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Universal Mobile Telecommunications System (UMTS); Base station and repeater electromagnetic compatibility (EMC) (3GPP TS 25.113 version 5.2.0 Release 5)



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Foreword

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1 Scope

The present document covers the assessment of base stations, repeaters and associated ancillary equipment in respect of Electromagnetic Compatibility (EMC).

The present document specifies the applicable test conditions, performance assessment and performance criteria for base stations, repeaters and associated ancillary equipment in one of the following categories:

- base stations for the FDD mode of UTRA meeting the requirements of TS 25.104 [1], with conformance demonstrated by compliance to TS 25.141 [3].
- base stations for both options of the TDD mode of UTRA meeting the requirements of TS 25.105 [2], with conformance demonstrated by compliance to TS 25.142 [4]. The two options are the 3,84 Mcps and 1,28 Mcps options respectively. The requirements are listed in different subsections only if the parameters deviate.
- repeaters for the FDD mode of UTRA meeting the requirements of TS 25.106 [10], with conformance demonstrated by compliance to TS 25.143 [11].

Technical requirements related to the antenna port of base stations or repeaters are not included in the present document. These are found in the relevant product standards [1], [2], [3], [4], [10], [11].

The environment classification used in the present document refers to the environment classification used in IEC 61000-6-1 [5] and IEC 61000-6-3 [6].

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.

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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TS 25.104: "UTRA (BS) FDD; Radio transmission and reception".
- [2] 3GPP TS 25.105: "UTRA (BS) TDD; Radio transmission and reception".
- [3] 3GPP TS 25.141: "UTRA (BS) FDD; Base station conformance testing (FDD)".
- [4] 3GPP TS 25.142: "UTRA (BS) TDD; Base station conformance testing (TDD)".
- [5] IEC 61000-6-1: 1997; "Electromagnetic compatibility (EMC) – Part 6: Generic standards – Section 1: Immunity for residential, commercial and light-industrial environments".
- [6] IEC 61000-6-3: 1996; "Electromagnetic compatibility (EMC) – Part 6: Generic standards – Section 3: mission standard for residential, commercial and light industrial environments".
- [7] IEC 60050(161): "International Electrotechnical Vocabulary - Chapter 161: Electromagnetic compatibility".
- [8] 3GPP TS 25.101: "UTRA (UE) FDD; UE Radio transmission and reception (FDD)".
- [9] 3GPP TS 25.102: "UTRA (UE) TDD; UE Radio transmission and reception (TDD)".

- [10] 3GPP TS 25.106: "UTRA Repeater; Radio Transmission and Reception"
- [11] 3GPP TS 25.143: "UTRA Repeater conformance testing"
- [12] ITU-R Rec. SM.329-9: "Spurious emissions"
- [13] CISPR 22 (1997): "Limits and methods of measurement of radio disturbance characteristics of information technology equipment".
- [14] CISPR 16-1 (1993): "Specification for radio disturbance and immunity measuring apparatus and methods".
- [15] IEC 61000-3-2 (2000): "Electromagnetic compatibility (EMC) - Part 3: Limits – Section 2: Limits for harmonic current emissions (equipment input current ≤ 16 A) "
- [16] IEC 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 ≤ 16 A"
- [17] IEC 61000-4-2: " Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test".
- [18] IEC 61000-4-3: " Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency electromagnetic field immunity test".
- [19] IEC 61000-4-4: " Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test".
- [20] IEC 61000-4-5: " Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques – Section 5: Surge immunity test".
- [21] IEC 61000-4-6: " Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques – Section 6: Immunity to contacted disturbances, induced by radio frequency fields".
- [22] IEC 61000-4-11 : " Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques – Section 11: Voltage dips, short interruptions and voltage variations. Immunity tests".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

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

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

Base Station equipment: Radio and/or ancillary equipment intended for operation at a fixed location and powered directly or indirectly (e.g. via an AC/DC converter or power supply) by AC mains network, or an extended local DC mains network.

BLER: BLER is block error ratio. The BLER calculation shall be based on evaluating the CRC on each transport block.

Continuous phenomena (continuous disturbance): Electromagnetic disturbance, the effects of which on a particular device or equipment cannot be resolved into a succession of distinct effects (IEC 60050-161 [7]).

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.

Port: A particular interface, of the specified equipment (apparatus), with the electromagnetic environment. For example, any connection point on an equipment intended for connection of cables to or from that equipment is considered as a port (see figure 1).

Repeater: A device that receives, amplifies and transmits the radiated or conducted RF carrier both in the down-link direction (from the base station to the mobile area) and in the up-link direction (from the mobile to the base station).

Signal and control : Port which carries information or control signals, excluding antenna ports.

