



**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
ElectroMagnetic Compatibility (EMC) standard
for radio equipment and services;
Part 50: Specific conditions for Cellular Communication
Base Station (BS), repeater and ancillary equipment**

Reference

DEN/ERM-EMC-281

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Foreword

This draft Harmonized European Standard (EN) 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 Directive 98/34/EC [i.2] as amended by Directive 98/48/EC [i.8].

The title and reference to the present document are intended to be included in the publication in the Official Journal of the European Union of titles and references of Harmonized Standard under the Directive 1999/5/EC [i.1].

See article 5.1 of Directive 1999/5/EC [i.1] for information on presumption of conformity and Harmonised Standards or parts thereof the references of which have been published in the Official Journal of the European Union.

The present document is part 50 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

Proposed national transposition dates	
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Introduction

The present document has been produced to rationalize the current EN 301 489 series [i.9] of EMC standards by collating the EMC requirements for Digital Cellular Communication Base Station (BS), repeater and ancillary Equipment into a single standard, there are no technical changes to product EMC Test requirements. The present document has been produced to replace EN 301 489-8 [i.10] (GSM/EDGE), EN 301 489-23 [i.11] (UTRA/E-UTRA), EN 301 489-26 [i.12] CDMA1x and those parts of EN 301 489-4 [i.13] which pertain to WiMAX BS and to incorporate IMT MSR and IMT Mobile WiMAX.

1 Scope

The present document, together with EN 301 489-1 [1], covers the assessment of:

Digital cellular base station equipment, repeaters and associated ancillary equipment in respect of ElectroMagnetic Compatibility (EMC).

Including individually and combinations of:

- IMT-2000 CDMA Direct Spread (UTRA and E-UTRA, i.e. LTE);
- IMT-2000 CDMA Multi-carrier;
- GSM equipment meeting Phase 2, and Phase 2+ requirements;
- IMT Multi-Standard Radio (MSR);
- IMT OFDMA TDD WMAN (Mobile WiMAX).

Technical specifications related to the antenna port and emissions from the enclosure port of radio equipment (base station (BS), and repeaters) are not included in the present document. Such technical specifications are found in the relevant product standards for the effective use of the radio spectrum.

Examples of base station equipment covered by the present document are given in annex A.

In case of differences (for instance concerning special conditions, definitions, abbreviations) between the present document and EN 301 489-1 [1], the provisions of the present document take precedence.

The environmental classification and the emission and immunity requirements used in the present document are as stated in EN 301 489-1 [1], except for any special conditions included in the present document.

2 References

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

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

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

2.1 Normative references

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

- [1] ETSI EN 301 489-1 (V1.9.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [2] ETSI TS 125 141 (V9.8.0): "Universal Mobile Telecommunications System (UMTS); Base Station (BS) conformance testing (FDD) (3GPP TS 25.141 version 9.8.0 Release 9)".
- [3] ETSI TS 125 142 (V9.4.0): "Universal Mobile Telecommunications System (UMTS); Base Station (BS) conformance testing (TDD) (3GPP TS 25.142 version 9.4.0 Release 9)".
- [4] ETSI TS 125 143 (V9.2.0): "Universal Mobile Telecommunications System (UMTS); UTRA repeater conformance testing (3GPP TS 25.143 version 9.2.0 Release 9)".

- [5] ETSI TS 136 104 (V9.8.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception (3GPP TS 36.104 version 9.8.0 Release 9)".
- [6] ETSI TS 136 141 (V9.8.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing (3GPP TS 36.141 version 9.8.0 Release 9)".
- [7] ETSI TS 145 008 (V9.7.0): "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (3GPP TS 45.008 version 9.7.0 Release 9)".
- [8] ETSI EN 301 502 (V9.2.1): "Global System for Mobile communications (GSM); Harmonized EN for Base Station Equipment covering the essential requirements of article 3.2 of the R&TTE Directive".
- [9] ETSI TS 151 021 (V9.6.0): "Digital cellular telecommunications system (Phase 2+); Base Station System (BSS) equipment specification; Radio aspects (3GPP TS 51.021 version 9.6.0 Release 9)".
- [10] ETSI TS 100 607-1 (V8.3.0): "Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification (3GPP 11.10-1 version 8.3.0 Release 1999)".
- [11] ETSI TS 137 104 (V9.5.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception (3GPP TS 37.104 version 9.5.0 Release 9)".
- [12] ETSI TS 137 141 (V9.4.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing (3GPP TS 37.141 version 9.4.0 Release 9)".
- [13] ETSI EN 301 908-5 (V5.2.1): "IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 5: CDMA Multi-Carrier (cdma2000) Base Stations (BS)".
- [14] ETSI EN 301 908-7 (V5.2.1): "IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 7: CDMA TDD (UTRA TDD) Base Stations (BS)".
- [15] ETSI EN 301 908-20 (V5.2.1): "IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 20: OFDMA TDD WMAN (Mobile WiMAX) TDD Base Stations (BS)".
- [16] ETSI EN 301 908-22 (V5.2.1): "IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 22: OFDMA TDD WMAN (Mobile WiMAX) FDD Base Stations (BS)".
- [17] ETSI EN 302 544-1 (V1.1.2): "Broadband Data Transmission Systems operating in the 2 500 MHz to 2 690 MHz frequency band; Part 1: TDD Base Stations; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".
- [18] TIA-97-E-1 (2004): "Base Station Performance Standards for Dual Mode Spread Spectrum Systems".
- [19] TIA/EIA/IS-2000 Series, Release A: "CDMA 2000® Series, Release A (2000)".
- [20] ETSI EN 301 449 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Harmonized EN for CDMA spread spectrum base stations operating in the 450 MHz cellular band (CDMA 450) and 410, 450 and 870 MHz PAMR bands (CDMA-PAMR) covering essential requirements of article 3.2 of the R&TTE Directive".
- [21] ETSI EN 302 426 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Harmonized EN for CDMA spread spectrum Repeaters operating in the 450 MHz cellular band (CDMA450) and the 410 MHz, 450 MHz and 870 MHz PAMR bands (CDMA-PAMR) covering essential requirements of article 3.2 of the R&TTE Directive".

