



**Universal Mobile Telecommunications System (UMTS);
LTE;
Active Antenna System (AAS) Base Station (BS)
Electromagnetic Compatibility (EMC)
(3GPP TS 37.114 version 18.2.0 Release 18)**



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Foreword

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In the present document, modal verbs have the following meanings:

- shall** indicates a mandatory requirement to do something
- shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

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- should** indicates a recommendation to do something
- should not** indicates a recommendation not to do something
- may** indicates permission to do something
- need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

- can** indicates that something is possible
- cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

- will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document
- will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document
- might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

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].

Technical requirements related to the TAB connector are not included in the present document. These are found in the relevant product standards [2, 3, 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] Void.
- [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: "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".
- [35] IEC 61000-4-21: "Electromagnetic compatibility (EMC) - Part 4-21: Testing and measurement techniques - Reverberation chamber test methods".

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] (see manufacturer's declaration D6.12 in TS 37.145-1 [3] and/or D9.25 in TS 37.145-2 [10]).

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:

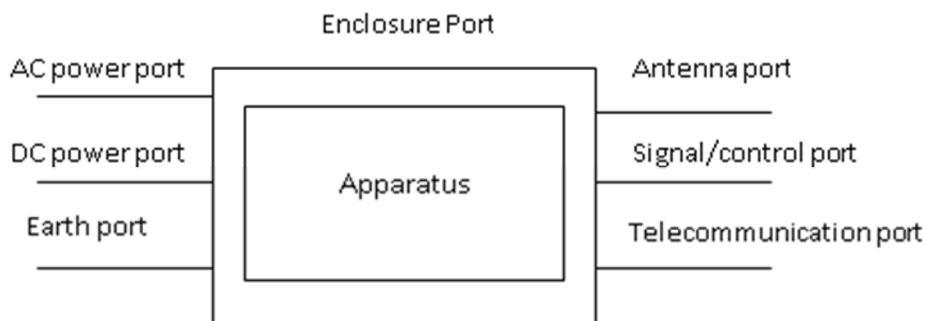


Figure 3.1-1: Examples of ports for *hybrid AAS BS*

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

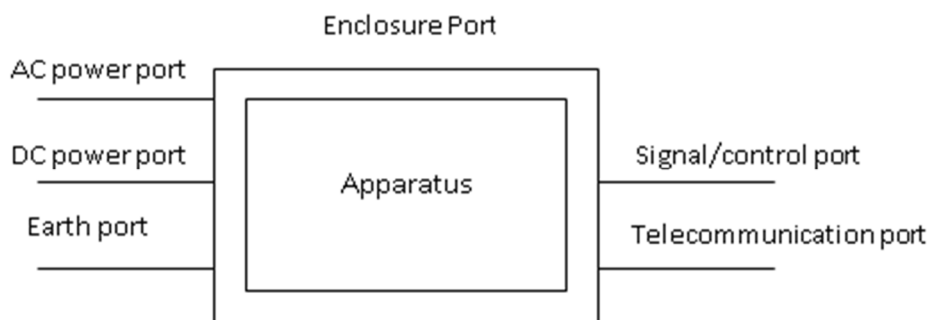


Figure 3.1-2: Examples of ports for OTA AAS BS

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 (see manufacturer's declaration D6.12 in TS 37.145-1 [3] and/or D9.25 in TS 37.145-2 [10]).

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 (see manufacturer's declaration D6.12 in TS 37.145-1 [3] and/or D9.25 in TS 37.145-2 [10]).

spatial exclusion zone: range of angles where no tests of radiated immunity are made for *OTA AAS BS* (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
$F_{\text{UL_high}}$	The highest frequency of the uplink operating band
$F_{\text{UL_low}}$	The lowest frequency of the uplink operating band
Δf_{OOB}	Maximum offset of the out-of-band boundary from the uplink operating band edge
$\Delta f_{\text{RIexclusion}}$	Maximum offset of the Radiated Immunity exclusion band from the uplink operating band edge for test without <i>spatial exclusion zone</i> 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

4 Test conditions

The equipment shall be tested in normal test environment defined in base station conformance testing specification TS 37.145-1 [3], or TS 37.145-2 [10]. The test conditions shall be recorded in the test report.

For an AAS BS supporting more than one RAT (see D6.12 in TS 37.145-1 [3], or D9.25 in TS 37.145-2 [10]), tests shall be performed with RATs activated according to the test configurations in subclause 4.4. Tests shall be performed relating to each type of port and RIB, and need not be repeated for each RAT if operating RATs are assessed simultaneously during the test.

For AAS BS supporting single RAT operation only (see D6.12 in TS 37.145-1 [3], or D9.25 in TS 37.145-2 [10]), tests relating to the *antenna port(s)* and RIBs shall be performed for each supported RAT.

For AAS BS capable of multi-band operation (see D6.13 in TS 37.145-1 [3], or D9.15 in TS 37.145-2 [10]), 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 respective test configurations in TS 25.113 [5], TS 36.113 [6], TS 37.113 [4], or TS 38.113 [30]. Tests shall be performed relating to each type of port and RIB, and all RATs per band shall be assessed during the tests.

Requirements apply only for the declared operating band(s) (see manufacturer's declaration D6.1 in TS 37.145-1 [3], or D9.4 in TS 37.145-2 [10]), and corresponding Band Categories as per CSA (see D6.12 in TS 37.145-1 [3]) and/or RCSA capability sets (see D9.25 in TS 37.145-2 [10]).

The manufacturer shall declare the supported capability set(s) according to TS 37.145-1 [3] and TS 37.145-2 [10]. Tests performed on an AAS BS according to a declared capability set(s) cover all single RAT and multi-RAT configurations included in the declared capability set. Exception can be made for immunity testing based on declaration DEMC.1, DEMC.2, DEMC.3, and DEMC.4 (see table 4.5-1), as detailed in annex A.

NOTE 1: *TAB connector* capability sets (CSA) for *hybrid AAS BS* are defined in TS 37.145-1 [3] and declared in D6.12 declaration.

NOTE 2: Radiated capability sets (RCSA) for *hybrid AAS BS* and OTA AAS BS are defined in TS 37.145-2 [10] and declared by D9.25 declaration.

