**3GPP TSG-RAN WG4 Meeting #96-e R4-2012608**

**Electronic meeting, 17 – 28 August 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.104** | **CR** | **0225** | **rev** | **1** | **Current version:** | **16.4.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | CR to TS 38.104: Introduction of NR-U into BS core specification | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_unlic-Core | | | | |  | ***Date:*** | | | 2020-08-07 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This is running Big CR with introduction of NR-U requirements to BS core specification TS 38.104. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduction of NR-U requirements.  Following changes were made compare to big CR after RAN4#95e meeting (R4-2008762):   * Latest version of specification (v16.4.0) is used * Inclusion of values for Rx requirements: Reference sensitivity, Dynamic range, In-channel sensitivity according as captured in R4-2008694 * Introduction of the requirements for a 6 GHz band for NR-U (band n96)   .  Following changes are introduced in the revision of R4-2010738:   * Text added in subclause 7.4.1.2 * New table added 7.4.1.2-1a * Removal of modification of table 7.4.1.2-2 and instead new table added 7.4.1.2-2a * Removal of modification of table 7.7.2-2 and instead new table added 7.7.2-2a * Note 4 added in table 7.5.3-1. * Update of PratedC,AC in OBUE mask to Prated,x * Correction of tables 6.6.4.2.4A-3 and 6.6.4.2.4A-4 for punctured mask with f\_offset changed to f\_BE\_offset in basic limits formulas and 2nd column with Frequency offset of measurmeent filter center frequency, * For band n96 only LA BS defined * NF of 11dB for MR BS and 14dB for LA BS used for respective Rx requirements * Added Note to table Table 5.2-1 that band n96: This band is applicable in the USA only subject to FCC Report and Order [FCC 20-51]. * Channel raster points and sync raster points updated | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Lack of NR-U feature requirements in specification. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.5, 5.2, 5.3.2, 5.3.5, 5.4.2.3, 5.4.3.3, 6.2.1, 6.3.3.1, 6.6.3.2, 6.6.4.2, 6.6.5.2.3, 6.6.5.2.4, 7.2.2, 7.3.2, 7.4.1.2, 7.4.2.2, 7.5.2, 7.5.3, 7.7.2, 7.8.2, Annex A.1, Annex A.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **N** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **Y** |  | Test specifications | | | | TS 38.141-1 | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | This is revision of R4-2010738. | | | | | | | | |

**<<< Start of Changes >>>**

## 4.5 Regional requirements

Some requirements in the present document may only apply in certain regions either as optional requirements, or as mandatory requirements set by local and regional regulation. It is normally not stated in the 3GPP specifications under what exact circumstances the regional requirements apply, since this is defined by local or regional regulation.

Table 4.5-1 lists all requirements in the present specification that may be applied differently in different regions.

Table 4.5-1: List of regional requirements

| Clause number | Requirement | Comments |
| --- | --- | --- |
| 5.2 | *Operating bands* | Some NR *operating bands* may be applied regionally. |
| 6.2.4 | Base station output power:  Additional requirements | These requirements may be applied regionally as additional base station output power requirements.  For operation with shared spectrum channel access, the BS may have to comply with the applicable BS power limits established regionally, when deployed in regions where those limits apply and under the conditions declared by the manufacturer. |
| 6.6.2,  9.7.2 | Occupied bandwidth,  OTA occupied bandwidth | The requirement may be applied regionally. There may also be regional requirements to declare the occupied bandwidth according to the definition in present specification. |
| 6.6.4.2,  9.7.4.2 | Operating band unwanted emission,  OTA operating band unwanted emissions | Category A or Category B operating band unwanted emissions limits may be applied regionally.  In addition, for operation with shared spectrum channel access, the BS may have to comply with the applicable operating band unwanted emission limits established regionally, when deployed in regions where those limits apply and under the conditions declared by the manufacturer. |
| 6.6.4.2.5.1,  9.7.4.2.1.2 | Operating band unwanted emission,  OTA operating band unwanted emissions:  Limits in FCC Title 47 | The BS may have to comply with the additional requirements, when deployed in regions where those limits are applied, and under the conditions declared by the manufacturer. |
| 6.6.4.2.5.2,  9.7.4.2.1.1 | Operating band unwanted emission,  OTA operating band unwanted emissions  Protection of DTT | The BS operating in Band n20 may have to comply with the additional requirements for protection of DTT, when deployed in certain regions. |
| 6.6.5.2.1,  9.7.5.2 | Tx spurious emissions,  OTA Tx spurious emissions | Category A or Category B spurious emission limits, as defined in ITU-R Recommendation SM.329 [2], may apply regionally.  The emission limits for *BS type 1-H* and *BS type 1-O* specified as the *basic limit* + X (dB) are applicable, unless stated differently in regional regulation.  In addition, for operation with shared spectrum channel access, the BS may have to comply with the applicable spurious emission limits established regionally, when deployed in regions where those limits apply and under the conditions declared by the manufacturer. |
| 6.6.5.2.3,  9.7.5.3.3 | Tx spurious emissions: additional requirements,  OTA Tx spurious emissions: additional requirements | These requirements may be applied for the protection of system operating in frequency ranges other than the BS *operating band*. |
| 6.7.2.1.1,  6.7.3.1.1  9.8.2 | Transmitter intermodulation,  OTA transmitter intermodulation | Interfering signal positions that are partially or completely outside of any downlink *operating band* of the base station are not excluded from the requirement in Japan in Band n77, n78, n79. |
| 7.6.4,  10.7.2  10.7.3 | Rx spurious emissions,  OTA Rx spurious emissions | The emission limits for BS type 1-H and BS type 1-O specified as the basic limit + X (dB) are applicable, unless stated differently in regional regulation.  Additional limits for BS type 2-O may apply regionally. |

**<<< Unchanged sections omitted >>>**

# 5 *Operating bands* and channel arrangement

## 5.1 General

The channel arrangements presented in this clause are based on the *operating bands* and *BS channel bandwidths* defined in the present release of specifications.

NOTE: Other *operating bands* and *BS channel bandwidth*s may be considered in future releases.

Requirements throughout the RF specifications are in many cases defined separately for different frequency ranges (FR). The frequency ranges in which NR can operate according to the present version of the specification are identified as described in table 5.1-1.

Table 5.1-1: Definition of frequency ranges

|  |  |
| --- | --- |
| Frequency range designation | Corresponding frequency range |
| FR1 | 410 MHz – 7125 MHz |
| FR2 | 24250 MHz – 52600 MHz |

## 5.2 *Operating bands*

NR is designed to operate in the *operating bands* defined in table 5.2-1 and 5.2-2.

NB-IoT is designed to operate in the NR operating bands n1, n2, n3, n5, n7, n8, n12, n14, n18, n20, n25, n28, n41, n65, n66, n70, n71, n74, n90 which are defined in Table 5.2-1.

Table 5.2-1: NR *operating bands* in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n2 | 1850 MHz – 1910 MHz | 1930 MHz – 1990 MHz | FDD |
| n3 | 1710 MHz – 1785 MHz | 1805 MHz – 1880 MHz | FDD |
| n5 | 824 MHz – 849 MHz | 869 MHz – 894 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n8 | 880 MHz – 915 MHz | 925 MHz – 960 MHz | FDD |
| n12 | 699 MHz – 716 MHz | 729 MHz – 746 MHz | FDD |
| n14 | 788 MHz – 798 MHz | 758 MHz – 768 MHz | FDD |
| n18 | 815 MHz – 830 MHz | 860 MHz – 875 MHz | FDD |
| n20 | 832 MHz – 862 MHz | 791 MHz – 821 MHz | FDD |
| n25 | 1850 MHz – 1915 MHz | 1930 MHz – 1995 MHz | FDD |
| n26 | 814 MHz – 849 MHz | 859 MHz – 894 MHz | FDD |
| n28 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |
| n29 | N/A | 717 MHz – 728 MHz | SDL |
| n30 | 2305 MHz – 2315 MHz | 2350 MHz – 2360 MHz | FDD |
| n34 | 2010 MHz – 2025 MHz | 2010 MHz – 2025 MHz | TDD |
| n38 | 2570 MHz – 2620 MHz | 2570 MHz – 2620 MHz | TDD |
| n39 | 1880 MHz – 1920 MHz | 1880 MHz – 1920 MHz | TDD |
| n40 | 2300 MHz – 2400 MHz | 2300 MHz – 2400 MHz | TDD |
| n41 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 MHz | TDD |
| n46 | 5150 MHz – 5925 MHz | 5150 MHz – 5925 MHz | TDD3 |
| n48 | 3550 MHz – 3700 MHz | 3550 MHz – 3700 MHz | TDD |
| n50 | 1432 MHz – 1517 MHz | 1432 MHz – 1517 MHz | TDD |
| n51 | 1427 MHz – 1432 MHz | 1427 MHz – 1432 MHz | TDD |
| n53 | 2483.5 MHz – 2495 MHz | 2483.5 MHz – 2495 MHz | TDD |
| n65 | 1920 MHz – 2010 MHz | 2110 MHz – 2200 MHz | FDD |
| n66 | 1710 MHz – 1780 MHz | 2110 MHz – 2200 MHz | FDD |
| n70 | 1695 MHz – 1710 MHz | 1995 MHz – 2020 MHz | FDD |
| n71 | 663 MHz – 698 MHz | 617 MHz – 652 MHz | FDD |
| n74 | 1427 MHz – 1470 MHz | 1475 MHz – 1518 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL |
| n76 | N/A | 1427 MHz – 1432 MHz | SDL |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |
| n80 | 1710 MHz – 1785 MHz | N/A | SUL |
| n81 | 880 MHz – 915 MHz | N/A | SUL |
| n82 | 832 MHz – 862 MHz | N/A | SUL |
| n83 | 703 MHz – 748 MHz | N/A | SUL |
| n84 | 1920 MHz – 1980 MHz | N/A | SUL |
| n86 | 1710 MHz – 1780 MHz | N/A | SUL |
| n89 | 824 MHz – 849 MHz | N/A | SUL |
| n90 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 MHz | TDD |
| n91 | 832 MHz – 862 MHz | 1427 MHz – 1432 MHz | FDD2 |
| n92 | 832 MHz – 862 MHz | 1432 MHz – 1517 MHz | FDD2 |
| n93 | 880 MHz – 915 MHz | 1427 MHz – 1432 MHz | FDD2 |
| n94 | 880 MHz – 915 MHz | 1432 MHz – 1517 MHz | FDD2 |
| n951 | 2010 MHz – 2025 MHz | N/A | SUL |
| n964 | 5925 MHz – 7125 MHz | 5925 MHz – 7125 MHz | TDD3 |
| NOTE 1: This band is applicable in China only.  NOTE 2: Variable duplex operation does not enable dynamic variable duplex configuration by the network, and is used such that DL and UL frequency ranges are supported independently in any valid frequency range for the band.  NOTE 3: This band is restricted to operation with shared spectrum channel access as defined in [37.213].  NOTE 4: This band is applicable in the USA only subject to FCC Report and Order [FCC 20-51] | | | |

Table 5.2-2: NR *operating bands* in FR2

|  |  |  |
| --- | --- | --- |
| NR *operating band* | Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive  FUL,low – FUL,high  FDL,low – FDL,high | Duplex mode |
| n257 | 26500 MHz – 29500 MHz | TDD |
| n258 | 24250 MHz – 27500 MHz | TDD |
| n259 | 39500 MHz – 43500 MHz | TDD |
| n260 | 37000 MHz – 40000 MHz | TDD |
| n261 | 27500 MHz – 28350 MHz | TDD |

## 5.3 *BS channel bandwidth*

### 5.3.1 General

The *BS channel bandwidth* supports a single NR RF carrier in the uplink or downlink at the Base Station. Different *UE channel bandwidths* may be supported within the same spectrum for transmitting to and receiving from UEs connected to the BS. The placement of the *UE channel bandwidth* is flexible but can only be completely within the *BS channel bandwidth*. The BS shall be able to transmit to and/or receive from one or more UE bandwidth parts that are smaller than or equal to the number of carrier resource blocks on the RF carrier, in any part of the carrier resource blocks.

The relationship between the channel bandwidth, the guardband and the *transmission bandwidth configuration* is shown in figure 5.3.1-1.

.

Figure 5.3.1-1: Definition of channel bandwidth and *transmission bandwidth configuration* for one NR channel

### 5.3.2 *Transmission bandwidth configuration*

The *transmission bandwidth configuration* NRB for each *BS channel bandwidth* and subcarrier spacing is specified in table 5.3.2.-1 for FR1 and table 5.3.2-2 for FR2.

Table 5.3.2-1: *Transmission bandwidth configuration* NRB for FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS (kHz) | 5  MHz | 10  MHz | 15  MHz | 20 MHz | 25 MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70  MHz | 80 MHz | 90  MHz | 100 MHz |
| NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB |
| 15 | 25 | 52 | 79 | 106 | 133 | 160 | 216 | 270 | N/A | N/A | N/A | N/A | N/A |
| 30 | 11 | 24 | 38 | 51 | 65 | 78 | 106 | 133 | 162 | 189 | 217 | 245 | 273 |
| 60 | N/A | 11 | 18 | 241 | 31 | 38 | 51 | 65 | 79 | 93 | 107 | 121 | 135 |
| NOTE: For operation with shared spectrum channel access NRB = TBD | | | | | | | | | | | | | |

Table 5.3.2-2: *Transmission bandwidth configuration* NRB for FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCS (kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| NRB | NRB | NRB | NRB |
| 60 | 66 | 132 | 264 | N/A |
| 120 | 32 | 66 | 132 | 264 |

NOTE: All Tx and Rx requirements are defined based on *transmission bandwidth configuration* specified in table 5.3.2-1 for FR1 and table 5.3.2-2 for FR2.

The transmission bandwidth configuration for NB-IoT is specified in TS 36.104 [13] clause 5.6.

### 5.3.3 Minimum guardband and *transmission bandwidth configuration*

The minimum guardband for each *BS channel bandwidth* and SCS is specified in table 5.3.3-1 for FR1 and in table 5.3.3-2 for FR2.

Table 5.3.3-1: Minimum guardband (kHz) (FR1)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS (kHz) | 5 MHz | 10 MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40  MHz | 50  MHz | 60  MHz | 70  MHz | 80  MHz | 90  MHz | 100  MHz |
| 15 | 242.5 | 312.5 | 382.5 | 452.5 | 522.5 | 592.5 | 552.5 | 692.5 | N/A | N/A | N/A | N/A | N/A |
| 30 | 505 | 665 | 645 | 805 | 785 | 945 | 905 | 1045 | 825 | 965 | 925 | 885 | 845 |
| 60 | N/A | 1010 | 990 | 1330 | 1310 | 1290 | 1610 | 1570 | 1530 | 1490 | 1450 | 1410 | 1370 |

Table: 5.3.3-2: Minimum guardband (kHz) (FR2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCS (kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| 60 | 1210 | 2450 | 4930 | N/A |
| 120 | 1900 | 2420 | 4900 | 9860 |

The minimum guardband of SCS 240 kHz SS/PBCH block for each *BS channel bandwidth* is specified in table 5.3.3-3 for FR2.

Table: 5.3.3-3: Minimum guardband (kHz) of SCS 240 kHz SS/PBCH block (FR2)

|  |  |  |  |
| --- | --- | --- | --- |
| SCS (kHz) | 100 MHz | 200 MHz | 400 MHz |
| 240 | 3800 | 7720 | 15560 |

NOTE: The minimum guardband in Table 5.3.3-3 is applicable only when the SCS 240 kHz SS/PBCH block is placed adjacent to the edge of the *BS channel bandwidth* within which the SS/PBCH block is located.

The number of RBs configured in any *BS channel bandwidth* shall ensure that the minimum guardband specified in this clause is met.

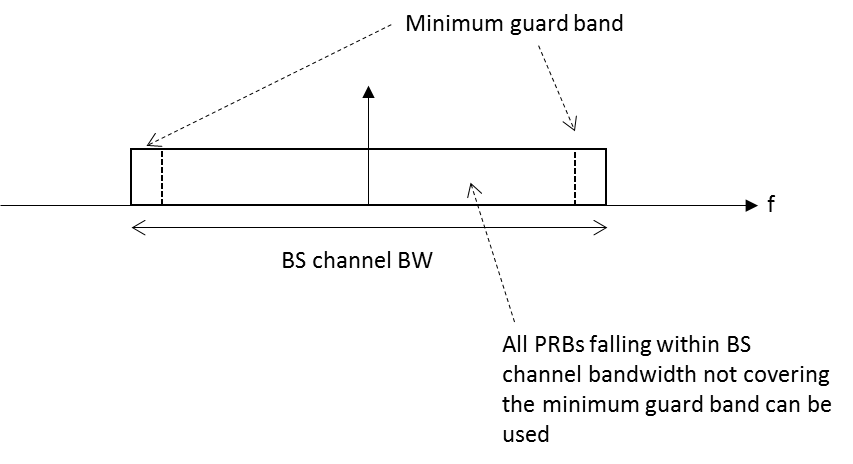


Figure 5.3.3-1: BS PRB utilization

In the case that multiple numerologies are multiplexed in the same symbol, the minimum guardband on each side of the carrier is the guardband applied at the configured *BS channel bandwidth* for the numerology that is transmitted/received immediately adjacent to the guard band.

For FR1, if multiple numerologies are multiplexed in the same symbol and the *BS channel bandwidth* is >50 MHz, the guardband applied adjacent to 15 kHz SCS shall be the same as the guardband defined for 30 kHz SCS for the same *BS channel bandwidth*.

For FR2, if multiple numerologies are multiplexed in the same symbol and the *BS channel bandwidth* is >200 MHz, the guardband applied adjacent to 60 kHz SCS shall be the same as the guardband defined for 120 kHz SCS for the same *BS channel bandwidth*.

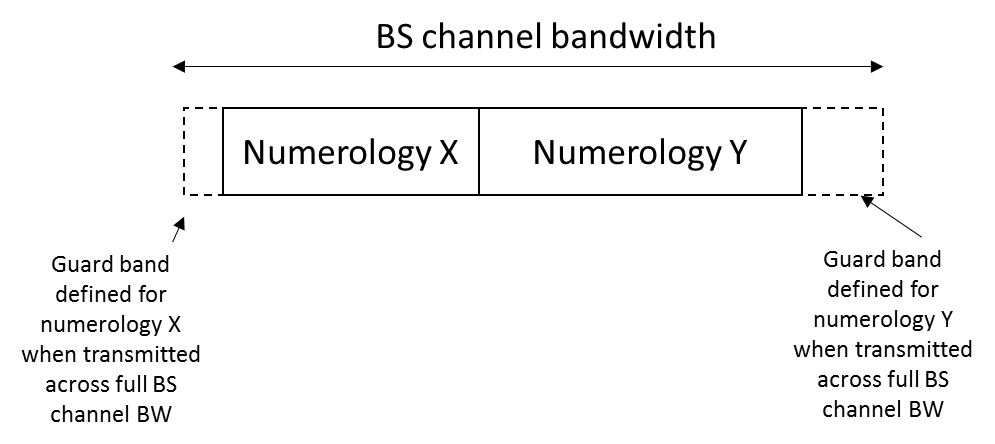


Figure 5.3.3-2: Guard band definition when transmitting multiple numerologies

NOTE: Figure 5.3.3-2 is not intended to imply the size of any guard between the two numerologies. Inter-numerology guard band within the carrier is implementation dependent.

Figure 5.3.3-3: Void

Figure 5.3.3-4: Void

Figure 5.3.3-5: Void

### 5.3.4 RB alignment

For each *BS channel bandwidth* and each numerology, *BS transmission bandwidth configuration* must fulfil the minimum guardband requirement specified in clause 5.3.3.

For each numerology, its common resource blocks are specified in clause 4.4.4.3 in [9], and the starting point of its *transmission bandwidth configuration* on the common resource block grid for a given channel bandwidth is indicated by an offset to “Reference point A” in the unit of the numerology.

For each numerology, all *UE transmission bandwidth configurations* indicated to UEs served by the BS by higher layer parameter *carrierBandwidth* defined in TS 38.331 [11] shall fall within the *BS transmission bandwidth configuration*.

### 5.3.5 *BS channel bandwidth* per *operating band*

The requirements in this specification apply to the combination of *BS channel bandwidths*, SCS and *operating bands* shown in table 5.3.5-1 for FR1 and in table 5.3.5-2 for FR2. The *transmission bandwidth configuration* in table 5.3.2-1 and table 5.3.2-2 shall be supported for each of the *BS channel bandwidths* within the BS capability. The *BS channel bandwidths* are specified for both the Tx and Rx path.

