

# ETSI TS 137 113 V15.5.0 (2019-04)



**Digital cellular telecommunications system (Phase 2+) (GSM);  
Universal Mobile Telecommunications System (UMTS);  
LTE;  
NR, E-UTRA, UTRA and GSM/EDGE;  
Multi-Standard Radio (MSR) Base Station (BS)  
Electromagnetic Compatibility (EMC)  
(3GPP TS 37.113 version 15.5.0 Release 15)**



---

**Reference**

RTS/TSGR-0437113vf50

---

**Keywords**

GSM,LTE,UMTS

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

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

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

**Important notice**

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at [www.etsi.org/deliver](http://www.etsi.org/deliver).

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2019.

All rights reserved.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.

**3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

**oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

**GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

---

# Intellectual Property Rights

## Essential patents

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

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

## Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

---

# Foreword

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

---

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# Contents

|  |    |
|--|----|
| Intellectual Property Rights .....   | 2  |
| Foreword.....  | 2  |
| Modal verbs terminology.....   | 2  |
| Foreword.....  | 5  |
| 1 Scope .....  | 6  |
| 2 References .....   | 6  |
| 3 Definitions, symbols and abbreviations .....                                 | 8  |
| 3.1 Definitions .....  | 8  |
| 3.2 Symbols.....   | 10 |
| 3.3 Abbreviations .....  | 11 |
| 4 Test conditions .....  | 11 |
| 4.1 General .....  | 11 |
| 4.2 Arrangements for establishing a communication link .....                   | 12 |
| 4.2.1 Multiple enclosure BS solution.....                                      | 12 |
| 4.3 Narrow band responses on receivers .....                                   | 12 |
| 4.4 Exclusion bands.....   | 13 |
| 4.4.1 Transmitter exclusion band.....  | 13 |
| 4.4.2 Receiver exclusion band .....  | 13 |
| 4.5 BS test configurations .....   | 14 |
| 5 Performance assessment.....  | 16 |
| 5.1 General .....  | 16 |
| 5.2 Assessment of performance in Downlink.....                                 | 17 |
| 5.3 Assessment of performance in Uplink.....                                   | 17 |
| 5.4 Ancillary equipment .....  | 17 |
| 6 Performance criteria .....   | 17 |
| 6.1 Performance criteria for continuous phenomena for BS .....                 | 17 |
| 6.1.1 E-UTRA performance criteria .....  | 17 |
| 6.1.2 UTRA performance criteria .....  | 18 |
| 6.1.3 GSM/EDGE performance criteria.....                                       | 18 |
| 6.1.3.1 GSM/EDGE downlink .....  | 18 |
| 6.1.3.2 GSM/EDGE uplink .....  | 19 |
| 6.1.4 NB-IoT performance criteria .....  | 19 |
| 6.1.5 NR performance criteria .....  | 19 |
| 6.2 Performance criteria for transient phenomena for BS .....                  | 20 |
| 6.3 Performance criteria for continuous phenomena for Ancillary equipment..... | 20 |
| 6.4 Performance criteria for transient phenomena for Ancillary equipment ..... | 20 |
| 7 Applicability overview .....   | 21 |
| 7.1 Emission .....   | 21 |
| 7.2 Immunity .....   | 21 |
| 8 Emission .....   | 22 |
| 8.1 Test configurations .....  | 22 |
| 8.2 Radiated emission from Base Station and ancillary equipment.....           | 22 |
| 8.2.1 Radiated emission for Base Stations .....                                | 22 |
| 8.2.1.1 Definition .....   | 22 |
| 8.2.1.2 Test method.....   | 22 |
| 8.2.1.3 Limits .....   | 23 |
| 8.2.1.4 Interpretation of the measurement results .....                        | 23 |
| 8.2.2 Radiated emission, ancillary equipment .....                             | 24 |
| 8.2.2.1 Definition .....   | 24 |
| 8.2.2.2 Test method.....   | 24 |
| 8.2.2.3 Limits .....   | 24 |
| 8.3 Conducted emission DC power input/output port .....                        | 24 |

|   |  |           |
|---|--|-----------|
| 8.3.1   | Definition.....  | 24        |
| 8.3.2   | Test method .....  | 25        |
| 8.3.3   | Limits.....  | 25        |
| 8.4   | Conducted emissions, AC mains power input/output port .....                        | 25        |
| 8.4.1   | Definition.....  | 25        |
| 8.4.2   | Test method .....  | 25        |
| 8.4.3   | Limits.....  | 25        |
| 8.5   | Harmonic current emissions (AC mains input port).....                              | 26        |
| 8.6   | Voltage fluctuations and flicker (AC mains input port) .....                       | 26        |
| 8.7   | Telecommunication ports .....  | 26        |
| 8.7.1   | Definition.....  | 26        |
| 8.7.2   | Test method .....  | 26        |
| 8.7.3   | Limits.....  | 26        |
| 9   | Immunity .....   | 26        |
| 9.1   | Test configurations .....  | 26        |
| 9.2   | RF electromagnetic field (80 MHz - 6000 MHz) .....                                 | 27        |
| 9.2.1   | Definition.....  | 27        |
| 9.2.2   | Test method and level.....   | 27        |
| 9.2.3   | Performance criteria.....  | 28        |
| 9.3   | Electrostatic discharge.....   | 28        |
| 9.3.1   | Definition.....  | 28        |
| 9.3.2   | Test method and level.....   | 28        |
| 9.3.3   | Performance criteria.....  | 28        |
| 9.4   | Fast transients common mode .....  | 28        |
| 9.4.1   | Definition.....  | 29        |
| 9.4.2   | Test method and level.....   | 29        |
| 9.4.3   | Performance criteria.....  | 29        |
| 9.5   | RF common mode (0,15 MHz - 80 MHz) .....   | 29        |
| 9.5.1   | Definition.....  | 29        |
| 9.5.2   | Test method and level.....   | 29        |
| 9.5.3   | Performance criteria.....  | 30        |
| 9.6   | Voltage dips and interruptions.....  | 30        |
| 9.6.1   | Definition.....  | 30        |
| 9.6.2   | Test method and level.....   | 30        |
| 9.6.3   | Performance criteria.....  | 30        |
| 9.7   | Surges, common and differential mode .....   | 31        |
| 9.7.1   | Definition.....  | 31        |
| 9.7.2   | Test method and level.....   | 31        |
| 9.7.2.1   | Test method for telecommunication ports directly connected to outdoor cables ..... | 31        |
| 9.7.2.2   | Test method for telecommunication ports connected to indoor cables .....           | 31        |
| 9.7.2.3   | Test method for AC power ports.....  | 31        |
| 9.7.3   | Performance criteria.....  | 31        |
| <b>Annex A (normative): BER assessment for GSM/EDGE .....</b> |  | <b>32</b> |
| A.1   | Assessment of BER at the output of a transmitter.....                              | 32        |
| A.1.1   | Assessment of BER using static layer 1 functions .....                             | 32        |
| A.1.2   | Assessment of BER using RXQUAL.....  | 32        |
| A.2   | Assessment of BER at the output of a receiver .....                                | 32        |
| A.2.1   | Assessment of BER using RXQUAL.....  | 32        |
| A.2.2   | Assessment of BER using reported BER .....   | 32        |
| <b>Annex B (informative): Change history .....</b>            |  | <b>33</b> |
| History .....   |  | 35        |

---

# Foreword

This Technical Specification has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

---

# 1 Scope

The present document covers the assessment of NR, E-UTRA, UTRA, GSM/EDGE and NB-IoT Multi-Standard Radio (MSR) Base Stations and associated ancillary equipment in respect of Electromagnetic Compatibility (EMC).

The present document specifies the applicable test conditions, performance assessment and performance criteria for NR, E-UTRA, UTRA, GSM/EDGE and NB-IoT Base Stations and associated ancillary equipment in one of the following categories:

- Multi-Standard Radio (MSR) Base Stations for NR, E-UTRA, UTRA and GSM/EDGE meeting the requirements of TS 37.104 [6], with conformance demonstrated by compliance to TS 37.141 [11].

NOTE: For NR, scope of this specification is limited to *BS type I-C*. For EMC requirements of the MSR BS for *BS type I-H* and *BS type I-O*, refer to TS 37.114 [39].