Telecommunication port: Ports which are intended to be connected to telecommunication networks (e.g. public switched telecommunication networks, integrated services digital networks), local area networks (e.g. Ethernet, Token Ring) and similar networks.

Transient phenomena: Pertaining to or designating a phenomena or a quantity which varies between two consecutive steady states during a time interval short compared with the time-scale of interest (IEC 60050-161 [7]).

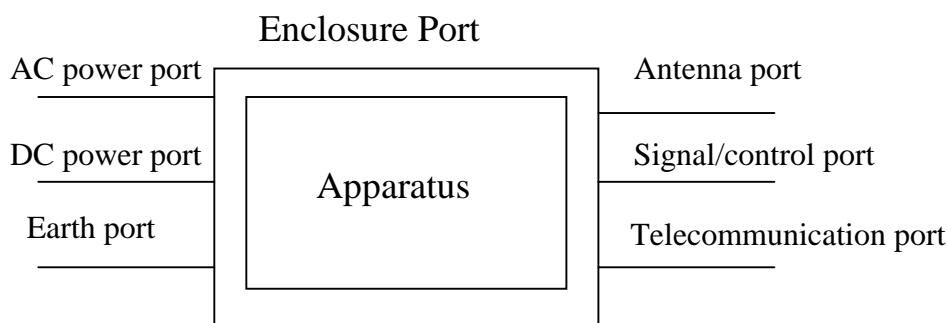


Figure 1: Examples of ports

3.2 Symbols

(void)

3.3 Abbreviations

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

AC	Alternating Current
AMN	Artificial Mains Network
DC	Direct Current
EMC	Electromagnetic Compatibility
ESD	Electrostatic discharge
EUT	Equipment Under Test
RF	Radio frequency
rms	root mean square
UTRA	Universal Terrestrial Radio Access

4 Test conditions

4.1 General

The equipment shall be tested in normal test environment defined in base station conformance testing specification TS 25.141 [3] or TS 25.142 [4] or in the UTRA Repeater conformance testing specification TS25.143 [11]. The test conditions shall be recorded in the test report.

For an EUT which contains more than one BS, it is sufficient to perform tests relating to connectors of each representative type of the BS forming part of the EUT.

4.2 Arrangements for establishing a communication link

The wanted RF input signal nominal frequency shall be selected by setting the UTRA Absolute Radio Frequency Channel Number (UARFCN) to an appropriate number.

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 air interface and/or the Iub 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 input signal level shall be set to a level 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 TS 25.141 (for FDD) [3] or TS 25.142 (for TDD) [4], to provide a stable communication link.

For immunity tests subclause 4.3 shall apply and the conditions shall be as follows:

4.3 Narrow band responses on receivers

4.3.1 FDD and 3,84 Mcps TDD option

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 increased, and then decreased by 10 MHz;
- if the deviation disappears in either or both of the above 10 MHz 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 12,5 MHz;
- 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.

4.3.2 1,28 Mcps TDD option

For 1.28Mcps chip rate TDD option, 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 quantity being monitored goes outside the specified tolerances, 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 increased, and then decreased by 3.2MHz;
- if the deviation disappears in either or both of the above 3.2 MHz 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 4MHz;
- 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.

4.4 Test condition for Repeater

The wanted RF input signal nominal frequency shall be selected by setting the Absolute Radio Frequency Channel Number (ARFCN) to an appropriate number within the operating band of the Repeater.

The Repeater path shall be tested with a suitable test system capable of measuring RF performance criteria (hereafter called "the test system"). The test system shall be located outside of the test environment.

When the EUT is required to be in the operational mode, the following conditions shall be met:

- the EUT shall be commanded to operate at maximum rated gain;
- Adequate measures shall be taken to avoid the effect of the unwanted signal on the measuring equipment;

For immunity tests conditions subclause 4.3 shall apply.

4.4.1 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.

5 Performance assessment

5.1 General

Following information shall be recorded in or annexed to the test report:

- the primary functions of the radio equipment to be tested during and after the EMC testing;
- the intended functions of the radio equipment which shall be in accordance with the documentation accompanying the equipment;
- the method to be used to verify that a communications link is established and maintained
- 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 equipment for testing (where applicable);
- the information about ancillary equipment intended to be used with the radio equipment;
- an exhaustive list of ports, classified as either power or signal/control. Power ports shall further be classified as AC or DC power.

5.2 Assessment of BLER in Downlink

The output of the transmitter shall be connected to an equipment which meet the requirements for the BLER assessment of TS25.101 [8] in case of FDD and TS25.102 [9] in case of TDD for the bearer used in the immunity tests. The level of the signal supplied to the equipment should be within the range for which the assessment of BLER is not impaired. Power control shall be off during the immunity testing.