Table 5.3.5-1: *BS channel bandwidths* and SCS per *operating band* in FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR band / SCS / *BS channel bandwidth* | | | | | | | | | | | | | | | | | | | | | | | | |
| NR Band | SCS  kHz | 5 MHz | | 10 MHz | | 15 MHz | 20 MHz | 25 MHz | | 30 MHz | | 40 MHz | | 50 MHz | | 60 MHz | | 70 MHz | | 80 MHz | | 90 MHz | | 100 MHz |
| n1 | 15 | Yes | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| n2 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n3 | 15 | Yes | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| n5 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n7 | 15 | Yes | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| n8 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n12 | 15 | Yes | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n14 | 15 | Yes | | Yes | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n18 | 15 | Yes | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n20 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n25 | 15 | Yes | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| n26 | 15 | Yes | Yes | | Yes | | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | Yes | | Yes | | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n28 | 15 | Yes | | Yes | | Yes | Yes |  | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n29 | 15 | Yes | | Yes | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n30 | 15 | Yes | | Yes | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n34 | 15 | Yes | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n38 | 15 | Yes | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| n39 | 15 | Yes | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| n40 | 15 | Yes4 | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | | Yes | |  | | Yes | |  | | Yes |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | | Yes | |  | | Yes | |  | | Yes |
| n41 | 15 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes |
| 60 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes |
| n46 | 15 |  | | Yes6 | |  | Yes |  | |  | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes6 | |  | Yes |  | |  | | Yes | |  | | Yes | |  | | Yes | |  | |  |
| 60 |  | | Yes6 | |  | Yes |  | |  | | Yes | |  | | Yes | |  | | Yes | |  | |  |
| n48 | 15 | Yes2 | | Yes | | Yes | Yes |  | |  | | Yes | | Yes1 | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | | Yes | | Yes1 | | Yes1 | |  | | Yes1 | | Yes1 | | Yes1 |
| 60 |  | | Yes | | Yes | Yes |  | |  | | Yes | | Yes1 | | Yes1 | |  | | Yes1 | | Yes1 | | Yes1 |
| n50 | 15 | Yes2 | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | | Yes | |  | | Yes | |  | |  |
| 60 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | | Yes | |  | | Yes | |  | |  |
| n51 | 15 | Yes | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n53 | 15 | Yes | Yes | |  | |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | Yes | |  | |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | Yes | |  | |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n65 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | | Yes | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes |  | |  | |  | | Yes | |  | |  | |  | |  | |  |
| n66 | 15 | Yes | Yes | | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | Yes | | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| 60 |  | Yes | | | Yes | Yes | Yes | | Yes | | Yes | |  | |  | |  | |  | |  | |  |
| n70 | 15 | Yes | | Yes | | Yes | Yes | Yes | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | |  | |  | |  | |  | |  | |  | |  | |  |
| n71 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n74 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n75 | 15 | Yes | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| n76 | 15 | Yes | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n77 | 15 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes |
| n78 | 15 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes |
| n79 | 15 |  | |  | |  |  |  | |  | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | |  | |  |  |  | |  | | Yes | | Yes | | Yes | |  | | Yes | |  | | Yes |
| 60 |  | |  | |  |  |  | |  | | Yes | | Yes | | Yes | |  | | Yes | |  | | Yes |
| n80 | 15 | Yes | | Yes | | Yes | Yes | Yes | | Yes | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes | Yes | | Yes | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes | Yes | | Yes | |  | |  | |  | |  | |  | |  | |  |
| n81 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n82 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n83 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n84 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n86 | 15 | Yes | | Yes | | Yes | Yes |  | |  | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | | Yes | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes | Yes |  | |  | | Yes | |  | |  | |  | |  | |  | |  |
| n89 | 15 | Yes | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n90 | 15 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes |
| 60 |  | | Yes | | Yes | Yes |  | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | | Yes |
| n91 | 15 | Yes | | Yes3 | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | |  | |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n92 | 15 | Yes | | Yes | | Yes | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |
| 30 |  | | Yes | | Yes | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |
| 60 |  | |  | |  |  |  |  | |  | |  | |  | |  | |  | |  | |  | |
| n93 | 15 | Yes | | Yes3 | |  |  |  |  | |  | |  | |  | |  | |  | |  | |  | |
| 30 |  | |  | |  |  |  |  | |  | |  | |  | |  | |  | |  | |  | |
| 60 |  | |  | |  |  |  |  | |  | |  | |  | |  | |  | |  | |  | |
| n94 | 15 | Yes | | Yes | | Yes | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |
| 30 |  | | Yes | | Yes | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |
| 60 |  | |  | |  |  |  |  | |  | |  | |  | |  | |  | |  | |  | |
| n95 | 15 | Yes | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 30 |  | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| 60 |  | | Yes | | Yes |  |  | |  | |  | |  | |  | |  | |  | |  | |  |
| n96 | 15 |  | |  | |  | Yes |  | |  | | Yes | |  | |  | |  | |  | |  | |  |
| 30 |  | |  | |  | Yes |  | |  | | Yes | |  | | Yes | |  | | Yes | |  | |  |
| 60 |  | |  | |  | Yes |  | |  | | Yes | |  | | Yes | |  | | Yes | |  | |  |
| NOTE 1: For this bandwidth, the minimum requirements are restricted to operation when carrier is configured as an downlink SCell part of CA configuration  NOTE 2: For this bandwidth, the minimum requirements are restricted to operation when carrier is configured as an SCell part of DC or CA configuration  NOTE 3: For this bandwidth, it only applies for UL transmission.  NOTE 4: For this bandwidth, the minimum requirements are restricted to operation when carrier is configured as an SCell part of DC or CA configuration.  NOTE 5: Void.  NOTE 6: This bandwidth can only be applied in certain regions where the absence of non 3GPP technologies can be guaranteed on a long term basis in this version of specification. | | | | | | | | | | | | | | | | | | | | | | | | |

Table 5.3.5-2: *BS channel bandwidths* and SCS per *operating band* in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band / SCS / *BS channel bandwidth* | | | | | |
| NR Band | SCS  kHz | 50 MHz | 100 MHz | 200  MHz | 400 MHz |
| n257 | 60 | Yes | Yes | Yes |  |
| 120 | Yes | Yes | Yes | Yes |
| n258 | 60 | Yes | Yes | Yes |  |
| 120 | Yes | Yes | Yes | Yes |
| n259 | 60 | Yes | Yes | Yes |  |
| 120 | Yes | Yes | Yes | Yes |
| n260 | 60 | Yes | Yes | Yes |  |
| 120 | Yes | Yes | Yes | Yes |
| n261 | 60 | Yes | Yes | Yes |  |
| 120 | Yes | Yes | Yes | Yes |

**<<< Unchanged sections omitted >>>**

### 5.4.2 Channel raster

#### 5.4.2.1 NR-ARFCN and channel raster

The global frequency raster defines a set of *RF reference frequencies* FREF. The *RF reference frequency* is used in signalling to identify the position of RF channels, SS blocks and other elements. The global frequency raster is defined for all frequencies from 0 to 100 GHz. The granularity of the global frequency raster is ΔFGlobal.

*RF reference frequencies* are designated by an NR Absolute Radio Frequency Channel Number (NR-ARFCN) in the range [0…3279165] on the global frequency raster. The relation between the NR-ARFCN and the *RF reference frequency* FREF in MHz is given by the following equation, where FREF-Offs and NRef-Offs are given in table 5.4.2.1-1 and NREF is the NR-ARFCN.

FREF = FREF-Offs + ΔFGlobal (NREF – NREF-Offs)

Table 5.4.2.1-1: NR-ARFCN parameters for the global frequency raster

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Range of frequencies (MHz) | ΔFGlobal (kHz) | FREF-Offs (MHz) | NREF-Offs | Range of NREF |
| 0 – 3000 | 5 | 0 | 0 | 0 – 599999 |
| 3000 – 24250 | 15 | 3000 | 600000 | 600000 – 2016666 |
| 24250 – 100000 | 60 | 24250.08 | 2016667 | 2016667 – 3279165 |

The *channel raster* defines a subset of *RF reference frequencies* that can be used to identify the RF channel position in the uplink and downlink. The *RF reference frequency* for an RF channel maps to a resource element on the carrier. For each *operating band*, a subset of frequencies from the global frequency raster are applicable for that band and forms a channel raster with a granularity ΔFRaster, which may be equal to or larger than ΔFGlobal.

For SUL bands, except n95 and for the uplink of all FDD bands defined in table 5.2-1 and for TDD band n90,

FREF,shift = FREF + Δshift, where Δshift = 0 kHz or 7.5 kHz

where Δshift is signalled by the network in higher layer parameter *frequencyShift7p5khz* as defined in TS 38.331 [11].

The mapping between the *channel raster* and corresponding resource element is given in clause 5.4.2.2. The applicable entries for each *operating band* are defined in clause 5.4.2.3.

#### 5.4.2.1A NB-IoT carrier frequency numbering

The NB-IoT carrier frequency numbering (EARFCN) is defined in clause 5.7 of TS 36.104 [4].

#### 5.4.2.2 Channel raster to resource element mapping

The mapping between the *RF reference frequency* on the channel raster and the corresponding resource element is given in table 5.4.2.2-1 and can be used to identify the RF channel position. The mapping depends on the total number of RBs that are allocated in the channel and applies to both UL and DL. The mapping must apply to at least one numerology supported by the BS.

Table 5.4.2.2-1: Channel Raster to Resource Element Mapping

|  |  |  |
| --- | --- | --- |
|  |  |  |
| Resource element index | 0 | 6 |
| Physical resource block number |  |  |

k,  and NRB are as defined in TS 38.211 [9].

#### 5.4.2.3 Channel raster entries for each *operating band*

The RF channel positions on the channel raster in each NR *operating band* are given through the applicable NR-ARFCN in table 5.4.2.3-1 for FR1 and table 5.4.2.3-2 for FR2, using the channel raster to resource element mapping in clause 5.4.2.2.

- For NR *operating bands* with 100 kHz channel raster, ΔFRaster = 20 × ΔFGlobal. In this case, every 20th NR-ARFCN within the *operating band* are applicable for the channel raster within the *operating band* and the step size for the channel raster in table 5.4.2.3-1 is given as <20>.

- For NR *operating bands* with 15 kHz channel raster below 3 GHz, ΔFRaster = *I* × ΔFGlobal, where *I* ϵ {3,6}. In this case, every *Ith* NR‑ARFCN within the *operating band* are applicable for the channel raster within the *operating band* and the step size for the channel raster in table 5.4.2.3-1 is given as <*I*>.

- For NR *operating bands* with 15 kHz and 60 kHz channel raster above 3 GHz, ΔFRaster = *I* ×ΔFGlobal, where *I* ϵ {1, 2}. In this case, every *Ith* NR‑ARFCN within the *operating band* are applicable for the channel raster within the *operating band* and the step size for the channel raster in table 5.4.2.3-1 and table 5.4.2.3-2 is given as <*I*>.

- For frequency bands with two ΔFRaster in FR1, the higher ΔFRaster applies to channels using only the SCS that is equal to or larger than the higher ΔFRaster and SSB SCS is equal to the higher ΔFRaster.

- For frequency bands with two ΔFRaster in FR2, the higher ΔFRaster applies to channels using only the SCS that is equal to the higher ΔFRaster and the SSB SCS that is equal to or larger than the higher ΔFRaster.

Table 5.4.2.3-1: Applicable NR-ARFCN per *operating band* in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | ΔFRaster  (kHz) | Uplink  range of NREF  (First – <Step size> – Last) | Downlink  range of NREF  (First – <Step size> – Last) |
| n1 | 100 | 384000 – <20> – 396000 | 422000 – <20> – 434000 |
| n2 | 100 | 370000 – <20> – 382000 | 386000 – <20> – 398000 |
| n3 | 100 | 342000 – <20> – 357000 | 361000 – <20> – 376000 |
| n5 | 100 | 164800 – <20> – 169800 | 173800 – <20> – 178800 |
| n7 | 100 | 500000 – <20> – 514000 | 524000 – <20> – 538000 |
| n8 | 100 | 176000 – <20> – 183000 | 185000 – <20> – 192000 |
| n12 | 100 | 139800 – <20> – 143200 | 145800 – <20> – 149200 |
| n14 | 100 | 157600 – <20> –159600 | 151600 – <20> – 153600 |
| n18 | 100 | 163000 – <20> – 166000 | 172000 – <20> – 175000 |
| n20 | 100 | 166400 – <20> – 172400 | 158200 – <20> – 164200 |
| n25 | 100 | 370000 – <20> – 383000 | 386000 – <20> – 399000 |
| n26 | 100 | 162800 – <20> – 169800 | 171800 – <20> – 178800 |
| n28 | 100 | 140600 – <20> – 149600 | 151600 – <20> – 160600 |
| n29 | 100 | N/A | 143400 – <20> – 145600 |
| n30 | 100 | 461000 – <20> – 463000 | 470000 – <20> – 472000 |
| n34 | 100 | 402000 – <20> – 405000 | 402000 – <20> – 405000 |
| n38 | 100 | 514000 – <20> – 524000 | 514000 – <20> – 524000 |
| n39 | 100 | 376000 – <20> – 384000 | 376000 – <20> – 384000 |
| n40 | 100 | 460000 – <20> – 480000 | 460000 – <20> – 480000 |
| n41 | 15 | 499200 – <3> – 537999 | 499200 – <3> – 537999 |
| 30 | 499200 – <6> – 537996 | 499200 – <6> – 537996 |
| n461 | 15 | 744000 – <1> – 794333 | 744000 – <1> – 794333 |
| n48 | 15 | 636667 – <1> – 646666 | 636667 – <1> – 646666 |
| 30 | 636668 – <2> – 646666 | 636668 – <2> – 646666 |
| n50 | 100 | 286400 – <20> – 303400 | 286400 – <20> – 303400 |
| n51 | 100 | 285400 – <20> – 286400 | 285400 – <20> – 286400 |
| n53 | 100 | 496700 – <20> – 499000 | 496700 – <20> – 499000 |
| n65 | 100 | 384000 – <20> – 402000 | 422000 – <20> – 440000 |
| n66 | 100 | 342000 – <20> – 356000 | 422000 – <20> – 440000 |
| n70 | 100 | 339000 – <20> – 342000 | 399000 – <20> – 404000 |
| n71 | 100 | 132600 – <20> – 139600 | 123400 – <20> – 130400 |
| n74 | 100 | 285400 – <20> – 294000 | 295000 – <20> – 303600 |
| n75 | 100 | N/A | 286400 – <20> – 303400 |
| n76 | 100 | N/A | 285400 – <20> – 286400 |
| n77 | 15 | 620000 – <1> – 680000 | 620000 – <1> – 680000 |
| 30 | 620000 – <2> – 680000 | 620000 – <2> – 680000 |
| n78 | 15 | 620000 – <1> – 653333 | 620000 – <1> – 653333 |
| 30 | 620000 – <2> – 653332 | 620000 – <2> – 653332 |
| n79 | 15 | 693334 – <1> – 733333 | 693334 – <1> – 733333 |
| 30 | 693334 – <2> – 733332 | 693334 – <2> – 733332 |
| n80 | 100 | 342000 – <20> – 357000 | N/A |
| n81 | 100 | 176000 – <20> – 183000 | N/A |
| n82 | 100 | 166400 – <20> – 172400 | N/A |
| n83 | 100 | 140600 – <20> –149600 | N/A |
| n84 | 100 | 384000 – <20> – 396000 | N/A |
| n86 | 100 | 342000 – <20> – 356000 | N/A |
| n89 | 100 | 164800 – <20> – 169800 | N/A |
| n90 | 15 | 499200 – <3> – 537999 | 499200 – <3> – 537999 |
| 30 | 499200 – <6> – 537996 | 499200 – <6> – 537996 |
| 100 | 499200 – <20> – 538000 | 499200 – <20> – 538000 |
| n91 | 100 | 166400 – <20> – 172400 | 285400 – <20> – 286400 |
| n92 | 100 | 166400 – <20> – 172400 | 286400 – <20> – 303400 |
| n93 | 100 | 176000 – <20> – 183000 | 285400 – <20> – 286400 |
| n94 | 100 | 176000 – <20> – 183000 | 286400 – <20> – 303400 |
| n95 | 100 | 402000 – <20> – 405000 | N/A |
| n962 | 15 | 795000 – <1> – 875000 | 795000 – <1> – 875000 |
| NOTE 1: Applicable NR-ARFCN for band n46  for 10 MHz channel bandwidth, NREF = {782000, 788668}  for 20 MHz channel bandwidth, NREF = {744000, 745332, 746668, 748000, 749332, 750668, 752000, 753332, 754668, 756000, 765332, 766668, 768000, 769332, 770668, 772000, 773332, 774668, 776000, 777332, 778668, 780000, 781332, 783000, 784332, 785668, 787000, 788332, 789668, 791000, 792332, 793668};  for 40 MHz channel bandwidth, NREF = {744668, 746000, 748668, 751332, 754000, 755332, 766000, 767332, 770000, 772668, 775332, 778000, 780668, 783668, 786332, 787668, 790332, 793000};  for 60 MHz channel bandwidth, NREF = {745332, 746668, 748000, 752000, 753332, 754668, 766668, 768000, 769332, 773332, 774668, 778668, 780000, 784332, 785668, 787000, 791000, 792332};  for 80 MHz channel bandwidth, NREF = {746000, 747332, 752668, 754000, 767332, 768668, 774000, 779332, 785000, 786332, 791668}  NOTE 2: Applicable NR-ARFCN for band n96  for 20 MHz channel bandwidth, NREF = {795668, 797000, 798332, 799668, 801000, 802332, 803668, 805000, 806332, 807668, 809000, 810332, 811668, 813000, 814332, 815668, 817000, 818332, 819668, 821000, 822332, 823668, 825000, 826332, 827668, 829000, 830332, 831668, 833000, 834332, 835668, 837000, 838332, 839668, 841000, 842332, 843668, 845000, 846332, 847668, 849000, 850332, 851668, 853000, 854332, 855668, 857000, 858332, 859668, 861000, 862332, 863668, 865000, 866332, 867668, 869000, 870332, 871668, 873000, 874332}  for 40 MHz channel bandwidth, NREF = {797668, 800332, 803000, 805668, 808332, 811000, 813668, 816332, 819000, 821668, 824332, 827000, 829668, 832332, 835000, 837668, 840332, 843000, 845668, 848332, 851000, 853668, 856332, 859000, 861668, 864332, 867000, 869668, 872332}  for 60 MHz channel bandwidth, NREF = {798332, 799668, 803668, 805000, 809000, 810332, 814332, 815668, 819668, 821000, 825000, 826332, 830332, 831668, 835668, 837000, 841000, 842332, 846332, 847668, 851668, 853000, 857000, 858332, 862332, 863668, 867668, 869000}  for 80 MHz channel bandwidth, NREF = {799000, 804332, 809668, 815000, 820332, 825668, 831000, 836332, 841668, 847000, 852332, 857668, 863000, 868332} | | | |

Table 5.4.2.3-2: Applicable NR-ARFCN per *operating band* in FR2

|  |  |  |
| --- | --- | --- |
| NR *operating band* | ΔFRaster  (kHz) | Uplink and Downlink  range of NREF  (First – <Step size> – Last) |
| n257 | 60 | 2054166 – <1> – 2104165 |
| 120 | 2054167 – <2> – 2104165 |
| n258 | 60 | 2016667 – <1> – 2070832 |
| 120 | 2016667 – <2> – 2070831 |
| n259 | 60 | 2270832 – <1> – 2337499 |
| 120 | 2270832– <2> – 2337499 |
| n260 | 60 | 2229166 – <1> – 2279165 |
| 120 | 2229167 – <2> – 2279165 |
| n261 | 60 | 2070833 – <1> – 2084999 |
| 120 | 2070833 – <2> – 2084999 |

### 5.4.3 Synchronization raster

#### 5.4.3.1 Synchronization raster and numbering

The synchronization raster indicates the frequency positions of the synchronization block that can be used by the UE for system acquisition when explicit signalling of the synchronization block position is not present.

A global synchronization raster is defined for all frequencies. The frequency position of the SS block is defined as SSREF with corresponding number GSCN. The parameters defining the SSREF and GSCN for all the frequency ranges are in table 5.4.3.1-1.

The resource element corresponding to the SS block reference frequency SSREF is given in clause 5.4.3.2. The synchronization raster and the subcarrier spacing of the synchronization block is defined separately for each band.

Table 5.4.3.1-1: GSCN parameters for the global frequency raster

|  |  |  |  |
| --- | --- | --- | --- |
| Range of frequencies (MHz) | SS block frequency position SSREF | GSCN | Range of GSCN |
| 0 – 3000 | N \* 1200 kHz + M \* 50 kHz,  N = 1:2499, M ϵ {1,3,5} (Note) | 3N + (M-3)/2 | 2 – 7498 |
| 3000 – 24250 | 3000 MHz + N \* 1.44 MHz,  N = 0:14756 | 7499 + N | 7499 – 22255 |
| 24250 – 100000 | 24250.08 MHz + N \* 17.28 MHz,  N = 0:4383 | 22256 + N | 22256 – 26639 |
| NOTE: The default value for *operating bands* which only support SCS spaced channel raster(s) is M=3. | | | |

5.4.3.2 Synchronization raster to synchronization block resource element mapping

The mapping between the synchronization raster and the corresponding resource element of the SS block is given in table 5.4.3.2-1.

**Table 5.4.3.2-1: Synchronization Raster to SS block Resource Element Mapping**

|  |  |
| --- | --- |
| Resource element index k | 120 |
|  |  |

*k* is the subcarrier number of SS/PBCH block defined in TS 38.211 clause 7.4.3.1 [9].

#### 5.4.3.3 Synchronization raster entries for each operating band

The synchronization raster for each band is give in table 5.4.3.3-1. The distance between applicable GSCN entries is given by the <Step size> indicated in table 5.4.3.3-1 for FR1 and table 5.4.3.3-2 for FR2.