- *BS type I-C* for NR meeting the requirements of TS 38.104 [35], with conformance demonstrated by compliance to TS 38.141-1 [36]
- Base Stations for E-UTRA meeting the requirements of TS 36.104 [4], with conformance demonstrated by compliance to TS 36.141 [9].
- Base Stations for UTRA FDD meeting the requirements of TS 25.104 [2], with conformance demonstrated by compliance to TS 25.141 [7].
- Base Stations for UTRA TDD meeting the requirements of TS 25.105 [3], with conformance demonstrated by compliance to TS 25.142 [8].
- Base Stations for GSM/EDGE meeting the requirements of TS 45.005 [5], with conformance demonstrated by compliance to TS 51.021 [10].
- Base Stations for NB-IoT meeting the requirements of TS 36.104 [4], with conformance demonstrated by compliance to TS 36.141 [9].

In addition to MSR base stations, the present document covers other BS supporting more than one RAT.

Technical requirements related to the antenna port of Base Stations are not included in the present document. These are found in the relevant product standards [2-11, 35, 36].

The environment classification used in the present document refers to the residential, commercial, and light industrial environment classification used in IEC 61000-6-1 [12] and IEC 61000-6-3 [13].

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 TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 25.104: "Base Station (BS) radio transmission and reception (FDD)".

[3] 3GPP TS 25.105: "Base Station (BS) radio transmission and reception (TDD)".

- [4] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".
- [5] 3GPP TS 45.005: "Radio transmission and reception".
- [6] 3GPP TS 37.104: "NR, E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception".
- [7] 3GPP TS 25.141: "Base Station (BS) conformance testing (FDD)".
- [8] 3GPP TS 25.142: "Base Station (BS) conformance testing (TDD)".
- [9] 3GPP TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing".
- [10] 3GPP TS 51.021: "Base Station System (BSS) equipment specification; Radio aspects".
- [11] 3GPP TS 37.141: "NR, E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing"
- [12] IEC 61000-6-1: 2005: "Electromagnetic compatibility (EMC) - Part 6: Generic standards – Section 1: Immunity for residential, commercial and light-industrial environments".
- [13] IEC 61000-6-3: 2006/AMD1:2010: "Electromagnetic compatibility (EMC) - Part 6: Generic standards – Section 3: Emission standard for residential, commercial and light industrial environments".
- [14] IEC 60050-161: "International Electrotechnical Vocabulary - Chapter 161: Electromagnetic compatibility".
- [15] ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain".
- [16] ITU-R Recommendation SM.1539 (2001): "Variation of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU-R SM.1541 and ITU-R SM.329".
- [17] Void
- [18] Void
- [19] IEC 61000-3-2 (2004): "Electromagnetic compatibility (EMC) - Part 3: Limits - Section 2: Limits for harmonic current emissions (equipment input current  $\leq 16$  A)".
- [20] IEC 61000-3-12 (2005): "Electromagnetic compatibility (EMC) - Part 3-12: Limits- Limits for harmonic current produced by equipment connected to public low-voltage system with input current  $>16$  A and  $\leq 75$  A".
- [21] IEC 61000-3-3 (2002): "Electromagnetic compatibility (EMC) - Part 3: Limits - Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current  $\leq 16$  A".
- [22] IEC 61000-3-11 (2000): "Electromagnetic compatibility (EMC) - Part 3-11: Limits –Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current  $\leq 75$  A and subject to conditional connections".
- [23] IEC 61000-4-3: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency electromagnetic field immunity test".
- [24] IEC 61000-4-2: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test".
- [25] IEC 61000-4-4: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test".
- [26] IEC 61000-4-6: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to contacted disturbances, induced by radio frequency fields".



- [27] IEC 61000-4-11: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 11: Voltage dips, short interruptions and voltage variations. Immunity tests".
- [28] IEC 61000-4-5: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test".
- [29] 3GPP TS 25.101: "User Equipment (UE) radio transmission and reception (FDD)".
- [30] 3GPP TS 25.102: "User Equipment (UE) radio transmission and reception (TDD)".
- [31] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".
- [32] 3GPP TS 45.008: "Radio subsystem link control".
- [33] 3GPP TS 51.010-1: " Mobile Station (MS) conformance specification; Part 1: Conformance specification".
- [34] CISPR 32: "Electromagnetic compatibility of multimedia equipment - Emission requirements".
- [35] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".
- [36] 3GPP TS 38.141-1: "NR; Base Station (BS) conformance testing; Part 1: Conducted conformance testing".
- [37] 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing".
- [38] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".
- [39] 3GPP TS 37.114: "Active Antenna System (AAS) Base Station (BS), Electromagnetic Compatibility (EMC) "

---

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**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).

**antenna connector:** connector at the conducted interface of the *BS type 1-C*

**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.

**Base Station RF bandwidth:** The bandwidth in which a Base Station transmits and/or receives multiple carriers and/or RATs simultaneously

**Base Station RF bandwidth edge:** The frequency of one of the edges of the Base Station RF bandwidth

**BS type 1-C:** NR base station operating at FR1 with requirements set consisting only of conducted requirements defined at individual *antenna connectors*

**Channel bandwidth:** The 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.

**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 [14]).

**Lower RF bandwidth edge:** The frequency of the lower edge of the Base Station RF bandwidth, used as a frequency reference point for transmitter and receiver requirements

**Maximum Base Station RF bandwidth:** The maximum RF bandwidth supported by a BS within an operating band.

**Maximum throughput:** The maximum achievable throughput for a reference measurement channel.

**MB-MSR Base Station:** MSR Base Station characterized by the ability of its transmitter and/or receiver to process two or more carriers in common active RF components simultaneously, where at least one carrier is configured at a different non-overlapping operating band than the other carrier(s).

**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).

NOTE: A Base Station where receiver or transmitter processes carriers of different RATs simultaneously, but not through common active RF components, is not an MSR BS according to the above definition. Such a BS is in the present specification referred to as "other BS supporting more than one RAT".

**NB-IoT In-band operation:** NB-IoT is operating in-band when it utilizes the resource block(s) within a normal E-UTRA carrier.

**NB-IoT guard band operation:** NB-IoT is operating in guard band when it utilizes the unused resource block(s) within an E-UTRA carrier's guard-band.

**NB-IoT standalone operation:** NB-IoT is operating standalone when it utilizes its own spectrum, for example the spectrum currently being used by GERAN systems as a replacement of one or more GSM carriers, as well as scattered spectrum for potential IoT deployment.

**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 equipment:** Equipment which contains Radio digital unit and Radio unit.

**Radio digital unit:** Equipment which contains base band and functionality for controlling Radio unit.

**Radio unit:** Equipment which contains transmitter and/or receiver.

**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 3.1.1).

**Receiver exclusion band:** The receiver exclusion band is the band of frequencies over which no tests of radiated immunity of a receiver are made. The exclusion band for receivers is expressed relative to the base station receive band.

**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.

**Throughput:** The number of payload bits successfully received per second for a reference measurement channel in a specified reference condition.

**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 [14]).

**Transmitter exclusion band:** The transmitter exclusion band is the band of frequencies over which no tests of radiated immunity of a transmitter are made. The exclusion band for transmitters is expressed relative to the carrier frequencies used (the carrier frequencies of the base stations activated transmitter(s).)

**Upper RF bandwidth edge:** The frequency of the upper edge of the Base Station RF bandwidth, used as a frequency reference point for transmitter and receiver requirements