5.3 Assessment of BLER in Uplink

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

5.4 Ancillary equipment

At the manufacturer's discretion the test may be performed on the ancillary equipment separately or a representative configuration of the combination of radio and ancillary equipment. In each case EUT is tested against all applicable immunity and emission clauses of the present document and in each case, compliance enables the ancillary equipment to be used with different radio equipment.

5.5 Repeaters

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

6 Performance Criteria

6.1 Performance criteria for continuous phenomena for BS

The test should, where possible, be performed using a bearer with the characteristics of data rate and BLER defined in Table 1. If the test is not performed using one of these bearers (for, example, if none of them are supported by the BS), the characteristics of the bearer used shall be recorded.

The BS Uplink and Downlink paths shall each meet the performance criteria defined in Table 1 during the test. If the Uplink and Downlink paths are evaluated as a one loop then the criteria is two times the value shown in Table 1. 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 1: BS Performance Criteria for continuous phenomena for BS

Bearer Information Data Rate	Performance Criteria
12.2 kbps	BLER < 10 ⁻² No loss of service
64 kbps	BLER < 10 ⁻² No loss of service
144 kbps	BLER < 10 ⁻² No loss of service
384 kbps	BLER < 10 ⁻² No loss of service

NOTE: The performance criteria, $BLER < 10^{-2}$ / No loss of service, applies also if a bearer with another characteristics is used in the test.

6.2 Performance criteria for transient phenomena for BS

The test should be, where possible, be performed using a bearer with the characteristics of data rate and BLER defined in Table 2. 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.

The BS Uplink and Downlink paths shall each meet the performance criteria defined in table 2 during the test. If the Uplink and Downlink paths are evaluated as a one loop then the criteria is two times the value shown in Table 2. 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 2: BS Performance Criteria for transient phenomena for BS

Bearer Information Data Rate	Performance Criteria
12.2 kbps	$BLER > 10^{-2}$ temporarily, however the communication link shall be maintained
64 kbps	$BLER > 10^{-2}$ temporarily, however the communication link shall be maintained
144 kbps	$BLER > 10^{-2}$ temporarily, however the communication link shall be maintained
384 kbps	$BLER > 10^{-2}$ temporarily, however the communication link shall be maintained

NOTE: The performance criteria, $BLER > 10^{-2}$ temporarily / however the communication link shall be maintained, applies also if a bearer with another characteristics is used in the test.

6.3 Performance criteria for voltage dips ($\geq 60\%$) and interruptions for BS

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of controls.

6.4 Performance criteria for continuous phenomena for Ancillary equipment

The apparatus 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 of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacture, 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.

6.5 Performance criteria for transient phenomena for Ancillary equipment

The apparatus 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 of performance. During the test, degradation of performance is however allowed. If the minimum performance level or the permissible performance loss is not specified

by the manufacture, 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.

6.6 Performance criteria for voltage dips ($\geq 60\%$) and interruptions for ancillary equipment

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of controls.

6.7 Performance criteria for continuous phenomena for repeaters

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

6.8 Performance criteria for transient phenomena for repeaters

The 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.

6.9 Performance criteria for voltage dips ($\geq 60\%$) and interruptions for repeaters

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of controls.

7 Applicability overview

7.1 Emission

Table 3: Emission applicability

Phenomenon	Application	Equipment test requirement			Reference subclause in the present document	Reference Standard
		BS equipment	Ancillary equipment	Repeater		
Radiated emission	Enclosure	applicable		applicable	8.3.1	ITU-R SM.329-9 [12]
Radiated emission	Enclosure		applicable		8.3.2	CISPR 22 [13]
Conducted emission	DC power input/output port	applicable	applicable	applicable	8.4	CISPR 22 [13], CISPR 16-1 [14]
Conducted emission	AC mains input/output port	applicable	applicable	applicable	8.5	CISPR 22 [13]
Harmonic current emissions	AC mains input port	applicable	applicable	applicable	8.6	IEC 61000-3-2 [15]
Voltage fluctuations and flicker	AC mains input port	applicable	applicable	applicable	8.7	IEC 61000-3-3 [16]

NOTE: spurious emissions from antenna connector shall be measured according to TS 25.141 [3] and TS 25.142 [4] and TS 25.143 [11].

