**3GPP TSG-RAN WG4 Meeting #104-e *R4-221xxxx***

**Electronic meeting, August 15 – 26, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-2** | **CR** | **XXXX** | **rev** | **-** | **Current version:** | **17.6.0** |  |
|  | | | | | | | | |
| *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 | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:*** | Big CR of TS38.101-2 for FR2-2 UE requirements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Intel Corporation | | | | | | | | | |
| ***Source to TSG:*** | RAN4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ext\_to\_71GHz-Core | | | | |  | ***Date:*** | | | 2022-08-29 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Latest agreements for FR2-2 need to be introduced to the specification | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Added content includes the following endorsed draft CRs:   * R4-2214430 - Draft CR for TS 38.101-2 on system parameter updates for FR2-2 * R4-2214883 - Draft CR to 38.101-2 on band n263 Tx aspects * R4-2214884 - Draft CR to 38.101-2 on band n263 Rx aspects * R4-2215142 - Draft CR for n263 RMC | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Some general aspects, system parameters and Tx and Rx requirements of FR2-2 will be missing from the specification | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5, 6, 7, Annex A | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **N** | Other core specifications | | | |  | | |
| ***affected:*** | | **Y** |  | Test specifications | | | | TS 38.521-2 | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

---------------------------------------- < Start of changes to Clause 5 > ----------------------------------------

*< start of changes >*

## 5.2 Operating bands

NR is designed to operate in the FR2 operating bands defined in Table 5.2-1.

Table 5.2-1: NR operating bands in FR2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Operating Band | Uplink (UL) operating band BS receive UE transmit | | | Downlink (DL) operating band BS transmit  UE receive | | | Duplex Mode |
|  | FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |  |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |
| n258 | 24250 MHz | – | 27500 MHz | 24250 MHz | – | 27500 MHz | TDD |
| n259 | 39500 MHz | – | 43500 MHz | 39500 MHz | – | 43500 MHz | TDD |
| n260 | 37000 MHz | – | 40000 MHz | 37000 MHz | – | 40000 MHz | TDD |
| n261 | 27500 MHz | – | 28350 MHz | 27500 MHz | – | 28350 MHz | TDD |
| n262 | 47200 MHz | – | 48200 MHz | 47200 MHz | – | 48200 MHz | TDD |
| n263 | 57000 MHz | – | 71000 MHz | 57000 MHz | – | 71000 MHz | TDD1 |
| NOTE 1: This band is for unlicensed operation and subject to regional and/or country specific regulatory requirements. | | | | | | | |

## 5.2A Operating bands for CA

### 5.2A.1 Intra-band CA

NR intra-band contiguous and non-contiguous carrier aggregation is designed to operate in the operating bands defined in Table 5.2A.1-1, where all operating bands are within FR2.

Table 5.2A.1-1: Intra-band contiguous and non-contiguous CA operating bands in FR2

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n257 | n257 |
| CA\_n258 | n258 |
| CA\_n259 | n259 |
| CA\_n260 | n260 |
| CA\_n261 | n261 |
| CA\_n263 | n263 |
| NOTE 1: In this release of the specification, only contiguous CA is applicable for this operating band. | |

### 5.2A.2 Inter-band CA

NR inter-band carrier aggregation is designed to operate in the operating bands defined in Table 5.2A.2-1, where all operating bands are within FR2.

Beam management type is according to UE capability declaration *IE beamManagementType-r16 or [BMTypeAgreed for\_r17]*. The requirements in the following clauses are only applicable to inter-band CA with IBM type.

Table 5.2A.2-1: Inter-band CA operating bands in FR2

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n257-n2591 | n257, n259 |
| CA\_n258-n2601 | n258, n260 |
| CA\_n258-n2611 | n258, n261 |
| CA\_n260-n2611 | n260, n261 |
| NOTE 1: The minimum requirements apply only when there is non-simultaneous Rx/Tx operation between inter-band NR carriers in the current version of this specification. | |

## 5.2D Operating bands for UL MIMO

NR UL MIMO is designed to operate in the operating bands defined in Table 5.2D-1.

Table 5.2D-1: NR UL MIMO operating bands

|  |
| --- |
| UL MIMO operating band  (Table 5.2-1) |
| n257 |
| n258 |
| n259 |
| n260 |
| n261 |
| n262 |

## 5.3 UE Channel bandwidth

### 5.3.1 General

The UE channel bandwidth supports a single NR RF carrier in the uplink or downlink at the UE. From a BS perspective, different UE channel bandwidths may be supported within the same spectrum for transmitting to and receiving from UEs connected to the BS. Transmission of multiple carriers to the same UE (CA) or multiple carriers to different UEs within the BS channel bandwidth can be supported.

From a UE perspective, the UE is configured with one or more BWP / carriers, each with its own UE channel bandwidth. The UE does not need to be aware of the BS channel bandwidth or how the BS allocates bandwidth to different UEs.

The placement of the UE channel bandwidth for each UE carrier is flexible but can only be completely within the BS channel bandwidth.

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 Maximum transmission bandwidth configuration

The maximum transmission bandwidth configuration NRB for each UE channel bandwidth and subcarrier spacing is specified in Table 5.3.2-1

Table 5.3.2-1: Maximum transmission bandwidth configuration NRB

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCS (kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
|  | NRB | NRB | NRB | NRB | NRB | NRB | NRB |
| 60 | 66 | 132 | 264 | N/A | N/A | N/A | N/A |
| 120 | 32 | 66 | 132 | 264 | N/A | N/A | N/A |
| 4801 | N/A | N/A | N/A | 66 | 124 | 248 | N/A |
| 9601 | N/A | N/A | N/A | 33 | 62 | 124 | 148 |
| Note 1: This SCS is optional in this release of the specification. | | | | | | | |

### 5.3.3 Minimum guardband and transmission bandwidth configuration

The minimum guardband for each UE channel bandwidth and SCS is specified in Table 5.3.3-1.

Table 5.3.3-1: Minimum guardband for each UE channel bandwidth and SCS (kHz)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCS (kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| 60 | 1210 | 2450 | 4930 | N/A | N/A | N/A | N/A |
| 120 | 1900 | 2420 | 4900 | 9860 | N/A | N/A | N/A |
| 480 | N/A | N/A | N/A | 9680 | 42640 | 85520 | N/A |
| 960 | N/A | N/A | N/A | 9440 | 42400 | 85280 | 147040 |

NOTE: The minimum guardbands have been calculated using the following equation: (BWChannel x 1000 (kHz) - NRB x SCS x 12) / 2 - SCS/2, where NRB are from Table 5.3.2-1.

The minimum guardband of receiving BS SCS 240 kHz SS/PBCH block for each UE channel bandwidth is specified in table 5.3.3-2 for FR2.

Table: 5.3.3-2: Minimum guardband (kHz) of SCS 240 kHz SS/PBCH block in FR2-1

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

NOTE: In FR2-1, the minimum guardband in Table 5.3.3-2 is applicable only when the SCS 240 kHz SS/PBCH block is received adjacent to the edge of the UE channel bandwidth within which the SS/PBCH block is located.

Figure 5.3.3-1: Void

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

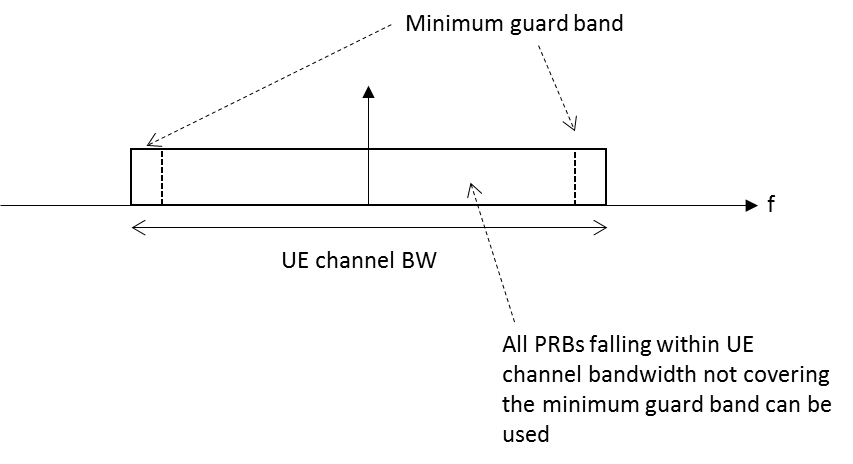


Figure 5.3.3-2 UE PRB utilization

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

If multiple numerologies are multiplexed in the same symbol and the UE channel bandwidth is > 200 MHz, the minimum guardband applied adjacent to 60 kHz SCS shall be the same as the minimum guardband defined for 120 kHz SCS for the same UE channel bandwidth.

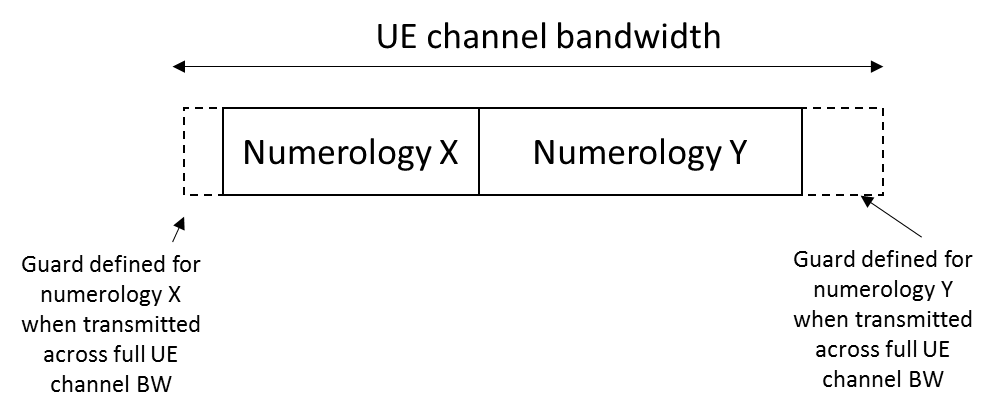


Figure 5.3.3-3 Guard band definition when transmitting multiple numerologies

Note: Figure 5.3.3-3 is not intended to imply the size of any guard between the two numerologies. Inter-numerology guard band within the carrier is implementation dependent.

### 5.3.4 RB alignment

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. The *UE transmission bandwidth configuration* is indicated by the higher layer parameter *carrierBandwidth* [13] and will fulfil the minimum UE guardband requirement specified in Clause 5.3.3.

5.3.5 Channel bandwidth per operating band

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

Table 5.3.5-1: Channel bandwidths for each NR band

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operating band | SCS (kHz) | UE channel bandwidth (MHz) | | | | | | |
| 50 | 100 | 200 | 400 | 800 | 1600 | 2000 |
| n257 | 60 | 50 | 100 | 200 |  |  |  |  |
|  | 120 | 50 | 100 | 200 | 4001 |  |  |  |
| n258 | 60 | 50 | 100 | 200 |  |  |  |  |
|  | 120 | 50 | 100 | 200 | 4001 |  |  |  |
| n259 | 60 | 50 | 100 | 200 |  |  |  |  |
|  | 120 | 50 | 100 | 200 | 4001 |  |  |  |
| n260 | 60 | 50 | 100 | 200 |  |  |  |  |
|  | 120 | 50 | 100 | 200 | 4001 |  |  |  |
| n261 | 60 | 50 | 100 | 200 |  |  |  |  |
|  | 120 | 50 | 100 | 200 | 4001 |  |  |  |
| n262 | 60 | 50 | 100 | 200 |  |  |  |  |
|  | 120 | 50 | 100 | 200 | 4001 |  |  |  |
| n263 | 120 |  | 100 |  | 400 |  |  |  |
| 4802 |  |  |  | 400 | 8001 | 16001 |  |
| 9602 |  |  |  | 400 | 8001 | 16001 | 20001 |
| NOTE 1: This UE channel bandwidth is optional in this release of the specification.  NOTE 2: This SCS is optional in this release of the specification. | | | | | | | | |

## 5.3A UE channel bandwidth for CA

### 5.3A.1 General

### 5.3A.2 Minimum guardband and transmission bandwidth configuration for CA

For intra-band contiguous carrier aggregation, *Aggregated Channel Bandwidth* and *Guard Bands* are defined as follows, see Figure 5.3A.2-1.

**FC, low**

**Lower Edge**

**Upper Edge**

**Lowest Carrier Transmission Bandwidth Configuration (RB)**

**FC, high**

**Foffset, low**

**Highest Carrier Transmission Bandwidth Configuration (RB)**

**Resource block**

***Aggregated Channel Bandwidth*, BWchannel\_CA (MHz)**

**Fedge, low**

**Fedge, high**

**Foffset, high**

Figure 5.3A.2-1: Definition of *Aggregated Channel Bandwidth* for intra-band carrier aggregation

The *aggregated channel bandwidth,* BWChannel\_CA, is defined as

BWChannel\_CA = Fedge,high - Fedge,low (MHz).

The lower bandwidth edge Fedge, low and the upper bandwidth edge Fedge,high of the aggregated channel bandwidth are used as frequency reference points for transmitter and receiver requirements and are defined by

Fedge,low = FC,low - Foffset,low

Fedge,high = FC,high + Foffset,high

The lower and upper frequency offsets depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carrier and are defined as

Foffset,low = (NRB,low\*12 + 1)\*SCSlow/2 + BWGB (MHz)

Foffset,high = (NRB,high\*12 - 1)\*SCShigh/2 + BWGB (MHz)

BWGB = max(BWGB,Channel(k))

NRB,low and NRB,high are the transmission bandwidth configurations according to Table 5.3.2-1 for the lowest and highest assigned component carrier, SCSlow and SCShigh are the sub-carrier spacing for the lowest and highest assigned component carrier respectively. SCSlow, SCShigh, NRB,low, NRB,high, and BWGB,Channel(k) use the largest μ value among the subcarrier spacing configurations supported in the operating band for both of the channel bandwidths according to Table 5.3.5-1 and BWGB,Channel(k) is the minimum guard band for carrier k according to Table 5.3.3-1 for the said *μ* value.

