**3GPP TSG-RAN WG4 Meeting # 102-e *draft R4-2207511***

**Electronic Meeting, 21 February – 3 March 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.104** | **CR** | **TBD** | **rev** | **-** | **Current version:** | **17.4.0** |  |
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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:*** | Big CR to 38.104 for Rel-17 NR extension up to 71 GHz introduction | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ext\_to\_71GHz-Core | | | | |  | ***Date:*** | | | 2022-02-11 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | ***B*** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | R4-2203014 Draft CR to TS 38.104: implementation of FR2-2 requirements: FRC annex  Referring to the WF in R4-2120678, the following work-split was agreed:   | **Specification clauses** | **Volunteer company** | | --- | --- | | 1-5 | N/A, handled in thread 128 | | 9.1 – 9.5 | Nokia | | 9.6 – 9.8 | Ericsson | | 10.1 – 10.5 | CATT | | 10.6 – 10.9 | ZTE | | Annexes for FRCs | Huawei |   Related modifications to FRC annex are provided, to introduce G-FR2-A1-6 and G-FR2-A1-7 FRCs for FR2-2.  R4-2207219 Draft CR for TS 38.104 on introduction of BS RF Rx requirements for >52.6GHz in clauses 10.1 – 10.5  The agreements in this meeting need to be updated in the CR and captured in the specification.  R4-2207220 Draft CR to TS 38.104: Addition of requirements for NR extension up to 71 GHz in subclause 9.6 to 9.8  As part of the work to extend NR frequency range up to 71 GHz this draft CR adds information related to requirements to subclauses 9.6 to 9.8. Additions will be collected in a “big” CR for the complete update of TS 38.104. This is a revision of R4-2203579. This version is based on TS 38.104 version 17.4.0.  R4-2207221 Draft CR to TR 38.104: Clauses 9.1 to 9.5  Extending current NR operation to 71 GHz.  R4-2207222 CR for TS 38.104 on introduction of BS RF Rx requirements for 57-71GHz in section 10.6 – 10.9  BS RF Rx requirements for 57-71GHz should be introduced in section 10.6 – 10.9 of TS 38.104 based on the latest agreements in WF R4-2203017. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | R4-2203014 Draft CR to TS 38.104: implementation of FR2-2 requirements: FRC annex  Introduction of G-FR2-A1-6 and G-FR2-A1-7 FRCs for FR2-2.  R4-2207219 Draft CR for TS 38.104 on introduction of BS RF Rx requirements for >52.6GHz in clauses 10.1 – 10.5  The changes in R4-2203015 are copied in the following,  1) Add OTA reference sensitivity for FR2-2 in Table 10.3.3-1.  2) Add OTA ACS requirement for FR2-2 in Table 10.5.1.3-1.  3) Aad OTA ACS interferer frequency offset for FR2-2 in Table 10.5.1.3-2.  4) Add ΔfOOB offset for FUL\_high – FUL\_low > 4000 MHz in Table 10.5.2.3-0.  5) Add general OTA blocking requirement in Table 10.5.2.3-1.  The updates in this meeting are as followins,  1) Remove [] for scaling factor of 9 dB of EISREFSENS , and add [] for 800, 1600, 2000 for 960kHz SCS in Table 10.3.3-1.  2) Add OTA ACS interferer frequency offset, and change [TBD] RBs of ACS interfering signal type to 64 RBs.  3) Add the upper band size boundary to 14000 MHz for ΔfOOB.  4) Change [TBD] RBs of in-band blocking interfering signal type to 64 RBs.  R4-2207220 Draft CR to TS 38.104: Addition of requirements for NR extension up to 71 GHz in subclause 9.6 to 9.8  In this draft CR all changes agreed in WF is collected in a common draft CR.  R4-2207221 Draft CR to TR 38.104: Clauses 9.1 to 9.5  Required changes to clauses 9.1 to 9.5 for extending current NR operation to 71 GHz.  R4-2207222 CR for TS 38.104 on introduction of BS RF Rx requirements for 57-71GHz in section 10.6 – 10.9  1) Add OOBB requirements for FR2-2 in section 10.6.3.  2) Add Rx spurious emission requirements in section 10.7.3.  3) Add Rx intermodulation requirements in section 10.8.3.  4) Add RX ICS requirements in section 10.9.3. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | R4-2203014 Draft CR to TS 38.104: implementation of FR2-2 requirements: FRC annex  FR2-2 RX requirements would not be possible to define.  R4-2207219 Draft CR for TS 38.104 on introduction of BS RF Rx requirements for >52.6GHz in clauses 10.1 – 10.5  The update of BS RF Rx requirements for >52.6GHz in clauses 10.1 – 10.5 of TS 38.104 would be missing.  R4-2207220 Draft CR to TS 38.104: Addition of requirements for NR extension up to 71 GHz in subclause 9.6 to 9.8  This draft CR is required to complete the work to collect updates to TS 38.104. If not approved, TS 38.104 cannot be updated according to the agreed work split in WF R4-2120678.  R4-2207221 Draft CR to TR 38.104: Clauses 9.1 to 9.5  Current NR operation is not extended to 71 GHz.  R4-2207222 CR for TS 38.104 on introduction of BS RF Rx requirements for 57-71GHz in section 10.6 – 10.9  BS RF Rx requirements for 57-71GHz in section 10.6 – 10.9 of TS 38.104 would be missing. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 9.4, 9.6, 9.7, 10.3.3, 10.5.1.3, 10.5.2.3, 10.6.3, 10.7.3, 10.8.3, 10.9.3, A.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.141-2 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Start of changes>

# 9 Radiated transmitter characteristics

## 9.1 General

Radiated transmitter characteristics requirements apply on the *BS type 1-H*, *BS type 1-O*, or *BS type 2-O* including all its functional components active and for all foreseen modes of operation of the BS unless otherwise stated.

## 9.2 Radiated transmit power

### 9.2.1 General

*BS type 1-H, BS type 1-O* and *BS type 2-O* are declared to support one or more beams, as per manufacturer's declarations specified in TS 38.141-2 [6]. Radiated transmit power is defined as the EIRP level for a declared beam at a specific *beam peak direction*.

For each beam, the requirement is based on declaration of a beam identity, *reference beam direction pair*, beamwidth, *rated beam EIRP*, *OTA peak directions set*, the *beam direction pairs* at the maximum steering directions and their associated *rated beam EIRP* and beamwidth(s).

For a declared beam and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the base station is declared to radiate at the associated *beam peak direction* during the *transmitter ON period*.

For each *beam peak direction* associated with a *beam direction pair* within the *OTA peak directions set*, a specific *rated beam EIRP* level may be claimed. Any claimed value shall be met within the accuracy requirement as described below. *Rated beam EIRP* is only required to be declared for the *beam direction pairs* subject to conformance testing as detailed in TS 38.141-2 [6].

NOTE 1: *OTA peak directions set* is set of *beam peak directions* for which the EIRP accuracy requirement is intended to be met. The *beam peak directions* are related to a corresponding contiguous range or discrete list of *beam centre directions* by the *beam direction pairs* included in the set.

NOTE 2: A *beam direction pair* is data set consisting of the *beam centre direction* and the related *beam peak direction.*

NOTE 3: A declared EIRP value is a value provided by the manufacturer for verification according to the conformance specification declaration requirements, whereas a claimed EIRP value is provided by the manufacturer to the equipment user for normal operation of the equipment and is not subject to formal conformance testing.

For *operating bands* where the supported *fractional bandwidth* (FBW) is larger than 6%, two rated carrier EIRP may be declared by manufacturer:

- Prated,c,FBWlow for lower supported frequency range, and

- Prated,c,FBWhigh for higher supported frequency range.

For frequencies in between FFBWlow and FFBWhigh the rated carrier EIRP is:

- Prated,c,FBWlow, for the carrier whose carrier frequency is within frequency range FFBWlow ≤ f < (FFBWlow +FFBWhigh) / 2,

- Prated,c,FBWhigh, for the carrier whose carrier frequency is within frequency range (FFBWlow +FFBWhigh) / 2 ≤ f ≤FFBWhigh.

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

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 of the claimed value.

For *BS type 1-O* only, for each declared beam, in extreme 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 ±2.7 dB of the claimed value.

Normal and extreme conditions are defined in TS 38.141-2, annex B [6].

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

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

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 ± 3.4 dB of the claimed value.

For each declared beam, in extreme 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 ±4.5 dB of the claimed value.

Normal and extreme conditions are defined in TS 38.141-2, annex B [6].

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.

## 9.3 OTA base station output power

### 9.3.1 General

OTA BS output power is declared as the TRP radiated requirement, with the output power accuracy requirement defined at the RIB during the *transmitter ON period*. TRP does not change with beamforming settings as long as the *beam peak direction* is within the *OTA peak directions set*. Thus the TRP accuracy requirement must be met for any beamforming setting for which the *beam peak direction* is within the *OTA peak directions set*.

The BS *rated carrier TRP output power* for *BS type 1-O* shall be within limits as specified in table 9.3.1-1.

Table 9.3.1-1: BS *rated carrier TRP output power* limits for *BS type 1-O*

|  |  |
| --- | --- |
| BS class | Prated,c,TRP |
| Wide Area BS | (note) |
| Medium Range BS | ≤ + 47 dBm |
| Local Area BS | ≤ + 33 dBm |
| NOTE: There is no upper limit for the Prated,c,TRP of the Wide Area Base Station. | |

There is no upper limit for the *rated carrier TRP output power* of *BS type 2-O*.

For Band n41 and n90 operation in Japan, the rated output power, Prated,c,TRP, declared by the manufacturer shall be equal to or less than 20 W per 10 MHz bandwidth.

Despite the general requirements for the BS output power described in clauses 9.3.2 – 9.3.3, additional regional requirements might be applicable.

NOTE: In certain regions, power limits corresponding to BS classes may apply for *BS type 2-O*.

### 9.3.2 Minimum requirement for *BS type 1-O*

In normal conditions, the *BS type 1-O* *maximum carrier TRP output power*, Pmax,c,TRP measured at the RIB shall remain within ±2 dB of the *rated carrier TRP output power* Prated,c,TRP, as declared by the manufacturer.

Normal conditions are defined in TS 38.141-1, annex B [6].

### 9.3.3 Minimum requirement for *BS type 2-O*

In normal conditions, the *BS type 2-O* *maximum carrier TRP output power*, Pmax,c,TRP measured at the RIB shall remain within ±3 dB of the *rated carrier TRP output power* Prated,c,TRP, as declared by the manufacturer.

Normal conditions are defined in TS 38.141-2, annex B [6].

### 9.3.4 Additional requirements (regional)

In certain regions, additional regional requirements may apply.

## 9.4 OTA output power dynamics

### 9.4.1 General

The requirements in clause 9.4 apply during the *transmitter ON period*. Transmit signal quality (as specified in clause 9.6) shall be maintained for the output power dynamics requirements.

The OTA output power requirements are *directional requirements* and apply to the *beam peak directions* over the *OTA peak directions set*.

### 9.4.2 OTA RE power control dynamic range

#### 9.4.2.1 General

The OTA RE power control dynamic range is the difference between the power of an RE and the average RE power for a BS at maximum output power (Pmax,c,EIRP) for a specified reference condition.

This requirement shall apply at each RIB supporting transmission in the *operating band*.

#### 9.4.2.2 Minimum requirement for *BS type 1-O*

The OTA RE power control dynamic range is specified the same as the conducted RE power control dynamic range requirement for *BS type 1-C* and *BS type 1-H* in table 6.3.2.2-1.

### 9.4.3 OTA total power dynamic range

#### 9.4.3.1 General

The OTA total power dynamic range is the difference between the maximum and the minimum transmit power of an OFDM symbol for a specified reference condition.

This requirement shall apply at each RIB supporting transmission in the *operating band*.

NOTE 1: The upper limit of the OTA total power dynamic range is the BS maximum carrier EIRP (Pmax,c,EIRP) when transmitting on all RBs. The lower limit of the OTA total power dynamic range is the average EIRP for single RB transmission in the same direction using the same beam. The OFDM symbol carries PDSCH and not contain RS or SSB.

#### 9.4.3.2 Minimum requirement for *BS type 1-O*

OTA total power dynamic range minimum requirement for *BS type 1-O* is specified such as for each NR carrier it shall be larger than or equal to the levels specified for the conducted requirement for *BS type 1-C* and *BS type 1-H* in table 6.3.3.2-1.

#### 9.4.3.3 Minimum requirement for *BS type 2-O*

OTA total power dynamic range minimum requirement for *BS type 2-O* is specified such as for each NR carrier it shall be larger than or equal to the levels specified in table 9.4.3.3-1 in FR2-1 and table 9.4.3.3-2 in FR2-2.

Table 9.4.3.3-1: Minimum requirement for *BS type 2-O* total power dynamic range in FR2-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCS | OTA total power dynamic range (dB) | | | |
| (kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| 60 | 18.1 | 21.2 | 24.2 | N/A |
| 120 | 15.0 | 18.1 | 21.2 | 24.2 |

Table 9.4.3.3-2: Minimum requirement for *BS type 2-O* total power dynamic range in FR2-2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SCS | OTA total power dynamic range (dB) | | | | |
| (kHz) | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| 120 | 18.1 | 24.2 | N/A | N/A | N/A |
| 480 | N/A | 18.1 | 21.2 | 24.2 | N/A |
| 960 | N/A | 15.1 | 18.1 | 21.2 | [21.9] |

## 9.5 OTA transmit ON/OFF power

### 9.5.1 General

OTA transmit ON/OFF power requirements apply only to TDD operation of NR BS.

### 9.5.2 OTA transmitter OFF power

#### 9.5.2.1 General

OTA transmitter OFF power is defined as the mean power measured over 70/N µs filtered with a square filter of bandwidth equal to the *transmission bandwidth configuration* of the BS (BWConfig) centred on the assigned channel frequency during the *transmitter OFF period*. N = SCS/15, where SCS is Sub Carrier Spacing in kHz.

For BS supporting intra-band contiguous CA, the OTA transmitter OFF power is defined as the mean power measured over 70/N us filtered with a square filter of bandwidth equal to the *Aggregated BS Channel Bandwidth* BWChannel\_CA centred on (Fedge,high+Fedge,low)/2 during the *transmitter OFF period*. N = SCS/15, where SCS is the smallest supported Sub Carrier Spacing in kHz in the *Aggregated BS Channel Bandwidth*.

For *BS type 1-O*, the transmitter OFF power is defined as the output power at the *co-location reference antenna* conducted output(s). For *BS type 2-O* the transmitter OFF power is defined as TRP.

For *multi-band* *RIBs* and *single band RIBs* supporting transmission in multiple bands, the requirement is only applicable during the *transmitter OFF period* in all supported *operating bands*.

#### 9.5.2.2 Minimum requirement for *BS type 1-O*

The total power from all *co-location reference antenna* conducted output(s) shall be less than -106 dBm/MHz.

