3GPP TSG-RAN WG4 Meeting # 95-e DRAFT R4-2008862

Electronic Meeting, 25 May – 5 June, 2020

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.843** | **CR** | **0040** | **rev** | **1** | **Current version:** | **15.6.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

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| ***Title:*** | CR to TR 37.843: internal TR references corrections and content redundancy removal (wrt. TR 37.941 for OTA BS testing), Rel-15 | | | | | | | | | |
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| ***Source to WG:*** | Huawei | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | OTA\_BS\_testing | | | | |  | ***Date:*** | | | 2020-05-14 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-15 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | In relation to the OTA BS testing WI and the new TR 37.941, multiple TR/TS were reviewed with the goal to capture the OTA BS testing content in a single external TR 37.941, as well as to remove any outstanding references to internal TRs.  This CR provides corrections to the internal TR references in TR 37.843 and removes technical content already captured in the TR 37.941.  Further discussion may be needed for the solution of Voiding multiple clauses and their concent vs. resulting TR readability. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * Scope clarifiaction added. * Removal of the references to TR 37.840, TR 37.842. * Multiple ”specific references” were removed, replaced by “non-specific references” for simplicity. * Multiple sections removed (to avoid redundant content), as already covered in TR 37.941. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Reference to the internal TR (not allowed by the drafting rules) and redundant content among RAN4 TRs would exist. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 1, 2 4.5, 5.1.1, 5.2.1, 5.2.3.1, 5.4.1, 5.6.3.1, 5.6.3.2, 6.2.2.2.2, 6.2.2.3.1, 7.6, 7.7, 7.8, 8.3, 8.4, 8.5, 8.6, 10, B, C, E | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*------------------------------ Modified section ------------------------------*

# 1 Scope

The present document is the Technical Report for the Work Item on Base Station (BS) radiated Radio Frequency (RF) requirements for Active Antenna System (AAS) [2]. The present document captures the background and the decisions on the specification of radiated RF requirements that are applicable to AAS BS.

The AAS BS specification contains requirements for both single RAT UTRA FDD, UTRA TDD and E-UTRA as well as MSR (including single RAT MSR requirements for each of the RATS), it was agreed that it may not be necessary to support so many variants for the OTA AAS BS hence a specification complexity reduction investigation was carried out. It was found the following was not needed for the OTA AAS BS requirements:

1. Radiated requirements applicable for eAAS not support UTRA TDD.

2. Radiated requirements applicable for eAAS not include UTRA pilot requirements.

NOTE: In Rel-15, multiple clauses related to the OTA measurements of the BS were shifted to the OTA BS testing TR 37.941 [36], which includes such aspects as e.g., test tolerance and measurement uncertainty derivations, OTA test chambers descriptions, calibration and test procedure descriptions, etc. *------------------------------ Next modified section ------------------------------*

# 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] RP-170844: "Work Item Description for Enhancements of Base Station (BS) RF and EMC requirements for Active Antenna System (AAS)"

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

[4] 3GPP TR 37.842: "Frequency (RF) requirement background for Active Antenna System (AAS) Base Station (BS)"

[5] 3GPP TR 36.942: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Frequency (RF) system scenarios"

[6] 3GPP TR 37.840: "Study of Radio Frequency (RF) and Electromagnetic Compatibility (EMC) requirements for Active Antenna Array System (AAS) base station"

[7] 3GPP TS 37.104: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception"

[8] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception"

[9] Recommendation ITU-R SM.328-11: "Spectra and bandwidth of emissions", ITU/R

[10] 3GPP TR 25.951: "FDD Base Station (BS) classification"

[11] 3GPP TR 37.809: "Evolved Universal Terrestrial Radio Access (E-UTRA) medium range and Multi-Standard Radio (MSR) medium range / local area Base Station (BS) class requirements"

[12] 3GPP TR 36.931: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Frequency (RF) requirements for LTE Pico Node B"

[13] 3GPP TS 37.114: "Active Antenna System (AAS) Base Station (BS) Electromagnetic Compatibility (EMC)"

[14] 3GPP TS 37.113: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) Electromagnetic Compatibility (EMC)"

[15] 3GPP TS 36.113: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)"

[16] 3GPP TS 25.113: "Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)"