7.2 Immunity

Table 4: Immunity applicability

Phenomenon	Application	Equipment test requirement			Reference subclause in the present document	Reference standard
		BS equipment	Ancillary equipment	Repeater		
RF electromagnetic field (80 - 1000 MHz)	Enclosure	applicable	applicable	applicable	3	IEC 61000-4-3 [18]
Electrostatic discharge	Enclosure	applicable	applicable	applicable	.4	IEC 61000-4-2 [17]
Fast transients common mode	Signal, telecommunications and control ports, DC and AC power input ports	applicable	applicable	applicable	9.5	IEC 61000-4-4 [19]
RF common mode 0,15 - 80 MHz	Signal, telecommunications and control ports, DC and AC power input ports	applicable	applicable	applicable	.6	IEC 61000-4-6 [21]
Voltage dips and interruptions	AC mains power input ports	applicable	applicable	applicable	.7	IEC 61000-4-11
Surges, common and differential mode	AC power input ports and telecommunications port	applicable	applicable	applicable	.8	IEC 61000-4-5 [20]

8 Emission

8.1 Methods of measurement and limits for EMC emissions

8.2 Test configurations

This subclause defines the configurations for emission tests as follows:

- the equipment shall be tested under normal test conditions as specified in the functional standards;
- the test configuration shall be as close to normal intended use as possible;
- if the equipment is part of a system, or can be connected to ancillary equipment, then it shall be acceptable to test the equipment while connected to the minimum configuration of ancillary equipment necessary to exercise the ports;
- if the equipment has a large number of ports, then a sufficient number shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are tested;
- the test conditions, test configuration and mode of operation shall be recorded in the test report;
- ports which in normal operation are connected shall be connected to an ancillary equipment or to a representative piece of cable correctly terminated to simulate the input/output characteristics of the ancillary equipment, Radio Frequency (RF) input/output ports shall be correctly terminated;
- ports which are not connected to cables during normal operation, e.g. service connectors, programming connectors, temporary connectors etc. shall not be connected to any cables for the purpose of EMC testing. Where cables have to be connected to these ports, or interconnecting cables have to be extended in length in order to exercise the EUT, precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition or extension of these cables;
- the test arrangements for transmitter and receiver sections of the transceiver are described separately for the sake of clarity. However, where possible the test of the transmitter section and receiver section of the EUT may be carried out simultaneously to reduce test time.

8.3 Radiated emission from Base station, Repeater and ancillary equipment

8.3.1 Radiated emission, Base stations and Repeater

This test is applicable to Base station and Repeater. This test shall be performed on a representative configuration of the Base station or Repeater.

8.3.1.1 Definition

This test assesses the ability of BS and Repeater to limit unwanted emission from the enclosure port.

8.3.1.2 Test method

8.3.1.2.1 FDD and 3,84 Mcps TDD option

- a) A test site fulfilling the requirements of ITU-R SM. 329-9 [12] shall be used. The BS or Repeater shall be placed on a non-conducting support and shall be operated from a power source via a RF filter to avoid radiation from the power leads.

Average power of any spurious components shall be detected by the test antenna and measuring receiver (e.g. a spectrum analyser). At each frequency at which a component is detected, the BS or Repeater shall be rotated and the height of the test antenna adjusted to obtain maximum response, and the effective radiated power (e.r.p.) of that component determined by a substitution measurement. The measurement shall be repeated with the test antenna in the orthogonal polarization plane.

NOTE: Effective radiated power (e.r.p.) refers to the radiation of a half wave tuned dipole instead of an isotropic antenna. There is a constant difference of 2,15 dB between e.i.r.p. and e.r.p.

$$\text{e.r.p. (dBm)} = \text{e.i.r.p. (dBm)} - 2,15 \text{Ref: ITU-R SM.329-9 ANNEX 1 [12].}$$

- b) The BS shall transmit with maximum power declared by the manufacturer with all transmitters active. Set the base station to transmit a signal as stated for measurement of spurious emission for FDD in the TS25.141 [3] and for 3.84 Mcps TDD option in the TS25.142 [4].

In case of a Repeater the gain and the output power shall be set to the maximum value as declared by the manufacturer.

- c) The received power shall be measured over the frequency range 30 MHz to 12.75 GHz, excluding 12.5MHz below the first carrier frequency to 12.5 MHz above the last carrier frequency used. The measurement bandwidth shall be 100 kHz between 30 MHz and 1 GHz and 1 MHz above 1 GHz as given in ITU-R SM.329-9 [12]. The video bandwidth shall be approximately three times the resolution bandwidth. If this video bandwidth is not available on the measuring receiver, it shall be the maximum available and at least 1 MHz.

8.3.1.2.2 1,28 Mcps TDD option

- a) A test site fulfilling the requirements of ITU-R SM. 329-9 [12] shall be used. The BS shall be placed on a non-conducting support and shall be operated from a power source via a RF filter to avoid radiation from the power leads.

Radiated power of any spurious components shall be detected by the test antenna and measuring receiver (e.g. a spectrum analyser). At each frequency at which a component is detected, the BS shall be rotated and the height of the test antenna adjusted to obtain maximum response, and the effective radiated power (e.r.p.) of that component determined by a substitution measurement. The measurement shall be repeated with the test antenna in the orthogonal polarisation plane.