Table 5.4.3.3-1: Applicable SS raster entries per *operating band* (FR1)

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | SS Block SCS | SS Block pattern (note) | Range of GSCN  (First – <Step size> – Last) |
| n1 | 15 kHz | Case A | 5279 – <1> – 5419 |
| n2 | 15 kHz | Case A | 4829 – <1> – 4969 |
| n3 | 15 kHz | Case A | 4517 – <1> – 4693 |
| n5 | 15 kHz | Case A | 2177 – <1> – 2230 |
| 30 kHz | Case B | 2183 – <1> – 2224 |
| n7 | 15 kHz | Case A | 6554 – <1> – 6718 |
| n8 | 15 kHz | Case A | 2318 – <1> – 2395 |
| n12 | 15 kHz | Case A | 1828 – <1> – 1858 |
| n14 | 15 kHz | Case A | 1901 – <1> – 1915 |
| n18 | 15kHz | CaseA | 2156 – <1> – 2182 |
| n20 | 15 kHz | Case A | 1982 – <1> – 2047 |
| n25 | 15 kHz | Case A | 4829 – <1> – 4981 |
| n26 | 15 kHz | Case A | 2153 – <1> – 2230 |
| n28 | 15 kHz | Case A | 1901 – <1> – 2002 |
| n29 | 15 kHz | Case A | 1798 – <1> – 1813 |
| n30 | 15 kHz | Case A | 5879 – <1> – 5893 |
| n34 | 15 kHz | Case A | 5030 – <1> – 5056 |
| n38 | 15 kHz | Case A | NOTE 2 |
| 30 kHz | Case C | 6437 – <1> – 6538 |
| n39 | 15 kHz | Case A | 4706 – <1> – 4795 |
| n40 | 30 kHz | Case C | 5762 – <1> – 5989 |
| n41 | 15 kHz | Case A | 6246 – <3> – 6717 |
| 30 kHz | Case C | 6252 – <3> – 6714 |
| n463 | 30 kHz | Case C | 8993 – <1> – 9530 |
| n48 | 30 kHz | Case C | 7884 – <1> – 7982 |
| n50 | 30 kHz | Case C | 3590 – <1> – 3781 |
| n51 | 15 kHz | Case A | 3572 – <1> – 3574 |
| n53 | 15 kHz | Case A | 6215 – <1> – 6232 |
| n65 | 15 kHz | Case A | 5279 – <1> – 5494 |
| n66 | 15 kHz | Case A | 5279 – <1> – 5494 |
| 30 kHz | Case B | 5285 – <1> – 5488 |
| n70 | 15 kHz | Case A | 4993 – <1> – 5044 |
| n71 | 15 kHz | Case A | 1547 – <1> – 1624 |
| n74 | 15 kHz | Case A | 3692 – <1> – 3790 |
| n75 | 15 kHz | Case A | 3584 – <1> – 3787 |
| n76 | 15 kHz | Case A | 3572 – <1> – 3574 |
| n77 | 30 kHz | Case C | 7711 – <1> – 8329 |
| n78 | 30 kHz | Case C | 7711 – <1> – 8051 |
| n79 | 30 kHz | Case C | 8480 – <16> – 8880 |
| n90 | 15 kHz | Case A | 6246 – <1> – 6717 |
| 30 kHz | Case C | 6252 – <1> – 6714 |
| n91 | 15 kHz | Case A | 3572 – <1> – 3574 |
| n92 | 15 kHz | Case A | 3584 – <1> – 3787 |
| n93 | 15 kHz | Case A | 3572 – <1> – 3574 |
| n94 | 15 kHz | Case A | 3584 – <1> – 3787 |
| n96**4** | 30 kHz | Case C | 9531 – <1> – 9877 |
| NOTE 1: SS Block pattern is defined in clause 4.1 in TS 38.213 [10].  NOTE 2: The applicable SS raster entries are GSCN = {6432, 6443, 6457, 6468, 6479, 6493, 6507, 6518, 6532, 6543}  NOTE 3: The following GSCN are allowed for operation in band n46:  {GSCN = 8996, 9010, 9024, 9038, 9051, 9065, 9079, 9093, 9107, 9121, 9218, 9232, 9246, 9260, 9274, 9288, 9301, 9315, 9329, 9343, 9357, 9371, 9385, 9402, 9416, 9430, 9444, 9458, 9472, 9485, 9499, 9513}.  NOTE 4: The following GSCN are allowed for operation in band n96:  GSCN = 9548, 9562, 9576, 9590, 9603, 9617, 9631, 9645, 9659, 9673, 9687, 9701, 9715, 9728, 9742, 9756, 9770, 9784, 9798, 9812, 9826, 9840, 9853, 9867, 9881, 9895, 9909, 9923, 9937, 9951, 9965, 9978, 9992, 10006, 10020, 10034, 10048, 10062, 10076, 10090, 10103, 10117, 10131, 10145, 10159, 10173, 10187, 10201, 10215, 10228, 10242, 10256, 10270, 10284, 10298, 10312, 10326, 10340, 10353 | | | |

Table 5.4.3.3-2: Applicable SS raster entries per *operating band* (FR2)

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | SS Block SCS | SS Block pattern (note) | Range of GSCN  (First – <Step size> – Last) |
| n257 | 120 kHz | Case D | 22388 – <1> – 22558 |
| 240 kHz | Case E | 22390 – <2> – 22556 |
| n258 | 120 kHz | Case D | 22257 – <1> – 22443 |
| 240 kHz | Case E | 22258 – <2> – 22442 |
| n259 | 120 kHz | Case D | 23140 – <1> – 23369 |
| 240 kHz | Case E | 23142 – <2> – 23368 |
| n260 | 120 kHz | Case D | 22995 – <1> – 23166 |
| 240 kHz | Case E | 22996 – <2> – 23164 |
| n261 | 120 kHz | Case D | 22446 – <1> – 22492 |
| 240 kHz | Case E | 22446 – <2> – 22490 |
| NOTE: SS Block pattern is defined in clause 4.1 in TS 38.213 [10]. | | | |

# 6 Conducted transmitter characteristics

## 6.1 General

Unless otherwise stated, the conducted transmitter characteristics are specified at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H*, with a full complement of transceiver units for the configuration in normal operating conditions.

For *BS type 1-H* the manufacturer shall declare the minimum number of supported geographical cells (i.e. geographical areas covered by beams). The minimum number of supported geographical cells (Ncells) relates to the BS setting with the minimum amount of cell splitting supported with transmission on all *TAB connectors* supporting the *operating band*, or with minimum amount of transmitted beams.

For *BS type 1-H* manufacturer shall also declare *TAB connector TX min cell groups*. Every *TAB connector* of the *BS type 1-H* supporting transmission in an *operating band* shall map to one *TAB connector* *TX min cell group* supporting the same *operating band*,where mapping of *TAB connector*s to cells/beams is implementation dependent.

The number of *active transmitter units* that are considered when calculating the conducted TX emissions limits (NTXU,counted) for *BS type 1-H* is calculated as follows:

NTXU,counted = *min(NTXU,active , 8×Ncells)*

NTXU,countedpercell is used for scaling of *basic limits* and is derived as NTXU,countedpercell = NTXU,counted / Ncells

NOTE: NTXU,active depends on the actual number of *active transmitter unit*s and is independent to the declaration of Ncells.

## 6.2 Base station output power

### 6.2.1 General

The BS conducted output power requirement is at *antenna connector* for *BS type 1-C*, or at *TAB connector* for *BS type 1-H*.

The *rated carrier output power* of the *BS type 1-C* shall be as specified in table 6.2.1-1.

Table 6.2.1-1: *BS type 1-C* rated output power limits for BS classes

|  |  |
| --- | --- |
| BS class | Prated,c,AC |
| Wide Area BS | (Note) |
| Medium Range BS | ≤ 38 dBm |
| Local Area BS | ≤ 24 dBm |
| NOTE: There is no upper limit for the Prated,c,AC rated output power of the Wide Area Base Station. | |

The *rated carrier output power* of the *BS type 1-H* shall be as specified in table 6.2.1-2.

Table 6.2.1-2: *BS type 1-H* rated output power limits for BS classes

| BS class | Prated,c,sys | Prated,c,TABC |
| --- | --- | --- |
| Wide Area BS | (Note) | (Note) |
| Medium Range BS | ≤ 38 dBm +10log(NTXU,counted) | ≤ 38 dBm |
| Local Area BS | ≤ 24 dBm +10log(NTXU,counted) | ≤ 24 dBm |
| NOTE: There is no upper limit for the Prated,c,sys or Prated,c,TABC of the Wide Area Base Station. | | |

In addition, for operation with shared spectrum channel access operation, the BS may have to comply with the applicable BS power limits established regionally, when deployed in regions where those limits apply and under the conditions declared by the manufacturer.

### 6.2.2 Minimum requirement for *BS type 1-C*

In normal conditions, Pmax,c,AC shall remain within +2 dB and -2 dB of the *rated carrier output power* Prated,c,AC, declared by the manufacturer.

In extreme conditions, Pmax,c,AC shall remain within +2.5 dB and -2.5 dB of the *rated carrier output power* Prated,c,AC, declared by the manufacturer.

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

NOTE: For NB-IoT operation in NR in-band, the NR carrier and NB-IoT carrier shall be seen as a single carrier occupied NR channel bandwidth, the output power over this carrier is shared between NR and NB-IoT. This note shall apply for Pmax,c,AC andPrated,c,AC.

### 6.2.3 Minimum requirement for *BS type 1-H*

In normal conditions, Pmax,c,TABC shall remain within +2 dB and -2 dB of the *rated carrier output power* Prated,c,TABC for each *TAB connector* as declared by the manufacturer.

In extreme conditions, Pmax,c,TABC shall remain within +2.5 dB and -2.5 dB of the *rated carrier output power* Prated,c,TABC for each *TAB connector* as declared by the manufacturer.

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

### 6.2.4 Additional requirements (regional)

In certain regions, additional regional requirements may apply.

## 6.3 Output power dynamics

### 6.3.1 General

The requirements in clause 6.3 apply during the *transmitter ON period*. Transmitted signal quality (as specified in clause 6.5) shall be maintained for the output power dynamics requirements of this clause.

Power control is used to limit the interference level.

### 6.3.2 RE power control dynamic range

#### 6.3.2.1 General

The 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,AC or Pmax,c,TABC) for a specified reference condition.

For *BS type 1-C* this requirement shall apply at the *antenna connector* supporting transmission in the *operating band*.

For *BS type 1-H* this requirement shall apply at each *TAB connector* supporting transmission in the *operating band*.

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

RE power control dynamic range:

Table 6.3.2.2-1: RE power control dynamic range

|  |  |  |
| --- | --- | --- |
| Modulation scheme used on the RE | RE power control dynamic range (dB) | |
| (down) | (up) |
| QPSK (PDCCH) | -6 | +4 |
| QPSK (PDSCH) | -6 | +3 |
| 16QAM (PDSCH) | -3 | +3 |
| 64QAM (PDSCH) | 0 | 0 |
| 256QAM (PDSCH) | 0 | 0 |
| NOTE: The output power per carrier shall always be less or equal to the maximum output power of the base station. | | |

### 6.3.3 Total power dynamic range

#### 6.3.3.1 General

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

For *BS type 1-C* this requirement shall apply at the *antenna connector* supporting transmission in the *operating band*.

For *BS type 1-H* this requirement shall apply at each *TAB connector* supporting transmission in the *operating band*.

NOTE 1: The upper limit of the dynamic range is the OFDM symbol power for a BS when transmitting on all RBs at maximum output power. The lower limit of the total power dynamic range is the average power for single RB transmission. The OFDM symbol shall carry PDSCH and not contain RS or SSB.

NOTE 2: The requirement does not apply to operation with shared spectrum channel access.

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

The downlink (DL) total power dynamic range for each NR carrier shall be larger than or equal to the level in table 6.3.3.2-1.

Table 6.3.3.2-1: Total power dynamic range

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Total power dynamic range  (dB) | | |
| 15 kHz SCS | 30 kHz SCS | 60 kHz SCS |
| 5 | 13.9 | 10.4 | N/A |
| 10 | 17.1 | 13.8 | 10.4 |
| 15 | 18.9 | 15.7 | 12.5 |
| 20 | 20.2 | 17 | 13.8 |
| 25 | 21.2 | 18.1 | 14.9 |
| 30 | 22 | 18.9 | 15.7 |
| 40 | 23.3 | 20.2 | 17 |
| 50 | 24.3 | 21.2 | 18.1 |
| 60 | N/A | 22 | 18.9 |
| 70 | N/A | 22.7 | 19.6 |
| 80 | N/A | 23.3 | 20.2 |
| 90 | N/A | 23.8 | 20.8 |
| 100 | N/A | 24.3 | 21.3 |

**<<< Unchanged sections omitted >>>**

## 6.6 Unwanted emissions

### 6.6.1 General

Unwanted emissions consist of out-of-band emissions and spurious emissions according to ITU definitions [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 out-of-band emissions requirement for the BS transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and *operating band* unwanted emissions (OBUE).

The maximum offset of the *operating band* unwanted emissions mask from the *operating band* edge is ΔfOBUE. The 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. Unwanted emissions outside of this frequency range are limited by a spurious emissions requirement.

The values of ΔfOBUE are defined in table 6.6.1-1 for the NR *operating bands*.

Table 6.6.1-1: Maximum offset of OBUE outside the downlink *operating band*

|  |  |  |
| --- | --- | --- |
| BS type | *Operating band* characteristics | ΔfOBUE (MHz) |
| *BS type 1-H* | FDL,high – FDL,low < 100 MHz | 10 |
| 100 MHz ≤ FDL,high – FDL,low ≤ [1200] MHz [Note 1] | 40 |
| *BS type 1-C* | FDL,high – FDL,low ≤ 200 MHz | 10 |
| 200 MHz < FDL,high – FDL,low ≤ [1200] MHz [Note 1] | 40 |
| Note 1: For band n96 maximum offset of OBUE is TBD. | | |

For *BS type 1-H* the unwanted emission requirements are applied per the *TAB connector TX min cell groups* for all the configurations supported by the BS. The *basic limits* and corresponding emissions scaling are defined in each relevant clause.

There is in addition a requirement for occupied bandwidth.

### 6.6.2 Occupied bandwidth

#### 6.6.2.1 General

The 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 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 occupied bandwidth according to the definition in the present clause.

For *BS type 1-C* this requirement shall be applied at the *antenna connector* supporting transmission in the *operating band*.

For *BS type 1-H* this requirement shall be appliedat each *TAB connector* supporting transmission in the *operating band.*

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

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

For NB.IoT operation in NR in-band, the occupied bandwidth for each NR carrier with NB-IoT shall be less than than the *BS channel bandwidth*.

### 6.6.3 Adjacent Channel Leakage Power Ratio

#### 6.6.3.1 General

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 requirements shall apply outside the *Base Station RF Bandwidth* or *Radio Bandwidth* whatever the type of transmitter considered (single carrier or multi-carrier) and for all transmission modes foreseen by the manufacturer’s specification.

The requirements shall also apply if the BS supports NB-IoT operation in NR in-band.

For a BS 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 connector*, 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.

The requirement shall apply during the *transmitter ON period*.

#### 6.6.3.2 Limits and *Basic limits*

The ACLR is defined with a square filter of bandwidth equal to the transmission bandwidth configuration of the transmitted signal (BWConfig) centred on the assigned channel frequency and a filter centred on the adjacent channel frequency according to the tables below.

For operation in paired and unpaired spectrum, the ACLR shall be higher than the value specified in table 6.6.3.2‑1.

Table 6.6.3.2-1: Base station 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 (informative) | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit |
| 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90,100 | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 45 dB |
| 2 x BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 45 dB |
| BWChannel /2 + 2.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 45 dB (Note 3) |
| BWChannel /2 + 7.5 MHz | 5 MHz E-UTRA | Square (4.5 MHz) | 45 dB (Note 3) |
| 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: The requirements are applicable when the band is also defined for E-UTRA or UTRA. | | | | |

For band n46 and n96, the ACLR shall be higher than the value specified in Table 6.6.3.2-1a.

**Table 6.6.3.2-1a: Base station ACLR limit for band n46 and n96**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***BS channel bandwidth* of lowest/highest NR 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 (informative)** | **Filter on the adjacent channel frequency and corresponding filter bandwidth** | **ACLR limit** |
| 10, 20, 40, 60, 80 | BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 35 dB |
| 2 x BWChannel | NR of same BW (Note 2) | Square (BWConfig) | 40 dB |
| NOTE 1: BWChannel and BWConfig are the *BS channel bandwidth* and transmission bandwidth configuration of the lowest/highest NR carrier transmitted on the assigned channel frequency.  NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig). | | | | |

The ACLR absolute *basic limit* is specified in table 6.6.3.2‑2.

Table 6.6.3.2-2: Base station ACLR absolute *basic limit*

|  |  |
| --- | --- |
| BS category / BS class | ACLR absolute *basic limit* |
| Category A Wide Area BS | -13 dBm/MHz |
| Category B Wide Area BS | -15 dBm/MHz |
| Medium Range BS | -25 dBm/MHz |
| Local Area BS | -32 dBm/MHz |

For operation in non-contiguous spectrum or multiple bands, the ACLR shall be higher than the value specified in Table 6.6.3.2‑2a.

Table 6.6.3.2-2a: Base Station ACLR limit in non-contiguous spectrum or multiple bands

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of *lowest/highest carrier* transmitted BWChannel (MHz) | Sub-block or Inter RF Bandwidth gap size (Wgap) where the limit applies (MHz) | BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | ACLR limit |
| 5, 10, 15, 20 | Wgap ≥ 15 (Note 3)  Wgap ≥ 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| Wgap ≥ 20 (Note 3)  Wgap ≥ 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | Wgap ≥ 60 (Note 4)  Wgap ≥ 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| Wgap ≥ 80 (Note 4)  Wgap ≥ 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| 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 in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz.  NOTE 4: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz. | | | | | |

For operation in non-contiguous spectrum for band n46 and n96, the ACLR shall be higher than the value specified in Table 6.6.3.2-2b.

**Table 6.6.3.2-2b: Base Station ACLR limit in non-contiguous spectrum for band n46 and n96**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***BS channel bandwidth* of lowest/highest NR carrier transmitted BWChannel (MHz)** | **Sub-block or Inter RF Bandwidth gap size (Wgap) where the limit applies (MHz)** | **BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap)** | **Assumed adjacent channel carrier** | **Filter on the adjacent channel frequency and corresponding filter bandwidth** | **ACLR limit** |
| 10, 20, 40, 60, 80 | Wgap ≥ 60 | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 35 dB |
| Wgap ≥ 80 | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 40 dB |
| 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). | | | | | |

The Cumulative Adjacent Channel Leakage power Ratio (CACLR) in a *sub-block gap* or the *Inter RF Bandwidth 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* or the *Inter RF Bandwidth gap*, and

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

The assumed filter for the adjacent channel frequency is defined in table 6.6.3.2-3 and the filters on the assigned channels are defined in table 6.6.3.2-4.

For operation in *non-contiguous spectrum* or multiple bands, the CACLR for NR carriers located on either side of the *sub-block gap* or the *Inter RF Bandwidth gap* shall be higher than the value specified in table 6.6.3.2-3.

The CACLR requirements in Table 6.6.3.2-3 apply to BS that supports NR, in any operating band except for band n46 and n96. The CACLR requirements for band n46 and n96 are in Table 6.6.3.2-3aa.

Table 6.6.3.2-3: Base Station CACLR limit

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *BS channel bandwidth* of *lowest/highest carrier* transmitted BWChannel (MHz) | Sub-block or Inter RF Bandwidth gap size (Wgap) where the limit applies (MHz) | BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap) | Assumed adjacent channel carrier | Filter on the adjacent channel frequency and corresponding filter bandwidth | CACLR limit |
| 5, 10, 15, 20 | 5 ≤Wgap< 15 (Note 3)  5 ≤Wgap< 45 (Note 4) | 2.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| 10 < Wgap< 20 (Note 3)  10 ≤Wgap< 50 (Note 4) | 7.5 MHz | 5 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| 25, 30, 40, 50, 60, 70, 80,90, 100 | 20 ≤Wgap< 60 (Note 4)  20 ≤Wgap< 30 (Note 3) | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| 40 < Wgap< 80 (Note 4)  40 ≤Wgap< 50 (Note 3) | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 45 dB |
| 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 in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz.  NOTE 4: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz. | | | | | |

For operation in non-contiguous spectrum for band n46 and n96, the CACLR for NR carriers located on either side of the sub-block gap shall be higher than the value specified in Table 6.6.3.2-3aa.

**Table 6.6.3.2-3aa: Base Station CACLR limit for band n46 and n96**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***BS channel bandwidth* of lowest/highest NR carrier transmitted BWChannel (MHz)** | **Sub-block or Inter RF Bandwidth gap size (Wgap) where the limit applies (MHz)** | **BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap)** | **Assumed adjacent channel carrier** | **Filter on the adjacent channel frequency and corresponding filter bandwidth** | **CACLR limit** |
| 10, 20, 40, 60, 80 | 20 ≤Wgap< 60 | 10 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 35 dB |
| 40 < Wgap< 80 | 30 MHz | 20 MHz NR (Note 2) | Square (BWConfig) | 40 dB |
| 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). | | | | | |

The CACLR absolute *basic limit* is specified in table 6.6.3.2‑3a.

Table 6.6.3.2-3a: Base station CACLR absolute *basic limit*

|  |  |
| --- | --- |
| BS category / BS class | CACLR absolute *basic limit* |
| Category A Wide Area BS | -13 dBm/MHz |
| Category B Wide Area BS | -15 dBm/MHz |
| Medium Range BS | -25 dBm/MHz |
| Local Area BS | -32 dBm/MHz |

Table 6.6.3.2-4: Filter parameters for the assigned channel

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

#### 6.6.3.3 Minimum requirement for *BS type 1-C*

The ACLR (CACLR) absolute *basic limits* in table 6.6.3.2-2, 6.6.3.2-3a or the ACLR (CACLR) *limits* 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 each *antenna connector*.