For intra-band non-contiguous carrier aggregation *Sub-block Bandwidth* and *Sub-block edges* are defined as follows, see Figure 5.3A.2-2.

...

Sub block n

**Transmission Bandwidth Configuration of the highest carrier in a sub-block [RB]**

**Transmission Bandwidth Configuration of the lowest carrier in a sub-block [RB]**

**Fedge,block n, low**

**FC,block n,high**

**Fedge,block n,high**

**Foffset,high**

**Foffset,low**

**FC,block n,low**

**Sub-block Bandwidth, BWChannel,block n (MHz)**

**Lower Sub-block Edge**

**Upper Sub-block Edge**

**Resource block**

Sub block n+1

**Foffset,low**

**Fedge,block n+1, low**

**FC,block n+1,low**

**FC,block n+1,high**

**Fedge,block n+1,high**

**Foffset,high**

**Sub-block Bandwidth, BWChannel,block n+1 (MHz)**

**Lower Sub-block Edge**

**Upper Sub-block Edge**

**Transmission Bandwidth Configuration of the highest carrier in a sub-block [RB]**

**Transmission Bandwidth Configuration of the lowest carrier in a sub-block [RB]**

**Resource block**

Figure 5.3A.2-2: Definition of sub-block bandwidth for intra-band non-contiguous spectrum

The lower sub-block edge of the Sub-block Bandwidth (BWChannel,block) is defined as

Fedge,block, low = FC,block,low - Foffset, low.

The upper sub-block edge of the Sub-block Bandwidth is defined as

Fedge,block,high = FC,block,high + Foffset, high.

The Sub-block Bandwidth, BWChannel,block, is defined as follows:

BWChannel,block = Fedge,block,high - Fedge,block,low (MHz)

The lower and upper frequency offsets Foffset,block,low and Foffset,block,high depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carriers within a sub-block and are defined as

Foffset,block,low = (NRB,low\*12 + 1)\*SCSlow/2 + BWGB (MHz)

Foffset,block,high = (NRB,high\*12 - 1)\*SCShigh/2 + BWGB (MHz)

BWGB = max(BWGB,Channel(k))

where NRB,low and NRB,high are the transmission bandwidth configurations according to Table 5.3.2-1 for the lowest and highest assigned component carrier within a sub-block, respectively. SCSlow and SCShigh are the sub-carrier spacing for the lowest and highest assigned component carrier within a sub-block, respectively. SCSlow, SCShigh, NRB,low, NRB,high, and BWGB,Channel(k) use the largest μ value among the subcarrier spacing configurations supported in the operating band for both of the channel bandwidths according to Table 5.3.5-1 and BWGB,Channel(k) is the minimum guard band for carrier k according to Table 5.3.3-1 for the said *μ* value.

The sub-block gap size between two consecutive sub-blocks Wgap is defined as

Wgap = Fedge,block n+1,low - Fedge,block n,high (MHz)

### 5.3A.3 RB alignment with different numerologies for CA

### 5.3A.4 UE channel bandwidth per operating band for CA

For intra-band contiguous carrier aggregation, a carrier aggregation configuration is a single operating band supporting a carrier aggregation bandwidth class with associated bandwidth combination sets specified in clause 5.5A.1. For each carrier aggregation configuration, requirements are specified for all aggregated channel bandwidths contained in a bandwidth combination set, UE can indicate support of several bandwidth combination sets per carrier aggregation configuration. The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier.

For intra-band non-contiguous carrier aggregation, a carrier aggregation configuration is a single operating band supporting two or more sub-blocks, each supporting a carrier aggregation bandwidth class. The requirements are applicable only when Uplink CCs in each UL sub-block are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier of a DL sub-block.

Frequency separation class (Fs) specified in Table 5.3A.4-2 indicates the maximum frequency span between lower edge of lowest component carrier and upper edge of highest component carrier that UE can support per band in downlink or uplink (DL Fs or UL Fs) respectively in non-contiguous intra-band operation within the bidirectional spectrum.

The DL-only frequency spectrum is the width of UE frequency spectrum available to network to configure DL CCs only, and it extends on one-side of the bidirectional spectrum in contiguous manner with no frequency gap between the two. Frequency separation class for DL-only spectrum (Fsd) specified in Table 5.3A.4-3 and is declared per band. The frequency separation class for DL-only spectrum (Fsd) can be equal but not larger than the frequency separation (DL Fs). The combined downlink spectrum (DL Fs + Fsd) cannot exceed 2400 MHz. A UE may configure DL-only spectrum only if the combined downlink spectrum (DL Fs + Fsd) exceeds 1400 MHz. When a UE configures DL-only spectrum, it shall not expect a CC to be configured across the boundary between bidirectional spectrum and DL-only spectrum UE can support respectively.

For inter-band carrier aggregation, a carrier aggregation configuration is a combination of operating bands, each supporting a carrier aggregation bandwidth class.

Table 5.3A.4-1: CA bandwidth classes

|  |  |  |  |
| --- | --- | --- | --- |
| NR CA bandwidth class | Aggregated channel bandwidth | Number of contiguous CC | Fallback group |
| A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4,5 |
| B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 |
| C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |  |
| D | 200 MHz < BWChannel\_CA ≤ 400 MHz | 2 | 2 |
| E | 400 MHz < BWChannel\_CA ≤ 600 MHz | 3 |  |
| F | 600 MHz < BWChannel\_CA ≤ 800 MHz | 4 |  |
| R | 800 MHz < BWChannel\_CA ≤ 1000 MHz | 5 |  |
| S | 1000 MHz < BWChannel\_CA ≤ 1200 MHz | 6 |  |
| T | 1200 MHz < BWChannel\_CA ≤ 1400 MHz | 7 |  |
| U | 1400 MHz < BWChannel\_CA ≤ 1600 MHz | 8 |  |
| G | 100 MHz < BWChannel\_CA ≤ 200 MHz | 2 | 3 |
| H | 200 MHz < BWChannel\_CA ≤ 300 MHz | 3 |  |
| I | 300 MHz < BWChannel\_CA ≤ 400 MHz | 4 |  |
| J | 400 MHz < BWChannel\_CA ≤ 500 MHz | 5 |  |
| K | 500 MHz < BWChannel\_CA ≤ 600 MHz | 6 |  |
| L | 600 MHz < BWChannel\_CA ≤ 700 MHz | 7 |  |
| M | 700 MHz < BWChannel\_CA ≤ 800 MHz | 8 |  |
| O | 100 MHz ≤ BWChannel\_CA ≤ 200 MHz | 2 | 4 |
| P | 150 MHz ≤ BWChannel\_CA ≤ 300 MHz | 3 |  |
| Q | 200 MHz ≤ BWChannel\_CA ≤ 400 MHz | 4 |  |
| R2 | 200 MHz ≤ BWChannel\_CA ≤ 400 MHz | 2 | 5 |
| R3 | 300 MHz ≤ BWChannel\_CA ≤ 600 MHz | 3 |  |
| R4 | 400 MHz ≤ BWChannel\_CA ≤ 800 MHz | 4 |  |
| R5 | 500 MHz ≤ BWChannel\_CA ≤ 1000 MHz | 5 |  |
| R6 | 600 MHz ≤ BWChannel\_CA ≤ 1200 MHz | 6 |  |
| R7 | 700 MHz ≤ BWChannel\_CA ≤ 1400 MHz | 7 |  |
| R8 | 800 MHz ≤ BWChannel\_CA ≤ 1600 MHz | 8 |  |
| R9 | 900 MHz ≤ BWChannel\_CA ≤ 1800 MHz | 9 |  |
| R10 | 1000 MHz ≤ BWChannel\_CA ≤ 2000 MHz | 10 |  |
| R11 | 1100 MHz ≤ BWChannel\_CA ≤ 2200 MHz | 11 |  |
| R12 | 1200 MHz ≤ BWChannel\_CA ≤ 2400 MHz | 12 |  |
| NOTE 1: Maximum supported component carrier bandwidths for fallback groups 1, 2, 3, 4 and 5 are 400 MHz, 200 MHz, 100 MHz, 100 MHz and 200 MHz respectively except for CA bandwidth class A. For CA bandwidth classes of fallback group 5, requirements apply for non-interlaced 100 MHz and 200 MHz channel bandwidths (each CA bandwidth class consisting of up to two contiguous sub-blocks each with component carriers of a single channel bandwidth).  NOTE 2: It is mandatory for a UE to be able to fallback to lower order CA bandwidth class configuration within a fallback group. It is not mandatory for a UE to be able to fallback to lower order CA bandwidth class configuration that belong to a different fallback group.  NOTE 3: In this release of the specification, the minimum requirements for intra-band contiguous CA configurations apply for aggregated channel bandwidths up to 1600 MHz (this note is not relevant for UE capability parsing by the network). | | | |

Table 5.3A.4-2: Frequency separation classes for non-contiguous intra-band operation

|  |  |
| --- | --- |
| Frequency separation class | Max. allowed frequency separation (Fs) |
| I | 800 MHz |
| II | 1200 MHz |
| III | 1400 MHz |
| IV | 1000 MHz |
| V | 1600 MHz |
| VI | 1800 MHz |
| VII | 2000 MHz |
| VIII | 2200 MHz |
| IX | 2400 MHz |
| X | 400 MHz |
| XI | 600 MHz |
| NOTE 1: Fs values larger than 1400 MHz apply only to downlink frequency separation. | |

Table 5.3A.4-3: Frequency separation classes for DL-only spectrum

|  |  |
| --- | --- |
| Frequency separation class | Max. allowed frequency separation (Fsd) |
| I | 200 MHz |
| II | 400 MHz |
| III | 600 MHz |
| IV | 800 MHz |
| V | 1000 MHz |
| VI | 1200 MHz |

## 5.3D Channel bandwidth for UL MIMO

The requirements specified in clause 5.3 are applicable to UE supporting UL MIMO.

## 5.4 Channel arrangement

### 5.4.1 Channel spacing

#### 5.4.1.1 Channel spacing for adjacent NR carriers

The spacing between carriers will depend on the deployment scenario, the size of the frequency block available and the channel bandwidths. The nominal channel spacing between two adjacent NR carriers is defined as following:

For NR operating bands with 60 kHz channel raster,

Nominal Channel spacing = (BWChannel(1) + BWChannel(2))/2 + {-20 kHz, 0 kHz, 20 kHz} for ∆FRaster equals to 60 kHz

Nominal Channel spacing = (BWChannel(1) + BWChannel(2))/2 + {-40 kHz, 0 kHz, 40 kHz} for ∆FRaster equals to 120 kHz

For operating band n263,

Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8)\*50.4 MHz,

where BWChannel(1) and BWChannel(2) are the channel bandwidths of the two respective NR carriers. The channel spacing can be adjusted depending on the channel raster to optimize performance in a particular deployment scenario.

### 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 frequency* is designated by an NR Absolute Radio Frequency Channel Number (NR-ARFCN) in the range [2016667...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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Frequency range (MHz) | ΔFGlobal (kHz) | FREF-Offs [MHz] | NREF-Offs | Range of NREF |
| 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.

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

#### 5.4.2.2 Channel raster to resource element mapping

The mapping between the RF reference frequency on 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 UE.

Table 5.4.2.2-1: Channel raster to resource element mapping

|  |  |  |
| --- | --- | --- |
|  | *NRB* mod 2 = 0 | *NRB* mod 2 = 1 |
| Resource element index *k* | 0 | 6 |
| Physical resource block number *nPRB* |  |  |

*k*, *nRB* , *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, using the channel raster to resource element mapping in clause 5.4.2.2.

- For NR operating bands with 60 kHz channel raster above 24 GHz, ΔFRaster = *I* ×ΔFGlobal , where *I* ϵ *{1,2}*. 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*>.

- In frequency bands with two ΔFRaster, the higher ΔFRaster applies to channels using only the SCS that equals 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

|  |  |  |
| --- | --- | --- |
| 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 | 2270833 – <1> – 2337499 |
|  | 120 | 2270833 – <2> – 2337499 |
| n260 | 60 | 2229166 – <1> – 2279165 |
|  | 120 | 2229167 – <2> – 2279165 |
| n261 | 60 | 2070833 – <1> – 2084999 |
|  | 120 | 2070833 – <2> – 2084999 |
| n262 | 60 | 2399166 – <1> – 2415832 |
|  | 120 | 2399167 – <2> – 2415831 |
| n263 | 120 | See Table 5.4.2.3-2 |
| 480 |
| 960 |

Table 5.4.2.3-2: Applicable NR-ARFCN for operation in band n263

|  |  |
| --- | --- |
| Channel Bandwidth | Applicable NR-ARFCN |
| 100 MHz | 2564083 + 1680 \* N, N = 0:137 |
| 400 MHz | 2566603 + 6720 \* N, N = 0:33 |
| 800 MHz | 2569963 + 6720 \* N, N = 0:32 |
| 1600 MHz | 2576683 + 6720 \* N, N =0:30 |
| 2000 MHz | 2580043 + 6720 \* N, N=0:29,  2585083, 2655643, 2692603, 2764843 |

### 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

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | SS block frequency position SSREF | GSCN | Range of GSCN |
| 24250 – 100000 MHz | 24250.08 MHz + N \* 17.28 MHz,  N = 0:4383 | 22256 + N | 22256 – 26639 |

#### 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.

Table 5.4.3.3-1: Applicable SS raster entries per operating band

|  |  |  |  |
| --- | --- | --- | --- |
| NR Operating Band | SS Block SCS | SS Block pattern1 | 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 |
| n262 | 120 kHz | Case D | 23586 – <1> – 23641 |
|  | 240 kHz | Case E | 23588 – <2> – 23640 |
| n263 | 120 kHz | Case D | Table 5.4.3.3-2 |
| 480 kHz | Case F |
| 960 kHz2 | Case G | 24162 – <6> – 24954 |
| NOTE 1: SS Block pattern is defined in clause 4.1 in TS 38.213 [10].  NOTE 2: SS Block SCS of 960 kHz is not used for initial access. | | | |

Table 5.4.3.3-2: Allowed GSCN for operation in band n263 for 120 kHz and 480 kHz

|  |  |
| --- | --- |
| SS Block SCS | Range of GSCN |
| 120 kHz | 24156 + 6 \* N – 3 \* floor((N+5)/18), N=0:137 |
| 480 kHz | 24162 + 24 \* N – 12 \* floor((N+4)/18), N=0:33 |

## 5.4A Channel arrangement for CA

### 5.4A.1 Channel spacing for CA

For intra-band contiguous carrier aggregation with two or more component carriers, the nominal channel spacing between two adjacent NR component carriers is defined as the following unless stated otherwise:

For NR operating bands with 60kHz channel raster:



with

*n = µ0 – 2*

and for operating band n263:

Nominal Channel spacing = ceil((BWChannel(1) + BWChannel(2))/100.8)\*50.4 MHz.

where BWChannel(1) and BWChannel(2) are the channel bandwidths of the two respective NR component carriers according to Table 5.3.2-1 with values in MHz, o is the largest  value among the subcarrier spacing configurations supported in the operating band for both of the channel bandwidths according to Table 5.3.5-1, and *GBChannel(i)* is the minimum guard band for channel bandwidth *i* according to Table 5.3.3-1 for the said  value, with  as defined in TS 38.211 [9].