NOTE: Effective radiated power (e.r.p.) refers to the radiation of a half wave tuned dipole instead of an isotropic antenna. There is a constant difference of 2,15 dB between e.i.r.p. and e.r.p.

$$\text{e.r.p. (dBm)} = \text{e.i.r.p. (dBm)} - 2,15 \text{Ref: ITU-R SM.329-9 ANNEX 1 [12].}$$

- b) The BS shall transmit with maximum power declared by the manufacturer with all transmitters active. Set the base station to transmit a signal as stated for measurement of spurious emission for 1.28 Mcps TDD in the TS25.142 [4].
- c) The received power shall be measured over the frequency range 30 MHz to 12.75 GHz, excluding 4MHz below the first carrier frequency to 4 MHz above the last carrier frequency used. The measurement bandwidth shall be 100 kHz between 30 MHz and 1 GHz and 1 MHz above 1 GHz as given in ITU-R SM.329-9 [12]. The video bandwidth shall be approximately three times the resolution bandwidth. If this video bandwidth is not available on the measuring receiver, it shall be the maximum available and at least 1 MHz.

8.3.1.3 Limits

8.3.1.3.1 FDD and 3,84 Mcps TDD option

The BS or the Repeater shall meet the limits below:

Table 5: Limits for radiated emissions from BS and repeater

Frequency range	Minimum requirement (e.r.p.)/Reference Bandwidth
$30 \text{ MHz} \leq f < 1000 \text{ MHz}$	-36 dBm/100 kHz
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	-30 dBm/ 1MHz
$F_{c1} - 12,5 \text{ MHz} < f < F_{c2} + 12,5 \text{ MHz}$	Not defined

Key:

Fc1: Center frequency of first carrier frequency used by the BS.

Fc2: Center frequency of last carrier frequency used by the BS.

8.3.1.3.2 1,28 Mcps TDD option

The BS shall meet the limits below:

Table 5A: Limits for radiated emissions from BS

Frequency range	Minimum requirement (e.r.p.)/Reference Bandwidth
$30 \text{ MHz} \leq f < 1000 \text{ MHz}$	-36 dBm/100 kHz
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	-30 dBm/ 1MHz
$F_{c1} - 4 \text{ MHz} < f < F_{c2} + 4 \text{ MHz}$	Not defined

Key:

Fc1: Center frequency of first carrier frequency used by the BS.

Fc2: Center frequency of last carrier frequency used by the BS.

8.3.2 Radiated emission, Ancillary equipment

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

8.3.2.1 Definition

This test assesses the ability of ancillary equipment to limit unwanted emission from the enclosure port.

8.3.2.2 Test method

The test method shall be in accordance with CISPR 22 [13]

8.3.2.3 Limits

The ancillary equipment shall meet the limits according to CISPR 22 [13] (10 m measuring distance) shown in table 2:

Table 6: Limits for radiated emissions from ancillary equipment, measured on a stand alone basis

Frequency range	Quasi-peak
30 MHz-230 MHz	30 dB μ V/m
230 MHz-1000 MHz	37 dB μ V/m

8.4 Conducted emission DC power input/output port

This test is applicable to equipment which may have DC cables longer than 3 m.

If the DC power cable of the radio equipment is intended to be less than 3 m in length, and intended only for direct connection to a dedicated AC to DC power supply, then the measurement shall be performed only on the AC power input of that power supply as specified in subclause 8.5.

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

8.4.1 Definition

This test assesses the ability of radio equipment and ancillary equipment to limit internal noise from the DC power input/output ports.

8.4.2 Test method

The test method shall be in accordance with CISPR 22 [13] and the Artificial Mains Network (AMN) shall be connected to a DC power source.

In the case of DC output ports, the ports shall be connected via a AMN to a load drawing the rated current of the source.

A measuring receiver shall be connected to each AMN measurement port in turn and the conducted emission recorded.

The equipment shall be installed with a ground plane as defined in CISPR 22 [13]. The reference earth point of the AMNs 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 section one of CISPR 16-1 [14].

8.4.3 Limits

The equipment shall meet the limits below (including the average limit and the quasi-peak limit) when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in subclause 8.4.2 above. 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 not necessary.

The equipment shall meet the limits given in table 7.

Table 7: Limits for conducted emissions

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

8.5 Conducted emissions, AC mains power input/output port

This test is applicable to equipment powered by the AC mains.

This test is not applicable to AC output ports which are connected directly (or via a circuit breaker) to the AC power port of the EUT.

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

8.5.1 Definition

This test assesses the ability of radio equipment and ancillary equipment to limit internal noise from the AC mains power input/output ports.

8.5.2 Test method

The test method shall be in accordance with CISPSR 22 [13].

Mains connected ancillary equipment which is not part of the EUT shall be connected to the mains via a separate AMN. According to CISPR 16-1 [14], the Protective Earth (PE) conductor shall also be terminated by a 50 Ω /50 μ H common mode RF impedance.