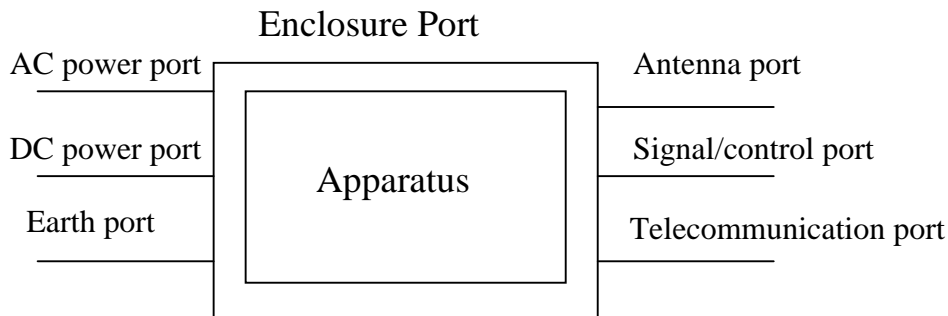


Figure 3.1-1: Examples of ports

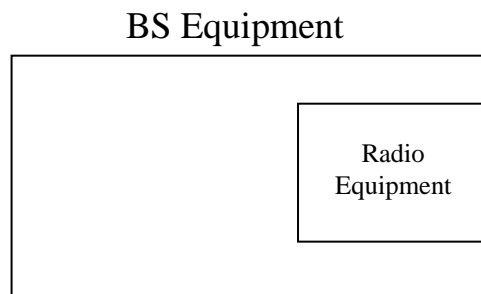


Figure 3.1-2: BS with single enclosure solution

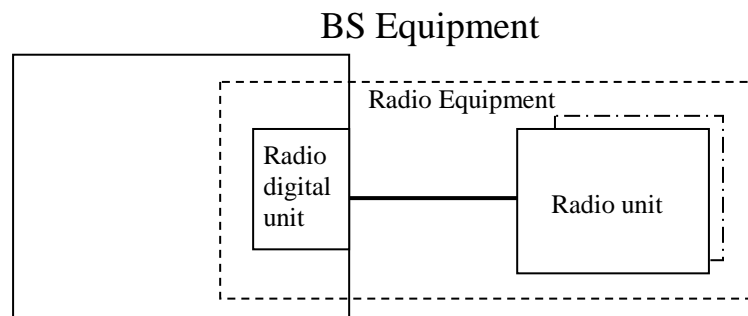


Figure 3.1-3: BS with multiple enclosure solution

### 3.2 Symbols

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

|                |   |
|----------------|---|
| $BW_{Channel}$ | Channel bandwidth   |
| $F_{C,high}$   | Center frequency of the highest transmitted/received carrier.           |
| $F_{C,low}$    | Center frequency of the lowest transmitted/received carrier.            |
| $F_{DL,high}$  | The highest frequency of the downlink operating band                    |
| $F_{DL,low}$   | The lowest frequency of the downlink operating band                     |
| $f_{offset}$   | Frequency offset used for discovering narrowband response for receivers |

|                          |   |
|--------------------------|---|
| $F_{\text{offset, RAT}}$ | Frequency offset from $F_{C,\text{high}}$ to the <i>upper RF bandwidth edge</i> or $F_{C,\text{low}}$ to the <i>lower RF bandwidth edge</i> for a specific <i>RAT</i> |
| $F_{\text{UL\_high}}$    | The highest frequency of the uplink operating band  |
| $F_{\text{UL\_low}}$     | The lowest frequency of the uplink operating band   |
| $\Delta f_{\text{OBUE}}$ | Maximum offset of the operating band unwanted emissions mask from the operating band edge   |
| $\Delta f_{\text{OOB}}$  | Maximum offset of the out-of-band boundary from the uplink operating band edge  |

### 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

|          |   |
|----------|---|
| AC       | Alternating Current                             |
| AMN      | Artificial Mains Network                        |
| ARFCN    | Absolute Radio Frequency Channel Number         |
| BC       | Band Category                                   |
| BER      | Bit Error Ratio                                 |
| BLER     | Block Error Ratio                               |
| CDN      | Coupling/Decoupling Network                     |
| CS       | Capability Set                                  |
| DC       | Direct Current                                  |
| E-UTRA   | Evolved Universal Terrestrial Radio Access      |
| EARFCN   | E-UTRA Absolute Radio Frequency Channel Number  |
| EMC      | Electromagnetic Compatibility                   |
| EPC      | Evolved Packet Core                             |
| ESD      | Electrostatic discharge                         |
| EUT      | Equipment Under Test                            |
| FR       | Frequency Range                                 |
| FRC      | Fixed Reference Channel                         |
| MB-MSR   | Multi-Band Multi-Standard Radio                 |
| MSR      | Multi-Standard Radio                            |
| NB-IoT   | Narrowband – Internet of Things                 |
| NR       | New Radio                                       |
| NR-ARFCN | NR Absolute Radio Frequency Channel Number      |
| NTC      | Test Configuration for Non-contiguous operation |
| RAT      | Radio Access Technology                         |
| RF       | Radio frequency                                 |
| rms      | root mean square                                |
| TC       | Test Configuration                              |
| UARFCN   | UTRA Absolute Radio Frequency Channel Number    |
| 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 37.141 [11]. The test conditions shall be recorded in the test report.

For a EUT which contains more than one BS, it is sufficient to perform tests relating to each type of port of each representative type of the BS forming part of the EUT. For an MSR BS or other BS supporting more than one RAT, tests shall be performed with RATs activated according to the test configuration in subclause 4.5. Tests shall be performed relating to each type of port, and need not be repeated for each RAT if operating RATs are assessed simultaneously during the test. 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.

For BS capable of multi-band operation, the requirements in the present document apply for each supported operating band unless otherwise stated. Operating bands and RATs shall be activated according to the test configuration in

subclause 4.5. Tests shall be performed relating to each type of port and all RATs per band shall be assessed during the tests.

The manufacturer shall declare the supported operating band(s) according to subclause 4.4 of TS 37.141 [11]. Requirements apply only for the declared operating band and corresponding Band Category.

The manufacturer shall declare the supported capability set(s) according to subclause 4.7 of TS 37.141 [11]. Tests performed on a Base Station according to a declared Capability Set cover all single RAT and multi-RAT configurations included in the declared Capability Set.

## 4.2 Arrangements for establishing a communication link

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

- The NR Absolute Radio Frequency Channel Number (NR-ARFCN) for NR carrier,
- 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,
- NB-IoT Narrowband – Internet of Things

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 (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.

NOTE: 15 dB above the reference sensitivity level has been used as an example of the wanted input signal level in UTRA TDD, UTRA FDD, E-UTRA or NB-IoT EMC specifications for establishing a stable communication link. The RAT-specific reference sensitivity levels are specified in:

- TS 25.142 [8] for UTRA TDD,
  - TS 25.141 [7] for UTRA FDD,
  - TS 36.141 [9] for E-UTRA or for NB-IoT,
  - TS 38.141-1 [36] for NR.
- For GSM/EDGE the wanted receiver input signal level shall be set to a nominal value of -47 dBm.

For immunity tests subclause 4.3 shall additionally apply.

### 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.

## 4.3 Narrow band responses on 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  $f_{\text{offset}}$ , where:

- For E-UTRA or for NR,  $f_{\text{offset}} = 2 \times \text{BW}_{\text{Channel}}$ , where  $\text{BW}_{\text{Channel}}$  is the channel bandwidth as defined in TS 36.104 [9] for E-UTRA, or in TS 38.104 [35] for NR;
- For UTRA,  $f_{\text{offset}} = 10 \text{ MHz}$
- For GSM/EDGE,  $f_{\text{offset}} = 400 \text{ kHz}$
- For NB-IoT,  $f_{\text{offset}} = 400 \text{ kHz}$
- 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.

For an MSR BS or other BS supporting more than one RAT, the method above shall be applied for each RAT supported. For BS capable of multi-band operation, all supported operating bands shall be considered for narrowband responses.

## 4.4 Exclusion bands

An exclusion band is a band of frequencies over which no tests of radiated immunity are made.

### 4.4.1 Transmitter exclusion band

For testing of radiated immunity there shall be no transmitter exclusion band.

### 4.4.2 Receiver exclusion band

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

The range of the exclusion band shall be:

$$F_{\text{UL\_low}} - \Delta f_{\text{OoB}} < f < F_{\text{UL\_high}} + \Delta f_{\text{OoB}}$$

Where:

The value of  $F_{\text{UL\_low}}$  and  $F_{\text{UL\_high}}$  are defined for each operating band for NR, E-UTRA, UTRA and GSM/EDGE in TS 37.104 [6].

The values of  $\Delta f_{\text{OoB}}$  are defined in table 4.4.2-1.

**Table 4.4.2-1: Maximum  $\Delta f_{\text{OoB}}$  offset outside the uplink operating band**

| <i>Operating band characteristics</i>   | $\Delta f_{\text{OoB}}$ (MHz) |
|---|-------------------------------|
| $200 \text{ MHz} \geq F_{\text{UL\_high}} - F_{\text{UL\_low}}$                   | 20                            |
| $200 \text{ MHz} < F_{\text{UL\_high}} - F_{\text{UL\_low}} \leq 900 \text{ MHz}$ | 60                            |

For BS capable of multi-band operation, the total receiver exclusion band shall be the combination of the exclusion bands for each operating band supported by the BS.

**Table 4.4-2: Void**

**Table 4.4-3: Void**

## 4.5 BS test configurations

The present clause defines the BS test configurations that shall be used for demonstrating conformance. This is specified in table 4.5-1, 4.5-1a and 4.5-1b for multi-RAT capable MSR Base Stations, in table 4.5-2 for single-RAT capable BS and in table 4.5-3 for multi-band capable BS. For other BS supporting more than one RAT (other than MSR BS), table 4.5-2 applies separately for each RAT supported.