- [22] ETSI TS 125 101 (V9.7.0): "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (FDD) (3GPP TS 25.101 version 9.7.0 Release 9)".
- [23] ETSI TS 125 102 (V9.4.0): "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (TDD) (3GPP TS 25.102 version 9.4.0 Release 9)".
- [24] ETSI TS 136 101 (V9.8.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 9.8.0 Release 9)".
- [25] ETSI TS 136 143 (V9.2.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater conformance testing (3GPP TS 36.143 version 9.2.0 Release 9)".
- [26] ETSI TS 151 010-1 (V9.5.0): "Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification (3GPP TS 51.010-1 version 9.5.0 Release 9)".

2.2 Informative references

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

- [i.1] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [i.2] 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.
- [i.3] ETSI TS 125 104 (V9.7.0): "Universal Mobile Telecommunications System (UMTS); Base Station (BS) radio transmission and reception (FDD) (3GPP TS 25.104 version 9.7.0 Release 9)".
- [i.4] ETSI TS 125 105 (V9.2.0): "Universal Mobile Telecommunications System (UMTS); Base Station (BS) radio transmission and reception (TDD) (3GPP TS 25.105 version 9.2.0 Release 9)".
- [i.5] ETSI TS 125 106 (V9.2.0): "Universal Mobile Telecommunications System (UMTS); UTRA repeater radio transmission and reception (3GPP TS 25.106 version 9.2.0 Release 9)".
- [i.6] ETSI TS 136 106 (V9.3.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater radio transmission and reception (3GPP TS 36.106 version 9.3.0 Release 9)".
- [i.7] ETSI EN 302 774 (V1.2.1): "Broadband Wireless Access Systems (BWA) in the 3 400 MHz to 3 800 MHz frequency band; Base Stations; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".
- [i.8] Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.
- [i.9] ETSI EN 301 489 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services".
- [i.10] ETSI EN 301 489-8: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 8: Specific conditions for GSM base stations".
- [i.11] ETSI EN 301 489-23: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 23: Specific conditions for IMT-2000 CDMA, Direct Spread (UTRA and E-UTRA) Base Station (BS) radio, repeater and ancillary equipment".

- [i.12] ETSI EN 301 489-26: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 26: Specific conditions for CDMA 1x spread spectrum Base Stations, repeaters and ancillary equipment".
- [i.13] ETSI EN 301 489-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links, Broadband Data Transmission System Base stations, ancillary equipment and services".
- [i.14] ITU-R Recommendation SM.329-11: "Unwanted emissions in the spurious domain".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 301 489-1 [1] and the following apply:

Abis interface: logical interface between a BTS and a BSC

bearer: information transmission path of defined characteristics for transfer of user data or predefined test data

CDMA 1x Spread Spectrum: term used to denote cdma2000 Spread Spectrum Systems and their evolution with spreading rate 1

CDMA-PAMR: term used to denote a PAMR system, based on TIA/EIA/IS-2000 [19] Spreading Rate 1 specifications

channel bandwidth: RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements

forward CDMA channel: CDMA channel from a base station to mobile stations

NOTE: The forward CDMA channel contains one or more code channels that are transmitted on a CDMA frequency assignment using a particular pilot PN offset.

