**3GPP TSG-RAN WG4 Meeting #99-e *R4-2108722***

**Electronic Meeting, 19 – 27 May, 2021**

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

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|  |
| ***Title:***  | CR to 38.104: In-band blocking for multi-band Base Stations |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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 canbe 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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Multi-band support for MSR and LTE BS was introduced in 3GPP Rel-11 and the work is summarized in TR 37.812. Many RF requirements were impacted, including in-band blocking, where in order to minimize the impact of blocking between the bands, the in-band blocking is modified for multi-band capable BS to ensure that the blocking probability for each band is kept to a reasonably low level and does not increase proportionally with the added frequency range with multiple bands. For this reason, the allowed degradation for blocking signals in bands other than the band with the wanted signal is set at 1.4 dB instead of the usual 6 dB. When NR specifications were drafted inRel-15, multi-band support was included, but the in-band blocking requirement is drafted with a 6 dB degradation only, without the exception for multi-band operation with the blocking signal in the “other” band. |
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| ***Summary of change:*** | A note is introduced for multi-band operation, similar to the note used in 37‑series specs for MSR BS. |
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| ***Consequences if not approved:*** | The in-band blocking requirements would remain incorrect. |
|  |  |
| ***Clauses affected:*** | 7.4.2.2. 10.5.2.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  |  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.141-1, TS 38.141-2 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | R1: Note text updated to refer to adjacent operating bands. The single-band operation case is added. Updates to requirements for BS type 1-O is added. |

### 7.4.2 In-band blocking

#### 7.4.2.1 General

The in-band blocking characteristics is a measure of the receiver’s ability to receive a wanted signal at its assigned channel at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* in the presence of an unwanted interferer, which is an NR signal for general blocking or an NR signal with one resource block for narrowband blocking.

#### 7.4.2.2 Minimum requirement for *BS type 1-C* and *BS type 1-H*

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *BS type 1-C* *antenna connector* or *BS type 1‑H* *TAB connector* using the parameters in tables 7.4.2.2-1, 7.4.2.2-2 and 7.4.2.2-3 for general blocking and narrowband blocking requirements. The reference measurement channel for the wanted signal is identified in clause 7.2.2 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 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.

The in-band blocking requirement shall apply from FUL,low - ΔfOOB to FUL,high + ΔfOOB, excluding the downlink frequency range of the FDD *operating band*. The ΔfOOB for *BS type 1-C* and *BS type 1-H* is defined in table 7.4.2.2-0.

Minimum conducted requirement is defined at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H.*

Table 7.4.2.2-0: ΔfOOB offset for NR *operating bands*

|  |  |  |
| --- | --- | --- |
| BS type | *Operating band* characteristics | ΔfOOB (MHz) |
| *BS type 1-C* | FUL,high – FUL,low ≤ 200 MHz | 20 |
| 200 MHz < FUL,high – FUL,low ≤ 900 MHz | 60 |
| *BS type 1-H* | FUL,high – FUL,low < 100 MHz | 20 |
| 100 MHz ≤ FUL,high – FUL,low ≤ 900 MHz  | 60 |

For a BS operating in *non-contiguous spectrum* within any *operating band*, the 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 tables 7.4.2.2-1. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For a *multi-band connector*, the 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 7.4.2.2-1.

For a BS operating in *non-contiguous spectrum* within any *operating band*, the narrowband blocking requirement shall apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the *channel bandwidth* of the NR interfering signal in Table 7.4.2.2-3. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For a *multi-band connector*, the narrowband blocking 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 7.4.2.2-3. The interfering signal offset is defined relative to the *Base Station RF Bandwidth* edges inside the *Inter RF Bandwidth gap*.

Table 7.4.2.2-1: Base station general blocking requirement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm) (Note 2) | 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 |
| 5, 10, 15, 20 | PREFSENS + x dB | Wide Area BS: -43Medium Range BS: -38Local Area BS: -35 | ±7.5 | 5 MHz DFT-s-OFDM NR signal15 kHz SCS, 25 RBs |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | PREFSENS + x dB | Wide Area BS: -43Medium Range BS: -38Local Area BS: -35 | ±30 | 20 MHz DFT-s-OFDM NR signal15 kHz SCS, 100 RBs |
| NOTE 1: PREFSENS depends on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3.NOTE 2: 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 7.4.2.2-2: Base Station narrowband blocking requirement

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* of the *lowest/highest carrier* received (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80,90, 100 (Note 1) | PREFSENS + 6 dB | Wide Area BS: -49Medium Range BS: -44Local Area BS: -41 |
| NOTE 1: The SCS for the *lowest/highest carrier* received is the lowest SCS supported by the BS for that *BS channel bandwidth*NOTE 2: PREFSENS depends on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3. NOTE 3: 7.5 kHz shift is not applied to the wanted signal. |

Table 7.4.2.2-3: Base Station narrowband blocking interferer frequency offsets

|  |  |  |
| --- | --- | --- |
| *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 |
| 40 | ±(565+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 positioned at the stated offset, the *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: The centre of the interfering RB refers to the frequency location between the two central subcarriers. |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*End of change\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Next changed section\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 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 |
| 5, 10, 15, 20 | EISREFSENS + x dB | Wide Area BS: -43 - ΔOTAREFSENSMedium Range BS: -38 - ΔOTAREFSENSLocal Area BS: -35 - ΔOTAREFSENS | ±7.5 | 5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 25 RBs |
| EISminSENS + x dB | Wide Area BS: -43 – ΔminSENSMedium Range BS: -38 – ΔminSENSLocal Area BS: -35 – ΔminSENS | ±7.5 |
| 25 ,30, 40, 50, 60, 70, 80, 90, 100 | EISREFSENS + x dB | Wide Area BS: -43 - ΔOTAREFSENSMedium Range BS: -38 - ΔOTAREFSENSLocal Area BS: -35 - ΔOTAREFSENS | ±30 | 20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| EISminSENS + x dB | Wide Area BS: -43 – ΔminSENSMedium Range BS: -38 – ΔminSENSLocal Area BS: -35 – ΔminSENS | ±30 |
| 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 - ΔOTAREFSENSMedium Range BS: -44 - ΔOTAREFSENSLocal Area BS: -41 - ΔOTAREFSENS |
| EISminSENS + 6 dB | Wide Area BS: -49 – ΔminSENSMedium Range BS: -44 – ΔminSENSLocal Area BS: -41 – ΔminSENS |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | EISREFSENS + 6 dB | Wide Area BS: -49 - ΔOTAREFSENSMedium Range BS: -44 - ΔOTAREFSENSLocal Area BS: -41 - ΔOTAREFSENS |
| EISminSENS + 6 dB | Wide Area BS: -49 – ΔminSENSMedium Range BS: -44 – ΔminSENSLocal 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 |
| 40 | ±(565 + 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. |