ETSI TS 138 113 V15.8.0 (2020-01)

5G;
NR;
Base Station (BS) ElectroMagnetic Compatibility (EMC)
(3GPP TS 38.113 version 15.8.0 Release 15)

Reference
RTS/TSGR-0438113vf80

Keywords
5G

ETSI

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Sous-Préfecture de Grasse (06) N° 7803/88

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Contents

Foreword

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

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1 Scope

The present document covers the assessment of NR Base Station (BS) and ancillary equipment in respect of Electromagnetic Compatibility (EMC).

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

- BS equipped with antenna connectors or *TAB connectors* which are possible to be terminated during EMC testing, meeting the *BS type 1-C* and *BS type 1-H* RF requirements of TS 38.104 [2], with conformance demonstrated by compliance to TS 38.141-1 [3].

- BS not equipped with antenna connectors nor *TAB connectors*, i.e. with antenna elements radiating during the EMC testing, meeting the *BS type 1-O* and *BS type 2-O* RF requirements of TS 38.104 [2], with conformance demonstrated by compliance to TS 38.141-2 [4].

The scope of the present document is twofold:

- Requirements, procedures and values of a BS with antenna connectors or *TAB connectors*,

- Requirements, procedures and values of a BS without antenna connectors, nor *TAB connectors*.

The environment classification used in the present document refers to the residential, commercial and light industrial environment classification used in IEC 61000-6-1 [7] and IEC 61000-6-3 [8].

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 38.104: "NR; Base Station (BS) radio transmission and reception".

[3] 3GPP TS 38.141-1: "NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing".

[4] 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing".

[5] 3GPP TS 37.113: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) Electromagnetic Compatibility (EMC)".

[6] 3GPP TS 37.114: "Active Antenna System (AAS) Base Station (BS) Electromagnetic Compatibility (EMC)".

[7] IEC 61000-6-1: "Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments".

[8] IEC 61000-6-3: "Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments".

[9] IEC 60050-161: "International Electrotechnical Vocabulary (IEV) - Part 161: Electromagnetic compatibility".

[10] 3GPP TR 38.817-02 "NR: General aspects for Base Station (BS) Radio Frequency (RF) for NR".

[11] CISPR 32: "Electromagnetic compatibility of multimedia equipment - Emission requirements".

[12] void

[13] IEC 61000-3-2: "Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)".

[14] IEC 61000-3-12: "Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage system with input current >16 A and ≤ 75 A per phase".

[15] IEC 61000-3-3: "Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection".

[16] IEC 61000-3-11: "Electromagnetic compatibility (EMC) - Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connections".

[17] IEC 61000-4-2: "Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test".

[18] IEC 61000-4-3: "Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test".

[19] IEC 61000-4-4: "Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test".

[20] IEC 61000-4-5: "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test".

[21] IEC 61000-4-6: "Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio frequency fields".

[22] IEC 61000-4-11: "Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests".

[23] ETSI EN 301 489-1: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU".

[24] Recommendation ITU-R SM.329-12: "Unwanted emissions in the spurious domain".

[25] 3GPP TS 37.105: "Active Antenna System (AAS) Base Station (BS) transmission and reception".

[26] Recommendation ITU-R SM.1539-1: "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".

[27] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".

[28] ETSI EN 301 489-50: "Electromagnetic compatibility (EMC) standard for radio equipment and services; Part 50: Specific conditions for cellular communication base station (BS), repeater and ancillary equipment; Harmonised standard covering the essential requirements of article 3.1(b) of the Directive 2014/53/EU".

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: electrical or electronic equipment, that is intended to be used with a receiver or transmitter

NOTE: It is considered as an ancillary equipment if:

- the equipment is intended for use with a receiver or transmitter 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 or transmitter; and
- the receiver or transmitter, 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 port: for EMC purposes, port for connection of an antenna used for intentional transmission and/or reception of radiated RF energy, equivalent to an RF antenna connector/*TAB connector* in TS 37.105 [25].

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

BS type 1-H: NR base station operating at FR1 with a requirement set consisting of conducted requirements defined at individual *TAB connectors* and OTA requirements defined at RIB.

BS type 1-O: NR base station operating at FR1 with a requirement set consisting only of OTA requirements defined at the RIB.

BS type 2-O: NR base station operating at FR2 with a requirement set consisting only of OTA requirements defined at the RIB.

channel bandwidth: the RF bandwidth supporting a single NR 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: electromagnetic disturbance, the effects of which on a particular device or equipment cannot be resolved into a succession of distinct effects (IEC 60050-161 [9]).

enclosure port: physical boundary of the equipment through which electromagnetic fields may radiate or impinge.

NOTE: In the case of *integral antenna* equipment, this port is inseparable from the antenna port.

exclusion band: frequency range(s) not subject to test or assessment.

integral antenna: antenna designed for permanent connection to the equipment and considered part of the enclosure port.

NOTE: An *integral antenna* may be fitted internally or externally.

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.

operating band: frequency range in which NR operates (paired or unpaired), that is defined with a specific set of technical requirements.

port: particular interface of EUT used for EMC requirements testing purposes.