#### 9.5.2.3 Minimum requirement for *BS type 2-O*

The OTA transmitter OFF TRP spectral density for *BS type 2-O* shall be less than ‑36 dBm/MHz.

### 9.5.3 OTA transient period

#### 9.5.3.1 General

The OTA *transmitter transient period* is the time period during which the transmitter is changing from the tra*nsmitter OFF period* to the *transmitter ON period* or vice versa. The *transmitter transient period* is illustrated in figure 6.4.2.1-1.

This requirement shall be applied at each RIB supporting transmission in the *operating band*.

#### 9.5.3.2 Minimum requirement for *BS type 1-O*

For *BS type 1-O*, the OTA *transmitter transient period* shall be shorter than the values listed in the minimum requirement table 9.5.3.2-1.

Table 9.5.3.2-1: Minimum requirement for the OTA *transmitter transient period* for *BS type 1-O*

|  |  |
| --- | --- |
| Transition | Transient period length (µs) |
| OFF to ON | 10 |
| ON to OFF | 10 |

#### 9.5.3.3 Minimum requirement for *BS type 2-O*

For *BS type 2-O*, the OTA *transmitter transient period* shall be shorter than the values listed in the minimum requirement table 9.5.3.3-1.

Table 9.5.3.3-1: Minimum requirement for the OTA *transmitter transient period* for *BS type 2-O*

|  |  |
| --- | --- |
| Transition | Transient period length (µs) |
| OFF to ON | 3 |
| ON to OFF | 3 |

## 9.6 OTA transmitted signal quality

### 9.6.1 OTA frequency error

#### 9.6.1.1 General

The requirements in clause 9.6.1 apply to the *transmitter ON period*.

OTA frequency error is the measure of the difference between the actual BS transmit frequency and the assigned frequency. The same source shall be used for RF frequency and data clock generation.

OTA frequency error requirement is defined as a *directional requirement* at the RIB and shall be met within the *OTA coverage range*.

#### 9.6.1.2 Minimum requirement for *BS type 1-O*

For *BS type 1-O*, the modulated carrier frequency of each NR carrier configured by the BS shall be accurate to within the accuracy range given in table 6.5.1.2-1 observed over 1 ms.

#### 9.6.1.3 Minimum requirement for *BS type 2-O*

For *BS type 2-O*, the modulated carrier frequency of each NR carrier configured by the BS shall be accurate to within the accuracy range given in table 9.6.1.3-1 observed over 1 ms.

Table 9.6.1.3-1: OTA frequency error minimum requirement

|  |  |
| --- | --- |
| BS class | Accuracy |
| Wide Area BS | ±0.05 ppm |
| Medium Range BS | ±0.1 ppm |
| Local Area BS | ±0.1 ppm |

### 9.6.2 OTA modulation quality

#### 9.6.2.1 General

Modulation quality is defined by the difference between the measured carrier signal and an ideal signal. Modulation quality can e.g. be expressed as Error Vector Magnitude (EVM). Details about how the EVM is determined are specified in Annex B for FR1 and Annex C for FR2.

OTA modulation quality requirement is defined as a *directional requirement* at the RIB and shall be met within the *OTA coverage range*.

#### 9.6.2.2 Minimum Requirement for *BS type 1-O*

For *BS type 1-O*, the EVM levels of each NR carrier for different modulation schemes on PDSCH outlined in table 6.5.2.2-1 shall be met. Requirements shall be the same as clause 6.5.2.2 and follow EVM frame structure from clause 6.5.2.3.

#### 9.6.2.3 Minimum Requirement for *BS type 2-O*

For *BS typ*e 2-O, the EVM levels of each NR carrier for different modulation schemes on PDSCH outlined in table 9.6.2.3-1 shall be met, following the EVM frame structure described in clause 9.6.2.3.1.

Table 9.6.2.3-1: EVM requirements for *BS type 2-O* carrier

|  |  |  |
| --- | --- | --- |
| Applicability | Modulation scheme for PDSCH | Required EVM (%) |
| FR2 | QPSK | 17.5 |
| FR2 | 16QAM | 12.5 |
| FR2 | 64QAM | 8 |
| FR2-1 | 256QAM | 3.5 |

##### 9.6.2.3.1 EVM frame structure for measurement

EVM requirements shall apply for each NR carrier over all allocated resource blocks. Different modulation schemes listed in table 9.6.2.3-1 shall be considered for rank 1.

For NR, for all bandwidths, the EVM measurement shall be performed for each NR carrier over all allocated resource blocks and downlink subframes within 10 ms measurement periods. The boundaries of the EVM measurement periods need not be aligned with radio frame boundaries.

### 9.6.3 OTA time alignment error

#### 9.6.3.1 General

This requirement shall apply to frame timing in MIMO transmission, *carrier aggregation* and their combinations.

Frames of the NR signals present in the radiated domain are not perfectly aligned in time. In relation to each other, the RF signals present in the radiated domain may experience certain timing differences.

The TAE is specified for a specific set of signals/transmitter configuration/transmission mode.

For a specific set of signals/transmitter configuration/transmission mode, the OTA Time Alignment Error (OTA TAE) is defined as the largest timing difference between any two different NR signals. The OTA time alignment error requirement is defined as a *directional requirement* at the RIB and shall be met within the *OTA coverage range.*

#### 9.6.3.2 Minimum requirement for *BS type 1-O*

The minimum requirement for TAE is given in Table 9.6.3.3-4.

Table 9.6.3.2-1: Void

Table 9.6.3.2-2: Void

Table 9.6.3.2-3: Void

Table 9.6.3.3-4: TAE requirements for *BS type 2-O*

|  |  |  |  |
| --- | --- | --- | --- |
| Requirement | TAE | | |
| 60, 120 kHz SCS  (ns) | 480 kHz SCS  (ns) | 960 kHz SCS  (ns) |
| MIMO transmission | 65 | 32.5 | 32.5 |
| *intra-band contiguous carrier aggregation*, with or without MIMO | 130 | 32.5 | 32.5 |
| *intra-band non-contiguous carrier aggregation*, with or without MIMO | 260 | [260] | [260] |
| inter-band *carrier aggregation*, with or without MIMO | 3000 | 3000 | 3000 |

#### 9.6.3.3 Minimum requirement for *BS type 2-O*

For MIMO transmission, at each carrier frequency, OTA TAE shall not exceed 65 ns.

For *intra-band contiguous carrier aggregation*, with or without MIMO, OTA TAE shall not exceed 130 ns.

For *intra-band non-contiguous carrier aggregation*, with or without MIMO, OTA TAE shall not exceed 260 ns.

For inter-band *carrier aggregation*, with or without MIMO, OTA TAE shall not exceed 3 µs.

Table 9.6.3.3-1: Void

Table 9.6.3.3-2: Void

Table 9.6.3.3-3: Void

## 9.7 OTA unwanted emissions

### 9.7.1 General

Unwanted emissions consist of so-called out-of-band emissions and spurious emissions according to ITU definitions ITU-R SM.329 [2]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the *BS channel bandwidth* resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions.

The OTA out-of-band emissions requirement for the *BS type 1-O* and *BS type 2-O* transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and operating band unwanted emissions (OBUE). The OTA Operating band unwanted emissions define all unwanted emissions in each supported downlink *operating band* plus the frequency ranges ΔfOBUE above and ΔfOBUE below each band. OTA Unwanted emissions outside of this frequency range are limited by an OTA spurious emissions requirement.

The maximum offset of the operating band unwanted emissions mask from the *operating band* edge is ΔfOBUE. The value of ΔfOBUE is defined in table 9.7.1-1 for *BS type 1-O* and *BS type 2-O* for the NR *operating bands*.

Table 9.7.1-1: Maximum offset ΔfOBUE outside the downlink *operating band*

|  |  |  |
| --- | --- | --- |
| BS type | *Operating band* characteristics (MHz) | ΔfOBUE (MHz) |
| *BS type 1-O* | FDL,high – FDL,low < 100 | 10 |
|  | 100 ≤ FDL,high – FDL,low ≤ 900 | 40 |
| *BS type 2-O* | FDL,high – FDL,low ≤ 4000 | 1500 |
| 4000 < FDL,high – FDL,low ≤ 14000 | 3500 |

The unwanted emission requirements are applied per cell for all the configurations. Requirements for OTA unwanted emissions are captured using TRP, *directional requirements* or co-location requirements as described per requirement.

There is in addition a requirement for occupied bandwidth.

### 9.7.2 OTA occupied bandwidth

#### 9.7.2.1 General

The OTA occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage /2 of the total mean transmitted power. See also recommendation ITU-R SM.328 [3].

The value of /2 shall be taken as 0.5%.

The OTA occupied bandwidth requirement shall apply during the *transmitter ON period* for a single transmitted carrier. The minimum requirement below may be applied regionally. There may also be regional requirements to declare the OTA occupied bandwidth according to the definition in the present clause.

The OTA occupied bandwidth is defined as a *directional requirement* and shall be met in the manufacturer's declared *OTA coverage range* at the RIB.

#### 9.7.2.2 Minimum requirement for *BS type 1-O* and *BS type* 2-O

The OTA occupied bandwidth for each NR carrier shall be less than the *BS channel bandwidth*. For intra-band contiguous CA, the OTA occupied bandwidth shall be less than or equal to the *Aggregated BS Channel Bandwidth*.

### 9.7.3 OTA Adjacent Channel Leakage Power Ratio (ACLR)

#### 9.7.3.1 General

OTA 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. The measured power is TRP.

The requirement shall be applied per RIB during the *transmitter ON period*.

#### 9.7.3.2 Minimum requirement for *BS type 1-O*

The ACLR (CACLR) absolute *basic limits* in table 6.6.3.2-2 + X, 6.6.3.2-2a + X (where X = 9 dB) or the ACLR (CACLR) *basic limit* in table 6.6.3.2-1, 6.6.3.2-2a or 6.6.3.2-3, whichever is less stringent, shall apply.

For a *RIB* operating in multi-carrier or contiguous CA, the ACLR requirements in clause 6.6.3.2 shall apply to *BS channel bandwidths* of the outermost carrier for the frequency ranges defined in table 6.6.3.2-1.For a RIB operating in *non-contiguous spectrum*, the ACLR requirement in clause 6.6.3.2 shall apply in *sub-block gaps* for the frequency ranges defined in table 6.6.3.2-2a, while the CACLR requirement in clause 6.6.3.2 shall apply in *sub-block gaps* for the frequency ranges defined in table 6.6.3.2-3.

For a *multi-band RIB*, the ACLR requirement in clause 6.6.3.2 shall apply in *Inter RF Bandwidth gaps* for the frequency ranges defined in table 6.6.3.2-2a, while the CACLR requirement in clause 6.6.3.2 shall apply in *Inter RF Bandwidth gaps* for the frequency ranges defined in table 6.6.3.2-3.

#### 9.7.3.3 Minimum requirement for *BS type 2-O*

The OTA ACLR limit is specified in table 9.7.3.3-1.

The OTA ACLR absolute limit is specified in table 9.7.3.3-2.

The OTA ACLR (CACLR) absolute limit in table 9.7.3.3-2 or 9.7.3.3-4a or the ACLR (CACLR) limit in table 9.7.3.3-1, 9.7.3.3-3 or 9.7.3.3-4, whichever is less stringent, shall apply.

For a *RIB* operating in multi-carrier or contiguous CA, the OTA ACLR requirements in table 9.7.3.3-1 shall apply to *BS channel bandwidths* of the outermost carrier for the frequency ranges defined in the table.For a RIB operating in *non-contiguous spectrum*, the OTA ACLR requirement in table 9.7.3.3-3 shall apply in *sub-block gaps* for the frequency ranges defined in the table, while the OTA CACLR requirement in table 9.7.3.3-4 shall apply in *sub-block gaps* for the frequency ranges defined in the table.

The CACLR in a *sub-block gap* is the ratio of:

a) the sum of the filtered mean power centred on the assigned channel frequencies for the two carriers adjacent to each side of the *sub-block gap*, and

b) the filtered mean power centred on a frequency channel adjacent to one of the respective *sub-block* edges.

The assumed filter for the adjacent channel frequency is defined in table 9.7.3.3-4 and the filters on the assigned channels are defined in table 9.7.3.3-5.

For operation in *non-contiguous spectrum*, the CACLR for NR carriers located on either side of the *sub-block gap* shall be higher than the value specified in table 9.7.3.3-4.

Table 9.7.3.3-1: *BS type 2-O* ACLR limit

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of *lowest/highest carrier* transmitted  BWChannel (MHz) | BS adjacent channel centre frequency offset below the *lowest* or above the *highest carrier* centre frequency transmitted | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit  (dB) |
| 50, 100, 200, 400 | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 28 (Note 3)  26 (Note 4)  24 (Note 5) |
| NOTE 1: BWChannel and BWConfig are the *BS channel bandwidth* and *transmission bandwidth configuration* of the *lowest/highest carrier* transmitted on the assigned channel frequency.  NOTE 2: With SCS that provides largest *transmission bandwidth configuration* (BWConfig).  NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz  NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz  NOTE 5: Applicable to bands defined within the frequency spectrum range of 52.6 – 71 GHz. | | | | |

Table 9.7.3.3-2: *BS type 2-O* ACLR absolute limit

|  |  |
| --- | --- |
| BS class | ACLR absolute limit |
| Wide area BS | -13 dBm/MHz |
| Medium range BS | -20 dBm/MHz |
| Local area BS | -20 dBm/MHz |

Table 9.7.3.3-3: *BS type 2-O* ACLR limit in non-contiguous spectrum

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of *lowest/highest carrier* transmitted (MHz) | *Sub-block gap* size (Wgap) where the limit applies (MHz) | BS adjacent channel centre frequency offset below or above the *sub-block* edge (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit |
| 50, 100 | Wgap≥ 100 (Note 5)  Wgap≥ 250 (Note 6) | 25 MHz | 50 MHz NR (Note 2) | Square (BWConfig) | 28 (Note 3)  26 (Note 4) |
| 200, 400 | Wgap≥ 400 (Note 6)  Wgap≥ 250 (Note 5) | 100 MHz | 200 MHz NR (Note 2) | Square (BWConfig) | 28 (Note 3)  26 (Note 4) |
| NOTE 1: BWConfig is the *transmission bandwidth configuration* of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides largest *transmission bandwidth configuration* (BWConfig).  NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz.  NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz.  NOTE 5: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz.  NOTE 6: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz. | | | | | |

Table 9.7.3.3-4: *BS type 2-O* CACLR limit in non-contiguous spectrum

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of *lowest/highest carrier* transmitted (MHz) | | *Sub-block gap* size (Wgap) where the limit applies (MHz) | BS adjacent channel centre frequency offset below or above the *sub-block* edge (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | CACLR limit |
| 50, 100 | | 50 ≤Wgap< 100 (Note 5)  50 ≤Wgap< 250 (Note 6) | 25 MHz | 50 MHz NR (Note 2) | Square (BWConfig) | 28 (Note 3)  26 (Note 4) |
| 200, 400 | | 200 ≤Wgap< 400 (Note 6)  200 ≤Wgap< 250 (Note 5) | 100 MHz | 200 MHz NR (Note 2) | Square (BWConfig) | 28 (Note 3)  26 (Note 4) |
| NOTE 1: BWConfig is the transmission bandwidth configuration of the assumed adjacent channel carrier.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig).  NOTE 3: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz.  NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz.  NOTE 5: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz.  NOTE 6: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz. | | | | | | |

Table 9.7.3.3-4a: *BS type 2-O* CACLR absolute limit

|  |  |
| --- | --- |
| BS class | CACLR absolute limit |
| Wide area BS | -13 dBm/MHz |
| Medium range BS | -20 dBm/MHz |
| Local area BS | -20 dBm/MHz |

Table 9.7.3.3-5: Filter parameters for the assigned channel

|  |  |
| --- | --- |
| RAT of the carrier adjacent to the *sub-block gap* | Filter on the assigned channel frequency and corresponding filter bandwidth |
| NR | NR of same BW with SCS that provides largest *transmission bandwidth configuration* |

### 9.7.4 OTA operating band unwanted emissions

#### 9.7.4.1 General

The OTA limits for operating band unwanted emissions are specified as TRP per RIB unless otherwise stated.