The test configurations apply according to the declared RAT Capability Set (CS) of the MSR Base Station according to subclause 4.7 of TS 37.141 [11] and the Band Category of the declared operating band (BC1, BC2 or BC3), as listed in the heading of each table.

The test configurations (TCx) are defined in TS 37.141 [11], subclause 4.8.

For a BS declared to be capable of contiguous operation only, the test configuration(s) in tables 4.5-1 and 4.5-2 denoted by a "C" shall be used for testing.

For a BS declared to be capable of contiguous and non-contiguous operation and where the parameters in the manufacture's declaration according to subclause 4.7.2 of TS 37.141 [11] are identical for contiguous and non-contiguous operation, the test configurations denoted by "CNC" shall be used.

For a BS declared to be capable of contiguous and non-contiguous operation and where the parameters in the manufacture's declaration according to subclause 4.7.2 of TS 37.141 [11] are not identical for contiguous and non-contiguous operation, the test configurations denoted by "C/NC" shall be used for testing.

For a BS declared to support NB-IoT operating in-band, the test configuration(s) in table 4.5-1 and 4.5-2 denoted by "NI" shall be used for testing.

For a BS declared to support NB-IoT operating in guard band, the test configuration(s) in table 4.5-1 and 4.5-2 denoted by "NG" shall be used for testing.

For a BS declared to support NB-IoT operating in guard band and in-band, the test configuration(s) in table 4.5-1 and 4.5-2 denoted by "NG" or/and "NI" shall be used for testing.

For a BS declared to support NB-IoT standalone, the test configuration(s) in table 4.5-1a, 4.5-1b and 4.5-2 and entries that refer to single-RAT specifications shall be used for testing.

For immunity tests:

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

Table 4.5-1: Test configurations for single-band Multi-RAT capable MSR BS (CS3-6)

| Capability Set  | UTRA + E-UTRA, NB-IoT in-band, NB-IoT guard band (Note 2, Note 3) (CS 3) |   |         | GSM+ UTRA (CS 4)                              | GSM + E-UTRA, NB-IoT in-band, NB-IoT guard band (Note 2, Note 3) (CS 5) | GSM + UTRA + E-UTRA, (CS 6)   |
|---|--|---|---------|---|---|---|
| BS test case  | BC1  | BC2   | BC3     | BC2   | BC2   | BC2   |
| Emission tests  | C: TC3a<br>CNC: NTC3a<br>C/NC: TC3a and NTC3a<br>NI: TC16<br>NG: TC19    | C: TC3a<br>CNC: NTC3a<br>C/NC: TC3a and NTC3a<br>NI: TC16<br>NG: TC19 | C: TC3b | C: TC4a<br>CNC: NTC4a<br>C/NC: TC4a and NTC4a | C: TC4b<br>CNC: NTC4b<br>C/NC: TC4b and NTC4b<br>NI: TC16<br>NG: TC19   | C: TC4c<br>CNC: NTC4c<br>C/NC: TC4c and NTC4c<br>NI: TC16<br>NG: TC19 |
| Immunity tests (Note 1)   | TC3a<br>NI: TC16<br>NG: TC19   | TC3a<br>NI: TC16<br>NG: TC19  | TC3b    | TC4a  | TC4b<br>NI: TC16<br>NG: TC19  | TC4c<br>NI: TC16<br>NG: TC19  |
| NOTE 1: The test configuration identified for immunity tests are intended for transmitter tests in TS 37.141 [11], but are here applied both for BS transmitter and receiver.             |  |   |         |   |   |   |
| NOTE 2: The support of NB-IoT in-band operation is optional and declared by the manufacturer. If not supported, the test configurations denoted by "NI" shall not be used for testing.    |  |   |         |   |   |   |
| NOTE 3: The support of NB-IoT guard band operation is optional and declared by the manufacturer. If not supported, the test configurations denoted by "NG" shall not be used for testing. |  |   |         |   |   |   |

Table 4.5-1a: Test configurations for single-band Multi-RAT capable MSR BS (CS9-13)

| Capability Set  | GSM+NB-IoT standalone (CS 9) | UTRA + NB-IoT standalone (CS 10) |      | E-UTRA + NB-IoT standalone (CS 11) |      | GSM+UTRA+NB-IoT standalone (CS 12) | GSM+ E-UTRA+ NB-IoT standalone (CS 13) |
|---|------------------------------|----------------------------------|------|------------------------------------|------|------------------------------------|--|
| BS test case  | BC2                          | BC1                              | BC2  | BC1                                | BC2  | BC2                                | BC2                                    |
| Emission tests  | TC9                          | TC10                             | TC10 | TC11                               | TC11 | TC12                               | TC13                                   |
| Immunity tests (Note)   | TC9                          | TC10                             | TC10 | TC11                               | TC11 | TC12                               | TC13                                   |
| NOTE: The test configuration identified for immunity tests are intended for transmitter tests in TS 37.141 [11], but are here applied both for BS transmitter and receiver. |                              |                                  |      |                                    |      |                                    |  |

Table 4.5-1b: Test configurations for single-band Multi-RAT capable MSR BS (CS14-15)

| Capability Set  | UTRA + E-UTRA + NB-IoT standalone (CS 14) |      | GSM + UTRA + E-UTRA + NB-IoT standalone (CS 15) |
|---|---|------|---|
| BS test case  | BC1                                       | BC2  | BC2   |
| Emission tests  | TC14                                      | TC14 | TC13  |
| Immunity tests (Note)   | TC14                                      | TC14 | TC13  |
| NOTE: The test configuration identified for immunity tests are intended for transmitter tests in TS 37.141 [11], but are here applied both for BS transmitter and receiver. |   |      |   |



**Table 4.5-2: Test configurations for single-band Single-RAT multi-carrier capable BS**

| Capability Set  | UTRA (MC) capable BS (CS1)                       |  |         | E-UTRA (MC) capable BS (CS2)<br>NB-IoT in-band,<br>NB-IoT guard band<br>(Note 2, Note 3) |  |  | NB-IoT (MC) capable BS (CS8) |     |
|---|--|--|---------|--|--|--|------------------------------|-----|
|   | BC1  | BC2  | BC3     | BC1  | BC2  | BC3  | BC1                          | BC2 |
| Emission tests  | C: TC1a<br>CNC: NTC1a<br>C/NC: TC1a<br>and NTC1a | C: TC1a<br>CNC: NTC1a<br>C/NC: TC1a<br>and NTC1a | C: TC1b | C: TC2<br>CNC: NTC2<br>C/NC: TC2<br>and NTC2   | C: TC2<br>CNC: NTC2<br>C/NC: TC2<br>and NTC2 | C: TC2<br>CNC: NTC2<br>C/NC: TC2<br>and NTC2 | TC8                          | TC8 |
| Immunity tests<br>(Note 1)  | TC1a   | TC1a   | TC1b    | TC2  | TC2  | TC2  | TC8                          | TC8 |
| NOTE 1: The test configuration identified for immunity tests are intended for transmitter tests in TS 37.141 [11], but are here applied both for BS transmitter and receiver.             |  |  |         |  |  |  |                              |     |
| NOTE 2: The support of NB-IoT in-band operation is optional and declared by the manufacturer. If not supported, the test configurations denoted by "NI" shall not be used for testing.    |  |  |         |  |  |  |                              |     |
| NOTE 3: The support of NB-IoT guard band operation is optional and declared by the manufacturer. If not supported, the test configurations denoted by "NG" shall not be used for testing. |  |  |         |  |  |  |                              |     |

**Table 4.5-3: Test configurations for multi-band capable BS (all Capability Sets)**

| Capability Set  | Multi-band testing |      |
|---|--------------------|------|
| BS test case  | BC1/BC2            | BC3  |
| Emission tests  | TC7b               | TC7b |
| Immunity tests<br>(Note)  | TC7a               | TC7a |
| NOTE: The test configuration identified for immunity tests are intended for transmitter tests in TS 37.141 [11], but are here applied both for BS transmitter and receiver. |                    |      |

## 5 Performance assessment

### 5.1 General

The 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;
- 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
- information about the common and/or band-specific active RF components and other HW blocks for a communication link in BS capable of multi-band operation;
- an exhaustive list of ports, classified as either power or signal/control. Power ports shall further be classified as AC or DC power.

Performance assessment of a BS with multiple enclosures may be done separately for the BS part with the Radio digital unit and the Radio unit respectively, according to the manufacturer's choice.

A communication link used by more than one RAT or more than one operating band, shall be assessed on all RATs and operating bands. Communication link(s) and/or radio performance parameters for the RATs and operating bands can during the test be assessed simultaneously or separately for each RAT and band, depending on the test environment capability.