NOTE: Any connection point on EUT intended for connection of cables to or from EUT during the EMC testing is considered as a port.

EXAMPLE 1: Examples of ports for *BS type 1-C* and *BS type 1-H* are as presented in figure 3.1-1:

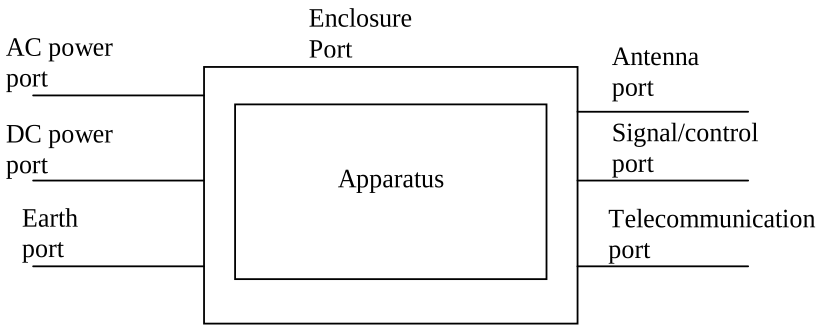

Figure 3.1-1: Examples of *ports* for *BS type 1-C* and *BS type 1-H*

EXAMPLE 2: Examples of ports for *BS type 1-O* and *BS type 2-O* (i.e. with no *antenna ports*) are as presented in figure 3.1-2:

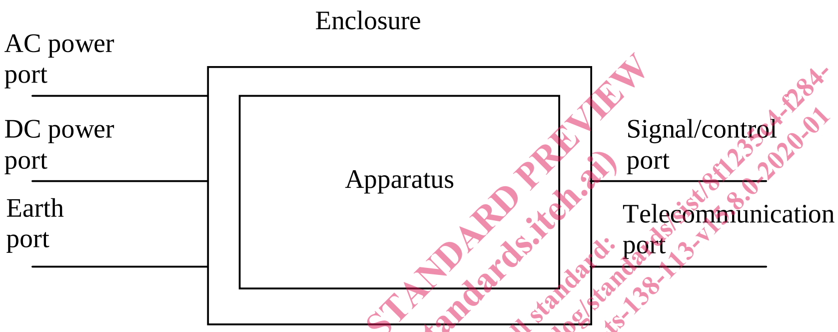

Figure 3.1-2: Examples of *ports* for *BS type 1-O* and *BS type 2-O*

receiver exclusion band: band of frequencies over which no tests of radiated immunity of a receiver are made, and expressed relative to the BS receive band.

signal port: port intended for the interconnection of components of an EUT, or between an EUT and associated equipment and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it).

spatial exclusion zone: range of angles where no tests of radiated immunity are made for *BS type 1-O* or *BS type 2-O* (i.e. half sphere around the EUT's radiating direction).

TAB connector: *transceiver array boundary* connector

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

transceiver array boundary: conducted interface between the *transceiver unit* array and the composite antenna.

transceiver unit: active unit consisting of transmitter and/or receiver which transmits and/or receives radio signals, and which may include passive RF filters.

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.

NOTE: *Telecommunication port* is called "wired network port" in CISPR 32 [11] and ETSI EN 301 489-1 [23].

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 [9]).

transmitter exclusion band: band of frequencies over which no tests of radiated immunity of a transmitter are made and 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.

3.2 Symbols

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

β	Bandwidth
$BW_{Channel}$	Channel bandwidth
Δf_{OBUE}	Maximum offset of the *operating band* unwanted emissions mask from the downlink *operating band* edge
Δf_{OOB}	Maximum offset of the out-of-band boundary from the uplink *operating band* edge
$F_{DL,low}$	The lowest frequency of the downlink *operating band*
$F_{DL,high}$	The highest frequency of the downlink *operating band*
$F_{UL,low}$	The lowest frequency of the uplink *operating band*
$F_{UL,high}$	The highest frequency of the uplink *operating band*
$\Delta f_{RIexclusion}$	Maximum offset of the Radiated Immunity exclusion band from the uplink *operating band* edge for test without *spatial exclusion zone* applied

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
BC	Band Category
BS	Base Station
CA	Carrier Aggregation
CDN	Coupling/Decoupling Network
CS	Capability Set
DC	Direct Current
EIRP	Equivalent Isotropic Radiated Power
EMC	Electromagnetic Compatibility
e.r.p.	Effective Radiated Power
ESD	Electrostatic Discharge
EUT	Equipment Under Test
FR	Frequency Range
FRC	Fixed Reference Channel
NC	Non Contiguous
NG	Next Generation
NGC	Next Generation Core
NR	New Radio
NR-ARFCN	NR Absolute Radio Frequency Channel Number
NRTC	NR Test Configuration
NTC	Test Configuration for Non-contiguous operation
RAT	Radio Access Technology
RF	Radio Frequency
RIB	Radiated Interface Boundary
rms	root mean square
SC	Single Carrier
SDL	Supplementary Downlink
TC	Test Configuration
UL	Uplink