#### 9.7.4.2 Minimum requirement for *BS type 1-O*

Out-of-band emissions in FR1 are limited by OTA operating band unwanted emission limits. Unless otherwise stated, the operating band unwanted emission limits in FR1 are defined from ΔfOBUE below the lowest frequency of each supported downlink *operating band* up to ΔfOBUE above the highest frequency of each supported downlink *operating band*. The values of ΔfOBUE are defined in table 9.7.1-1 for the NR *operating bands*.

The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer's specification. For a *RIB* operating in multi-carrier or contiguous CA, the requirements apply to *BS channel bandwidths* of the outermost carrier for the frequency ranges defined in clause 6.6.4.1.

For a *RIB* operating in *non-contiguous spectrum*, the requirements shall apply inside any *sub-block gap* for the frequency ranges defined in clause 6.6.4.1.

For a *multi-band RIB*, the requirements shall apply inside any *Inter RF Bandwidth gap* for the frequency ranges defined in clause 6.6.4.1.

The OTA operating band unwanted emission requirement for *BS type 1-O* is that for each applicable *basic limit* in clause 6.6.4.2, the power of any unwanted emission shall not exceed an OTA limit specified as the *basic limit* + X, where X = 9 dB.

##### 9.7.4.2.1 Additional requirements

9.7.4.2.1.1 Protection of DTT

In certain regions the following requirement may apply for protection of DTT. For *BS type 1-O* operating in Band n20, the level of emissions in the band 470-790 MHz, measured in an 8 MHz filter bandwidth on centre frequencies Ffilter according to table 9.7.4.2.1.1-1, shall not exceed the maximum emission TRP level shown in the table. This requirement applies in the frequency range 470-790 MHz even though part of the range falls in the spurious domain.

Table 9.7.4.2.1.1-1: Declared emissions levels for protection of DTT

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Case | Measurement filter centre frequency | Condition on BS maximum aggregate TRP / 10 MHz, PTRP\_10MHz  (NOTE) | Maximum level  PTRP,N,MAX | *Measurement bandwidth* |
| A: for DTT frequencies where | N\*8 + 306 MHz,  21 ≤ N ≤ 60 | PTRP\_10MHz ≥ 59 dBm | 0 dBm | 8 MHz |
| broadcasting is protected | N\*8 + 306 MHz,  21 ≤ N ≤ 60 | 36 ≤ PTRP\_10MHz < 59 dBm | PTRP\_10MHz – 59 dBm | 8 MHz |
|  | N\*8 + 306 MHz,  21 ≤ N ≤ 60 | PTRP\_10MHz < 36 dBm | -23 dBm | 8 MHz |
| B: for DTT frequencies where | N\*8 + 306 MHz,  21 ≤ N ≤ 60 | PTRP\_10MHz ≥ 59 dBm | 10 dBm | 8 MHz |
| broadcasting is subject to an | N\*8 + 306 MHz,  21 ≤ N ≤ 60 | 36 ≤ PTRP\_10MHz < 59 dBm | PTRP\_10MHz – 49 dBm | 8 MHz |
| intermediate level of protection | N\*8 + 306 MHz,  21 ≤ N ≤ 60 | PTRP\_10MHz < 36 dBm | -13 dBm | 8 MHz |
| C: for DTT frequencies where broadcasting is not protected | N\*8 + 306 MHz,  21 ≤ N ≤ 60 | N/A | 22 dBm | 8 MHz |
| NOTE: PTRP\_10MHz (dBm) is defined by PTRP\_10MHz = P10MHz + Gant + 9dB, where Gant is 17 dBi. | | | | |

9.7.4.2.1.2 Limits in FCC Title 47

The BS may have to comply with the applicable emission limits established by FCC Title 47 [8], when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer.

#### 9.7.4.3 Minimum requirement for *BS type 2-O*

##### 9.7.4.3.1 General

The requirements of either clause 9.7.4.3.2 (Category A limits) or clause 9.7.4.3.3 (Category B limits) shall apply. The application of either Category A or Category B limits shall be the same as for General OTA transmitter spurious emissions requirements (*BS type 2-O*) in clause 9.7.5.3.2. In addition, the limits in clause 9.7.4.3.4 may also apply.

Out-of-band emissions in FR2 are limited by OTA operating band unwanted emission limits. Unless otherwise stated, the OTA operating band unwanted emission limits in FR2 are defined from ΔfOBUE below the lowest frequency of each supported downlink *operating band* up to ΔfOBUE above the highest frequency of each supported downlink *operating band*. The values of ΔfOBUE are defined in table 9.7.1-1 for the NR *operating bands*.

The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer's specification. For a *RIB* operating in multi-carrier or contiguous CA, the requirements apply to the frequencies (ΔfOBUE) starting from the edge of the *contiguous transmission bandwidth.* In addition, for a *RIB* operating in *non-contiguous spectrum*, the requirements apply inside any *sub-block gap*.

Emissions shall not exceed the maximum levels specified in the tables below, where:

- Δf is the separation between the *contiguous transmission bandwidth* edge frequency and the nominal -3dB point of the measuring filter closest to the *contiguous transmission bandwidth* edge.

- f\_offset is the separation between the *contiguous transmission bandwidth* edge frequency and the centre of the measuring filter.

- f\_offsetmax is the offset to the frequency ΔfOBUE outside thedownlink *operating band*, where ΔfOBUE is defined in table 9.7.1-1.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

In addition, inside any *sub-block gap* for a *RIB* operating in *non-contiguous spectrum*, emissions shall not exceed the cumulative sum of the limits specified for the adjacent *sub-blocks* on each side of the *sub-block gap*. The limit for each *sub-block* is specified in clauses 9.7.4.3.2 and 9.7.4.3.3 below, where in this case:

- Δf is the separation between the *sub-block* edge frequency and the nominal -3 dB point of the measuring filter closest to the *sub-block* edge.

- f\_offset is the separation between the *sub-block* edge frequency and the centre of the measuring filter.

- f\_offsetmax is equal to the *sub-block gap* bandwidth minus half of the bandwidth of the measuring filter.

- Δfmax is equal to f\_offsetmax minus half of the bandwidth of the measuring filter.

##### 9.7.4.3.2 OTA operating band unwanted emission limits (Category A)

BS unwanted emissions shall not exceed the maximum levels specified in table 9.7.4.3.2‑1 and 9.7.4.3.2-2.

Table 9.7.4.3.2-1: OBUE limits applicable in the frequency range 24.25 – 33.4 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-5 dBm, Max(Prated,t,TRP – 35 dB, -12 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13 dBm, Max(Prated,t,TRP – 43 dB, -20 dBm)) | 1 MHz |
| NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limitwithin *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. | | | |

Table 9.7.4.3.2-2: OBUE limits applicable in the frequency range 37 – 52.6 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-5 dBm, Max(Prated,t,TRP – 33 dB, -12 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13 dBm, Max(Prated,t,TRP – 41 dB, -20 dBm)) | 1 MHz |
| NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limitwithin *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. | | | |

Table 9.7.4.3.2-3: Void

Table 9.7.4.3.2-4: OBUE limits applicable in the frequency range 52.6 – 71 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3B point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-5 dBm, Max(Prated,t,TRP – 31 dB, -12 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < Δfmax | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < f\_ offsetmax | Min(-13 dBm, Max(Prated,t,TRP – 39 dB, -20 dBm)) | 1 MHz |
| NOTE 1: For *non-contiguous spectrum* operation within any *operating band* the limitwithin *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. | | | |

##### 9.7.4.3.3 OTA operating band unwanted emission limits (Category B)

BS unwanted emissions shall not exceed the maximum levels specified in table 9.7.4.3.3‑1 or 9.7.4.3.3-2.

Table 9.7.4.3.3-1: OBUE limits applicable in the frequency range 24.25 – 33.4 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3 dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-5 dBm, Max(Prated,t,TRP – 35 dB, -12 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < ΔfB | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < ΔfB +0.5 MHz | Min(-13 dBm, Max(Prated,t,TRP – 43 dB, -20 dBm)) | 1 MHz |
| ΔfB ≤ Δf < Δfmax | ΔfB +5 MHz ≤ f\_offset < f\_ offsetmax | Min(-5 dBm, Max(Prated,t,TRP – 33 dB, -10 dBm)) | 10 MHz |
| NOTE 1: For non-contiguous spectrum operation within any *operating band* the limitwithin sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the sub-block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block.  NOTE 2: ΔfB = 2\*BWcontiguous when BWcontiguous ≤ 500 MHz, otherwise ΔfB = BWcontiguous + 500 MHz. | | | |

Table 9.7.4.3.3-2: OBUE limits applicable in the frequency range 37 – 52.6 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3 dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-5 dBm, Max(Prated,t,TRP – 33 dB, -12 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < ΔfB | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < ΔfB +0.5 MHz | Min(-13 dBm, Max(Prated,t,TRP – 41 dB, -20 dBm)) | 1 MHz |
| ΔfB ≤ Δf < Δfmax | ΔfB +5 MHz ≤ f\_offset < f\_ offsetmax | Min(-5 dBm, Max(Prated,t,TRP – 31 dB, -10 dBm)) | 10 MHz |
| NOTE 1: For non-contiguous spectrum operation within any *operating band* the limitwithin sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the sub-block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block.  NOTE 2: ΔfB = 2\*BWcontiguous when BWcontiguous ≤ 500 MHz, otherwise ΔfB = BWcontiguous + 500 MHz. | | | |

Table 9.7.4.3.3-3: OBUE limits applicable in the frequency range 52.6 – 71 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter -3 dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Limit | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.1\*BWcontiguous | 0.5 MHz ≤ f\_offset < 0.1\* BWcontiguous +0.5 MHz | Min(-5 dBm, Max(Prated,t,TRP – 31 dB, -12 dBm)) | 1 MHz |
| 0.1\*BWcontiguous ≤ Δf < ΔfB | 0.1\* BWcontiguous +0.5 MHz ≤ f\_offset < ΔfB +0.5 MHz | Min(-13 dBm, Max(Prated,t,TRP – 39 dB, -20 dBm)) | 1 MHz |
| ΔfB ≤ Δf < Δfmax | ΔfB +5 MHz ≤ f\_offset < f\_ offsetmax | Min(-5 dBm, Max(Prated,t,TRP – 29 dB, -10 dBm)) | 10 MHz |
| NOTE 1: For non-contiguous spectrum operation within any *operating band* the limitwithin sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the sub-block gap, where the contribution from the far-end sub-block shall be scaled according to the measurement bandwidth of the near-end sub-block.  NOTE 2: ΔfB = 2\*BWcontiguous when BWcontiguous ≤ 500 MHz, otherwise ΔfB = BWcontiguous + 500 MHz. | | | |

##### 9.7.4.3.4 Additional OTA operating band unwanted emission requirements

9.7.4.3.4.1 Protection of Earth Exploration Satellite Service

For BS operating in the frequency range 24.25 – 27.5 GHz, the power of unwanted emission shall not exceed the limits in table 9.7.4.3.4.1-1.

Table 9.7.4.3.4.1-1: OBUE limits for protection of Earth Exploration Satellite Service

|  |  |  |
| --- | --- | --- |
| Frequency range | Limit | *Measurement Bandwidth* |
| 23.6 – 24 GHz | -3 dBm (Note 1) | 200 MHz |
| 23.6 – 24 GHz | -9 dBm (Note 2) | 200 MHz |
| NOTE 1: This limit applies to BS brought into use on or before 1 September 2027.  NOTE 2: This limit applies to BS brought into use after 1 September 2027. | | |

### 9.7.5 OTA transmitter spurious emissions

#### 9.7.5.1 General

Unless otherwise stated, all requirements are measured as mean power.

The OTA spurious emissions limits are specified as TRP per RIB unless otherwise stated.

#### 9.7.5.2 Minimum requirement for *BS type 1-O*

##### 9.7.5.2.1 General

The OTA transmitter spurious emission limits for FR1 shall apply from 30 MHz to 12.75 GHz, excluding the frequency range from ΔfOBUE below the lowest frequency of each supported downlink *operating band*, up to ΔfOBUE above the highest frequency of each supported downlink *operating band*, where the ΔfOBUE is defined in table 9.7.1-1. For some FR1 *operating bands*, the upper limit is higher than 12.75 GHz in order to comply with the 5th harmonic limit of the downlink *operating band*, as specified in ITU-R recommendation SM.329 [2].

For *multi-band RIB* each supported *operating band* and ΔfOBUE MHz around each band are excluded from the OTA transmitter spurious emissions requirements.

The requirements shall apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

*BS type 1-O* requirements consists of OTA transmitter spurious emission requirements based on TRP and co-location requirements not based on TRP.

##### 9.7.5.2.2 General OTA transmitter spurious emissions requirements

The Tx spurious emissions requirements for *BS type 1-O* are that for each applicable *basic limit* above 30 MHz in clause 6.6.5.2.1, the TRP of any spurious emission shall not exceed an OTA limit specified as the *basic limit* + X, where X = 9 dB, unless stated differently in regional regulation.

##### 9.7.5.2.3 Protection of the BS receiver of own or different BS

This requirement shall be applied for NR FDD operation in order to prevent the receivers of own or a different BS of the same band being desensitised by emissions from a type 1-O BS.

This requirement is a co-location requirement as defined in clause 4.9, the power levels are specified at the *co-location reference antenna* output.

The total power of any spurious emission from both polarizations of the *co-location reference antenna* connector output shall not exceed the *basic limits* in clause 6.6.5.2.2 + X dB, where X = -21 dB.