#### 6.6.3.4 Minimum requirement for *BS type 1-H*

The ACLR (CACLR) absolute *basic limits* in table 6.6.3.2-2 + X, 6.6.3.2-3a + X (where X = 10log10(NTXU,countedpercell)) or the ACLR (CACLR) *limits* 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 each *TAB connector TX min cell group*.

NOTE: Conformance to the *BS type 1-H* ACLR requirement can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer:

1) The ratio of the sum of the filtered mean power measured on each *TAB connector* in the *TAB connector TX min cell group* at the assigned channel frequency to the sum of the filtered mean power measured on each *TAB connector* in the *TAB connector TX min cell group* at the adjacent channel frequency shall be greater than or equal to the ACLR *basic limit* of the BS. This shall apply for each *TAB connector TX min cell group*.

Or

2) The ratio of the filtered mean power at the *TAB connector* centred on the assigned channel frequency to the filtered mean power at this *TAB connector* centred on the adjacent channel frequency shall be greater than or equal to the ACLR *basic limit* of the BS for every *TAB connector* in the *TAB connector TX min cell group*, for each *TAB connector TX min cell group*.

In case the ACLR (CACLR) absolute *basic limit* of *BS type 1-H* are applied, the conformance can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer:

1) The sum of the filtered mean power measured on each *TAB connector* in the *TAB connector TX min cell group* at the adjacent channel frequency shall be less than or equal to the ACLR (CACLR) absolute ba*sic limit* + X of the BS. This shall apply to each *TAB* connector *TX min cell group.*

Or

2) The filtered mean power at each *TAB connector* centred on the adjacent channel frequency shall be less than or equal to the ACLR (CACLR) absolute *basic limit* of the BS scaled by X -10log10(*n*) for every *TAB connector* in the *TAB connector TX min cell group*, for each *TAB connector TX min cell group*, where *n* is the number of *TAB connectors* in the *TAB connector TX min cell group.*

### 6.6.4 Operating band unwanted emissions

#### 6.6.4.1 General

Unless otherwise stated, the operating band unwanted emission (OBUE) 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 6.6.1‑1 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. In addition, for a BS operating in *non-contiguous spectrum*, the requirements apply inside any *sub-block gap*. In addition, for a BS operating in multiple bands, the requirements apply inside any *Inter RF Bandwidth gap*.

*Basic limits* are specified in the tables below, where:

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

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

- f\_offsetmax is the offset to the frequency ΔfOBUE outside the downlink *operating band*, where ΔfOBUE is defined in table 6.6.1-1.

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

For a *multi-band connector* inside any *Inter RF Bandwidth gaps* with Wgap < 2\*ΔfOBUE, a combined *basic* limit shall be applied which is the cumulative sum of the *basic limit*s specified at the *Base Station RF Bandwidth edges* on each side of the *Inter RF Bandwidth gap*. The *basic limit* for *Base Station RF Bandwidth edge* is specified in clauses 6.6.4.2.1 to 6.6.4.2.4 below, where in this case:

- Δf is the separation between the *Base Station RF Bandwidth edge* frequency and the nominal -3 dB point of the measuring filter closest to the *Base Station RF Bandwidth edge*.

- f\_offset is the separation between the *Base Station RF Bandwidth edge* frequency and the centre of the measuring filter.

- f\_offsetmax is equal to the *Inter RF Bandwidth gap* minus half of the bandwidth of the measuring filter.

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

For a *multi-band connector*, the operating band unwanted emission limits apply also in a supported *operating band* without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported *operating band*. In this case, no cumulative *basic limit* is applied in the *inter-band gap* between a supported downlink *operating band* with carrier(s) transmitted and a supported downlink *operating band* without any carrier transmitted and

- In case the *inter-band gap* between a supported downlink *operating band* with carrier(s) transmitted and a supported downlink *operating band* without any carrier transmitted is less than 2\*ΔfOBUE, f\_offsetmax shall be the offset to the frequency ΔfOBUE MHz outside the outermost edges of the two supported downlink *operating bands* and the operating band unwanted emission *basic limits* of the band where there are carriers transmitted, as defined in the tables of the present clause, shall apply across both downlink bands.

- In other cases, the operating band unwanted emission *basic limits* of the band where there are carriers transmitted, as defined in the tables of the present clause for the largest frequency offset (Δfmax), shall apply from ΔfOBUE MHz below the lowest frequency, up to ΔfOBUE MHz above the highest frequency of the supported downlink *operating band* without any carrier transmitted.

For a multicarrier *single-band connector* or a *single-band connector* configured for intra-band contiguous or non-contiguous *carrier aggregation* the definitions above apply to the lower edge of the carrier transmitted at the *lowest carrier* frequency and the upper edge of the carrier transmitted at the *highest carrier* frequency within a specified frequency band.

In addition inside any *sub-block gap* for a *single-band connector* operating in *non-contiguous spectrum*, a combined *basic* limit shall be applied which is the cumulative sum of the *basic limit*s specified for the adjacent *sub-blocks* on each side of the *sub-block gap*. The *basic limit* for each *sub-block* is specified in clauses 6.6.4.2.1 to 6.6.4.2.4 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.

For Wide Area BS, the requirements of either clause 6.6.4.2.1 (Category A limits) or clause 6.6.4.2.2 (Category B limits) shall apply.

For Medium Range BS, the requirements in clause 6.6.4.2.3 shall apply (Category A and B).

For Local Area BS, the requirements of clause 6.6.4.2.4 shall apply (Category A and B).

The requirements shall also apply if the BS supports NB-IoT operation in NR in-band.

The application of either Category A or Category B *basic limits* shall be the same as for Transmitter spurious emissions in clause 6.6.5.

#### 6.6.4.2 *Basic limits*

##### 6.6.4.2.1 *Basic limits* for Wide Area BS (Category A)

For BS operating in Bands n5, n8, n12, n14, n18, n26, n28, n29, n71, *basic limits* are specified in table 6.6.4.2.1‑1.

Table 6.6.4.2.1-1: Wide Area BS operating band unwanted emission limits   
(NR bands below 1 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -13 dBm (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be -13 dBm/100 kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gap*s is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

For BS operating in Bands n1, n2, n3, n7, n25, n30, n34, n38, n39, n40, n41, n48, n50, n65, n66, n70, n74, n75, n77, n78, n79, n90, n92, n94, *basic limits* are specified in table 6.6.4.2.1-2:

Table 6.6.4.2.1-2: Wide Area BS *operating band* unwanted emission limits   
(NR bands above 1 GHz) for Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -13 dBm (Note 3) | 1MHz |
| NOTE 1: For a BS supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *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*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be ‑13 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*, where the contribution from the far-end *sub-block* or RF Bandwidth shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

##### 6.6.4.2.2 Basic limits for Wide Area BS (Category B)

For Category B Operating band unwanted emissions, there are two options for the *basic limits* that may be applied regionally. Either the *basic limits* in clause 6.6.4.2.2.1 or clause 6.6.4.2.2.2 shall be applied.

###### 6.6.4.2.2.1 Category B requirements (Option 1)

For BS operating in Bands n5, n8, n12, n20, n26, n28, n29, n71, the *basic limits* are specified in table 6.6.4.2.2.1-1:

Table 6.6.4.2.2.1-1: Wide Area BS operating band unwanted emission limits   
(NR bands below 1 GHz) for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -16 dBm (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *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*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be ‑16 dBm/100 kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*, where the contribution from the far-end *sub-block* or RF Bandwidth shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

For BS operating in Bands n1, n2, n3, n7, n25, n34, n38, n39, n40, n41, n48, n50, n65, n66, n70, n75, n77, n78, n79, n90, n92, n94, *basic limits* are specified in tables 6.6.4.2.2.1-2:

Table 6.6.4.2.2.1-2: Wide Area BS operating band unwanted emission limits   
(NR bands above 1 GHz) for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf <  min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset <  min(10.05 MHz, f\_offsetmax) | -14 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -15 dBm (Note 3) | 1MHz |
| NOTE 1: For a BS supporting *non-contiguous spectrum* operation within any *operating band*, the emission limits within *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*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be ‑15 dBm/1 MHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*, where the contribution from the far-end *sub-block* or RF Bandwidth shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

###### 6.6.4.2.2.2 Category B requirements (Option 2)

The limits in this clause are intended for Europe and may be applied regionally for BS operating in bands n1, n3, n7, n8, n38, n65.

For a BS operating in bands n1, n3, n8, n65 or *BS type 1-C* operating in bands n7 or n38, *basic limits* are specified in Table 6.6.4.2.2.2-1:

Table 6.6.4.2.2.2-1: Regional Wide Area BS operating band unwanted emission limits for Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 0.2 MHz | 0.015 MHz ≤ f\_offset < 0.215 MHz | -14 dBm | 30 kHz |
| 0.2 MHz ≤ Δf < 1 MHz | 0.215 MHz ≤ f\_offset < 1.015 MHz |  | 30 kHz |
| (Note 4) | 1.015 MHz ≤ f\_offset < 1.5 MHz | -26 dBm | 30 kHz |
| 1 MHz ≤ Δf ≤  min( 10 MHz, Δfmax) | 1.5 MHz ≤ f\_offset <  min(10.5 MHz, f\_offsetmax) | -13 dBm | 1 MHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.5 MHz ≤ f\_offset < f\_offsetmax | -15 dBm (Note 3) | 1 MHz |
| NOTE 1: For a BS supporting *non-contiguous spectrum* operation within any *operating band*, the minimum requirement within *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*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the minimum requirement within *sub-block gaps* shall be -15dBm/1MHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the minimum requirement within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*, where the contribution from the far-end *sub-block* or RF Bandwidth shall be scaled according to the *measurement bandwidth* of the near-end *sub-block* or RF Bandwidth.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz.  NOTE 4: This frequency range ensures that the range of values of f\_offset is continuous. | | | |

##### 6.6.4.2.3 *Basic limits* for Medium Range BS (Category A and B)

For Medium Range BS, *basic limits* are specified in table 6.6.4.2.3-1 and table 6.6.4.2.3-2.

For the tables in this clause for *BS type 1-C* Prated,x = Prated,c,AC, and for *BS type 1-H* Prated,x = Prated,c,cell – 10\*log10(NTXU,countedpercell), and for *BS type 1-O* Prated,x = Prated,c,TRP – 9 dB.

Table 6.6.4.2.3-1: Medium Range BS *operating band* unwanted emission limits, 31< Prated,x ≤ 38 dBm

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | Prated,x - 60dB | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | Min(Prated,x - 60dB, -25dBm) (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be Min(Prated,x -60dB, ‑25dBm)/100kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

Table 6.6.4.2.3-2: Medium Range BS operating band unwanted emission limits, Prated,x ≤ 31 dBm

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -29 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -29 dBm (Note 3) | 100 kHz |
| NOTE 1: For a BS supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be -29dBm/100kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*.  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

##### 6.6.4.2.4 *Basic limits* for Local Area BS (Category A and B)

For Local Area BS, *basic limits* are specified in table 6.6.4.2.4-1.

Table 6.6.4.2.4-1: Local Area BS operating band unwanted emission limits

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | *Basic limits* (Note 1, 2) | *Measurement bandwidth* |
| 0 MHz ≤ Δf < 5 MHz | 0.05 MHz ≤ f\_offset < 5.05 MHz |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) | -37 dBm | 100 kHz |
| 10 MHz ≤ Δf ≤ Δfmax | 10.05 MHz ≤ f\_offset < f\_offsetmax | -37 dBm (Note 10) | 100 kHz |
| NOTE 1: For a BS supporting *non-contiguous spectrum* operation within any *operating band* the emission limits within *sub-block gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* on each side of the *sub-block gap*. Exception is f ≥ 10MHz from both adjacent *sub-blocks* on each side of the *sub-block gap*, where the emission limits within *sub-block gaps* shall be -37dBm/100kHz.  NOTE 2: For a *multi-band connector* with *Inter RF Bandwidth gap* < 2\*ΔfOBUE the emission limits within the *Inter RF Bandwidth gaps* is calculated as a cumulative sum of contributions from adjacent *sub-blocks* or RF Bandwidth on each side of the *Inter RF Bandwidth gap*  NOTE 3: The requirement is not applicable when Δfmax < 10 MHz. | | | |

6.6.4.2.4A Basic limits for Local Area and Medium Range BS for band n46 and n96 (Category A and B)

For Local Area and Medium Range BS operating in Band n46, basic limits for 10 MHz channel bandwidth are specified in table 6.6.2.4A-1. For Local Area and Medium Range BS operating in Band n46 and for Local Area BS operating in Band n96, basic limits for 20 MHz, 40 MHz, 60 MHz and 80 MHz channel bandwidth are specified in table 6.6.2.4A-2. The nominal bandwidth N = BWChannel of the transmitted carrier. For one non-transmitted channel basic limits are specified in table 6.6.2.4A-3, and for two non-transmitted channels basic limits are specified in table 6.6.2.4A-4.

**Table 6.6.4.2.4A-1: Medium Range BS and Local Area BS operating band unwanted emission limits for 10 MHz channel bandwidth for band n46**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | **Basic limits (Note 1)** | **Measurement bandwidth (Note 8)** |
| 0 MHz ≤ Δf < 0.5 MHz | 0.05 MHz ≤ f\_offset < 0.55 MHz |  | 100 kHz |
| 0.5 MHz ≤ Δf < 5 MHz | 0.55 MHz ≤ f\_offset < min(5.05 MHz, f\_offsetmax) |  | 100 kHz |
| 5 MHz ≤ Δf < min(10 MHz, Δfmax) | 5.05 MHz ≤ f\_offset < min(10.05 MHz, f\_offsetmax) |  | 100 kHz |
| 10 MHz ≤ Δf < min(85 MHz, Δfmax) | 10.05 MHz ≤ f\_offset < min(85.05 MHz, f\_offsetmax) | Max(Prated,x – 59.5dB, -40dBm) | 100 kHz |
| 85 MHz ≤ Δf < min(103 MHz, Δfmax) | 85.05 MHz ≤ f\_offset < min(103.05 MHz, f\_offsetmax) | Max(Prated,x – 61.5dB, -40dBm) | 100 kHz |
| 103 MHz ≤ Δf ≤ Δfmax | 103.05 MHz ≤ f\_offset < f\_offsetmax | Max(Prated,x – 66.5dB, -40dBm) | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any operating band, the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ 10 MHz from both adjacent sub blocks on each side of the sub-block gap, where the minimum requirement within sub-block gaps shall be Max (Prated,x – 59.5dB, -40 dBm)/100kHz. | | | |

**Table 6.6.4.2.4A-2: Medium Range BS and Local Area BS operating band unwanted emission limits for 20 MHz, 40 MHz, 60 MHz and 80 MHz channel bandwidth for band n46 and Local Area BS operating band unwanted emission limits for 20 MHz, 40 MHz, 60 MHz and 80 MHz channel bandwidth for band n96**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_offset** | **Basic limits (Note 1)** | **Measurement bandwidth (Note 8)** |
| 0 MHz ≤ Δf < 1 MHz | 0.05 MHz ≤ f\_offset < 1.05 MHz |  | 100 kHz |
| 1 MHz ≤ Δf < min(0.5N MHz, Δfmax) | 1.05 MHz ≤ f\_offset < min((0.5N+0.05) MHz, f\_offsetmax) |  | 100 kHz |
| 0.5N MHz ≤ Δf < min(N MHz, Δfmax) | (0.5N+0.05) MHz ≤ f\_offset < min((N+0.05) MHz, f\_offsetmax) |  | 100 kHz |
| N MHz ≤ Δf < min(8.5N MHz, Δfmax) | (N+0.05) MHz ≤ f\_offset < min((8.5N+0.05) MHz, f\_offsetmax) |  | 100 kHz |
| 8.5N MHz ≤ Δf < min(10.3N MHz, Δfmax) | (8.5N+0.05) MHz ≤ f\_offset < min((10.3N+0.05) MHz, f\_offsetmax) |  | 100 kHz |
| 10.3N MHz ≤ Δf ≤ Δfmax | (10.3N+0.05) MHz ≤ f\_offset < f\_offsetmax |  | 100 kHz |
| NOTE 1: For a BS supporting non-contiguous spectrum operation within any operating band, the minimum requirement within sub-block gaps is calculated as a cumulative sum of contributions from adjacent sub blocks on each side of the sub block gap. Exception is f ≥ N MHz from both adjacent sub blocks on each side of the sub-block gap, where the minimum requirement within sub-block gaps shall be | | | |

In the case of one or two non-transmitted 20 MHz channels between transmitted channels, when a NR-U channel bandwidth of 60 MHz or 80 MHz have been assigned, the spectrum emission mask for non-transmitted channels specified in Table 6.6.4.2.4A-3 and Table 6.6.4.2.4A-4 applies for one and two non-transmitted channels respectively. The spectrum emission mask for non-transmitted channels apply to frequencies (ΔfBE\_offset) starting from the edge of the last transmitted channel of the channels assigned for NR-U channel bandwidth. The relative power of any BS emission shall not exceed the most stringent levels given by Table 6.6.4.2.4A-2 and Table 6.6.4.2.4A-3 in the case of non-transmitted channels between transmitted channels.

**Table 6.6.4.2.4A-3: Medium Range BS and Local Area BS operating band unwanted emission limits for one non-transmitted channel for 60 MHz and 80MHz channel bandwidth for band n46 and n96**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, Δf** | **Frequency offset of measurement filter centre frequency, f\_BE\_offset** | ***Basic limits* (Note 1)** | **Measurement bandwidth (Note 8)** |
| 0 MHz  f < 1 MHz | 0.05 MHz  f\_BE\_offset < 1.05 MHz |  | 100 kHz |
| 1 MHz  f < 10 MHz | 1.05 MHz  f\_BE\_offset < 10.05 MHz |  | 100 kHz |
| 10 MHz  f < 19 MHz | 10.05 MHz  f\_BE offset < 19.05 MHz |  | 100 kHz |
| 19 MHz  f < 19.9 MHz | 19.05 MHz  f\_BE\_offset < 19.95 MHz |  | 100 kHz |
|  | | | |
|  | | | |

**Table 6.6.4.2.4A-4: Medium Range BS and Local Area BS operating band unwanted emission limits for two non-transmitted channels of 80 MHz channel bandwidth for band n46 and n96**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset of measurement filter ‑3dB point, f** | **Frequency offset of measurement filter centre frequency, f\_BE\_offset** | ***Basic limits* (Note 1)** | **Measurement bandwidth (Note 8)** |
| 0 MHz  f < 1 MHz | 0.05 MHz  f\_BE\_offset < 1.05 MHz |  | 100 kHz |
| 1 MHz  f <10 MHz | 1.05 MHz  f\_BE\_offset < 10.05 MHz |  | 100 kHz |
| 10 MHz  f <30 MHz | 10.05 MHz  f\_BE offset < 30.05 MHz |  | 100 kHz |
| 30 MHz  f < 39 MHz | 30.05 MHz  f\_BE\_offset < 39.05 MHz |  | 100 kHz |
| 39 MHz  f < 39.9 MHz | 39.05 MHz  f\_BE\_offset < 39.95 MHz |  | 100 kHz |

In the case of non-transmitted 20 MHz channel(s) on the edges of an assigned NR-U channel bandwidth the general spectrum emission mask specified in Table 6.6.4.2.4A-2 is applied to the remaining transmitted channels to form an additional spectrum emission mask. The additional spectrum emission mask is applied to the total bandwidth of the remaining transmitted channels.

The additional spectrum emission mask is floored a t .

The relative power of any BS emission shall not exceed the most stringent levels given by the initial general spectrum emission mask with full channel bandwidth and the additional spectrum emission mask with the channel bandwidth of the transmitted channels in the case of non-transmitted channels at the edge of an assigned NR-U channel bandwidth.

[An exception to the spectrum emission requirements for the non-transmitted 20 MHz channels allows a single [2] MHz bandwidth to extend to [], or [-20] dBm, whichever is the greatest. ]

##### 6.6.4.2.5 *Basic limits* for additional requirements

###### 6.6.4.2.5.1 Limits in FCC Title 47

In addition to the requirements in clauses 6.6.4.2.1, 6.6.4.2.2, 6.6.4.2.3 and 6.6.4.2.4, 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.

###### 6.6.4.2.5.2 Protection of DTT

In certain regions the following requirement may apply for protection of DTT. For *BS type 1-C* or *BS type 1-H* 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 6.6.4.2.5.2-1, a *basic limits* PEM,N is declared by the manufacturer. This requirement applies in the frequency range 470-790 MHz even though part of the range falls in the spurious domain.

Table 6.6.4.2.5.2-1: Declared emissions *basic limit* for protection of DTT

|  |  |  |
| --- | --- | --- |
| Filter centre frequency, Ffilter | *Measurement bandwidth* | Declared emission *basic limit* (dBm) |
| Ffilter = 8\*N + 306 (MHz);  21 ≤ N ≤ 60 | 8 MHz | PEM,N |

Note: The regional requirement is defined in terms of EIRP (effective isotropic radiated power), which is dependent on both the BS emissions at the *antenna connector* and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the BS needed to verify compliance with the regional requirement. Compliance with the regional requirement can be determined using the method outlined in TS 36.104 [13], annex F.

###### 6.6.4.2.5.3 Additional operating band unwanted emissions limits for Band n48

The following requirement may apply to BS operating in Band n48 in certain regions. Emissions shall not exceed the maximum levels specified in table 6.6.4.2.5.3-1.