Where the *hybrid AAS BS* has multiple *TAB connectors* which are declared to be equivalent then it is sufficient to perform EMC tests on a single representative *TAB connector*. For the definition of the *TAB connector* equivalence declaration (D6.70), refer to TS 37.145-1 [3].

EMC test shall not be performed with the AAS BS *antenna array* radiating, all *TAB connectors* shall be disconnected from the *radio distribution network* (RDN)/*antenna array* as specified in TS 37.105 [2] and terminated in an appropriate load impedance. For the description of the general AAS BS radio architecture and relations between the RDN/*antenna array* and the Transceiver Array Boundary, refer to TS 37.105 [2].

Depending on RAT capability sets supported by the AAS BS, the following test conditions shall be referred and applied for the BS test configurations:

- For AAS BS in *single RAT UTRA operation* the test conditions from TS 25.113 [5] apply.
- For AAS BS in *single RAT E-UTRA operation* the test conditions from TS 36.113 [6] apply.
- For AAS BS in *single RAT NR operation* the test conditions from TS 38.113 [30] apply.
- For AAS BS in *MSR operation* the test conditions from TS 37.113 [4] apply.

Whenever ports are considered for the emissions and immunity testing in the referred TS 25.113 [5], TS 36.113 [6] and TS 37.113 [4] specifications, special considerations shall be taken to test conditions specification for OTA AAS BS due to lack of *antenna ports*.

NOTE 3: The receiver exclusion bands defined in E-UTRA and MSR specifications for Band 46 operation are not applicable for AAS BS, as the Band 46 operation is not supported by AAS BS.

NOTE 4: The NB-IoT operation is not supported by AAS BS.

4.1 Exclusion bands

4.1.1 Transmitter exclusion band

The *transmitter exclusion band* for BS is the frequency range over which no tests of radiated immunity of a transmitter are made. The *transmitter exclusion band* only applies to OTA AAS BS.

The *transmitter exclusion band* is defined as:

$$F_{DL,low} - \Delta f_{OBUE} < f < F_{DL,high} + \Delta f_{OBUE}$$

Where:

The value of Δf_{OBUE} , $F_{UL,low}$ and $F_{UL,high}$ are defined for each *operating band* for NR, E-UTRA, UTRA in TS 37.105 [2].

NOTE: For BS capable of multi-band operation, the frequency ranges relating to the RF bandwidths of all supported bands apply.

4.1.2 Receiver exclusion band

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

In case the spatial exclusion (as discussed in subclause 9.2.2 and depicted in figure 9.2.2-1) is used during the EMC RI testing, the receiver exclusion band for OTA AAS BS is defined as:

$$F_{UL,low} - \Delta f_{OOb} < f < F_{UL,high} + \Delta f_{OOb}$$

Where:

- Values of $F_{UL,low}$ and $F_{UL,high}$ are defined for each *operating band* in TS 37.104 [33].
- The values of Δf_{OOb} are defined in table 4.1.2-1.

Table 4.1.2-1: Maximum Δf_{OOb} offset outside the uplink operating band

<i>Operating band characteristics</i>	Δf_{OOb} (MHz)
$100 \text{ MHz} \geq F_{UL,high} - F_{UL,low}$	20
$100 \text{ MHz} < F_{UL,high} - F_{UL,low} \leq 900 \text{ MHz}$	60

In case the *spatial exclusion zone* (as discussed in subclause 9.2.2 and depicted in figure 9.2.2-1) is not used during the EMC RI testing, the receiver exclusion band for OTA AAS BS and *BS type I-O* is defined as:

$$F_{UL,low} - \Delta f_{RIexclusion} < f < F_{UL,high} + \Delta f_{RIexclusion}$$

Where the values of $\Delta f_{RIexclusion}$ are defined in table 4.1.2-2.

Table 4.1.2-2: Maximum $\Delta f_{RIexclusion}$ offset outside the uplink operating band

<i>Operating band characteristics</i>	$\Delta f_{RIexclusion}$ (MHz)
$100 \text{ MHz} \geq F_{UL,high} - F_{UL,low}$	60
$100 \text{ MHz} < F_{UL,high} - F_{UL,low}$	200

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 AAS BS.

NOTE 1: The receiver exclusion bands do not apply for SDL bands.

NOTE 2: Void

4.2 Arrangements for establishing a communication link

Depending on RAT capability sets supported by the AAS BS, the following arrangements for establishing a communication link shall be referred and applied:

- For AAS BS in single RAT UTRA operation, the arrangements for establishing a communication link from TS 25.113 [5] apply.
- For AAS BS in single RAT E-UTRA operation, the arrangements for establishing a communication link from TS 36.113 [6] apply.
- For AAS BS in MSR operation, the arrangements for establishing a communication link from TS 37.113 [4] apply.
- For AAS BS in single RAT NR operation, the arrangements for establishing a communication link from TS 38.113 [30] apply.

4.3 Narrow band responses on receivers

Depending on RAT capability sets supported by the AAS BS, the following narrow band responses on receivers shall be referred and applied:

- For AAS BS in single RAT UTRA operation, the narrow band responses on receivers from TS 25.113 [5] apply.
- For AAS BS in single RAT E-UTRA operation, the narrow band responses on receivers from TS 36.113 [6] apply.
- For AAS BS in MSR operation the arrangements for narrow band responses on receivers from TS 37.113 [4] apply.
- For AAS BS in single RAT NR operation, the arrangements for narrow band responses on receivers from TS 38.113 [30] apply.

4.4 BS test configurations

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

- AAS BS 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]. In this case, the EMC test configuration are listed in tables 4.4-1, 4.4-3, 4.4-5, 4.4-7, 4.4-9, 4.4-11 respectively.
- AAS BS for UTRA FDD, E-UTRA, NR and MSR meeting the OTA requirements of TS 37.105 [2], with conformance demonstrated by compliance to TS 37.145-2 [10]. In this case, the EMC test configuration are listed in table 4.4-2, 4.4-4, 4.4-6, 4.4-8, 4.4-10, 4.4-12 respectively.

