3GPP TSG-RAN WG4 Meeting # 95-e DRAFT R4-2008863

Electronic Meeting, 25 May – 5 June, 2020

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.817-02** | **CR** | **0067** | **rev** | **1** | **Current version:** | **15.7.0** |  |
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| *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 38.817-02: 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 38.817-02.  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 37.842 and TR 37.843, replaced by reference to TR 37.941. * 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, 5.1, 5.3.2, 5.6, 6.7.2, 9.1.1, 9.2.2, 9.3.2, 9.6.2, 9.6.6, 10.1, 10.2, 10.3.3.3, 10.5.3.2, 10.5.3.3, 10.6.1, 11.4, 12, A | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 a technical report for the work item on Work Item on New Radio (NR) Access Technology, covering the general aspects for BS RF for NR.

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.

# 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] Recommendation ITU-R M.1036-5 (10/2015), "Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)".

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

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

[5] ITU-R Recommendation SM.328: "Spectra and bandwidth of emissions".

[6] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".

[7] 3GPP TS 37.105: "Active Antenna System (AAS) Base Station (BS) transmission and reception".

[8] 3GPP TR 37.842: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Universal Terrestrial Radio Access (UTRA; Radio Frequency (RF) requirement background for Active Antenna System (AAS) Base Station (BS)".

[9] 3GPP TR 37.843: "Radio Frequency (RF) requirement background for Active Antenna System (AAS) Base Station (BS) radiated requirements".

[10] R4-1700305, "LS on Characteristics of terrestrial IMT systems for frequency sharing/interference analysis in the frequency range between 24.25 GHz and 86 GHz".

[11] Code of Federal Regulations, Title 47, Part 30.203, Upper Microwave Flexible Use Service; Emission limits, Federal Communications Commission.

[12] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".

[13] Void.

[14] ETSI EN 301 489: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services".

[15] 3GPP TS 38.113: "NR; Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)".

[16] 3GPP TS 37.114: "Active Antenna System (AAS) Base Station (BS) Electromagnetic Compatibility (EMC)".

[17] 3GPP TS 38.141-1: "NR; Base Station (BS) conformance testing; Part 1: Conducted conformance testing".

[18] 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing".

[19] 3GPP TS 37.104: " NR, E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception".

[20] 3GPP TS 38.817-01: "General aspects for User Equipment (UE) Radio Frequency (RF) for NR".

[21] 3GPP TR 36.815: "Further Advancements for E-UTRA; LTE-Advanced feasibility studies in RAN WG4".

[22] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[23] 3GPP TS 37.113: "Multi-Standard Radio (MSR) Base Station (BS) Electromagnetic Compatibility (EMC)".

[24] 3GPP TR 38.803: "Study on new radio access technology: Radio Frequency (RF) and co-existence aspects".

[25] 3GPP TS 38.211: "NR; Physical channels and modulation".

[26] 3GPP TR 37.843: "Radio Frequency (RF) requirement background for Active Antenna System (AAS) Base Station (BS) radiated requirements". v15.2.0

[27] 3GPP TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing".

[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] ITU-T Recommendation K.114: “Electromagnetic compatibility requirements and measurement methods for digital cellular mobile communication base station equipment”

[30] ITU-T Recommendation K.48: “EMC requirements for telecommunication equipment - Product family Recommendation”

[31] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[32] 3GPP TS 37.141: "NR, E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing".

[33] 3GPP TS 37.145-1: "Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: Conducted conformance testing".

[34] 3GPP TS 37.145-2: "Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: radiated conformance testing".

[35] ERC Recommendation 74-01, "Unwanted emissions in the spurious domain"

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

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## 5.1 Relationship with other core specifications

The following relations among the single RAT NR BS core specification and the MSR BS, AAS BS and EMC specifications are identified:

**RAT NR BS:** 3GPP TS 38.104 [3] is a Single RAT NR BS specification. It is expected to capture BS requirements for the following aspects:

- Tx, Rx and BS demodulation core requirements for NR BS,

- Conducted and radiated sets of core requirements for the above listed categories (i.e. Tx, Rx and BS demodulation),

- Requirements for NSA NR and SA NR deployments (with the consideration of the NSA/SA prioritization in Rel-15),

- Requirements for FR1 and FR2 frequency ranges, based on the classification defined in 3GPP TR 38.803 [24]:

- FR1: Both conducted and OTA requirements will be required for FR1. The applicability may depend on the requirements.