##### 9.7.5.2.4 Additional spurious emissions requirements

These requirements may be applied for the protection of systems operating in frequency ranges other than the BS downlink *operating band*. The limits may apply as an optional protection of such systems that are deployed in the same geographical area as the BS, or they may be set by local or regional regulation as a mandatory requirement for an NR *operating band*. It is in some cases not stated in the present document whether a requirement is mandatory or under what exact circumstances that a limit applies, since this is set by local or regional regulation. An overview of regional requirements in the present document is given in clause 4.5.

Some requirements may apply for the protection of specific equipment (UE, MS and/or BS) or equipment operating in specific systems (GSM, CDMA, UTRA, E-UTRA, NR, etc.). The Tx additional spurious emissions requirements for *BS type 1-O* are that for each applicable *basic limit* in clause 6.6.5.2.3, the TRP of any spurious emission shall not exceed an OTA limit specified as the *basic limit* + X, where X = 9 dB.

##### 9.7.5.2.5 Co-location with other base stations

These requirements may be applied for the protection of other BS receivers when GSM900, DCS1800, PCS1900, GSM850, CDMA850, UTRA FDD, UTRA TDD, E-UTRA and/or NR BS are co-located with a BS.

The requirements assume co-location with base stations of the same class.

NOTE: For co-location with UTRA, the requirements are based on co-location with UTRA FDD or TDD base stations.

This requirement is a co-location requirement as defined in clause 4.9, the power levels are specified at the *co-location reference antenna* output(s).

The power sum of any spurious emission is specified over all supported polarizations at the output(s) of the *co-location reference antenna* and shall not exceed the *basic limits* in clause 6.6.5.2.4 + X dB, where X = -21 dB.

For a *multi-band RIB*, the exclusions and conditions in the notes column of table 6.6.5.2.4-1 apply for each supported *operating band*.

#### 9.7.5.3 Minimum requirement for *BS type 2-O*

##### 9.7.5.3.1 General

In FR2, the OTA transmitter spurious emission limits apply from 30 MHz to 2nd harmonic of the upper frequency edge of the downlink *operating band*, excluding the frequency range from ΔfOBUE below the lowest frequency of the downlink *operating band*, up to ΔfOBUE above the highest frequency of the downlink *operating band*, where the ΔfOBUE is defined in table 9.7.1-1.

##### 9.7.5.3.2 General OTA transmitter spurious emissions requirements

9.7.5.3.2.1 General

The requirements of either clause 9.7.5.3.2.2 (Category A limits) or clause 9.7.5.3.2.3 (Category B limits) shall apply. The application of either Category A or Category B limits shall be the same as for Operating band unwanted emissions in clause 9.7.4.3.

Table 9.7.5.3.2-1: Void

NOTE: Table 9.7.5.3.2-1 is moved to clause 9.7.5.3.2.2 as Table 9.7.5.3.2.2-1.

9.7.5.3.2.2 OTA transmitter spurious emissions (Category A)

The power of any spurious emission shall not exceed the limits in table 9.7.5.3.2-1

Table 9.7.5.3.2.2-1: BS radiated Tx spurious emission limits in FR2

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | Limit | *Measurement Bandwidth* | Note |
| 30 MHz – 1 GHz |  | 100 kHz | Note 1 |
| 1 GHz – 2nd harmonic of the upper frequency edge of the DL *operating band* | -13 dBm | 1 MHz | Note 1, Note 2 |
| NOTE 1: Bandwidth as in ITU-R SM.329 [2], s4.1  NOTE 2: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1. | | | |

9.7.5.3.2.3 OTA transmitter spurious emissions (Category B)

The power of any spurious emission shall not exceed the limits in table 9.7.5.3.2.3-1.

Table 9.7.5.3.2.3-1: BS radiated Tx spurious emission limits in FR2 (Category B)

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range  (Note 4) | Limit | *Measurement Bandwidth* | Note |
| 30 MHz ↔ 1 GHz | -36 dBm | 100 kHz | Note 1 |
| 1 GHz ↔ 18 GHz | -30 dBm | 1 MHz | Note 1 |
| 18 GHz ↔ Fstep,1 | -20 dBm | 10 MHz | Note 2 |
| Fstep,1  ↔ Fstep,2 | -15 dBm | 10 MHz | Note 2 |
| Fstep,2 ↔ Fstep,3 | -10 dBm | 10 MHz | Note 2 |
| Fstep,4  ↔ Fstep,5 | -10 dBm | 10 MHz | Note 2 |
| Fstep,5  ↔ Fstep,6 | -15 dBm | 10 MHz | Note 2 |
| Fstep,6 ↔ 2nd harmonic of the upper frequency edge of the DL *operating band* | -20 dBm | 10 MHz | Note 2, Note 3 |
| NOTE 1: Bandwidth as in ITU-R SM.329 [2], s4.1  NOTE 2: Limit and bandwidth as in ERC Recommendation 74-01 [19], Annex 2.  NOTE 3: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1.  NOTE 4: The step frequencies Fstep,X are defined in Table 9.7.5.3.2.3-2. | | | |

Table 9.7.5.3.2.3-2: Step frequencies for defining the BS radiated Tx spurious emission limits in FR2 (Category B)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Operating band | Fstep,1 (GHz) | Fstep,2 (GHz) | Fstep,3 (GHz) (Note 2) | Fstep,4 (GHz) (Note 2) | Fstep,5 (GHz) | Fstep,6 (GHz) |
| n257 | 18 | 23.5 | 25 | 31 | 32.5 | 41.5 |
| n258 | 18 | 21 | 22.75 | 29 | 30.75 | 40.5 |
| n259 | 23.5 | 35.5 | 38 | 45 | 47.5 | 59.5 |
| n263 | 18 | 43 | 53.5 | 74.5 | 85 | 127 |
| NOTE 1: Fstep,X are based on ERC Recommendation 74-01 [19], Annex 2.  NOTE 2: Fstep,3 and Fstep,4 are aligned with the values for ΔfOBUE in Table 9.7.1-1. | | | | | | |

##### 9.7.5.3.3 Additional OTA transmitter spurious emissions requirements

These requirements may be applied for the protection of systems operating in frequency ranges other than the BS downlink operating band. The limits may apply as an optional protection of such systems that are deployed in the same geographical area as the BS, or they may be set by local or regional regulation as a mandatory requirement for an NR operating band. It is in some cases not stated in the present document whether a requirement is mandatory or under what exact circumstances that a limit applies, since this is set by local or regional regulation. An overview of regional requirements in the present document is given in clause 4.5.

9.7.5.3.3.1 Limits for protection of Earth Exploration Satellite Service

For BS operating in the frequency range 24.25 – 27.5 GHz, the power of any spurious emissions shall not exceed the limits in Table 9.7.5.3.3.1-1.

Table 9.7.5.3.3.1-1: Limits for protection of Earth Exploration Satellite Service

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | Limit | *Measurement Bandwidth* | Note |
| 23.6 – 24 GHz | -3 dBm | 200 MHz | Note 1 |
| 23.6 – 24 GHz | -9 dBm | 200 MHz | Note 2 |
| NOTE 1: This limit applies to BS brought into use on or before 1 September 2027.  NOTE 2: This limit applies to BS brought into use after 1 September 2027. | | | |

## 9.8 OTA transmitter intermodulation

### 9.8.1 General

The OTA transmitter intermodulation requirement is a measure of the capability of the transmitter unit to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter unit via the RDN and antenna array from a co-located base station. The requirement shall apply during the *transmitter ON period* and the *transmitter transient period*.

The requirement shall apply at each RIB supporting transmission in the *operating band*.

The transmitter intermodulation level is the *total radiated power* of the intermodulation products when an interfering signal is injected into the *co-location reference antenna*.

The OTA transmitter intermodulation requirement is not applicable for *BS type 2-O*.

### 9.8.2 Minimum requirement for *BS type 1-O*

For *BS type 1-O* the transmitter intermodulation level shall not exceed the TRP unwanted emission limits specified for OTA transmitter spurious emission in clause 9.7.5.2 (except clause 9.7.5.2.3 and clause 9.7.5.2.5), OTA operating band unwanted emissions in clause 9.7.4.2 and OTA ACLR in clause 9.7.3.2 in the presence of a wanted signal and an interfering signal, defined in table 9.8.2-1.

The requirement is applicable outside the *Base Station RF Bandwidth edges*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth* *edges* or *Radio Bandwidth* edges.

For RIBs supporting operation in *non-contiguous spectrum*, the requirement is also applicable inside a *sub-block gap* for interfering signal offsets where the interfering signal falls completely within the *sub-block gap*. The interfering signal offset is defined relative to the *sub-block* edges.

For RIBs supporting operation in multiple *operating bands*, the requirement shall apply relative to the *Base Station RF Bandwidth* *edges* of each *operating band*. In case the *inter RF Bandwidth gap* is less than 3\*BWChannel (where BWChannel is the minimal *BS channel bandwidth* of the band), the requirement in the gap shall apply only for interfering signal offsets where the interfering signal falls completely within the *inter RF Bandwidth gap*.

Table 9.8.2-1: Interfering and wanted signals for  
the OTA transmitter intermodulation requirement

| Parameter | Value |
| --- | --- |
| Wanted signal | NR signal or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers |
| Interfering signal type | NR signal the minimum *BS channel bandwidth* (BWChannel) with 15 kHz SCS of the band defined in clause 5.3.5 |
| Interfering signal level | min(46 dBm, Prated,t,TRP) |
| Interfering signal centre frequency offset from the lower (upper) edge of the wanted signal or edge of *sub-block* inside a gap | , for n=1, 2 and 3 |
| NOTE 1: Interfering signal positions that are partially or completely outside of any downlink *operating band* of the RIB are excluded from the requirement, unless the interfering signal positions fall within the frequency range of adjacent downlink *operating bands* in the same geographical area. In case that none of the interfering signal positions fall completely within the frequency range of the downlink *operating band*, TS 38.141-2 [6] provides further guidance regarding appropriate test requirements.  NOTE 2: In Japan, NOTE 1 is not applied in Band n77, n78, n79.  NOTE 3: The Prated,t,TRP is split between polarizations at the *co-location reference antenna*. | |

# 10 Radiated receiver characteristics

## 10.1 General

Radiated receiver characteristics are specified at RIB for *BS type 1-H*, *BS type 1-O*, or *BS type 2-O*, with full complement of transceivers for the configuration in normal operating condition.

Unless otherwise stated, the following arrangements apply for the radiated receiver characteristics requirements in clause 10:

- Requirements apply during the BS receive period.

- Requirements shall be met for any transmitter setting.

- For FDD operation the requirements shall be met with the transmitter unit(s) ON.

- Throughput requirements defined for the radiated receiver characteristics do not assume HARQ retransmissions.

- When BS is configured to receive multiple carriers, all the throughput requirements are applicable for each received carrier.

- For ACS, blocking and intermodulation characteristics, the negative offsets of the interfering signal apply relative to the lower *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*, and the positive offsets of the interfering signal apply relative to the upper *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*.

- Each requirement shall be met over the RoAoA specified.

NOTE 1: In normal operating condition the BS in FDD operation is configured to transmit and receive at the same time.

NOTE 2: In normal operating condition the BS in TDD operation is configured to TX OFF power during *receive period*.

For FR1 requirements which are to be met over the *OTA REFSENS RoAoA* absolute requirement values are offset by the following term:

ΔOTAREFSENS = 44.1 - 10\*log10(BeWθ,REFSENS\*BeWφ,REFSENS) dB for the reference direction

and

ΔOTAREFSENS = 41.1 - 10\*log10(BeWθ,REFSENS\*BeWφ,REFSENS) dB for all other directions

For requirements which are to be met over the *minSENS RoAoA* absolute requirement values are offset by the following term:

ΔminSENS = PREFSENS – EISminSENS (dB)

For FR2 requirements which are to be met over the *OTA REFSENS RoAoA* absolute requirement values are offset by the following term:

ΔFR2\_REFSENS = -3 dB for the reference direction

and

ΔFR2\_REFSENS = 0 dB for all other directions

## 10.2 OTA sensitivity

### 10.2.1 *BS type 1-H* and *BS type 1-O*

#### 10.2.1.1 General

The OTA sensitivity requirement is a *directional requirement* based upon the declaration of one or more *OTA sensitivity direction declarations* (OSDD), related to a *BS type 1-H* and *BS type 1-O* receiver.

The *BS type 1-H* and *BS type 1-O* may optionally be capable of redirecting/changing the *receiver target* by means of adjusting BS settings resulting in multiple *sensitivity RoAoA*. The *sensitivity RoAoA* resulting from the current BS settings is the active *sensitivity RoAoA*.

If the BS is capable of redirecting the *receiver target* related to the OSDD then the OSDD shall include:

- *BS channel bandwidth* and declared minimum EISlevel applicable to any active *sensitivity RoAoA* inside the *receiver target redirection range* in the OSDD.

- A declared *receiver target redirection range*, describing all the angles of arrival that can be addressed for the OSDD through alternative settings in the BS.

- Five declared *sensitivity RoAoA* comprising the conformance testing directions as detailed in TS 38.141‑2 [6].

- The *receiver target reference direction*.

NOTE 1: Some of the declared *sensitivity RoAoA* may coincide depending on the redirection capability.

NOTE 2: In addition to the declared *sensitivity RoAoA*, several *sensitivity RoAoA* may be implicitly defined by the *receiver target redirection range* without being explicitly declared in the OSDD.

NOTE 3: (Void)

If the BS is not capable of redirecting the *receiver target* related to the OSDD, then the OSDD includes only:

- The set(s) of RAT, *BS channel bandwidth* and declared minimum EISlevel applicable to the *sensitivity RoAoA* in the OSDD.

- One declared active *sensitivity RoAoA*.

- The *receiver target reference direction*.

NOTE 4: For BS without target redirection capability, the declared (fixed) *sensitivity RoAoA* is always the active *sensitivity RoAoA*.

The OTA sensitivity EIS level declaration shall apply to each supported polarization, under the assumption of *polarization match*.

#### 10.2.1.2 Minimum requirement

For a received signal whose AoA of the incident wave is within the active *sensitivity RoAoA* of an OSDD, the error rate criterion as described in clause 7.2 shall be met when the level of the arriving signal is equal to the minimum EIS level in the respective declared set of EIS level and *BS channel bandwidth*.

### 10.2.2 *BS type 2-O*

There is no OTA sensitivity requirement for FR2, the OTA sensitivity is the same as the OTA reference sensitivity in clause 10.3.

## 10.3 OTA reference sensitivity level

### 10.3.1 General

The OTA REFSENS requirement is a *directional requirement* and is intended to ensure the minimum OTA reference sensitivity level for a declared *OTA REFSENS RoAoA*. The OTA reference sensitivity power level EISREFSENS is the minimum mean power received at the RIB at which a reference performance requirement shall be met for a specified reference measurement channel.

