ETSI TS 137 114 V15.2.0 (2018-07)

Universal Mobile Telecommunications System (UMTS);
LTE;
Active Antenna System (AAS) Base Station (BS)
Electromagnetic Compatibility (EMC)
(3GPP TS 37.114 version 15.2.0 Release 15)

Reference
RTS/TSGR-0437114vf20

Keywords
LTE,UMTS

ETSI

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Contents

Foreword

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

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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

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

NOTE: Whenever the UTRA AAS BS is referred in the following section, UTRA TDD and UTRA FDD shall be considered, unless otherwise stated.

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 3GPP TS 37.105 [2], with conformance demonstrated by compliance to 3GPP TS 37.145-1 [3],

- Active Antenna System Base Station for UTRA FDD, E-UTRA, NR and MSR meeting the OTA requirements of 3GPP TS 37.105 [2], with conformance demonstrated by compliance to 3GPP 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] and 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 3GPP TS 36.113 [6], or for AAS BS in *MSR operation* using E-UTRA as defined in 3GPP 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 an *hybrid AAS BS* with *TAB connectors* for every transceiver unit at the *transceiver array boundary* (TAB), subject to conducted requirements,

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

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] CISPR 16-1-1: “Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus”

[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”

[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] 3GPP TS 38.145-2: "NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing"

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*

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:

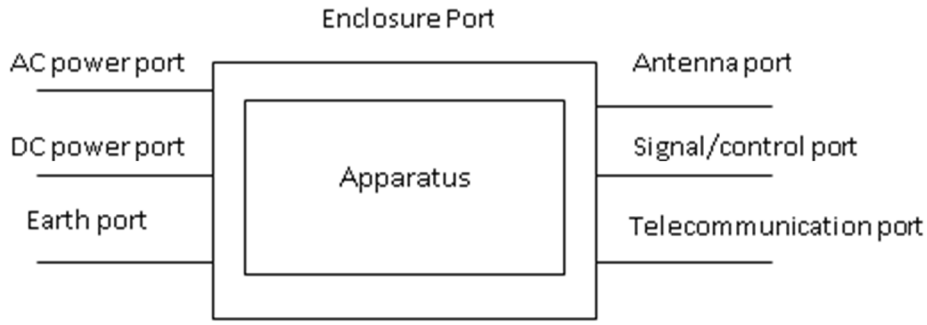

Figure 3.1-1: Examples of ports for *hybrid AAS BS*

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

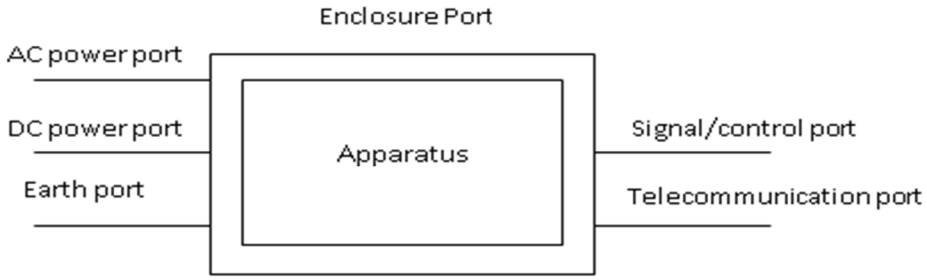

Figure 3.1-2: Examples of ports for OTA AAS BS

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

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:

Δf_{OOB} Maximum offset of the out-of-band boundary from the uplink operating band edge
F_{UL_low} The lowest frequency of the uplink operating band
F_{UL_high} The highest frequency of the uplink operating band

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
EMC ElectroMagnetic Compatibility
EUT Equipement Under Test
FR1 Frequency Range 1
MSR Multi-Standard Radio
NB-IoT Narrowband – Internet of Things
NR New Radio
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]. The test conditions shall be recorded in the test report.

For an AAS BS supporting more than one RAT, tests shall be performed with RATs activated according to the test configurations in TS 37.113 [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 only single RAT operation only, tests relating to the *antenna port(s)* and RIBs shall be performed for each supported RAT.