- Requirement set 1-C: Conducted requirements for FR1 Non-AAS BS (which doesn’t include antenna functionality).

- Requirement set 1-H: Conducted requirements and OTA requirements for FR1 hybrid AAS BS (which includes antenna functionality).

- Requirement set 1-O: OTA requirements for FR1 OTA AAS BS (which includes antenna functionality).

- FR2: Only OTA requirements will be required for FR2.

- Requirement set 2-O: OTA requirements for FR2 OTA AAS BS.

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### 5.3.2 General

There are 4 distinct types of NR BS each has a different architecture and requirements set corresponding to Table 5.3.2‑1

Table 5.3.2-1: Supported requirement sets

| BS type / Requirement set | BS Description | Additional information |
| --- | --- | --- |
| 1-C | A BS operating at FR1 with all requirements defined at individual antenna connectors. | Following the approach used in 3GPP TS 36.104 and 3GPP TS 37.104 [19] |
| 1-H | A BS operating at FR1 with a requirement set holding requirements defined at the TAB and OTA requirements defined at RIB. | The requirement set is like the one defined for Hybrid AAS BS. Following the approach used in 3GPP TS 37.105 [7] |
| 1-O | A BS operating at FR1 with a requirement set consisting only OTA requirements defined at the RIB. | Following the approach developed in eAAS and documented in 3GPP TR 37.843 [9]. |
| 2-O | A BS operating at FR2 with a requirement set consisting only of OTA requirements defined at the RIB. | This requirement set is relevant for AAS BS and does not require access to RF connectors. |

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## 5.6 Applicability of requirements

The mapping between requirement set and individual requirement is captured in Table 5.6-1.

Table 5.6-1: Requirement set applicability

| Requirement | Requirement set | | | | Spatial applicability  of the requirements |
| --- | --- | --- | --- | --- | --- |
| 1-C | 1-H | 1-O | 2-O |
| Base station output power | 6.2 | 6.2 | NA | NA | Conducted requirement |
| Output power dynamics | 6.3 | 6.3 | NA | NA |
| Transmit ON/OFF power | 6.4 | 6.4 | NA | NA |
| Transmitted signal quality | 6.5 | 6.5 | NA | NA |
| Occupied bandwidth | 6.6.2 | 6.6.2 | NA | NA |
| ACLR | 6.6.3 | 6.6.3 | NA | NA |
| Operating band unwanted  Emissions | 6.6.4.x | 6.6.4.x | NA | NA |
| Transmitter spurious emissions | 6.6.5.x | 6.6.5.x | NA | NA |
| Transmitter intermodulation | 6.7.2 | 6.7.2 and 6.7.3 | NA | NA |
| Reference sensitivity level | 7.2 | 7.2 | NA | NA |
| Dynamic range | 7.3 | 7.3 | NA | NA |
| In-band selectivity and blocking | 7.4 | 7.4 | NA | NA |
| Out-of-band blocking | 7.5 | 7.5 | NA | NA |
| Receiver spurious emissions | 7.6 | 7.6 | NA | NA |
| Receiver intermodulation | 7.7 | 7.7 | NA | NA |
| In-channel selectivity | 7.8 | 7.8 | NA | NA |
| Performance requirements | Note | Note | NA | NA |
| Radiated transmit power | NA | 9.2 | 9.2 | 9.2 | Radiated directional requirement |
| OTA Base station output power | NA | NA | 9.3 | 9.3 | Radiated TRP requirement |
| OTA Output power dynamics | NA | NA | 9.4 | 9.4 | Radiated directional requirement |
| OTA Transmit ON/OFF power | NA | NA | 9.5 | 9.5 | Co-location requirement for 1-O  Radiated TRP requirement for 2-O |
| OTA Transmitted signal quality | NA | NA | 9.6 | 9.6 | Radiated directional requirement |
| OTA Occupied bandwidth | NA | NA | 9.7.2 | 9.7.2 | Radiated directional requirement |
| OTA ACLR | NA | NA | 9.7.3 | 9.7.3 | Radiated TRP requirement |
| OTA Operating band unwanted emission | NA | NA | 9.7.4 | 9.7.4 | Radiated TRP requirement |
| OTA Transmitter spurious emission | NA | NA | 9.7.5 | 9.7.5 | Radiated TRP requirement except for co-location requirements applicable for 1-O |
| OTA Transmitter intermodulation | NA | NA | 9.8 | NA | Co-location requirement |
| OTA sensitivity | NA | 10.2 | 10.2 | NA | Radiated directional requirement |
| OTA Reference sensitivity level | NA | NA | 10.3 | 10.3 | Radiated directional requirement |
| OTA Dynamic range | NA | NA | 10.4 | NA | Radiated directional requirement |
| OTA In-band selectivity and blocking | NA | NA | 10.5 | 10.5 | Radiated directional requirement |
| OTA Out-of-band blocking | NA | NA | 10.6 | 10.6 | Radiated directional requirement except for co-location requirements applicable for 1-O |
| OTA Receiver spurious emission | NA | NA | 10.7 | 10.7 | Radiated TRP requirement |
| OTA Receiver intermodulation | NA | NA | 10.8 | 10.8 | Radiated directional requirement |
| OTA In-channel selectivity | NA | NA | 10.9 | 10.9 | Radiated directional requirement |
| Radiated Performance requirements | NA | NA | [Note] | [Note] | Radiated directional requirement |
| NOTE: Performance requirements / radiated performance requirements were developed based on performance requirements for eAAS BS in TR 37.843 [9]. | | | | | |

