essential requirements of the EC Council Directive 89/336/EEC	32
Annex B (normative):	Method of assessment of Performance for Continuous phenomena applied to Repeaters and Ancillary RF Amplifiers (CRptr)	33
B.1	Test purpose	33
B.2	Test method	33
B.3	Performance assessment.....	33
Annex C (normative):	Method of assessment of Performance for Transient phenomena applied to Repeaters and Ancillary RF Amplifiers (TRptr)	34
C.1	Test purpose	34
C.2	Test method.....	34
C.3	Performance assessment.....	34
Annex D (normative):	Test of RF conducted immunity, antenna port of ancillary RF amplifiers	35
D.1	Definition	35
D.2	Test method.....	35
	Bibliography	37
	History	38

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://www.etsi.org/ipr>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Candidate Harmonized 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 Council Directive 98/34/EC [21] (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized 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 [4] as amended).

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

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 protection requirements of the EMC Directive.

The present document is part 3 of a multi-part EN covering Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro-Magnetic Compatibility (EMC) Standard for digital cellular telecommunications system (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";
- Part 3: "Base station radio and ancillary equipment and repeaters meeting Phase 2 GSM requirements".

For equipment which can be connected to the Alternating Current (AC) mains supply, the requirements of EN 61000-3-2 [19] and EN 61000-3-3 [20] apply where appropriate from 1-1-2001.

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 GSM base station, ancillary amplifiers, GSM repeaters, and ancillary equipment in respect of ElectroMagnetic Compatibility (EMC).

Technical specifications, relevant to the antenna port and emissions of the enclosure port for base stations and repeaters, are found in the related product standard for the effective use of the radio spectrum.

The present document specifies the applicable EMC tests, the methods of measurements, the limits and the minimum performance criteria for the following classes of equipment meeting Phase 2 and Phase 2+ requirements of the GSM digital cellular telecommunications system, and operating in the P-GSM 900, E-GSM 900, R-GSM 900 or DCS 1 800 bands:

- equipment forming part of the Base Station System (BSS);
- associated ancillary equipment;
- ancillary RF amplifiers, for transmission and/or reception;
- GSM repeaters.

The present document is also applicable to:

- equipment which operates in other frequency bands, provided that the performance requirements (other than operating frequency) are the same as the Phase 2 or Phase 2+ GSM requirements for the antenna and the enclosure ports contained in the present document;
- equipment which is designed to meet Phase 1 GSM requirements, provided that it also meets the Phase 2 GSM requirements for the antenna and the enclosure ports contained in the present document.

NOTE 1: This provision is particularly intended for equipment which is designed to meet either the Phase 1 or the Phase 2 GSM requirements by a change of software.

The environment classification used in the present document refers to the environment classification used in the Generic Standards EN 50081-1 [1] and EN 50082-1 [2].

For the purposes of the present document, Base Transceiver Stations (BTS), and single cabinet Base Station Systems (BSS), are considered to be radio communications equipment.

The present document is applicable to radiocommunications equipment including integral antennas provided that any antenna can be disconnected for test purposes and test signals applied to antenna connectors.

NOTE 2: EN 301 087 [7] and ETS 300 609-4 [18] define performance requirements at the antenna port and enclosure port.

For the purposes of the present document the manufacturer may declare that Base Station Controllers (BSC) and Transcoders (TRAU) are ancillary equipment (see clause 3 for the definition of ancillary equipment). Alternatively, ancillary equipment may be constructed in accordance with other applicable EMC Harmonized Standards.

The present document is not applicable to equipment which forms part of the GSM Network Subsystem (NSS), including Mobile services Switching Centres (MSC), Echo Cancellers (EC) and Operations and Maintenance Centres (OMC).

The EMC requirements have been selected to ensure an adequate level of compatibility for apparatus at residential, commercial, and light industrial 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 port, or both.

Compliance of GSM 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 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 of the present document, should be recorded in the test report.

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] 99/05/EC (1999): "Council Directive on the approximation of the laws of the Member States relating to radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity".
- [4] 89/336/EEC (1989): "Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility".
- [5] ETR 350: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms (GSM 01.04 version 5.0.1)".
- [6] EN 300 911: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (GSM 05.08 version 6.5.0 Release 1997)".
- [7] EN 301 087 (1999-04): "Digital cellular telecommunications system (Phase 2 & Phase 2+); Base Station System (BSS) equipment specification; Radio aspects (GSM 11.21 version 7.1.1 Release 1998)".
- [8] EN 55022: "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".
- [9] CISPR 16-1 (1993): "Specification for radio disturbance and immunity measuring apparatus and methods".
- [10] EN 61000-4-3 (1996): "Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test".
- [11] EN 61000-4-2 (1995): "Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test".
- [12] EN 61000-4-4 (1995): "Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test".
- [13] EN 61000-4-6 (1996): "Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields".

- [14] EN 61000-4-11 (1994): "Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests".
- [15] EN 61000-4-5 (1995): "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity tests".
- [16] I-ETS 300 020-1: "European digital cellular telecommunications system (Phase 1); Mobile station conformance test system Part 1: Mobile station conformity specification".
- [17] ETS 300 607-1: "Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification; Part 1: Conformance specification (GSM 11.10-1 version 4.26.0)".
- [18] ETS 300 609-4 (Edition 4): "Digital cellular telecommunications system (Phase 2 and Phase 2+); Base Station System (BSS) equipment specification; Part 4: Repeaters (GSM 11.26 version 5.2.1)".
- [19] EN 61000-3-2 (1995): "Electromagnetic compatibility (EMC) - Part 3: Limits - Section 2: Limits for harmonic current emissions (equipment input current up to and including 16A per phase)".
- [20] EN 61000-3-3 (1995): "Electromagnetic compatibility (EMC) - Part 3: Limits - Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current up to 16 A".
- [21] 98/34/EC (1983): "Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations".
- [22] EN 300 607-1: "Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification (GSM 11.10-1 version 6.1.0 Release 1997)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 301 087 [7] and the following apply:

A interface: logical interface between a BSC and an msC

Abis interface: logical interface between a BTS and a BSC

ancillary equipment: equipment (apparatus), used in connection with a base station, ancillary RF amplifier or repeater, is considered as an ancillary equipment if:

- the equipment is intended for use in conjunction with a base station, ancillary RF amplifier or repeater to provide additional operational and/or control features (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 base station, ancillary RF amplifier or repeater; and
- the base station, ancillary RF amplifier or repeater to which it is connected, is capable of providing some intended operation in accordance with GSM specifications without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions); and
- there is a physical connection between the base station, ancillary RF amplifier or repeater and the ancillary equipment (i.e. a repeater is not considered to be an ancillary equipment to a base station); and
- the primary function of the equipment is not to provide amplification between the transmit and/or receive antenna connector of a base station and an antenna.

ancillary RF amplifier: equipment (apparatus), used in connection with a base station, is considered as an ancillary RF amplifier if:

- the primary function of the equipment is to provide amplification between the transmit and/or receive antenna connector of a base station and an antenna; and
- the RF connection between the equipment and the base station uses co-axial cable; and
- the equipment is capable of meeting its specified performance without requiring any control signal which defines the characteristics of the signal being amplified (e.g. the timing of the GSM timeslots or the commanded transmit power); and
- if the equipment is dedicated to operate only with certain specified types of base station, these base stations are capable of meeting GSM specifications separately from the ancillary RF amplifier.