The channel spacing for intra-band contiguous carrier aggregation can be adjusted to any multiple of least common multiple of channel raster and sub-carrier spacing less than the nominal channel spacing to optimize performance in a particular deployment scenario.

For intra-band non-contiguous carrier aggregation, the channel spacing between two NR component carriers in different sub-blocks shall be larger than the nominal channel spacing defined in this clause.

## 5.5 Configurations

## 5.5A Configurations for CA

### 5.5A.1 Configurations for intra-band contiguous CA

Table 5.5A.1-1: NR CA configurations, bandwidth combination sets, and fallback group defined for intra-band contiguous CA

| NR CA configuration / Bandwidth combination set / Fallback group | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configurations | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | BWChannel (MHz) | Maximum aggregated  BW (MHz) | BCS | Fallback group |
| CA\_n257B | CA\_n257B | 50, 100, 200, 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n257C | CA\_n257B | 50, 100, 200, 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 |  |
| CA\_n257D | CA\_n257D | 50, 100, 200 | 200 |  |  |  |  |  |  | 400 | 0 | 2 |
| CA\_n257E | CA\_n257D  CA\_n257E | 50, 100, 200 | 200 | 200 |  |  |  |  |  | 600 | 0 |  |
| CA\_n257F | CA\_n257D  CA\_n257E  CA\_n257F | 50, 100, 200 | 200 | 200 | 200 |  |  |  |  | 800 | 0 |  |
| CA\_n257G | CA\_n257G | 50, 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n257H | CA\_n257G  CA\_n257H | 50, 100 | 100 | 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n257I | CA\_n257G  CA\_n257H  CA\_n257I | 50, 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 |  |
| CA\_n257J | CA\_n257G  CA\_n257H  CA\_n257I  CA\_n257J | 50, 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 |  |
| CA\_n257K | CA\_n257G  CA\_n257H  CA\_n257I  CA\_n257J  CA\_n257K | 50, 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 |  |
| CA\_n257L | CA\_n257G  CA\_n257H  CA\_n257I  CA\_n257J  CA\_n257K  CA\_n257L | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 |  |
| CA\_n257M | CA\_n257G  CA\_n257H  CA\_n257I  CA\_n257J  CA\_n257K  CA\_n257L  CA\_n257M | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 |  |
| CA\_n258B | CA\_n258B | 50, 100, 200, 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n258C | CA\_n258B  CA\_n258C | 50, 100, 200, 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 |  |
| CA\_n258D | CA\_n258D | 50, 100, 200 | 200 |  |  |  |  |  |  | 400 | 0 | 2 |
| CA\_n258E | CA\_n258D  CA\_n258E | 50, 100, 200 | 200 | 200 |  |  |  |  |  | 600 | 0 |  |
| CA\_n258F | CA\_n258D  CA\_n258E  CA\_n258F | 50, 100, 200 | 200 | 200 | 200 |  |  |  |  | 800 | 0 |  |
| CA\_n258G | CA\_n258G | 50, 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n258H | CA\_n258G  CA\_n258H | 50, 100 | 100 | 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n258I | CA\_n258G  CA\_n258H  CA\_n258I | 50, 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 |  |
| CA\_n258J | CA\_n258G  CA\_n258H  CA\_n258I  CA\_n258J | 50, 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 |  |
| CA\_n258K | CA\_n258G  CA\_n258H  CA\_n258I  CA\_n258J  CA\_n258K | 50, 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 |  |
| CA\_n258L | CA\_n258G  CA\_n258H  CA\_n258I  CA\_n258J  CA\_n258K  CA\_n258L | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 |  |
| CA\_n258M | CA\_n258G  CA\_n258H  CA\_n258I  CA\_n258J  CA\_n258K  CA\_n258L  CA\_n258M | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 |  |
| CA\_n258O | CA\_n258O | 50, 100 | 50, 100 |  |  |  |  |  |  | 200 | 0 | 4 |
| CA\_n258P | CA\_n258O  CA\_n258P | 50, 100 | 50, 100 | 50, 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n258Q | CA\_n258O  CA\_n258P  CA\_n258Q | 50, 100 | 50, 100 | 50, 100 | 50, 100 |  |  |  |  | 400 | 0 |  |
| CA\_n259B | CA\_n259B | 50, 100, 200, 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n259C | CA\_n259B | 50, 100, 200, 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 |  |
| CA\_n259G | CA\_n259G | 50, 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n259H | CA\_n259G  CA\_n259H | 50, 100 | 100 | 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n259I | CA\_n259G  CA\_n259H  CA\_n259I | 50, 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 |  |
| CA\_n259J | CA\_n259G  CA\_n259H  CA\_n259I  CA\_n259J | 50, 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 |  |
| CA\_n259K | CA\_n259G  CA\_n259H  CA\_n259I  CA\_n259J  CA\_n259K | 50, 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 |  |
| CA\_n259L | CA\_n259G  CA\_n259H  CA\_n259I  CA\_n259J  CA\_n259K  CA\_n259L | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 |  |
| CA\_n259M | CA\_n259G  CA\_n259H  CA\_n259I  CA\_n259J  CA\_n259K  CA\_n259L  CA\_n259M | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 |  |
| CA\_n260B | CA\_n260B | 50, 100, 200, 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n260C | CA\_n260B | 50, 100, 200, 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 |  |
| CA\_n260D | CA\_n260D | 50, 100, 200 | 200 |  |  |  |  |  |  | 400 | 0 | 2 |
| CA\_n260E | CA\_n260D  CA\_n260E | 50, 100, 200 | 200 | 200 |  |  |  |  |  | 600 | 0 |  |
| CA\_n260F | CA\_n260D  CA\_n260E  CA\_n260F | 50, 100, 200 | 200 | 200 | 200 |  |  |  |  | 800 | 0 |  |
| CA\_n260G | CA\_n260G | 50, 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n260H | CA\_n260G  CA\_n260H | 50, 100 | 100 | 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n260I | CA\_n260G  CA\_n260H  CA\_n260I | 50, 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 |  |
| CA\_n260J | CA\_n260G  CA\_n260H  CA\_n260I  CA\_n260J | 50, 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 |  |
| CA\_n260K | CA\_n260G  CA\_n260H  CA\_n260I  CA\_n260J  CA\_n260K | 50, 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 |  |
| CA\_n260L | CA\_n260G  CA\_n260H  CA\_n260I  CA\_n260J  CA\_n260K  CA\_n260L | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 |  |
| CA\_n260M | CA\_n260G  CA\_n260H  CA\_n260I  CA\_n260J  CA\_n260K  CA\_n260L  CA\_n260M | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 |  |
| CA\_n260O | CA\_n260O | 50, 100 | 50, 100 |  |  |  |  |  |  | 200 | 0 | 4 |
| CA\_n260P | CA\_n260O  CA\_n260P | 50, 100 | 50, 100 | 50, 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n260Q | CA\_n260O  CA\_n260P  CA\_n260Q | 50, 100 | 50, 100 | 50, 100 | 50, 100 |  |  |  |  | 400 | 0 |  |
| CA\_n261B | CA\_n261B | 50, 100, 200, 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n261C | CA\_n261B | 50 | 400 | 400 |  |  |  |  |  | 850 | 0 |  |
| CA\_n261D | CA\_n261D | 50, 100, 200 | 200 |  |  |  |  |  |  | 400 | 0 | 2 |
| CA\_n261E | CA\_n261D  CA\_n261E | 50, 100, 200 | 200 | 200 |  |  |  |  |  | 600 | 0 |  |
| CA\_n261F | CA\_n261D  CA\_n261E  CA\_n261F | 50, 100, 200 | 200 | 200 | 200 |  |  |  |  | 800 | 0 |  |
| CA\_n261G | CA\_n261G | 50, 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n261H | CA\_n261G  CA\_n261H | 50, 100 | 100 | 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n261I | CA\_n261G  CA\_n261H  CA\_n261I | 50, 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 |  |
| CA\_n261J | CA\_n261G  CA\_n261H  CA\_n261I  CA\_n261J | 50, 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 |  |
| CA\_n261K | CA\_n261G  CA\_n261H  CA\_n261I  CA\_n261J  CA\_n261K | 50, 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 |  |
| CA\_n261L | CA\_n261G  CA\_n261H  CA\_n261I  CA\_n261J  CA\_n261K  CA\_n261L | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 |  |
| CA\_n261M | CA\_n261G  CA\_n261H  CA\_n261I  CA\_n261J  CA\_n261K  CA\_n261L  CA\_n261M | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 |  |
| CA\_n261O | CA\_n261O | 50, 100 | 50, 100 |  |  |  |  |  |  | 200 | 0 | 4 |
| CA\_n261P | CA\_n261O  CA\_n261P | 50, 100 | 50, 100 | 50, 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n261Q | CA\_n261O  CA\_n261P  CA\_n261Q | 50, 100 | 50, 100 | 50, 100 | 50, 100 |  |  |  |  | 400 | 0 |  |
| CA\_n262G | CA\_n262G | 50, 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n262H | CA\_n262G  CA\_n262H | 50, 100 | 100 | 100 |  |  |  |  |  | 300 | 0 |  |
| CA\_n262I | CA\_n262G  CA\_n262H  CA\_n262I | 50, 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 |  |
| CA\_n262J | CA\_n262G  CA\_n262H  CA\_n262I  CA\_n262J | 50, 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 |  |
| CA\_n262K | CA\_n262G  CA\_n262H  CA\_n262I  CA\_n262J  CA\_n262K | 50, 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 |  |
| CA\_n262L | CA\_n262G  CA\_n262H  CA\_n262I  CA\_n262J  CA\_n262K  CA\_n262L | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 |  |
| CA\_n262M | CA\_n262G  CA\_n262H  CA\_n262I  CA\_n262J  CA\_n262K  CA\_n262L  CA\_n262M | 50, 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 |  |
| CA\_n263B | CA\_n263A | 400 | 400 |  |  |  |  |  |  | 800 | 0 | 1 |
| CA\_n263C | CA\_n263A | 400 | 400 | 400 |  |  |  |  |  | 1200 | 0 | 1 |
| CA\_n263G | CA\_n263A | 100 | 100 |  |  |  |  |  |  | 200 | 0 | 3 |
| CA\_n263H | CA\_n263A | 100 | 100 | 100 |  |  |  |  |  | 300 | 0 | 3 |
| CA\_n263I | CA\_n263A | 100 | 100 | 100 | 100 |  |  |  |  | 400 | 0 | 3 |
| CA\_n263J | CA\_n263A | 100 | 100 | 100 | 100 | 100 |  |  |  | 500 | 0 | 3 |
| CA\_n263K | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 |  |  | 600 | 0 | 3 |
| CA\_n263L | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 | 100 |  | 700 | 0 | 3 |
| CA\_n263M | CA\_n263A | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 800 | 0 | 3 |
| NOTE 1: Void  NOTE 2: For the NR CA configuration with more than two component carries, the bandwidths in a BCS which may introduce combinations more than requested unintentionally should be listed in a row separately.  NOTE 3: In this release of the specification, contiguous DL CA configurations within FR2-2 may only contain multiples of the same channel bandwidth. | | | | | | | | | | | | |

### 5.5A.2 Configurations for intra-band non-contiguous CA

*< end of changes >*

**--------------------------------------------------------------------- < End of changes to Clause 7 > --------------------------------------------------------------------**

**--------------------------------------- < Start of changes to Clause 6 > ---------------------------------------**

*< begin changes >*

#### 6.2.1.3 UE maximum output power for power class 3

The following requirements define the maximum output power radiated by the UE for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). The minimum output power values for EIRP are found in Table 6.2.1.3-1. The requirement is verified with the test metric of total component of EIRP (Link=TX beam peak direction, Meas=Link angle). The requirement for the UE which supports a single FR2 band is specified in Table 6.2.1.3-1. The requirement for the UE which supports multiple FR2 bands is specified in both Table 6.2.1.3-1 and Table 6.2.1.3-4.

Table 6.2.1.3-1: UE minimum peak EIRP for power class 3

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 22.4 |
| n258 | 22.4 |
| n259 | 18.7 |
| n260 | 20.6 |
| n261 | 22.4 |
| n262 | 16.0 |
| n263 | 14.1 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance  NOTE 2: Void | |

The maximum output power values for TRP and EIRP are found on the Table 6.2.1.3-2. The max allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and the total component of EIRP (Link=TX beam peak direction, Meas=Link angle.