## 5.2 Assessment of performance in Downlink

In the immunity tests, the output of the transmitter shall be connected to equipment which meets the requirements for the performance assessment of RAT and bearer used in the immunity tests according to the following:

- Throughput assessment in TS 38.101-4 [38] in case of NR
- Throughput assessment in TS 36.101 [31] in case of E-UTRA
- BLER assessment in TS 25.101 [29] in case of UTRA FDD
- BLER assessment in TS 25.102 [30] in case of UTRA TDD
- BER assessment in annex A.1 in case of GSM/EDGE
- Throughput assessment in TS 36.101 [31] in case of NB-IoT

Power control shall be OFF during the immunity testing.

## 5.3 Assessment of performance in Uplink

In the immunity tests, the performance in the uplink shall be monitored at a telecommunications port(s) by using suitable test equipment according to the following:

- The value of the throughput shall be monitored in case of E-UTRA, and/or in case of NR
- The value of the BLER shall be monitored in case of UTRA FDD and UTRA TDD
- The value of the BER shall be monitored in case of GSM/EDGE (see annex A.2)
- The value of the throughput shall be monitored in case of NB-IoT

## 5.4 Ancillary equipment

At the manufacturer's discretion the test may be performed on the ancillary equipment separately or on 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.

---

# 6 Performance criteria

The test should, where possible, be performed using a bearer with the characteristics of data rate and performance criteria defined for NR, E-UTRA, UTRA, GSM/EDGE and NB-IoT below. 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 in the test report.

## 6.1 Performance criteria for continuous phenomena for BS

### 6.1.1 E-UTRA performance criteria

The throughput in table 6.1.1-1 is stated relative to the maximum throughput of the FRC. The maximum throughput for an FRC is equal to the payload size \* the number of uplink subframes per second.

The BS Uplink and Downlink paths shall each meet the performance criteria defined in table 6.1.1-1 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 6.1.1-1. 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 6.1.1-1: E-UTRA BS Performance criteria for continuous phenomena for BS**

| E-UTRA channel bandwidth (MHz) | Bearer information data rate  | Performance criteria (Note 1, Note 2)   |
|--------------------------------|---|---|
| 1.4                            | FRC A1-1 in Annex A.1 in TS 36.104 [2]  | Throughput > 95 %<br>No loss of service |
| 3                              | FRC A1-2 in Annex A.1 in TS 36.104 [2]  |   |
| 3                              | FRC A1-6 in Annex A.1 in TS 36.104 [2] for E-UTRA with NB-IoT in-band operation |   |
| 5                              | FRC A1-3 in Annex A.1 in TS 36.104 [2]  |   |
| 5                              | FRC A1-7 in Annex A.1 in TS 36.104 [2] for E-UTRA with NB-IoT in-band operation |   |
| 10                             | FRC A1-3 in Annex A.1 in TS 36.104 [2] (Note 3)                                 |   |
| 15                             | FRC A1-3 in Annex A.1 in TS 36.104 [2] (Note 3)                                 |   |
| 20                             | FRC A1-3 in Annex A.1 in TS 36.104 [2] (Note 3)                                 |   |

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.

## 6.1.2 UTRA performance criteria

The BS Uplink and Downlink paths shall each meet the performance criteria defined in table 6.1.2-1 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 6.1.2-1. 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 6.1.2-1: UTRA BS performance criteria for continuous phenomena for BS**

| Bearer information data rate | Performance criteria                          |
|------------------------------|---|
| 12.2 kbps                    | BLER < 10 <sup>-2</sup><br>No loss of service |
| 64 kbps                      |   |
| 144 kbps                     |   |
| 384 kbps                     |   |

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

## 6.1.3 GSM/EDGE performance criteria

### 6.1.3.1 GSM/EDGE downlink

The BER of the downlink shall be assessed during the test according to one of the test methods of Annex A.1.

If the test method of Annex A.1.1 is used, the measured BER of the class 2 bits of TCH/FS shall not exceed 1,6 % during the test.

NOTE: This BER is the upper limit in TS 45.008 [32] for RXQUAL = 3.

If the test method of Annex A.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.

### 6.1.3.2 GSM/EDGE uplink

The BER of the uplink shall be assessed during the test according to one of the test methods of Annex A.2.

If the test method of Annex A.2.1 is used, the value of RXQUAL shall not exceed 3 during the test.

If the test method of Annex A.2.2 is used, the measured BER of the class 2 bits of TCH/FS shall not exceed 1,6 % during the test.

NOTE: This BER is the upper limit in TS 45.008 [32] for RXQUAL = 3.

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

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

### 6.1.4 NB-IoT performance criteria

The throughput in table 6.1.4-1 is stated relative to the maximum throughput of the FRC. The Maximum throughput for an FRC equals the Payload size / (Number of Resource Unit \* time to send one Resource Unit).

The BS Uplink and Downlink paths shall each meet the performance criteria defined in table 6.1.4-1 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 6.1.4-1. 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 6.1.4-1: NB-IoT BS Performance criteria for continuous phenomena for BS**

| NB-IoT Sub-carrier spacing [kHz] | Reference measurement channel            | Performance criteria (Note 1, Note 2)   |
|----------------------------------|--|---|
| 15                               | FRC A14-1 in Annex A.14 in TS 36.104 [2] | Throughput > 95 %<br>No loss of service |
| 3.75                             | FRC A14-2 in Annex A.14 in TS 36.104 [2] |   |

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.

### 6.1.5 NR performance criteria

The throughput in table 6.1.5-1 is stated relative to the maximum throughput of the FRC. The maximum throughput for an FRC is equal to the [payload size \* the number of uplink subframes per second].

The BS Uplink and Downlink paths shall each meet the performance criteria defined in table 6.1.5-1 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 6.1.5-1. 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 6.1.5-1: NR BS performance criteria for continuous phenomena for BS**

| NR channel bandwidth (MHz)   | Sub-carrier spacing (kHz) | Bearer information data rate (as in TS 38.104 [35], annex A.1) | Performance criteria (Note1, Note 2)     |
|--|---------------------------|--|--|
| 5, 10, 15  | 15                        | G-FR1-A1-1   | Throughput > 95 %,<br>No loss of service |
| 10, 15   | 30                        | G-FR1-A1-2   |  |
| 10, 15   | 60                        | G-FR1-A1-3   |  |
| 20, 25, 30, 40, 50   | 15                        | G-FR1-A1-4   |  |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  | 30                        | G-FR1-A1-5   |  |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100  | 60                        | G-FR1-A1-6   |  |
| NOTE 1: The performance criteria, Throughput < 95 % temporarily, however the communication link shall be maintained, applies also if a bearer with another characteristics is used in the test.    |                           |  |  |
| NOTE 2: The performance criteria, Throughput < 90 % temporarily, however the communication link shall be maintained, applies instead if the Uplink and Downlink paths are evaluated as a one loop. |                           |  |  |

## 6.2 Performance criteria for transient phenomena for 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.

## 6.3 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. 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.

## 6.4 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. 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

### 7.1 Emission

Table 7.1-1: Emission applicability

| Phenomenon                       | Application                | Equipment test requirement |                     | Reference subclause in the present document | Reference standard                        |
|----------------------------------|----------------------------|----------------------------|---------------------|---|---|
|                                  |                            | BS equipment               | Ancillary equipment |   |   |
| Radiated emission (NOTE)         | Enclosure                  | applicable                 |                     | 8.2.1                                       | ITU-R SM.329 [15]                         |
| Radiated emission                | Enclosure                  |                            | applicable          | 8.2.2                                       | CISPR 32 [34]                             |
| Conducted emission               | DC power input/output port | applicable                 | applicable          | 8.3   | CISPR 32 [34], CISPR 16-1-1 [18]          |
| Conducted emission               | AC mains input/output port | applicable                 | applicable          | 8.4   | CISPR 32 [34]                             |
| Harmonic current emissions       | AC mains input port        | applicable                 | applicable          | 8.5   | IEC 61000-3-2 [19] or IEC 61000-3-12 [20] |
| Voltage fluctuations and flicker | AC mains input port        | applicable                 | applicable          | 8.6   | IEC 61000-3-3 [21] or IEC 61000-3-11 [22] |
| Conducted emission               | Telecommunication port     | applicable                 | applicable          | 8.7   | CISPR 32 [34]                             |

NOTE: The radiated emissions requirement for the BS equipment covers radiated emissions in the spurious domain. For GSM/EDGE, it corresponds to the “Radiated spurious emissions” requirement in TS 51.021 [10] for radio aspects.