The OTA REFSENS requirement shall apply to each supported polarization, under the assumption of *polarization match*.

### 10.3.2 Minimum requirement for *BS type 1-O*

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in the corresponding table and annex A.1 when the OTA test signal is at the corresponding EISREFSENS level and arrives from any direction within the *OTA REFSENS RoAoA.*

Table 10.3.2-1: Wide Area BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | OTA reference sensitivity level, EISREFSENS  (dBm) |
| 5, 10, 15 | 15 | G-FR1-A1-1 | -101.7 - ΔOTAREFSENS |
| 10, 15 | 30 | G-FR1-A1-2 | -101.8 - ΔOTAREFSENS |
| 10, 15 | 60 | G-FR1-A1-3 | -98.9 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50 | 15 | G-FR1-A1-4 | -95.3 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -95.6 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -95.7 - ΔOTAREFSENS |
| NOTE: EISREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | |

Table 10.3.2-2: Medium Range BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | OTA reference sensitivity level, EISREFSENS  (dBm) |
| 5, 10, 15 | 15 | G-FR1-A1-1 | -96.7 - ΔOTAREFSENS |
| 10, 15 | 30 | G-FR1-A1-2 | -96.8 - ΔOTAREFSENS |
| 10, 15 | 60 | G-FR1-A1-3 | -93.9 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50 | 15 | G-FR1-A1-4 | -90.3 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -90.6 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -90.7 - ΔOTAREFSENS |
| NOTE: EISREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | |

Table 10.3.2-3: Local Area BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | OTA reference sensitivity level, EISREFSENS  (dBm) |
| 5, 10, 15 | 15 | G-FR1-A1-1 | -93.7 - ΔOTAREFSENS |
| 10, 15 | 30 | G-FR1-A1-2 | -93.8 - ΔOTAREFSENS |
| 10, 15 | 60 | G-FR1-A1-3 | -90.9 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50 | 15 | G-FR1-A1-4 | -87.3 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -87.6 - ΔOTAREFSENS |
| 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -87.7 - ΔOTAREFSENS |
| NOTE: EISREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | |

### 10.3.3 Minimum requirement for *BS type 2-O*

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in the corresponding table and annex A.1 when the OTA test signal is at the corresponding EISREFSENS level and arrives from any direction within the *OTA REFSENS RoAoA*.

EISREFSENS levels are derived from a single declared basis level EISREFSENS\_50M, which is based on a reference measurement channel with 50 MHz *BS channel bandwidth*. EISREFSENS\_50M itself is not a requirement and although it is based on a reference measurement channel with 50 MHz *BS channel bandwidth* it does not imply that BS has to support 50 MHz *BS channel bandwidth*.

For Wide Area BS, EISREFSENS\_50M is an integer value in the range -96 to -119 dBm. The specific value is declared by the vendor.

For Medium Range BS, EISREFSENS\_50M is an integer value in the range -91 to -114 dBm. The specific value is declared by the vendor.

For Local Area BS, EISREFSENS\_50M is an integer value in the range -86 to -109 dBm. The specific value is declared by the vendor.

Table 10.3.3-1: FR2 OTA reference sensitivity requirement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Frequency Range* | *BS channel Bandwidth*  (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | OTA reference sensitivity level, EISREFSENS (dBm) |
| FR2-1 | 50, 100, 200 | 60 | G-FR2-A1-1 | EISREFSENS\_50M + ΔFR2\_REFSENS |
| 50 | 120 | G-FR2-A1-2 | EISREFSENS\_50M + ΔFR2\_REFSENS |
| 100, 200, 400 | 120 | G-FR2-A1-3 | EISREFSENS\_50M + 3+ ΔFR2\_REFSENS |
| FR2-2 | 100,400 | 120 | G-FR2-A1-3 | EISREFSENS\_50M + 3+ ΔFR2\_REFSENS |
| 400, 800, 1600 | 480 | G-FR2-A1-6 | EISREFSENS\_50M + 9 + ΔFR2\_REFSENS |
| 400, 800, 1600, 2000 | 960 | G-FR2-A1-7 | EISREFSENS\_50M + 9 + ΔFR2\_REFSENS |
| NOTE 1: EISREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*.  NOTE 2: The declared EISREFSENS\_50M shall be within the range specified above. | | | | |

## 10.4 OTA dynamic range

### 10.4.1 General

The OTA dynamic range is a measure of the capability of the receiver unit to receive a wanted signal in the presence of an interfering signal inside the received *BS channel bandwidth*.

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

### 10.4.2 Minimum requirement for *BS type 1-O*

For NR, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel.

Table 10.4.2-1: Wide Area BS OTA dynamic range for NR carrier

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | 15 | G-FR1-A2-1 | -70.7- ΔOTAREFSENS | -82.5- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -71.4- ΔOTAREFSENS |  |  |
| 10 | 15 | G-FR1-A2-1 | -70.7- ΔOTAREFSENS | -79.3- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -71.4- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-3 | -68.4- ΔOTAREFSENS |  |  |
| 15 | 15 | G-FR1-A2-1 | -70.7- ΔOTAREFSENS | -77.5- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -71.4- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-3 | -68.4- ΔOTAREFSENS |  |  |
| 20 | 15 | G-FR1-A2-4 | -64.5- ΔOTAREFSENS | -76.2- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 25 | 15 | G-FR1-A2-4 | -64.5- ΔOTAREFSENS | -75.2- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 30 | 15 | G-FR1-A2-4 | -64.5- ΔOTAREFSENS | -74.4- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 35 | 15 | G-FR1-A2-4 | -64.5- ΔOTAREFSENS | -73.7- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 40 | 15 | G-FR1-A2-4 | -64.5- ΔOTAREFSENS | -73.1- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 45 | 15 | G-FR1-A2-4 | -64.5- ΔOTAREFSENS | -72.6- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 50 | 15 | G-FR1-A2-4 | -64.5- ΔOTAREFSENS | -72.1- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 60 | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS | -71.3- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 70 | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS | -70.7- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 80 | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS | -70.1- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 90 | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS | -69.5- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| 100 | 30 | G-FR1-A2-5 | -64.5- ΔOTAREFSENS | -69.1- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -64.8- ΔOTAREFSENS |  |  |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | |

Table 10.4.2-2: Medium Range BS OTA dynamic range for NR carrier

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | 15 | G-FR1-A2-1 | -65.7- ΔOTAREFSENS | -77.5- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -66.4- ΔOTAREFSENS |  |  |
| 10 | 15 | G-FR1-A2-1 | -65.7- ΔOTAREFSENS | -74.3- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -66.4- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-3 | -63.4- ΔOTAREFSENS |  |  |
| 15 | 15 | G-FR1-A2-1 | -65.7- ΔOTAREFSENS | -72.5- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -66.4- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-3 | -63.4- ΔOTAREFSENS |  |  |
| 20 | 15 | G-FR1-A2-4 | -59.5- ΔOTAREFSENS | -71.2- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 25 | 15 | G-FR1-A2-4 | -59.5- ΔOTAREFSENS | -70.2- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 30 | 15 | G-FR1-A2-4 | -59.5- ΔOTAREFSENS | -69.4- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 35 | 15 | G-FR1-A2-4 | -59.5- ΔOTAREFSENS | -68.7- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 40 | 15 | G-FR1-A2-4 | -59.5- ΔOTAREFSENS | -68.1- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 45 | 15 | G-FR1-A2-4 | -59.5- ΔOTAREFSENS | -67.6- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 50 | 15 | G-FR1-A2-4 | -59.5- ΔOTAREFSENS | -67.1- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 60 | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS | -66.3- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 70 | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS | -65.7- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 80 | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS | -65.1- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 90 | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS | -64.5- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| 100 | 30 | G-FR1-A2-5 | -59.5- ΔOTAREFSENS | -64.1- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -59.8- ΔOTAREFSENS |  |  |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | |

Table 10.4.2-3: Local Area BS OTA dynamic range for NR carrier

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | 15 | G-FR1-A2-1 | -62.7- ΔOTAREFSENS | -74.5- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -64.4- ΔOTAREFSENS |  |  |
| 10 | 15 | G-FR1-A2-1 | -62.7- ΔOTAREFSENS | -71.3- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -64.4- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-3 | -60.4- ΔOTAREFSENS |  |  |
| 15 | 15 | G-FR1-A2-1 | -62.7- ΔOTAREFSENS | -69.5- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-2 | -64.4- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-3 | -60.4- ΔOTAREFSENS |  |  |
| 20 | 15 | G-FR1-A2-4 | -56.5- ΔOTAREFSENS | -68.2- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 25 | 15 | G-FR1-A2-4 | -56.5- ΔOTAREFSENS | -67.2- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 30 | 15 | G-FR1-A2-4 | -56.5- ΔOTAREFSENS | -66.4- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 35 | 15 | G-FR1-A2-4 | -56.5- ΔOTAREFSENS | -65.7- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 40 | 15 | G-FR1-A2-4 | -56.5- ΔOTAREFSENS | -65.1- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 45 | 15 | G-FR1-A2-4 | -56.5- ΔOTAREFSENS | -64.6- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 50 | 15 | G-FR1-A2-4 | -56.5- ΔOTAREFSENS | -64.1- ΔOTAREFSENS | AWGN |
|  | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS |  |  |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 60 | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS | -63.3- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 70 | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS | -62.7- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 80 | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS | -62.1- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 90 | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS | -61.5- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| 100 | 30 | G-FR1-A2-5 | -56.5- ΔOTAREFSENS | -61.1- ΔOTAREFSENS | AWGN |
|  | 60 | G-FR1-A2-6 | -56.8- ΔOTAREFSENS |  |  |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | | | |

## 10.5 OTA in-band selectivity and blocking

### 10.5.1 OTA adjacent channel selectivity

#### 10.5.1.1 General

OTA Adjacent channel selectivity (ACS) is a measure of the receiver's ability to receive an OTA wanted signal at its assigned channel frequency in the presence of an OTA adjacent channel signal with a specified centre frequency offset of the interfering signal to the band edge of a victim system.

#### 10.5.1.2 Minimum requirement for *BS type 1-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *minSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption o*f polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel.

For FR1, the OTA wanted and the interfering signal are specified in table 10.5.1.2-1 and table 10.5.1.2-2 for OTA ACS. The reference measurement channel for the OTA wanted signal is further specified in annex A.1. The characteristics of the interfering signal is further specified in annex D.

The OTA ACS requirement is applicable outside the *Base Station RF Bandwidth* or *Radio Bandwidth*. The OTA interfering signal offset is defined relative to the *Base station RF Bandwidth edges* or *Radio Bandwidth edges*.

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA ACS requirement shall apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the NR interfering signal in table 10.5.1.2-2. The OTA interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For *multi-band RIBs*, the OTA ACS requirement shall apply in addition inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as the NR interfering signal in table 10.5.1.2-2. The interfering signal offset is defined relative to the *Base Station RF Bandwidth* edges inside the *Inter RF Bandwidth gap*.

Table 10.5.1.2-1: OTA ACS requirement for *BS type 1-O*

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm)  (Note 2) | Interfering signal mean power (dBm) |
| 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80,90, 100 (Note 1) | EISminSENS + 6 dB | Wide Area BS: -52 – ΔminSENS  Medium Range BS: -47– ΔminSENS  Local Area BS: -44– ΔminSENS |
| NOTE 1: The SCS for the *lowest/highest carrier* received is the lowest SCS supported by the BS for that bandwidth  NOTE 2: EISminSENS depends on the *BS channel bandwidth* | | |

Table 10.5.1.2-2: OTA ACS interferer frequency offset for *BS type 1-O*

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering signal centre frequency offset from the lower/upper *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap* (MHz) | Type of interfering signal |
| 5 | ±2.5025 |  |
| 10 | ±2.5075 | 5 MHz DFT-s-OFDM NR signal, |
| 15 | ±2.5125 | 15 kHz SCS, 25 RBs |
| 20 | ±2.5025 |  |
| 25 | ±9.4675 |  |
| 30 | ±9.4725 |  |
| 35 | ±9.4625 |  |
| 40 | ±9.4675 |  |
| 45 | ±9.4725 |  |
| 50 | ±9.4625 | 20 MHz DFT-s-OFDM NR signal, |
| 60 | ±9.4725 | 15 kHz SCS, 100 RBs |
| 70 | ±9.4675 |  |
| 80 | ±9.4625 |  |
| 90 | ±9.4725 |  |
| 100 | ±9.4675 |  |

#### 10.5.1.3 Minimum requirement for *BS type 2-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption o*f polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel.

For FR2, the OTA wanted and the interfering signal are specified in table 10.5.1.3-1 and table 10.5.1.3-2 for OTA ACS. The reference measurement channel for the OTA wanted signal is further specified in annex A.1. The characteristics of the interfering signal is further specified in annex D.

The OTA ACS requirement is applicable outside the *Base Station RF Bandwidth*. The OTA interfering signal offset is defined relative to the Base station *RF Bandwidth edges*.

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA ACS requirement shall apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the NR interfering signal in table 10.5.1.3-2. The OTA interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

Table 10.5.1.3-1: OTA ACS requirement for *BS type 2-O*

|  |  |  |  |
| --- | --- | --- | --- |
| *Frequency Range* | *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| FR2-1 | 50, 100, 200, 400 | EISREFSENS + 6 dB (Note 3) | EISREFSENS\_50M + 27.7 + ΔFR2\_REFSENS (Note 1)  EISREFSENS\_50M + 26.7 + ΔFR2\_REFSENS (Note 2) |
| FR2-2 | 100, 400, 800, 1600, 2000 | EISREFSENS + 6 dB (Note 3) | EISREFSENS\_50M + 25.7 + ΔFR2\_REFSENS (Note 4) |
| NOTE 1: Applicable to bands defined within the frequency spectrum range of 24.25 – 33.4 GHz  NOTE 2: Applicable to bands defined within the frequency spectrum range of 37 – 52.6 GHz  NOTE 3: EISREFSENS is given in clause 10.3.3  NOTE 4: Applicable to bands defined within the frequency spectrum range of 57 – 71 GHz | | | |

Table 10.5.1.3-2: OTA ACS interferer frequency offset for *BS type 2-O*

|  |  |  |  |
| --- | --- | --- | --- |
| *Frequency Range* | *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering signal centre frequency offset from the lower/upper *Base Station RF Bandwidth* *edge* or sub*-block edge* inside a *sub-block gap* (MHz) | Type of interfering signal |
| FR2-1 | 50 | ±24.29 |  |
| 100 | ±24.31 | 50 MHz DFT-s-OFDM NR |
| 200 | ±24.29 | signal,60 kHz SCS, 64 RBs |
| 400 | ±24.31 |  |
| FR2-2 | 100 | ±48.58 | 100 MHz DFT-s-OFDM NR  signal,120 kHz SCS, 64 RBs |
| 400 | ±48.58 |
| 800 | ±48.62 |
| 1600 | ±48.58 |
| 2000 | ±48.62 |

### 10.5.2 OTA in-band blocking

#### 10.5.2.1 General

The OTA in-band blocking characteristics is a measure of the receiver's ability to receive a OTA wanted signal at its assigned channel in the presence of an unwanted OTA interferer, which is an NR signal for general blocking or an NR signal with one RB for narrowband blocking.

