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Contents

Foreword

This Technical Specification has been produced by the 3rd 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:

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1 Scope

The present document covers the assessment of UTRA TDD, UTRA FDD, E-UTRA, NR and Multi-Standard Radio (MSR) Active Antenna Systems Base Stations in respect of Electromagnetic Compatibility (EMC).

NOTE 1: Whenever the AAS BS in *single RAT UTRA operation*, or AAS BS in *MSR operation* using UTRA is referred in this specification, UTRA TDD and UTRA FDD shall be considered, unless otherwise stated.

NOTE 2: For NR, scope of this specification is limited to *BS type 1-H* and *BS type 1-O*. For EMC requirements of the MSR BS for *BS type 1-C*, refer to TS 37.113 [4].

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

- Active Antenna System Base Station for UTRA TDD, UTRA FDD, E-UTRA, NR and MSR meeting the conducted requirements of TS 37.105 [2], with conformance demonstrated by compliance to TS 37.145-1 [3],
- Active Antenna System Base Station for UTRA FDD, E-UTRA, NR and MSR meeting the OTA requirements of 3TS 37.105 [2], with conformance demonstrated by compliance to TS 37.145-2 [10].

The present document does not cover ancillary equipment requirements, where ancillary equipment is not incorporated in the radio equipment and can be assessed on a stand-alone basis, as declared by the manufacturer. Ancillary equipment EMC requirements are still applicable to the AAS BS and are covered by other EMC specifications in TS 25.113 [5], TS 36.113 [6], TS 37.113 [4] or TS 38.113 [30].

The present document does not specify test conditions, performance assessment and performance criteria for the Narrow-Band Internet of Things (NB-IoT) in band, NB-IoT guard band, or standalone NB-IoT operation, for AAS BS in *single RAT E-UTRA operation* as defined in TS 36.113 [6], or for AAS BS in *MSR operation* using E-UTRA as defined in TS 37.113 [4].

The present document does not specify test conditions, performance assessment and performance criteria for Band 46 operation as it is not supported by AAS BS.

The scope of the present document is twofold:

- Requirement, procedures and values of a *hybrid AAS BS* with *TAB connectors* for every transceiver unit at the *transceiver array boundary* (TAB), subject to conducted requirements,

NOTE 3: *hybrid AAS BS* in the single RAT NR operation is equivalent to *BS type 1-H* defined in NR BS specification TS 38.104 [31].

- Requirements, procedures and values of an OTA AAS BS without *TAB connectors* and relying in the radiated interface, subject to radiated requirements.

NOTE 4: OTA AAS BS in the single RAT NR operation is equivalent to *BS type 1-O* defined in NR BS specification TS 38.104 [31].

The electromagnetic 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 37.105: "Active Antenna System (AAS) Base Station (BS) transmission and reception".

[3] 3GPP TS 37.145-1: "Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: Conducted conformance testing".

[4] 3GPP TS 37.113: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) Electromagnetic Compatibility (EMC)".

[5] 3GPP TS 25.113: "Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)".

[6] 3GPP TS 36.113: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)".

[7] IEC 61000-6-1: 2016: "Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments".

[8] IEC 61000-6-3: 2006/AMD1:2010: "Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments".

[9] 3GPP TR 37.842: "Radio Frequency (RF) requirement background for Active Antenna System (AAS) Base Station (BS)".

[10] 3GPP TS 37.145-2: "Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: radiated conformance testing".

[11] IEC 61000-3-2: 2014: "Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)".

[12] IEC 61000-3-3: 2013: "Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection".

[13] IEC 61000-3-11: 2017 "Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connection".

[14] IEC 61000-3-12: 2011: "Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase".

[15] IEC 61000-4-2: 2008: "Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test".

[16] IEC 61000-4-3: 2006+AMD1:2007+AMD2:2010: "Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test".

[17] IEC 61000-4-4: 2012: "Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test".

[18] IEC 61000-4-5: 2014+AMD1:2017: "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test".

[19] IEC 61000-4-6: 2013: "Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields".

[20] IEC 61000-4-11: 2004+AMD1:2017: "Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests".

[21] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".

[22] Void

[23] Void

[24] ITU-R SM.329-10: "Unwanted emissions in the spurious domain".

[25] ETSI EN 301 489-50, v2.1.0: "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 Directive 2014/53/EU".

[26] 3GPP TS 25.102: "User Equipment (UE) radio transmission and reception (TDD)".

[27] 3GPP TS 25.101: "User Equipment (UE) radio transmission and reception (FDD)".

[28] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

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

[30] 3GPP TS 38.113: "NR; Base Station (BS) ElectroMagnetic Compatibility (EMC)".

[31] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

[32] Void

[33] 3GPP TS 37.104: "NR, E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception".

[34] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".

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], TS 37.113 [4] 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] or TS 37.113 [4].