[17] Conversion of power to field strength in the book "Automotive Antenna Design and Applications", by Victor Rabinovich, Nikolai Alexandrov, Basim Alkhateeb; 2010

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

[19] 3GPP TS 25.104: "Universal Terrestrial Radio Access (UTRA); Base Station (BS) radio transmission and reception (FDD)"

[20] 3GPP TS 25.105: "Universal Terrestrial Radio Access (UTRA); Base Station (BS) radio transmission and reception (TDD)"

[21] 3GPP TS 25.141: "Base Station (BS) conformance testing (FDD)"

[22] 3GPP TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing"

[23] 3GPP TS 37.145-1: "Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: Conducted conformance testing"

[24] 3GPP TS 37.145-2: "Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: Radiated conformance testing"

[25] IEEE Std 149: "IEEE Standard Test Procedures for Antennas", IEEE

[26] TSGR4#8(99)631: "Antenna-to-Antenna Isolation Measurements", Allgon

[27] Report ITU-R M.2244: "Isolation between antennas of IMT base stations in the land mobile service", ITU-R

[28] 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”

[29] Hald, J.; Hansen, J. E.; Jensen, F. & Holm Larsen, F. Hansen, J. (Ed.) Spherical Near-Field Antenna Measurements, Peter Peregrinus Ltd., 1998, vol 26.

[30] "Sparse Sampling Analysis Tool" Matlab code: <https://se.mathworks.com/matlabcentral/fileexchange/67143-sparse-sampling-analysis-tool?s_tid=srchtitle>

[31] J. Fridén, A. Razavi, and A. Stjernman, “Angular sampling, Test Signal, and Near-Field Aspects for Over-the-Air Total Radiated Power Assessment in Anechoic Chambers”, IEEE Access, 2018, https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8470084.

[32] IEEE Std 145: “IEEE Standard Definitions of Terms for Antennas”, IEEE

[33] IEC 61000-4-21. “Electromagnetic compatibility (EMC) - Part 4-21: Testing and measurement techniques - Reverberation chamber test methods” Edition 2.0 2011-01, The International Electrotechnical Commision (IEC), 2011

[34] Hill, D.A., “Boundary fields in reverberation chambers,” IEEE Transactions on Electromagnetic Compatibility, vol. 47, no. 2, pp. 281-290, May 2005

[35] Krauthäuser, H. G.; Winzerling, T.; J., N.; Eulig, N. & Enders, A. “Statistical interpretation of autocorrelation coefficients for fields in mode-stirred chambers” 2005 International Symposium on Electromagnetic Compatibility, EMC 2005, 2005, 2, 550-555

[36] 3GPP TR 37.941: "Radio Frequency (RF) conformance testing background for radiated Base Station (BS) requirements"

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## 4.5 Coordinate system

For the description of the coordinate system for the OTA BS measurements, refer to TR 37.941 [36].

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### 5.1.1 Spatial requirements

OTA requirements for the AAS BS are belonging to one of the two groups:

- Directional requirements

- *TRP requirements*

*-* Co-location requirements

For the requirements classification and descriptions of the above requirement groups, refer to TR 37.941 [36].

All OTA requirements are met in either the *OTA coverage range* or *OTA peak direction set(s)* as shown in the overview table of the radiated Tx requirements in table 5.1-1.

Table 5.1-1: Overview of radiated Tx requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AAS BS requirement | | OTA requirement type | Coverage range | Notes |
| Base station output power | Output power accuracy for EIRP | Directional requirement | OTA peak directions set | Output power accuracy for EIRP requirement is already included as a core requirement in TS 37.105. |
| Output power accuracy for TRP | TRP | n/a |  |
| E-UTRA DL RS power | | Directional Requirement | OTA peak directions set | Conformance testing is carried out in the reference direction |
| Output power dynamics | | Directional requirement | OTA peak directions set | Conformance testing is carried out in the reference direction. |
| Transmit ON/OFF power | | co-location requirement | n/a |  |
| Frequency Error | | Directional requirement | *OTA coverage range* | Conformance testing is carried out in the reference direction. |
| Time Alignment Error | | Directional requirement | *OTA coverage range* | Conformance testing is carried out in the reference direction. |
| Modulation Quality (EVM) | | Directional requirement | *OTA coverage range* | Conformance testing is carried out in the reference direction and the maximum directions of the OTA coverage range on each axis. |
| Unwanted emissions | |  |  |  |
| Occupied Bandwidth | | Directional requirement | *OTA coverage range* | Conformance testing is carried out in the reference direction. |
| Adjacent Channel Leakage Radio (ACLR) | | TRP | n/a |  |
| Spectrum emission mask | | TRP | n/a |  |
| Spurious emissions | |  |  |  |
| Mandatory Requirements | | TRP | n/a |  |
| Protection of the BS receiver of own or different BS | | co-location requirement | n/a |  |
| Additional spurious emissions requirements | | TRP | n/a | Includes co-existence in same geographical area |
| Co-location with other base stations | | co-location requirement | n/a |  |
| Transmitter intermodulation | | co-location requirement | n/a | The interferer is applied as a co-location requirements, the radiated emissions requirements are specified in the appropriated referenced sub-clause. Generally TRP |