Table 6.2.1.3-2: UE maximum output power limits for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Max EIRP  (dBm/MHz) | Notes |
| n257 | 23 | 43 |  |  |
| n258 | 23 | 43 |  |  |
| n259 | 23 | 43 |  |  |
| n260 | 23 | 43 |  |  |
| n261 | 23 | 43 |  |  |
| n262 | 23 | 43 |  |  |
| n263 | FFS | FFS |  | [Default for NS\_200] |
|  | 27 | 40 (NOTE1) | 23 | Applies when “NS\_204” is indicated in the cell  NOTE 1: it is max average EIRP |

The minimum EIRP at the 50th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2.1.3-3 below. The requirement is verified with the test metric of the total component of EIRP (Link=Beam peak search grids, Meas=Link angle). The requirement for the UE which supports a single FR2 band is specified in Table 6.2.1.3-3. The requirement for the UE which supports multiple FR2 bands is specified in both Table 6.2.1.3-3 and Table 6.2.1.3-4.

Table 6.2.1.3-3: UE spherical coverage for power class 3

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50%-tile CDF (dBm) |
| n257 | 11.5 |
| n258 | 11.5 |
| n259 | 5.8 |
| n260 | 8 |
| n261 | 11.5 |
| n262 | 2.9 |
| n263 | 2.3 |
| NOTE 1: Minimum EIRP at 50 %-tile CDF is defined as the lower limit without tolerance  NOTE 2: Void  NOTE 3: The requirements in this table are verified only under normal temperature conditions as defined in Annex E.2.1. | |

For the UEs that support multiple FR2 bands, minimum requirement for peak EIRP and EIRP spherical coverage in Tables 6.2.1.3-1 and 6.2.1.3-3 shall be decreased per band, respectively, by the peak EIRP relaxation parameter MBP,n and EIRP spherical coverage relaxation parameter MBS,n, as defined in Table 6.2.1.3-4..

Table 6.2.1.3-4: UE multi-band relaxation factors for power class 3

|  |  |  |
| --- | --- | --- |
| **Band** | **MBP,n (dB)** | **MBS,n (dB)** |
| n257 | 0.73 | 0.73 |
| n258 | 0.6 | 0.7 |
| n259 | 0.5 | 0.4 |
| n260 | 0.51 | 0.41 |
| n261 | 0.52,4 | 0.74 |
| n262 | 0.7 | 0.7 |
| n263 | 1.0 | 1.0 |
| Note 1: n260 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n260  Note 2: n261 peak relaxation is 0 dB for UE that exclusively supports n261+n260  Note 3: n257 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257  Note 4: n261 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257 | | |

*< end changes >*

*< text omitted >*

*< begin changes >*

#### 6.2.2.1 UE maximum output power reduction for power class 1

For power class 1, MPR for contiguous allocations is defined as:

MPR = max(MPRWT, MPRnarrow)

Where,

MPRnarrow = 14.4 dB, when BWalloc,RB ≤ 1.44 MHz, MPRnarrow = 10 dB, when 1.44 MHz < BWalloc,RB ≤ 10.8 MHz, where BWalloc,RB is the bandwidth of the RB allocation size.

MPRWT is the maximum power reduction due to modulation orders, transmission bandwidth configurations listed in table 5.3.2-1, and waveform types. MPRWT is defined in Tables 6.2.2.1-1 and 6.2.2.1-2 for FR2-1 and in Tables 6.2.2.1-3 and 6.2.2.1-4 for FR2-2.

Table 6.2.2.1-1 MPRWT for power class 1, BWchannel ≤ 200 MHz

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPRWT (dB), BWchannel ≤ 200 MHz | | |
|  | | Outer RB allocations | Inner RB allocations | |
|  | |  | Region 1 | Region 2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | 0.0 | ≤ 3.0 |
|  | QPSK | ≤ 6.5 | 0.0 | ≤ 3.0 |
|  | 16 QAM | ≤ 6.5 | ≤ 4.0 | ≤ 4.0 |
|  | 64 QAM | ≤ 6.5 | ≤ 5.0 | ≤ 5.0 |
| CP-OFDM | QPSK | ≤ 7.0 | ≤ 4.5 | ≤ 4.5 |
|  | 16 QAM | ≤ 7.0 | ≤ 5.5 | ≤ 5.5 |
|  | 64 QAM | ≤ 7.5 | ≤ 7.5 | ≤ 7.5 |

Table 6.2.2.1-2 MPRWT for power class 1, BWchannel = 400 MHz

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPRWT (dB), BWchannel = 400 MHz | | |
|  | | Outer RB allocations | Inner RB allocations | |
|  | |  | Region 1 | Region 2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | 0.0 | ≤ 3.0 |
|  | QPSK | ≤ 6.5 | 0.0 | ≤ 3.5 |
|  | 16 QAM | ≤ 6.5 | ≤ 4.5 | ≤ 4.5 |
|  | 64 QAM | ≤ 6.5 | ≤ 6.5 | ≤ 6.5 |
| CP-OFDM | QPSK | ≤ 7.0 | ≤ 5.0 | ≤ 5.0 |
|  | 16 QAM | ≤ 7.0 | ≤ 6.5 | ≤ 6.5 |
|  | 64 QAM | ≤ 9.0 | ≤ 9.0 | ≤ 9.0 |

Table 6.2.2.1-3 MPRWT for power class 1, BWchannel = 100 MHz in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPRWT (dB), BWchannel = 100 MHz | | |
|  | | Outer RB allocations | Inner RB allocations | |
|  | |  | Region 1 | Region 2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [5.5] | [0.0] | ≤ [3.5] |
|  | QPSK | ≤ [6.5] | [0.0] | ≤ [3.5] |
|  | 16 QAM | ≤ [7.0] | ≤ [2.5] | ≤ [2.5] |
|  | 64 QAM | ≤ [8.0] | ≤ [8.0] | ≤ [8.0] |
| CP-OFDM | QPSK | ≤ [8.0] | ≤ [1.5] | ≤ [3.5] |
|  | 16 QAM | ≤ [8.0] | ≤ [3.5] | ≤ [4.0] |
|  | 64 QAM | ≤ [9.5] | ≤ [9.5] | ≤ [9.5] |

Table 6.2.2.1-4 MPRWT for power class 1, BWchannel >= 400 MHz in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPRWT (dB), BWchannel = 400, 800, 1600, 2000 MHz | | |
|  | | Outer RB allocations | Inner RB allocations | |
|  | |  | Region 1 | Region 2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [6.0] | ≤ [1.0] | ≤ [3.5] |
|  | QPSK | ≤ [6.0] | ≤ [1.0] | ≤ [4.0] |
|  | 16 QAM | ≤ [4.5] | ≤ [3.0] | ≤ [3.0] |
|  | 64 QAM | ≤ [8.0] | ≤ [8.0] | ≤ [8.0] |
| CP-OFDM | QPSK | ≤ [6.0] | ≤ [1.5] | ≤ [3.5] |
|  | 16 QAM | ≤ [6.0] | ≤ [4.0] | ≤ [5.5] |
|  | 64 QAM | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] |

Where the following parameters are defined to specify valid RB allocation ranges for the RB allocations regions in Tables 6.2.2.1-1 , 6.2.2.1-2, 6.2.2.1-3, and 6.2.2.1-4:

NRB is the maximum number of RBs for a given Channel bandwidth and sub-carrier spacing defined in Table 5.3.2-1.

RBend = RBStart + LCRB - 1

RBStart,Low = Max(1, Floor(LCRB/2))

RBStart,High = NRB – RBStart,Low – LCRB

An RB allocation is an Outer RB allocation if

RBStart < RBStart,Low OR RBStart > RBStart,High OR LCRB > Ceil(NRB/2)

An RB allocation belonging to table 6.2.2.1-1 is a Region 1 inner RB allocation if

RBstart ≥ Ceil(1/3 NRB) AND RBend < Ceil(2/3 NRB)

An RB allocation belonging to table 6.2.2.1-2 is a Region 1 inner RB allocation if

RBstart ≥ Ceil(1/4 NRB) AND RBend < Ceil(3/4 NRB) AND LCRB ≤ Ceil(1/4 NRB)

An RB allocation is a Region 2 inner allocation if it is NOT an Outer allocation AND NOT a Region 1 inner allocation

For the UE maximum output power modified by MPR, the power limits specified in clause 6.2.4 apply.

*< end changes >*

*< text omitted >*

*< begin changes >*

#### 6.2.2.3 UE maximum output power reduction for power class 3

For power class 3, MPR for contiguous allocations is defined as:

MPR = max(MPRWT, MPRnarrow)

For transmission bandwidth configuration less than or equal to 200MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil((2/3NRB)- LCRB) < RBstart ≤ NRB-LCRB:

- MPRnarrow = 2.5 dB, when BWalloc,RB is less than or equal to 1.44 MHz,

- MPRnarrow = 2.0 dB, when 1.44 MHz < BWalloc,RB <= 4.32 MHz,

- otherwise MPRnarrow = 0 dB.

MPRWT is the maximum power reduction due to modulation orders, transmission bandwidth configurations listed in Table 5.3.2-1, and waveform types. MPRWT is defined for FR2-1 in Table 6.2.2.3-1.

Table 6.2.2.3-1 MPRWT for power class 3, BWchannel ≤ 200 MHz, FR2-1

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel ≤ 200 MHz | |
|  | | Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 2.0 |
|  | QPSK | 0.0 | ≤ 2.0 |
|  | 16 QAM | ≤ 3.0 | ≤ 3.5 |
|  | 64 QAM | ≤ 5.0 | ≤ 5.5 |
| CP-OFDM | QPSK | ≤ 3.5 | ≤ 4.0 |
|  | 16 QAM | ≤ 5.0 | ≤ 5.0 |
|  | 64 QAM | ≤ 7.5 | ≤ 7.5 |

MPRWT is defined for FR2-2 in Table 6.2.2.3-1b.

Table 6.2.2.3-1b MPRWT for power class 3, BWchannel = 100 MHz, FR2-2

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel = 100 MHz | |
|  | | Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ [0.5] |
|  | QPSK | 0.0 | ≤ [0.5] |
|  | 16 QAM | ≤ [3.0] | ≤ [3.0] |
|  | 64 QAM | ≤ [8.5] | ≤ [8.5] |
| CP-OFDM | QPSK | ≤ [1.5] | ≤ [1.5] |
|  | 16 QAM | ≤ [4.0] | ≤ [4.0] |
|  | 64 QAM | ≤ [10.0] | ≤ [10.0] |

Where the following parameters are defined to specify valid RB allocation ranges for RB allocations in Table 6.2.2.3-1:

- RBStart,Low = max(1, LCRB), where max() indicates the largest value of all arguments.

- RBStart,High = NRB – RBStart,Low – LCRB,

An RB allocation belonging to table 6.2.2.3-1 is a Region 1 inner RB allocation if:

- RBStart,Low ≤ RBStart ≤ RBStart,High, and LCRB ≤ ceil(NRB/3), where ceil(x) is the smallest integer greater than or equal to x.

For transmission bandwidth configuration equal to 400MHz,

MPRnarrow = 2.5 dB, when BWalloc,RB is less than or equal to 1.44 MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil(2/3NRB) ≤ RBstart ≤ NRB-LCRB, where BWalloc,RB is the bandwidth of the RB allocation size.

MPRWT is the maximum power reduction due to modulation orders, transmission bandwidth configurations listed in Table 5.3.2-1, and waveform types. MPRWT is defined for FR2-1 in Table 6.2.2.3-2.

Table 6.2.2.3-2 MPRWT for power class 3, BWchannel = 400 MHz, FR2-1

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel = 400 MHz | |
|  | | Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 3.0 |
|  | QPSK | 0.0 | ≤ 3.0 |
|  | 16 QAM | ≤ 4.5 | ≤ 4.5 |
|  | 64 QAM | ≤ 6.5 | ≤ 6.5 |
| CP-OFDM | QPSK | ≤ 5.0 | ≤ 5.0 |
|  | 16 QAM | ≤ 6.5 | ≤ 6.5 |
|  | 64 QAM | ≤ 9.0 | ≤ 9.0 |

MPRWT is defined for FR2-2 in Table 6.2.2.3-2b and 6.2.2.3-2c.

Table 6.2.2.3-2b MPRWT for power class 3, BWchannel = 400 MHz, FR2-2

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel = 400 MHz | |
|  | | Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [1.0] | ≤ 3.0 |
|  | QPSK | ≤ [1.0] | ≤ 3.0 |
|  | 16 QAM | ≤ 4.5 | ≤ 4.5 |
|  | 64 QAM | ≤ [9.5] | ≤ [9.0] |
| CP-OFDM | QPSK | ≤ 5.0 | ≤ 5.0 |
|  | 16 QAM | ≤ 6.5 | ≤ 6.5 |
|  | 64 QAM | ≤ 10.0 | ≤ 10.0 |

Table 6.2.2.3-2c MPRWT for power class 3, BWchannel >= 800 MHz, FR2-2

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel = 400 MHz | |
|  | | Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [1.0] | ≤ 4.0 |
|  | QPSK | ≤ [1.0] | ≤ 4.0 |
|  | 16 QAM | ≤ 6.0 | ≤ 6.0 |
|  | 64 QAM | ≤ [9.5] | ≤ [9.0] |
| CP-OFDM | QPSK | ≤ 6.5 | ≤ 6.5 |
|  | 16 QAM | ≤ 8.0 | ≤ 8.0 |
|  | 64 QAM | ≤ 10.5 | ≤ 10.5 |

Where the following parameters are defined to specify valid RB allocation ranges for RB allocations in Table 6.2.2.3-2:

NRB is the maximum number of RBs for a given Channel bandwidth and sub-carrier spacing defined in Table 5.3.2-1.

RBend = RBStart + LCRB - 1

An RB allocation belonging to table 6.2.2.3-2 is a Region 1 inner RB allocation if

RBstart ≥ Ceil(1/4 NRB) AND RBend < Ceil(3/4 NRB) AND LCRB ≤ Ceil(1/4 NRB)











For all transmission bandwidth configurations, an RB allocation is an Edge allocation if it is NOT a Region 1 inner allocation.