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### 6.7.2 Co-location transmitter intermodulation

Traditionally for the transmitter intermodulation requirement is to address the coexistence between the transmitter antenna from one BS and the transmitter antenna from another BS in case the antennas are co-located with assumption that the worst-case coupling loss between them is 30 dB. The requirement assumes that they transmit the same level of power, and the transmitted signals are adjacent to each other in the frequency domain.

For BS type 1-C this results in the power level of the interfering signal being specified as the power at the antenna connector minus the coupling factor of 30dB.

For BS type 1-H the specific co-location coupling is between an aggressor co-located system and the element/sub array of the victim BS type 1-H. Whilst the top-level co-location scenario is the same the resulting interference power definition different as the TAB connector power is not necessarily the same as the aggressor signal power and the coupling between the aggressor antenna and the element/sub array is not necessarily 30dB. However, these 2 effects tend to cancel each other out resulting in the final definition of the interfere being very similar, where the interferer applied to each TAB connector is the wanted signal power at the TAB connector minus 30dB, according to 3GPP TR 37.842 [8], sub-clause 8.2.5.1.

*------------------------------ Unchanged part omitted------------------------------*

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# 9 Radiated BS transmitter characteristics

## 9.1 General

### 9.1.1 Spatial definitions

NOTE: For description of spatial definition for the OTA requirements, refer to the OTA BS testing TR 37.941 [36].Table 9.1.1-1: Void



## 9.2 Radiated transmit power

### 9.2.1 General

The minimum requirements for radiated transmit power, are placed on one or more manufacturer declared beam(s) over a declared *OTA peak direction set*. OTA requirements for NR BS output power are defined for directional EIRP requirements as radiated transmit power requirements (sub-clauses 9.2.2 and 9.2.3) and for TRP requirements as OTA base station output power (sub-clauses 9.3.2 and 9.3.3).

Some NR bands have a significantly larger fractional band width than existing bands as shown in Table 9.2.1-1.