The test configurations apply according to the declared RAT capability sets (i.e. CSA as declared in D6.12 in TS 37.145-1 [3], or RCSA as declared in D9.25 in TS 37.145-2 [10]) of the AAS BS and the Band Category of the declared operating band (i.e. BC1, BC2 or BC3).

The AAS BS test configurations are defined as ATCx in TS 37.145-1 [3] and ATCRx in TS 37.145-2 [10], clause 4.11.

- For AAS BS declared to be capable of contiguous operation only (see D6.14 in TS 37.145-1 [3], or D9.28 in TS 37.145-2 [10]), the test configuration(s) in tables 4.4-1, 4.4-2 and 4.4-3, 4.4-4 denoted by a "C" shall be used for testing.
- For AAS BS declared to be capable of contiguous and non-contiguous operation (see D6.14 in TS 37.145-1 [3], or D9.28 in TS 37.145-2 [10]), and where the parameters in the manufacture's declaration D6.15 in TS 37.145-1 [3] or D9.29 in TS 37.145-2 [10] are identical for contiguous and non-contiguous operation, the test configurations denoted by "CNC" shall be used.

- For AAS BS declared to be capable of contiguous and non-contiguous operation (see D6.14 in TS 37.145-1 [3], or D9.28 in TS 37.145-2 [10]), and where the parameters in the manufacture's D6.15 in TS 37.145-1 [3] or D9.29 in TS 37.145-2 [10] are not identical for contiguous and non-contiguous operation, the test configurations denoted by "C/NC" shall be used for testing.

For AAS BS where signals from supported RATs are processed in common active components (see DEMC.2 and DEMC.4 in table 4.5-1), it is sufficient to consider a reduced set of CSs for immunity testing, as described in Annex A.

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 4.4-1: Test configuration applicability to requirements and capability sets for *TAB* connectors supporting MSR operation

TAB connector test case	UTRA + E-UTRA (CSA3)			E-UTRA + NR (CSA3A)			UTRA + E-UTRA + NR (CSA3B)
	BC1	BC2	BC3	BC1	BC2	BC3	BC1,BC2
Emission tests	C: ATC3a CNC: ANTC3 C/NC: ATC3a, ANTC3	C: ATC3a CNC: ANTC3 C/NC: ATC3a, ANTC3	C: ATC3b	C: ATC6 CNC: ANTC6 C/NC: ATC6, ANTC6	C: ATC6 CNC: ANTC6 C/NC: ATC6, ANTC6	C: ATC6 CNC: ANTC6 C/NC: ATC6, ANTC6	C: ATC8 CNC: ANTC8 C/NC: ANTC8, ATC8
Immunity tests	C: ATC3a CNC: ANTC3 C/NC: ATC3a, ANTC3	C: ATC3a CNC: ANTC3 C/NC: ATC3a, ANTC3	C: ATC3b	C: ATC6 CNC: ANTC6 C/NC: ATC6, ANTC6	C: ATC6 CNC: ANTC6 C/NC: ATC6, ANTC6	C: ATC6 CNC: ANTC6 C/NC: ATC6, ANTC6	C: ATC8 CNC: ANTC8 C/NC: ANTC8, ATC8

Table 4.4-2: Test configuration applicability to requirements and capability sets for AAS BS supporting MSR operation

Test case	UTRA + E-UTRA (RCSA 3)			E-UTRA + NR (RCSA 3A)			UTRA + E-UTRA + NR (RCSA 3B)
	BC1	BC2	BC3	BC1	BC2	BC3	BC1,BC2
Emission tests	C: ATCR3a CNC: ANTCR3 C/NC: ATCR3a, ANTCR3	C: ATCR3a CNC: ANTCR3 C/NC: ATCR3a, ANTCR3	N/A	C: ATCR7 CNC: ANTCR7 C/NC: ATCR7, ANTCR7	C: ATCR7 CNC: ANTCR7 C/NC: ATCR7, ANTCR7	C: ATCR7 CNC: ANTCR7 C/NC: ATCR7, ANTCR7	C: ATCR9 CNC: ANTCR9 C/NC: ATCR9, ANTCR9
Immunity tests	C: ATCR3a CNC: ANTCR3 C/NC: ATCR3a, ANTCR3	C: ATCR3a CNC: ANTCR3 C/NC: ATCR3a, ANTCR3	N/A	C: ATCR7 CNC: ANTCR7 C/NC: ATCR7, ANTCR7	C: ATCR7 CNC: ANTCR7 C/NC: ATCR7, ANTCR7	C: ATCR7 CNC: ANTCR7 C/NC: ATCR7, ANTCR7	C: ATCR9 CNC: ANTCR9 C/NC: ATCR9, ANTCR9

Table 4.4-3: Test configuration applicability to requirements and capability sets for TAB connectors supporting one RAT only MSR operation

Capability set	UTRA (MC) capable BS (CSA1)			E-UTRA (MC) capable BS (CSA2)		
<i>TAB connector</i> test case	BC1	BC2	BC3	BC1	BC2	BC3
Emission tests	C: ATC1a CNC: ANTC1a C/NC: ATC1a, ANTC1a	C: ATC1a CNC: ANTC1a C/NC: ATC1a, ANTC1a	C: ATC1b	C: ATC2a CNC: ANTC2 C/NC: ATC2a, ANTC2	C: ATC2a CNC: ANTC2 C/NC: ATC2a, ANTC2	C: ATC2a CNC: ANTC2 C/NC: ATC2a, ANTC2
Immunity tests	C: ATC1a CNC: ANTC1a C/NC: ATC1a, ANTC1a	C: ATC1a CNC: ANTC1a C/NC: ATC1a, ANTC1a	C: ATC1b	C: ATC2a CNC: ANTC2 C/NC: ATC2a, ANTC2	C: ATC2a CNC: ANTC2 C/NC: ATC2a, ANTC2	C: ATC2a CNC: ANTC2 C/NC: ATC2a, ANTC2

Table 4.4-4: Test configuration applicability to requirements and capability sets for operating bands supporting one RAT only MSR operation