International Mobile Telecommunications-2000 (IMT-2000): third generation mobile systems which provide access, by means of one or more radio links, to a wide range of telecommunications services supported by the fixed telecommunication networks (e.g. PSTN, ISDN or IP), and to other services which are specific to mobile users

maximum throughput: maximum achievable throughput for a reference measurement channel

MSR Base Station: Base Station characterized by the ability of its receiver and transmitter to process two or more carriers in common active RF components simultaneously in a declared RF bandwidth, where at least one carrier is of a different RAT than the other carrier(s)

necessary bandwidth: As defined in ITU-R Recommendation SM.329-11 [i.14].

radio communications equipment: telecommunications equipment which includes one or more transmitters and/or receivers and/or parts thereof for use in a fixed, mobile or portable application. It can be operated with ancillary equipment but if so, is not dependent on it for basic functionality

Radio Configuration (RC): set of Forward Traffic Channel and Reverse Traffic Channel transmission formats that are characterized by physical layer parameters such as transmission rates, modulation characteristics, and spreading rate

radio digital unit: equipment which contains base band and functionality for controlling Radio unit

radio equipment: equipment which contains Radio digital unit and Radio unit

radio unit: equipment which contains transmitter and receiver

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

reverse CDMA channel: CDMA channel from the mobile station to the base station

NOTE: From the base station's perspective, the Reverse CDMA Channel is the sum of all mobile station transmissions on a CDMA frequency assignment.

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 TS 145 008 [7], clause 8.2

throughput: number of payload bits successfully received per second for a reference measurement channel in a specified reference condition

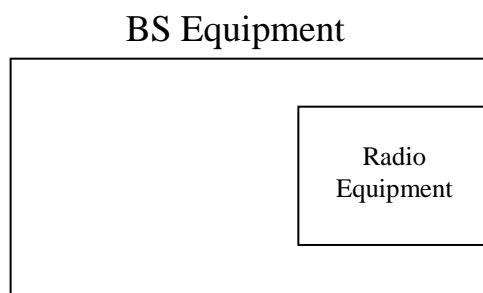


Figure 1a: BS with single enclosure solution

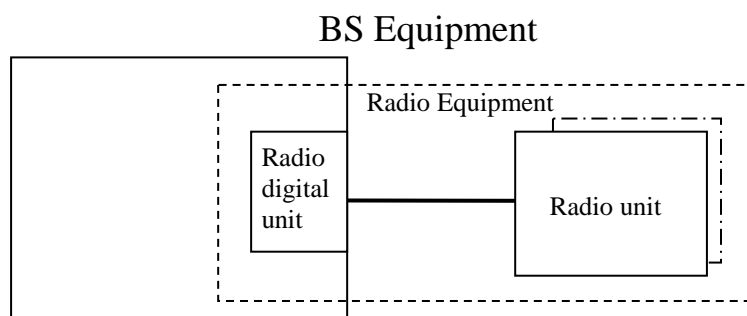


Figure 1b: BS with multiple enclosure solution

3.2 Abbreviations

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

ARFCN	Absolute Radio Frequency Channel Number
BER	Bit Error Ratio
BLER	Block Error Ratio
BS	Base Station
BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver Station
BW_{Channel}	Channel bandwidth
CDMA	Code Division Multiple Access
CRC	Cyclic Redundancy Check
CS	Capability Set
DC	Direct Current
DCS	Digital Cellular System
EARFCN	E-UTRA Absolute Radio Frequency Channel Number

EMC	ElectroMagnetic Compatibility
EPC	Evolved Packet Core
EUT	Equipment Under Test
E-UTRA	Evolved Universal Terrestrial Radio Access
FDD	Frequency Division Duplex
FER	Frame Error Rate
FRC	Fixed Reference Channel
GSM	Global System for Mobile communication
HW	Hardware
IF	Intermediate Frequency
IMT	International Mobile Telecommunications
IMT-2000	International Mobile Telecommunications 2000
IP	Internet Protocol
ISDN	Integrated Services Digital Network
Iub	Interface between RNC and BS
MSR	Multi Standard Radio
PAMR	Public Access Mobile Radio
PN	Pseudorandom Number
PSTN	Public Switched Telephone Network
RAT	Radio Access Technology
RC	Radio Configuration
RF	Radio Frequency
RNC	Radio Network Controller
RXQUAL	Received Signal Quality
TCH	Traffic Channel
TCH/FS	Full rate Speech TCH
TCx	Test Configurations
TDD	Time Division Duplex
UARFCN	UTRA Absolute Radio Frequency Channel Number
UTRA	Universal Terrestrial Radio Access
WiMAX	Trade marked name for the OFDMA TDD WMAN IMT Technology
WMAN	Wireless Metropolitan Area Network

4 Test conditions

For the purpose of the present document, the test conditions of EN 301 489-1 [1], clause 4, shall apply as appropriate. Further product related test conditions for base station equipment are specified in the present document.

4.1 General

The equipment shall be tested in the normal test environment defined in the appropriate conformance testing specification as specified below:

Base station:

- UTRA (FDD) base station TS 125 141 [2];
- UTRA (TDD) base station TS 125 142 [3];
- E-UTRA base station TS 136 141 [6];
- GSM/EDGE base station EN 301 502 [8];
- MSR base station TS 137 141 [12];
- Mobile Wimax TDD base station EN 301 908-20 [15];
- Mobile Wimax FDD base station EN 301 908-22 [16];
- CDMA Multi-Carrier base station TIA-97-E-1 [18].