### 7.2 Immunity

Table 7.2-1: Immunity applicability

| Phenomenon                               | Application   | Equipment test requirement |                     | Reference subclause in the present document | Reference Standard  |
|--|---|----------------------------|---------------------|---|---------------------|
|  |   | BS equipment               | Ancillary equipment |   |                     |
| RF electromagnetic field (80 - 6000 MHz) | Enclosure   | applicable                 | applicable          | 9.2   | IEC 61000-4-3 [23]  |
| Electrostatic discharge                  | Enclosure   | applicable                 | applicable          | 9.3   | IEC 61000-4-2 [24]  |
| Fast transients common mode              | Signal, telecommunications and control ports, DC and AC power input ports | applicable                 | applicable          | 9.4   | IEC 61000-4-4 [25]  |
| RF common mode 0,15 - 80 MHz             | Signal, telecommunications and control ports, DC and AC power input ports | applicable                 | applicable          | 9.5   | IEC 61000-4-6 [26]  |
| Voltage dips and interruptions           | AC mains power input ports  | applicable                 | applicable          | 9.6   | IEC 61000-4-11 [27] |
| Surges, common and differential mode     | AC power input ports and telecommunications port                          | applicable                 | applicable          | 9.7   | IEC 61000-4-5 [28]  |

## 8 Emission

### 8.1 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.

### 8.2 Radiated emission from Base Station and ancillary equipment

#### 8.2.1 Radiated emission for Base Stations

This test is applicable to BS, except for BS that are only single-RAT GSM/EDGE capable. This test shall be performed on a representative configuration of the BS.

For BS that are only single-RAT GSM/EDGE capable, the test method and limits in clause 8 of TS 51.021 [10] apply.

##### 8.2.1.1 Definition

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

##### 8.2.1.2 Test method

- a) A test site fulfilling the requirements of ITU-R SM. 329 [15] 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.

Mean 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 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.

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

- b) The BS shall transmit with rated power declared by the manufacturer with all transmitters active. Set the BS to transmit a signal as stated in subclause 4.5.
- c) The received power shall be measured over the frequency range from 30 MHz to  $F_{DL\_low} - \Delta f_{OBUE}$  and from  $F_{DL\_high} + \Delta f_{OBUE}$  up to 12.75 GHz. 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. Unless otherwise stated, all measurements are done as mean power (RMS).  $\Delta f_{OBUE}$  is defined in table 8.2.1.3-2.

### 8.2.1.3 Limits

The frequency boundary and reference bandwidths for the detailed transitions of the limits between the requirements for out of band emissions and spurious emissions are based on ITU-R Recommendations SM.329 [10] and SM.1539 [23].

The BS shall meet the limits below:

**Table 8.2.1.3-1: 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                                    |
| $F_{DL\_low} - \Delta f_{OBUE} < f < F_{DL\_high} + \Delta f_{OBUE}$ (NOTE)  | Not defined                                      |
| NOTE: For BS capable of multi-band operation, the frequency ranges relating to the RF bandwidths of all supported bands apply. |  |

**Table 8.2.1.3-2: Maximum offset of OBUE outside the downlink operating band**

| Operating band characteristics                                      | $\Delta f_{OBUE}$ (MHz) |
|---|-------------------------|
| $F_{DL\_high} - F_{DL\_low} < 200 \text{ MHz}$                      | 10                      |
| $200 \text{ MHz} < F_{DL\_high} - F_{DL\_low} \leq 900 \text{ MHz}$ | 40                      |

### 8.2.1.4 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the radiated emission measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 8.2.1-4-1 for BS.

Table 8.2.2 specifies the Maximum measurement uncertainty of the Test System. The Test System shall enable the equipment under test to be measured with an uncertainty not exceeding the specified values. All tolerances and uncertainties are absolute values, and are valid for a confidence level of 95 %, unless otherwise stated.

A confidence level of 95% is the measurement uncertainty tolerance interval for a specific measurement that contains 95% of the performance of a population of test equipment.



**Table 8.2.1.4-1: Maximum measurement uncertainty (BS)**

| Parameter   | Uncertainty for EUT dimension $\leq 1$ m | Uncertainty for EUT dimension $>1$ m |
|---|--|--------------------------------------|
| Effective radiated RF power between 30 MHz to 180 MHz   | $\pm 6$ dB                               | $\pm 6$ dB                           |
| Effective radiated RF power between 180 MHz to 4 GHz  | $\pm 4$ dB                               | $\pm 6$ dB                           |
| Effective radiated RF power between 4 GHz to 12,75 GHz  | $\pm 6$ dB                               | $\pm 9$ dB (NOTE)                    |
| NOTE: This value may be reduced to $\pm 6$ dB when further information on the potential radiation characteristic of the EUT is available. |  |                                      |

NOTE: If the Test System for a test is known to have a measurement uncertainty greater than that specified in table 8.2.2, this equipment can still be used, provided that an adjustment is made follows:

Any additional uncertainty in the Test System over and above that specified in table 8.2.1.4-1 is used to tighten the Test Requirements - making the test harder to pass. This procedure will ensure that a Test System not compliant with table 8.2.1.4-1 2 does not increase the probability of passing a EUT that would otherwise have failed a test if a Test System compliant with table 8.2.1.4-1 had been used.

## 8.2.2 Radiated emission, ancillary equipment

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

### 8.2.2.1 Definition

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

### 8.2.2.2 Test method

The test method shall be in accordance with CISPR 32 [34].

### 8.2.2.3 Limits

The ancillary equipment shall meet the limits according to CISPR 32 [34] table A.4 and table A.5.

For the referred limit values, the following shall apply:

- Where the limits value varies over a given frequency range, it changes linearly with respect to the logarithm of the frequency.
- Where there is a step in the relevant limit, the lower value shall be applied at the transition frequency.

**Table 8.2.2.3-1: Void**

**Table 8.2.2.3-2: Void**

## 8.3 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 8.4.

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.

### 8.3.1 Definition

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

### 8.3.2 Test method

The test method shall be in accordance with CISPR 32 [34] 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 an 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 32 [34]. 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 16-1-1 [18].

### 8.3.3 Limits

The equipment shall meet the limits according to CISPR 32 [11] table A.9, which are defined for average detector receiver and for quasi-peak detector receiver. 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.

Where there is a step in the referred limit values, the lower value shall be applied at the transition frequency.

**Table 8.3.3-1: Void**

## 8.4 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.

### 8.4.1 Definition

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

### 8.4.2 Test method

The test method shall be in accordance with CISPR 32 [34].

### 8.4.3 Limits

The equipment shall meet the limits according to CISPR 32 [11] table A.10, which are defined the average detector receiver and for quasi-peak detector receiver. 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.

For the referred limit values following shall apply:

- Where the limits value varies over a given frequency range, it changes linearly with respect to the logarithm of the frequency.
- Where there is a step in the relevant limit, the lower value shall be applied at the transition frequency.

**Table 8.4.3-1: Void**

Alternatively, for equipment intended to be used in telecommunication centres the limits given in CISPR 32 [11] table A.9 shall be used.

**Table 8.4.3-2: Void**

## 8.5 Harmonic current emissions (AC mains input port)

The requirements of IEC 61000-3-2 [19] for harmonic current emission apply for equipment covered by the scope of the present document. For equipment with an input current of greater than 16 A per phase, IEC 61000-3-12 [20] applies.

## 8.6 Voltage fluctuations and flicker (AC mains input port)

The requirements of IEC 61000-3-3 [21] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document. For equipment with an input current of greater than 16 A per phase, IEC 61000-3-12 [20] applies.

## 8.7 Telecommunication ports

This test is applicable for radio equipment and/or ancillary equipment for fixed use which have telecommunication ports.

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

### 8.7.1 Definition

This test assesses the EUT unwanted emission present at the telecommunication ports.

### 8.7.2 Test method

The test method shall be in accordance with CISPR 32 [34].

The measurement frequency range extends from 150 kHz to 30 MHz.

### 8.7.3 Limits

The telecommunication ports shall meet the limits according to CISPR 32 [34] table A.12, clause A12.2.

For the referred limit values, following shall apply:

- Where the limits value varies over a given frequency range, it changes linearly with respect to the logarithm of the frequency.
- Where there is a step in the relevant limit, the lower value shall be applied at the transition frequency.

**Table 8.7.3-1: Void**

Alternatively, for equipment intended to be used in telecommunication centres only, the limits given in CISPR 32 [11] table A.11 clause A11.2 shall be used.