NOTE 1: If an ancillary RF amplifier is dedicated to operate only with certain specified types of base station, and these base stations are only capable of meeting GSM specifications in conjunction with the ancillary RF amplifier, the ancillary RF amplifier is considered to be part of the base station.

antenna port: port of an apparatus which is designed, in normal operation, to be connected to an antenna using coaxial cable

base station: equipment under test which includes at least one BTS, integrated BSS, or BSC

enclosure port: physical boundary of the apparatus onto which an electromagnetic field may impinge, or from which an electromagnetic field may radiate

integral antenna: antenna which is a physical part of the EUT, and which is designed to be directly connected to an antenna port or internal antenna connector of a BTS in the equipment without any external connections

maintenance port: external interface used for maintenance, testing or configuration, but not connected during normal operation

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

NOTE 2: An interface which uses optical fibre is not a port for the purposes of testing because it does not interact with the electromagnetic environment within the frequency range which is applicable for the present document. An optical fibre interface may still be used in the assessment of performance.

radio communications equipment: apparatus which includes one or more transmitters and/or receivers and/or RF amplifiers and/or parts thereof

NOTE 3: An apparatus without an antenna connector with external optical interfaces which carry GSM signals modulated at a radio frequency is not considered to be a radio communications apparatus in respect of these interfaces. Such apparatus can only be tested to the present document in conjunction with other apparatus, which together form a radio communications equipment, with antenna connector(s).

repeater: device with two RF ports, both of which are intended to be connected to antennas, which is capable of receiving, amplifying and transmitting simultaneously in one direction a signal in a BSS transmit band and in the other direction a signal in the corresponding BSS receive band

RXQUAL: measure of the received signal quality, which is generated by the base station for use as a criterion in the RF power control and handover processes. The characteristics and requirements are specified in EN 300 911 [6], subclause 8.2

signal and control port: port which carries information or control signals, excluding antenna ports

3.2 Abbreviations

For the purposes of the present document, the abbreviations of ETR 350 [5], in addition to the following, apply:

AC	Alternating Current
BER	Bit Error Ratio
BTS	Base Transceiver Station
CRptr	performance criteria for Continuous phenomena applied to Repeaters and Ancillary RF Amplifiers
CRx	performance criteria for Continuous phenomena applied to Receivers
CT	performance criteria for Continuous phenomena applied to Transmitters
DC	Direct Current
EC	Echo Cancellor
EUT	Equipment Under Test
LISN	Line Impedance Stabilizing Network
NSS	Network Sub System
RXQUAL	Received Signal Quality
TRx	performance criteria for Transient phenomena applied to Receivers
TRX	Transceiver
TRAU	Transcoder
TRptr	performance criteria for Transient phenomena applied to Repeaters and Ancillary RF Amplifiers
TT	performance criteria for Transient phenomena applied to Transmitters

4 General test conditions

4.1 Test conditions

The EUT shall be tested under normal test conditions, as defined in EN 301 087 [7] or in 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. The test configurations for transmitters and receivers are described separately for the sake of clarity. However, the test of the transmitter section and receiver section of the EUT may be carried out simultaneously to reduce test time.

4.2 General test configuration

This subclause defines the general requirements for test configurations for tests:

- the measurement shall be made in the operational mode as required in subclause 4.1;
- the equipment shall be configured in a manner which is representative of a normal/typical operation, where practical;
- for emissions tests:
 - measurements shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications;
 - an attempt shall be made to maximize the detected radiated emission, e.g. by moving the cables of the equipment;
 - all transmitters in the EUT shall be transmitting at full power;
 - the transmitters' operating frequencies should be selected by setting the Absolute Radio Frequency Channel Numbers (ARFCN) equally distributed over the BSS operating band, subject to any restrictions of the configuration of the EUT;

- if the equipment is part of a system, or can be connected to ancillary equipment, then the equipment may be tested connected to the minimum representative configuration of ancillary equipment necessary to exercise the ports;
- for the immunity tests of ancillary equipment, without a separate pass/fail criteria, the receiver, transmitter or transceiver coupled to the fixed ancillary equipment shall be used to judge whether the ancillary equipment passes or fails;
- the configuration and mode of operation during measurements shall be precisely noted in the test report;
- if the equipment has a large number of ports, then a sufficient number shall be tested to simulate actual operational conditions and to ensure that all the different types of termination are adequately tested;
- for an EUT which contains more than one BTS, it is sufficient to perform tests relating to the antenna connector or connectors of each representative BTS;
- ports which in normal operation are connected, shall be connected to an ancillary equipment or to a representative piece of cable terminated to simulate the impedance of the ancillary equipment. RF input/output ports shall be correctly terminated;
- maintenance ports need not be connected (unless this is necessary for the operation of the EUT in the test configuration).

4.3 Test conditions for immunity tests

For the immunity tests of transmitter(s), the transmitter(s) shall be operated at the maximum rated output power, up to and not exceeding a maximum of 20 W, modulated with normal test modulation (see subclause 4.4). A communication link shall be established (see subclause 4.6).

For the immunity tests of receivers, the wanted input signal, coupled to the receiver, shall be modulated with normal test modulation (see subclauses 4.4 and 4.7). A communication link shall be established (see subclause 4.5).

For the immunity tests of base stations including duplex filters, the wanted input signal, coupled to the receiver, shall be modulated with normal test modulation (see subclauses 4.4 and 4.7). The transmitter(s) shall be operated at the maximum rated output power, up to and not exceeding a maximum of 20 W. A communication link shall be established (see subclause 4.6).

For the immunity tests of repeaters, the wanted input signal shall be coupled to one antenna port at a level which will result, when measured, in the maximum rated RF output power per channel, as declared by the manufacturer. The test shall either be repeated with a wanted signal coupled to the other antenna port, or a single test shall be performed with the specified input signals being simultaneously coupled to both antenna ports.