Repeater:

- UTRA-repeater conformance testing specification TS 125 143 [4];
- E-UTRA repeater conformance testing specification TS 136 143 [25].

The test conditions shall be recorded in the test report.

For emission and immunity tests the test arrangements, etc., as specified in the present document, clauses 4.2 to 4.6, shall apply.

For an EUT which contains more than one BS, it is sufficient to perform tests relating to connectors of each representative type of port forming part of the EUT. For an MSR BS or other BS supporting more than one RAT, tests shall be performed relating to each port, but need not be repeated for each RAT that use the same port unless the test configuration in clause 4.6 calls for multi-RAT test configuration. For other BS supporting more than one RAT however (other than MSR BS), tests relating to the antenna port(s) shall always be performed for each supported RAT.

4.2 Arrangements for test signals

The provisions of EN 301 489-1 [1], clause 4.2 shall apply, with the following modifications.

UTRA/E-UTRA/GSM-EDGE/MSR

The wanted RF signal nominal frequency shall be selected by setting the channel number according to the following:

- The Absolute Radio Frequency Channel Number (EARFCN) for E-UTRA carrier.
- The Absolute Radio Frequency Channel Number (UARFCN) for UTRA carrier.
- The Absolute Radio Frequency Channel Number (ARFCN) for GSM/EDGE carrier.

CDMA - Set the CDMA channel to an appropriate number.

Mobile WiMAX - The wanted signal(s) shall be (a) representative baseband input signal(s) corresponding to normal operation.

A communication link shall be set up with a suitable test system capable of evaluating the required performance criteria (hereafter called "the test system") at the radio interface and telecommunication port/ports (e.g. the S1/Iub/Abis interface).

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

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 rated transmit power.
- Adequate measures shall be taken to avoid the effect of the unwanted signal on the measuring equipment.
- The wanted RF input signal level shall be set to a level where the performance is not limited by the receiver noise floor or strong signal effects.
 - For E-UTRA, the wanted signal can be set e.g. 15 dB above the reference sensitivity level as defined in TS 136 141 [6] to provide a stable communication link.
 - For UTRA FDD and TDD, the wanted signal can be set e.g. 15 dB above the reference sensitivity level as defined in TS 125 141 [2] or TS 125 142 [3] respectively, to provide a stable communication link.
 - For GSM/EDGE the wanted receiver input signal level shall be set to a nominal value of -47 dBm.

Mobile WiMAX

The input signal level shall be at a nominal value of 15 dB above the receiver input level for a Bit Error Ratio (BER) of 1×10^{-5} .

CDMA

A communication link shall be set up with a suitable mobile station simulator (hereafter called "the test system") according to the Radio Configuration (RC) supported by the base station (see clause 1.3 in TIA-97-E-1 [18] using full data rate only).

4.2.1 Multiple enclosure BS solution

For a BS with multiple enclosures, the BS part with Radio digital unit and the Radio unit may be tested separately. Communication link shall be set up in the same way as if they are in single BS enclosure. The Radio Digital unit and the Radio unit shall communicate over an interface enabling establishment of a communication link.

4.2.2 Arrangements for test signals at the input of transmitters

The provisions of EN 301 489-1 [1], clause 4.2.1 shall apply.

4.2.3 Arrangements for test signals at the output of transmitters

The provisions of EN 301 489-1 [1], clause 4.2.2 shall apply.

4.2.4 Arrangements for test signals at the input of receivers

The provisions of EN 301 489-1 [1], clause 4.2.3 shall apply with the following modification.

The wanted input signal level shall be set to a level to provide a stable communication link where the performance is not limited by the receiver noise floor or strong signal effects e.g. 15 dB above the reference sensitivity level as defined in:

- UTRA TS 125 141 [2] (for FDD), TS 125 142 [3] (for TDD);
- E-UTRA TS 136 141 [6];
- CDMA TIA-97-E-1 [18];
- Mobile WiMAX for a Bit Error Ratio (BER) of 1×10^{-5} .

GSM/EDGE

The source of the wanted RF input signal shall be at a nominal value of -47 dBm.

CDMA

For immunity testing the wanted RF signal level at the input of the EUT shall be set to no more than 40 dB above the reference sensitivity level as defined in TIA-97-E-1 [18].

4.2.5 Arrangements for test signals at the output of receivers

The provisions of EN 301 489-1 [1], clause 4.2.4 shall apply.

4.2.6 Arrangements for test signals for repeaters

For immunity tests of repeaters, the wanted RF 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.

4.3 Exclusion bands

4.3.1 Transmitter exclusion band

UTRA, E-UTRA, GSM/Edge, CDMA, Mobile WiMAX and MSR - for testing of radiated immunity there shall be no transmitter exclusion band.

4.3.2 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.

Extends from the lower frequency of the Base Station receive band minus 20 MHz to the upper frequency of the Base Station receive band plus 20 MHz.