Table 9.2.1-1: NR bands

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Band | *Band Definition*  *fl* to *fh*  (MHz) | Absolute Bandwidth  *fh* – *fl*  (MHz) | Relative Bandwidth  *fh*/*fl*  (dB) | Fractional Bandwidth  100.(*fh*-*fl*)/*fc*  (%) |
| n41 | 2496 to 2690 | 194 | 0.3 | 7.5 |
| n77 | 3300 to 4200 | 900 | 1.0 | 24.0 |
| n78 | 3300 to 3800 | 500 | 0.6 | 14.1 |
| n79 | 4400 to 5000 | 600 | 0.6 | 12.8 |
| n257 | 26500 to 29500 | 3000 | 0.5 | 10.7 |
| n258 | 24250 to 27500 | 3250 | 0.5 | 12.6 |
| n260 | 37000 to 40000 | 2500 | 0.3 | 6.5 |
| n261 | 27500 to 28350 | 850 | 0.13 | 3.0 |

The fractional bandwidth FBW is given in percent as:



The radiated transmit power in a specific direction in terms of EIRP can be expressed as: EIRP = TRP + *D* in dBm, where TRP is the total radiated power in dBm and *D* is the directivity in dBi. For an array antenna the composite directivity is determined by the element directivity and the array factor directivity. From TR 38.803 [24] Annex C, the element directivity can be expressed as:



where *Aeff* is the antenna aperture in m2 and  is the wave length in m.

For a uniform rectangular array antenna, where elements as separated *d* m along both y-axis and the z-axis, the maximum area for the antenna aperture is limited to an area of (*d*)2 m2. Typically, the d is in the range of 0.5 to 0.7 and ** is derived from the highest supported frequency. Since the directivity is depending on frequency, it is interesting to analyze the directivity characteristics as function of very wide operation bands.

In Table 9.2.1-2, some wide NR bands have been analyzed with respect to directivity variations (**due to fixed antenna aperture.

Table 9.2.1-2: Directivity variation over supported frequency range

|  |  |
| --- | --- |
| Band | **  (dB) |
| n41 | -0.6 |
| n77 | -2.1 |
| n78 | -1.2 |
| n79 | -1.1 |
| n257 | -0.9 |
| n258 | -1.1 |
| n260 | -0.7 |

It’s clear that the directivity is lower at lowest supported frequency compared with the highest supported frequency as expected. For a NR base station supporting wide bands the directivity variation is managed by declaring EIRP at lowest supported frequency and highest supported frequency within a specific band.

### 9.2.2 Minimum requirement for BS type 1-O and BS type 1-H

For requirement set 1-H and 1-O, the radiated transmit power requirements will be the same as those for E-UTRA, background information for the minimum requirement is captured in 3GPP TR 37.842 [8], sub-clause 7.2.4. The radiated transmit power requirements for FR1 are defined as the directional requirements on the output power accuracy for EIRP.

As the radiated transmit power for FR1 is based on the manufacturer’s declarations, the *basic limit* concept does not apply to this requirement.

The technical background for BS type 1-O extreme condition requirement is captured in TR 37.843 [9].

### 9.2.3 Minimum requirement for BS type 2-O

Based on the background information in TR 37.842 [8], and aspects related to FR2 captured in TR 38.803 [24], the minimum requirement for BS type 2-O will be defined. For requirement set 2-O, the radiated transmit power requirements will be defined as the directional requirements on the output power accuracy for EIRP.

The technical background for BS type 2-O extreme condition requirement is influenced by TR 37.843 [9] and adapted for FR2.

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### 9.6.2 OTA frequency error for FR1

The OTA frequency error requirement is defined to capture the maximum allowable difference between an assigned frequency and the actual generated frequency. The frequency error requirement is a regulatory requirement in some regions.

Based on the motivation captured in 3GPP TS 37.843 [9], the OTA frequency error will be correlated among all TRX units forming the beam, hence the frequency error is coherent, will have a ‘flat’ response in the spatial domain, i.e. OTA frequency error will not depend on the selection of the measurement point within beam’s compliance directions set.

*------------------------------ Unchanged part omitted------------------------------*

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### 9.6.6 OTA modulation quality for FR1

OTA transmit modulation signal quality is measured in terms of error vector magnitude (EVM). EVM captures a maximum allowed distortion due to degradations in the BS transmitter.

For NR EVM is defined similar to that of E-UTRA in that the measurement device contains a equalization algorithm and the EVM is assessed after equalization. For 2-O, common phase error compensation algorithm is also needed to be applied in addition to the simple equalization algorithm. EVM is also measured over a root mean square average over 10 sub-frames.