8.5.3 Limits

The equipment shall meet the limits below (including the average limit and the quasi-peak limit) when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in subclause 8.5.2 above. 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 not necessary.

Table 8: Limits for conducted emissions

Frequency range	Quasi-peak	Average
> 0,15-0,5 MHz	66 - 56 dB μ V	56 - 46 dB μ V
> 0.5- 5 MHz	56 dB μ V	46 dB μ V
> 5-30 MHz	60 dB μ V	50 dB μ V
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

Alternatively, for equipment intended to be used in telecommunication centres the limits given in table 9 shall be used.

Table 9: Limits for conducted emissions

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

8.6 Harmonic Current emissions (AC mains input port)

The requirements of IEC 61000-3-2 [15] 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 requirements of IEC 61000-3-3 [16] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document.

9 Immunity

9.1 Test methods and levels for immunity tests

9.2 Test configurations

This subclause defines the configurations for immunity tests as follows:

- the equipment shall be tested under normal test conditions as specified in the functional standards;
- the test configuration shall be as close to normal intended use as possible;

- if the equipment is part of a system, or can be connected to ancillary equipment, then it shall be acceptable to test the equipment while connected to the minimum configuration of ancillary equipment necessary to exercise the ports;
- if the equipment has a large number of ports, then a sufficient number shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are tested;
- the test conditions, test configuration and mode of operation shall be recorded in the test report;
- ports which in normal operation are connected shall be connected to an ancillary equipment or to a representative piece of cable correctly terminated to simulate the input/output characteristics of the ancillary equipment, Radio Frequency (RF) input/output ports shall be correctly terminated;
- ports which are not connected to cables during normal operation, e.g. service connectors, programming connectors, temporary connectors etc. shall not be connected to any cables for the purpose of EMC testing. Where cables have to be connected to these ports, or interconnecting cables have to be extended in length in order to exercise the EUT, precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition or extension of these cables;
- Immunity tests on the entire base station shall be performed by establishing communication links at the air-interface (e.g. with the mobile simulator) and the Iub-interface (e.g. with an RNC simulator) and evaluating the BLER (see figure 1);
- Immunity tests shall be performed on both the Uplink and Downlink paths. The tests shall also include both the air-interface and Iub-interface. BLER 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 Iub-interface. In case of looping is used care have to be taken that the BLER information doesn't change due to looping. The BLER evaluation shall be based on the number of transmitted blocks i.e including possible deleted blocks.

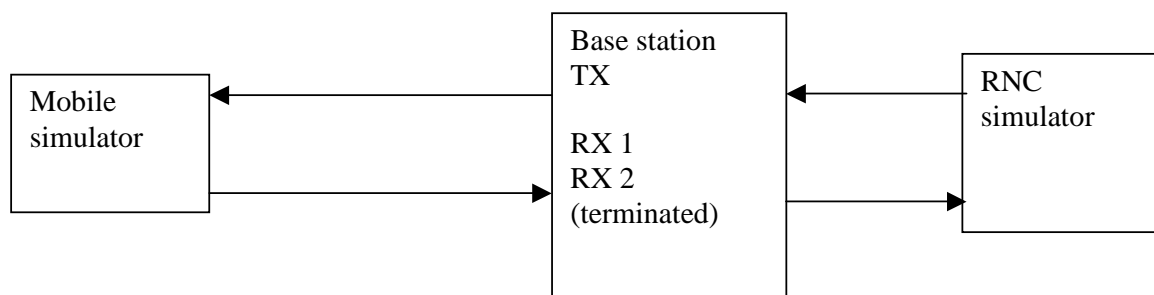


Figure 2: Communication link set up for BS immunity measurement

9.3 RF electromagnetic field (80 MHz - 1000 MHz)

The test shall be performed on a representative configuration of the equipment, the associated ancillary equipment, or representative configuration of the combination of radio and ancillary equipment.

9.3.1 Definition

This test assesses the ability of radio equipment and ancillary equipment to operate as intended in the presence of a radio frequency electromagnetic field disturbance at the enclosure.

9.3.2 Test method and level

The test method shall be in accordance with IEC 61000-4-3 [18]:

- for transmitters, receivers and transceivers the following requirements 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 - 1 000 MHz,
- responses in stand alone receivers or receivers which are part of transceivers occurring at discrete frequencies which are narrow band responses, shall be disregarded, see subclause 4.3;
- the frequencies selected during the test shall be recorded in the test report.

9.3.3 Performance criteria

Base station:

The performance criteria of subclause 6.1 shall apply.

Ancillary equipment:

The performance criteria of subclause 6.4 shall apply.

Repeater:

The performance criteria of subclause 6.7 shall apply.