Capability set	UTRA (MC) capable BS (RCSA1)			E-UTRA (MC) capable BS (RCSA2)		
Test case	BC1	BC2	BC3	BC1	BC2	BC3
Emission tests	C: ATCR1a CNC: ANTCR1a C/NC: ATCR1a, ANTCR1a	C: ATCR1a CNC: ANTCR1a C/NC: ATCR1a, ANTCR1a	N/A	C: ATCR2a CNC: ANTCR2 C/NC: ATCR2a, ANTCR2	C: ATCR2a CNC: ANTCR2 C/NC: ATCR2a, ANTCR2	C: ATCR2a CNC: ANTCR2 C/NC: ATCR2a, ANTCR2
Immunity tests	C: ATCR1a CNC: ANTCR1a C/NC: ATCR1a, ANTCR1a	C: ATCR1a CNC: ANTCR1a C/NC: ATCR1a, ANTCR1a	N/A	C: ATCR2a CNC: ANTCR2 C/NC: ATCR2a, ANTCR2	C: ATCR2a CNC: ANTCR2 C/NC: ATCR2a, ANTCR2	C: ATCR2a CNC: ANTCR2 C/NC: ATCR2a, ANTCR2

Table 4.4-5: Test configurations for a *TAB connector* supporting single-RAT UTRA operation

<i>TAB connector</i> test case	Single-RAT UTRA FDD MC capable <i>TAB connector</i> (CSA4) C capable only	Single-RAT UTRA FDD MC capable <i>TAB connector</i> (CSA4) C and NC capable with identical parameters	Single-RAT UTRA FDD MC capable <i>TAB connector</i> (CSA4) C and NC capable with different parameters	Single-RAT UTRA TDD MC capable <i>TAB connector</i> (CSA4) C capable only
Emission tests	ATC1a	ANTC1	ATC1a, ANTC1	ATC1b
Immunity tests	ATC1a	ANTC1	ATC1a, ANTC1	ATC1b

Table 4.4-6: Test configurations for an AAS BS supporting single-RAT UTRA operation

Test case	Single-RAT UTRA FDD MC capable AAS BS operating band (RCSA4) C capable only	Single-RAT UTRA FDD MC capable AAS BS operating band (RCSA4) C and NC capable with identical parameters	Single-RAT UTRA FDD MC capable AAS BS operating band (RCSA4) C and NC capable with different parameters	Single-RAT UTRA TDD MC AAS BS operating band (RCSA4) C capable only
Emission tests	ATC1a	ANTC1	ATC1a, ANTC1	N/A
Immunity tests	ATCR1a	ANTCR1	ATCR1a, ANTCR1	N/A

Table 4.4-7: Test configurations for a *TAB connector* supporting single-RAT E-UTRA operation capable of both contiguous and non-contiguous spectrum in multi-carrier and/or CA operation in single band

<i>TAB connector</i> test case	Single-RAT E-UTRA MC capable <i>TAB connector</i> (CSA5) C capable only	Single-RAT E-UTRA MC capable <i>TAB connector</i> (CSA5) C and NC capable BS with identical parameters (CNC)	Single-RAT E-UTRA MC capable <i>TAB connector</i> (CSA5) C and NC capable BS with different parameters (CNC)
Emission tests	ATC2a	ANTC2	ATC2a, ANTC2
Immunity tests	ATC2a	ANTC2	ATC2a, ANTC2

Table 4.4-8: Test configurations for an AAS BS supporting single-RAT E-UTRA operation capable of both contiguous and non-contiguous spectrum in multi-carrier and/or CA operation in single band

Test case	Single-RAT E-UTRA MC capable AAS BS operating band (RCSA5) C capable only	Single-RAT E-UTRA MC capable AAS BS operating band (RCSA5) C and NC capable BS with identical parameters	Single-RAT E-UTRA MC capable AAS BS operating band (RCSA5) C and NC capable BS with different parameters
Emission tests	ATCR2a	ANTCR2	ATCR2a, ANTCR2
Immunity tests	ATCR2a	ANTCR2	ATCR2a, ANTCR2

Table 4.4-9: Test configuration for *multi-band TAB connectors* supporting MSR operation

<i>TAB connector</i> test case	Test configuration for MBT	
	BC1/BC2	BC3
Emission tests	ATC5b	ATC5b
Immunity tests	ATC5b	ATC5b

Table 4.4-10: Test configuration for AAS BS operating bands containing beams with multi-band dependencies supporting MSR operation

<i>TAB connector</i> test case	Test configuration for MBT	
	BC1/BC2	BC3
Emission tests	ATCR5b	ATCR5b
Immunity tests	ATCR5b	ATCR5b

Table 4.4-11: Test configuration for *multi-band TAB connectors* supporting Single-RAT only

<i>TAB connector</i> test case	UTRA FDD CSA4	UTRA TDD CSA4	E-UTRA Test CSA5
Emission test	ATC1a/ANTC1 (note 1) ATC5b	ATC1b (note 2), ATC5a	ATC2a/ANTC2 (note 3), ATC5b
Immunity test	ATC5b	ATC5a	ATC5b

NOTE 1: ATC1a and/or ANTC1 shall be applied in each supported operating band according to table 4.4-3a.
NOTE 2: ATC1b shall be applied in each supported operating band according to table 4.4-3a.
NOTE 3: ATC2 and/or ANTC2 shall be applied in each supported operating band according to table 4.4-4a.

Table 4.4-12: Test configuration for AAS BS operating bands with multi-band dependencies supporting single-RAT only

<i>TAB connector</i> test case	UTRA FDD CSA4	UTRA TDD CSA4	E-UTRA Test CSA5
Emission test	ATCR1a/ANTCR1 (note 1) ATCR5b	N/A	ATCR2a/ANTCR2 (note 2), ATCR5b
Immunity test	ATCR5b	N/A	ATCR5b

NOTE 1: ATCR1a and/or ANTCR1 shall be applied in each supported operating band according to table 4.4-3b.
NOTE 2: ATCR2 and/or ANTCR2 shall be applied in each supported operating band according to table 4.4-4b.

4.5 Manufacturer declarations

The following EMC-specific manufacturer's declarations listed in table 4.5-1 are required to be provided by the manufacturer for AAS BS requirements testing.

NOTE: The below listed manufacturer's declarations are supplementary to declarations covered in TS 37.145-1 [3], and in TS 37.145-2 [10].