The *OTA peak directions set(s)* are the same as the *EIRP accuracy directions set(s)* used in the REL13 specification, the name has been changed as they are now used for other requirements. Examples of *OTA peak directions sets* remain the same as related *EIRP accuracy directions set(s)* in TR 37.842 [4].

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### 5.2.1 Background information on the conducted requirement

The conducted single RAT specifications TS 25.104 [19], TS 25.105 [20] and TS 36.104 [8] as well as the MSR specification TS 37.104 [7] and the Rel-13 AAS BS specification TS 37.105 [3] all contain a set of manufacturer’s declarations and a requirement on conducted output power. The requirement is placed upon the rated carrier output powerper carrier and applies to each antenna connector in non-AAS BS, and *TAB connector* in AAS BS. The rated carrier output power per carrier is declared, and the requirement is that the measured value is within ± 2dB (±2.5 dB in extreme conditions) of the declared value. In addition to the accuracy requirement on the carrier output power, a limit on the maximum declarable total rated output power per carrier, dependent on the BS class, is captured in the core specification TS 37.105 although not subject to any conformance test.

In the AAS BS conformance test specification TS 37.145-1 [23], the conducted power accuracy test is not carried out with a single carrier active, but with a set of carriers active such that the total output power at the *TAB connector* is at its maximum level and hence the power amplifier is operated at its maximum output power. Operation at maximum output power is an essential condition for a number of other transmitter tests, including in-band emissions, TX spurious emissions and EVM.

In the AAS BS specification TS 37.105, a requirement on EIRP accuracy was introduced. The requirement is based on a set of declarations that associate declared beams, beam steering ranges and EIRP achieved at certain points within the steering ranges. The declarations associated with the EIRP accuracy requirement are described in more detail in TR 37.842 [4]. The requirement itself states that the declared EIRP is achieved to within a ±2.2 dB accuracy interval at a number of (declared) directions.

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#### 5.2.3.1 Core requirement

The existing EIRP accuracy requirements are adopted for the requirement in normal conditions. The accuracy requirement is hence ±2.2 dB.

As there are now a number of transmitter requirements which are specified as *directional requirements* the existing directions set name and definition over which the EIRP accuracy is met (i.e. *EIRP accuracy directions set*) is no longer suitable. EIRP accuracy is now be defined over the more general *OTA peak directions set(s)*, the requirement is modified accordingly.

For each declared beam, in normal conditions, for any specific *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a manufacturer claimed EIRP level in the corresponding *beam peak direction* shall be achievable to within +2.2 dB and -2.2 dB of the claimed value.

EIRP accuracy was derived based on 3 methods outlined in sub-clause 7.2.3, TR 37.842 [4]:

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### 5.4.1 Background

The TDD TX OFF power ensures that receivers of other TDD system are not desensitized by the noise from an aggressor BS.

The TX OFF level requirement was first derived for the UTRA TDD requirement, the rationale for the UTRA TDD 1.28Mcps TX off level is given in TR 25.942

*Assuming the Noise Figure(NF) of BS is 7dB and Minimum Couple Loss(MCL) is 30dB. For the victim receiver, the Tx OFF power should not exceed the thermal noise. If Tx OFF power is 6dB below thermal noise, it will introduce 1dB degradation. The proposal for Tx OFF power is as follows:*

**

**

*NOTE: In 1.28 Mcps TDD option, The noise figure of BS is assumed to be 7dB, it is based on that this parameter has been approved by CWTS yet and it is easier for implementation of BS.*

For E-UTRA the power level is in 1MHz (rather than 1.28MHz) and the assumed NR is 5dB the requirement is hence:

And for E-UTRA (specified as -85dBm/MHz)

**

**

There are a number of different receivers which can be identified as being victims to the Tx OFF power:

- Own receiver – this is possible but, it is unlikely a TDD system has separate Tx and Rx antennas so is identified by the RX sensitivity requirement even for a conducted system.