9.4 Electrostatic discharge

The test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or representative configuration of the combination of radio and ancillary equipment.

9.4.1 Definition

This test assesses the ability of radio equipment and ancillary equipment to operate as intended in the event of an electrostatic discharge.

9.4.2 Test method and level

The test method shall be in accordance with IEC 61000-4-2 [17]:

- 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;
- electrostatic discharge shall be applied to all exposed surfaces of the EUT except where the user documentation specially indicates a requirement for appropriate protective measures.

NOTE: Ensure that the EUT is fully discharged between each ESD exposure.

9.4.3 Performance criteria

Base station:

The performance criteria of subclause 6.2 shall apply.

Ancillary equipment:

The performance criteria of subclause 6.5 shall apply.

Repeater:

The performance criteria of subclause 6.8 shall apply.

9.5 Fast transients common mode

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

This test shall be performed on signal ports, telecommunication ports, control ports and DC power input/output ports if the cables may be longer than 3 m.

Where this test is not carried out on a port or any other ports because the manufacturer declares that it is not intended to be used with cables longer than 3 m, 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 equipment, the associated ancillary equipment, or representative configuration of the combination of radio and ancillary equipment.

9.5.1 Definition

This test assesses the ability of radio equipment and ancillary equipment to operate as intended in the event of fast transients present on one of the input/output ports.

9.5.2 Test method and level

The test method shall be in accordance with IEC 61000-4-4 [19]:

- the test level for signal ports, telecommunication ports and control ports shall be 0,5 kV open circuit voltage as given in IEC 61000-4-4 [19];
- the test level for DC power input/output ports shall be 0.5 kV open circuit voltage as given in IEC 61000-4-4 [19];
- the test level for AC mains power input ports shall be 1 kV open circuit voltage as given in IEC 61000-4-4 [19].

For AC and DC power input ports the transients shall be applied (in parallel) to all the conductors in the cable with reference to the cabinet reference earth (true common mode) and the source impedance shall be 50 Ω .

9.5.3 Performance criteria

Base station:

The performance criteria of subclause 6.2 shall apply.

Ancillary equipment:

The performance criteria of subclause 6.5 shall apply.

Repeater:

The performance criteria of subclause 6.8 shall apply.

9.6 RF common mode (0,15 MHz - 80 MHz)

The test shall be performed on AC mains power input/output ports.

This test shall be performed on signal ports, telecommunication ports, control and DC power input/output ports, which may have cables longer than 3 m.

Where this test is not carried out on a port or any other ports because the manufacturer declares that it is not intended to be used with cables longer than stated above, 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 equipment, the associated ancillary equipment, or representative configuration of the combination of radio and ancillary equipment.

NOTE: This test can also be performed using the intrusive method, where appropriate, see IEC 61000-4-6 [21].

9.6.1 Definition

This test assesses the ability of radio equipment and ancillary equipment to operate as intended in the presence of a radio frequency electromagnetic disturbance.

9.6.2 Test method and level

The test method shall be in accordance with IEC 61000-4-6 [21]:

- the test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 kHz;
- 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 IEC 61000-4-6 [21] corresponding to 3 V rms, at a transfer impedance of 150 Ω ;
- the test shall be performed over the frequency range 150 kHz - 80 MHz;
- the injection method to be used shall be selected according to the basic standard IEC 61000-4-6 [21];
- responses of stand alone receivers or receivers which are part of transceivers occurring at discrete frequencies which are narrow band responses, shall be disregarded, see subclause 4.3;
- the frequencies of the immunity test signal selected and used during the test shall be recorded in the test report.

9.6.3 Performance criteria

Base station:

The performance criteria of subclause 6.1 shall apply.

Ancillary equipment:

The performance criteria of subclause 6.4 shall apply.

Repeater:

The performance criteria of subclause 6.7 shall apply.

9.7 Voltage dips and interruptions

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

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

9.7.1 Definition

These tests assess the ability of radio equipment and ancillary equipment to operate as intended in the event of voltage dips and interruptions present on the AC mains power input ports.

9.7.2 Test method and level

The following requirements shall apply.

The test method shall be in accordance with IEC 61000-4-11 [22].

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.

9.7.3 Performance criteria

For a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms the performance criteria of subclause 6.2 shall apply for base station and performance criteria of subclause 6.5 for ancillary equipment and performance criteria of subclause 6.8 for repeater.

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 performance criteria of subclause 6.3 shall apply for base station, performance criteria of subclause 6.6 for ancillary equipment and performance criteria of subclause 6.9 for repeater with following exception:

- in the case 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.

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.

9.8 Surges, common and differential mode

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

This test shall be additionally performed on telecommunication ports.

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

9.8.1 Definition

These tests assess the ability of radio equipment and ancillary equipment to operate as intended in the event of surges being present at the AC mains power input ports.