#### 6.2.2.4 UE maximum output power reduction for power class 4

*< end changes >*

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*< begin changes >*

#### 6.2A.2.2 Maximum output power reduction for power class 1

##### 6.2A.2.2.1 Maximum output power reduction for power class 1 intra-band contiguous UL CA

For power class 1, MPR for intra-band contiguous UL CA with contiguous allocations within the cumulative aggregated bandwidth is defined as:

MPRC\_CA = max(MPRWT\_C\_CA, MPRnarrow)

Where,

MPRnarrow = 14.4 dB, when BWalloc,RB is less than or equal to 1.44 MHz, MPRnarrow = 10 dB, when 1.44 MHz < BWalloc,RB ≤ 10.8 MHz, where BWalloc,RB is the bandwidth of the RB allocation size.

MPRWT\_C\_CA is the maximum power reduction due to modulation orders, transmit bandwidth configurations, and waveform types. MPRWT\_C\_CA is defined in Tables 6.2A.2.2-1 and 6.2A.2.2-2.

Table 6.2A.2.2-1: Maximum power reduction (MPRWT\_C\_CA) for UE power class 1 in FR2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Waveform Type | | Cumulative aggregated channel bandwidth | | | |
|  | | < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.51 | 7.71 | 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 6.51 | 8.71 | 9.7 | ≤ 9.7 |
|  | 16 QAM | ≤ 6.5 | 8.7 | 9.2 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | 10.7 | 11.2 | ≤ 11.7 |
| CP-OFDM | QPSK | ≤ 6.5 | 8.7 | 8.7 | ≤ 9.7 |
|  | 16 QAM | ≤ 6.5 | 8.7 | 8.7 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | 10.7 | 11.2 | ≤ 11.7 |
| NOTE 1: (Void) | | | | | |

Table 6.2A.2.2-2: Maximum power reduction (MPRWT\_C\_CA) for UE power class 1 in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth | | | |
| < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2000 MHz |
| Pi/2 BPSK | ≤ [7.0] | ≤ [5.0] | ≤ [2.0] | ≤ [2.0] |
| QPSK | ≤ [8.0] | ≤ [6.0] | ≤ [3.0] | ≤ [3.0] |
| 16 QAM | ≤ [8.0] | ≤ [6.0] | ≤ [4.0] | ≤ [4.0] |
| 64 QAM | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] |

In case of a contiguous RB, DFT-s-BPSK or DFT-s-QPSK UL allocation in a single CC of a CA configuration with contiguous CCs, and whose cumulative aggregated BW ≤ 400 MHz, MPRWT\_C\_CA shall be derived instead as MAX(MPR1, MPR2), where:

MPR1 shall be determined from Table 6.2.2.1-1 if CABW ≤ 200 MHz, from Table 6.2.2.1-2 if CABW > 200 MHz.

MPR2 shall be determined from Table 6.2.2.1-1 if UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.1-2 if UL BWchannel\_CA > 200 MHz.

and assume all UL CCs use the same SCS for the purpose of determination of inner and outer RB allocations in Table 6.2.2.1-1 and Table 6.2.2.1-2:

NRB shall be chosen as the sum of NRB of all constituent UL CCs in the CA configuration.

LCRB shall be chosen as BWalloc,RB

RBstart shall be derived as: RBstart\_allocatedCC+NRB\_unallocatedCC\_low

RBstart\_allocatedCC is the index of the first allocated RB in the CC with allocation

NRB\_unallocatedCC\_low is the sum of NRB in all UL CCs lower in frequency compared to the CC with allocation

When different waveform types exist across CCs, the requirement is set by the waveform type used in the configuration with the largest MPRC\_CA.

For intra-band contiguous UL CA with non-contiguous RB allocations, the following rule for MPR applies:

MPR = max(MPRC\_CA, -10\*A + 14.4)

Where:

A = NRB\_alloc / NRB\_agg\_C.

NRB\_alloc is the total number of allocated UL RBs

NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs

*< end changes >*

*< text omitted >*

*< begin changes >*

##### 6.2A.2.4.1 Maximum output power reduction for power class 3 intra-band contiguous CA

For power class 3, MPR for intra-band contiguous UL CA with contiguous allocations within the cumulative aggregated bandwidth is denoted as MPRC\_CA and is defined in Tables 6.2A.2.4-1 and 6.2A.2.4-2.

Table 6.2A.2.4-1: Maximum power reduction (MPRC\_CA) for UE power class 3 in FR2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | Cumulative aggregated channel bandwidth (CABW) | | | |
|  | | ≤ 400 MHz | > 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.01 | ≤ 7.71 | ≤ 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 5.01 | ≤ 7.71 | ≤ 8.2 | ≤ 9.7 |
|  | 16 QAM | ≤ 6.5 | ≤ 8.7 | ≤ 9.3 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| CP-OFDM | QPSK | ≤ 5.0 | ≤ 7.5 | ≤ 8.0 | ≤ 9.7 |
|  | 16 QAM | ≤ 6.5 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| NOTE 1: (Void). | | | | | |

Table 6.2A.2.4-2: Maximum power reduction (MPRWT\_C\_CA) for UE power class 3 in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth | | | |
| < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2000 MHz |
| Pi/2 BPSK | ≤ [1.0] | ≤ [1.0] | ≤ [1.0] | ≤ [1.0] |
| QPSK | ≤ [2.0] | ≤ [2.0] | ≤ [2.0] | ≤ [2.0] |
| 16 QAM | ≤ [4.0] | ≤ [4.0] | ≤ [4.0] | ≤ [4.0] |
| 64 QAM | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] |

In case of a contiguous RB, DFT-s-BPSK or DFT-s-QPSK UL allocation in a single CC of a CA configuration with contiguous CCs, and whose cumulative aggregated BW ≤ 400 MHz, MPRC\_CA shall be derived instead as MAX(MPR1, MPR2), where:

MPR1 shall be determined from Table 6.2.2.3-1 if CABW ≤ 200 MHz, from Table 6.2.2.3-2 if CABW > 200 MHz.

MPR2 shall be determined from Table 6.2.2.3-1 if UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.3-2 if UL BWchannel\_CA > 200 MHz.

and assume all UL CCs use the same SCS for the purpose of determination of inner and outer RB allocations in Table 6.2.2.3-1 and Table 6.2.2.3-2:

NRB shall be chosen as the sum of NRB of all constituent UL CCs in the CA configuration.

LCRB shall be chosen as BWalloc,RB

RBstart shall be derived as: RBstart\_allocatedCC+NRB\_unallocatedCC\_low

RBstart\_allocatedCC is the index of the first allocated RB in the CC with allocation

NRB\_unallocatedCC\_low is the sum of NRB in all UL CCs lower in frequency compared to the CC with allocation

When different waveform types exist across CCs, the requirement is set by the waveform type used in the configuration with the highest contiguous MPR.

For intra-band contiguous UL CA with non-contiguous RB allocations, the following rule for MPR applies:

MPR = max(MPRC\_CA, -10\*A +7.0)

Where:

A = NRB\_alloc / NRB\_agg\_C.

NRB\_alloc is the total number of allocated UL RBs

NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs

##### 6.2A.2.4.2 Maximum output power reduction for power class 3 intra-band non-contiguous CA

For intra-band non-contiguous UL CA, the following rule for MPR applies:

MPR = max(MPRNC\_CA, -8\*A +10.0)

Where:

MPRNC\_CA is derived from table 6.2A.2.4.2-1

Table 6.2A.2.4.2-1: MPRNC\_CA for UE power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | Cumulative aggregated channel bandwidth (CABW) | | | |
|  | | ≤ 400 MHz | > 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | ≤ 7.7 | ≤ 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 6 | ≤ 7.7 | ≤ 8.2 | ≤ 8.7 |
|  | 16 QAM | ≤ 7 | ≤ 8.7 | ≤ 9.3 | ≤ 9.8 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| CP-OFDM | QPSK | ≤ 6 | ≤ 7.5 | ≤ 8.0 | ≤ 8.5 |
|  | 16 QAM | ≤ 7 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |

*< end changes >*

*< text omitted >*

*< begin changes >*

### 6.2A.4 Configured transmitted power for CA

#### 6.2A.4.1 Configured transmitted power for intra-band UL CA

A UE configured with carrier aggregation can configure its maximum output power for each uplink activated serving cell *c* and its total configured maximum output power PCMAX. The definition of the configured UE maximum output power PCMAX,*f,c* for each carrier *f* of a serving cell *c* is used for power headroom reporting for carrier *f* of serving cell *c* only and is in accordance with that specified in clause 6.2.4 with parameters MPR, A-MPR and P-MPR replaced with those specified in subclause 6.2A.2, 6.2A.3 and 6.2.4, respectively. The UE maximum configured power PCMAX in a transmission occasion is determined by the UL grants for carriers *f* of all serving cells *c* with non-zero granted power in the respective reference point.

For uplink intra-band contiguous carrier aggregation, MPR is specified in clause 6.2A.2. PCMAX is calculated under the assumption that power spectral density for each RB in each component carrier is same.

The configured UE maximum output power PCMAX shall be set such that the corresponding measured total peak EIRP PUMAX is within the following bounds

PPowerclass – MAX(MAX(MPR, A-MPR) + ΔMBP,n, P-MPR) – MAX{T(MAX(MPR, A-MPR)),T(P-MPR)} ≤ PUMAX ≤ EIRPmax

with PPowerclass the peak EIRP as specified in sub-clause 6.2A.1, EIRPmax the applicable maximum EIRP as specified in sub-clause 6.2A.1, MPR as specified in sub-clause 6.2A.2, A-MPR as specified in sub-clause 6.2A.3, ΔMBP,n the peak EIRP relaxation as specified in clause 6.2.1, P-MPR the power management term for the UE as described in 6.2.4.

The measured configured power PUMAX for carrier aggregation is defined as

where pUMAX,f,c is the linear value of the measured power PUMAX,f,c for carrier *f=f(c)* of serving cell *c*. The measured total radiated power PTMAX for carrier aggregation is defined as

where pTMAX,f,c is the linear value of the measured total radiated power PTMAX,f,c for carrier *f* = *f*(*c*) of serving cell *c*. The total radiated power PTMAX is bounded by

PTMAX ≤ TRPmax

where TRPmax the maximum TRP for the UE power class as specified in sub-clause 6.2A.1.

The tolerance T(ΔP) for applicable values of ΔP (values in dB) is specified in Table 6.2A.4.1-1 and Table 6.2A.4.1-2.

Table 6.2A.4.1-1: PUMAX tolerance for FR2-1

|  |  |  |
| --- | --- | --- |
| Operating Band | ∆P (dB) | Tolerance T(∆P)  (dB) |
| n257, n258, n259, n260, n261, n262 | P = 0 | 0 |
|  | 0 < P ≤ 2 | 1.5 |
|  | 2 < P ≤ 3 | 2.0 |
|  | 3 < P ≤ 4 | 3.0 |
|  | 4 < P ≤ 5 | 4.0 |
|  | 5 < P ≤ 10 | 5.0 |
|  | 10 < P ≤ 15 | 7.0 |
|  | 15 < P ≤ X | 8.0 |
| NOTE: X is the value such that Pumax lower bound, PPowerclass - P – T(P) = minimum output power specified in clause 6.3A.1 | | |

Table 6.2A.4.1-2: PUMAX tolerance for FR2-2

|  |  |  |
| --- | --- | --- |
| Operating Band | ∆P (dB) | Tolerance T(∆P)  (dB) |
| n263 | P = 0 | [0] |
|  | 0 < P ≤ 2 | [1.5] |
|  | 2 < P ≤ 3 | [2.0] |
|  | 3 < P ≤ 4 | [3.0] |
|  | 4 < P ≤ 5 | [4.0] |
|  | 5 < P ≤ 10 | [5.0] |
|  | 10 < P ≤ 15 | [7.0] |
|  | 15 < P ≤ X | [8.0] |
| NOTE: X is the value such that Pumax lower bound, PPowerclass - P – T(P) = minimum output power specified in clause 6.3A.1 | | |

*< end changes >*

*< text omitted >*

*< begin changes >*

### 6.3.1 Minimum output power

#### 6.3.1.0 General

The minimum controlled output power of the UE is defined as the EIRP in the channel bandwidth for all transmit bandwidth configurations (resource blocks) when the power is set to a minimum value.

The minimum output power is defined as the mean power in at least one sub frame (1ms).

#### 6.3.1.1 Minimum output power for power class 1

For power class 1 UE, the minimum output power shall not exceed the values specified in Table 6.3.1.1-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3.1.1-1: Minimum output power for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261, n262 | 50 | 4 | 47.58 |
| 100 | 4 | 95.16 |
| 200 | 4 | 190.20 |
| 400 | 4 | 380.28 |
| n263 | 100 | 4 | 95.16 |
| 400 | 4 | 381.12 |
| 800 | 4 | 715.20 |
| 1600 | 4 | 1429.44 |
| 2000 | 4 | 1705.92 |

#### 6.3.1.2 Minimum output power for power class 2, 3, and 4

The minimum output power shall not exceed the values specified in Table 6.3.1.2-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3.1.2-1: Minimum output power for power class 2, 3, and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261, n262 | 50 | -13 | 47.58 |
|  | 100 | -13 | 95.16 |
|  | 200 | -13 | 190.20 |
|  | 400 | -13 | 380.28 |
| n263 | 100 | -13 | 95.16 |
| 400 | -13 | 381.12 |
| 800 | -13 | 715.20 |
| 1600 | -13 | 1429.44 |
| 2000 | -13 | 1705.92 |
| NOTE 1: n260 is not applied for power class 2.  NOTE 2: n259 is not applied for power class 2 and 4.  NOTE 3: power class 4 is not applicable to n263 | | | |

#### 6.3.1.3 Minimum output power for power class 5 and 6

*< end changes >*

*< text omitted >*

*< begin changes >*

### 6.3.2 Transmit OFF power

The transmit OFF power is defined as the TRP in the channel bandwidth when the transmitter is OFF. The transmitter is considered OFF when the UE is not allowed to transmit on any of its ports.