4.4 Normal test modulation for base Stations

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

The wanted RF input signal nominal frequency shall be selected by setting the ARFCN to an appropriate number, e.g. channel M as defined in EN 301 087 [7].

The following conditions shall be met:

- unless it is otherwise stated, the EUT shall be commanded to operate with all transceivers (TRX) in the EUT activated at maximum transmit power, up to, and not exceeding, a maximum of 20 W;
- the uplink RXQUAL or BER and downlink RXQUAL or BER shall be monitored.

4.5 Arrangements for test signals at the input of the transmitter and the output of the receiver

A communication link shall be set up between the EUT and the test system using the A or Abis interface, or an equivalent interface which carries the information to be transmitted by the air interface.

4.6 Arrangements for test signals at the output of the transmitter

The test system shall be located outside of the test environment.

The wanted signal to establish a communication link shall be delivered from the antenna connector by a coaxial cable. Adequate measures shall be taken to minimize the effect of unwanted currents on the external conductor of the coaxial cable at the point of entry to the measuring equipment. Adequate measures shall also be taken to avoid the effect of the unwanted signal on the measuring equipment.

4.7 Arrangements for test signals at the input of the receiver

The test system shall be located outside of the test environment.

The wanted signal to establish a communication link shall be presented to the antenna connector by a coaxial cable. Adequate measures shall be taken to minimize the effect of unwanted currents on the external conductor of the coaxial cable at the point of entry to the measuring equipment. The source of the wanted input signal shall be located outside of the test environment and shall be at a nominal value of -47 dBm except for the tests carried out in subclause 9.7.2, where the wanted signal level shall be that specified in those subclauses.

4.8 Base station receiver exclusion band

The BSS receiver exclusion band is the band of frequencies over which no tests of radiated immunity of a receiver are made.

The lower frequency of the exclusion band is the lower frequency of the BSS receive band of the EUT minus 5 %.

The upper frequency of the exclusion band is the upper frequency of the BSS receive band of the EUT plus 5 %.

4.9 Base station transmitter exclusion band

The BSS transmitter exclusion band is the band of frequencies over which no tests of radiated immunity of a transmitter are made.

The exclusion band for transmitters extends ± 200 kHz from the carrier frequency of each activated transmitter.

4.10 Narrow band responses in receiver immunity tests

Responses on receivers or duplex transceivers occurring during the test at discrete frequencies which are narrow band responses (spurious responses), are identified by the following method:

- if during an immunity test the RXQUAL or BER being monitored goes outside the specified limit, it is necessary to establish whether the RXQUAL or BER increase is due to a narrow band response or to a wide band phenomenon. Therefore, the test shall be repeated with the unwanted signal frequency increased, and then decreased by 400 kHz;
- if the RXQUAL or BER meets the conformance requirement in either or both of the above 400 kHz offset cases, then the response is considered as a narrow band response;
- if the RXQUAL or BER continues not to meet the conformance requirement, this may be due to the fact that the offset has made the frequency of the unwanted signal correspond to the frequency of another narrow band response. Under these circumstances the procedure is repeated with the increase and decrease of the frequency of the unwanted signal set to 500 kHz;
- if the RXQUAL or BER still continues not to meet the conformance requirement with the increased and/or decreased frequency, the phenomenon is considered wide band and the equipment therefore fails the test.

Narrow band responses are disregarded.

4.11 Repeater and ancillary RF amplifier exclusion band

The exclusion band for repeaters and ancillary RF amplifiers is the band of frequencies over which no tests of radiated immunity of the EUT are made.

The exclusion band for a repeater or ancillary RF amplifier is the range (or ranges) of frequencies for which at least one of the following conditions are met:

- the gain (measured in either direction between two RF ports) is greater than 25 dB;
- the gain (measured in either direction between two RF ports) is no more than 25 dB below the gain measured at the centre of a manufacturers declared operating band.

A range of frequencies is only considered to be an operating band if the measured gain at the centre of this band is greater than 0 dB.

4.12 Arrangements for testing of equipment with an integral antenna

EN 301 087 [7] and ETS 300 609-4 [18] only specify tests for equipment for which there is an accessible antenna connector (which may be external or internal to the equipment).

For tests in the present document, any integral antenna shall be disconnected from the BTS, and any antenna connector which is connected to an integral antenna connector in normal operation shall be correctly terminated, either connected to test equipment or an appropriate non-radiating load.

Precautions should be taken to ensure that the cables connecting antenna connectors to test equipment or terminations do not influence the test results.

5 Performance assessment

5.1 General

The manufacturer shall at the time of submission of the equipment for test, supply the following information which shall be recorded in the test report:

- any primary functions of the radio communications equipment additional to those specified in clause 6, as requested by the manufacturer, to be tested during and after the EMC testing;
- the intended functions of the EUT which shall be in accordance with the documentation accompanying the equipment;
- the user-control functions and stored data that are required for normal operation and the method to be used to assess whether these have been lost after EMC stress;
- the ancillary equipment to be combined with the radio communications equipment for testing;
- the ancillary equipment submitted for test on a stand alone basis, not combined with the radio communications equipment;
- an exhaustive list of ports, classified as antenna, other RF, power signal/control or maintenance. Power ports shall further be classified as AC or DC power.

If the ancillary equipment is intended for use at a remote location, the equipment shall meet the requirements of all applicable immunity clauses and emission clauses of the present document.

In the case of ancillary equipment tested on a stand alone basis and/or radio communications equipment of a specialized nature (see clause 6) the manufacturer shall define the method of test to determine the acceptable level of performance or degradation of performance during and/or after the test. Under these circumstances the manufacturer shall also provide the following information:

- the pass/fail criteria for the EUT;
- the method of observing a degradation of performance of the equipment.

The degradation of performance assessment which shall be carried out during and/or at the conclusion of the tests, shall be simple, but at the same time give adequate proof that the essential functions of the equipment are operational.

An ancillary equipment may, at the manufacturer's discretion, be declared compliant separately from a base station to all the applicable immunity and emission clauses of the present document.

Alternatively, at the manufacturer's discretion, an ancillary equipment may be declared compliant to another harmonized EMC standard.

Either way, this compliance may enable the ancillary equipment to be used with different base stations.

An ancillary equipment may, at the manufacturer's discretion, be tested with it connected to a base station during the tests, in which case compliance shall be demonstrated to the appropriate clauses of the present document.

5.2 Assessment of BER at the output of a transmitter

The BER at the output of the transmitter may be assessed using either of the techniques described below.

5.2.1 Assessment of BER using static layer 1 functions

The bit sequence from the output of the transmitter shall be monitored according to the test case of EN 301 087 [7], subclause 6.1.2, and the BER of the class 2 bits for TCH/FS assessed.