Table 4.5-1: EMC-specific manufacturer declarations

Declaration identifier	Declaration	Description
DEMC.1 (NOTE)	Ports intended to be used with cables less than 3 m	Declaration of any port(s) intended to be used with cables less than 3 m.
DEMC.2	Common and/or RAT-specific active RF components	Declaration of common and/or RAT-specific active RF components and other HW blocks for a communication link in AAS BS or other BS supporting more than one RAT.
DEMC.3	Common and/or band-specific active RF components	Declaration of common and/or band-specific active RF components and other HW blocks for a communication link in BS capable of multi-band operation.
DEMC.4 (NOTE)	RAT dependencies for simplified immunity testing	Declaration of RAT dependencies for simplified immunity testing. For the case where BS employs common active RF components (DEMC.2), declare RATs which are handled per operating band in common active components in the radio digital unit. Declared per supported operating band (in case supported by multiple RATs).
NOTE: This manufacturer declaration is optional.		

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 AAS BS supporting more than one RAT; (see declaration DEMC.2);
- information about the common and/or band-specific active RF components and other HW blocks for a communication link in AAS BS capable of multi-band operation; (see declaration DEMC.3);
- an exhaustive list of ports (and RIBs), classified as either power or signal/control. Power ports shall further be classified as AC or DC power.

A communication link used by more than one tested RAT or more than one tested operating band, shall be assessed on all tested 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.

NOTE 1: The present document does not cover ancillary equipment requirements. However, the ancillary equipment EMC requirements are still applicable to the AAS BS and for the ancillary equipment performance assessment the appropriate non-AAS specifications in TS 25.113 [5], TS 36.113 [6], TS 37.113 [4] or TS 38.113 [30] shall be referred.

NOTE 2: The NB-IoT operation is not supported by AAS BS.

5.2 Assessment of performance in Downlink

In the immunity tests, the output of the transmitter shall be connected (via port for hybrid AAS BS, or via RIB for OTA AAS BS) to test equipment which meets the requirements for the performance assessment of RAT and bearer used in the immunity tests according to the following:

- BLER assessment in TS 25.102 [26] in case of UTRA TDD
- BLER assessment in TS 25.101 [27] in case of UTRA FDD
- Throughput assessment in TS 36.101 [28] in case of E-UTRA
- Throughput assessment in TS 38.101-4 [34] in case of NR

The level of the signal supplied to the equipment should be within the range for which the assessment of throughput is not impaired. 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 or in case of NR
- The value of the BLER shall be monitored in case of UTRA FDD or in case of UTRA TDD

6 Performance criteria

The test should, where possible, be performed using a bearer with the characteristics of data rate and performance criteria defined for UTRA TDD, UTRA FDD, E-UTRA, or NR. 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.

Depending on RAT capability sets supported by the AAS BS, the following performance criteria for continuous or for transient phenomena shall be referred and applied:

- For AAS BS in *single RAT UTRA operation*, the performance criteria from TS 25.113 [5] apply.
- For AAS BS in *single RAT E-UTRA operation*, the performance criteria from TS 36.113 [6] apply.
- For AAS BS in *MSR operation*, the performance criteria from TS 37.113 [4] apply.
- For AAS BS in *single RAT NR operation*, the performance criteria from TS 38.113 [30] apply.

NOTE 1: The present document does not cover ancillary equipment requirements. However, the ancillary equipment EMC requirements are still applicable to the AAS BS and for the ancillary equipment performance criteria the appropriate non-AAS specifications in TS 25.113 [5], TS 36.113 [6], TS 37.113 [4] or TS 38.113 [30] shall be referred.

NOTE 2: The NB-IoT operation is not supported by AAS BS.

7 Applicability overview

7.1 Emission

Table 7.1-1: Emission requirements applicability

Phenomenon	Application	Equipment test requirement	Reference subclause in the present document	Reference standard
		BS equipment		
Radiated emission	Enclosure	applicable for <i>hybrid</i> AAS BS (Note)	8.2.1	ITU-R SM.329 [24]
Conducted emission	DC power input/output port	applicable	8.3	CISPR 32 [29]
Conducted emission	AC mains input/output port	applicable	8.4	CISPR 32 [29]
Conducted emission	Telecommunication port	applicable	8.5	CISPR 32 [29]
Harmonic current emissions	AC mains input port	applicable	8.6	IEC 61000-3-2 [11] or IEC 61000-3-12 [14]
Voltage fluctuations and flicker	AC mains input port	applicable	8.7	IEC 61000-3-3 [12] or IEC 61000-3-11 [13]
NOTE: The EMC radiated emissions requirements for the OTA AAS BS are covered by the RF radiated emissions requirement in TS 37.105 [2], conforming to the TS 37.145-2 [10].				

7.2 Immunity

Table 7.2-1: Immunity requirements applicability

Phenomenon	Application	Equipment test requirement	Reference subclause in the present document	Reference standard
		BS equipment		
RF electromagnetic field (80 – 6000 MHz)	Enclosure	applicable	9.2	IEC 61000-4-3 [16]
Electrostatic discharge	Enclosure	applicable	9.3	IEC 61000-4-2 [15]
Fast transients common mode	Signal, telecommunications and control ports, DC and AC power input ports	applicable	9.4	IEC 61000-4-4 [17]
RF common mode 0.15 - 80 MHz	Signal, telecommunications and control ports, DC and AC power input ports	applicable	9.5	IEC 61000-4-6 [19]
Voltage dips and interruptions	AC mains power input ports	applicable	9.6	IEC 61000-4-11 [20]
Surges, common and differential mode	AC power input ports and telecommunications port	applicable	9.7	IEC 61000-4-5 [18]

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, In case of *hybrid AAS BS*, Radio Frequency (RF) input/output ports shall be correctly terminated;
- For OTA AAS BS without Radio Frequency (RF) input/output ports but intentionally radiating through the *antenna array*, the equipment shall be placed in a test setup suitable for the radiated power;
- 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 clauses of the transceiver are described separately for the sake of clarity. However, where possible the test of the transmitter clause and receiver clause of the EUT may be carried out simultaneously to reduce test time.

8.2 Radiated emission from base station

8.2.1 Radiated emission, hybrid AAS BS

This test is applicable to *hybrid AAS BS*. This test shall be performed on a representative configuration of the *hybrid AAS BS*.