- Co-located receivers – the requirement is measured for the Tx channel – however the same noise can be expected across the whole operational band. Other co-located receivers using other channels in the band are hence protected.

- Same geographical area receivers – most co-location requirements in the same geographical area assume a reasonable separation between BS’s, hence the isolation is assumed to be greater.

For the release 13 AAS BS requirements the TX OFF level was applied to each *TAB connector* as the primary purpose of the requirement is to prevent desensitization of your own receiver. With a conducted interface the receiver sensitivity requirement alone is not sufficient to guarantee that, this is further documented in TR 37.842 [4].

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#### 5.6.3.1 Background information on the conducted requirement

The Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency, expressed in dB. ACLR is defined for both the first adjacent channel and the second adjacent channel.

The Wide Area BS ACLR was originally derived by means of co-existence simulations as documented in the TR 36.942 [5]. The coexistence simulations captured DL network throughput loss due to interference from an aggressor network in the downlink vs. so-called ACIR. ACIR incorporates power in the UE receive band due to the transmitter unwanted emissions (ACLR) and the receiver (ACS), and is calculated as:

 (assuming linear terms)

The coexistence simulation result for ACIR was split into ACLR and ACS, resulting in for wide area BS ACLR of 45dB and a UE ACS of 33dB.

An AAS BS may consist of multiple transmitters that perform beamforming. If the adjacent channel interference is not necessarily beam formed in the same manner as the wanted channel, hence ACLR may vary in space. Before setting a conducted requirement in the Release 13 AAS BS specification TS 37.105 [3], further co-existence simulations were performed in the AAS SI TR 37.840 [6] and AAS WI TR 37.842 [4]. These simulations revealed that it is the total power and not the spatial distribution of unwanted emissions (i.e. the correlation of adjacent channel noise between transmitter units) that impacts co-existence KPIs. Hence an ACLR based on total wanted channel and adjacent channel power was defined at *TAB connectors*.

In addition to the ACLR ratio of 45 dB, an absolute level of adjacent channel emissions is defined. The base station fulfils whichever is the less stringent of the ACLR ratio or the absolute level. The definition of an absolute level avoids specifying unnecessarily low levels on any BS that operate with a low wanted carrier transmit power. For wide area BS, the absolute level is defined in TS 37.104 [7] as either -13 dBm/MHz for category A, or -15dBm/MHz for category B emissions requirements, relating to regulatory frameworks.

In the AAS BS specification TS 37.105 [3] the ACLR requirement is set on the ratio of the total wanted signal power at all *TAB connectors* to the total power at all connectors of adjacent channel power. For the absolute requirement, the non-AAS requirement forms a *basic limit*, which is scaled up to an AAS BS requirement according to the number of *active transceiver units,* up to a maximum 8 times for E-UTRA (4 for UTRA), in the same manner as the scaling applied to other unwanted emissions requirements.

For medium range BS and local area BS, the ACLR requirement of 45 dB was retained in TS 37.104 [7] without any further simulation investigations. For TS 37.105 [3], the 45 dB ACLR was also retained for the other base station classes.

In the non-AAS specifications, the absolute limits for adjacent channel emissions are adjusted for the medium range and local area BS classes. For the local area BS class, the absolute limit are adjusted to -32 dBm/MHz. The limit of ‑32 dBm/MHz corresponds to an ACLR of roughly 45 dB for a local area BS with a 10 MHz carrier operating at the maximum permitted output power. For the medium range BS, the absolute limit are also adjusted. The absolute limit is set to -25 dBm/MHz. This again roughly corresponds to an ACLR of 45 dB for a medium range BS transmitting a 10MHz carrier near to maximum allowable output power, and also matches to the WCDMA SEM.

The absolute unwanted emissions requirements for medium range BS and local area BS were also used as *basic limits* in TS 37.105 [3], with the scaling mechanism applying in the same way as for wide area BS.