If the EUT does not support TCH/FS, the manufacturer shall declare the logical channel for which the performance shall be assessed, and the corresponding performance criteria.

5.2.2 Assessment of BER using RXQUAL

The output of the transmitter shall be connected to an equipment which meet the requirements of either I-ETS 300 020-1 [16], ETS 300 607-1 [17] or EN 300 607-1 [22] for the assessment of RXQUAL. The level of the signal supplied to the equipment should be within the range for which the assessment of RXQUAL is not impaired. The RXQUAL shall be monitored during the test.

NOTE: This equipment can be a GSM mobile station with suitable provision for the monitoring of RXQUAL.

5.3 Assessment of BER at the output of a receiver

The BER at the output of the receiver may be assessed using either of the techniques described below.

5.3.1 Assessment of BER using RXQUAL

The value of the RXQUAL reported by the BTS or BSS shall be monitored using suitable test equipment.

5.3.2 Assessment of BER using reported BER

The BER of the class 2 bits at the output of the receiver shall be assessed using suitable test equipment.

If the EUT does not support TCH/FS, the manufacturer shall declare the logical channel for which the performance shall be assessed, and the corresponding performance criteria.

NOTE: This can be performed by a "test loopback" which uses the transmitter of the BTS to return the data which has been decoded by the receiver back to the test equipment which generated the bit sequence. For immunity tests of signal ports, the "test loopback" includes an external connection between signal ports.

5.4 Performance assessment of repeaters and ancillary RF amplifiers

The parameter used for assessment of performance of a repeater or ancillary RF amplifier is the gain within the operating band. The assessment shall be performed using the method of annex B or annex C of the present document.

6 Performance criteria

The establishment and maintenance of a communications link, and the assessment of RXQUAL or BER are used as the performance criteria to ensure that all the primary functions of the transmitter and receiver of a BTS are evaluated during the immunity tests. The parameter used as performance criteria for repeaters and ancillary RF amplifiers is the gain.

Specifically the equipment shall meet the minimum performance criteria as specified in the following subclauses as appropriate.

If an equipment is of a specialized nature, such that the performance criteria described in the following subclauses are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after testing, as required by the present documents. The performance specification shall be included in the product description and documentation. The performance criteria specified by the manufacturer shall, however, give the same degree of immunity protection as called for in the following subclauses.

6.1 Performance criteria for Continuous phenomena applied to Transmitters (CT)

A communications link (see subclauses 4.5 and 4.6) shall be established at the start of the test, and maintained during the test.

The BER of the downlink shall be assessed during the test according to one of the test methods of subclause 5.2.

If the test method of subclause 5.2.1 is used, the measured BER of the class 2 bits of TCH/FS shall not exceed 1,6 % during the test.

NOTE: This BER is the upper limit in EN 300 911 [6] for $RXQUAL = 3$.

If the test method of subclause 5.2.2 is used, the value of $RXQUAL$ shall not exceed 3 during the test.

At the conclusion of the test the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained.

6.2 Performance criteria for Transient phenomena applied to Transmitters (TT)

A communications link (see subclauses 4.5 and 4.6) shall be established at the start of the test.

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.

6.3 Performance criteria for Continuous phenomena applied to Receivers (CRx)

A communications link (see subclauses 4.5 and 4.7) shall be established at the start of the test, and maintained during the test.

The BER of the uplink shall be assessed during the test according to one of the test methods of subclause 5.3.

If the test method of subclause 5.3.1 is used, the value of $RXQUAL$ shall not exceed 3 during the test.

If the test method of subclause 5.3.2 is used, the measured BER of the class 2 bits of TCH/FS shall not exceed 1,6 % during the test.

NOTE: This BER is the upper limit in EN 300 911 [6] for $RXQUAL = 3$.

For a base station the $RXQUAL$ of the uplink shall not exceed three (3) measured during the test sequence.

At the conclusion of the test the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained.

6.4 Performance criteria for Transient phenomena applied to Receivers (TRx)

A communications link (see subclauses 4.5 and 4.7) shall be established at the start of the test.

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.

6.5 Performance criteria for Continuous phenomena applied to Repeaters and Ancillary RF Amplifiers (CRptr)

The gain of the EUT shall be measured throughout the period of exposure to the phenomenon. The gain shall be measured using the method of annex B.

The gain measured during the test shall not change from the gain measured before the test by more than 1 dB.

At the conclusion of the test the EUT shall operate as intended with no loss of user control functions or stored data.

6.6 Performance criteria for Transient phenomena applied to Repeaters and Ancillary RF Amplifiers (TRptr)

The gain shall be measured before the test, and after each exposure. The gain shall be measured using the method of annex C.

At the conclusion of each exposure the gain of the EUT shall not have changed by more than 1 dB.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the gain of the EUT shall not have changed by more than 1 dB.

7 Applicability overview tables

In this clause, the requirements for base stations and for repeaters and ancillary RF amplifiers also apply to ancillary equipment which is tested in conjunction with them.

NOTE: These applicability tables should be read in conjunction with the Foreword and annexes B, C and D of the present document.

7.1 Emission

Table 1: Emission applicability

Phenomenon	Application	Equipment test requirement				Reference subclause in the present document	Reference document
		Base station equipment	Ancillary equipment	Repeaters	Ancillary RF amplifiers		
Radiated emission	Enclosure		Applicable			8.1	EN 55022 [8].
Radiated emission	Enclosure				applicable	7.3	see subclause 7.3.
Conducted emission	DC power in/out	applicable	Applicable	applicable	applicable	8.2	EN 55022 [8], CISPR 16-1 [9].
Conducted emission	AC mains	applicable	Applicable	applicable	applicable	8.3	EN 55022 [8].
emission	Antenna ports				applicable	7.3	see subclause 7.3.
Harmonic current emissions	AC mains power input ports	applicable	applicable	applicable	applicable	8.6	EN 61000-3-2 [19].
Voltage fluctuations and flicker	AC mains power input ports	applicable	applicable	applicable	applicable	8.7	EN 61000-3-3 [20].