Although EVM is expressed in terms of a percentage it is a ratio, that of the error vector and the reference power. Whilst the reference (or wanted) signal may be subjected to beam forming the error vector power has unknown correlation level between transmitter units and hence may be beam formed or not.

The EVM requirement is important only between the BS and its intended UE. Hence the EVM is only of importance in directions where the BS intends to communicate with the UE’s. It is therefore in a set of specific directions from the AAS BS which is of interest rather than the average or total EVM over the entire sphere. Based upon the method captured in 3GPP TR 37.843 [9], the EVM requirement is defined over a declared OTA coverage range. The range of directions which the NR BS meets the EVM requirement is declared by the manufacturer as *OTA coverage range*.

*------------------------------ Unchanged part omitted------------------------------*

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# 10 Radiated BS receiver characteristics

## 10.1 General

For BS type 1-H and BS type 1-O the same spatial definitions are used as for the AAS BS, as described in TR 37.941 [36].

For BS type 2-O spatial definitions defined for BS type 1-O are reused, with few exceptions described in table 10.1-1.

For NR BS type 1-O OTA sensitivity is valid over the RoAoA(s) in the declared OSDD(s), where any number of OSDD’s may be declared by the manufacturer to describe the receiver capabilities.

Minimum sensitivity (minSENS) is defined as the lowest declared EIS value from all the declared OSDD’s and is valid over the *minSENS RoAoA*.

Absolute levels which are based on performance at minSENS are offset from the appropriate conducted absolute power level by the following:

ΔminSENS = PREFSENS – EISminSENS

OTA REFSENS is valid over the OTA REFSENS RoAoA which is declared by the manufacturer, absolute levels which are based on performance at OTA REFSENS are offset from the appropriate conducted absolute power level by the following:

ΔREFSENS = PREFSENS – EISREFSENS

In table 10.1-1 classification of the radiated Rx requirements is provided with brief justification.

Table 10.1-1: Classification of radiated Rx requirements

|  |  |  |
| --- | --- | --- |
| Rx requirement | Description and discussion | Classification |
| OTA sensitivity | Based on the Rel-13 EIS requirement declaration over the OSDD, the OTA sensitivity is directional requirement by definition.  Conformance testing for OTA sensitivity is performed for the five directions same as the Rel-13 AAS OTA sensitivity requirements. This requirement is not applicable for BS type 2-O. | Directional |
| OTA reference sensitivity level | Conformance testing for OTA reference sensitivity is performed for five directions declared by the manufacturer. | Directional |
| OTA dynamic range | It was agreed that the requirement assumes that the wanted signal and interfering signal come from the same direction. Testing is defined in the receiver target reference direction, meaning that this is directional requirement. This requirement is not applicable for BS type 2-O. | Directional |
| OTA in-band selectivity and blocking | The OTA blocking requirement is tested as follows:  - In the reference direction of the minSENS OSDD using the minSENS based requirement level  - In each of the 4 conformance directions at the extremities of the OTA REFSENS RoAoA using the REFSENS based requirement level. | Directional |
| OTA out-of-band blocking | Out of band blocking is a long test and hence it is optimum to minimize the number of conformance test directions. The antenna gain can be assumed to be maximum at the reference direction, therefore it is sufficient to show conformance at the reference direction only. | Directional, except for co-location requirement applicable for BS type 1-O |
| OTA receiver spurious emission | The Rx spurious emissions requirement follows the approach for the Tx spurious emissions, i.e. the emissions in the spurious region needs to be measured as TRP due to unknown radiation pattern. | TRP |
| OTA receiver intermodulation | Since RX sensitivity and blocking already test at all conformance directions, it is sufficient to test RX IM only in a single direction. | Directional |
| OTA in-channel selectivity | In channel selectivity requirement is tested in a single direction. | Directional |

Spatial definitions relevant for co-location requirements applicable for BS type 1-O are described in TR 37.941 [36].