For AAS BS capable of multi-band operation, the requirements in the present document apply for each supported operating band unless otherwise stated. Operating bands and RATs shall be activated according to the respective test configurations in TS 25.113 [5], TS 36.113 [6], or TS 37.113 [4]. 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 and corresponding Band Categories as per capability sets and manufacturer's declarations of the AAS BS in TS 37.145-1 [3] and 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 a AAS BS according to a declared capability set(s) cover all single RAT and multi-RAT configurations included in the declared capability set.

NOTE 1: Capability sets for *hybrid AAS BS* are defined in 3GPP TS 37.141-1 [3] and declared in D6.12 declaration.

NOTE 2: Radiated capability sets for *hybrid AAS BS* and OTA AAS BS are defined in 3GPP TS 37.141-2 [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 TR 37.842 [9].

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 UTRA AAS BS the test conditions from TS 25.113 [5] apply.
- For E-UTRA AAS BS the test conditions from TS 36.113 [6] apply.
- For MSR AAS BS 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, TS 36.113 and TS 37.113 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 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

4.4.1 Transmitter exclusion band

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

4.4.2 Receiver exclusion band

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

For the receiver exclusion bands for for AAS BS, the range of the exclusion band shall be:

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

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 4.4.2-1.

Table 4.4.2-1: Maximum Δf_{OOB} offset outside the uplink operating band

***Operating band* characteristics**	**Δf_{OOB} [MHz]**
100 MHz ≥ $F_{UL\_high} - F_{UL\_low}$	20
100 MHz < $F_{UL\_high} - F_{UL\_low}$ ≤ 900 MHz	60

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

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

NOTE 2: Exclusion bands for *BS type 2-O* in radiated immunity test do not have to be defined considering the frequency range from 80MHz to 6GHz.

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

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] or TS 37.113 [4] 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

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
- The value of the BLER shall be monitored in case of UTRA FDD and 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 and E-UTRA. 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 shall be referred and applied:

- For UTRA AAS BS the performance criteria from TS 25.113 [5] apply.
- For E-UTRA AAS BS the performance criteria from TS 36.113 [6] apply.
- For MSR AAS BS the performance criteria from TS 37.113 [4] 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] or TS 37.113 [4] 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 BS equipment	Reference subclause in the present document	Reference standard
Radiated emission (Note)	Enclosure	applicable for *hybrid AAS BS*	8.2.1	ITU-R SM.329 [24]
Conducted emission	DC power input/output port	applicable	8.3	CISPR 32 [29], CISPR 16-1-1 [23]
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]. The EMC radiated emission requirements for the *hybrid AAS BS* are described in subclause 8.2.1.1.				

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 sections of the transceiver are described separately for the sake of clarity. However, where possible the test of the transmitter section and receiver section of the EUT may be carried out simultaneously to reduce test time.

8.2 Radiated emission from base station

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

8.2.2 Radiated emission, 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].

For BS type 1-O, the radiated emission requirement is covered by RF radiated spurious emission requirement in TS 38.104 [31], conforming to the test requirement in TS 38.141-2 [32].

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

- For E-UTRA AAS BS the AC mains power input/output port conducted emissions requirements from TS 36.113 [6] apply.
- For MSR AAS BS the AC mains power input/output port conducted emissions requirements from TS 37.113 [4] apply.
- For NR, 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 3GPP TS 25.113 [5], 3GPP TS 36.113 [6], 3GPP TS 38.113 [30] and 3GPP 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 RATs and operating band(s) are activated during the test according to the applicable test configurations in subclause 4.5. Performance assessment may be done separately for each RAT and/or operating band.

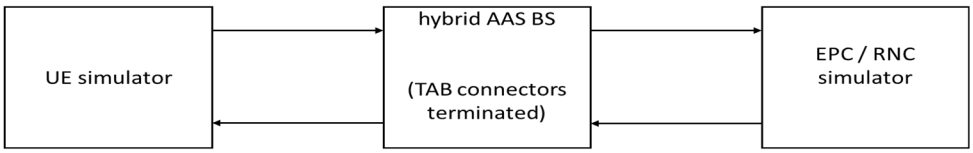

Figure 9.1-1: Communication link set up for *hybrid AAS BS* immunity measurement

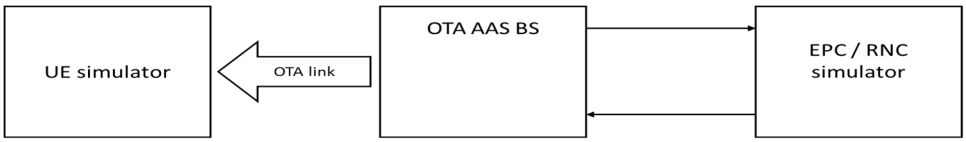

Figure 9.1-2: Communication link set up for OTA AAS BS immunity measurement

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 3GPP TS 25.113 [5], 3GPP TS 36.113 [6], 3GPP TS 38.113 [30] and 3GPP TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