7.2 Immunity

Table 2: Immunity applicability

Phenomena	Application	Equipment test requirement				Reference subclause in the present document	Reference document
		Base station equipment	Ancillary equipment	Repeaters	Ancillary RF amplifiers		
RF electro-magnetic field (80 to 1 000 MHz)	enclosure	applicable, excluding exclusion bands defined in subclauses 4.8 and 4.9	applicable	applicable, excluding exclusion bands defined in subclause 4.11	applicable, excluding exclusion bands defined in subclause 4.11	9.1	EN 61000-4-3 [10].
Electrostatic discharge	enclosure	applicable	applicable	applicable	applicable	9.2	EN 61000-4-2 [11].
Fast transients common mode	signal and control ports, DC and AC power ports	applicable	applicable	applicable	applicable	9.3	EN 61000-4-4 [12].
RF common mode 0,15 MHz to 80 MHz	signal and control ports, DC and AC power ports	applicable	applicable	applicable	applicable	9.4	EN 61000-4-6 [13].
Voltage dips and interruptions	AC mains power input ports	applicable	applicable	applicable	applicable	9.5	EN 61000-4-11 [14].
Surges, common and differential mode	AC mains power input ports	applicable	applicable	applicable	applicable	9.6	EN 61000-4-5 [15].

7.3 Applicability of tests for ancillary RF amplifiers

This subclause describes the applicability of tests for the antenna and enclosure ports of ancillary RF amplifiers.

For the purposes of demonstrating compliance to the present document, an ancillary RF amplifier may be regarded either as an independent equipment, or as part of a BTS.

NOTE: Ancillary RF amplifiers are not separately defined entities in GSM specifications because they are, from the perspective of the logical architecture of GSM, part of the BTS. However, they are physically separate from the BTS, and they may be supplied independently from the BTS.

7.3.1 Independent ancillary RF amplifiers

If an ancillary RF amplifier is regarded as an independent equipment, the subclauses of the present document in tables 3 and 4 apply in addition to the subclauses which are identified as applicable in tables 1 and 2.

Table 3: Emissions applicability for ancillary RF amplifiers tested independently

Equipment test requirement			
Application	ancillary RF amplifiers tested independently	reference subclause in the present document	reference document
Enclosure	applicable	8.5	ETS 300 609-4 [18]
Antenna ports	applicable	8.4	ETS 300 609-4 [18]

Table 4: Immunity applicability for ancillary RF amplifiers tested independently

Equipment test requirement			
Application	ancillary RF amplifiers tested independently	reference subclause in the present document	reference document
Antenna ports	applicable	9.7	annex D

7.3.2 Ancillary RF amplifiers tested in conjunction with a BTS

If an ancillary RF amplifier is regarded as part of the BTS, the subclauses of the present document in tables 3 and 4 apply in addition to the subclauses which are identified as applicable in tables 1 and 2. The performance criteria for the tests are those of the BTS.

If an ancillary RF amplifier is tested in conjunction with a BTS, this demonstrates the compliance of the ancillary RF amplifier to the present document only when used with a BTS of a type for which the BTS used for the test is representative. The antenna ports of the ancillary RF amplifier are regarded as the antenna connectors of the BTS.

8 Test methods and limits for emission tests of base stations, repeaters, ancillary RF amplifiers and/or ancillary equipment

8.1 Enclosure port, ancillary equipment

This test is applicable to ancillary equipment not physically incorporated into a base station, repeater or ancillary RF amplifier.

This test shall be performed on a representative configuration of the ancillary equipment.

8.1.1 Definition

This test assesses the ability of ancillary equipment to limit any spurious radiation from its enclosure.

8.1.2 Test method

The test method shall be in accordance with EN 55022 [8].

8.1.3 Test limits

Class B limits shall be according to EN 55022 [8] shown in table 5 (10 m measuring distance).

Table 5: Limits for spurious radiation (Class B)

Frequency range	Limit (quasi-peak)
30 MHz to 230 MHz	30 dB μ V/m
> 230 MHz to 1 000 MHz	37 dB μ V/m
NOTE: If this test is performed according to EN 55022 [8] at an alternative measuring distance, the applicable limit values from EN 55022 [8] should be used.	

8.2 DC power input/output port

This test is applicable for base stations, repeaters, ancillary RF amplifiers and ancillary equipment which may have DC power cables longer than three (3) metres.

This test shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

8.2.1 Definition

This test assesses the ability of base stations repeaters, ancillary RF amplifiers and ancillary equipment to limit internal noise from being present on the DC power input/output ports.

8.2.2 Test method

For equipment with a manufacturer's declared maximum current consumption (for the configuration under test) of 16 A or less, the test method shall be in accordance with EN 55022 [8] and the Line Impedance Stabilizing Networks (LISNs) shall be connected to a DC power source.

For equipment with a manufacturer's declared maximum current consumption (for the configuration under test) above 16 A, the DC power input ports shall be connected via a 5 μ H LISN), with 50 Ω impedance measurement ports to a DC power source. The LISN shall be in accordance with the requirements of CISPR 16-1 [9].

The equipment shall be installed with a ground plane as defined in subclause 10.3 of EN 55022 [8]. The reference earth point of the LISNs shall be connected to the reference ground plane with a conductor as short as possible.

The measurement receiver shall be in accordance with the requirements of CISPR 16-1 [9].

A measuring receiver shall be connected to each LISN measurement port in turn and the conducted emission levels recorded. The LISN measurement ports not being used for measurement shall be terminated with a 50 Ω load.

8.2.3 Test limits

The equipment shall meet the limits in table 6 (including the quasi-peak limit and the average limit) when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in subclause 8.2.2. If the average limit is met when using a quasi-peak detector, the equipment shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

Table 6: Limits for conducted RF signals

Frequency range	Quasi-peak	Average
0,15 MHz to 0,5 MHz	79 dB μ V	66 dB μ V
> 0,5 MHz to 30 MHz	73 dB μ V	60 dB μ V

8.3 AC mains power input/output ports

This test is applicable for base stations, repeaters, ancillary RF amplifiers and ancillary equipment powered by AC mains.

This test shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

8.3.1 Definition

This test assesses the ability of base stations, repeaters, ancillary RF amplifiers and ancillary equipment to limit its internal noise from being present on the AC mains power input/output ports.

8.3.2 Test method

The test method shall be in accordance with EN 55022 [8].

8.3.3 Test limits

The limits shall be class B according to EN 55022 [8] shown in table 7.

Table 7: Limits for conducted RF signals (class B)

Frequency range	Quasi-peak	Average
0,15 MHz to 0,5 MHz	66 dB μ V to 56 dB μ V	56 dB μ V to 46 dB μ V
> 0,5 MHz to 5 MHz	56 dB μ V	46 dB μ V
> 5 MHz to 30 MHz	60 dB μ V	50 dB μ V

NOTE: The limit decreases linearly with the logarithm of frequency in the range 0,15 MHz to 0,50 MHz.

8.4 Antenna port, ancillary RF amplifiers

This test is applicable to antenna ports of ancillary RF amplifiers, and to internal connectors which are connected to an integral antenna in normal operation and which are accessible for test purposes.