In addition to ACLR, a requirement on so-called Cumulative ACLR (CACLR) is applied for multicarrier and multiband BS. The CACLR requirement considers adjacent channel emissions falling onto a carrier that is adjacent to 2 active carriers; one at a lower frequency offset and one a higher frequency offset. The CACLR requirement is also 45 dB.

The CACLR requirements also apply in TS 37.105 [3] in the same manner as ACLR.

#### 5.6.3.2 ACLR OTA: Core requirement

Based on the findings of the simulation work done in TR 37.842 [4] the effect of adjacent channel interference on the throughput of adjacent networks is dependent on the total radiated adjacent channel power rather than the power in the main beam.

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##### 6.2.2.2.2 OTA reference sensitivity

OTA REFSENS is specified over the RoAoA which define a contour equivalent to the 3dB beam width of a non-AAS passive antenna covering the same RoAoA. Using the 3dB contour allows for simple estimation of equivalent directivity by use of standard formula.

The OTA REFSENS level (EISREFSENS) depends on the equivalent directivity of a passive antenna pattern which has the same beam width(s) as the AAS element or sub-array (declared via OTA REFSENS RoAoA) and can be calculated in dBm as follows:



Where:

- DRX\_OTA\_MARGIN is an implementation margin to allow for errors associated with beam forming in the UL. The DRX\_OTA\_MARGIN value is 1dB.

- PREFSENS is the conducted reference sensitivity level in dBm in the Rel-13 TS 37.105 [3].

- D0 is the estimated antenna peak directivity in dBi of a non-AAS BS, which has a beam pattern related to the AAS BS OTA REFSENS RoAoA region. D0 is approximated by the Elliot’s formula and expressed as,



Where,

- BeWθ,REFSENS is the beamwidth equivalent to the OTA REFSENS RoAoA in the θ-axis in degrees.

- BeWφ,REFSENS is the beamwidth equivalent to the OTA REFSENS RoAoA in the φ-axis in degrees.*OTA REFSENS RoAoA* is declared by the vendor.

- Doff-peak is the peak directivity off-peak margin, it is defined as follows:

- The OTA REFSENS RoAoA is defined as the contour where the EIS is 3dB higher than in the reference direction, therefore by definition Doff-peak in the reference direction is 0dB. In all other directions within the OTA REFSENS RoAoA Doff-peak is 3dB.

Redirection capability is a spatial performance characteristic of the antenna and hence is part of the OTA sensitivity requirement. The OTA REFSENS requirement demonstrates the minimum sensitivity of the OTA AAS BS receiver and hence requires only a single OTA REFSENS RoAoA to be declared per operating band.

DRX\_OTA\_MARGIN allows for degradation in receiver performance due to beam forming aspects, including (but not excluded to):

- Steering error

- Correlation of noise sources in RX units.

- Baseband combining efficiency/implementation margin

Steering error is primarily due to errors in phase alignment of the receiver units causing a steering error, this is similar to the beam steering error estimated for the EIRP accuracy value. The average EIRP beam steering error component of the EIRP accuracy documented in TR 37.842 [4] was 0.85dB.

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##### 6.2.2.3.1 OTA Sensitivity

Conformance testing for OTA sensitivity is performed for the five directions same as the Rel-13 OTA sensitivity requirements as described in TR 37.941 [36]. Same requirements for Rel-13 OTA sensitivity apply.

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## 7.6 Conformance requirements

The OTA related parts of the conformance testing test procedures for the demodulation requirements are based upon the RX dynamic range requirement OTA procedure, as described in subclause 10.3.4. The setup and operation of the signal generator and measurement instruments are the same as for the corresponding conducted requirements.

Measurement Uncertainties for the OTA requirements are the same as for the conducted requirements, as described in subclause 10.11.

It is noted, that the possibility of OTA testing is considered also for those BS demodulation requirements, which were declared as Optional in TS 25.141 [21] and TS 36.141 [22].

For OTA test setup for the BS demodulation requirements and for description of the BS demodulation requirements feasible OTA, refer to TR 37.941 [36].

## 7.7 OTA test setup

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [36].

## Figure 7.7-1: VoidFigure 7.7-2: VoidFigure 7.7-3: VoidFigure 7.7-4: Void7.8 BS demodulation requirements feasible OTA

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [36].