Depending on RAT capability sets supported by the *hybrid AAS BS*, the following radiated emission requirements apply:

- For *hybrid AAS BS* in *single RAT UTRA operation*, the base stations radiated emission requirements from TS 25.113 [5] apply.
- For *hybrid AAS BS* in *single RAT E-UTRA operation* the base stations radiated emission requirements from TS 36.113 [6] apply.
- For *hybrid AAS BS* in *MSR operation*, the base stations radiated emission requirements from TS 37.113 [4] apply.
- For *hybrid AAS BS* in *single RAT NR operation*, the *BS type 1-H* radiated emission requirements from TS 38.113 [30] apply.

8.2.2 Radiated emission, OTA AAS BS

This test is applicable to OTA AAS BS. This test shall be performed on a representative configuration of the OTA AAS BS.

For OTA AAS BS, the radiated emission requirement is covered by RF radiated spurious emission requirement in TS 37.105 [2], conforming to the test requirement in TS 37.145-2 [10].

NOTE: As the EMC radiated emissions of the OTA AAS BS cannot be distinguished between the intended emissions (nor to any spurious emissions related to these intentional transmissions) a single radiated emissions requirement is used for the OTA AAS BS.

8.3 Conducted emissions, 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.

Depending on RAT capability sets supported by the BS, the following conducted emission requirements apply:

- For AAS BS in *single RAT UTRA operation*, the DC power input/output port conducted emissions requirements from TS 25.113 [5] apply.
- For AAS BS in *single RAT E-UTRA operation*, the DC power input/output port conducted emissions requirements from TS 36.113 [6] apply.
- For AAS BS in *MSR operation*, the DC power input/output port conducted emissions requirements from TS 37.113 [4] apply.
- For AAS BS in single RAT NR operation, the DC power input/output port conducted emissions requirements from TS 38.113 [30] apply.

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.

Depending on RAT capability sets supported by the BS, the following conducted emission requirements apply:

- For AAS BS in *single RAT UTRA operation*, the AC mains power input/output port conducted emissions requirements from TS 25.113 [5] apply.
- For AAS BS in *single RAT E-UTRA operation*, the AC mains power input/output port conducted emissions requirements from TS 36.113 [6] apply.
- For AAS BS in *MSR operation*, the AC mains power input/output port conducted emissions requirements from TS 37.113 [4] apply.
- For AAS BS in single RAT NR operation, the AC mains power input/output port conducted emissions requirements from TS 38.113 [30] apply.

8.5 Harmonic current emissions (AC mains input port)

The requirements of IEC 61000-3-2 [11] 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 [14] applies.

8.6 Voltage fluctuations and flicker (AC mains input port)

The requirements of IEC 61000-3-3 [12] 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 61000-3-11 [13] applies.

8.7 Conducted emissions, telecommunication ports

This test is applicable for radio equipment for fixed use which have telecommunication ports.

This test shall be performed on a representative configuration of radio equipment.

The test method and limits shall be in accordance with CISPR 32 [29], as captured in TS 25.113 [5], TS 36.113 [6], TS 38.113 [30] and TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

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;
- During test, the RF output power may be reduced to a power level sufficient for establishing and maintaining the required communication link;
- 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, In case of *hybrid AAS BS*, Radio Frequency (RF) input/output ports shall be correctly terminated;
- For OTA AAS BS intentionally radiating through the *antenna array*, the equipment shall be placed in a test setup capable to reduce the power to a level sufficient for establishing and maintaining the communication link;
- 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 AAS BS shall be performed by establishing communication links at the radio interface (e.g. with the mobile simulator) and the S1/Iub interface (e.g. with an RNC/EPC simulator) and evaluating the BLER/throughput (see figures 9.1-1 and 9.1-2);
- 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 interface. BLER/throughput 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 interface. In case of looping is used care have to be taken that the BLER/throughput information doesn't change due to looping;
- For AAS BS capable of multi-RAT and/or multi-band operation, communication links shall be established in such a way that all tested 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 tested RAT and/or operating band

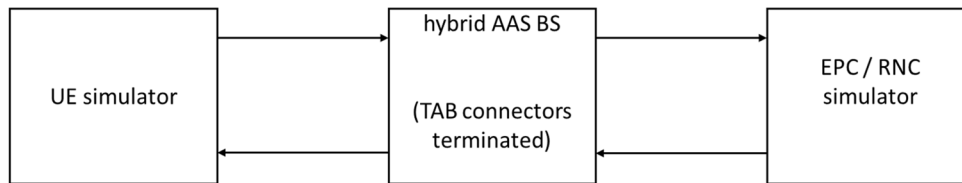


Figure 9.1-1: Communication link set up for *hybrid AAS BS* immunity measurement

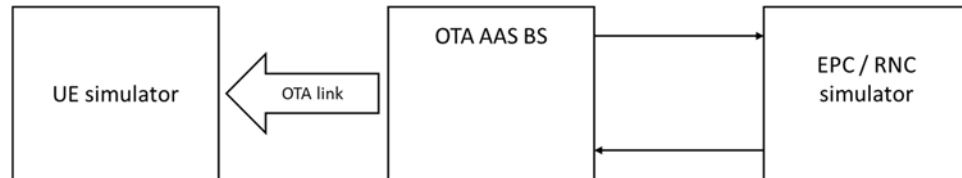


Figure 9.1-2: Communication link set up for *OTA AAS BS* immunity measurement

9.2 RF electromagnetic field (80 MHz - 6000 MHz)

9.2.1 RF electromagnetic field, hybrid AAS BS

This test assesses the ability of radio equipment to operate as intended in the presence of a radio frequency electromagnetic field disturbance at the enclosure. This test is applicable to *hybrid AAS BS* and shall be performed on a representative configuration of the *hybrid AAS BS*.

The test method and levels shall be in accordance with IEC 61000-4-3 [16] as captured in TS 25.113 [5], TS 36.113 [6], TS 38.113 [30] and TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively. The use of reverberation chamber test method according to IEC 61000-4-21 [35], clause 6.1 and Annex D as alternative method is allowed.