This test shall be performed on a representative configuration of the communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

8.4.1 Definition

This test assesses the ability of an ancillary RF amplifier to limit its internal noise from being conducted to the antenna as spurious emissions.

8.4.2 Test method

The test method for emissions shall be in accordance with ETS 300 609-4 [18], subclause 5.2 a).

8.4.3 Test limits

The measured power shall not exceed:

- 36 dBm (250 nW) in the frequency band 9 kHz to 1 GHz;
- 30 dBm (1 μ W) in the frequency band 1 GHz to 12,75 GHz.

NOTE: These limits are taken from ETS 300 609-4 [18].

8.5 Enclosure, ancillary RF amplifiers

This test is applicable for ancillary RF amplifiers.

This test shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

For an ancillary RF amplifier which is designed to use an integral antenna in normal operation, this shall be disconnected and the antenna connector correctly terminated.

8.5.1 Definition

This test assesses the ability of ancillary RF amplifiers to limit any spurious radiation from the enclosure.

8.5.2 Test method

The test method for emissions from the enclosure shall be in accordance with ETS 300 609-4 [18].

8.5.3 Test limits

The measured power shall not exceed:

- 36 dBm (250 nW) in the frequency band 9 kHz to 1 GHz;
- 30 dBm (1 μ W) in the frequency band 1 GHz to 12,75 GHz.

NOTE: These limits are taken from ETS 300 609-4 [18].

8.6 Harmonic current emissions (AC mains input port)

The appropriate requirements of EN 61000-3-2 [19] for harmonic current emission apply for equipment covered by the scope of the present document.

8.7 Voltage fluctuations and flicker (AC mains input port)

The appropriate requirements of EN 61000-3-3 [20] for voltage fluctuations and flicker apply for equipment covered by the scope of this standard.

9 Test methods and levels for immunity tests of base stations, repeaters, ancillary RF amplifiers and/or ancillary equipment

9.1 RF electromagnetic field (80 MHz to 1 000 MHz)

This test is applicable for base stations, repeaters, ancillary RF amplifiers and ancillary equipment. For equipment used with integral antennas in normal operation, the antenna shall be disconnected and any antenna connectors shall be correctly terminated, either by measuring equipment or an appropriate non-radiating load.

This test shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

9.1.1 Definition

This test assesses the ability of base stations, repeaters, ancillary RF amplifiers and ancillary equipment to operate as intended in the presence of a radio frequency electromagnetic field disturbance to its enclosure.

9.1.2 Test method and level

The test method shall be in accordance with EN 61000-4-3 [10] except that the following requirements and evaluation of test results shall apply:

- the test level shall be 3 V/m amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 kHz;
- the stepped frequency increments shall be 1 % of the momentary frequency;
- the test shall be performed over the frequency range 80 MHz to 1 000 MHz with the exception of any exclusion band:
 - for transmitters, (see subclause 4.9);
 - for receivers (see subclause 4.8);
 - for repeaters and ancillary RF amplifiers (see subclause 4.11).
- responses of receivers and receivers of transceivers occurring at discrete frequencies which are narrow band responses, shall be disregarded from the test (see subclause 4.10);
- the frequencies selected during the test shall be recorded in the test report.

9.1.3 Performance criteria

For transmitters the performance criteria CT (see subclause 6.1) shall apply.

For receivers, the performance criteria CRx (see subclause 6.3) shall apply.

For repeaters and ancillary RF amplifiers, the performance criteria CRptr (see subclause 6.5) shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

9.2 Electrostatic discharge

This test is applicable for base stations, repeaters, ancillary RF amplifiers and ancillary equipment.

This test shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

9.2.1 Definition

This test assesses the ability of base stations, repeaters, ancillary RF amplifiers and ancillary equipment to operate as intended in the event of an electrostatic discharge to surfaces exposed in normal operation.

NOTE: This test does not apply to surfaces which are exposed only during maintenance.

9.2.2 Test method and levels

The test method shall be in accordance with EN 61000-4-2 [11].

For base stations, repeaters, ancillary RF amplifiers and ancillary equipment the following requirements shall apply:

- for contact discharge, the equipment shall pass at ± 2 kV and ± 4 kV; for air discharge shall pass at ± 2 kV, ± 4 kV and ± 8 kV (see EN 61000-4-2 [11], clause 5);
- electrostatic discharges shall be applied to all exposed surfaces of the EUT except where the user documentation specifically indicates a requirement for appropriate protective measures (EN 61000-4-2 [11], subclause 8.3.1).

9.2.3 Performance criteria

For transmitters the performance criteria TT (see subclause 6.2) shall apply.

For receivers the performance criteria TRx (see subclause 6.4) shall apply.

For repeaters and ancillary RF amplifiers, the performance criteria TRptr (see subclause 6.6) shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

9.3 Fast transients common mode

This test is applicable for base stations, repeaters, ancillary RF amplifiers and ancillary equipment.

This test shall be performed on AC mains power input ports.

This test shall be performed on signal and control ports and DC power input/output ports if the cables may be longer than three (3) metres.

Where this test is not carried out on any ports because the manufacturer declares that it is not intended to be used with cables longer than three (3) metres, a list of ports which were not tested for this reason shall be included in the test report.

This test shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

9.3.1 Definition

This test assesses the ability of base stations, repeaters, ancillary RF amplifiers and ancillary equipment to operate as intended in the event of fast transients present on one of the input/output ports.

9.3.2 Test method and levels

The test method shall be in accordance with EN 61000-4-4 [12] except that the following requirements shall apply.

For base stations, repeaters, ancillary RF amplifiers and ancillary equipment, which have DC power, signal or control cables longer than three (3) metres, or are connected to the AC mains:

- the test level for signal and control ports shall be severity level 2 corresponding to 0,5 kV open circuit voltage as given in clause 5 of EN 61000-4-4 [12];
- the test level for DC power input/output ports shall be severity level 2 corresponding to 0,5 kV open circuit voltage as given in clause 5 of EN 61000-4-4 [12];
- the test level for AC mains power input ports shall be severity level 3 corresponding to 1 kV open circuit voltage as given in clause 5 of EN 61000-4-4 [12].

For AC power input and DC power input/output ports the transients shall be applied (in parallel) to all the wires in the cable with reference to the cabinet reference ground, i.e. line-to-ground, (true common mode), with a source impedance of 50 Ω .

9.3.3 Performance criteria

For transmitters the performance criteria TT (see subclause 6.2) shall apply.

For receivers the performance criteria TRx (see subclause 6.4) shall apply.

For repeaters and ancillary RF amplifiers, the performance criteria TRptr (see subclause 6.6) shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria shall apply.

9.4 RF common mode, 0,15 MHz to 80 MHz

This test is applicable for base stations, repeaters, ancillary RF amplifiers and ancillary equipment.