Table 6.6.4.2.5.3-1: Additional operating band unwanted emission limits for Band n48

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel bandwidth | Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Minimum requirement | *Measurement bandwidth* (Note) |
| All | 0 MHz ≤ Δf < 10 MHz | 0.5 MHz ≤ f\_offset < 9.5 MHz | -13 dBm | 1 MHz |

NOTE: The resolution bandwidth of the measuring equipment should be equal to the *measurement bandwidth*. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the *measurement bandwidth*. When the resolution bandwidth is smaller than the *measurement bandwidth*, the result should be integrated over the *measurement bandwidth* in order to obtain the equivalent noise bandwidth of the *measurement bandwidth*.

###### 6.6.4.2.5.4 Additional operating band unwanted emissions limits for Band n53

The following requirement may apply to BS operating in Band n53 in certain regions. Emissions shall not exceed the maximum levels specified in table 6.6.4.2.5.4-1.

Table 6.6.4.2.5.4-1: Additional operating band unwanted emission limits for Band n53

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Channel bandwidth [MHz] | Frequency range [MHz] | Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Minimum requirement | Measurement bandwidth (Note) |
| 5 | 2400 - 2477.5 | 6 MHz ≤ Δf < 83.5 MHz | 6.5 MHz ≤ f\_offset < 83 MHz | -25 dBm | 1 MHz |
| 10 | 2400 - 2473.5 | 10 MHz ≤ Δf < 83.5 MHz | 10.5 MHz ≤ f\_offset < 83 MHz | -25 dBm | 1 MHz |
| 5 | 2477.5 - 2478.5 | 5 MHz ≤ Δf < 6 MHz | 5.5 MHz | -13 dBm | 1 MHz |
| 10 | 2473.5 - 2478.5 | 5 MHz ≤ Δf < 10 MHz | 5.5 MHz ≤ f\_offset < 9.5 MHz | -13 dBm | 1 MHz |
| All | 2478.5 - 2483.5 | 0 MHz ≤ Δf < 5 MHz | 0.5 MHz ≤ f\_offset < 4.5 MHz | -10 dBm | 1 MHz |
| 5 | 2495 - 2501 | 0 MHz ≤ Δf < 6 MHz | 0.5 MHz ≤ f\_offset < 5.5 MHz | -13 dBm | 1 MHz |
| 10 | 2495 - 2505 | 0 MHz ≤ Δf < 10 MHz | 0.5 MHz ≤ f\_offset < 9.5 MHz | -13 dBm | 1 MHz |
| 5 | 2501 - 2690 | 6 MHz ≤ Δf < 195 MHz | 6.5 MHz ≤ f\_offset < 194.5 MHz | -25 dBm | 1 MHz |
| 10 | 2505 - 2690 | 10 MHz ≤ Δf < 195 MHz | 10.5 MHz ≤ f\_offset < 194.5 MHz | -25 dBm | 1 MHz |

NOTE: The resolution bandwidth of the measuring equipment should be equal to the *measurement bandwidth*. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the *measurement bandwidth*. When the resolution bandwidth is smaller than the *measurement bandwidth*, the result should be integrated over the *measurement bandwidth* in order to obtain the equivalent noise bandwidth of the *measurement bandwidth*.

6.6.4.2.5.5 Additional operating band unwanted emissions limits for operation with shared spectrum channel access

In addition, for operation with shared spectrum channel access, the BS may have to comply with the applicable operating band unwanted emission limits established regionally, when deployed in regions where those limits apply and under the conditions declared by the manufacturer. The regional requirements may be in the form of conducted power, power spectral density, EIRP and other types of limits. In case of regulatory limits based on EIRP, assessment of the EIRP level is described in Annex F.2.

#### 6.6.4.3 Minimum requirements for *BS type 1-C*

The operating band unwanted emissions for *BS type 1-C* for each *antenna connector* shall be below the applicable *basic limits* defined in clause 6.6.4.2.

#### 6.6.4.4 Minimum requirements for *BS type 1-H*

The operating band unwanted emissions requirements for *BS type 1-H* are that for each *TAB connector TX min cell group* and each applicable *basic limit* in clause 6.6.4.2, the power summation emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed a BS limit specified as the *basic limit* + X, where X = 10log10(NTXU,countedpercell).

NOTE: Conformance to the *BS type 1-H* spurious emission requirement can be demonstrated by meeting at least one of the following criteria as determined by the manufacturer:

1) The sum of the emissions power measured on each *TAB connector* in the *TAB connector TX min cell group* shall be less than or equal to the limit as defined in this clause for the respective frequency span.

Or

2) The unwanted emissions power at each *TAB connector* shall be less than or equal to the *BS type 1-H* limit as defined in this clause for the respective frequency span, scaled by -10log10(n), where n is the number of *TAB connectors* in the *TAB connector TX min cell group*.

### 6.6.5 Transmitter spurious emissions

#### 6.6.5.1 General

The transmitter spurious emission limits shall apply from 9 kHz 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 6.6.1-1. For some *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 a *multi-band connector*, for each supported *operating band* together with ΔfOBUE around the band is excluded from the transmitter spurious emissions requirement.

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.

The requirements shall also apply if the BS supports NB-IoT operation in NR in-band.

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

#### 6.6.5.2 *Basic limits*

##### 6.6.5.2.1 General transmitter spurious emissions requirements

The *basic limits* of either table 6.6.5.2.1-1 (Category A limits) or table 6.6.5. 2.1-2 (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 6.6.4.

Table 6.6.5.2.1-1: General BS transmitter spurious emission limits in FR1, Category A

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | *Basic limit* | *Measurement bandwidth* | Notes |
| 9 kHz – 150 kHz | -13 dBm | 1 kHz | Note 1, Note 4 |
| 150 kHz – 30 MHz | 10 kHz | Note 1, Note 4 |
| 30 MHz – 1 GHz | 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 DL *operating band* in GHz | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: *Measurement bandwidth*s 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 DL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: This spurious frequency range applies only to *BS type 1-C* and *BS type 1-H*. | | | |

Table 6.6.5.2.1-2: General BS transmitter spurious emission limits in FR1, Category B

|  |  |  |  |
| --- | --- | --- | --- |
| Spurious frequency range | *Basic limit* | *Measurement bandwidth* | Notes |
| 9 kHz – 150 kHz | -36 dBm | 1 kHz | Note 1, Note 4 |
| 150 kHz – 30 MHz | 10 kHz | Note 1, Note 4 |
| 30 MHz – 1 GHz | 100 kHz | Note 1 |
| 1 GHz – 12.75 GHz | -30 dBm | 1 MHz | Note 1, Note 2 |
| 12.75 GHz – 5th harmonic of the upper frequency edge of the DL *operating band* in GHz | 1 MHz | Note 1, Note 2, Note 3 |
| NOTE 1: *Measurement bandwidth*s 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 DL *operating band* is reaching beyond 12.75 GHz.  NOTE 4: This spurious frequency range applies only to *BS type 1-C* and *BS type 1-H*. | | | |

##### 6.6.5.2.2 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 the BSs being desensitised by emissions from a BS transmitter. It is measured at the transmit *antenna connector* for *BS type 1-C* or at the *TAB connector* for *BS type 1-H* for any type of BS which has common or separate Tx/Rx *antenna* *connectors* / *TAB connectors*.

The spurious emission *basic limits* are provided in table 6.6.5.2.2-1.

Table 6.6.5.2.2-1: BS spurious emissions *basic limits* for protection of the BS receiver

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BS class | Frequency range | *Basic limits* | *Measurement bandwidth* | Note |
| Wide Area BS | FUL,low – FUL,high | -96 dBm | 100 kHz |  |
| Medium Range BS | FUL,low – FUL,high | -91 dBm | 100 kHz |  |
| Local Area BS | FUL,low – FUL,high | -88 dBm | 100 kHz |  |

##### 6.6.5.2.3 Additional spurious emissions requirements

These requirements may be applied for the protection of system 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.) as listed below.

The spurious emission *basic limits* are provided in table 6.6.5.2.3 -1 for a BS where requirements for co-existence with the system listed in the first column apply. For a *multi-band connector*, the exclusions and conditions in the Note column of table 6.6.5.2.3 -1 apply for each supported *operating band*.

Table 6.6.5.2.3-1: BS spurious emissions *basic* *limits* for BS for co-existence with systems operating in other frequency bands

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| System type for NR to co-exist with | Frequency range for co-existence requirement | *Basic limits* | *Measurement bandwidth* | Note |
| GSM900 | 921 – 960 MHz | -57 dBm | 100 kHz | This requirement does not apply to BS operating in band n8 |
| 876 – 915 MHz | -61 dBm | 100 kHz | For the frequency range 880-915 MHz, this requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.6.5.2.2. |
| DCS1800 | 1805 – 1880 MHz | -47 dBm | 100 kHz | This requirement does not apply to BS operating in band n3. |
| 1710 – 1785 MHz | -61 dBm | 100 kHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in clause 6.6.5.2.2. |
| PCS1900 | 1930 – 1990 MHz | -47 dBm | 100 kHz | This requirement does not apply to BS operating in band n2, n25 or band n70. |
| 1850 – 1910 MHz | -61 dBm | 100 kHz | This requirement does not apply to BS operating in band n2 or n25 since it is already covered by the requirement in clause 6.6.5.2.2. |
| GSM850 or CDMA850 | 869 – 894 MHz | -57 dBm | 100 kHz | This requirement does not apply to BS operating in band n5 or n26. |
| 824 – 849 MHz | -61 dBm | 100 kHz | This requirement does not apply to BS operating in band n5 or n26, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band I or  E-UTRA Band 1 or NR Band n1 | 2110 – 2170 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n1 or n65 |
| 1920 – 1980 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n1 or n65, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band II or  E-UTRA Band 2 or NR Band n2 | 1930 – 1990 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n2 or n70. |
| 1850 – 1910 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band III or  E-UTRA Band 3 or NR Band n3 | 1805 – 1880 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n3. |
| 1710 – 1785 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band IV or  E-UTRA Band 4 | 2110 – 2155 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n66 |
| 1710 – 1755 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band V or  E-UTRA Band 5 or NR Band n5 | 869 – 894 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n5 or n26. |
| 824 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n5 or n26, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band VI, XIX or  E-UTRA Band 6, 18, 19 or NR Band n18 | 860 – 890 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n18. |
| 815 – 830 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n18, since it is already covered by the requirement in clause 6.6.5.2.2. |
| 830 – 845 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band VII or  E-UTRA Band 7 or NR Band n7 | 2620 – 2690 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n7. |
| 2500 – 2570 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n7, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band VIII or  E-UTRA Band 8 or NR Band n8 | 925 – 960 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n8. |
| 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band IX or  E-UTRA Band 9 | 1844.9 – 1879.9 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n3. |
| 1749.9 – 1784.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band X or  E-UTRA Band 10 | 2110 – 2170 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n66 |
| 1710 – 1770 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band XI or XXI or  E-UTRA Band 11 or 21 | 1475.9 – 1510.9 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n50, n74, n75, n92 or n94. |
| 1427.9 – 1447.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
| 1447.9 – 1462.9 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n50, n74, n75, n92 or n94. |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 729 – 746 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n12. |
| 699 – 716 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n12, since it is already covered by the requirement in clause 6.6.5.2.2.  For NR BS operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| UTRA FDD Band XIII or  E-UTRA Band 13 | 746 – 756 MHz | -52 dBm | 1 MHz |  |
| 777 – 787 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XIV or  E-UTRA Band 14 or NR band n14 | 758 – 768 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n14. |
| 788 – 798 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n14, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 17 | 734 – 746 MHz | -52 dBm | 1 MHz |  |
| 704 – 716 MHz | -49 dBm | 1 MHz | For NR BS operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 791 – 821 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n20 or n28. |
| 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in clause 6.6.5.2.2. |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3510 – 3590 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n48, n77 or n78. |
| 3410 – 3490 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n77 or n78. |
| E-UTRA Band 24 | 1525 – 1559 MHz | -52 dBm | 1 MHz |  |
| 1626.5 – 1660.5 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD Band XXV or  E-UTRA Band 25 or NR band n25 | 1930 – 1995 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, n25 or n70. |
| 1850 – 1915 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n25 since it is already covered by the requirement in clause 6.6.5.2.2. For BS operating in Band n2, it applies for 1910 MHz to 1915 MHz, while the rest is covered in clause 6.6.5.2.2. |
| UTRA FDD Band XXVI or  E-UTRA Band 26 or NR Band n26 | 859 – 894 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n5 or n26. |
| 814 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n26 since it is already covered by the requirement in clause 6.6.5.2.2. For BS operating in Band n5, it applies for 814 MHz to 824 MHz, while the rest is covered in clause 6.6.5.2.2. |
| E-UTRA Band 27 | 852 – 869 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n5. |
| 807 – 824 MHz | -49 dBm | 1 MHz | This requirement also applies to BS operating in Band n28, starting 4 MHz above the Band n28 downlink *operating band* (Note 5). |
| E-UTRA Band 28 or NR Band n28 | 758 – 803 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n20 or n28. |
| 703 – 748 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n28, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 29 or NR Band n29 | 717 – 728 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n29. |
| E-UTRA Band 30 or NR Band n30 | 2350 – 2360 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n30 |
| 2305 – 2315 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n30, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 31 | 462.5 – 467.5 MHz | -52 dBm | 1 MHz |  |
| 452.5 – 457.5 MHz | -49 dBm | 1 MHz |  |
| UTRA FDD band XXXII or E-UTRA band 32 | 1452 – 1496 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n50, n74, n75, n92 or n94. |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n34. |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n2 or n25. |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -52 dBm | 1 MHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n38. |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n39. |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n30 or n40. |
| E-UTRA Band 41 or NR Band n41, n90 | 2496 – 2690 MHz | -52 dBm | 1 MHz | This is not applicable to BS operating in Band n41, n53 or [n90]. |
| E-UTRA Band 42 | 3400 – 3600 MHz | -52 dBm | 1 MHz | This is not applicable to BS operating in Band n48, n77 or n78. |
| E-UTRA Band 43 | 3600 – 3800 MHz | -52 dBm | 1 MHz | This is not applicable to BS operating in Band n48, n77 or n78. |
| E-UTRA Band 44 | 703 – 803 MHz | -52 dBm | 1 MHz | This is not applicable to BS operating in Band n28. |
| E-UTRA Band 45 | 1447 – 1467 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 46 or NR Band n46 | 5150 – 5925 MHz | -52 dBm | 1 MHz | This is not applicable to BS operating in Band n46. |
| E-UTRA Band 47 | 5855 – 5925 MHz | -52 dBm | 1 MHz |  |
| E-UTRA Band 48 or NR Band n48 | 3550 – 3700 MHz | -52 dBm | 1 MHz | This is not applicable to BS operating in Band n48, n77 or n78. |
| E-UTRA Band 50 or NR band n50 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75, n76, n91, n92, n93 or n94. |
| E-UTRA Band 53 or NR Band n53 | 2483.5 - 2495 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n41, n53 or n90. |
| E-UTRA Band 65 or NR Band n65 | 2110 – 2200 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n1 or n65. |
| 1920 – 2010 MHz | -49 dBm | 1 MHz | For BS operating in Band n1, it applies for 1980 MHz to 2010 MHz, while the rest is covered in clause 6.6.5.2.2.  This requirement does not apply to BS operating in band n65, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 66 or NR Band n66 | 2110 – 2200 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n66. |
| 1710 – 1780 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 67 | 738 – 758 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n28. |
| E-UTRA Band 68 | 753 -783 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n28. |
| 698-728 MHz | -49 dBm | 1 MHz | For BS operating in Band n28, this requirement applies between 698 MHz and 703 MHz, while the rest is covered in clause 6.6.5.2.2. |
| E-UTRA Band 69 | 2570 – 2620 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n38. |
| E-UTRA Band 70 or NR Band n70 | 1995 – 2020 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, n25 or n70 |
| 1695 – 1710 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n70, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 71 or NR Band n71 | 617 – 652 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n71 |
| 663 – 698 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n71, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 72 | 461 – 466 MHz | -52 dBm | 1 MHz |  |
| 451 – 456 MHz | -49 dBm | 1 MHz |  |
| E-UTRA Band 74 or NR Band n74 | 1475 – 1518 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n50, n74, n75, n92 or n94. |
| 1427 – 1470 MHz | -49 dBm | 1MHz | This requirement does not apply to BS operating in band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
| E-UTRA Band 75 or NR Band n75 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75, n76, n91, n92, n93 or n94. |
| E-UTRA Band 76 or NR Band n76 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75, n76, n91, n92, n93 or n94. |
| NR Band n77 | 3.3 – 4.2 GHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n48, n77 or n78 |
| NR Band n78 | 3.3 – 3.8 GHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n48, n77 or n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n79 |
| NR Band n80 | 1710 – 1785 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n81 | 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n82 | 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n83 | 703 – 748 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n28, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n84 | 1920 – 1980 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n1, since it is already covered by the requirement in clause 6.6.5.2.2. |
| E-UTRA Band 85 | 728 – 746 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in band n12.  For NR BS operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| 698 – 716 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n12, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n86 | 1710 – 1780 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n89 | 824 – 849 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n5, since it is already covered by the requirement in clause 6.6.5.2.2. |
| NR Band n91 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75 or n76. |
| 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in clause 6.6.5.5.1.2. |
| NR Band n92 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| 832 – 862 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in clause 6.6.5.5.1.2. |
| NR Band n93 | 1427 – 1432 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75 or n76. |
| 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.6.5.5.1.2. |
| NR Band n94 | 1432 – 1517 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| 880 – 915 MHz | -49 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.6.5.5.1.2. |
| NR Band n95 | 2010 – 2025 MHz | -52 dBm | 1 MHz |  |
| NR Band n96 | 5925 – 7125 MHz | -52 dBm | 1 MHz | This requirement does not apply to BS operating in Band n96. |

NOTE 1: As defined in the scope for spurious emissions in this clause, except for the cases where the noted requirements apply to a BS operating in Band n28, the co-existence requirements in table 6.6.5.2.3 -1 do not apply for the ΔfOBUE frequency range immediately outside the downlink *operating band* (see table 5.2-1). Emission limits for this excluded frequency range may be covered by local or regional requirements.

NOTE 2: Table 6.6.5.2.3 -1 assumes that two *operating bands*, where the frequency ranges in table 5.2-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NOTE 3: TDD base stations deployed in the same geographical area, that are synchronized and use the same or adjacent *operating bands* can transmit without additional co-existence requirements. For unsynchronized base stations, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NOTE 4: For NR Band n28 BS, specific solutions may be required to fulfil the spurious emissions limits for BS for co-existence with E-UTRA Band 27 UL *operating band*.

NOTE 5: For NR Band n29 BS, specific solutions may be required to fulfil the spurious emissions limits for NR BS for co-existence with UTRA Band XII, E-UTRA Band 12 or NR Band n12 UL operating band, E-UTRA Band 17 UL operating band or E-UTRA Band 85 UL operating band.

The following requirement may be applied for the protection of PHS. This requirement is also applicable at specified frequencies falling between ΔfOBUE below the lowest BS transmitter frequency of the downlink *operating band* and ΔfOBUE above the highest BS transmitter frequency of the downlink *operating band*. ΔfOBUE is defined in clause 6.6.1.

The spurious emission *basic limit* for this requirement is:

Table 6.6.5.2.3-2: BS spurious emissions *basic limits* for BS for co-existence with PHS

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | *Basic limit* | *Measurement Bandwidth* | Note |
| 1884.5 – 1915.7 MHz | -41 dBm | 300 kHz | Applicable when co-existence with PHS system operating in 1884.5 – 1915.7 MHz |

Table 6.6.5.2.3-3: Void

In certain regions, the following requirement may apply to NR BS operating in Band n50 and n75 within the 1432 – 1452 MHz, and in Band n51 and Band n76. The *basic limit is* specified in Table 6.6.5.2.3-4. This requirement is also applicable at the frequency range from ΔfOBUE below the lowest frequency of the BS downlink *operating band* up to ΔfOBUE above the highest frequency of the BS downlink *operating band*.

Table 6.6.5.2.3-4: Additional operating band unwanted emission *basic limit* for NR BS operating in Band n50 and n75 within 1432 – 1452 MHz, and in Band n51 and n76

|  |  |  |
| --- | --- | --- |
| Filter centre frequency, Ffilter | *Basic limit* | *Measurement Bandwidth* |
| Ffilter = 1413.5 MHz | -42 dBm | 27 MHz |

In certain regions, the following requirement may apply to BS operating in NR Band n50 and n75 within 1492-1517 MHz and in Band n74 within 1492-1518 MHz. The maximum level of emissions, measured on centre frequencies Ffilter with filter bandwidth according to Table 6.6.5.2.3-5, shall be defined according to the *basic limits* PEM,n50/n75,a nor PEM,n50/n75,b declared by the manufacturer.

Table 6.6.5.2.3-5: *Operating band* n50, n74 and n75 declared emission above 1518 MHz

|  |  |  |
| --- | --- | --- |
| Filter centre frequency, Ffilter | Declared *basic limits* (dBm) | *Measurement bandwidth* |
| 1518.5 MHz ≤ Ffilter ≤ 1519.5 MHz | PEM, n50/n75,a | 1 MHz |
| 1520.5 MHz ≤ Ffilter ≤ 1558.5 MHz | PEM,n50/n75,b | 1 MHz |

In certain regions, the following requirement shall be applied to BS operating in Band n14 to ensure that appropriate interference protection is provided to 700 MHz public safety operations. This requirement is also applicable at the frequency range from 10 MHz below the lowest frequency of the BS downlink operating band up to 10 MHz above the highest frequency of the BS downlink operating band.