**Table 8.7.3-2: Void**

---

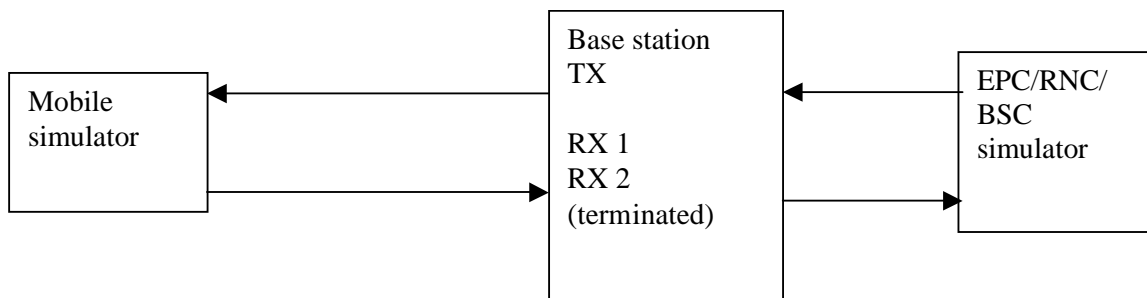
# 9 Immunity

## 9.1 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 radio interface (e.g. with the mobile simulator) and the S1/Iub/ Abis interface (e.g. with an RNC/EPC/BSC simulator) and evaluating the BLER/throughput/BER (see Figure 9.1-1);
- Immunity tests shall be performed on both the Uplink and Downlink paths. The tests shall also include both the radio interface and the S1/Iub/ Abis interface. BLER/throughput/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 radio interface or S1/Iub/ Abis interface. In case of looping is used care have to be taken that the BLER/throughput/BER information doesn't change due to looping.
- For BS capable of multi-RAT and/or multi-band operation, communication links shall be established in such a way that all RATs and operating band(s) are activated during the test according to the applicable test configurations in subclause 4.5. Performance assessment may be done separately for each RAT and/or operating band.



**Figure 9.1-1: Communication link set up for BS immunity measurement**

## 9.2 RF electromagnetic field (80 MHz - 6000 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.

### 9.2.1 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.

### 9.2.2 Test method and level

The test method shall be in accordance with IEC 61000-4-3 [23]:

- 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 - 6000 MHz with the exception of the exclusion band for receivers (see subclause 4.4);
- 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.

### 9.2.3 Performance criteria

**Base station:**

The performance criteria of subclause 6.1 shall apply.

**Ancillary equipment:**

The performance criteria of subclause 6.3 shall apply.

## 9.3 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.

### 9.3.1 Definition

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

### 9.3.2 Test method and level

The test method shall be in accordance with IEC 61000-4-2 [24]:

- for contact discharge, the equipment shall pass at  $\pm 4$  kV;
- for air discharge shall pass at  $\pm 8$  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.

### 9.3.3 Performance criteria

**Base station:**

The performance criteria of subclause 6.2 shall apply.

**Ancillary equipment:**

The performance criteria of subclause 6.4 shall apply.

## 9.4 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.

### 9.4.1 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.

### 9.4.2 Test method and level

The test method shall be in accordance with IEC 61000-4-4 [25]:

- 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 [25];
- the test level for DC power input/output ports shall be 0.5 kV open circuit voltage as given in IEC 61000-4-4 [25];
- the test level for AC mains power input ports shall be 1 kV open circuit voltage as given in IEC 61000-4-4 [25].

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  $\Omega$ .

### 9.4.3 Performance criteria

#### Base station:

The performance criteria of subclause 6.2 shall apply.

#### Ancillary equipment:

The performance criteria of subclause 6.4 shall apply.

## 9.5 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 [26].

### 9.5.1 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.

### 9.5.2 Test method and level

The test method shall be in accordance with IEC 61000-4-6 [26]:

- 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 [26] corresponding to 3 V rms, at a transfer impedance of 150  $\Omega$ ;
- 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 [26];

- 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.

### 9.5.3 Performance criteria

#### Base station:

The performance criteria of subclause 6.1 shall apply.

#### Ancillary equipment:

The performance criteria of subclause 6.3 shall apply.

## 9.6 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.

### 9.6.1 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.

### 9.6.2 Test method and level

The following requirements shall apply.

The test method shall be in accordance with IEC 61000-4-11 [27].

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.

### 9.6.3 Performance criteria

For a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms the performance criteria for transient phenomena shall be applied:

- Criteria 6.2 for base station
- Criteria 6.4 for ancillary equipment

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

1. In the case where the equipment is fitted with or connected to a battery back-up, the following performance criteria shall be applied:
  - Criteria 6.2 for base station
  - Criteria 6.4 for ancillary equipment
2. In the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need not to be maintained and lost functions should be recoverable by user or operator:
  - No unintentional responses shall occur at the end of the test

- In the event of loss of communications link or in the event of loss of user data, this fact shall be recorded in the test report

## 9.7 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.

### 9.7.1 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 and telecommunication ports.

### 9.7.2 Test method and level

The test method shall be in accordance with IEC 61000-4-5 [28].

The requirements and evaluation of test results given in subclause 9.7.2.1 (telecommunication ports, outdoor cables), subclause 9.7.2.2 (telecommunication ports, indoor cables) and subclause 9.7.2.3 (AC power ports) shall apply, but no test shall be required where normal functioning cannot be achieved, because of the impact of the CDN on the EUT.

#### 9.7.2.1 Test method for telecommunication ports directly connected to outdoor cables

The test level for telecommunications ports, intended to be directly connected to the telecommunications network via outdoor cables, shall be 1 kV line to ground as given in IEC 61000-4-5 [28], however, in telecommunications centres 0,5 kV line to ground shall be used. In this case the total output impedance of the surge generator shall be in accordance with the basic standard IEC 61000-4-5 [28].

The test generator shall provide the 1,2/50  $\mu$ s pulse as defined in IEC 61000-4-5 [28].

#### 9.7.2.2 Test method for telecommunication ports connected to indoor cables

The test level for telecommunication ports, intended to be connected to indoor cables (longer than 10 m) shall be 0,5 kV line to ground. In this case the total output impedance of the surge generator shall be in accordance with the basic standard IEC 61000-4-5 [28].

The test generator shall provide the 1,2/50  $\mu$ s pulse as defined in IEC 61000-4-5 [28].

#### 9.7.2.3 Test method for AC power ports

The test level for AC power input ports shall be 2 kV line to ground, and 1 kV line to line, with the output impedance of the surge generator as given in IEC 61000-4-5 [28].

In telecommunication centres 1 kV line to ground and 0,5 kV line to line shall be used.

The test generator shall provide the 1,2/50  $\mu$ s pulse as defined in IEC 61000-4-5 [28].

### 9.7.3 Performance criteria

#### **Base station:**

The performance criteria of subclause 6.2 shall apply.

#### **Ancillary equipment:**

The performance criteria of subclause 6.4 shall apply.



---

## Annex A (normative): BER assessment for GSM/EDGE

### A.1 Assessment of BER at the output of a transmitter

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

#### A.1.1 Assessment of BER using static layer 1 functions

The transmitter under test shall be operated according to the test case of TS 51.021 [10], subclause 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 51.021 [10], subclause 7.1.2, and the BER of the class 2 bits for TCH/FS assessed. The BER shall not exceed the values specified in subclause 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.

#### A.1.2 Assessment of BER using RXQUAL

The output of the transmitter shall be connected to an equipment which meets the requirements of TS 51.010-1 [33] for the assessment of RXQUAL. The level of the signal supplied to the equipment should be within the range for which the assessment of RXQUAL is not impaired. The RXQUAL shall be monitored during the test. The RXQUAL shall not exceed the values specified in subclause 6.1 of the present document.