#### 10.5.2.2 Minimum requirement for *BS type 1-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and:

- when the wanted signal is based on EISREFSENS: the AoA of the incident wave of a received signal and the interfering signal are within the *OTA REFSENS RoAoA.*

- when the wanted signal is based on EISminSENS: the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with OTA wanted and OTA interfering signal specified in tables 10.5.2.2-1, table 10.5.2.2-2 and table 10.5.2.2-3 for general OTA and narrowband OTA blocking requirements. The reference measurement channel for the OTA wanted signal is identified in clause 10.3.2 and are further specified in annex A.1. The characteristics of the interfering signal is further specified in annex D.

The OTA in-band blocking requirements apply outside the *Base Station RF Bandwidth* or *Radio Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Radio Bandwidth* edges.

For *BS type 1-O* the OTA in-band blocking requirement shall apply in the in-band blocking frequency range, which is from FUL,low - ΔfOOB to FUL,high + ΔfOOB, excluding the downlink frequency range of the FDD *operating band.* The ΔfOOB for *BS type 1-O* is defined in table 10.5.2.2-0.

Table 10.5.2.2-0: ΔfOOB offset for NR *operating bands* in FR1

|  |  |  |
| --- | --- | --- |
| BS type | *Operating band* characteristics | ΔfOOB (MHz) |
| *BS type 1-O* | FUL,high – FUL,low < 100 MHz | 20 |
|  | 100 MHz ≤ FUL,high – FUL,low ≤ 900 MHz | 60 |

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA in-band blocking requirements apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as twice the interfering signal minimum offset in table 10.5.2.2-1. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For *multi-band RIBs*, the OTA in-band blocking requirements apply in the in-band blocking frequency ranges for each supported *operating band*. The requirement shall apply in addition inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as twice the interfering signal minimum offset in tables 10.5.2.2-1 and 10.5.2.2-3.

For a RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA narrowband blocking requirements apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the interfering signal minimum offset in table 10.5.2.2-3. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For a *multi-band RIBs*, the OTA narrowband blocking requirements apply in the narrowband blocking frequency ranges for each supported *operating band*. The requirement shall apply in addition inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as the interfering signal minimum offset in table 10.5.2.2-3.

Table 10.5.2.2-1: General OTA blocking requirement for *BS type 1-O*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm)  (Note 1) | Interfering signal mean power (dBm) | Interfering signal centre frequency minimum offset from the lower/upper *Base Station RF Bandwidth edge* or *sub-block* edge inside a *sub-block gap* (MHz) | Type of interfering signal |
|  | EISREFSENS + x dB | Wide Area BS: -43 - ΔOTAREFSENS  Medium Range BS: -38 - ΔOTAREFSENS  Local Area BS: -35 - ΔOTAREFSENS | ±7.5 |  |
| 5, 10, 15, 20 | EISminSENS + x dB | Wide Area BS: -43 – ΔminSENS  Medium Range BS: -38 – ΔminSENS  Local Area BS: -35 – ΔminSENS | ±7.5 | 5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 25 RBs |
|  | EISREFSENS + x dB | Wide Area BS: -43 - ΔOTAREFSENS  Medium Range BS: -38 - ΔOTAREFSENS  Local Area BS: -35 - ΔOTAREFSENS | ±30 |  |
| 25 ,30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | EISminSENS + x dB | Wide Area BS: -43 – ΔminSENS  Medium Range BS: -38 – ΔminSENS  Local Area BS: -35 – ΔminSENS | ±30 | 20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| NOTE 1: For a BS capable of single band operation only, "x" is equal to 6 dB. For a BS capable of multi-band operation, "x" is equal to 6 dB in case of interfering signals that are in the in-band blocking frequency range of the operating band where the wanted signal is present or in the in-band blocking frequency range of an adjacent or overlapping operating band. For other in-band blocking frequency ranges of the interfering signal for the supported operating bands, "x" is equal to 1.4 dB. | | | | |

Table 10.5.2.2-2: OTA narrowband blocking requirement for *BS type 1-O*

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | OTA Wanted signal mean power (dBm) | OTA Interfering signal mean power (dBm) |
| 5, 10, 15, 20 | EISREFSENS + 6 dB | Wide Area BS: -49 - ΔOTAREFSENS  Medium Range BS: -44 - ΔOTAREFSENS  Local Area BS: -41 - ΔOTAREFSENS |
|  | EISminSENS + 6 dB | Wide Area BS: -49 – ΔminSENS  Medium Range BS: -44 – ΔminSENS  Local Area BS: -41 – ΔminSENS |
| 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | EISREFSENS + 6 dB | Wide Area BS: -49 - ΔOTAREFSENS  Medium Range BS: -44 - ΔOTAREFSENS  Local Area BS: -41 - ΔOTAREFSENS |
|  | EISminSENS + 6 dB | Wide Area BS: -49 – ΔminSENS  Medium Range BS: -44 – ΔminSENS  Local Area BS: -41 – ΔminSENS |
| NOTE 1: The SCS for the *lowest/highest carrier* received is the lowest SCS supported by the BS for that bandwidth.  NOTE 2: 7.5 kHz shift is not applied to the wanted signal. | | |

Table 10.5.2.2-3: OTA narrowband blocking interferer frequency offsets for *BS type 1-O*

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering RB centre frequency offset to the lower/upper *Base Station RF Bandwidth edge* or *sub-block edge* inside a *sub-block gap* (kHz) (Note 2) | Type of interfering signal |
| 5 | ±(350 + m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 | 5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB |
| 10 | ±(355 + m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 |  |
| 15 | ±(360 + m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 |  |
| 20 | ±(350 + m\*180),  m=0, 1, 2, 3, 4, 9, 14, 19, 24 |  |
| 25 | ±(565 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 | 20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB |
| 30 | ±(570 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 35 | ±(560+m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 40 | ±(565 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 45 | ±(570+m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 50 | ±(560 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 60 | ±(570 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 70 | ±(565 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 80 | ±(560 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 90 | ±(570 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| 100 | ±(565 + m\*180),  m=0, 1, 2, 3, 4, 29, 54, 79, 99 |  |
| NOTE 1: Interfering signal consisting of one resource block is positioned at the stated offset, the channel bandwidthof the interfering signal is located adjacently to the lower/upper *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*.  NOTE 2: The centre of the interfering RB refers to the frequency location between the two central subcarriers. | | |

#### 10.5.2.3 Minimum requirement for *BS type 2-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption o*f polarization match*.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel.

For *BS type 2-O*, the OTA wanted and OTA interfering signals are provided at RIB using the parameters in table 10.5.2.3-1 for general OTA blocking requirements. The reference measurement channel for the wanted signal is further specified in annex A.1. The characteristics of the interfering signal is further specified in annex D.

The OTA blocking requirements are applicable outside the *Base Station RF Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth* edges.

For *BS type 2-O* the OTA in-band blocking requirement shall apply from FUL\_low - ΔfOOB to FUL\_high + ΔfOOB*.* The ΔfOOB for *BS type 2-O* is defined in table 10.5.2.3-0.

Table 10.5.2.3-0: ΔfOOB offset for NR *operating bands* in FR2

|  |  |  |  |
| --- | --- | --- | --- |
| BS type | *Frequency Range* | *Operating band* characteristics (MHz) | ΔfOOB (MHz) |
| *BS type 2-O* | FR2-1 | FUL\_high – FUL\_low ≤ 4000 | 1500 |
| FR2-2 | 4000 < FUL\_high – FUL\_low ≤14000 | 3500 |

For a RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA blocking requirements apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as twice the interfering signal minimum offset in table 10.5.2.3-1. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

Table 10.5.2.3-1: General OTA blocking requirement for *BS type 2-O*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Frequency Range* | *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | OTA wanted signal mean power (dBm) | OTA interfering signal mean power (dBm) | OTA interfering signal centre frequency offset  from the lower/upper *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap* (MHz) | Type of OTA interfering signal |
| FR2-1 | 50, 100, 200, 400 | EISREFSENS + 6 dB | EISREFSENS\_50M + 33 + ΔFR2\_REFSENS | ±75 | 50 MHz DFT-s-OFDM NR signal,  60 kHz SCS, 64 RBs |
| FR2-2 | 100, 400, 800, 1600, 2000 | EISREFSENS + 6 dB | EISREFSENS\_50M + 33 + ΔFR2\_REFSENS | ±150 | 100 MHz DFT-s-OFDM NR signal,  120 kHz SCS, 64 RBs |
| NOTE: EISREFSENS and EISREFSENS\_50M are given in clause 10.3.3. | | | | | |

## 10.6 OTA out-of-band blocking

### 10.6.1 General

The OTA out-of-band blocking characteristics are a measure of the receiver unit ability to receive a wanted signal at the *RIB* at its assigned channel in the presence of an unwanted interferer.

### 10.6.2 Minimum requirement for *BS type 1-O*

#### 10.6.2.1 General minimum requirement

The requirement shall apply at the RIBwhen the AoA of the incident wave of the received signal and the interfering signal are from the same direction and are within the *minSENS RoAoA*.

The wanted signal applies to each supported polarization, under the assumption of *polarization match.* The interferer shall be *polarization matched* in-band and the polarization maintained for out-of-band frequencies.

For OTA wanted and OTA interfering signals provided at the RIB using the parameters in table 10.6.2.1-1, the following requirements shall be met:

- The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in clause 10.3.2 for each *BS channel bandwidth* and further specified in annex A.1.

For a *multi-band RIB*, the OTA out-of-band requirement shall apply for each supported *operating band*, with the exception that the in-band blocking frequency ranges of all supported *operating bands* according to clause 7.4.2.2 shall be excluded from the OTA out‑of‑band blocking requirement.

For *BS type 1-O* the OTA out-of-band blocking requirement apply from 30 MHz to FUL,low - ΔfOOB and from FUL,high + ΔfOOB up to 12750 MHz, including the downlink frequency range of the FDD *operating band* for BS supporting FDD. The ΔfOOB for *BS type 1-O* is defined in table 10.5.2.2-0.

Table 10.6.2.1-1: OTA out-of-band blocking performance requirement

|  |  |  |
| --- | --- | --- |
| Wanted signal mean power (dBm) | Interfering signal RMS field-strength (V/m) | Type of interfering Signal |
| EISminSENS + 6 dB  (Note 1) | 0.36 | CW carrier |
| NOTE 1: EISminSENS depends on the *channel bandwidth* as specified in clause 10.2.  NOTE 2: The RMS field-strength level in V/m is related to the interferer EIRP level at a distance described as , where EIRP is in W and r is in m; for example, 0.36 V/m is equivalent to 36 dBm at fixed distance of 30 m. | | |

#### 10.6.2.2 Co-location minimum requirement

This additional OTA out-of-band blocking requirement may be applied for the protection of BS receivers when NR, E‑UTRA BS, UTRA BS, CDMA BS or GSM/EDGE BS operating in a different frequency band are co-located with a BS.

The requirement is a co-location requirement. The interferer power levels are specified at the *co-location reference antenna* conducted input. The interfering signal power is specified per supported polarization.

The requirement is valid over the *minSENS RoAoA*.

For OTA wanted and OTA interfering signal provided at the RIB using the parameters in table 10.6.2.1-1, the following requirements shall be met:

- The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in clause 10.3.2 for each *BS channel bandwidth* and further specified in annex A.1.

For *BS type 1-O* the OTA blocking requirement for co-location with BS in other frequency bands is applied for all *operating bands* for which co-location protection is provided.

Table 10.6.2.2-1: OTA blocking requirement for co-location with BS in other frequency bands

| Frequency range of interfering signal | Wanted signal mean power (dBm) | Interfering signal mean power for WA BS (dBm) | Interfering signal mean power for MR BS (dBm) | Interfering signal mean power for LA BS (dBm) | Type of interfering signal |
| --- | --- | --- | --- | --- | --- |
| Frequency range of co-located downlink *operating band* | EISminSENS + 6 dB  (Note 1) | +46 | +38 | +24 | CW carrier |
| NOTE 1: EISminSENS depends on the BS class and on the *BS channel bandwidth*, see clause 10.2.  NOTE 2: The requirement does not apply when the interfering signal falls within any of the supported uplink *operating band(s)* or in ΔfOOB immediately outside any of the supported uplink *operating band(s)*. | | | | | |

### 10.6.3 Minimum requirement for *BS type 2-O*

#### 10.6.3.1 General minimum requirement

The requirement shall apply at the RIBwhen the AoA of the incident wave of the received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA*.

The wanted signal applies to each supported polarization, under the assumption of *polarization match*. The interferer shall be *polarization matched* in-band and the polarization maintained for out-of-band frequencies.

For *BS type 2-O* operating in FR2-1, the OTA out-of-band blocking requirement apply from 30 MHz to FUL,low – 1500 MHz and from FUL,high + 1500 MHz up to 2nd harmonic of the upper frequency edge of the *operating band*.

For *BS type 2-O* operating in FR2-2, the OTA out-of-band blocking requirement apply from 30 MHz to FUL,low – 3500 MHz and from FUL,high + 3500 MHz up to 2nd harmonic of the upper frequency edge of the *operating band*.

For OTA wanted and OTA interfering signals provided at the RIB using the parameters in table 10.6.3.1-1, the following requirements shall be met:

- The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in clause 10.3.3 for each *BS channel bandwidth* and further specified in annex A.1.

Table 10.6.3.1-1: OTA out-of-band blocking performance requirement

| *Frequency Range* | Frequency range of interfering signal  (MHz) | Wanted signal mean power  (dBm) | Interferer RMS field-strength  (V/m) | Type of interfering signal |
| --- | --- | --- | --- | --- |
| FR2-1 | 30 to 12750 | EISREFSENS + 6 dB | 0.36 | CW |
| 12750 to FUL,low – 1500 | EISREFSENS + 6 dB | 0.1 | CW |
| FUL,high + 1500 to 2nd harmonic of the upper frequency edge of the *operating band* | EISREFSENS + 6 dB | 0.1 | CW |
| FR2-2 | 30 to 12750 | EISREFSENS + 6 dB | 0.36 | CW |
| 12750 to FUL,low – 3500 | EISREFSENS + 6 dB | 0.1 | CW |
| FUL,high + 3500 to 2nd harmonic of the upper frequency edge of the *operating band* | EISREFSENS + 6 dB | 0.1 | CW |

## 10.7 OTA receiver spurious emissions

### 10.7.1 General

The OTA RX spurious emission is the power of the emissions radiated from the antenna array from a receiver unit.