9.2.2 RF electromagnetic field, OTA AAS BS

This test assesses the ability of radio equipment to operate as intended in the presence of a radio frequency electromagnetic field disturbance at the enclosure. The *OTA AAS BS* includes an antenna which is an intentional radiator and does not form part of the EMC enclosure, application of RF electromagnetic fields in these directions may damage the BS receivers unintentionally.

In the operational range of angles of the *OTA AAS BS* antenna receivers are protected by the RF blocking requirements defined in TS 37.105 [2], conforming to the test requirement in TS 37.145-2 [10] and are not part of the EMC RF electromagnetic field immunity requirement.

In the range of angles except the operational range of angles of the *OTA AAS BS* antenna (i.e. except for the half sphere around the DUT radiating direction as depicted on figure 9.2.2-1) and for the frequency range above 690 MHz (according to ETSI EN 301 489-50 [25]), the EMC RF electromagnetic field immunity requirement with a level of 10 V/m applies on the non-radiating faces of the *OTA AAS BS*, as depicted on figure 9.2.2-1.

When no spatial exclusion is implemented the use of reverberation chamber test method according to IEC 61000-4-21 [35], clause 6.1 and Annex D as alternative method is allowed.

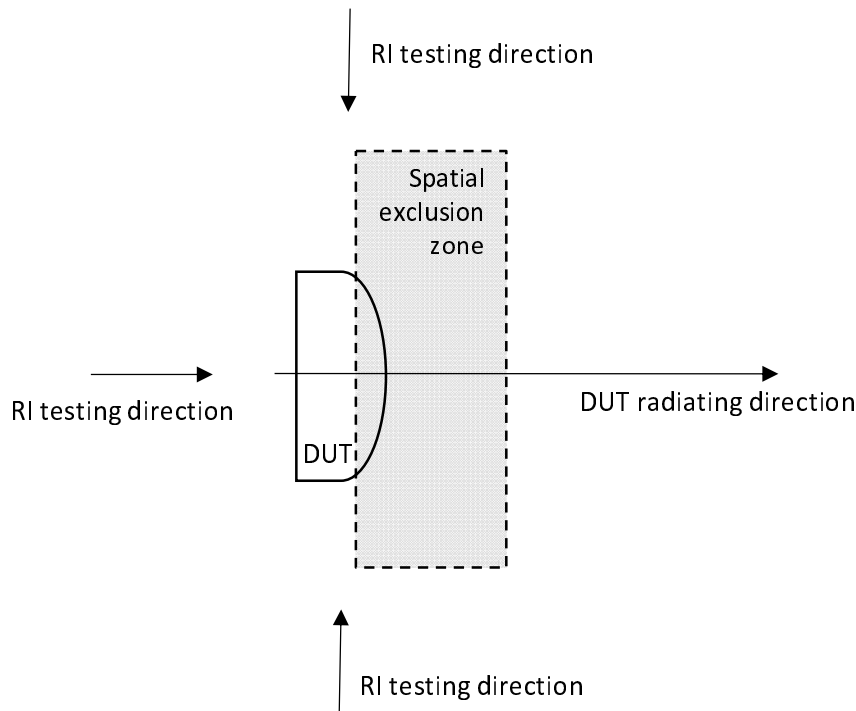


Figure 9.2.2-1 EMC RF electromagnetic field immunity requirement testing directions for OTA AAS BS (horizontal plane depicted) with the *spatial exclusion zone* applied

Depending on RAT capability sets supported by the OTA AAS BS, the following RF electromagnetic field requirements apply over the range of angles covered by the EMC RF electromagnetic field immunity requirement:

- For OTA AAS BS in *single RAT UTRA operation*, the RF electromagnetic field immunity requirements from TS 25.113 [5] apply.
- For OTA AAS BS in *single RAT E-UTRA operation*, the RF electromagnetic field immunity requirements from TS 36.113 [6] apply.
- For OTA AAS BS in *MSR operation*, the RF electromagnetic field immunity requirements from TS 37.113 [4] apply.
- For OTA AAS BS in *single RAT NR operation*, the *BS type 1-O* requirements for the RF electromagnetic field immunity from TS 38.113 [30] apply.

9.3 Electrostatic discharge

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

The test shall be performed on a representative configuration of the radio equipment.

The test method and levels shall be in accordance with IEC 61000-4-2 [15] as captured in TS 25.113 [5], TS 36.113 [6], TS 38.113 [30] and TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

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 in DEMC.1 (see table 4.5-1) 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 test method and levels shall be in accordance with IEC 61000-4-4 [17] as captured in TS 25.113 [5], TS 36.113 [6], TS 38.113 [30] and TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

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 in DEMC.1 (see table 4.5-1) 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 test method and levels shall be in accordance with IEC 61000-4-6 [19] as captured in TS 25.113 [5], TS 36.113 [6], TS 38.113 [30] and TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

NOTE: This test can also be performed using the clamp injection method, where appropriate, see IEC 61000-4-6 [19].

9.6 Voltage dips and interruptions

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

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

These tests shall be performed on a representative configuration of the equipment.

The test method and levels shall be in accordance with IEC 61000-4-11 [20] as captured in TS 25.113 [5], TS 36.113 [6], TS 38.113 [30] and TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

9.7 Surges, common and differential mode

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

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 test method and levels shall be in accordance with IEC 61000-4-5 [18] as captured in TS 25.113 [5], TS 36.113 [6], TS 38.113 [30] and TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

Annex A (normative): Simplified immunity testing

A.1 Applicability

Simplified immunity testing applies, per operating band, only to the BS which satisfies both of the following conditions:

- Radio unit employs common active RF components for supported RATs, as described in DEMC.2.
- Radio digital unit employs common active components for supported RATs, as described in DEMC.4.

NOTE: If the above condition is not met, all applicable test configurations in clause 4.4 apply for testing.

A.2 Capability Sets for simplified immunity testing

The set of RATs which are considered sufficient for the immunity testing purposes depends on the BS hardware capabilities declared by the manufacturer in DEMC.4.

The following RAT combinations were identified as candidates for the immunity testing reductions:

- For AAS BS declared to support E-UTRA and UTRA, UTRA does not have to be configured.
- For AAS BS declared to support NR and UTRA, UTRA does not have to be configured.