Table 7.8-1: VoidTable 7.8-2: Void*------------------------------ Next modified section ------------------------------*

# 8 EMC requirements

## 8.1 General

The Rel-13 AAS EMC specification [13] was drafted with a simple principle of applying the existing EMC requirements to the AAS BS architecture hence it was possible to refer to the existing UTRA , E-UTRA and MSR EMC specifications [16][15][14]. It was possible to use this approach since release 13 of AAS BS specification [3] only allows for AAS BS architectures with a conducted interface, which means that the *antenna array* can be disconnected and *TAB connectors* can be terminated. Hence the system can be treated in the same way as in the existing specifications and therefore the EMC requirements remained applicable in exactly the same way.

The OTA AAS BS architecture does not have a conducted interface and so the antennas cannot be disconnected. This means that the conducted methods where the *EMC antenna port*s are terminated are no longer be possible and hence new methods for EMC testing are needed.

Figure 8.1-1 shows the prime difference in architecture from an EMC view point when comparing the ports on a conventional non-AAS BS to the ports on an AAS BS.





Figure 8.1-1: Comparison between BS architectures for EMC testing

Since the *antenna array* for the OTA AAS BS is integrated within the EUT, the transmissions from the EUT within the test chamber have *antenna gain* included in them.

Figure 8.1-2 illustrates the status of *EMC antenna port*s during EMC testing where it is noted that the ports are connected to a terminating load and the *hybrid AAS BS* is then set to transmit at full power.



Figure 8.1-2: *EMC Antenna port* status during EMC testing

NOTE: In Rel-15 version of this TR, multiple clauses related to the OTA measurements of the EMC requirements were shifted to the OTA BS testing TR 37.941 [36].

## 8.2 Regulatory EMC requirements

The following table provides a summary of the existing EMC regulatory requirements in EU and US market. These requirements should serve as a reference when specifying the EMC requirements for the AAS BS.

Table 8.2-1: Overview of the regulatory EMC requirements for EU and US markets

|  |  |  |
| --- | --- | --- |
|  | EU market | US market |
| RF Radiated Spurious Emission (RSE) requirements | -36dBm/100kHz ERP below 1 GHz and -30dBm/1MHz ERP above 1 GHz  Requirements specified in ETSI EN 301 908-1, and are tested with the antenna port connected in a terminating load.  No TX exclusion bands defined for BS equipment today. | General requirement of -13 dBm/MHz ERP is applicable  Requirements specified in FCC Part 2.  FCC does not define any TX exclusion bands for BS equipment today. |
| EMC Radiated Emission (RE) requirements | -50dBm/MHz ERP general requirement. Not applicable for BS equipment  Defined in ETSI EN 55032. | -50dBm/MHz above 1 GHz mandatory requirement.  Specified in FCC Part 15, §15.35. |
| Radiated Immunity (RF electromagnetic field) requirements | Two type of requirements defined:  3 V/m, 80 MHz – 690 MHz, and  10 V/m 690 MHz – 6 GHz.  Defined in ETSI EN 301 489-1 and ENSI EN 301 489-50  RX Exclusion bands defined 20 MHz above and below the operating band | No requirements today |

Note: From the above regulatory requirements, the radiated spurious emission requirements (-36 dBm/100kHz and -30 dBm/1MHz) are reflected in the existing EMC specifications for AAS BS [13] and non-AAS BS [14]. Similarly, the 3 V/m immunity requirement is captured in the existing EMC specifications.

## 8.3 Field strength in EMC chamber

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [36].

## 8.4 Protection of measurement equipment

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [36].

## 8.5 EMC radiated emission requirement

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [36].

## Figure 8.5-1: Void8.6 Radiated Immunity

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [36].

*------------------------------ Next modified section ------------------------------*

# 10 Conformance testing aspects

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [36].



















































































































































































































































































































































































*----------------------------- End of modified section ------------------------------*

Annex B:  
OTA sensitivity measurement error contribution descriptions

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [36].

Annex C:  
Beam sweeping

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [36].

Annex D:  
Sparse sampling for spurious emissions

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [36].



Annex E:  
Radiated transmit measurement error contribution descriptions

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [36].

Annex F:  
Test equipment uncertainty values

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [36].











Annex G:  
Power density measurements close to EUT

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [36].