NOTE: Multi-word definitions are treated as linguistic expressions and printed in italic font throughout this requirement specification. Linguistic expressions may not be split and are printed in their entirety.

active antenna system base station: BS system which combines an *antenna array* with a transceiver unit array and a *radio distribution network.*

antenna array: group of radiating elements characterized by the geometry and the properties of the *array elements.*

antenna port: RF interface at the *transceiver array boundary*, specifically the *TAB 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.

hybrid AAS BS: AAS BS which has both a conducted RF interface and a radiated RF interface in the far field and conforms to a *hybrid requirements set.*

MSR operation: operation of AAS BS declared to be MSR in particular *operating band(s)* (including any of UTRA, E-UTRA and/or NR operation as single RAT or multi-RAT based on TS 37.104 [33]).

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.

OTA AAS BS: AAS BS which has ≥8 *transceiver units* for E-UTRA or MSR and ≥4 *transceiver units* for UTRA per cell and has a radiated RF interface only and conforms to the *OTA requirements set.*

OTA requirements set: complete set of OTA requirements applied to an OTA AAS BS.

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 *hybrid AAS BS* are as presented in figure 3.1-1:

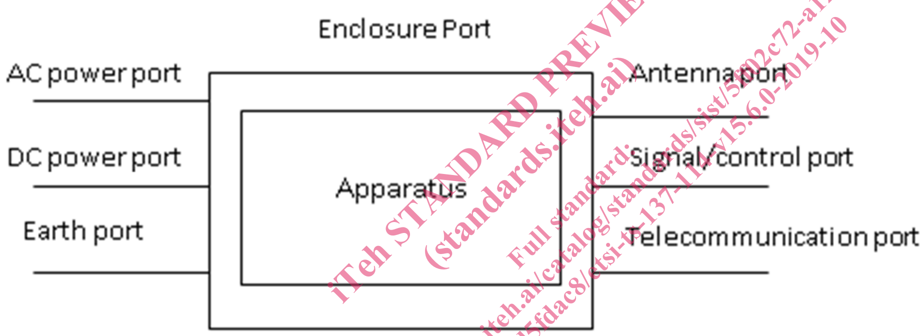

Figure 3.1-1: Examples of ports for *hybrid AAS BS*

EXAMPLE 2: Examples of ports for OTA AAS BS (i.e. with no antenna ports) are as presented in figure 3.1-2:

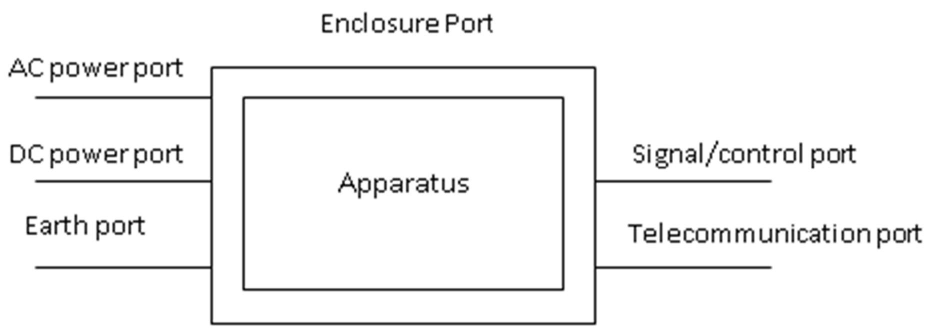

Figure 3.1-2: Examples of ports for OTA AAS BS

radiated interface boundary: operating band specific radiated requirements reference where the radiated requirements apply.

radio distribution network: linear passive network which distributes the RF power generated by the transceiver unit array to the *antenna array*, and/or distributes the radio signals collected by the *antenna array* to the transceiver unit array.

NOTE: In the case when the active transceiver units are physically integrated with the *array elements* of the *antenna array*, the *radio distribution network* is a one-to-one mapping.

single RAT E-UTRA operation: operation of AAS BS declared to be single RAT E-UTRA in the operating band.

NOTE: *Single RAT E-UTRA operation* does not cover in-band NB-IoT, nor guardband NB-IoT operation.

single RAT UTRA operation: operation of AAS BS declared to be single RAT UTRA in the operating band.

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.

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: ETSI EN 301 489-1 [21] calls *telecommunication port* as the "wired network port".

3.2 Symbols

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

$BW_{Channel}$	Channel bandwidth
f_{offset}	Frequency offset used for discovering narrowband response for receivers
F_{UL_high}	The highest frequency of the uplink operating band
F_{UL_low}	The lowest frequency of the uplink operating band
Δf_{OOB}	Maximum offset of the out-of-band boundary from the uplink operating band edge
$\Delta f_{RIexclusion}$	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].

AAS	Active Antenna System
AAS BS	AAS Base Station
CSA	Capability Set supported by the AAS BS
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
FR1	Frequency Range 1
MSR	Multi-Standard Radio
NB-IoT	Narrowband – Internet of Things
NR	New Radio
RCSA	Radiated Capability Set supported by the AAS BS
RDN	Radio Distribution Network
RF	Radio Frequency
RIB	Radiated Interface Boundary
TAB	Transceiver Array Boundary