4.4 Narrow band responses of receivers

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

- if during an immunity test the quantity being monitored goes outside the specified tolerances (clause 6), it is necessary to establish whether the deviation is due to a narrow band response or to a wide band (EMC) phenomenon. Therefore, the test shall be repeated with the unwanted signal frequency first increased, and then decreased by an offset f_{offset} , where:
 - for UTRA, $f_{\text{offset}} = 10 \text{ MHz}$;
 - for E-UTRA, $f_{\text{offset}} = 2 \times \text{BW}_{\text{Channel}}$, where $\text{BW}_{\text{Channel}}$ is the channel bandwidth as defined in TS 136 104 [5];
 - for GSM/EDGE, $f_{\text{offset}} = 400 \text{ kHz}$;
 - CDMA, $f_{\text{offset}} = 10 \text{ MHz}$, $f_{\text{offset}} = 12,5 \text{ MHz}$;
 - mobile WiMAX – $f_{\text{offset}} = 2 \times \text{BW}_{\text{Channel}}$, where $\text{BW}_{\text{Channel}}$ is the channel bandwidth;
- if the deviation disappears in either or both of the above offset cases, then the response is considered as a narrow band response;
- if the deviation does not disappear, 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 $1,25 \times f_{\text{offset}}$;
- if the deviation does not disappear with the increased and/or decreased frequency, the phenomenon is considered wide band and therefore an EMC problem and the equipment fails the test.

Narrow band responses are disregarded.

4.5 Normal test modulation

A communication link shall be set up with a suitable base station system test equipment.

UTRA

The normal test modulation should be a bearer with the characteristics of data rate shown in table 1.

If the test is not performed using one of these bearers, (for example none of them are supported by the BS), the characteristics of the bearer used shall be declared by the manufacturer and recorded in the test report.

Table 1: Bearer information data rate

Bearer Information Data Rate
12,2 kbit/s
64 kbit/s
144 kbit/s
384 kbit/s

E-UTRA

The normal test modulation should be a bearer with the characteristics of data rate shown in table 2.

If the test is not performed using one of these bearers, (for example none of them are supported by the BS), the characteristics of the bearer used shall be declared by the manufacturer and recorded in the test report.

Table 2: Bearer information data rate

E-UTRA Channel Bandwidth [MHz]	Bearer Information Data Rate
1,4	FRC A1-1 in clause A.1 in TS 136 104 [5]
3	FRC A1-2 in clause A.1 in TS 136 104 [5]
5	FRC A1-3 in clause A.1 in TS 136 104 [5]
10	FRC A1-3 in clause A.1 in TS 136 104 [5](see note)
15	FRC A1-3 in clause A.1 in TS 136 104 [5] (see note)
20	FRC A1-3 in clause A.1 in TS 136 104 [5] (see note)
NOTE: This is the information data rate of a single instance of the bearer mapped to 25 resource blocks. The performance criteria shall be met for each consecutive application of a single instance of the bearer mapped to disjoint frequency ranges with a width of 25 resource blocks each.	

GSM/EDGE

The normal test modulation shall be delivered by a suitable mobile station or base station system test equipment (BSSTE).

Mobile WiMAX

A representative modulated RF signal corresponding to normal operation.

CDMA

A communication link shall be set up with a suitable base station system test equipment. The normal test modulation should be setup according to the Radio Configuration (RC) supported by the base station under test using full data rate only (see clause 1.3 in TIA-97-E-1 [18]).

4.6 MSR BS test configurations

The present clause defines the test configurations for MSR Base Stations that shall be used for demonstrating conformance.

The Test configurations apply according to the declared RAT Capability Set (CS) of the MSR Base Station according to clause 4.7 of TS 137 141 [12] and the Band Category of the declared operating band (BC1, BC2 or BC3), as listed in the heading of each table.

For emission tests:

- The test configurations (TCx) are defined in TS 137 141 [12], clause 4.8.

For immunity tests:

- The communication link for the RAT(s) listed in the table shall be established according to clause 4.2.
- Tests for ports relating to the RAT(s) supported shall be performed according to clause 4.1.

Table 3: Test configurations for Multi-RAT capable MSR BS

Capability Set	UTRA + E-UTRA (CS 3)			GSM+ UTRA (CS 4)	GSM + E-UTRA (CS 5)	GSM + UTRA + E-UTRA (CS 6)
	BS test case	BC1	BC2	BC3	BC2	BC2
Emission tests	TC3a	TC3a	TC3b	TC4a	TC4b	TC4c
Immunity tests (see note)	TC3a	TC3a	TC3b	TC4a	TC4b	TC4c
NOTE:	The test configuration identified for immunity tests are intended for transmitter tests in TS 137 141 [12], but are here applied both for BS transmitter and receiver.					

5 Performance assessment

5.1 General

The provision of EN 301 489-1 [1], clause 5.1 shall apply with the following modifications:

Additionally information about the common and/or RAT-specific active RF components and other HW blocks for a communication link in MSR BS or other BS supporting more than one RAT shall be recorded to the test report.

The information about the bandwidth of the IF amplifier immediately preceding the demodulator as set out in EN 301 489-1 [1], clause 5.1 is not applicable for radio equipment in the scope of the present document.