The power of any spurious emission shall not exceed:

Table 6.6.5.2.3-6: BS Spurious emissions limits for protection of 700 MHz public safety operations

|  |  |  |  |
| --- | --- | --- | --- |
| Operating Band | Frequency range | Maximum Level | *Measurement Bandwidth* |
| n14 | 769 - 775 MHz | -46 dBm | 6.25 kHz |
| n14 | 799 - 805 MHz | -46 dBm | 6.25 kHz |

In certain regions, the following requirement may apply to NR BS operating in Band n30. This requirement is also applicable at the frequency range from 10 MHz below the lowest frequency of the BS downlink operating band up to 10 MHz above the highest frequency of the BS downlink operating band.

The power of any spurious emission shall not exceed:

Table 6.6.5.2.3-7: Additional NR BS Spurious emissions limits for Band n30

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | *Basic limit* | *Measurement Bandwidth* | Note |
| 2200 – 2345 MHz | -45 dBm | 1 MHz |  |
| 2362.5 – 2365 MHz | -25 dBm | 1 MHz |  |
| 2365 – 2367.5 MHz | -40 dBm | 1 MHz |  |
| 2367.5 – 2370 MHz | -42 dBm | 1 MHz |  |
| 2370 – 2395 MHz | -45 dBm | 1 MHz |  |

The following requirement may apply to BS operating in Band n48 in certain regions. The power of any spurious emission shall not exceed:

Table 6.6.5.2.3-8: Additional BS Spurious emissions limits for Band n48

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | Maximum Level | *Measurement Bandwidth* (NOTE) | Note |
| 3530 MHz – 3720 MHz | -25 dBm | 1 MHz | Applicable 10 MHz from the assigned *channel edge* |
| 3100 MHz – 3530 MHz  3720 MHz – 4200 MHz | -40 dBm | 1 MHz |  |

NOTE: The resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

NOTE: The regional requirement, included in [12], is defined in terms of EIRP, which is dependent on both the BS emissions at the *antenna connector* and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the base station needed to verify compliance with the regional requirement. The assessment of the EIRP level is described in Annex F.

The following requirement shall be applied to BS operating in Band n26 to ensure that appropriate interference protection is provided to 800 MHz public safety operations. This requirement is also applicable at the frequency range from 10 MHz below the lowest frequency of the BS downlink operating band up to 10 MHz above the highest frequency of the BS downlink operating band.

The power of any spurious emission shall not exceed:

Table 6.6.5.2.3-9: BS Spurious emissions limits for protection of 800 MHz public safety operations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Frequency range | Maximum Level | Measurement Bandwidth | Note |
| n26 | 851 - 859 MHz | -13 dBm | 100 kHz | Applicable for offsets > 37.5kHz from the channel edge |

##### 6.6.5.2.4 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 a 30 dB coupling loss between transmitter and receiver and are based on co-location with base stations of the same class.

The *basic limits* are in table 6.6.5.2.4-1 for a BS where requirements for co-location with a BS type listed in the first column apply, depending on the declared Base Station class. For a *multi-band connector*, the exclusions and conditions in the Note column of table 6.6.5.2.4-1 shall apply for each supported *operating band*.

Table 6.6.5.2.4-1: BS spurious emissions *basic* limits for BS co-located with another BS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type of co-located BS | Frequency range for co-location requirement | *Basic limits* | | | Measurement bandwidth | Note |
| WA BS | MR BS | LA BS |
| GSM900 | 876 – 915 MHz | -98 dBm | -91 dBm | -70 dBm | 100 kHz |  |
| DCS1800 | 1710 – 1785 MHz | -98 dBm | -91 dBm | -80 dBm | 100 kHz |  |
| PCS1900 | 1850 – 1910 MHz | -98 dBm | -91 dBm | -80 dBm | 100 kHz |  |
| GSM850 or CDMA850 | 824 – 849 MHz | -98 dBm | -91 dBm | -70 dBm | 100 kHz |  |
| UTRA FDD Band I or E-UTRA Band 1 or NR Band n1 | 1920 – 1980 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band II or E-UTRA Band 2 or NR Band n2 | 1850 – 1910 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band III or E-UTRA Band 3 or NR Band n3 | 1710 – 1785 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band IV or E-UTRA Band 4 | 1710 – 1755 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band V or E-UTRA Band 5 or NR Band n5 | 824 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VI, XIX or E-UTRA Band 6, 19 | 830 – 845 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VII or E-UTRA Band 7 or NR Band n7 | 2500 – 2570 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band VIII or E-UTRA Band 8 or NR Band n8 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band IX or E-UTRA Band 9 | 1749.9 – 1784.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band X or E-UTRA Band 10 | 1710 – 1770 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XI or E-UTRA Band 11 | 1427.9 –1447.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n50, n75, n91, n92, n93 or n94 |
| UTRA FDD Band XII or  E-UTRA Band 12 or NR Band n12 | 699 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XIII or  E-UTRA Band 13 | 777 – 787 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XIV or  E-UTRA Band 14 or NR Band n14 | 788 – 798 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 17 | 704 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 18 or NR Band n18 | 815 – 830 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXI or E-UTRA Band 21 | 1447.9 – 1462.9 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n50, n75, n92 or n94 |
| UTRA FDD Band XXII or E-UTRA Band 22 | 3410 – 3490 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n48, n77 or n78 |
| E-UTRA Band 23 | 2000 – 2020 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 24 | 1626.5 – 1660.5 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXV or  E-UTRA Band 25 or NR Band n25 | 1850 – 1915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA FDD Band XXVI or  E-UTRA Band 26 or NR Band n26 | 814 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 27 | 807 – 824 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 28 or NR Band n28 | 703 – 748 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 30 or NR Band n30 | 2305 – 2315 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 31 | 452.5 – 457.5 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n34 |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n2 or band n25 |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n38. |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n39 |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n30 or n40. |
| E-UTRA Band 41 or NR Band n41, n90 | 2496 – 2690 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n41, n53 or [n90] |
| E-UTRA Band 42 | 3400 – 3600 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n48, n77 or n78 |
| E-UTRA Band 43 | 3600 – 3800 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n48, n77 or n78 |
| E-UTRA Band 44 | 703 – 803 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n28 |
| E-UTRA Band 45 | 1447 – 1467 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 46 or NR Band n46 | 5150 – 5925 MHz | N/A | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n46 |
| E-UTRA Band 48 or NR Band n48 | 3550 – 3700 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n48, n77 or n78 |
| E-UTRA Band 50 or NR Band n50 | 1432 – 1517 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n51, n74, n75, n91, n92, n93 or n94 |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | N/A | N/A | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n50, n74, n75, n76, n91, n92, n93 or n94 |
| E-UTRA Band 53 or NR Band n53 | 2483.5 – 2495 MHz | N/A | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n41, n53 or n90 |
| E-UTRA Band 65 or NR Band n65 | 1920 – 2010 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 66 or NR Band n66 | 1710 – 1780 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 68 | 698 – 728 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 70 or NR Band n70 | 1695 – 1710 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 71 or NR Band n71 | 663 – 698 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 72 | 451 – 456 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 74 or NR Band n74 | 1427 – 1470 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n50, n51, n91, n92, n93 or n94 |
| NR Band n77 | 3.3 – 4.2 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n48, n77 or n78 |
| NR Band n78 | 3.3 – 3.8 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz | This is not applicable to BS operating in Band n48, n77 or n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n80 | 1710 – 1785 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n81 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n82 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n83 | 703 – 748 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n84 | 1920 – 1980 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| E-UTRA Band 85 | 698 – 716 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n86 | 1710 – 1780 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n89 | 824 – 849 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n91 | 832 – 862 MHz | N/A | N/A | -88 dBm | 100 kHz |  |
| NR Band n92 | 832 – 862 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n93 | 880 – 915 MHz | N/A | N/A | -88 dBm | 100 kHz |  |
| NR Band n94 | 880 – 915 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n95 | 2010 – 2025 MHz | -96 dBm | -91 dBm | -88 dBm | 100 kHz |  |
| NR Band n96 | 5925 – 7125 MHz | N/A | N/A | -87 dBm | 100 kHz | This is not applicable to BS operating in Band n96 |

NOTE 1: As defined in the scope for spurious emissions in this clause, the co-location requirements in table 6.6.5.2.4-1 do not apply for the frequency range extending ΔfOBUE immediately outside the BS transmit frequency range of a downlink *operating band* (see table 5.2-1). The current state-of-the-art technology does not allow a single generic solution for co-location with other system on adjacent frequencies for 30dB BS-BS minimum coupling loss. However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [4].

NOTE 2: Table 6.6.5.2.4-1 assumes that two *operating bands*, where the corresponding BS transmit and receive frequency ranges in table 5.2-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-location requirements may apply that are not covered by the 3GPP specifications.

NOTE 3: Co-located TDD base stations that are synchronized and using the same or adjacent *operating band* can transmit without special co-locations requirements. For unsynchronized base stations, special co-location requirements may apply that are not covered by the 3GPP specifications.

**<<< Unchanged sections omitted >>>**

## 6.7 Transmitter intermodulation

### 6.7.1 General

The 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 antenna, RDN and antenna array. The requirement shall apply during the *transmitter ON period* and the *transmitter transient period*.

For *BS type 1-C*, the transmitter intermodulation level is the power of the intermodulation products when an interfering signal is injected into the *antenna connector*.

For *BS type 1-H*, the transmitter intermodulation level is the power of the intermodulation products when an interfering signal is injected into the *TAB connector*.

For *BS type 1-H*, there are two types of transmitter intermodulation cases captured by the transmitter intermodulation requirement:

1) Co-location transmitter intermodulation in which the interfering signal is from a co-located base station.

2) Intra-system transmitter intermodulation in which the interfering signal is from other transmitter units within the *BS type 1-H*.

For *BS type 1-H*, the co-location transmitter intermodulation requirement is considered sufficient if the interference signal for the co-location requirement is higher than the declared interference signal for intra-system transmitter intermodulation requirement.

### 6.7.2 Minimum requirements for *BS type 1-C*

#### 6.7.2.1 Co-location minimum requirements

For *BS type 1-C*, the wanted signal and interfering signal centre frequency is specified in table 6.7.2.1‑1, where interfering signal level is *Rated total output power* (Prated,t,AC) at *antenna connector* in the *operating band* – 30 dB.

The requirement is applicable 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 a BS operating 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 a *multi-band connector*, the requirement shall apply relative to the *Base Station RF Bandwidth edges* of each supported *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*.

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6.3, 6.6.4 and 6.6.5 in the presence of an NR interfering signal according to table 6.7.2.1-1.

Table 6.7.2.1-1: Interfering and wanted signals for the co-location transmitter intermodulation requirement

| Parameter | Value |
| --- | --- |
| Wanted signal type | NR single carrier, or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers, with NB-IoT operation in NR in-band if supported. |
| 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 | *Rated total output power* (Prated,t,AC) in the *operating band* – 30 dB |
| Interfering signal centre frequency offset from the lower/upper edge of the wanted signal or edge of *sub-block* inside a *sub-block 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 base station 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 38.141-1 [5] provides further guidance regarding appropriate test requirements.  NOTE 2: In Japan, NOTE 1 is not applied in Band n77, n78, n79. | |

#### 6.7.2.2 Additional requirements

No additional requirements.

### 6.7.3 Minimum requirements for *BS type 1-H*

#### 6.7.3.1 Co-location minimum requirements

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6.3, 6.6.4 and 6.6.5 in the presence of an NR interfering signal according to table 6.7.3.1-1

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 *TAB connectors* 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 *multi-band connector*, 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 6.7.3.1-1: Interfering and wanted signals for the co-location transmitter intermodulation requirement

| Parameter | Value |
| --- | --- |
| Wanted signal type | NR single carrier, 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 | *Rated total output power* per *TAB connector* (Prated,t,TABC) in the *operating band* – 30 dB |
| 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 *TAB connector* 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 38.141-1 [5] provides further guidance regarding appropriate test requirements.  NOTE 2: In Japan, NOTE 1 is not applied in Band n77, n78, n79. | |

#### 6.7.3.2 Intra-system minimum requirements

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 6.6.3 and 6.6.4 in the presence of an NR interfering signal according to table 6.7.3.2-1.

Table 6.7.3.2-1: Interfering and wanted signals for  
intra-system transmitter intermodulation requirement

| Parameter | Value |
| --- | --- |
| Wanted signal type | NR signal |
| Interfering signal type | NR signal of the same *BS channel bandwidth* and SCS as the wanted signal (Note 1). |
| Interfering signal level | Power level declared by the base station manufacturer (Note 2). |
| Frequency offset between interfering signal and wanted signal | 0 MHz |
| NOTE 1: The interfering signal shall be incoherent with the wanted signal.  NOTE 2: The declared interfering signal power level at each *TAB connector* is the sum of the co-channel leakage power coupled via the combined RDN and Antenna Array from all the other *TAB connectors*, but does not comprise power radiated from the Antenna Array and reflected back from the environment. The power at each of the interfering *TAB connectors* is Prated,c,TABC. | |

#### 6.7.3.3 Additional requirements

No additional requirements.

**<<< Unchanged sections omitted >>>**

## 7.2 Reference sensitivity level

### 7.2.1 General

The reference sensitivity power level PREFSENS is the minimum mean power received at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* at which a throughput requirement shall be met for a specified reference measurement channel.

### 7.2.2 Minimum requirements for *BS type 1-C* and *BS type 1-H*

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 7.2.2-1 for Wide Area BS, in table 7.2.2-2 for Medium Range BS and in table 7.2.2-3 for Local Area BS.

The reference sensitivity level requirements for NB-IoT are specified in TS 36.104 [13] clause 7.2.

Table 7.2.2-1: NR Wide Area BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel  (NOTE 5) | Reference sensitivity power level, PREFSENS  (dBm) |
| 5, 10, 15 | 15 | G-FR1-A1-1 (Note 1) | -101.7 |
| G-FR1-A1-10 (Note 3) | -101.7 (Note 2) |
| 10, 15 | 30 | G-FR1-A1-2 (Note 1) | -101.8 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) | -98.9 |
| 20, 25, 30, 40, 50 | 15 | G-FR1-A1-4 (Note 1) | -95.3 |
| G-FR1-A1-11 (Note 4) | -95.3 (Note 2) |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 (Note 1) | -95.6 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 (Note 1) | -95.7 |
| NOTE 1: PREFSENS 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 requirements apply to BS that supports NB-IoT operation in NR in-band.  NOTE 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.  NOTE 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each.  NOTE 5: These reference measurement channels are not applied for band n46 and n96 except 60 kHz sub-carrier spacing. | | | |

**Table 7.2.2-2a: NR Medium Range BS reference sensitivity levels for band n46**

|  |  |  |  |
| --- | --- | --- | --- |
| ***BS channel bandwidth* (MHz)** | **Sub-carrier spacing (kHz)** | **Reference measurement channel** | **Reference sensitivity power level, PREFSENS**  **(dBm)** |
| 10 | 15 | G-FR1-A1-12 (NOTE 2) | -103.0 |
| 30 | G-FR1-A1-13 (NOTE 2) | -100.7 |
| 60 | G-FR1-A1-3 (NOTE 1) | -93.9 |
| 20 | 15 | G-FR1-A1-14 (NOTE 2) | -100.1 |
| 30 | G-FR1-A1-15 (NOTE 2) | -97.1 |
| 60 | G-FR1-A1-6 (NOTE 1) | -90.7 |
| 40 | 15 | G-FR1-A1-16 (NOTE 2) | -97.0 |
| 30 | G-FR1-A1-17 (NOTE 2) | -94.0 |
| 60 | G-FR1-A1-6 (NOTE 1) | -90.7 |
| 60 | 30 | G-FR1-A1-18 (NOTE 2) | -92.4 |
| 60 | G-FR1-A1-6 (NOTE 1) | -90.7 |
| 80 | 30 | G-FR1-A1-19 (NOTE 2) | -91.1 |
| 60 | G-FR1-A1-6 (NOTE 1) | -90.7 |
| NOTE 1: PREFSENS 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: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each single interlace of FRC G-FR1-A1-12 and G-FR1-A1-19, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | |

Table 7.2.2-2: NR Medium Range BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | Reference sensitivity power level, PREFSENS  (dBm) |
| 5, 10, 15 | 15 | G-FR1-A1-1 (Note 1) | -96.7 |
| G-FR1-A1-10 (Note 3) | -96.7 (Note 2) |
| 10, 15 | 30 | G-FR1-A1-2 (Note 1) | -96.8 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) | -93.9 |
| 20, 25, 30, 40, 50 | 15 | G-FR1-A1-4 (Note 1) | -90.3 |
| G-FR1-A1-11 (Note 4) | -90.3 (Note 2) |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 (Note 1) | -90.6 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 (Note 1) | -90.7 |
| NOTE 1: PREFSENS 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 requirements apply to BS that supports NB-IoT operation in NR in-band.  NOTE 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.  NOTE 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each. | | | |

Table 7.2.2-3: NR Local Area BS reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | Reference sensitivity power level, PREFSENS  (dBm) |
| 5, 10, 15 | 15 | G-FR1-A1-1 (Note 1) | -93.7 |
| G-FR1-A1-10 (Note 3) | -93.7 (Note 2) |
| 10, 15 | 30 | G-FR1-A1-2 (Note 1) | -93.8 |
| 10, 15 | 60 | G-FR1-A1-3 (Note 1) | -90.9 |
| 20, 25, 30, 40, 50 | 15 | G-FR1-A1-4 (Note 1) | -87.3 |
| G-FR1-A1-11 (Note 4) | -87.3 (Note 2) |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 30 | G-FR1-A1-5 (Note 1) | -87.6 |
| 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 60 | G-FR1-A1-6 (Note 1) | -87.7 |
| NOTE 1: PREFSENS 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 requirements apply to BS that supports NB-IoT operation in NR in-band.  NOTE 3: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-10 mapped to the 24 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-1 mapped to disjoint frequency ranges with a width of 25 resource blocks each.  NOTE 4: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for a single instance of G-FR1-A1-11 mapped to the 105 NR resource blocks adjacent to the NB-IoT PRB, and for each consecutive application of a single instance of G-FR1-A1-4 mapped to disjoint frequency ranges with a width of 106 resource blocks each.  NOTE 5: These reference measurement channels are not applied for band n46 and n96 except 60 kHz sub-carrier spacing. | | | |

**Table 7.2.2-3a: NR Local Area BS reference sensitivity levels for band n46**

|  |  |  |  |
| --- | --- | --- | --- |
| ***BS channel bandwidth* (MHz)** | **Sub-carrier spacing (kHz)** | **Reference measurement channel** | **Reference sensitivity power level, PREFSENS**  **(dBm)** |
| 10 | 15 | G-FR1-A1-12 (NOTE 2) | -100.0 |
| 30 | G-FR1-A1-13 (NOTE 2) | -97.7 |
| 60 | G-FR1-A1-3 (NOTE 1) | -90.9 |
| 20 | 15 | G-FR1-A1-14 (NOTE 2) | -97.1 |
| 30 | G-FR1-A1-15 (NOTE 2) | -94.1 |
| 60 | G-FR1-A1-6 (NOTE 1) | -87.7 |
| 40 | 15 | G-FR1-A1-16 (NOTE 2) | -94.0 |
| 30 | G-FR1-A1-17 (NOTE 2) | -91.0 |
| 60 | G-FR1-A1-6 (NOTE 1) | -87.7 |
| 60 | 30 | G-FR1-A1-18 (NOTE 2) | -89.4 |
| 60 | G-FR1-A1-6 (NOTE 1) | -87.7 |
| 80 | 30 | G-FR1-A1-19 (NOTE 2) | -88.1 |
| 60 | G-FR1-A1-6 (NOTE 1) | -87.7 |
| NOTE 1: PREFSENS 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: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each single interlace of FRC G-FR1-A1-12 and G-FR1-A1-19, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | |

**Table 7.2.2-3b: NR Local Area BS reference sensitivity levels for band n96**

|  |  |  |  |
| --- | --- | --- | --- |
| ***BS channel bandwidth* (MHz)** | **Sub-carrier spacing (kHz)** | **Reference measurement channel** | **Reference sensitivity power level, PREFSENS**  **(dBm)** |
| 20 | 15 | G-FR1-A1-14 (NOTE 2) | -96.1 |
| 30 | G-FR1-A1-15 (NOTE 2) | -93.1 |
| 60 | G-FR1-A1-6 (NOTE 1) | -86.7 |
| 40 | 15 | G-FR1-A1-16 (NOTE 2) | -93.0 |
| 30 | G-FR1-A1-17 (NOTE 2) | -90.0 |
| 60 | G-FR1-A1-6 (NOTE 1) | -86.7 |
| 60 | 30 | G-FR1-A1-18 (NOTE 2) | -88.4 |
| 60 | G-FR1-A1-6 (NOTE 1) | -86.7 |
| 80 | 30 | G-FR1-A1-19 (NOTE 2) | -87.1 |
| 60 | G-FR1-A1-6 (NOTE 1) | -86.7 |
| NOTE 1: PREFSENS 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: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each single interlace of FRC G-FR1-A1-12 and G-FR1-A1-19, except for one instance that might overlap one other instance to cover the full *BS channel bandwidth*. | | | |

## 7.3 Dynamic range

### 7.3.1 General

The dynamic range is specified as a measure of the capability of the receiver to receive a wanted signal in the presence of an interfering signal at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* inside the received *BS channel bandwidth*. In this condition, a throughput requirement shall be met for a specified reference measurement channel. The interfering signal for the dynamic range requirement is an AWGN signal.

### 7.3.2 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 as specified in annex A.2 with parameters specified in table 7.3.2-1 for Wide Area BS, in table 7.3.2-2 for Medium Range BS and in table 7.3.2-3 for Local Area BS.