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

---

### A.2 Assessment of BER at the output of a receiver

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

#### A.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.

#### A.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.

## Annex B (informative): Change history

| Change history |         |           |      |     |     |   |             |
|----------------|---------|-----------|------|-----|-----|---|-------------|
| Date           | Meeting | TDoc      | CR   | Rev | Cat | Subject/Comment   | New version |
| 2010-02        | R4#54   | R4-100572 |      |     |     | Specification skeleton  | 0.0.1       |
| 2010-04        | R4#55   | R4-101577 |      |     |     | E-mail approved Text Proposals after RAN4 AH#2:<br>R4-101189, "TS 37.113: TP on References, Definitions, symbols and abbreviations (TS ch 2 and 3) "<br>R4-101190, "TS 37.113: TP on Test conditions (TS ch 4)"<br>R4-101191, "TS 37.113: TP on Performance assessment (TS ch 5)"<br>R4-101192, "TS 37.113: TP on Performance Criteria (TS ch 6)"<br>R4-101193, "TS 37.113: TP on Applicability overview (TS ch 7)"<br>R4-101194, "TS 37.113: TP on Emission (TS ch 8)"<br>R4-101195, "TS 37.113: TP on Immunity (TS ch 9)" | 0.1.0       |
| 2010-06        | RP#48   | RP-100581 |      |     |     | Presentation to TSG RAN.  | 1.0.0       |
| 2010-06        | RP#48   | RP-100581 |      |     |     | Approval by TSG RAN.  | 9.0.0       |
| 2010-09        | RP-49   | RP-100923 | 002  | 1   |     | EMC updates for multi-RAT operation   | 9.1.0       |
| 2010-09        | RP-49   | RP-100923 | 003  |     |     | Clarification of radiated emissions requirement   | 9.1.0       |
| 2010-09        | RP-49   | RP-100927 | 001  |     |     | CR LTE_TDD_2600_US spectrum band definition additions for MSR BS to TS 37.113   | 10.0.0      |
| 2010-12        | RP-50   | RP-101345 | 010  |     |     | Band XII/12 frequency range   | 10.1.0      |
| 2010-12        | RP-50   | RP-101346 | 006  |     |     | MSR test configuration for EMC  | 10.1.0      |
| 2010-12        | RP-50   | RP-101346 | 008  |     |     | Correction of CR implementation in clause 6.2 of TS 37.113  | 10.1.0      |
| 2010-12        | RP-50   | RP-101356 | 004  | 1   |     | Band 42 and 43 parameters for UMTS/LTE 3500 (TDD) for TS 37.113   | 10.1.0      |
| 2011-06        | RP-52   | RP-110812 | 014  | 1   |     | Add 2GHz S-Band (Band 23) in 37.113   | 10.2.0      |
| 2011-09        | RP-53   | RP-111255 | 017  |     |     | Add Band 22/XXII for LTE/UMTS 3500 (FDD) to TS 37.113   | 10.3.0      |
| 2011-12        | RP-54   | RP-111734 | 018  | 1   |     | Removal of references to operating bands i) and h)  | 10.4.0      |
| 2011-12        | RP-54   | RP-111735 | 019  | 1   |     | EMC requirements for MSR-NC   | 10.4.0      |
| 2012-03        | RP-55   | RP-120305 | 020  |     |     | Add Extending 850 MHz Upper Band (814 - 849 MHz) to TS37.113  | 11.0.0      |
| 2012-06        | RP-56   | RP-120793 | 023  |     |     | Introduction of APAC700(FDD) into TS 37.113   | 11.1.0      |
| 2012-06        | RP-56   | RP-120793 | 024  |     |     | Introduction of APAC700(TDD) into TS 37.113   | 11.1.0      |
| 2012-06        | RP-56   | RP-120791 | 025  |     |     | Introduction of e850_LB (Band 27) to TS 37.113  | 11.1.0      |
| 2013-06        | RP-60   | RP-130792 | 026  |     |     | Introduction of Band 30 in TS 37.113  | 12.0.0      |
| 2013-06        | RP-60   | RP-130790 | 027  |     |     | Introduction of LTE 450 into TS 37.113  | 12.0.0      |
| 2014-06        | RP-64   | RP-140914 | 033  |     |     | Introduction of band 29 in TS 37.113  | 12.1.0      |
| 2014-06        | RP-64   | RP-140926 | 029  |     |     | Introduction of Band 32/XXXII in TS 37.113  | 12.1.0      |
| 2014-09        | RP-65   | RP-141562 | 0036 | 1   |     | Update of definitions to support supplemental DL in TS37.113  | 12.2.0      |
| 2014-12        | RP-66   | RP-142146 | 038  |     |     | EMC testing of multi-band operation for MSR BS  | 12.3.0      |
| 2015-12        | RP-70   | RP-152171 | 0039 |     |     | Introduction of Band 65   | 13.0.0      |
| 2015-12        | RP-70   | RP-152172 | 0040 |     |     | Introduction of Band 66   | 13.0.0      |
| 2015-12        | RP-70   | RP-152157 | 0041 |     |     | Introduction of Band 67   | 13.0.0      |
| 2015-12        | RP-70   | RP-152173 | 0042 |     |     | Introduction of 1447-1467MHz Band into 37.113   | 13.0.0      |
| 2016-03        | RP-71   | RP-160483 | 0043 |     | B   | Introduction of Band 68 into 37.113   | 13.1.0      |
| 2016-03        | RP-71   | RP-160490 | 0044 |     | F   | Introduction of Band 46 in TS 37.113  | 13.1.0      |

|         |        |           |      |   |   |   |        |
|---------|--------|-----------|------|---|---|---|--------|
| 2016-06 | RP-72  | RP-161142 | 0047 | - | F | Clarification in EMC environmental conditions references                                | 13.2.0 |
| 2016-06 | RP-72  | RP-161141 | 0052 | - | F | Necessary updates in 37.113 on receiver exclusion bands                                 | 13.2.0 |
| 2016-06 | RP-72  | RP-161125 | 0045 | - | B | Introduction of Band 70 to 37.113   | 14.0.0 |
| 2016-06 | RP-72  | RP-161124 | 0048 | - | B | CR to 37.113 on receiver exclusion band update due to Band 69                           | 14.0.0 |
| 2016-12 | RP-74  | RP-162379 | 0054 | - | A | CR to TS 37.113 – Introduction of NB-IoT  | 14.1.0 |
| 2016-12 | RP-74  | RP-162405 | 0055 | - | B | Introduction of Band 48   | 14.1.0 |
| 2017-06 | RP-76  | RP-171285 | 0068 | - | A | CR on eLAA BS for TS 37.113   | 14.2.0 |
| 2017-09 | RP-77  | RP-171948 | 0070 | - | B | Introduction of the FDD L-band (Band 74) into TS 37.113                                 | 15.0.0 |
| 2017-09 | RP-77  | RP-171952 | 0071 | - | B | CR to 37.113: Introduction of Band 71   | 15.0.0 |
| 2017-09 | RP-77  | RP-171950 | 0073 | - | B | CR to 37.113: Introduction of B75 and B76   | 15.0.0 |
| 2017-09 | RP-77  | RP-171946 | 0074 | - | B | Introduction of Band 72 into TS37.113   | 15.0.0 |
| 2017-09 | RP-77  | RP-171949 | 0075 | 1 | B | Introduction of TDD L-band into TS 37.113   | 15.0.0 |
| 2017-12 | RAN#78 | RP-172593 | 0076 | - | B | Introduction of Band 73 into TS 37.113  | 15.1.0 |
| 2018-03 | RAN#79 | RP-180279 | 0078 | - | B | CR to 37.113: Introduction of Band 85   | 15.2.0 |
| 2018-03 | RAN#79 | RP-180282 | 0079 | 1 | F | CR to TS 37.113: correction of the CISPR reference and ESD levels                       | 15.2.0 |
| 2018-03 | RAN#79 | RP-180278 | 0080 | - | B | Introduction of TDD 3.3-3.4GHz band (band 52)   | 15.2.0 |
| 2018-06 | RAN#80 | RP-181075 | 0082 | 1 | B | CR to TS 37.113 (MSR EMC): NR EMC Core Requirements updates                             | 15.3.0 |
| 2018-09 | RAN#81 | RP-181896 | 0084 | 1 | F | CR to TS 37.113: correction of the exclusion band for BS radiated emission test (8.2.1) | 15.4.0 |
| 2018-09 | RAN#81 | RP-181896 | 0085 |   | F | CR to TS 37.113: CISPR32 requirements tables correction                                 | 15.4.0 |
| 2018-12 | RAN#82 | RP-182362 | 0088 | 1 | B | Update the title to add NR of TS 37.113   | 15.5.0 |
| 2018-12 | RAN#82 | RP-182361 | 0089 | 1 | F | CR to TS 37.113 (subclause 2 and 8.4.2 )  | 15.5.0 |
| 2018-12 | RAN#82 | RP-182362 | 0092 |   | B | CR to TS 37.113: introduction of the NR to MSR EMC specification                        | 15.5.0 |

---

# History

| <b>Document history</b> |              |             |
|-------------------------|--------------|-------------|
| V15.3.0                 | July 2018    | Publication |
| V15.4.0                 | October 2018 | Publication |
| V15.5.0                 | April 2019   | Publication |
|                         |              |             |
|                         |              |             |