The metric used to capture OTA receiver spurious emissions for *BS type 1-O* and *BS type 2-O* is *total radiated power* (TRP), with the requirement defined at the RIB.

### 10.7.2 Minimum requirement for *BS type 1-O*

For a BS operating in FDD, OTA RX spurious emissions requirement do not apply as they are superseded by the OTA TX spurious emissions requirement. This is due to the fact that TX and RX spurious emissions cannot be distinguished in OTA domain.

For a BS operating in TDD, the OTA RX spurious emissions requirement shall apply during the *transmitter OFF period* only.

For RX only *multi-band RIB*, the OTA RX spurious emissions requirements are subject to exclusion zones in each supported *operating band*.

The OTA RX spurious emissions requirement for *BS type 1-O* is that for each *basic limit* specified in table 10.7.2‑1*,* the power sum of emissions at the RIB shall not exceed limits specified as the *basic limit* + X, where X = 9 dB, unless stated differently in regional regulation.

Table 10.7.2-1: General BS receiver spurious emission basic limits for *BS type 1-O*

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | *Basic limit* (Note 4) | Measurement bandwidth | Notes |
| 30 MHz – 1 GHz | -36 dBm | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz |  | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the UL *operating band* in GHz | -30 dBm | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: Measurement bandwidths as in ITU-R SM.329 [2], s4.1.  NOTE 2: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1.  NOTE 3: This spurious frequency range applies only for *operating bands* for which the 5th harmonic of the upper frequency edge of the UL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: Additional limits may apply regionally.  NOTE 5: The frequency range from ΔfOBUE below the lowest frequency of the BS transmitter *operating band* to ΔfOBUE above the highest frequency of the BS transmitter *operating band* may be excluded from the requirement. ΔfOBUE is defined in clause 9.7.1. For *multi-band* *RIB*, the exclusion applies for all supported *operating bands*. | | | |

### 10.7.3 Minimum requirement for *BS type 2-O*

The OTA RX spurious emissions requirement shall apply during the *transmitter OFF period* only.

For the *BS type 2-O*, the power of any RX spurious emission shall not exceed the limits in table 10.7.3-1.

10.7.3-1: Radiated Rx spurious emission limits for *BS type 2-O*

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious  frequency range  (Note 4) | Limit (Note 5) | Measurement Bandwidth | Note |
| 30 MHz ↔ 1 GHz | -36 dBm | 100 kHz | Note 1 |
| 1 GHz ↔ 18 GHz | -30 dBm | 1 MHz | Note 1 |
| 18 GHz ↔ Fstep,1 | -20 dBm | 10 MHz | Note 2 |
| Fstep,1  ↔ Fstep,2 | -15 dBm | 10 MHz | Note 2 |
| Fstep,2 ↔ Fstep,3 | -10 dBm | 10 MHz | Note 2 |
| Fstep,4  ↔ Fstep,5 | -10 dBm | 10 MHz | Note 2 |
| Fstep,5  ↔ Fstep,6 | -15 dBm | 10 MHz | Note 2 |
| Fstep,6 ↔ 2nd harmonic of the upper frequency edge of the UL *operating band* | -20 dBm | 10 MHz | Note 2, Note 3 |
| NOTE 1: Bandwidth as in ITU-R SM.329 [2], s4.1.  NOTE 2: Limit and bandwidth as in ERC Recommendation 74-01 [19], Annex 2.  NOTE 3: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1.  NOTE 4: The step frequencies Fstep,X are defined in table 10.7.3-2.  NOTE 5: Additional limits may apply regionally. | | | |

Table 10.7.3-2: Step frequencies for defining the radiated Rx spurious emission limits for *BS type 2-O*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Operating band | Fstep,1 (GHz) | Fstep,2 (GHz) | Fstep,3 (GHz) | Fstep,4 (GHz) | Fstep,5 (GHz) | Fstep,6 (GHz) |
| n257 | 18 | 23.5 | 25 | 31 | 32.5 | 41.5 |
| n258 | 18 | 21 | 22.75 | 29 | 30.75 | 40.5 |
| n259 | 23.5 | 35.5 | 38 | 45 | 47.5 | 59.5 |
| n260 | 25 | 34 | 35.5 | 41.5 | 43 | 52 |
| n261 | 18 | 25.5 | 26.0 | 29.85 | 30.35 | 38.35 |
| n262 | 37.2 | 45.2 | 45.7 | 49.7 | 50.2 | 58.2 |
| n263 | 18 | 43 | 53.5 | 74.5 | 85 | 127 |

In addition to the requirements in Table 10.7.3-1, the requirement for protection of EESS for BS operating in frequency range 24.25 - 27.5 GHz in clause 9.7.5.3.3 may be applied.

## 10.8 OTA receiver intermodulation

### 10.8.1 General

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver unit to receive a wanted signal on its assigned channel frequency in the presence of two interfering signals which have a specific frequency relationship to the wanted signal. The requirement is defined as a *directional requirement* at the *RIB*.

### 10.8.2 Minimum requirement for *BS type 1-O*

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and:

- when the wanted signal is based on EISREFSENS: the AoA of the incident wave of a received signal and the interfering signal are within the *OTA REFSENS RoAoA.*

- when the wanted signal is based on EISminSENS: the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

The throughputshall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted signal at the assigned channel frequency and two interfering signals at the RIB with the conditions specified in tables 10.8.2-1 and 10.8.2-2 for intermodulation performance and in tables 10.8.2-3 and 10.8.2-4 for narrowband intermodulation performance.

The reference measurement channel for the wanted signal is identified in table 10.3.2-1, table 10.3.2-2 and table 10.3.2-3 for each *BS channel bandwidth* and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex D.

The subcarrier spacing for the modulated interfering signal shall be the same as the subcarrier spacing for the wanted signal, except for the case of wanted signal subcarrier spacing 60kHz and *BS channel bandwidth* <=20MHz, for which the subcarrier spacing of the interfering signal shall be 30kHz.

The receiver intermodulation requirement is applicable outside the *Base Station RF Bandwidth* or *Radio Bandwidth edges*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Radio Bandwidth edges*.

For a RIBs supporting operation in non-contiguous spectrum within any *operating band*, the narrowband intermodulation requirement shall apply in addition inside any *sub-block gap* in case the *sub-block gap* is at least as wide as the *BS channel bandwidth* of the NR interfering signal in tables 10.8.2-2 and 10.8.2-4. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For *multi-band RIBs*, the intermodulation requirement shall apply in addition inside any *Inter RF Bandwidth gap*, in case the gap size is at least twice as wide as the NR interfering signal centre frequency offset from the *Base Station RF Bandwidth edge*.

For *multi-band RIBs*, the narrowband intermodulation requirement shall apply in addition inside any *Inter RF Bandwidth gap* in case the gap size is at least as wide as the NR interfering signal in tables 10.8.2-2 and 10.8.2-4. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Table 10.8.2-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| BS class | Wanted Signal mean power (dBm) | Mean power of the interfering signals (dBm) | Type of interfering signals |
| Wide Area BS | EISREFSENS + 6 dB | -52 - ΔOTAREFSENS |  |
|  | EISminSENS + 6 dB | -52 - ΔminSENS |  |
| Medium Range | EISREFSENS + 6 dB | -47 - ΔOTAREFSENS | See Table 10.8.2-2 |
| BS | EISminSENS + 6 dB | -47 - ΔminSENS |  |
| Local Area BS | EISREFSENS + 6 dB | -44 - ΔOTAREFSENS |  |
|  | EISminSENS + 6 dB | -44 - ΔminSENS |  |
| NOTE 1: EISREFSENS and EISminSENS depend on the BS class and on the *BS channel bandwidth*, see clause 10.3 and 10.2. | | | |

Table 10.8.2-2: Interfering signals for intermodulation requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering signal centre frequency offset from the lower/upper *base station RF Bandwidth edge* (MHz) | Type of interfering signal (Note 3) |
| 5 | ±7.5 | CW |
|  | ±17.5 | 5 MHz DFT-s-OFDM NR signal (Note 1) |
| 10 | ±7.465 | CW |
|  | ±17.5 | 5 MHz DFT-s-OFDM NR signal (Note 1) |
| 15 | ±7.43 | CW |
|  | ±17.5 | 5 MHz DFT-s-OFDM NR signal (Note 1) |
| 20 | ±7.395 | CW |
|  | ±17.5 | 5 MHz DFT-s-OFDM NR signal (Note 1) |
| 25 | ±7.465 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 30 | ±7.43 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 35 | ±7.44 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 40 | ±7.45 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 45 | ±7.37 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 50 | ±7.35 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 60 | ±7.49 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 70 | ±7.42 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 80 | ±7.44 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 90 | ±7.46 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| 100 | ±7.48 | CW |
|  | ±25 | 20 MHz DFT-s-OFDM NR signal (Note 2) |
| NOTE 1: Number of RBs is 25 for 15 kHz subcarrier spacing and 10 for 30 kHz subcarrier spacing.  NOTE 2: Number of RBs is 100 for 15 kHz subcarrier spacing, 50 for 30 kHz subcarrier spacing and 24 for 60 kHz subcarrier spacing.  NOTE 3: The RBs shall be placed adjacent to the transmission bandwidth configuration edge which is closer to the *Base Station RF Bandwidth* edge. | | |

Table 10.8.2-3: Narrowband intermodulation performance requirement in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| BS class | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signals |
| Wide Area BS | EISREFSENS + 6 dB (Note 1) | -52 - ΔOTAREFSENS |  |
|  | EISminSENS + 6 dB (Note 1) | -52 - ΔminSENS |  |
| Medium Range BS | EISREFSENS + 6 dB (Note 1) | -47 - ΔOTAREFSENS | See Table 10.8.2-4 |
|  | EISminSENS + 6 dB (Note 1) | -47 - ΔminSENS |  |
| Local Area BS | EISREFSENS + 6 dB (Note 1) | -44 - ΔOTAREFSENS |  |
|  | EISminSENS + 6 dB (Note 1) | -44 - ΔminSENS |  |
| NOTE 1: EISREFSENS / EISminSENS depends on the *BS* *channel bandwidth*, see clause 10.3 and 10.2. | | | |

Table 10.8.2-4: Interfering signals for narrowband intermodulation requirement in FR1

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering RB centre frequency offset from the lower/upper *Base Station RF Bandwidth edge* or *sub-block* edge inside a *sub-block gap* (kHz) (Note 3) | Type of interfering signal |
| 5 | ±360 | CW |
|  | ±1420 | 5 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 10 | ±370 | CW |
|  | ±1960 | 5 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 15 (NOTE 2) | ±380 | CW |
|  | ±1960 | 5 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 20 (NOTE 2) | ±390 | CW |
|  | ±2320 | 5 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 25 (NOTE 2) | ±325 | CW |
|  | ±2350 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 30 (NOTE 2) | ±335 | CW |
|  | ±2350 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 35 (NOTE 2) | ±345 | CW |
|  | ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 40 (NOTE 2) | ±355 | CW |
|  | ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 45 (NOTE 2) | ±365 | CW |
|  | ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 50 (NOTE 2) | ±375 | CW |
|  | ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 60 (NOTE 2) | ±395 | CW |
|  | ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 70 (NOTE 2) | ±415 | CW |
|  | ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 80 (NOTE 2) | ±435 | CW |
|  | ±2710 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 90 (NOTE 2) | ±365 | CW |
|  | ±2530 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| 100 (NOTE 2) | ±385 | CW |
|  | ±2530 | 20 MHz DFT-s-OFDM NR signal, 1 RB (NOTE 1) |
| NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the *BS channel bandwidth* of the interfering signal is located adjacently to the lower/upper *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*.  NOTE 2: This requirement shall apply only for a G-FRC mapped to the frequency range at the *channel edge* adjacent to the interfering signals.  NOTE 3: The centre of the interfering RB refers to the frequency location between the two central subcarriers. | | |

### 10.8.3 Minimum requirement for *BS type 2-O*

The requirement shall apply at the RIBwhen the AoA of the incident wave of the received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA.*

The wanted and interfering signals applies to each supported polarization, under the assumption of *polarization match.*

Throughputshall be ≥ 95% of the maximum throughput of the reference measurement channel, with OTA wanted signal at the assigned channel frequency and two OTA interfering signals provided at the RIB using the parameters in tables 10.8.3-1 and 10.8.3-2. All of the OTA test signals arrive from the same direction, and the requirement is valid if the signals arrive from any direction within the *OTA REFSENS RoAoA*. The reference measurement channel for the wanted signal is identified in table 10.3.3-1 for each *BS channel bandwidth* and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex D.

The subcarrier spacing for the modulated interfering signal shall be the same as the subcarrier spacing for the wanted signal except for FR2-2 with 800MHz, 1600MHz and 200MHz case.

The receiver intermodulation requirement is applicable outside the *Base Station RF Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges*.

Table 10.8.3-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signals |
| 50, 100, 200, 400 | EISREFSENS + 6 | EISREFSENS\_50M + 25 + ΔFR2\_REFSENS | See Table 10.8.3-2 |
| NOTE: EISREFSENS and EISREFSENS\_50M are given in clause 10.3.3. | | | |

Table 10.8.3-2: Interfering signals for intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| *Frequency Range* | *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Interfering signal centre frequency offset from the lower/upper *Base Station RF Bandwidth edge* (MHz) | Type of interfering signal |
|  | 50 | ±7.5 | CW |
| FR2-1 |  | ±40 | 50MHz DFT-s-OFDM NR signal  (Note 1) |
| 100 | ±6.88 | CW |
|  | ±40 | 50MHz DFT-s-OFDM NR signal  (Note 1) |
| 200 | ±5.64 | CW |
|  | ±40 | 50MHz DFT-s-OFDM NR signal  (Note 1) |
| 400 | ±6.02 | CW |
|  |  | ±45 | 50MHz DFT-s-OFDM NR signal  (Note 1) |
| FR2-2 | 100 | [±7.5] | CW |
| [±65] | 100MHz DFT-s-OFDM NR signal  (Note 2) |
| 400 | [±6.28] | CW |
| [±70] | 100MHz DFT-s-OFDM NR signal  (Note 2) |
| 800 | [±6.32] | CW |
| [±80] | [100MHz DFT-s-OFDM NR signal  (Note 2)] |
| 1600 | [±6.4] | CW |
| [±100] | [100MHz DFT-s-OFDM NR signal  (Note 2)] |
| 2000 | [±5.52] | CW |
| [±160] | [100MHz DFT-s-OFDM NR signal  (Note 2)] |
| NOTE 1: Number of RBs is 64 for the 60 kHz subcarrier spacing, 32 for the 120 kHz subcarrier spacing.  NOTE 2: Number of RBs is [64] with 120 kHz subcarrier spacing. | | | |

## 10.9 OTA in-channel selectivity

### 10.9.1 General

In-channel selectivity (ICS) is a measure of the receiver ability to receive a wanted signal at its assigned resource block locations in the presence of an interfering signal received at a larger power spectral density. In this condition a throughput requirement shall be met for a specified reference measurement channel. The interfering signal shall be an NR signal as specified in annex A.1 and shall be time aligned with the wanted signal.