The transmit OFF power shall not exceed the values specified in Tables 6.3.2-1 and 6.3.2-2 for each operating band supported. The requirement is verified with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

Table 6.3.2-1: Transmit OFF power for FR2-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n259, n260, n261, n262 | -35 | -35 | -35 | -35 |
|  | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |

Table 6.3.2-2: Transmit OFF power for FR2-2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating band |  | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
|  | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| n263 | -35 | -35 | -35 | -35 | -35 |
|  | 95.16 MHz | 381.12 MHz | 715.20 | 1429.44 | 1705.92 |

For UE indicating [IE UL Gap], UE will meet OFF power requirement defined in this clause for the band for which UL transmission is stopped in the activated UL gap.

*< end changes >*

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*< begin changes >*

## 6.3A Output power dynamics for CA

### 6.3A.1 Minimum output power for CA

Table 6.3A.1-1: Void

#### 6.3A.1.0 General

For intra-band contiguous and non-contiguous carrier aggregation, the minimum controlled output power of the UE is defined as the transmit power of the UE per component carrier, i.e., EIRP in the channel bandwidth of each component carrier for all transmit bandwidth configurations (resource blocks), when the power on both component carriers are set to a minimum value.

The minimum output power is defined as the mean power in at least one sub frame (1ms).

#### 6.3A.1.1 Minimum output power for power class 1

For intra-band contiguous and non-contiguous carrier aggregation, the minimum output power shall not exceed the values specified in Table 6.3A.1.1-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3A.1.1-1: Minimum output power for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261, n262 | 50 | 4 | 47.58 |
|  | 100 | 4 | 95.16 |
|  | 200 | 4 | 190.20 |
|  | 400 | 4 | 380.28 |
| n263 | 100 | 4 | 95.16 |
|  | 400 | 4 | 381.12 |
|  | 800 | 4 | 715.20 |
|  | 1600 | 4 | 1429.44 |
|  | 2000 | 4 | 1705.92 |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the minimum output power is defined per carrier and is specified in clause 6.3.1.1.

#### 6.3A.1.2 Minimum output power for power class 2, 3, and 4

For intra-band contiguous and non-contiguous carrier aggregation, the minimum output power shall not exceed the values specified in Table 6.3A.1.2-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3A.1.2-1: Minimum output power for CA for power class 2, 3, and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n259, n260, n261, n262 | 50 | -13 | 47.58 |
|  | 100 | -13 | 95.16 |
|  | 200 | -13 | 190.20 |
|  | 400 | -13 | 380.28 |
| n263 | 100 | -13 | 95.16 |
|  | 400 | -13 | 381.12 |
|  | 800 | -13 | 715.20 |
|  | 1600 | -13 | 1429.44 |
|  | 2000 | -13 | 1705.92 |
| NOTE 1: n260 is not applied for power class 2.  NOTE 2: n259 is not applied for power class 2 and 4. | | | |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the minimum output power is defined per carrier and is specified in clause 6.3.1.2.

#### 6.3A.1.3 Minimum output power for power class 5

For intra-band contiguous and non-contiguous carrier aggregation, the minimum output power shall not exceed the values specified in Table 6.3A.1.3-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3A.1.2-1: Minimum output power for CA for power class 5

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n259 | 50 | -6 | 47.52 |
| 100 | -6 | 95.04 |
| 200 | -6 | 190.08 |
| 400 | -6 | 380.16 |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the minimum output power is defined per carrier and is specified in clause 6.3.1.3.

### 6.3A.2 Transmit OFF power for CA

For intra-band contiguous and non-contiguous carrier aggregation, the transmit OFF power is defined as the TRP in the channel bandwidth per component carrier when the transmitter is OFF. The transmitter is considered OFF when the UE is not allowed to transmit on any of it sports.

The transmit OFF power shall not exceed the values specified in Table 6.3A.2-1 and Table 6.3A.2-2 for each operating band supported.

Table 6.3A.2-1: Transmit OFF power for CA for FR2-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n259, n260, n261, n262 | -35 | -35 | -35 | -35 |
|  | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |

Table 6.3A.2-2: Transmit OFF power for CA for FR2-2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating band |  | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
|  | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| n263 | -35 | -35 | -35 | -35 | -35 |
|  | 95.16 MHz | 381.12 MHz | 715.20 | 1429.44 | 1705.92 |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the transmit OFF power specified in clause 6.3.2.1 is applicable for each CC when the transmitter is OFF on all CCs. The transmitter is considered to be OFF when the UE is not allowed to transmit on any of its ports.

*< end changes >*

*< text omitted >*

*< begin change**s >*

#### 6.4.2.1 Error vector magnitude

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM, the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in sub-clauses 6.4.2.4 and 6.4.2.5. For DFT-s-OFDM waveforms, the EVM result is defined after the front-end FFT and IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %. For CP-OFDM waveforms, the EVM result is defined after the front-end FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is one preamble sequence for the PRACH and one slot for PUCCH and PUSCH in the time domain. The EVM measurement interval is reduced by any symbols that contains an allowable power transient in the measurement interval as as defined in clause 6.3.3.

The RMS average of the basic EVM measurements over 10 subframes for the average EVM case, and over 60 subframes for the reference signal EVM case, for the different modulation schemes shall not exceed the values specified in Table 6.4.2.1-1 for the parameters defined in Table 6.4.2.1-2 or 6.4.2.1-3, depending on UE power class. For EVM evaluation purposes, all 13 PRACH preamble formats and all 5 PUCCH formats are considered to have the same EVM requirement as QPSK modulated.

The requirement is verified with the test metric of EVM (Link=TX beam peak direction, Meas=Link angle).

Table 6.4.2.1-1: Minimum requirements for error vector magnitude

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Average EVM level | Reference signal EVM level |
| Pi/2 BPSK | % | 30.0 | 30.0 |
| QPSK | % | 17.5 | 17.5 |
| 16 QAM | % | 12.5 | 12.5 |
| 64 QAM | % | 8.0 | 8.0 |

Table 6.4.2.1-2: Parameters for Error Vector Magnitude for power class 1 in FR2-1

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | ≥ 4 |
| UE EIRP for UL 16 QAM | dBm | ≥ 7 |
| UE EIRP for UL 64 QAM | dBm | ≥ 11 |
| Operating conditions |  | Normal conditions |

**Table 6.4.2.1-2a: Parameters for Error Vector Magnitude for power class 1 in FR2-2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Level | | | | |
| Parameter | Unit | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| UE EIRP | dBm | ≥ 4 | ≥ [2] | ≥ [5] | ≥ [8] | ≥ [9] |
| UE EIRP for UL 16 QAM | dBm | ≥ 7 | ≥ [5] | ≥ [8] | ≥ [11] | ≥ [12] |
| UE EIRP for UL 64 QAM | dBm | ≥ 11 | ≥ [9] | ≥ [12] | ≥ [15] | ≥ [16] |
| Operating conditions | Normal Conditions | | | | | |
| NOTE 1: PTRS is configured for 16 QAM and 64 QAM | | | | | | |

Table 6.4.2.1-3: Parameters for Error Vector Magnitude for power class 2, 3, 4 and 7 in FR2-1

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | ≥ -13 |
| UE EIRP for UL 16 QAM | dBm | ≥ -10 |
| UE EIRP for UL 64 QAM | dBm | ≥ -6 |
| Operating conditions |  | Normal conditions |

Table 6.4.2.1-3a: Parameters for Error Vector Magnitude for power class 3 in FR2-2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Level | | | | |
| Parameter | Unit | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| UE EIRP | dBm | ≥ -13 | [≥ -11] | [≥ -8] | [≥ -5] | [≥ -4] |
| UE EIRP for UL 16 QAM | dBm | ≥ -10 | [≥ -8] | [≥ -5] | [≥ -2] | [≥ -1] |
| UE EIRP for UL 64 QAM | dBm | ≥ -6 | [≥ -4] | [≥ -1] | [≥ 2] | [≥ 3] |
| Operating conditions | Normal Conditions | | | | | |
| NOTE 1: PTRS is configured for 16 QAM and 64 QAM | | | | | | |

**Table 6.4.2.1-3b: Parameters for Error Vector Magnitude for power class 2 in FR2-2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Level | | | | |
| Parameter | Unit | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| UE EIRP | dBm | ≥ -13 | ≥ [-11] | ≥ [-8] | ≥ [-5] | ≥ [-4] |
| UE EIRP for UL 16 QAM | dBm | ≥ -10 | ≥ [-8] | ≥ [-5] | ≥ [-2] | ≥ [-1] |
| UE EIRP for UL 64 QAM | dBm | ≥ -6 | ≥ [-4] | ≥ [-1] | ≥ [2] | ≥ [3] |
| Operating conditions | Normal Conditions | | | | | |
| NOTE 1: PTRS is configured for 16 QAM and 64 QAM | | | | | | |

Table 6.4.2.1-4: Parameters for Error Vector Magnitude for power class 5

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | ≥ -6 |
| UE EIRP for UL 16 QAM | dBm | ≥ -3 |
| UE EIRP for UL 64 QAM | dBm | ≥ 1 |
| Operating conditions |  | Normal conditions |

#### 6.4.2.2 Carrier leakage

##### 6.4.2.2.1 General

Carrier leakage is an additive sinusoid waveform. The carrier leakage requirement is defined for each component carrier. The measurement interval is one slot in the time domain. The relative carrier leakage power is a power ratio of the additive sinusoid waveform to the power in the modulated waveform.

The requirement is verified with the test metric of Carrier Leakage (Link=TX beam peak direction, Meas=Link angle).

##### 6.4.2.2.2 Carrier leakage for power class 1

When carrier leakage is contained inside the spectrum confined within the configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.2-1 and Table 6.4.2.2.2-2 for power class 1 UEs.

Table 6.4.2.2.2-1: Minimum requirements for relative carrier leakage power for power class 1 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 17 dBm | -25 |
| 4 dBm ≤ EIRP ≤ 17 dBm | -20 |

Table 6.4.2.2.2-2: Minimum requirements for relative carrier leakage power for power class 1 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 13.4 dBm | -25 |
| 0.4 dBm ≤ EIRP ≤ 13.4 dBm | -20 |

##### 6.4.2.2.3 Carrier leakage for power class 2

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-1 and Table 6.4.2.2.3-2 for power class 2.

Table 6.4.2.2.3-1: Minimum requirements for relative carrier leakage power for power class 2 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 6 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 6 dBm | -20 |

Table 6.4.2.2.3-2: Minimum requirements for relative carrier leakage power for power class 2 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 5.8 dBm | -25 |
| -13.2 dBm ≤ EIRP ≤ 5.8 dBm | -20 |

##### 6.4.2.2.4 Carrier leakage for power class 3

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.4-1 and Table 6.4.2.2.4-2 for power class 3 UEs.

Table 6.4.2.2.4-1: Minimum requirements for relative carrier leakage power for power class 3 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 0 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 0 dBm | -20 |

Table 6.4.2.2.4-2: Minimum requirements for relative carrier leakage power for power class 3 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > -1.9 dBm | -25 |
| -14.9 dBm ≤ EIRP ≤ -1.9 dBm | -20 |

##### 6.4.2.2.5 Carrier leakage for power class 4

*< end changes >*

*< text omitted >*

*< begin changes >*

#### 6.4.2.3 In-band emissions

##### 6.4.2.3.1 General

The in-band emission is defined as the average across 12 sub-carriers and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non–allocated RB to the UE output power in an allocated RB. The IBE requirement does not apply if UE declares support for *mpr-PowerBoost-FR2-r16,* UL transmission is QPSK,MPRf,c = 0 and when NS\_200 applies, and the network configures the UE to operate with *mpr-PowerBoost-FR2-r16.*

The basic in-band emissions measurement interval is identical to that of the EVM test.

The requirement is verified with the test metric of In-band emission (Link=TX beam peak direction, Meas=Link angle).

##### 6.4.2.3.2 In-band emissions for power class 1

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.2-1 for power class 1 UEs.

Table 6.4.2.3.2-1: Requirements for in-band emissions for power class 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | | Applicable Frequencies |
| General | dB |  | | | Any non-allocated (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | > 27 dBm | > 23.4 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | ≤ 27 dBm | ≤ 23.4 dBm |  |
| Carrier leakage | dBc | -25 | > 17 dBm | > 13.4 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | 4 dBm ≤ Output power ≤ 17 dBm | 0.4 dBm ≤ Output power ≤ 13.4 dBm |  |
| NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of (- 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. is defined in NOTE 10.  NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier frequency, but excluding any allocated RBs.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Clause 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Clause 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB = 1 or RB = -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | | |

##### 6.4.2.3.3 In-band emissions for power class 2

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.3-1 for power class 2.

Table 6.4.2.3.3-1: Requirements for in-band emissions for power class 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | | Applicable Frequencies |
| General | dB |  | | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | Output power > 16 dBm | Output power > 15.8 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | Output power ≤ 16 dBm | Output power ≤ 15.8 dBm |  |
| Carrier leakage | dBc | -25 | Output power > 6 dBm | Output power > 5.8 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 6 dBm | -13.2 dBm ≤ Output power ≤ 5.8 dBm |  |
| NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of (- 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. is defined in NOTE 9.  NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.3-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | | |

Table 6.4.2.3.3-2: Void

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | |  |
|  |  |  | |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | | | | |

##### 6.4.2.3.4 In-band emissions for power class 3

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.4-1 for power class 3 UEs.

Table 6.4.2.3.4-1: Requirements for in-band emissions for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | | Applicable Frequencies |
| General | dB |  | | | Any non-allocated (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | > 10 dBm | > 8.1 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | ≤ 10 dBm | ≤ 8.1 dBm |  |
| Carrier leakage | dBc | -25 | > 0 dBm | > -1.9dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 0 dBm | -14.9 dBm ≤ Output power ≤ -1.9 dBm |  |
| NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of (- 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. is defined in NOTE 10.  NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier frequency, but excluding any allocated RBs.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit depend on the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Clause 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Clause 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB = 1 or RB = -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | | |

##### 6.4.2.3.5 In-band emissions for power class 4

*< end changes >*

*< text omitted >*

*< begin changes >*

#### 6.4A.2.2 Carrier leakage

##### 6.4A.2.2.1 General

Carrier leakage is an additive sinusoid waveform. The carrier leakage requirement is defined for each component carrier and is measured on the component carrier with PRBs allocated. The measurement interval is one slot in the time domain.