This test shall be performed on signal, control, DC power and AC mains power input/output ports of base stations, repeaters, ancillary RF amplifiers and ancillary equipment, which may have cables longer than one (1) metre.

Where this test is not carried out on any ports because the manufacturer declares that it is not intended to be used with cables longer than one (1) metre, a list of ports which were not tested shall be included in the test report.

This test shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

9.4.1 Definition

This test assesses the ability of base stations, repeaters, ancillary RF amplifiers and ancillary equipment to operate as intended in the presence of a radio frequency electromagnetic disturbance on the input/output ports.

9.4.2 Test method and level

The test should be performed using the intrusive or direct connection method, where appropriate; see EN 61000-4-6 [13]. The test method may be the current clamp method in accordance with EN 61000-4-6 [13]. Narrowband spurious responses found during testing shall be disregarded in the measurement (see subclause 4.10).

The following modifications shall apply:

- the test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 kHz;
- for receivers and transmitters the stepped frequency increments shall be 50 kHz in the frequency range 150 kHz to 5 MHz and 1 % frequency increment of the momentary frequency in the frequency range 5 MHz to 80 MHz;
- the test level shall be severity level 2 as given in EN 61000-4-6 [13] corresponding to 3 V rms, at a transfer impedance of 150 Ω ;
- if an intrusive or direct connection to any of the lines of any input/output port would affect the operation of the port, the current clamp injection method shall be used instead;
- the test shall be performed over the frequency range 150 kHz to 80 MHz;
- the frequencies selected during the test shall be recorded in the test report.

9.4.3 Performance criteria

For transmitters the performance criteria CT (see subclause 6.1) shall apply.

For receivers, the performance criteria CRx (see subclause 6.3) shall apply.

For repeaters and ancillary RF amplifiers, the performance criteria CRptr (see subclause 6.5) shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with base stations, repeaters, ancillary RF amplifiers in which case the corresponding performance criteria above shall apply.

9.5 Voltage dips and interruptions

These tests are applicable for base stations, repeaters, ancillary RF amplifiers and ancillary equipment, powered by the AC mains.

These tests shall be performed on AC mains power input ports.

These tests shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

9.5.1 Definition

These tests assess the ability of base stations, repeaters, ancillary RF amplifiers and ancillary equipment to operate as intended in the event of voltage dips and interruptions present on the AC mains power input ports.

9.5.2 Test method and levels

The following requirements shall apply.

The test method shall be in accordance with EN 61000-4-11 [14].

The test levels shall be:

- a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms;
- a voltage dip corresponding to a reduction of the supply voltage of 60 % for 100 ms;
- a voltage interruption corresponding to a reduction of the supply voltage of > 95 % for 5 000 ms.

9.5.3 Performance criteria

For a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms the following performance criteria shall apply:

- for transmitters the performance criteria TT (see subclause 6.1);
- for receivers the performance criteria TRx (see subclause 6.3);
- for repeaters and ancillary RF amplifiers, the performance criteria TRptr (see subclause 6.5);
- for ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with receivers, transmitters or transceivers in which case the corresponding performance criteria above shall apply.

For a voltage dip corresponding to a reduction of the supply voltage of 60 % for 100 ms and/or a voltage interruption corresponding to a reduction of the supply voltage of > 95 % for 5 000 ms the following performance criteria shall apply:

- for base stations, associated ancillary equipment and stand alone ancillary equipment, where the equipment is fitted with or connected to a battery back-up, the performance criteria TT (see subclause 6.2), or TRx (see subclause 6.4) apply as appropriate;
- for base stations, associated ancillary equipment and stand alone ancillary equipment, where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up), the communications link need not be maintained and may have to be re-established and volatile user data may have been lost;
- for repeaters, ancillary RF amplifiers and associated ancillary equipment, the performance criterion TRptr (see subclause 6.6) shall apply following a period for stabilization of the EUT after the supply voltage is restored to its nominal value. This period shall be as declared by the manufacturer or, if no value is declared, one minute.

In the event of loss of the communications link or in the event of loss of user data, this fact shall be recorded in the test report, the product description and the user documentation.

9.6 Surges, common and differential mode

These tests are applicable for base stations, repeaters, ancillary RF amplifiers and ancillary equipment.

These tests shall be performed on AC mains power input ports.

These tests shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

9.6.1 Definition

These tests assess the ability of base stations, repeaters, ancillary RF amplifiers and ancillary equipment to operate as intended in the event of surges present at the AC mains power input ports.

9.6.2 Test method and level

The following requirements shall apply.

The test method shall be in accordance with EN 61000-4-5 [15], except that the following requirements shall apply:

- the test level shall be installation level 2 corresponding to 1 kV open circuit voltage for line-to-ground and installation level 2 corresponding to 0,5 kV open circuit voltage for line-to-line;
- the transients shall be applied (in parallel) to all the wires in the cable with reference to the cabinet reference ground, for line-to-ground tests, i.e. true common mode, with a series resistance of 10 Ω .

9.6.3 Performance criteria

For transmitters the performance criteria TT (see subclause 6.2) shall apply.

For receivers the performance criteria TRx (see subclause 6.4) shall apply.

For repeaters and ancillary RF amplifiers, the performance criteria TRptr (see subclause 6.6) shall apply.

For ancillary equipment the pass/fail criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with base stations, repeaters, ancillary RF amplifiers in which case the corresponding performance criteria above shall apply.

9.7 RF conducted immunity, ancillary RF amplifiers

This test is applicable to antenna connectors of ancillary RF amplifiers which are the input to an RF amplifier.

This test shall be performed on a representative configuration of the radio communications equipment or a representative configuration of the combination of radio communications and ancillary equipment.

9.7.1 Definition

This test assesses the ability of an ancillary RF amplifier to correctly amplify a wanted signal in the presence of an interfering signal at the same antenna port.

9.7.2 Test method

The test method, frequencies and levels shall be in accordance with annex D of the present document.

9.7.3 Performance criteria

The change in gain of any amplifier tested due to the presence of the second RF signal shall not be more than 1 dB.

