3GPP TSG-RAN WG4 Meeting # 95-e DRAFT R4-2008861

Electronic Meeting, 25 May – 5 June, 2020

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.842** | **CR** | **0016** | **rev** | **1** | **Current version:** | **13.3.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | CR to TR 37.842: internal TR references corrections and content redundancy removal (wrt. TR 37.941 for OTA BS testing), Rel-15 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***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 37.842 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, replaced with the reference to TR 37.941. * Multiple ”specific references” were removed, replaced by “non-specific references” for simplicity. * Multiple sections removed/voided (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, 4.2, 4.5, 5.3.2, 5.3.3.1, 5.3.3.2, 6.1, 7.3.3, 8.2.4.1, 10.1, 10.3, 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) Radio Frequency (RF) requirements for Active Antenna System (AAS), which was approved at TSG RAN#59. The present document captures the background and the decisions on the specification of RF requirements that are applicable.

NOTE: In Rel-15, multiple clauses related to the OTA measurements of the BS were shifted to the OTA BS testing TR 37.941 [26], which includes such aspects as e.g., test tolerance and measurement uncertainty derivations, OTA test chambers descriptions, calibration and test procedure descriptions, etc.

# 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 TR 37.840: "Study of Radio Frequency (RF) and Electromagnetic Compatibility (EMC) requirements for Active Antenna Array System (AAS) base station".

[3] RP-130373: "Base Station (BS) RF requirements for Active Antenna System (AAS)".

[4] 3GPP TR 25.942: "UTRA Radio Frequency (RF) system scenarios".

[5] 3GPP TR 36.942: "E-UTRA Radio Frequency (RF) system scenarios".

[6] 3GPP TS 25.104: "Base Station (BS) radio transmission and reception (FDD)".

[7] 3GPP TS 36.104: "E-UTRA Base Station (BS) radio transmission and reception".

[8] 3GPP TS 37.104: E-UTRA, UTRA and GSM/EDGE Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception".

[9] 3GPP TS 25.105: "Base Station (BS) radio transmission and reception (TDD)".

[10] 3GPP TS 25.141: "Base Station (BS) conformance testing (FDD)".

[11] 3GPP TS 25.142: "Base Station (BS) conformance testing (TDD)".

[12] 3GPP TS 36.141: "E-UTRA Base Station (BS) conformance testing".

[13] ANSI/IEEE Std 149-1979: "IEEE Standard Test Procedures for Antennas".

[14] 3GPP TR 25.914: "Technical Specification 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; Measurements of Radio Performances for UMTS Terminals in Speech Mode".

[15] ETSI TS 102 273-1-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 1: Uncertainties in the measurement of mobile radio equipment characteristics; Sub-part 1: Introduction".

[16] ETSI TS 102 273-1-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 1: Uncertainties in the measurement of mobile radio equipment characteristics; Sub-part 2: Examples and annexes".

[17] 3GPP TS 37.145-2: "Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: radiated conformance testing".

[18] 3GPP TS 37.114: "Active Antenna System (AAS) Base Station (BS) Electromagnetic Compatibility (EMC)".

[19] 3GPP TS 37.113: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) Electromagnetic Compatibility (EMC)".

[20] 3GPP TS 25.113: "Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)".

[21] 3GPP TS 36.113: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)".

[22] 3GPP TS 37.105: "Active Antenna System (AAS) Base Station (BS) transmission and reception (Release 13)".

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

[24] 3GPP TS 37.145-1: "Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: conducted conformance testing".

[25] JCGM 100:2008: “Evaluation of measurement data — Guide to the expression of uncertainty in measurement”.

[26] 3GPP TR 37.941: "Radio Frequency (RF) conformance testing background for radiated Base Station (BS) requirements"

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

## 4.2 Work Item objectives

A Study Item (SI) phase on Active Antenna System BS was concluded and the investigation results are captured in 3GPP TR 37.840 [2]. Particularly the SI conclusion is captured in subclause 9 in 3GPP TR 37.840 [2]. A WI was approved in [3] and the objectives of the Work Item are to firstly decide the list of radiated requirements as well as the list of conducted requirements based on the identified representative deployment scenarios, and then to create the specifications for the requirements that are applicable to AAS BS.

The AAS BS test methods and specification of the conformance requirements corresponding to the core requirements will be defined.

Detailed WI texts are presented in [3].

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

## 4.5 Void

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

### 5.3.2 UE specific beamforming simulation assumptions

In case of UE specific beamforming, the AAS BS may generate beams, each pointing to a specific UE. The overall radiation pattern of the beams can be derived as:



where is the element pattern defined in table 5.3.3.1-1, and and are the *array factors* defined in table 5.3.2-1.



Due to the non-linearization characteristics of the transmitters, the 3rd order intermodulation productions generated by the beams may be pointed to different directions as the weighting vector for each of the beams are involved in the intermodulation process, and combinations of any three of the weighting vectors generated a different direction for the 3rd order intermodulation product. The overall radiation pattern of the IMD3 products can be derived as:



where is number of IMD3 beams generated, and . Please be noted that the triplet (p, q, l) is order sensitive and they represent any of the three UE specific beams with an intermodulation relation of p+q- l. Please also be noted that p, q, l can take the same value. Therefore:



=



and is the weighting vector for the IMD3 products generated by the three beams and:



=



The weighting factor above is for the IMD3 products which is generated by+-, where , , and represent any frequency component in beam p, q, l correspondingly.



Based on the radiation pattern of wanted signal and IMD3 products, the ACLR pattern can be derived as:

+



where is the ACLR performance of each transmitter.