The above RAT combinations were further translated into the Capability Sets in tables below.

For single-band AAS BS, the sufficient CSs in tables A.2-1 and A.2-2 may be considered, instead of the CSs in tables 4.4-1 and 4.4-2, respectively.

The test configurations (TCx) are associated to the sufficient CSs according to tables 4.4-1 and 4.4-2.

Example: BS declared to support CSA3 (corresponding to ATC3a) in table A.2-1, will be tested using ATC2a (corresponding to CSA2).

Table A.2-1: Declared and sufficient CSs for testing

Declared Capability Set	UTRA + E-UTRA (CSA3)	E-UTRA + NR (CSA3A)	UTRA + E-UTRA + NR (CSA3B)
Sufficient CS for testing	E-UTRA (MC) capable BS (CSA2)	E-UTRA + NR (CSA3A)	E-UTRA + NR (CSA3A)

Table A.2-2: Declared and sufficient CSs for testing

Declared Capability Set	UTRA + E-UTRA (RCSA 3)	E-UTRA + NR (RCSA 3A)	UTRA + E-UTRA + NR (RCSA 3B)
Sufficient CS for testing	E-UTRA (MC) capable BS (RCSA2)	E-UTRA + NR (RCSA 3A)	E-UTRA + NR (RCSA 3A)

For multi-band multi-RAT capable MSR BS, the rationale described above applies for each band.

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2016-02	RAN4#78	R4-161123				First version of TS	0.1.0
2016-03	RAN#71	RP-160401				Presented to RAN for approval. Editorial cotrections recommended by ETSI editHelp	1.0.0
2016-03	RP-71					TR approved by RAN plenary	13.0.0
2016-06	RP-72	RP-161142	0002	1	F	Clarification in EMC environmental conditions references	13.1.0
2017-03	RP-75	RP-170586	0004	-	F	CR to TS 37.114: Clarification of the EMC specification's scope	13.2.0
2017-03	RP-75	-	-	-	-	Update to Rel-14 version (MCC)	14.0.0
2017-06	RP-76	RP-171306	0009		A	CR to TS 37.114: Isolation of Band 46 and NB-IoT from the AAS BS specification	14.1.0
2017-12	RAN#78	RP-172599	0059	1	B	Big CR to TS 37.114: eAAS EMC specification, v15.0.0	15.0.0
2018-03	RAN#79	RP-180282	0064		F	CR to TS37.114	15.1.0
2018-06	RAN#80	RP-181075	0067	1	B	CR to TS 37.114: NR introduction into AAS EMC specification	15.2.0
2018-12	RAN#82	RP-182362	0071	2	B	CR to TS 37.114: Clarification on Exclusion Bands for Radiated Immunity Test in FR2	15.3.0
2018-12	RAN#82	RP-182386	0073	1	F	CR to TS 37.114: additional inputs for introduction of NR to the AAS EMC specification	15.3.0
2018-12	RAN#82	RP-182386	0074		F	CR to TS 37.114: RAT-specific AAS BS operation terminology corrections	15.3.0
2018-12	RAN#82	RP-182386	0075	1	B	CR to TS 37.114: Consideration of the narrowband responses and communication link	15.3.0
2018-12	RAN#82	RP-182386	0076		F	CR to TS 37.114: clarification on CSA and RCSA capability sets	15.3.0
2019-03	RAN#83	RP-190401	0077	1	B	Draft CR to TS 37.114 Exclusion Bands for Radiated	15.4.0
2019-06	RAN#84	RP-191262	0078	1	F	CR to TS 37.114: Updates for Rx exclusion zone size and terminology for EMC RI testing purposes	15.5.0
2019-06	RAN#84	RP-191262	0080	1	F	CR to TS 37.114 subclause 4.2	15.5.0
2019-06	RAN#84	RP-191262	0084		F	CR to 37.114 Subsections index in Section 4.1	15.5.0
2019-09	RAN#85	RP-192019	0085		F	CR to TS 37.114 Correction on CISPR 16-1-1 for DC conducted Emission(clause 2 and subclause 7.1)	15.6.0
2019-09	RAN#85	RP-192053	0087	1	F	CR to 37.114 Editorial Corrections	15.6.0
2019-12	RAN#86	RP-193002	0093		F	CR to TS 37.114 Correction on definitions subclause 3.1	15.7.0
2019-12	RAN#86	RP-193002	0094		F	CR to TS 37.114 Correction on notes in subclause 7.1	15.7.0
2020-03	RAN#87	RP-200393	0095	1	F	CR to TS 37.114 Add the transmitter exclusion band for MSR BS(subclause 4.1)	15.8.0
2020-06	RAN#88	RP-201005	0096		F	CR to TS 37.114: internal TR reference corrections, Rel-15	15.9.0
2020-06	RAN#88	RP-200984	0097	1	F	[R15]CR to TS 37.114 Add the reverberation chamber for radiated immunity testing (clause 2)	15.9.0
2020-06	RAN#88	-	-	-	-	Update to Rel-16 version (MCC)	16.0.0

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2022-03	SA#95					Update to Rel-17 version (MCC)	17.0.0
2023-03	RAN#99	RP-230502	0100		F	CR to TS 37.114 AAS BS test configuration R15	17.1.0
2023-03	RAN#99	RP-230505	0106		F	TS 37.114: Corrections in clause 1 Scope and clause 9 Immunity	17.1.0

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2023-12	RAN#102	RP-233360	0108	1	F	[AAS_BS_LTE_UTRA-Core, TEI18] CR to TS 37.114: framework for the EMC-specific manufacturer's declarations, Rel-18	18.0.0
2023-12	RAN#102	RP-233364	0109	1	B	CR to TS 37.114: Implementation of AAS BS testing simplifications, Rel-18	18.0.0
2024-03	RAN#103	RP-240607	0112		F	(NR_LTE_EMC_enh-Perf) CR to TS 37.114 on correction of example used in Annex A	18.1.0
2025-03	RAN#107	RP-250609	0113		F	(AAS_BS_LTE_UTRA-Core) Correction of reference to Suspended version of ITU-R SM.329 Recommendation	18.2.0

History

Document history		
V18.1.0	May 2024	Publication
V18.2.0	April 2025	Publication