9.8.2 Test method and level

The test method shall be in accordance with IEC 61000-4-5 [20].

The following requirements and evaluation of test results shall apply:

- the test levels for telecommunication ports, intended to be directly connected to a telecommunication network, shall be 0,5 kV line to ground as given in IEC 61000-4-5. In this case the total output impedance of the surge generator shall be in accordance with the basic standard IEC 61000-4-5 [20].
- the test level for ac mains power input ports shall be 1 kV line to earth and 0,5 kV line to line with the output impedance of the surge generator as given in the IEC61000-4-5 [20];
- the test generator shall provide the 1,2/50 (8/20) μ sec pulse as defined in IEC 61000-4-5 [20].

9.8.3 Performance criteria

Base station:

The performance criteria of subclause 6.2 shall apply.

Ancillary equipment:

The performance criteria of subclause 6.5 shall apply.

Repeater:

The performance criteria of subclause 6.8 shall apply.

Annex A (informative): Change history

Table A.1: Change requests approved at TSG-RAN#7

RAN doc	Spec	CR	R	Ph	Subject	Cat	Curr	New
RP-000019	25.113	001		R99	Corrections to TS 25.113	F	3.0.0	3.1.0
RP-000019	25.113	002		R99	Definitions for TS 25.113	F	3.0.0	3.1.0
RP-000019	25.113	003		R99	Corrections and additions to TS 25.113	F	3.0.0	3.1.0

Table A.2: Change request approved at TSG-RAN#8.

RAN doc	Spec	CR	R	Ph	Subject	Cat	Curr	New
RP-000208	25.113	004		R99	Correction according to IEC and CISPR Standards	F	3.1.0	3.2.0

Table A.3: Change request approved at TSG-RAN#9.

RAN doc	Spec	CR	R	Ph	Subject	Cat	Curr	New
RP-000398	25.113	005		R99	Alignment of EMC requirements.	F	3.2.0	3.3.0

Table A.4: CRs approved at TSG RAN#10

RAN doc	Spec	CR	R	Ph	Subject	Cat	Curr	New
R4-000979	25.113	6		R99	Alignments with other EMC standards	F	3.3.0	3.4.0
R4-001001	25.113	7		R99	Correction for the immunity measurement	F	3.3.0	3.4.0

Table A.5: Release 1999 CRs approved at TSG RAN#11

RAN doc	Spec	CR	R	Ph	Subject	Cat	Curr	New
RP-010089	25.113	8		R99	Correction to the description of the radiated spurious emission test method	F	3.4.0	3.5.0
RP-010089	25.113	9		R99	Alignment of TS25.113 with CISPR 22 standard	F	3.4.0	3.5.0

Table A.6: Release 4CRs approved at TSG RAN#11

RAN doc	Spec	CR	R	Ph	Subject	Cat	Curr	New
RP-010097	25.113	10		Rel-4	BS electromagnetic compatibility for 1.28 Mcps TDD	B	3.5.0	4.0.0
RP-010098	25.113	11		Rel-4	Text proposal for EMC for repeater	B	3.4.0	3.5.0

Table A.7: Release 4 CR approved at TSG RAN#12

RAN Doc	Spec	CR	R	Ph	Title	Cat	Curr	New
RP-010362	25.113	12		Rel-4	Correction to the description of the radiated spurious emission test method (1.28 Mcps TDD option)	F	4.0.0	4.1.0

Table A.8: Release 4 CR approved at TSG RAN#13

RAN Tdoc	Spec	CR	R	Ph	Title	Cat	Curr	New
RP-010629	25.113	13		Rel-4	Add Arrangements for testing Repeater	F	4.1.0	4.2.0

Table A.9: Decision at TSG RAN#15

	Title	Curr	New
25.113	Rel-5 version created by TSG RAN decision, no CRs	4.2.0	5.0.0

Table A.10: Editorial correction

	Title	Curr	New
25.113	Editorial correction in the title	5.0.0	5.0.1

Table A.11: Release 5 CR approved at TSG RAN#16

RAN Tdoc	Spec	CR	R	Ph	Title	Cat	Curr	New	Work Item
RP-020303	25.113	15	1	Rel-5	Restructuring of 25.113 and correction of references	F	5.0.1	5.1.0	TEI5

Table A.12: Release 5 CR approved at TSG RAN#17

RAN Tdoc	Spec	CR	R	Ph	Title	Cat	Curr	New	Work Item
RP-020478	25.113	17	1	Rel-5	Correction to radiated spurious emission limits for 1,28 Mcps TDD option	A	5.1.0	5.2.0	LCRTDD-RF

History

Document history		
V5.0.0	March 2002	Publication
V5.0.1	March 2002	Publication
V5.1.0	June 2002	Publication
V5.2.0	September 2002	Publication