For NB-IoT operation in NR in-band, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in Annex A of TS 36.104 [13] with parameters specified in table 7.3.2-1a for Wide Area BS, in table 7.3.2-2a for Medium Range BS and in table 7.3.2-3a for Local Area BS.

Table 7.3.2-1: Wide Area BS dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *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 | -82.5 | AWGN |
| 30 | G-FR1-A2-2 | -71.4 |
| 10 | 15 | G-FR1-A2-1 | -70.7 | -79.3 | AWGN |
| 30 | G-FR1-A2-2 | -71.4 |
| 60 | G-FR1-A2-3 | -68.4 |
| 15 | 15 | G-FR1-A2-1 | -70.7 | -77.5 | AWGN |
| 30 | G-FR1-A2-2 | -71.4 |
| 60 | G-FR1-A2-3 | -68.4 |
| 20 | 15 | G-FR1-A2-4 | -64.5 | -76.2 | AWGN |
| 30 | G-FR1-A2-5 | -64.5 |
| 60 | G-FR1-A2-6 | -64.8 |
| 25 | 15 | G-FR1-A2-4 | -64.5 | -75.2 | AWGN |
| 30 | G-FR1-A2-5 | -64.5 |
| 60 | G-FR1-A2-6 | -64.8 |
| 30 | 15 | G-FR1-A2-4 | -64.5 | -74.4 | AWGN |
| 30 | G-FR1-A2-5 | -64.5 |
| 60 | G-FR1-A2-6 | -64.8 |
| 40 | 15 | G-FR1-A2-4 | -64.5 | -73.1 | AWGN |
| 30 | G-FR1-A2-5 | -64.5 |
| 60 | G-FR1-A2-6 | -64.8 |
| 50 | 15 | G-FR1-A2-4 | -64.5 | -72.1 | AWGN |
| 30 | G-FR1-A2-5 | -64.5 |
| 60 | G-FR1-A2-6 | -64.8 |
| 60 | 30 | G-FR1-A2-5 | -64.5 | -71.3 | AWGN |
| 60 | G-FR1-A2-6 | -64.8 |
| 70 | 30 | G-FR1-A2-5 | -64.5 | -70.7 | AWGN |
| 60 | G-FR1-A2-6 | -64.8 |
| 80 | 30 | G-FR1-A2-5 | -64.5 | -70.1 | AWGN |
| 60 | G-FR1-A2-6 | -64.8 |
| 90 | 30 | G-FR1-A2-5 | -64.5 | -69.5 | AWGN |
| 60 | G-FR1-A2-6 | -64.8 |
| 100 | 30 | G-FR1-A2-5 | -64.5 | -69.1 | AWGN |
| 60 | G-FR1-A2-6 | -64.8 |
| 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 7.3.2-1a: Wide Area BS dynamic range for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A15-1 in Annex A.15 in TS 36.104 [13] | -99.7 | -82.5 | AWGN |
| 10 | -79.3 |
| 15 | -77.5 |
| 20 | -76.2 |
| 25 | -75.2 |
| 30 | -74.4 |
| 40 | -73.1 |
| 50 | -72.1 |
| 5 | FRC A15-2 in Annex A.15 in TS 36.104 [13] | -105.6 | -82.5 | AWGN |
| 10 | -79.3 |
| 15 | -77.5 |
| 20 | -76.2 |
| 25 | -75.2 |
| 30 | -74.4 |
| 40 | -73.1 |
| 50 | -72.1 |

Table 7.3.2-2: Medium Range BS dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *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 | -77.5 | AWGN |
| 30 | G-FR1-A2-2 | -66.4 |
| 10 | 15 | G-FR1-A2-1 | -65.7 | -74.3 | AWGN |
| 30 | G-FR1-A2-2 | -66.4 |
| 60 | G-FR1-A2-3 | -63.4 |
| 15 | 15 | G-FR1-A2-1 | -65.7 | -72.5 | AWGN |
| 30 | G-FR1-A2-2 | -66.4 |
| 60 | G-FR1-A2-3 | -63.4 |
| 20 | 15 | G-FR1-A2-4 | -59.5 | -71.2 | AWGN |
| 30 | G-FR1-A2-5 | -59.5 |
| 60 | G-FR1-A2-6 | -59.8 |
| 25 | 15 | G-FR1-A2-4 | -59.5 | -70.2 | AWGN |
| 30 | G-FR1-A2-5 | -59.5 |
| 60 | G-FR1-A2-6 | -59.8 |
| 30 | 15 | G-FR1-A2-4 | -59.5 | -69.4 | AWGN |
| 30 | G-FR1-A2-5 | -59.5 |
| 60 | G-FR1-A2-6 | -59.8 |
| 40 | 15 | G-FR1-A2-4 | -59.5 | -68.1 | AWGN |
| 30 | G-FR1-A2-5 | -59.5 |
| 60 | G-FR1-A2-6 | -59.8 |
| 50 | 15 | G-FR1-A2-4 | -59.5 | -67.1 | AWGN |
| 30 | G-FR1-A2-5 | --59.5 |
| 60 | G-FR1-A2-6 | -59.8 |
| 60 | 30 | G-FR1-A2-5 | -59.5 | -66.3 | AWGN |
| 60 | G-FR1-A2-6 | -59.8 |
| 70 | 30 | G-FR1-A2-5 | -59.5 | -65.7 | AWGN |
| 60 | G-FR1-A2-6 | -59.8 |
| 80 | 30 | G-FR1-A2-5 | -59.5 | -65.1 | AWGN |
| 60 | G-FR1-A2-6 | -59.8 |
| 90 | 30 | G-FR1-A2-5 | -59.5 | -64.5 | AWGN |
| 60 | G-FR1-A2-6 | -59.8 |
| 100 | 30 | G-FR1-A2-5 | -59.5 | -64.1 | AWGN |
| 60 | G-FR1-A2-6 | -59.8 |
| NOTE 1: 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*.  NOTE 2: These reference measurement channels are not applied for band n46 and n96 except 60 kHz sub-carrier spacing. | | | | | |

Table 7.3.2-2a: Medium Range BS dynamic range for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A15-1 in Annex A.15 in TS 36.104 [13] | -94.7 | -77.5 | AWGN |
| 10 | -74.3 |
| 15 | -72.5 |
| 20 | -71.2 |
| 25 | -70.2 |
| 30 | -69.4 |
| 40 | -68.1 |
| 50 | -67.1 |
| 5 | FRC A15-2 in Annex A.15 in TS 36.104 [13] | -100.6 | -77.5 | AWGN |
| 10 | -74.3 |
| 15 | -72.5 |
| 20 | -71.2 |
| 25 | -70.2 |
| 30 | -69.4 |
| 40 | -68.1 |
| 50 | -67.1 |

**Table 7.3.2-2b: Medium Range BS dynamic range for band n46**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***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** |
| 10 | 15 | G-FR1-A2-7 | -72.8 | -74.3 | AWGN |
| 30 | G-FR1-A2-8 | -70.6 |
| 60 | G-FR1-A2-3 | -63.4 |
| 20 | 15 | G-FR1-A2-9 | -69.8 | -71.2 | AWGN |
| 30 | G-FR1-A2-10 | -66.8 |
| 60 | G-FR1-A2-6 | -59.8 |
| 40 | 15 | G-FR1-A2-11 | -66.7 | -68.1 | AWGN |
| 30 | G-FR1-A2-12 | -63.7 |
| 60 | G-FR1-A2-6 | -59.8 |
| 60 | 30 | G-FR1-A2-13 | -61.9 | -66.3 | AWGN |
| 60 | G-FR1-A2-6 | -59.8 |
| 80 | 30 | G-FR1-A2-14 | -60.7 | -65.1 | AWGN |
| 60 | G-FR1-A2-6 | -59.8 |
| 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 7.3.2-3: Local Area BS dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *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 | -74.5 | AWGN |
| 30 | G-FR1-A2-2 | -63.4 |
| 10 | 15 | G-FR1-A2-1 | -62.7 | -71.3 | AWGN |
| 30 | G-FR1-A2-2 | -63.4 |
| 60 | G-FR1-A2-3 | -60.4 |
| 15 | 15 | G-FR1-A2-1 | -62.7 | -69.5 | AWGN |
| 30 | G-FR1-A2-2 | -63.4 |
| 60 | G-FR1-A2-3 | -60.4 |
| 20 | 15 | G-FR1-A2-4 | -56.5 | -68.2 | AWGN |
| 30 | G-FR1-A2-5 | -56.5 |
| 60 | G-FR1-A2-6 | -56.8 |
| 25 | 15 | G-FR1-A2-4 | -56.5 | -67.2 | AWGN |
| 30 | G-FR1-A2-5 | -56.5 |
| 60 | G-FR1-A2-6 | -56.8 |
| 30 | 15 | G-FR1-A2-4 | -56.5 | -66.4 | AWGN |
| 30 | G-FR1-A2-5 | -56.5 |
| 60 | G-FR1-A2-6 | -56.8 |
| 40 | 15 | G-FR1-A2-4 | -56.5 | -65.1 | AWGN |
| 30 | G-FR1-A2-5 | -56.5 |
| 60 | G-FR1-A2-6 | -56.8 |
| 50 | 15 | G-FR1-A2-4 | -56.5 | -64.1 | AWGN |
| 30 | G-FR1-A2-5 | -56.5 |
| 60 | G-FR1-A2-6 | -56.8 |
| 60 | 30 | G-FR1-A2-5 | -56.5 | -63.3 | AWGN |
| 60 | G-FR1-A2-6 | -56.8 |
| 70 | 30 | G-FR1-A2-5 | -56.5 | -62.7 | AWGN |
| 60 | G-FR1-A2-6 | -56.8 |
| 80 | 30 | G-FR1-A2-5 | -56.5 | -62.1 | AWGN |
| 60 | G-FR1-A2-6 | -56.8 |
| 90 | 30 | G-FR1-A2-5 | -56.5 | -61.5 | AWGN |
| 60 | G-FR1-A2-6 | -56.8 |
| 100 | 30 | G-FR1-A2-5 | -56.5 | -61.1 | AWGN |
| 60 | G-FR1-A2-6 | -56.8 |
| NOTE 1: 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*.  NOTE 2: These reference measurement channels are not applied for band n46 and n96 except 60 kHz sub-carrier spacing. | | | | | |

Table 7.3.2-3a: Local Area BS dynamic range for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A15-1 in Annex A.15 in TS 36.104 [13] | -91.7 | -74.5 | AWGN |
| 10 | -71.3 |
| 15 | -69.5 |
| 20 | -68.2 |
| 25 | -67.2 |
| 30 | -66.4 |
| 40 | -65.1 |
| 50 | -64.1 |
| 5 | FRC A15-2 in Annex A.15 in TS 36.104 [13] | -97.6 | -74.5 | AWGN |
| 10 | -71.3 |
| 15 | -69.5 |
| 20 | -68.2 |
| 25 | -67.2 |
| 30 | -66.4 |
| 40 | -65.1 |
| 50 | -64.1 |

**Table 7.3.2-3b: Local Area BS dynamic range for band n46**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***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** |
| 10 | 15 | G-FR1-A2-7 | -69.8 | -71.3 | AWGN |
| 30 | G-FR1-A2-8 | -67.6 |
| 60 | G-FR1-A2-3 | -60.4 |
| 20 | 15 | G-FR1-A2-9 | -66.8 | -68.2 | AWGN |
| 30 | G-FR1-A2-19 | -63.8 |
| 60 | G-FR1-A2-6 | -56.8 |
| 40 | 15 | G-FR1-A2-11 | -63.7 | -65.1 | AWGN |
| 30 | G-FR1-A2-12 | -60.7 |
| 60 | G-FR1-A2-6 | -56.8 |
| 60 | 30 | G-FR1-A2-13 | -58.9 | -63.3 | AWGN |
| 60 | G-FR1-A2-6 | -56.8 |
| 80 | 30 | G-FR1-A2-14 | -57.7 | -62.1 | AWGN |
| 60 | G-FR1-A2-6 | -56.8 |
| 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 interleaved 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. | | | | | |

**Table 7.3.2-3c: Local area BS dynamic range for band n96**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***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** |
| 20 | 15 | G-FR1-A2-9 | -65.8 | -67.2 | AWGN |
| 30 | G-FR1-A2-19 | -62.8 |
| 60 | G-FR1-A2-6 | -55.8 |
| 40 | 15 | G-FR1-A2-11 | -62.7 | -64.1 | AWGN |
| 30 | G-FR1-A2-12 | -59.7 |
| 60 | G-FR1-A2-6 | -55.8 |
| 60 | 30 | G-FR1-A2-13 | -57.9 | -62.3 | AWGN |
| 60 | G-FR1-A2-6 | -55.8 |
| 80 | 30 | G-FR1-A2-14 | -56.7 | -61.1 | AWGN |
| 60 | G-FR1-A2-6 | -55.8 |
| 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 interleaved 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. | | | | | |

## 7.4 In-band selectivity and blocking

### 7.4.1 Adjacent Channel Selectivity (ACS)

#### 7.4.1.1 General

Adjacent channel selectivity (ACS) is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* in the presence of an adjacent channel signal with a specified centre frequency offset of the interfering signal to the band edge of a victim system.

#### 7.4.1.2 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.

For BS, the wanted and the interfering signal coupled to the *BS* *type 1-C* *antenna connector* or *BS type 1-H* *TAB connector* are specified in table 7.4.1.2-1 and the frequency offset between the wanted and interfering signal in table 7.4.1.2-2 for ACS. The reference measurement channel for the wanted signal is identified in table 7.2.2-1, 7.2.2-2 and 7.2.2-3 for each *BS channel bandwidth* and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex D.

For BS operating in band n46 and n96, the wanted and the interfering signal coupled to the BS type 1-C antenna connector or BS type 1-H TAB connector are specified in table 7.4.1.2-1a and in table 7.4.1.2-1b and the frequency offset between the wanted and interfering signal in table 7.4.1.2-2a for ACS. The reference measurement channel for the wanted signal is identified in table 7.2.2-2a and 7.2.2-3a for each BS channel bandwidth and further specified in annex A.1a. The characteristics of the interfering signal is further specified in annex D.

For BS supporting NB-IoT operation in NR in-band, the wanted and the interfering signal coupled to the *BS* *type 1-C* *antenna connector* are specified in table 7.4.1.2-1 and the frequency offset between the wanted and interfering signal in table 7.4.1.2-2 for ACS. The reference measurement channel for the NB-IoT wanted signal is identified in clause 7.2.1 of TS 36.104 [13]. The characteristics of the interfering signal is further specified in annex D.

The ACS requirement is applicable 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 a BS operating in *non-contiguous spectrum* within any *operating band*, the 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 7.4.1.2-2. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For a *multi-band connector*, the 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 7.4.1.2‑2. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

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 7.4.1.2-1: Base station ACS 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: -52  Medium Range BS: -47  Local Area BS: -44 |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that bandwidth.  NOTE 2: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2, 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5, 7.2.1-5a and 7.2.1-5c of TS 36.104 [13]. | | |

**Table 7.4.1.2-1a: Base station ACS requirement for band n46**

|  |  |  |
| --- | --- | --- |
| ***BS channel bandwidth* of the lowest/*highest carrier* received (MHz)** | **Wanted signal mean power (dBm)** | **Interfering signal mean power (dBm)** |
| 10, 20, 40, 60, 80 (Note 1) | PREFSENS + 6 dB | Medium Range BS: -47  Local Area BS: -44 |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that bandwidth.  NOTE 2: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in tables 7.2.2-2a, 7.2.2-3a. | | |

**Table 7.4.1.2-1a: Base station ACS requirement for band n96**

|  |  |  |
| --- | --- | --- |
| ***BS channel bandwidth* of the lowest/*highest carrier* received (MHz)** | **Wanted signal mean power (dBm)** | **Interfering signal mean power (dBm)** |
| 20, 40, 60, 80 (Note 1) | PREFSENS + 6 dB | Medium Range BS: -46  Local Area BS: -43 |
| NOTE 1: The SCS for the lowest/highest carrier received is the lowest SCS supported by the BS for that bandwidth.  NOTE 2: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in tables 7.2.2-2a, 7.2.2-3a. | | |

Table 7.4.1.2-2: Base Station ACS interferer frequency offset values

|  |  |  |
| --- | --- | --- |
| *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 | 5 MHz DFT-s-OFDM NR signal  15 kHz SCS, 25 RBs |
| 10 | ±2.5075 |
| 15 | ±2.5125 |
| 20 | ±2.5025 |
| 25 | ±9.4675 | 20 MHz DFT-s-OFDM NR signal  15 kHz SCS, 100 RBs |
| 30 | ±9.4725 |
| 40 | ±9.4675 |
| 50 | ±9.4625 |
| 60 | ±9.4725 |
| 70 | ±9.4675 |
| 80 | ±9.4625 |
| 90 | ±9.4725 |
| 100 | ±9.4675 |

**Table 7.4.1.2-2a: Base Station ACS interferer frequency offset values for band n46 and n96**

|  |  |  |
| --- | --- | --- |
| ***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** |
| 10 | ±9.4675 | 20 MHz DFT-s-OFDM NR signal  15 kHz SCS, 100 RBs |
| 20 | ±9.4625 |
| 40 | ±9.4675 |
| 60 | ±9.4725 |
| 80 | ±9.4625 |

#### 7.4.1.3 Void

#### 7.4.1.4 Void

### 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. Narrowband blocking requirements are not applied for band n46 and n96. 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.

For NB-IoT operation in NR in-band, 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* using the parameters in tables 7.4.2.2-1, 7.4.2.2-2a and 7.4.2.2-3 for general blocking and narrowband blocking requirements. The reference measurement channel for the NB-IoT wanted signal is identified in clause 7.2.1 of TS 36.104 [13]. 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 ≤ [1200] MHz [Note 1] | 60 |
| *BS type 1-H* | FUL,high – FUL,low < 100 MHz | 20 |
| 100 MHz ≤ FUL,high – FUL,low ≤ [1200] MHz [Note 1] | 60 |
| Note 1: For band n96 ΔfOOB offset is TBD. | | |

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) | 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 + 6 dB | Wide Area BS: -43  Medium Range BS: -38  Local Area BS: -35 | ±7.5 | 5 MHz DFT-s-OFDM NR signal  15 kHz SCS, 25 RBs |
| 25, 30, 40, 50, 60, 70, 80, 90, 100 | PREFSENS + 6 dB | Wide Area BS: -43  Medium Range BS: -38  Local Area BS: -35 | ±30 | 20 MHz DFT-s-OFDM NR signal  15 kHz SCS, 100 RBs |
| NOTE: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5, 7.2.1-5a and 7.2.1-5c of TS 36.104 [13]. | | | | |

**Table 7.4.2.2-1a: Base station general blocking requirement for n46**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***BS channel bandwidth* of the *lowest/highest carrier* received (MHz)** | **Wanted signal mean power (dBm)** | **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** |
| 10, 20, 40, 60, 80 | PREFSENS + 6 dB | Medium Range BS: -38  Local Area BS: -35 | ±30 | 20 MHz DFT-s-OFDM NR signal  15 kHz SCS, 100 RBs |
| NOTE: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3. | | | | |

**Table 7.4.2.2-1b: Base station general blocking requirement for n96**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***BS channel bandwidth* of the *lowest/highest carrier* received (MHz)** | **Wanted signal mean power (dBm)** | **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** |
| 20, 40, 60, 80 | PREFSENS + 6 dB | Local Area BS: [-35] | ±30 | 20 MHz DFT-s-OFDM NR signal  15 kHz SCS, 100 RBs |
| NOTE 1: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3. | | | | |

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: -49  Medium Range BS: -44  Local 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 7.4.2.2-2a: Base Station narrowband blocking requirement for NB-IoT operation in NR in-band

|  |  |  |
| --- | --- | --- |
| *BS channel bandwidth* (MHz) | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) |
| 5, 10, 15, 20, 25, 30, 40, 50 | PREFSENS + x dB (Note 2) | Wide Area: -49  Medium Range: -44  Local Area: -41 |
| NOTE 1: PREFSENS depends on the *sub-carrier spacing* as specified in tables 7.2.1-5, 7.2.1-5a and 7.2.1-5c of TS 36.104 [13].  NOTE 2: “x” is equal to 8 in case of 5 MHz channel bandwidth and equal to 6 otherwise. | | |

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. | | |

**<<< Unchanged sections omitted >>>**

## 7.5 Out-of-band blocking

### 7.5.1 General

The out-of-band blocking characteristics is a measure of the receiver 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 out of the *operating band*, which is a CW signal for out-of-band blocking.

### 7.5.2 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 table 7.5.2-1. 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.

For NB-IoT operation in NR in-band, 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* using the parameters in table 7.5.2-1. The reference measurement channel for the NB-IoT wanted signal is identified in clause 7.2.1 of TS 36.104 [13].

The out-of-band blocking requirement apply from 1 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-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.*

For a *multi-band connector*, the requirement in the out-of-band blocking frequency ranges apply for each *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 out-of-band blocking requirement.