Annex A (normative):

Subclauses of the present document relevant for compliance with the essential requirements of the EC Council Directive 89/336/EEC

Table A.1: Subclauses of the present document relevant for compliance with the essential requirements of the EC Council Directive 89/336/EEC [4]

Clause/subclause number and title		Corresponding article of Council Directive 89/336/EEC [4]	Qualifying remarks
8	Test methods and limits for emission tests of base stations, repeaters, ancillary RF amplifiers and/or ancillary equipment		
8.1	Enclosure port, ancillary equipment	4(a)	
8.2	DC power input/output port	4(a)	
8.3	AC mains power input/output ports	4(a)	
8.4	Antenna port, ancillary RF amplifiers	4(a)	
8.5	Enclosure, ancillary RF amplifiers	4(a)	
8.6	Harmonic current emissions (AC mains input port)	4(a)	
8.7	Voltage fluctuations and flicker (AC mains input port)	4(a)	
9	Test methods and levels for immunity tests of base stations, repeaters, ancillary RF amplifiers and/or ancillary equipment		
9.1	RF electromagnetic field (80 MHz to 1 000 MHz)	4(b)	
9.2	Electrostatic discharge	4(b)	
9.3	Fast transients common mode	4(b)	
9.4	RF common mode, 0,15 MHz to 80 MHz	4(b)	
9.5	Voltage dips and interruptions	4(b)	
9.6	Surges, common and differential mode	4(b)	
9.7	RF conducted immunity, ancillary RF amplifiers	4(b)	

Annex B (normative): Method of assessment of Performance for Continuous phenomena applied to Repeaters and Ancillary RF Amplifiers (CRptr)

B.1 Test purpose

The purpose of this test is to provide a method of identifying degradation of performance for tests of immunity to continuous EMC phenomena.

B.2 Test method

An unmodulated RF signal shall be input to an RF connector which is the input to an amplifier within the EUT. The frequency shall be within the operating band of the EUT. The signal shall be monitored at an RF connector which is an output from the amplifier under test. The level of the RF signal shall be increased until the level at the output RF connector equals the manufacturers declared maximum RF output power for a single RF carrier.

The gain of the RF amplifier is the ratio, expressed in dB of the output power to the input power.

The gain shall be measured throughout the period of exposure to the phenomenon.

This test shall be performed for each RF connector which is the input to an RF amplifier. In each case, the gain of the amplifier shall be determined by measurement at an antenna connector which is one representative output from the amplifier. This may be achieved by performing one test for which the gain of all the amplifiers in the EUT is measured, or by repeating the test for each amplifier to be tested.

Care should be taken to ensure that the gain of an amplifier does not change due to any reason other than the phenomenon being applied. In particular:

- the ambient temperature should be stable;
- the power supply voltage should be stable;
- power should be applied for sufficient time before the start of testing for the internal temperature of the EUT to stabilize.

B.3 Performance assessment

The gain of the EUT shall be measured during the test.

Annex C (normative): Method of assessment of Performance for Transient phenomena applied to Repeaters and Ancillary RF Amplifiers (TRptr)

C.1 Test purpose

The purpose of this test is to provide a method of identifying degradation of performance for tests of immunity to transient EMC phenomena.

C.2 Test method

An unmodulated RF signal shall be input to an RF connector which is the input to an amplifier within the EUT. The frequency shall be within the operating band of the EUT. The signal shall be monitored at an RF connector which is an output from the amplifier under test. The level of the RF signal shall be increased until the level at the output RF connector equals the manufacturers declared maximum RF output power for a single RF carrier.

The gain of the RF amplifier is the ratio, expressed in dB of the output power to the input power.

The gain shall be measured before the test, and after each exposure.

This test shall be performed for each RF connector which is the input to an RF amplifier. In each case, the gain of the amplifier shall be determined by measurement at an antenna connector which is one representative output from the amplifier. This may be achieved by performing one test for which the gain of all the amplifiers in the EUT is measured, or by repeating the test for each amplifier to be tested.

Care should be taken to ensure that the gain of an amplifier does not change due to any reason other than the phenomenon being applied. In particular:

- the ambient temperature should be stable;
- the power supply voltage should be stable;
- power should be applied for sufficient time before the start of testing for the internal temperature of the EUT to stabilize.

C.3 Performance assessment

At the conclusion of each exposure the change in gain of the EUT shall be measured.

At the conclusion of the total test comprising the series of individual exposures, the change in gain of the EUT shall be measured.

Annex D (normative): Test of RF conducted immunity, antenna port of ancillary RF amplifiers

D.1 Definition

This test assesses the ability of an ancillary RF amplifier to correctly amplify a wanted signal in the presence of an interfering signal at the same antenna port.

This test shall be performed on representative antenna ports of ancillary RF amplifiers which are the input to an RF amplifier.

NOTE: This test is derived from the relevant parts of EN 301 087 [7], subclause 7.6 (BTS receiver blocking).

D.2 Test method

Two RF signals shall be input via a coupling device to an RF connector which is the input to an amplifier within the EUT. The first signal shall be unmodulated with a frequency within the operating band of the EUT.

The first RF signal shall be monitored at an RF connector which is an output from the amplifier under test within the EUT. The level of the RF signal shall be increased until the level at the output RF connector equals the manufacturers declared maximum RF output power for a single RF carrier.

The gain of the RF amplifier is the ratio, expressed in dB of the output power to the input power.

A second unmodulated RF signal shall then be applied to the RF connector via the coupling device. The power of this signal shall be as specified in table D.1, or as declared by the manufacturer; if the manufacturer declares values which differ from table D.1, these shall be contained in the product description and documentation.

Table D.1: Level and exclusion band of second RF signal

	RGSM 900	PGSM 900	EGSM 900	DCS 1800
Power	+8 dBm	+8 dBm	+8 dBm	0 dBm
Exclusion band	856 MHz to 921 MHz	870 MHz to 935 MHz	860 MHz to 935 MHz	1 690 MHz to 1 805 MHz

The frequency of the second RF signal shall be varied over the frequency range of 10 MHz to 4 GHz, excluding the exclusions band, either using a continuous sweep or setting to the following frequencies:

- the upper and lower limit of the exclusion band;
- all integer multiples of 10 MHz.

The gain of the RF amplifier under test shall be measured throughout the period of the test.

This test shall be performed for a representative set of RF connectors which are an input to an RF amplifier. In each case, the gain of the amplifier shall be determined by measurement at an antenna connector which is one representative output from the amplifier. This may be achieved by performing one test for which the gain of all the amplifiers in the EUT is measured, or by repeating the test for each amplifier to be tested.

Care should be taken to ensure that the gain of an amplifier does not change due to any reason other than the presence of the second RF signal. In particular:

- the ambient temperature should be stable;
- the power supply voltage should be stable;
- power should be applied for sufficient time before the start of testing for the internal temperature of the EUT to stabilize.

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

TS 100 910: "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (GSM 05.05 version 6.2.0 Release 1997)".

ETS 300 113: "Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector".

History

Document history		
Edition 1	October 1999	Publication as ETS 300 342-3.
V1.2.1	December 1999	Public Enquiry PE 200016: 1999-12-22 to 2000-04-21