## 10.2 OTA sensitivity

The minimum requirements for OTA sensitivity, are based on one or more manufacturer declared OSDD. For BS type 1-H and 1-O, the OTA sensitivity requirements will be as those for E-UTRA, except that NR specific FRCs required for NR. The background information for the minimum requirement is captured in 3GPP TR 37.842, sub-clause 7.3.2.

For BS type 2-O there are no equivalent conducted requirements and a certain minimum level of beam forming gain is required. As such it is not necessary to have both declared OTA sensitivity and reference sensitivity requirements. Hence there is only one sensitivity requirement for FR2, which is used as reference sensitivity and hence is called REFSENS.

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#### 10.3.3.3 Noise figure assumptions

The noise figure for the receiver will increase as the frequency increases, the following values have been agreed for each frequency range:

Table 10.3.3.3-1: Noise Figure values for the WP5D response in TR 38.803 [24]

|  |  |  |
| --- | --- | --- |
| Frequency range | 30 GHz  (24.25 – 33.4 GHz) | 45GHz  (37 – 52.6 GHz) |
| BS | 10 dB | 12 dB |

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#### 10.5.3.2 FR1

In-band blocking for BS type 1-O uses the same approach as that used for E-UTRA AAS as described in 3GPP TR 37.843. Wanted signal and interferer levels are adjusted to be in line with NR channel BW and FRC’s.

Both the in-band interferer and the wanted signal have requirements at 2 power levels associated with OTA REFSENS and minSENS.

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

#### 10.5.3.3 FR2

BS type 2-O has a number of differences when considering the OTA blocking levels.

- There are no conducted requirements, so simulation of conducted interferer power levels do not give a final OTA power level.

- Beam forming is necessary in order to overcome the path loss.

- A wide range of implementations with varying antenna maximum beam forming gain are envisaged.

- Different beam forming architectures result in different statistical spread of interferer power at the active Rx input (i.e. the LNA).

Traditionally the in-band blocking level has been analysis on a statistical basis based on the 99.99% probability of an interferer being possible. This has been used since UTRA where WCDMA modulation was susceptible to blocking and the entire system would be blocked if such an event occurred. The NR OFDMA scheme does not suffer so greatly due to a blocking event hence such a high probability is not required, probabilities between 99% and 99.9% have also been considered.

In the past the wanted signal has not been considered when studying the interferer level, however with an OTA requirement and a beam forming system when considering a statistical worst case, it is important to consider both the wanted and the interfering signal. This is due to the fact that blocking arises when a low power wanted signal and a high-power blocking signal occur simultaneously (the likelihood of this occurring depends on instantaneous power control, scheduling and beam directions) Hence the difference between the wanted signal and the interferer is also important.

Initially the probability of the interferer alone was simulated looking at the same scenarios identified in the co-existence simulation in 3GPP TR 38.803 [24].

The probability of the blocking signal level and also the probability of simultaneous low wanted signal and high blocking signal were both considered. Simulations of both of these aspects suggested that the blocking signal is typically 33dB above the reference sensitivity level. This result was consistent when considering different architectures.

It was agreed that the specification for the interferer power level will be 33dB higher than the OTA REFSENS power level.

As for FR2 there is only a single sensitivity requirement, a 6dB offset from OTA reference sensitivity is used for the wanted signal and a 33dB offset from reference sensitivity is used for the interferer.

## 10.6 OTA Out-of-band blocking

### 10.6.1 FR1 OTA out-of-band blocking

The OTA out-of-band blocking requirement derivation for NR is the same as that for AAS and is documented in 3GPP TR 37.843 [9], in summary the OTA out of band blocking is difficult to translate directly from the conducted out of band blocking requirement as

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

## 11.4 Radiated immunity requirements

For the measurement aspects of the radiated immunity requirements, refer to TR 37.941 [36].

### 11.4.1 Measurement set-up for testing radiated immunity

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

### Figure 11.4.1-1: Void11.4.2 Alternatives to protect BS type 1-O during RI test

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

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# 12 Conformance testing aspects

## 12.1 General

This clause captures conformance testing aspects related to the measurement uncertainty of test system for conducted requirements.

For measurement uncertainty of test system for radiated requirements, refer to TR 37.941 [36].