A common communication link used by more than one RAT, shall be assessed on any one RAT.

5.2 Equipment which can provide a continuous communication link

The provision of EN 301 489-1 [1], clause 5.2 shall apply.

5.2.1 Assessment of BLER/Throughput/BER/FER in Downlink

The level of the signal supplied to the equipment should be within the range for which the assessment of BLER/Throughput/BER is not impaired. Power control shall be off during the immunity testing.

For UTRA (BLER)

In order to assess the BLER of the bearer used during the immunity tests, the output of the transmitter shall be connected to an equipment which meets the requirements for the BLER assessment of TS 125 101 [22] in case of FDD and TS 125 102 [23] in case of TDD.

For E-UTRA (Throughput)

The output of the transmitter shall be connected to an equipment which meet the requirements for the throughput assessment of TS 136 101 [24] for the bearer used in the immunity tests.

CDMA (FER)

For immunity testing, the output of the transmitter shall be connected to a test system which meets the requirements for the FER assessment in accordance with TIA/EIA/IS-2000.2-1 [19] and TIA-97-E-1 [18]. The level of the signal supplied to the test system shall be attenuated such that it is within the range for which the assessment of FER is not impaired.

Mobile WiMAX

The output of the transmitter shall be connected to an equipment which meets the requirements for throughput assessment.

For GSM/EDGE (BER)

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

5.2.1.1 Assessment of BER using static layer 1 functions

The transmitter under test shall be operated according to the test case of TS 151 021 [9], clause 6.1.2.

The bit sequence from the output of the transmitter shall be monitored by the test system according to the test case of TS 151 021 [9], clause 7.1.2, and the BER of the class 2 bits for TCH/FS assessed. The BER shall not exceed the values specified in clause 6.1 of the present document.

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.

5.2.1.2 Assessment of BER using RXQUAL

The output of the transmitter shall be connected to an equipment which meets the requirements of either TS 151 010-1 [26], or TS 100 607-1 [10] for the assessment of RXQUAL. The RXQUAL shall be monitored during the test. The RXQUAL shall not exceed the values specified in clause 6.1 of the present document.

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

5.2.2 Assessment of BLER/Throughput/BER/FER in Uplink

For UTRA (BLER)

The value of the BLER at the output of the receiver reported by the BS shall be monitored at the Iub interface by using a suitable test equipment.

For E-UTRA (Throughput)

The value of the throughput at the output of the receiver shall be monitored at S1 interface by using suitable test equipment.

CDMA (FER)

The value of the FER at the output of the receiver reported by the BS shall be monitored using a suitable test system.

Mobile WiMAX

The value of the throughput at the output of the receiver shall be monitored at the backhaul interface by using suitable test equipment.

For GSM/EDGE (BER)

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

5.2.2.1 Assessment of BER using RXQUAL

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

5.2.2.2 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.

5.2.3 Assessment of RF gain variations of repeaters

The parameter used for the performance assessment of a repeater is the RF gain within the operating frequency band.

5.3 Equipment which does not provide a continuous communication link

The provision of EN 301 489-1 [1], clause 5.3 shall apply.

5.4 Ancillary equipment

The provision of EN 301 489-1 [1], clause 5.4 shall apply.

5.5 Equipment classification

The provision of EN 301 489-1 [1], clause 5.5 shall apply.

6 Performance criteria

6.1 Performance criteria for continuous phenomena applied to Base Stations and Repeaters

6.1.1 Base Stations (BS)

For UTRA

The BLER calculation shall be based on evaluating the CRC on each transport block.

During immunity tests of the BS Uplink and Downlink paths the observed BLER shall be less than 1×10^{-2} and the BS shall operate as intended. If the Uplink and Downlink paths are evaluated as one loop then the criteria is less than 2×10^{-2} .

After each test case the BS shall operate as intended with no loss of user control functions or stored data, the communications link shall be maintained.

For E-UTRA

The test should, where possible, be performed using a bearer with the characteristics of data rate and throughput defined in table 4. If the test is not performed using one of these bearers (for, example, of none of them are supported by the BS), the characteristics of the bearer used shall be recorded in the test report.

The throughput in table 4 is stated relative to the maximum throughput of the FRC. The maximum throughput for an FRC is equal to the payload size \times the number of uplink subframes per second.

The BS Uplink and Downlink paths shall each meet the performance criteria defined in table 4 during the test. If the Uplink and Downlink paths are evaluated as a one loop then the criteria is two times the throughput reduction shown in table 4. After each test case BS shall operate as intended with no loss of user control function, stored data and the communication link shall be maintained.