Table 7.5.2-1: Out-of-band blocking performance requirement for NR

|  |  |  |
| --- | --- | --- |
| Wanted Signal mean power (dBm) | Interfering Signal mean power (dBm) | Type of Interfering Signal |
| PREFSENS +6 dB (Note) | -15 | CW carrier |
| NOTE 1: PREFSENS depends on the RAT. For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in Table 7.2.2-1, 7.2.2-2, and 7.2.2-3. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5, 7.2.1-5a and 7.2.1-5c of TS 36.104 [13].  NOTE 2: For NB-IoT, up to 24 exceptions are allowed for spurious response frequencies in each wanted signal frequency when measured using a 1MHz step size. For these exceptions the above throughput requirement shall be met when the blocking signal is set to a level of -40 dBm for 15 kHz subcarrier spacing and -46 dBm for 3.75 kHz subcarrier spacing. In addition, each group of exceptions shall not exceed three contiguous measurements using a 1MHz step size.  NOTE 3: For band n96 Interfering Signal mean power is [-15] dBm. | | |

**<<< Unchanged sections omitted >>>**

7.5.3 Co-location minimum requirements for *BS type 1-C* and *BS type 1-H*

This additional blocking requirement may be applied for the protection of NR BS receivers when GSM, CDMA, UTRA, E-UTRA or NR BS operating in a different frequency band are co-located with a NR BS. The requirement is applicable to all *BS channel bandwidths* supported by the NR BS.

The requirements in this clause assume a 30 dB coupling loss between interfering transmitter and NR BS receiver and are based on co-location with base stations of the same class.

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* input using the parameters in table 7.5.3-1 for all the BS classes. The reference measurement channel for the wanted signal is identified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3 for each *BS channel bandwidth* and further specified in annex A.1.

The blocking requirement for co-location with BS in other bands is applied for all *operating bands* for which co-location protection is provided.

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 7.5.3-1: Blocking performance requirement for NR BS when co-located with BS in other frequency bands.**

| **Frequency range of interfering signal** | **Wanted signal mean power for WA BS (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* | PREFSENS +6dB (Note 1) | +16 | +8 | x (Note 2) | CW carrier |
| NOTE 1: PREFSENS depends on the *BS channel bandwidth* as specified in Table 7.2.2-1, 7.2.2-2, and 7.2.2-3.  NOTE 2: x = -7 dBm for NR BS co-located with Pico GSM850 or Pico CDMA850 x = -4 dBm for NR BS co-located with Pico DCS1800 or Pico PCS1900 x = -6 dBm for NR BS co-located with UTRA bands or E-UTRA bands or NR bands  NOTE 3: 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)*.  NOTE 4: For unsynchronized base stations (except in band n46 and n96), special co-location requirements may apply that are not covered by the 3GPP specifications | | | | | |

**<<< Unchanged sections omitted >>>**

## 7.7 Receiver intermodulation

### 7.7.1 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 to receive a wanted signal on its assigned channel frequency at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* in the presence of two interfering signals which have a specific frequency relationship to the wanted signal.

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

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 coupled to the *BS type 1-C antenna connector* or *BS type 1-H* *TAB connector*, with the conditions specified in tables 7.7.2-1 and 7.7.2-2 for intermodulation performance and in tables 7.7.2-3, and 7.7.2-4 for narrowband intermodulation performance. Narrowband intermodulation requirements are not applied for band n46 and n96. The reference measurement channel for the wanted signal is identified in tables 7.2.2-1, 7.2.2-2 and 7.2.2-3 for each *BS channel bandwidth* and further specified in annex A.1. The characteristics of the interfering signal is further specified in annex D.

For NB-IoT operation in NR in-band, 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 coupled to the *BS type 1-C antenna connector*, with the conditions specified in tables 7.7.2-1 and 7.7.2-2 for intermodulation performance and in tables 7.7.2-3, and 7.7.2-4 for narrowband intermodulation performance. The reference measurement channel for the NB-IoT wanted signal is identified in clause 7.2.1 of TS 36.104 [13]. The characteristics of the interfering signal is further specified in annex D.

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

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 BS operating 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 *channel bandwidth* of the NR interfering signal in table 7.7.2-2 or 7.7.2-4. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For a *multi-band connector*, 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 a *multi-band connector*, 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 7.7.2-2 and 7.7.2-4. The interfering signal offset is defined relative to the Base Station RF Bandwidth edges inside the *Inter RF Bandwidth gap*.

Table 7.7.2-1: General intermodulation requirement

|  |  |  |  |
| --- | --- | --- | --- |
| Base Station Type | Wanted Signal mean power (dBm) | Mean power of interfering signals (dBm) | Type of interfering signals |
| Wide Area BS | PREFSENS +6 dB | -52 | See Table 7.7.2-2 |
| Medium Range BS | PREFSENS +6 dB | -47 |
| Local Area BS | PREFSENS +6 dB | -44 |
| NOTE 1: PREFSENS depends on the RAT and the BS class. For NR, PREFSENS depends also on the *BS channel bandwidth*, see clause 7.2. For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5, 7.2.1-5a and 7.2.1-5c of TS 36.104 [13]. | | | |

**Table 7.7.2-1: General intermodulation requirement for band n96**

|  |  |  |  |
| --- | --- | --- | --- |
| **Base Station Type** | **Wanted Signal mean power (dBm)** | **Mean power of interfering signals (dBm)** | **Type of interfering signals** |
| Local Area BS | PREFSENS +6 dB | -43 | See Table 7.7.2-2a |
| NOTE 1: PREFSENS depends on the RAT and the BS class. For NR, PREFSENS depends also on the *BS channel bandwidth*, see clause 7.2. | | | |

Table 7.7.2-2: 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 | 20MHz DFT-s-OFDM NR signal (Note 2) |
| 30 | ±7.43 | 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) |
| 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 7.7.2-2a: Interfering signals for intermodulation requirement for n46 and n96**

|  |  |  |
| --- | --- | --- |
| ***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 2)** |
| 10 | ±7.57 | CW (Note 3) |
| ±25 | 20 MHz DFT-s-OFDM NR signal (Note 1, 3) |
| 20 | ±7.50 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal (Note 1) |
| 40 | ±7.45 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal (Note 1) |
| 60 | ±7.49 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal (Note 1) |
| 80 | ±7.44 | CW |
| ±25 | 20 MHz DFT-s-OFDM NR signal (Note 1) |
| NOTE 1: Number of RBs is 100 for 15 kHz subcarrier spacing, 50 for 30 kHz subcarrier spacing and 24 for 60 kHz subcarrier spacing.  NOTE 2: The RBs shall be placed adjacent to the transmission bandwidth configuration edge which is closer to the *Base Station RF Bandwidth* edge.  NOTE 3: This type of interfering signal is only applied for band n46. | | |

Table 7.7.2-3: Narrowband intermodulation performance requirement in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| BS type | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) | Type of interfering signals |
| Wide Area BS | PREFSENS + 6dB  (Note 1) | -52 | See Table 7.7.2-4 |
| Medium Range BS | PREFSENS + 6dB  (Note 2) | -47 |
| Local Area BS | PREFSENS + 6dB  (Note 3) | -44 |
| NOTE 1: PREFSENS depends on the RAT.  For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in table 7.2.2-1.  For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5 of TS 36.104 [13].  NOTE 2: PREFSENS depends on the RAT.  For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in table 7.2.2-2.  For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5c of TS 36.104 [13].  NOTE 3: PREFSENS depends on the RAT.  For NR, PREFSENS depends also on the *BS channel bandwidth* as specified in table 7.2.2-3.  For NB-IoT, PREFSENS depends also on the *sub-carrier spacing* as specified in tables 7.2.1-5a of TS 36.104 [13].  NOTE 4: For NB-IoT, the requirement shall apply only for a FRC A1-3 of TS 36.104 [13] mapped to the frequency range at the channel edge adjacent to the interfering signals.  NOTE 5: For NB-IoT, the frequency offset shall be adjusted to accommodate the IMD product to fall in the NB-IoT RB for NB-IoT operation in NR in-band.  NOTE 6: For NB-IoT, if a BS RF receiver fails the test of the requirement, the test shall be performed with the CW interfering signal frequency shifted away from the wanted signal by 180 kHz and the NR interfering signal frequency shifted away from the wanted signal by 360 kHz. If the BS RF receiver still fails the test after the frequency shift, then the BS RF receiver shall be deemed to fail the requirement. | | | |

Table 7.7.2-4: 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) |
| 40 (Note 2) | ±355 | 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. | | |

## 7.8 In-channel selectivity

### 7.8.1 General

In-channel selectivity (ICS) is a measure of the receiver ability to receive a wanted signal at its assigned resource block locations at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* 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 which is time aligned with the wanted signal.

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

For *BS type 1-C* and *BS type* *1-H*, 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 7.8.2-1 for Wide Area BS, in table 7.8.2-2 for Medium Range BS, in table 7.8.2-2b for Medium Range BS for band n46, in table 7.8.2-3 for Local Area BS, in table 7.8.2-3b for Local Area BS for band n46, and in table 7.8.2-3c for Local Area BS for band n96. The characteristics of the interfering signal is further specified in annex D.

For NB-IoT operation in NR in-band, the throughput shall be ≥ 95% of the maximum throughput of the NB-IoT reference measurement channel as specified in Annex A of TS 36.104 [13] with parameters specified in table 7.8.2-1a for Wide Area BS, in table 7.8.2-2a for Medium Range BS and in table 7.8.2-3a for Local Area BS.

Table 7.8.2-1: 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 | -81.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10,15,20,25,30 | 15 | G-FR1-A1-1 | -98.7 | -77.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40,50 | 15 | G-FR1-A1-4 | -92.3 | -71.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| 5 | 30 | G-FR1-A1-8 | -101.3 | -81.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  5 RBs |
| 10,15,20,25,30 | 30 | G-FR1-A1-2 | -98.8 | -78.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 40,50,60,70,80,90,100 | 30 | G-FR1-A1-5 | -92.6 | -71.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  50 RBs |
| 10,15,20,25,30 | 60 | G-FR1-A1-9 | -98.2 | -78.4 | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40,50,60,70,80,90,100 | 60 | G-FR1-A1-6 | -92.7 | -71.6 | 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* ofthe wanted signalaccording 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 7.8.2-1a: Wide Area BS in-channel selectivity for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A14-1 in Annex A.14 in TS 36.104 [13] | -124.3 | -81.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30 | -77.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 50 | -71.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| 5 | FRC A14-2 in Annex A.14 in TS 36.104 [13] | -130.2 | -81.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30 | -77.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 50 | -71.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| NOTE: Interfering signal is placed in one side of the Fc, while the NB-IoT PRB is placed on the other side. Both interfering signal and NB-IoT PRB are placed at the middle of the available PRB locations. The wanted NB-IoT tone is placed at the centre of this NB-IoT PRB. | | | | |

Table 7.8.2-2: 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 | -76.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10,15,20,25,30 | 15 | G-FR1-A1-1 | -93.7 | -72.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40,50 | 15 | G-FR1-A1-4 | -87.3 | -66.4 | DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs |
| 5 | 30 | G-FR1-A1-8 | -96.3 | -76.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  5 RBs |
| 10,15,20,25,30 | 30 | G-FR1-A1-2 | -93.8 | -73.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 40,50,60,70,80,90,100 | 30 | G-FR1-A1-5 | -87.6 | -66.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  50 RBs |
| 10,15,20,25,30 | 60 | G-FR1-A1-9 | -93.2 | -73.4 | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40,50,60,70,80,90,100 | 60 | G-FR1-A1-6 | -87.7 | -66.6 | 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 signalaccording 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 7.8.2-2a: Medium Range BS in-channel selectivity for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A14-1 in Annex A.14 in TS 36.104 [13] | -119.3 | -76.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30 | -72.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 50 | -66.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| 5 | FRC A14-2 in Annex A.14 in TS 36.104 [13] | -125.2 | -76.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30 | -72.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 50 | -66.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| NOTE: Interfering signal is placed in one side of the Fc, while the NB-IoT PRB is placed on the other side. Both interfering signal and NB-IoT PRB are placed at the middle of the available PRB locations. The wanted NB-IoT tone is placed at the centre of this NB-IoT PRB. | | | | |

**Table 7.8.2-2b: Medium Range BS in-channel selectivity for band n46**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***BS channel bandwidth* (MHz)** | **Subcarrier spacing (kHz)** | **Reference measurement channel** | **Wanted signal mean power (dBm)** | **Interfering signal mean power (dBm)** | **Type of interfering signal** |
| 10 | 15 | G-FR1-A1-12 | -100.0 | -79.5 | CP-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 30 | G-FR1-A1-13 | -97.7 | -77.4 | CP-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 60 | G-FR1-A1-9 | -93.2 | -73.4 | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 20 | 15 | G-FR1-A1-14 | -97.1 | -76.4 | CP-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 30 | G-FR1-A1-15 | -94.1 | -73.4 | CP-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 60 | G-FR1-A1-9 | -93.2 | -73.4 | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40 | 15 | G-FR1-A1-16 | -94.0 | -73.2 | CP-OFDM NR signal, 15 kHz SCS,  20 RBs |
| 30 | G-FR1-A1-17 | -91.0 | -70.2 | CP-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 60 | G-FR1-A1-6 | -87.7 | -66.6 | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| 60 | 30 | G-FR1-A1-18 | -89.4 | -68.4 | CP-OFDM NR signal, 30 kHz SCS,  20 RBs |
| 60 | G-FR1-A1-6 | -87.7 | -66.6 | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| 80 | 30 | G-FR1-A1-19 | -88.1 | -67.1 | CP-OFDM NR signal, 30 kHz SCS,  20 RBs |
| 60 | G-FR1-A1-6 | -87.7 | -66.6 | 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 signalaccording 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 7.8.2-3: 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 | -73.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10,15,20,25,30 | 15 | G-FR1-A1-1 | -90.7 | -69.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40,50 | 15 | G-FR1-A1-4 | -84.3 | -63.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| 5 | 30 | G-FR1-A1-8 | -93.3 | -73.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  5 RBs |
| 10,15,20,25,30 | 30 | G-FR1-A1-2 | -90.8 | -70.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 40,50,60,70,80,90,100 | 30 | G-FR1-A1-5 | -84.6 | -63.4 | DFT-s-OFDM NR signal, 30 kHz SCS,  50 RBs |
| 10,15,20,25,30 | 60 | G-FR1-A1-9 | -90.2 | -70.4 | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40,50,60,70,80,90,100 | 60 | G-FR1-A1-6 | -84.7 | -63.6 | 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 7.8.2-3a: Local Area BS in-channel selectivity for NB-IoT operation in NR in-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *BS channel bandwidth* (MHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | FRC A14-1 in Annex A.14 in TS 36.104 [13] | -116.3 | -73.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30 | -69.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 50 | -63.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| 5 | FRC A14-2 in Annex A.14 in TS 36.104 [13] | -122.2 | -73.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 10, 15, 20, 25, 30 | -69.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  25 RBs |
| 40, 50 | -63.4 | DFT-s-OFDM NR signal, 15 kHz SCS,  100 RBs |
| NOTE: Interfering signal is placed in one side of the Fc, while the NB-IoT PRB is placed on the other side. Both interfering signal and NB-IoT PRB are placed at the middle of the available PRB locations. The wanted NB-IoT tone is placed at the centre of this NB-IoT PRB. | | | | |

**Table 7.8.2-3b: Local Area BS in-channel selectivity for band n46**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***BS channel bandwidth* (MHz)** | **Subcarrier spacing (kHz)** | **Reference measurement channel** | **Wanted signal mean power (dBm)** | **Interfering signal mean power (dBm)** | **Type of interfering signal** |
| 10 | 15 | G-FR1-A1-12 | -97.0 | -76.5 | CP-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 30 | G-FR1-A1-13 | -94.7 | -74.4 | CP-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 60 | G-FR1-A1-9 | -90.2 | -70.4 | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 20 | 15 | G-FR1-A1-14 | -94.1 | -73.4 | CP-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 30 | G-FR1-A1-15 | -91.1 | -70.4 | CP-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 60 | G-FR1-A1-9 | -90.2 | -70.4 | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40 | 15 | G-FR1-A1-16 | -91.0 | -70.2 | CP-OFDM NR signal, 15 kHz SCS,  20 RBs |
| 30 | G-FR1-A1-17 | -88.0 | -67.2 | CP-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 60 | G-FR1-A1-6 | -84.7 | -63.6 | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| 60 | 30 | G-FR1-A1-18 | -86.4 | -65.4 | CP-OFDM NR signal, 30 kHz SCS,  20 RBs |
| 60 | G-FR1-A1-6 | -84.7 | -63.6 | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| 80 | 30 | G-FR1-A1-19 | -85.1 | -64.1 | CP-OFDM NR signal, 30 kHz SCS,  20 RBs |
| 60 | G-FR1-A1-6 | -84.7 | -63.6 | 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 signalaccording 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 7.8.2-3c: Local Area BS in-channel selectivity for band n96**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***BS channel bandwidth* (MHz)** | **Subcarrier spacing (kHz)** | **Reference measurement channel** | **Wanted signal mean power (dBm)** | **Interfering signal mean power (dBm)** | **Type of interfering signal** |
| 20 | 15 | G-FR1-A1-14 | -93.1 | -72.4 | CP-OFDM NR signal, 15 kHz SCS,  10 RBs |
| 30 | G-FR1-A1-15 | -90.1 | -69.4 | CP-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 60 | G-FR1-A1-9 | -90.2 | -70.4 | DFT-s-OFDM NR signal, 60 kHz SCS,  5 RBs |
| 40 | 15 | G-FR1-A1-16 | -90.0 | -69.2 | CP-OFDM NR signal, 15 kHz SCS,  20 RBs |
| 30 | G-FR1-A1-17 | -87.0 | -66.2 | CP-OFDM NR signal, 30 kHz SCS,  10 RBs |
| 60 | G-FR1-A1-6 | -84.7 | -63.6 | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| 60 | 30 | G-FR1-A1-18 | -85.4 | -64.4 | CP-OFDM NR signal, 30 kHz SCS,  20 RBs |
| 60 | G-FR1-A1-6 | -84.7 | -62.6 | DFT-s-OFDM NR signal, 60 kHz SCS,  24 RBs |
| 80 | 30 | G-FR1-A1-19 | -84.1 | -63.1 | CP-OFDM NR signal, 30 kHz SCS,  20 RBs |
| 60 | G-FR1-A1-6 | -84.7 | -63.6 | 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 signalaccording 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. | | | | | |

**<<< Unchanged sections 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 [5].  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 [5].  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 |
| Subcarrier spacing (kHz) | 60 | 120 | 120 | 60 | 120 |
| Allocated resource blocks | 66 | 32 | 66 | 33 | 16 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 5632 | 2792 | 5632 | 2856 | 1416 |
| Transport block CRC (bits) | 24 | 16 | 24 | 16 | 16 |
| Code block CRC size (bits) | - | - | - | - | - |
| Number of code blocks - C | 1 | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits) (Note 3) | 5656 | 2808 | 5656 | 2872 | 1432 |
| Total number of bits per slot | 19008 | 9216 | 19008 | 9504 | 4608 |
| Total symbols per slot | 9504 | 4608 | 9504 | 4752 | 2304 |
| 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 [5].  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)

The parameters for the reference measurement channels are specified in table A.2-1 for FR1 dynamic range and OTA dynamic range. The parameters for the band n46 and n96 reference measurement channels are specified in table A.2-1a and A.2-1b for band n46 and n96 dynamic range.

Table A.2-1: FRC parameters for FR1 dynamic range and OTA dynamic range

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A2-1 | G-FR1-A2-2 | G-FR1-A2-3 | G-FR1-A2-4 | G-FR1-A2-5 | G-FR1-A2-6 |
| Subcarrier spacing (kHz) | 15 | 30 | 60 | 15 | 30 | 60 |
| Allocated resource blocks | 25 | 11 | 11 | 106 | 51 | 24 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |
| Code rate (Note 2) | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 |
| Payload size (bits) | 9224 | 4032 | 4032 | 38936 | 18960 | 8968 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | - | - | 24 | 24 | 24 |
| Number of code blocks - C | 2 | 1 | 1 | 5 | 3 | 2 |
| Code block size including CRC (bits) (Note 3) | 4648 | 4056 | 4056 | 7816 | 6352 | 4520 |
| Total number of bits per slot | 14400 | 6336 | 6336 | 61056 | 29376 | 13824 |
| Total symbols per slot | 3600 | 1584 | 1584 | 15264 | 7344 | 3456 |
| 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 [5].  NOTE 2: MCS index 16 and target coding rate = 658/1024 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]. | | | | | | |

**Table A.2-1a: FRC parameters for dynamic range for band n46 and n96**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference channel** | G-FR1-A2-7 | G-FR1-A2-8 | G-FR1-A2-9 | G-FR1-A2-10 | G-FR1-A2-11 | G-FR1-A2-12 | G-FR1-A2-13 | G-FR1-A2-14 |
| 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 | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |
| Code rate (Note 2) | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 |
| Payload size (bits) | 1864 | 1480 | 3752 | 3752 | 7808 | 7808 | 11784 | 15880 |
| Transport block CRC (bits) | 16 | 16 | 16 | 16 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | - | - | - | - | - | - | 24 | 24 |
| Number of code blocks - C | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| Code block size including CRC (bits) (Note 3) | 1880 | 1496 | 3768 | 3768 | 7832 | 7832 | 5928 | 7976 |
| Total number of bits per slot | 2880 | 2304 | 5760 | 5760 | 12096 | 12096 | 18432 | 24768 |
| Total symbols per slot | 720 | 576 | 1440 | 1440 | 3024 | 3024 | 4608 | 6192 |
| 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 [5].  NOTE 2: MCS index 16 and target coding rate = 658/1024 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].  NOTE 4: For reference channel A2-7, 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={0,1,2,3,4,5,6,7,8,9}.  NOTE 5: For reference channel A2-8, 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 6: For reference channel A2-9, 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 7: For reference channel A2-10, 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 8: For reference channel A2-11, 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 9: For reference channel A2-12, 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 10: For reference channel A2-13, 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 11: For reference channel A2-14, 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}. | | | | | | | | |

**<<< End of Changes >>>**