The assumption in table 5.4.3.1-1 in 3GPP TR 37.840 [2] was used for UE beamforming scenarios but the number of UEs activated in each cell is assumed to be 4. A 10x4 *antenna array* is employed to generate beams pointed directly at each UE dropped in cell.

Table 5.3.2-1: Simulation assumptions for UE specific beamforming

|  |  |
| --- | --- |
| Parameters | Values |
| Cellular layout | Hexagonal, 3 sectors/cell (19 cell wrap-around), uncoordinated |
| UE distribution | Average 10 UEs per sector |
| Carrier frequency | 2 GHz |
| System bandwidth | 10 MHz |
| Inter Site Distance (ISD) | 750m |
| Minimum distance UE<->BS | 35m |
| Log normal shadowing | Standard Deviation of 10 dB |
| Shadow correlation coefficient | 0.5 (inter site)/1.0 (intra site) |
| Scheduling algorithm | Round Robin, Full buffer |
| RB number per active UEs | DL: 12RBs |
| Number of active UEs | DL: 4UEs |
| UE max Tx power | 23 dBm |
| UE min Tx power | -40 dBm |
| Active array loss | 1 dB |
| Losses of legacy system | 2 dB |
| Legacy BS max Tx power | 46 dBm |
| AAS BS max Tx power | 46 dBm |
| Antenna configuration at UE | Omni-directional |
| The height of BS | 30 m |
| The height of UE | 1.5 m |
| *Antenna array* configuration (Row×Column) | 10×4 |
| ACS of LTE UE | 33 dB |
| Performance evaluation | Throughput loss criteria, as derived from the truncated Shannon bound approach of 3GPP TR 36.942 [5] |

### 5.3.3 Antenna array model

#### 5.3.3.1 General

The AAS BS *antenna array* model is determined by *array element* pattern, *array factor* and signals applied to the system. The element pattern and composite antenna pattern are defined in the subclauses 5.3.3.2 and 5.3.3.3.

NOTE: The and definition in this subclause is based on the coordinate system in subclause 5.4.4.1 of 3GPP TR 37.840 [2].

#### 5.3.3.2 Array element pattern

Table 5.3.3.2-1: Array element pattern for *antenna array* model

|  |  |
| --- | --- |
| Horizontal Radiation Pattern |  |
| Horizontal half-power bandwidth of single array element | For single column antenna: 65º  For multi-column antenna: 80º |
| *Front-to-back ratio* | Am = 30 dB |
| Vertical Radiation Pattern | , SLAv =30 dB |
| Vertical half-power bandwidth of single array element | 65º |
| Array element radiation pattern |  |
| Element Gain without antenna losses | For single column antenna: GE,max = 9 dBi  For multi-column antenna: GE,max = 7.5 dBi (note) |
| NOTE: GE,max is obtained from 3GPP TR 37.840 [2], table 5.4.4.2.1-1. | |

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

## 6.1 Minimum coupling loss

AAS BS is classified according to the deployment scenarios defined in subclause 5.2.1 in 3GPP TR 37.840 [2] and those scenarios are the same as for non-AAS BS. One of the key parameters that characterise each of the deployment scenarios is the MCL between BS and UE, which includes the path loss and the antenna gains of both UE and BS.

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

### 7.3.3 The conformance requirements

For the desciprions of the spatial aspects of the OSDD, refer to TR 37.941 [26].

Figure 7.3.3-1: Void

#### Figure 7.3.3-2: Void*------------------------------ Next modified section ------------------------------*8.2.4.1 Maximum Output Power

The objectives of defining conducted output power of the AAS BS are to verify the capabilities of the transmitter to feed antennas and the accuracy of the maximum output power.

Regulatory review on output power is presented in 3GPP TR 37.840 [2]. The following summarises regulatory views and requirements for BS employing *antenna arrays*.

# *------------------------------ Next modified section ------------------------------*10 Conformance testing aspects

### 10.1 Conformance testing framework

### 10.1.1 General

For conducted test requirements, it is expected that one test method will be sufficient for each core requirement. Hence the traditional approach for devising test specifications can be followed. This is depicted in figure 10.1.1-1.



Figure 10.1.1-1: Conducted requirement to test mapping

For the descriotion of the conformance testing frameworkvfor the OTA requirements, refer to TR 37.941 [26].

Figure 10.1.1-2: Void

### 10.1.2 Uncertainty budget calculation principle

For the descriotion of the uncertainty budget calculation principles for the OTA requirements, refer to TR 37.941 [26].

## *------------------------------ Next modified section ------------------------------*10.3 OTA tests

### 10.3.1 Radiated transmit power

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [26], which includes such aspects of the radiated transmit power requirement as: test tolerance and measurement uncertainty derivations, OTA test chambers descriptions, calibration and test procedure descriptions, etc.







































### 10.3.2 OTA sensitivity

NOTE: In Rel-15, content of this clause was shifted to the OTA BS testing TR 37.941 [26], which includes such aspects of the OTA sensitivity requirement as: test tolerance and measurement uncertainty derivations, OTA test chambers descriptions, calibration and test procedure descriptions, etc.







































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

Annex B:  
Radiated transmit power measurement error contribution descriptions

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [26].

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

Annex C:  
OTA sensitivity measurement error contribution descriptions

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [26].

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

Annex E:  
Test equipment uncertainty values

NOTE: In Rel-15, content of this annex was shifted to the OTA BS testing TR 37.941 [26].







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