9.2.2 RF electromagnetic field, OTA AAS BS

This test assesses the ability of radio equipment 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 the test method in ETSI EN 301 489-50 [25]), the EMC RF electromagnetic field immunity requirement applies.

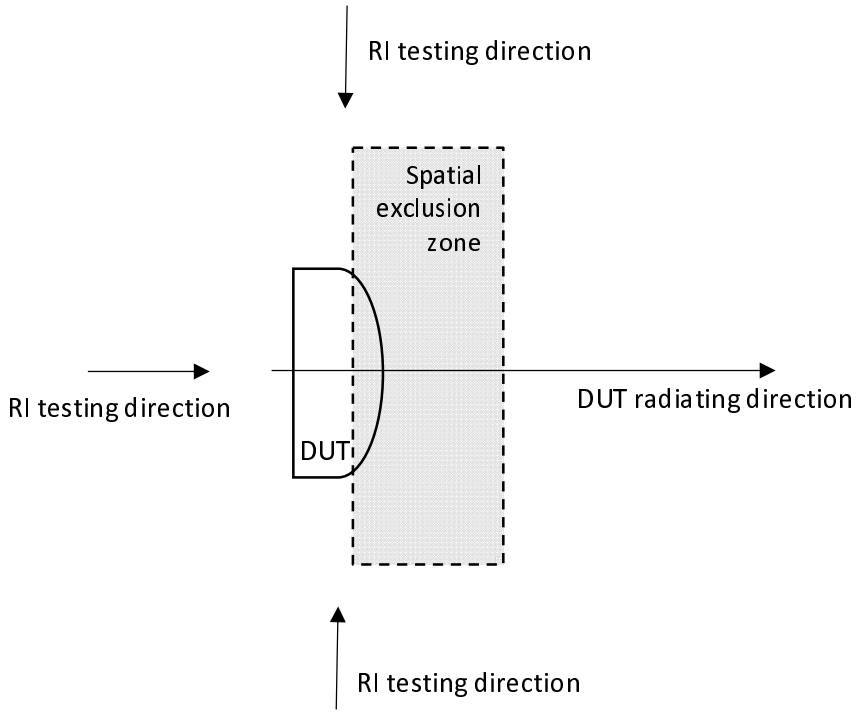

Figure 9.2.2-1 EMC RF electromagnetic field immunity requirement testing directions for OTA AAS BS (horizontal plane depicted)

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 UTRA FDD OTA AAS BS the RF electromagnetic field immunity requirements from TS 25.113 [5] apply.
- For E-UTRA OTA AAS BS the RF electromagnetic field immunity requirements from TS 36.113 [6] apply.
- For MSR OTA AAS BS the RF electromagnetic field immunity requirements from TS 37.113 [4] apply.
- For NR *BS type 1-O*, the RF electromagnetic field immunity requirements 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 3GPP TS 25.113 [5], 3GPP TS 36.113 [6], 3GPP TS 38.113 [30] and 3GPP 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 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 3GPP TS 25.113 [5], 3GPP TS 36.113 [6], 3GPP TS 38.113 [30] and 3GPP 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 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 3GPP TS 25.113 [5], 3GPP TS 36.113 [6], 3GPP TS 38.113 [30] and 3GPP TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

NOTE: This test can also be performed using the intrusive 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 3GPP TS 25.113 [5], 3GPP TS 36.113 [6], 3GPP TS 38.113 [30] and 3GPP 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 3GPP TS 25.113 [5], 3GPP TS 36.113 [6], 3GPP TS 38.113 [30] and 3GPP TS 37.113 [4] for UTRA, E-UTRA, NR and MSR, respectively.

Annex A (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 cotrrections 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

History

Document history		
V15.2.0	July 2018	Publication