## 12.2 Conformance testing for conducted requirements

### 12.2.1 Measurement uncertainty of test system

For the frequency range up to 4.2 GHz, the same measurement uncertainty as E-UTRA in TS 36.141 [27] were adopted for conducted requirements.

For frequency range 4.2 - 6 GHz, for measurement of transmitter, all uncertainty factors including instrumentation related MU were judged to the same as for the 3 – 4.2 GHz range and thus the total MU for 4.2 – 6 GHz is the same as for 3 - 4.2 GHz.

For frequency range 4.2 - 6 GHz, for measurement of receiver, both the wanted signal level error and interferer level error may differ for frequency ranges. Hence the MU for the frequency range is defined separately. The derivation of maximum test system uncertainty for 4.2 – 6 GHz receiver tests is shown in table 12.2.1-1.

This assessment was made under the assumption of testing BS designed for licensed spectrum; for unlicensed spectrum the MU may differ.

Table 12.2.1-1: Maximum test system uncertainty for 4.2 – 6 GHz conducted receiver tests

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Requirement | Derivation of Test System Uncertainty | MU (dB) | | | | |
| Wanted signal level error | Modulated Interferer level error | CW Interferer level error | ACLR effect or Broadband noise effect | Total |
| 7.2 Reference sensitivity level | wanted\_level\_error | 1.22 | N/A | N/A | N/A | 1.2 |
| 7.4.1 Adjacent channel selectivity | [SQRT (wanted\_level\_error2 + interferer\_level\_error2)] + leakage effect | 1.22 | 1.22 | N/A | 0.4 | 2.1 |
| 7.4.2 In-band blocking (General blocking) | [SQRT (wanted\_level\_error2 + interferer\_level\_error2)] + leakage effect | 1.22 | 1.39 | N/A | 0.4 | 2.2 |
| 7.4.2 In-band blocking (Narrow band blocking) | [SQRT (wanted\_level\_error2 + interferer\_level\_error2)] + leakage effect | 1.22 | 1.22 | N/A | 0.4 | 2.1 |
| 7.5.5.1 Out-of-band blocking (General requirements)  1MHz < finterferer ≤ 3 GHz | [SQRT (wanted\_level\_error2 + interferer\_level\_error2)] + Broadband noise effect | 1.22 | N/A | 1 | 0.1 | 1.7 |
| 7.5.5.1 Out-of-band blocking (General requirements)  3.0GHz < finterferer ≤ 4.2 GHz | [SQRT (wanted\_level\_error2 + interferer\_level\_error2)] + Broadband noise effect | 1.22 | N/A | 1.2 | 0.1 | 1.8 |
| 7.5.5.1 Out-of-band blocking (General requirements)  4.2GHz < finterferer ≤ 12.75 GHz | [SQRT (wanted\_level\_error2 + interferer\_level\_error2)] + Broadband noise effect | 1.22 | N/A | 3 | 0.1 | 3.3 |
| 7.5.5.2 Out-of-band blocking (Co-location requirements) | [SQRT (wanted\_level\_error2 + interferer\_level\_error2)] + Broadband noise effect | 1.22 | N/A | 2 | 0.4 | 2.7 |
| 7.7 Receiver intermodulation | SQRT [(2 x CW\_level\_error)2 +(mod interferer\_level\_error)2 +(wanted signal\_level\_error)2] + ACLR effect | 1.22 | 1.22 | 0.98 | 0.4 | 3 |
| 7.8 In-channel selectivity | [SQRT (wanted\_level\_error2 + interferer\_level\_error2)] + leakage effect | 1.22 | 1.22 | N/A | 0.4 | 2.1 |

## 12.3 Conformance testing for OTA TX directional requirements

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











## 12.4 Conformance testing for OTA RX directional requirements

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











































## 12.5 Conformance testing for OTA RX out of band blocking

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







## 12.6 Conformance testing for OTA in band TRP requirements

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















































## 12.7 Conformance testing for OTA out of band TRP requirements

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



























## 12.8 Conformance testing for OTA co-location requirements

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



## 12.9 Conformance testing for performance requirements

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



## 12.10 TRP measurements

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



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Annex A:  
Aspects related to measurement of OTA unwanted emission

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

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