Note: When UE has DL configured for intra-band non-contiguous CA, carrier leakage may land outside the spectrum occupied by all configured UL and DL CC.

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The requirement is verified with the test metric of Carrier Leakage (Link=TX beam peak direction, Meas=Link angle).

##### 6.4A.2.2.2 Carrier leakage for power class 1

For intra-band contiguous and non-contiguous carrier aggregation, when carrier leakage is contained inside the spectrum occupied by all configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4A.2.2.2-1 and Table 6.4A.2.2.2-2 for power class 1 UEs.

Table 6.4A.2.2.2-1: Minimum requirements for relative carrier leakage for power class 1 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 17 dBm | -25 |
| 4 dBm ≤ EIRP ≤ 17 dBm | -20 |

Table 6.4A.2.2.2-2: Minimum requirements for relative carrier leakage for power class 1 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 13.4 dBm | -25 |
| 0.4 dBm ≤ EIRP ≤ 13.4 dBm | -20 |
| NOTE: Not applicable for Intraband non-contiguous carrier aggregation | |

##### 6.4A.2.2.3 Carrier leakage for power class 2

For intra-band contiguous and non-contiguous carrier aggregation, when carrier leakage is contained inside the spectrum occupied by all configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4A.2.2.3-1 and Table 6.4A.2.2.3-2 for power class 2.

Table 6.4A.2.2.3-1: Minimum requirements for relative carrier leakage power class 2 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| EIRP > 6 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 6 dBm | -20 |

Table 6.4A.2.2.3-2: Minimum requirements for relative carrier leakage power class 2 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| EIRP > 5.8 dBm | -25 |
| -13.2 dBm ≤ EIRP ≤ 5.8 dBm | -20 |
| NOTE: Not applicable for Intraband non-contiguous carrier aggregation | |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the carrier leakage requirements are specified in clause 6.4.2.2.3 and are applicable for each CC with all CCs active with non-zero UL RB allocation.

##### 6.4A.2.2.4 Carrier leakage for power class 3

For intra-band contiguous and non-contiguous carrier aggregation, when carrier leakage is contained inside the spectrum occupied by all configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4A.2.2.4-1 and Table 6.4A.2.2.4-2 for power class 3 UEs.

Table 6.4A.2.2.4-1: Minimum requirements for relative carrier leakage power class 3 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| Output power > 0 dBm | -25 |
| -13 dBm ≤ Output power EIRP ≤ 0 dBm | -20 |

Table 6.4A.2.2.4-2: Minimum requirements for relative carrier leakage power class 3 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| Output power > -1.9 dBm | -25 |
| -14.9 dBm ≤ Output power EIRP ≤ -1.9 dBm | -20 |
| NOTE: Not applicable for Intraband non-contiguous carrier aggregation | |

##### 6.4A.2.2.5 Carrier leakage for power class 4

*< end changes >*

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#### 6.4A.2.3 Inband emissions

##### 6.4A.2.3.1 General

For intra-band contiguous and non-contiguous carrier aggregation, the Inband emission requirement is defined over the spectrum occupied by all configured UL and DL CCs. The measurement interval is as defined in clause 6.4.2.4. The requirement is verified with the test metric of In-band emission (Link=TX beam peak direction, Meas=Link angle).

For intra-band contiguous and non-contiguous carrier aggregation, the requirements in this clause apply with all component carriers active and with one single contiguous PRB allocation in one of uplink component carriers. The inband emission is defined as the interference falling into the non-allocated resource blocks for all component carriers.

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the in-band emissions requirements are applicable for each CC with all CCs active with non-zero UL RB allocation.

##### 6.4A.2.3.2 Inband emissions for power class 1

For intra-band contiguous and non-contiguous carrier aggregation, the average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4A.2.3.2-1 for power class 1 UEs.

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the in-band emissions requirements are specified in clause 6.4.2.3.2 and are applicable for each CC with all CCs active with non-zero UL RB allocation.

Table 6.4A.2.3.2-1: Requirements for in-band emissionsfor power class 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | | Applicable Frequencies |
| General | dB |  | | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | Output power > 27 dBm | > 23.4 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | Output power ≤ 27 dBm | ≤ 23.4 dBm |  |
| Carrier leakage | dBc | -25 | Output power > 17 dBm | > 13.4 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | 4 dBm ≤ Output power ≤ 17 dBm | 0.4 dBm ≤ Output power ≤ 13.4 dBm |  |
| NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of (- 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. is defined in NOTE 9.  NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.3-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | | |

##### 6.4A.2.3.3 Inband emissions for power class 2

For intra-band contiguous and non-contiguous carrier aggregation, the average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4A.2.3.3-1 for power class 2.

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the in-band emissions requirements are specified in clause 6.4.2.3.3 and are applicable for each CC with all CCs active with non-zero UL RB allocation.

Table 6.4A.2.3.3-1: Requirements for in-band emissions for power class 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | | Applicable Frequencies |
| General | dB |  | | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | Output power > 16 dBm | Output power > 15.8 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | Output power ≤ 16 dBm | Output power ≤ 15.8 dBm |  |
| Carrier leakage | dBc | -25 | Output power > 6 dBm | Output power > 5.8 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 6 dBm | -13.2 dBm ≤ Output power ≤ 5.8 dBm |  |
| NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of (- 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. is defined in NOTE 9.  NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.3-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | | |

##### 6.4A.2.3.4 Inband emissions for power class 3

For intra-band contiguous and non-contiguous carrier aggregation, the average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4A.2.3.4-1 for power class 3 UEs.

Table 6.4A.2.3.4-1: Requirements for in-band emissions for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | | Applicable Frequencies |
| General | dB |  | | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | Output power > 10 dBm | > 8.1 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | Output power ≤ 10 dBm | ≤ 8.1 dBm |  |
| Carrier leakage | dBc | -25 | Output power > 0 dBm | > -1.9dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 0 dBm | -14.9 dBm ≤ Output power ≤ -1.9 dBm |  |
| NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of (- 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. is defined in NOTE 9.  NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.3-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | | |

*< end changes >*

*< text omitted >*

*< begin changes >*

### 6.5A.2 Out of band emissions

#### 6.5A.2.1 Spectrum emission mask for CA

##### 6.5A.2.1.0 General

For intra-band CA, the requirements specified in this clause shall apply if the UE has at least one of UL or DL configured for CA or if the UE is configured for single CC operation with different channel bandwidths in UL and DL carriers. In case the CA configuration consists of a single UL CC, spectrum emission mask defined in subclause 6.5.2.1 applies. Spectral emission mask requirements do not apply at any frequency where IBE requirements of clause 6.4A.2.3 apply.

The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction).

##### 6.5A.2.1.1 Spectrum emission mask for intra-band contiguous UL CA

For intra-band contiguous UL carrier aggregation, the spectrum emission mask of the UE applies to frequencies (ΔfOOB) starting from the ± edge of the UL aggregated channel bandwidth (Table 5.3A.5-1). For any bandwidth class defined in Table 5.3A.5-1, the UE emission shall not exceed the levels specified in Table 6.5A.2.1-1.

Table 6.5A.2.1.1-1: General NR spectrum emission mask for intra-band contiguous CA in FR2-1 and FR2-2

|  |  |  |
| --- | --- | --- |
| ΔfOOB  (MHz) | Any carrier aggregation bandwidth class | Measurement bandwidth |
| ± 0-0.1\*BWChannel\_CA | -5 | 1 MHz |
| ± 0.1\*BWChannel\_CA -2\*BWChannel\_CA | -13 | 1 MHz |
| NOTE 1: (void) | | |

*< end changes >*

*< text omitted >*

*< begin changes >*

#### 6.5A.2.3 Adjacent channel leakage ratio for CA

##### 6.5A.2.3.1 Adjacent channel leakage ratio for CA intra-band contiguous UL CA

In case the CA configuration consists of a single UL CC, the adjacent channel leakage ratio defined in subclause 6.5.2.3 applies. For intra-band contiguous UL carrier aggregation, the carrier aggregation NR adjacent channel leakage power ratio (CA NRACLR) is the ratio of the filtered mean power centred on the UL aggregated channel bandwidth to the filtered mean power centred on an adjacent UL aggregated channel bandwidth at spacing equal to the UL aggregated channel bandwidth. The assigned UL aggregated channel bandwidth power and adjacent UL aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidths specified in Table 6.5A.2.3.1-1. If the measured adjacent channel power is greater than -35 dBm then the CA NRACLR shall be higher than the value specified in Table 6.5A.2.3.1-1.

Table 6.5A.2.3.1-1: General requirements for contiguous UL CA NRACLR

|  |  |
| --- | --- |
|  | CA bandwidth class / CA NRACLR / Measurement bandwidth |
|  | Any CA bandwidth class |
| CA NRACLR for band n257, n258, n261 | 17 dB |
| CA NRACLR for band n259, n260, n262 | 16 dB |
| CA NRACLR for band n263 | 15 dB |
| NR channel measurement bandwidth1 | BWChannel\_CA – 2\*BWGB |
| Adjacent channel centre frequency offset (in MHz) | + BWChannel\_CA  /  - BWChannel\_CA |
| NOTE 1: BWGB is defined in clause 5.3A.2. | |

##### 6.5A.2.3.2 Adjacent channel leakage ratio for CA intra-band non-contiguous UL CA

For intra-band non-contiguous carrier aggregation, adjacent channel leakage power ratio (CA NRACLR) is the ratio of the sum of the filtered mean powers centred on each sub-block bandwidth to the filtered mean power centred on an adjacent sub-block frequency at nominal spacing equal to the sub-block bandwidth. The power in the configured UL CCs and power in the sub-block bandwidth adjacent to each sub-block of configured UL CCs are measured with rectangular filters with measurement bandwidths specified in Table 6.5A.2.3.1-2. In case a sub-block consists of a single component carrier, the measurement bandwidths and adjacent frequency offset from subclause 6.5.2.3 shall be used. If the measured adjacent sub-block power is greater than -35 dBm then the CA NRACLR shall be higher than the value specified in Table 6.5A.2.3.1-2.

No requirement applies in the gap between neighbouring sub-blocks if the frequency span between the lowest edge of the upper sub-block and the highest edge of the lower sub-block is smaller than the bandwidth of either sub-block.

Table 6.5A.2.3.1-2: General requirements for NC UL CA NRACLR

|  |  |
| --- | --- |
|  | CA bandwidth class / CA NRACLR / Measurement bandwidth |
|  | Any CA bandwidth class |
| CA NRACLR for band n257, n258, n261 | 17 dB |
| CA NRACLR for band n260 | 16 dB |
| CA NRACLR for band n263 | 15 dB |
| NR channel measurement bandwidth1 | Σ(BWChannel,block) |
| Adjacent sub-block centre frequency offset (in MHz) | + BWChannel,block  /  - BWChannel\_block |
| NOTE 1: BWChannel\_block is defined in clause 5.3A.2.  NOTE 2: ‘Adjacent sub-block centre frequency offset’ is defined for each sub-block in the UL CA configuration | |

*< end changes >*

*< text omitted >*

*< begin changes >*

### 6.6.4 Beam correspondence for power class 3

#### 6.6.4.1 General

The beam correspondence requirement for power class 3 UEs consists of three components: UE minimum peak EIRP (as defined in Clause 6.2.1.3), UE spherical coverage (as defined in Clause 6.2.1.3), and beam correspondence tolerance (as defined in Clause 6.6.4.2). The beam correspondence requirement is fulfilled if the UE satisfies one of the following conditions, depending on the UE's beam correspondence capability IE *beamCorrespondenceWithoutUL-BeamSweeping*, as defined in TS 38.306 [14]:

UEs supporting FR2-2 shall support *beamCorrespondenceWithoutUL-BeamSweeping.*

- If *beamCorrespondenceWithoutUL-BeamSweeping* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 with its autonomously chosen UL beams and without uplink beam sweeping. Such a UE is considered to have met the beam correspondence tolerance requirement.

- If *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceSSB-based-r16* are supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 using the side conditions for SSB based enhanced beam correspondence requirements as defined in Clause 6.6.4.3.2.

- If *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceCSI-RS-based-r16* are supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 using the side conditions for CSI-RS based enhanced beam correspondence requirements as defined in Clause 6.6.4.3.3.

- If *beamCorrespondenceWithoutUL-BeamSweeping* is not present, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 with uplink beam sweeping. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.4.2 and shall support uplink beam management, as defined in TS 38.306 [14].

- If *beamCorrespondenceWithoutUL-BeamSweeping* is not present and *beamCorrespondenceSSB-based-r16* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 with uplink beam sweeping using the side conditions for SSB based enhanced beam correspondence requirements as defined in Clause 6.6.4.3.2. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.4.2 and shall support uplink beam management, as defined in TS 38.306 [14].

- If *beamCorrespondenceWithoutUL-BeamSweeping* is not present and *beamCorrespondenceCSI-RS-based-r16* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 with uplink beam sweeping using the side conditions for CSI-RS based enhanced beam correspondence requirements as defined in Clause 6.6.4.3.3. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.4.2 and shall support uplink beam management, as defined in TS 38.306 [14].

#### 6.6.4.2 Beam correspondence tolerance for power class 3

The beam correspondence tolerance requirement ∆EIRPBC for power class 3 UEs is defined based on a percentile of the distribution of ∆EIRPBC, defined as ∆EIRPBC = EIRP2 - EIRP1 over the link angles spanning a subset of the spherical coverage grid points, such that

- EIRP1 is the total EIRP in dBm calculated based on the beam the UE chooses autonomously (corresponding beam) to transmit in the direction of the incoming DL signal, which is based on beam correspondence without relying on UL beam sweeping.