### 10.9.2 Minimum requirement for *BS type 1-O*

The requirement shall apply at the RIBwhen the AoA of the incident wave of the received signal and the interfering signal are the same direction and are within the *minSENS RoAoA*

The wanted and interfering signals applies to each supported polarization, under the assumption of *polarization match.*

For a wanted and an interfering signal coupled to the RIB, the following requirements shall be met:

- For *BS type 1-O*, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in table 10.9.2-1 for Wide Area BS, in table 10.9.2-2 for Medium Range BS and in table 10.9.2-3 for Local Area BS. The characteristics of the interfering signal is further specified in annex D.

Table 10.9.2-1: Wide Area BS in-channel selectivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signal |
| 5 | 15 | G-FR1-A1-7 | -100.6-ΔminSENS | -81.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30, 35 | 15 | G-FR1-A1-1 | -98.7-ΔminSENS | -77.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 45, 50 | 15 | G-FR1-A1-4 | -92.3-ΔminSENS | -71.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| 5 | 30 | G-FR1-A1-8 | -101.3-ΔminSENS | -81.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  5 RBs |
| 10, 15, 20, 25, 30, 35 | 30 | G-FR1-A1-2 | -98.8-ΔminSENS | -78.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 40, 45, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -92.6-ΔminSENS | -71.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  50 RBs |
| 10, 15, 20, 25, 30, 35 | 60 | G-FR1-A1-9 | -98.2-ΔminSENS | -78.4 - ΔminSENS | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40, 45, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -92.7-ΔminSENS | -71.6 - ΔminSENS | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1 . The aggregated wanted and interferer signal shall be centred in the *BS channel bandwidth* of the wanted signal. | | | | | |

Table 10.9.2-2: Medium Range BS in-channel selectivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signal |
| 5 | 15 | G-FR1-A1-7 | -95.6-ΔminSENS | -76.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30, 35 | 15 | G-FR1-A1-1 | -93.7-ΔminSENS | -72.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 45, 50 | 15 | G-FR1-A1-4 | -87.3-ΔminSENS | -66.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| 5 | 30 | G-FR1-A1-8 | -96.3-ΔminSENS | -76.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  5 RBs |
| 10, 15, 20, 25, 30, 35 | 30 | G-FR1-A1-2 | -93.8-ΔminSENS | -73.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 40, 45, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -87.6-ΔminSENS | -66.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  50 RBs |
| 10, 15, 20, 25, 30, 35 | 60 | G-FR1-A1-9 | -93.2-ΔminSENS | -73.4 - ΔminSENS | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40, 45, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -87.7-ΔminSENS | -66.6 - ΔminSENS | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1. The aggregated wanted and interferer signal shall be centred in the *BS channel bandwidth* of the wanted signal. | | | | | |

Table 10.9.2-3: Local area BS in-channel selectivity

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signal |
| 5 | 15 | G-FR1-A1-7 | -92.6-ΔminSENS | -73.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30, 35 | 15 | G-FR1-A1-1 | -90.7-ΔminSENS | -69.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 45, 50 | 15 | G-FR1-A1-4 | -84.3-ΔminSENS | -63.4 - ΔminSENS | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| 5 | 30 | G-FR1-A1-8 | -93.3-ΔminSENS | -73.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  5 RBs |
| 10, 15, 20, 25, 30, 35 | 30 | G-FR1-A1-2 | -90.8-ΔminSENS | -70.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 40, 45, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 | -84.6-ΔminSENS | -63.4 - ΔminSENS | DFT-s-OFDM NR signal, 30 kHz SCS,  50 RBs |
| 10, 15, 20, 25, 30, 35 | 60 | G-FR1-A1-9 | -90.2-ΔminSENS | -70.4 - ΔminSENS | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40, 45, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 | -84.7-ΔminSENS | -63.6 - ΔminSENS | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| NOTE: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1. The aggregated wanted and interferer signal shall be centred in the *BS channel bandwidth* of the wanted signal. | | | | | |

### 10.9.3 Minimum requirement for *BS type 2-O*

The requirement shall apply at the RIBwhen the AoA of the incident wave of the received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA.*

The wanted and interfering signals applies to each supported polarization, under the assumption of *polarization match.*

For *BS type 2-O*, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in table 10.9.3-1. The characteristics of the interfering signal is further specified in annex D.

Table 10.9.3-1: OTA in-channel selectivity requirement for *BS type 2-O*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Frequency Range* | *BS channel bandwidth* (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm)  (Note 2) | Interfering signal mean power (dBm)  (Note 2) | Type of interfering signal |
| FR2-1 | 50 | 60 | G-FR2-A1-4 | EISREFSENS\_50M + ΔFR2\_REFSENS | EISREFSENS\_50M + 10 + ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 60 kHz SCS,  32 RB |
| 100,200 | 60 | G-FR2-A1-1 | EISREFSENS\_50M + 3+ ΔFR2\_REFSENS | EISREFSENS\_50M + 13 + ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 60 kHz SCS,  64 RB |
| 50 | 120 | G-FR2-A1-5 | EISREFSENS\_50M + ΔFR2\_REFSENS | EISREFSENS\_50M + 10 + ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 120 kHz SCS,  16 RB |
| 100,200,400 | 120 | G-FR2-A1-2 | EISREFSENS\_50M+ 3+ ΔFR2\_REFSENS | EISREFSENS\_50M + 13 + ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 120 kHz SCS,  32 RB |
| FR2-2 | 100,400 | 120 | G-FR2-A1-2 | EISREFSENS\_50M+ 3+ ΔFR2\_REFSENS | EISREFSENS\_50M + 13 + ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 120 kHz SCS,  32 RB |
| 400 | 480 | G-FR2-A1-8 | EISREFSENS\_50M+ 9+ ΔFR2\_REFSENS | EISREFSENS\_50M + 19+ ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 480 kHz SCS,  32 RB |
| 800, 1600 | 480 | G-FR2-A1-6 | EISREFSENS\_50M+ 12+ ΔFR2\_REFSENS | EISREFSENS\_50M + 22 + ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 480 kHz SCS,  64 RB |
| 400 | 960 | G-FR2-A1-9 | EISREFSENS\_50M+ 9+ ΔFR2\_REFSENS | EISREFSENS\_50M + 19+ ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 960 kHz SCS,  16 RB |
| 800, 1600, 2000 | 960 | G-FR2-A1-7 | EISREFSENS\_50M+ 12+ ΔFR2\_REFSENS | EISREFSENS\_50M + 22+ ΔFR2\_REFSENS | DFT-s-OFDM NR signal, 960 kHz SCS,  32 RB |
| NOTE 1: Wanted and interfering signal are placed adjacently around Fc, where the Fc is defined for *BS channel bandwidth* of the wanted signal according to the table 5.4.2.2-1. The aggregated wanted and interferer signal shall be centred in the *BS channel bandwidth* of the wanted signal.  NOTE 2: EISREFSENS\_50M is defined in clause 10.3.3. | | | | | | |

Table 10.9.3-2: (Void)

Table 10.9.3-3: (Void)

<Unchanged section omitted>

Annex A (normative):  
Reference measurement channels

# A.1 Fixed Reference Channels for reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation and in-channel selectivity (QPSK, R=1/3)

The parameters for the reference measurement channels are specified in table A.1-1 for FR1 reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation, in-channel selectivity, OTA sensitivity, OTA reference sensitivity level, OTA ACS, OTA in-band blocking, OTA out-of-band blocking, OTA receiver intermodulation and OTA in-channel selectivity. The parameters for the band n46 and n96 reference measurement channels are specified in table A.1-1a and A.1-1b for reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation, in-channel selectivity.

The parameters for the reference measurement channels are specified in table A.1-2 for FR2 OTA reference sensitivity level, OTA ACS, OTA in-band blocking, OTA out-of-band blocking, OTA receiver intermodulation and OTA in-channel selectivity.

Table A.1-1: FRC parameters for FR1 reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation, in-channel selectivity, OTA sensitivity, OTA reference sensitivity level, OTA ACS, OTA in-band blocking, OTA out-of-band blocking, OTA receiver intermodulation and OTA in-channel selectivity

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A1-1 | G-FR1-A1-2 | G-FR1-A1-3 | G-FR1-A1-4 | G-FR1-A1-5 | G-FR1-A1-6 | G-FR1-A1-7 | G-FR1-A1-8 | G-FR1-A1-9 | G-FR1-A1-10 | G-FR1-A1-11 |
| Subcarrier spacing (kHz) | 15 | 30 | 60 | 15 | 30 | 60 | 15 | 30 | 60 | 15 | 15 |
| Allocated resource blocks | 25 | 11 | 11 | 106 | 51 | 24 | 15 | 6 | 6 | 24 | 105 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 2152 | 984 | 984 | 9224 | 4352 | 2088 | 1320 | 528 | 528 | [2088] | [8968] |
| Transport block CRC (bits) | 16 | 16 | 16 | 24 | 24 | 16 | 16 | 16 | 16 | 16 | 24 |
| Code block CRC size (bits) | - | - | - | 24 | - | - | - | - | - | - | 24 |
| Number of code blocks - C | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Code block size including CRC (bits) (Note 3) | 2168 | 1000 | 1000 | 4648 | 4376 | 2104 | 1336 | 544 | 544 | [2104] | [4520] |
| Total number of bits per slot | 7200 | 3168 | 3168 | 30528 | 14688 | 6912 | 4320 | 1728 | 1728 | [6912] | [30240] |
| Total symbols per slot | 3600 | 1584 | 1584 | 15264 | 7344 | 3456 | 2160 | 864 | 864 | [3456] | [15120] |
| NOTE 1: *UL-DMRS-config-type* = 1 with *UL-DMRS-max-len* = 1, *UL-DMRS-add-pos* = 1 with = 2, = 11 as per table 6.4.1.1.3-3 of TS 38.211 [9].  NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity and in-channel selectivity  NOTE 3: Code block size including CRC (bits) equals to  in sub-clause 5.2.2 of TS 38.212 [15].NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity and in-channel selectivity  NOTE 3: Code block size including CRC (bits) equals to  in sub-clause 5.2.2 of TS 38.212 [15]. | | | | | | | | | | | |

Table A.1-1a: FRC parameters for band n46 and n96 reference sensitivity level, ACS, in-band blocking, out-of-band blocking, receiver intermodulation, in-channel selectivity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A1-12 | G-FR1-A1-13 | G-FR1-A1-14 | G-FR1-A1-15 | G-FR1-A1-16 | G-FR1-A1-17 | G-FR1-A1-18 | G-FR1-A1-19 |
| Channel bandwidth (MHz) | 10 | 10 | 20 | 20 | 40 | 40 | 60 | 80 |
| Subcarrier spacing (kHz) | 15 | 30 | 15 | 30 | 15 | 30 | 30 | 30 |
| Allocated resource blocks | 5 | 4 | 10 | 10 | 21 | 21 | 32 | 43 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 432 | 352 | 888 | 888 | 1864 | 1864 | 2792 | 3752 |
| Transport block CRC (bits) | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| Code block CRC size (bits) | - | - | - | - | - | - | - | - |
| Number of code blocks - C | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits) (Note 3) | 448 | 368 | 904 | 904 | 1880 | 1880 | 2808 | 3768 |
| Total number of bits per slot | 1440 | 1152 | 2880 | 2880 | 6048 | 6048 | 9216 | 12384 |
| Total symbols per slot | 720 | 576 | 1440 | 1440 | 3024 | 3024 | 4608 | 6192 |
| NOTE 1: *UL-DMRS-config-type* = 1 with *UL-DMRS-max-len* = 1, *UL-DMRS-add-pos* = 1 with = 2, = 11 as per table 6.4.1.1.3-3 of TS 38.211 [9].  NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity and in-channel selectivity  NOTE 3: Code block size including CRC (bits) equals to  in sub-clause 5.2.2 of TS 38.212 [15].  NOTE 4: For reference channel A1-12, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+10, N+20, N+30, N+40 where N={0,1,2,3,4,…,9}.  NOTE 5: For reference channel A1-13, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5, N+10, N+15 where N={0,1,2,3,4}.  NOTE 7: For reference channel A1-14, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+10,N+20,..N+90 where N={0,1,2,3,...,9}.  NOTE 8: For reference channel A1-15, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5,N+10,..,N+45 where N={0,1,2,3,4}.  NOTE 10: For reference channel A1-16, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+10,N+20,...,N+200 where N={0,1,2,3,4,...,9}.  NOTE 11: For reference channel A1-17, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5, N+10, ..., N+100 where N={0,1,2,3,4}.  NOTE 12: For reference channel A1-18, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5,N+10,...,N+155 where N={0,1,2,3,4}.  NOTE 13: For reference channel A1-19, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5,N+10,...,N+210 where N={0,1,2,3,4}. | | | | | | | | |

Table A.1-2: FRC parameters for FR2 OTA reference sensitivity level, OTA ACS, OTA in-band blocking, OTA out-of-band blocking, OTA receiver intermodulation and OTA in-channel selectivity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR2-A1-1 | G-FR2-A1-2 | G-FR2-A1-3 | G-FR2-A1-4 | G-FR2-A1-5 | G-FR2-A1-6 | G-FR2-A1-7 |
| Subcarrier spacing (kHz) | 60 | 120 | 120 | 60 | 120 | 480 | 960 |
| Allocated resource blocks | 66 | 32 | 66 | 33 | 16 | TBD  From Table 5.3.2-2; 400Hz channel | TBD  From Table 5.3.2-2; 400Hz channel |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 5632 | 2792 | 5632 | 2856 | 1416 | TBD | TBD |
| Transport block CRC (bits) | 24 | 16 | 24 | 16 | 16 | TBD | TBD |
| Code block CRC size (bits) | - | - | - | - | - | - | - |
| Number of code blocks - C | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits) (Note 3) | 5656 | 2808 | 5656 | 2872 | 1432 | TBD | TBD |
| Total number of bits per slot | 19008 | 9216 | 19008 | 9504 | 4608 | TBD | TBD |
| Total symbols per slot | 9504 | 4608 | 9504 | 4752 | 2304 | TBD | TBD |
| NOTE 1: DM-RS configuration type = 1 with DM-RS duration = single-symbol DM-RS, additional DM-RS position = pos1 with *l0* = 2, *l* = 11 as per table 6.4.1.1.3-3 of TS 38.211 [9].  NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size.  NOTE 3: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15]. | | | | | | | |

# A.2 Fixed Reference Channels for dynamic range (16QAM, R=2/3)

<End of changes>