Table 4: BS Performance Criteria for continuous phenomena for BS

E-UTRA Channel Bandwidth [MHz]	Bearer Information Data Rate	Performance Criteria (see notes 1 and 2)
1,4	FRC A1-1 in clause A.1 in TS 136 104 [5]	Throughput > 95 % No loss of service
3	FRC A1-2 in clause A.1 in TS 136 104 [5]	Throughput > 95 % No loss of service
5	FRC A1-3 in clause A.1 in TS 136 104 [5]	Throughput > 95 % No loss of service
10	FRC A1-3 in clause A.1 in TS 136 104 [5] (see note 3)	Throughput > 95 % No loss of service
15	FRC A1-3 in clause A.1 in TS 136 104 [5] (see note 3)	Throughput > 95 % No loss of service
20	FRC A1-3 in clause A.1 in TS 136 104 [5] (see note 3)	Throughput > 95 % No loss of service
NOTE 1: The performance criteria, Throughput > 95 % / No loss of service, applies also if a bearer with another characteristics is used in the test.		
NOTE 2: The performance criteria, Throughput > 90 % / No loss of service, applies instead if the Uplink and Downlink paths are evaluated as a one loop.		
NOTE 3: This is the information data rate of a single instance of the bearer mapped to 25 resource blocks. The performance criteria shall be met for each consecutive application of a single instance of the bearer mapped to disjoint frequency ranges with a width of 25 resource blocks each.		

After each test case the BS shall operate as intended with no loss of user control functions or stored data, the communications link shall be maintained.

For GSM/EDGE

Downlink

The BER of the downlink shall be assessed during the test according to one of the test methods of clause 5.2.1.

If the test method of clause 5.2.1.1 is used, the measured BER of the class 2 bits of TCH/FS shall not exceed 1,6 % during the test.

NOTE 1: This BER is the upper limit in TS 145 008 [7] for RXQUAL = 3.

If the test method of clause 5.2.1.2 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.

Uplink

The BER of the uplink shall be assessed during the test according to one of the test methods of clause 5.2.2.

If the test method of clause 5.2.2.1 is used, the value of RXQUAL shall not exceed 3 during the test.

If the test method of clause 5.2.2.2 is used, the measured BER of the class 2 bits of TCH/FS shall not exceed 1,6 % during the test.

NOTE 2: This BER is the upper limit in TS 145 008 [7] 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.

CDMA

During the immunity test, the observed Frame Error Rate (FER) of the BS forward link and reverse link shall not exceed 1,0 % with 95 % confidence (see clause 6.8 in TIA-97-E-1 [18]), and the BS shall operate as intended. However, in the case of PAMR base stations the observed Frame Error Rate (FER) of the BS forward link and reverse link shall not exceed 2,0 % with 95 % confidence (see clause 6.8 in TIA-97-E-1 [18]), and the BS shall operate as intended.

Table 5: Mobile WiMAX

Mobile WiMAX Channel Bandwidth [MHz]		Performance Criteria (see notes 1 and 2)
5		Throughput > 95 % No loss of service
10		Throughput > 95 % No loss of service
NOTE 1: The performance criteria, Throughput > 95 % / No loss of service, applies also if a bearer with another characteristics is used in the test.		
NOTE 2: The performance criteria, Throughput > 90 % / No loss of service, applies instead if the Uplink and Downlink paths are evaluated as a one loop.		

After each test case, the BS shall operate as intended with no loss of user control function, or stored data, the communication link shall be maintained.

6.1.2 Repeaters

The RF gain of the EUT shall be measured throughout the period of exposure to the phenomenon. The RF gain measured during the test shall not deviate 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.

6.2 Performance criteria for transient phenomena for Base Station and Repeaters

6.2.1 Base stations (BS)

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.

6.2.2 Repeaters

The RF gain of the EUT shall be measured before the test and after each exposure. 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.

6.3 Performance criteria for ancillary equipment tested on a stand alone basis

The provision of EN 301 489-1 [1], clause 6.4 shall apply. In addition, the provisions of clauses 6.3.1 and 6.3.2 of the present document shall apply.

6.3.1 Performance criteria for continuous phenomena for ancillary equipment

The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible performance loss. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

6.3.2 Performance criteria for transient phenomena for ancillary equipment

The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible performance loss. During the test, degradation of performance is however allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

7 Applicability overview tables

7.1 Emission

7.1.1 General

EN 301 489-1 [1], table 1 contains the applicability of EMC emission measurements to the relevant ports of radio and/or associated ancillary equipment.

7.1.2 Special conditions

The following special conditions set out in table 6, relate to the emission test methods used in the EN 301 489-1 [1], clause 8.

Table 6: Special conditions for EMC emission measurements

Reference to clauses in EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions in EN 301 489-1 [1], clause 8		
8.3 DC power input/output ports	For this type of equipment the limits below apply.		
8.3.3 Limits	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

7.2 Immunity

7.2.1 General

EN 301 489-1 [1], table 2 contains the applicability of EMC immunity measurements to the relevant ports of radio and/or associated ancillary equipment.

7.2.2 Special conditions

The following special conditions set out in table 7 relate to the immunity test configurations set out in EN 301 489-1 [1], clause 9.1.

Table 7: Special conditions for EMC immunity measurements

Reference to clauses in EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test configuration in EN 301 489-1 [1], clause 9.1
9.1 E-UTRA, UTRA, GSM/EDGE, CDMA Test configuration	<ul style="list-style-type: none"> - Immunity tests on the entire base station shall be performed by establishing communication links at the air interface (e.g. with the mobile simulator(s)) and the S1/lub/Abis interface (e.g. with an EPC/RNC/BSC simulator) and evaluating the throughput/BLER/BER (see figure 9.2.1). - Immunity tests shall be performed on both the Uplink and Downlink paths. The tests shall also include both the air interface and S1/lub/Abis interface. Throughput/BLER/BER evaluation may be carried out at either interface, where appropriate, and the measurements for the Uplink and Downlink paths may be carried out as a single path looped at either the air interface or S1/lub/Abis interface. In case of looping is used care have to be taken that the throughput/BLER/BER information does not change due to looping. - Immunity tests on the MSR base station shall be performed by activating all supported RATs concurrently. <div style="text-align: center; margin-top: 20px;"> <pre> graph LR MS[Mobile simulator(s)] <--> BS[Base station TX RX 1 RX 2 (terminated)] BS <--> EPC[EPC/RNC/BSC simulator(s)] MS <--> EPC </pre> </div>

Annex A (informative): Examples of base station radio equipment for digital cellular radio telecommunications systems within the scope of the present document

The present document covers types of base station digital cellular radio telecommunications equipment as set out below.

A.1 Base station equipment for IMT-2000 CDMA Direct Spread (UTRA)

The present document applies to 3rd Generation Partnership Project (UTRA) radio equipment intended for use in digital cellular mobile radio services. Definitions for base station equipment within the scope of the present document are found in the following functional radio specifications:

- TS 125 104 [i.3];
- TS 125 105 [i.4];
- TS 125 106 [i.5].

A.2 Base station equipment for Evolved Universal Terrestrial Radio Access (E-UTRA)

The present document applies to 3rd Generation Partnership Project (UTRA) radio equipment intended for use in digital cellular mobile radio services. Definitions for base station equipment within the scope of the present document are found in the following functional radio specifications:

- E-UTRA base stations meeting the requirements of TS 136 104 [5], with conformance demonstrated by compliance to TS 136 141 [6].
- E-UTRA repeaters meeting the requirements of TS 136 106 [i.6], with conformance demonstrated by compliance to TS 136 143 [25].

A.3 GSM base station, ancillary RF amplifiers, and GSM repeaters meeting Phase 2 and 2+

The present document applies to GSM base stations meeting Phase 2 and 2+ requirements of the GSM digital cellular telecommunications system, and operating in the P-GSM 900 MHz, E-GSM 900 MHz or DCS 1 800 MHz bands.

A.4 Other types of GSM base station, ancillary RF amplifiers, and GSM repeaters equipment

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 2+ GSM requirements;

- equipment which is designed to meet Phase 1 GSM requirements, provided that it also meets the Phase 2 or 2+ GSM requirements.

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

A.5 Multi Standard Radio (MSR) Base station equipment

The present document applies to Multi-Standard Radio (MSR) base station equipment intended for use in digital cellular mobile radio services. Definitions for base station equipment within the scope of the present document are found in the following functional radio specification:

- the requirements of TS 137 104 [11], with conformance demonstrated by compliance to TS 137 141 [12].

A.6 WiMAX Base station equipment

The present document applies to Broadband Data Transmission System base station equipment.

This equipment can be found in networks operating in a number of frequency bands subject to national licensing conditions. Examples of such frequency bands are 2 500 MHz to 2 690 MHz, 3 400 MHz to 3 600 MHz and 3 600 MHz to 3 800 MHz details of such equipment can be found in the following harmonized standards:

- EN 302 544-1 [17];
- EN 302 774 [i.7].

A.7 Mobile WiMAX Base station equipment

The present document applies to Mobile WiMAX base station equipment. Definitions of base station equipment within the scope of the present document are found in the following functional radio specifications:

- EN 301 908-20 [15];
- EN 301 908-22 [16].

A.8 CDMA 1x spread spectrum Base stations, repeaters and ancillary equipment

The present document covers types of base stations and repeaters using CDMA 1x spread spectrum technology and associated ancillary equipments. Definitions of examples of base station equipment within the scope of the present document are found in the following functional radio specifications:

- IMT-2000 CDMA Multi-carrier radio equipment intended for use in digital cellular mobile radio services operating in any of the Band Classes described in TIA-97-E-1 [18].
- CDMA-PAMR radio equipment operating in one or more of the band classes defined in TIA-97-E-1 [18].
- EN 301 908-5 [13].
- EN 301 908-7 [14].
- EN 301 449 [20].
- EN 302 426 [21].

Annex B (informative): Bibliography

ETSI EN 301 526 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Harmonized EN for CDMA spread spectrum mobile stations operating in the 450 MHz cellular band (CDMA 450) and 410, 450 and 870 MHz PAMR bands (CDMA-PAMR) covering essential requirements of article 3.2 of the R&TTE Directive".

History

Document history		
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