- EIRP2 is the best total EIRP (beam yielding highest EIRP in a given direction) in dBm which is based on beam correspondence with relying on UL beam sweeping.

- The link angles are the ones corresponding to the top Nth percentile of the EIRP2 measurement over the whole sphere, where the value of N is according to the test point of EIRP spherical coverage requirement for power class 3, i.e. N = 50.

For power class 3 UEs, the requirement is fulfilled if the UE's corresponding UL beams satisfy the maximum limit in Table 6.6.4.2-1.

Table 6.6.4.2-1: UE beam correspondence tolerance for power class 3

|  |  |
| --- | --- |
| Operating band | Max ∆EIRPBC at 85th %-tile ∆EIRPBC CDF (dB) |
| n257 | 3.0 |
| n258 | 3.0 |
| n259 | 3.2 |
| n260 | 3.2 |
| n261 | 3.0 |
| n262 | 3.2 |
|  |  |
| NOTE: The requirements in this table are verified only under normal temperature conditions as defined in Annex E.2.1 | |

#### 6.6.4.3 Side Conditions

##### 6.6.4.3.1 Side Condition for beam correspondence based on SSB and CSI-RS

The beam correspondence requirements are only applied under the following side conditions:

- The downlink reference signals including both SSB and CSI-RS are provided and Type D QCL shall be maintained between SSB and CSI-RS.

- The reference measurement channel for beam correspondence are fulfilled according to the CSI-RS configuration in Annex A.3.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.4.3.1-1 and Table 6.6.4.3.1-2.

Table 6.6.4.3.1-1: Conditions for SSB based L1-RSRP measurements for beam correspondence

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of arrival | NR operating bands | Minimum SSB\_RP Note 2 | SSB Ês/Iot |
|  |  | dBm / SCSSSB | dB |
|  |  | SCSSSB = 120 kHz |  |
| All angles **Note 1** | n257 | -96.2 | ≥6 |
|  | n258 | -96.2 |  |
|  | n259 | -90.7 |  |
|  | n260 | -91.9 |  |
|  | n261 | -96.2 |  |
|  | n262 | -88.5 |  |
|  |  |  |  |
| NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB\_RP values for all angles are increased by MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1.  NOTE 2: Values specified at the radiated requirements reference point to give minimum SSB Ês/Iot, with no applied noise. | | | |

Table 6.6.4.3.1-2: Conditions for CSI-RS based L1-RSRP measurements for beam correspondence

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of arrival | NR operating bands | Minimum CSI-RS\_RP Note 2 | CSI-RS Ês/Iot |
|  |  | dBm / SCSCSI-RS | dB |
|  |  | SCSCSI-RS = 120 kHz |  |
| All angles **Note 1** | n257 | -96.2 | ≥6 |
|  | n258 | -96.2 |  |
|  | n259 | -90.7 |  |
|  | n260 | -91.9 |  |
|  | n261 | -96.2 |  |
|  | n262 | -88.5 |  |
|  |  |  |  |
| NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB\_RP values for all angles are increased by MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1.  NOTE 2: Values specified at the radiated requirements reference point to give minimum CSI-RS Ês/Iot, with no applied noise. | | | |

##### 6.6.4.3.2 Side Condition for SSB based enhanced Beam Correspondence requirements

The beam correspondence requirements for beam correspondence based on SSB are only applied under the following side conditions:

- The downlink reference signal SSB is provided and CSI-RS is not provided.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.4.3.1-1.

##### 6.6.4.3.3 Side Condition for CSI-RS based enhanced Beam Correspondence requirements

The beam correspondence requirements for beam correspondence based on CSI-RS are only applied under the following side conditions:

- The downlink reference signals including both SSB and CSI-RS are provided.

- The reference measurement channel for beam correspondence are fulfilled according to the CSI-RS configuration in Annex A.3.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.4.3.1-2 and SSB signal is provided according to Table 6.6.4.3.3-1.

Table 6.6.4.3.3-1: SSB signal conditions for CSI-RS based beam correspondence requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of arrival | NR operating bands | Minimum SSB\_RP Note 2 | SSB Ês/Iot |
|  |  | dBm / SCSSSB | dB |
|  |  | SCSSSB = 120 kHz |  |
| All angles **Note 1** | n257 | -101,4 | ≥1 |
|  | n258 | -101,4 |  |
|  | n259 | -97,1 |  |
|  | n260 | -97,1 |  |
|  | n261 | -101,4 |  |
|  | n262 | -93,5 |  |
|  |  |  |  |
| NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB\_RP values for all angles are increased by MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1.  NOTE 2: Values specified at the radiated requirements reference point to give minimum SSB Ês/Iot, with no applied noise. | | | |

#### 6.6.4.4 Applicability

For UEs supporting more than one type of beam correspondence, the following applicability rules apply:

- If a UE meets enhanced beam correspondence requirements either based on SSB or based on CSI-RS, it is considered to have met the beam correspondence requirements based on SSB and CSI-RS.

- For a UE supporting either SSB based or CSI-RS based enhanced beam correspondence, the UE shall meet the supported enhanced beam correspondence requirements.

- For a UE supporting both SSB based and CSI-RS based enhanced beam correspondence, the UE shall meet both SSB based and CSI-RS based enhanced beam correspondence requirements and the following applicability rules for verifying the requirements apply:

- The enhanced beam correspondence requirements shall be verified with the SSB based enhanced beam correspondence side conditions in clause 6.6.4.3.2. If the UE meets the SSB based enhanced beam correspondence requirements using the side conditions in clause 6.6.4.3.2 and meets the minimum peak EIRP requirement as defined in clasue 6.2.1.3 using the CSI-RS based side conditions in clause 6.6.4.3.3, where the link direction is determined in the SSB based enhanced beam correspondence test, the UE is considered to have met both the SSB based and CSI-RS based enhanced beam correspondence requirements.

- Otherwise, if UE does not meet the minimum peak EIRP requirement as defined in clasue 6.2.1.3 using the CSI-RS based side conditions in clause 6.6.4.3.3, the enhanced beam correspondence requirements shall be further verified for the UE with the CSI-RS based enhanced beam correspondence side conditions in clause 6.6.4.3.3.

### 6.6.5 (Void)

*< end changes >*

**---------------------------------------- < End of changes to Clause 6 > ---------------------------------------**

**--------------------------------------- < Start of changes to Clause 7 > ---------------------------------------**

*< start of changes >*

### 7.3.2 Reference sensitivity power level

#### 7.3.2.1 Reference sensitivity power level for power class 1

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.1-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.1-1: Reference sensitivity for power class 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Operating band | REFSENS (dBm) / Channel bandwidth | | | | | | |
| 50  MHz | 100  MHz | 200  MHz | 400  MHz | 800  MHz | 1600  MHz | 2000  MHz |
| n257 | -97.5 | -94.5 | -91.5 | -88.5 | N/A | N/A | N/A |
| n258 | -97.5 | -94.5 | -91.5 | -88.5 | N/A | N/A | N/A |
| n260 | -94.5 | -91.5 | -88.5 | -85.5 | N/A | N/A | N/A |
| n261 | -97.5 | -94.5 | -91.5 | -88.5 | N/A | N/A | N/A |
| n262 | -92.5 | -89.5 | -86.5 | -83.5 | N/A | N/A | N/A |
| n263 | N/A | -85 | N/A | -79 | -76 | -73 | -72 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 | | | | | | | |



The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Table 7.3.2.1-2: Uplink configuration for reference sensitivity

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operating  band | NR Band / Channel bandwidth / NRB / SCS / Duplex mode | | | | | | | | |
| 50  MHz | 100 MHz | 200  MHz | 400  MHz | 800  MHz | 1600  MHz | 2000  MHz | SCS | Duplex mode |
| n257 | 32 | 64 | 128 | 256 | N/A | N/A | N/A | 120 kHz | TDD |
| n258 | 32 | 64 | 128 | 256 | N/A | N/A | N/A | 120 kHz | TDD |
| n260 | 32 | 64 | 128 | 256 | N/A | N/A | N/A | 120 kHz | TDD |
| n261 | 32 | 64 | 128 | 256 | N/A | N/A | N/A | 120 kHz | TDD |
| n262 | 32 | 64 | 128 | 256 | N/A | N/A | N/A | 120 kHz | TDD |
| n263 | N/A | 64 | N/A | 256 | N/A | N/A | N/A | 120 kHz | TDD |
| N/A | N/A | N/A | [64] | 120 | [240] | N/A | 480 kHz |
| N/A | N/A | N/A | [32] | [60] | [120] | 144 | 960 kHz |



Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

*< text omitted >*

### 7.3.4 EIS spherical coverage

#### 7.3.4.1 EIS spherical coverage for power class 1

The reference measurement channels and throughput criterion shall be as specified in clause 7.3.2.1

The maximum EIS at the 85th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.1-1 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

Table 7.3.4.1-1: EIS spherical coverage for power class 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Operating band | EIS at 85th %-tile CCDF (dBm) / Channel bandwidth | | | | | | |
| 50  MHz | 100  MHz | 200  MHz | 400  MHz | 800  MHz | 1600  MHz | 2000  MHz |
| n257 | -89.5 | -86.5 | -83.5 | -80.5 | N/A | N/A | N/A |
| n258 | -89.5 | -86.5 | -83.5 | -80.5 | N/A | N/A | N/A |
| n260 | -86.5 | -83.5 | -80.5 | -77.5 | N/A | N/A | N/A |
| n261 | -89.5 | -86.5 | -83.5 | -80.5 | N/A | N/A | N/A |
| n262 | -84.3 | -81.3 | -78.3 | -75.3 | N/A | N/A | N/A |
| n263 | N/A | -73.5 | N/A | -67.5 | -64.5 | -61.5 | -60.5 |



The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

*< text omitted >*

### 7.3A.2 Reference sensitivity power level for CA

#### 7.3A.2.1 Intra-band contiguous CA

For each component carrier in the intra-band contiguous carrier aggregation, the throughput in QPSK R = 1/3 shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity values determined from clause 7.3.2, and relaxation applied to peak reference sensitivity requirement as specified in Table 7.3A.2.1-1.

Table 7.3A.2.1-1: EIS Relaxation for CA operation by aggregated channel bandwidth

|  |  |
| --- | --- |
| Aggregated Channel BW 'BWChannel\_CA' (MHz) | (dB) |
| BWChannel\_CA ≤ 800 | 0.0 |
| 800 < BWChannel\_CA ≤ 1200 | 0.5 |
| 1200 < BWChannel\_CA ≤ 1600 | 1.0 |
| 1600 < BWChannel\_CA ≤ 2000 | [1.5] |

7.3A.2.2 Intra-band non-contiguous CA

*< text omitted >*

## 7.4 Maximum input level

The maximum input level is defined as the maximum mean power, for which the throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

The maximum input level is defined as a directional requirement. The requirement is verified in beam locked mode in the direction where peak gain is achieved.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annex A (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with parameters specified in Table 7.4.-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 7.4-1: Maximum input level

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rx Parameter | Units | Channel bandwidth | | | | | | |
| 50  MHz | 100  MHz | 200  MHz | 400  MHz | 800  MHz | 1600  MHz | 2000  MHz |
| Power in transmission bandwidth configuration | dBm | 25(NOTE 2)  -27 (NOTE 3) | | | | | | |
| NOTE 1: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2.  NOTE 2: Reference measurement channel is specified in Annex A.3.3.2: QPSK, R=1/3 variant with one sided dynamic OCNG Pattern as described in Annex A.  NOTE 3: Reference measurement channel is specified in Annex A.3.3.5: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern as described in Annex A. | | | | | | | | |



Table 7.4-2: Void

*< text omitted >*

## 7.5 Adjacent channel selectivity

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a NR signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

The requirement applies at the RIB when the AoA of the incident wave of the wanted signal and the interfering signal are both from the direction where peak gain is achieved.

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

The UE shall fulfil the minimum requirement specified in Table 7.5-1 for all values of an adjacent channel interferer up to –25 dBm. However, it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5-2 and Table 7.5-3 where the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2, with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

**Table 7.5-1: Adjacent channel selectivity**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operating band | Units | Adjacent channel selectivity / Channel bandwidth | | | | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| n257, n258, n261 | dB | 23 | 23 | 23 | 23 | N/A | N/A | N/A |
| n259, n260, n262 | dB | 22 | 22 | 22 | 22 | N/A | N/A | N/A |
| n263 | dB | N/A | 21 | N/A | 21 | 20 | 20 | 20 |

**Table 7.5-2: Adjacent channel selectivity test parameters, Case 1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rx Parameter | Units | Channel bandwidth | | | | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| Power in Transmission Bandwidth Configuration | dBm | REFSENS + 14 dB | | | | | | |
| PInterferer for band n257, n258, n261 | dBm | REFSENS  + 35.5 dB | REFSENS +35.5 dB | REFSENS  +35.5 dB | REFSENS  +35.5 dB | N/A | N/A | N/A |
| PInterferer for band n259, n260, n262 | dBm | REFSENS  + 34.5 dB | REFSENS +34.5 dB | REFSENS  +34.5 dB | REFSENS  +34.5 dB | N/A | N/A | N/A |
| PInterferer for band n263 | dBm | N/A | REFSENS +33.5 dB | N/A | REFSENS  +33.5 dB | REFSENS  + 32.5 dB | REFSENS  + 32.5 dB | REFSENS  + 32.5 dB |
| BWInterferer | MHz | 50 | 100 | 200 | 400 |  |  |  |
| FInterferer (offset) | MHz | 50  /  -50  NOTE 3 | 100  /  -100  NOTE 3 | 200  /  -200  NOTE 3 | 400  /  -400  NOTE 3 | 800  /  -800  NOTE 3 | 1600  /  -1600  NOTE 3 | 2000  /  -2000  NOTE 3 |
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern as described in Annex A.3.2 and set-up according to Annex C.  NOTE 2: The REFSENS power level is specified in Clause 7.3.2, which are applicable to different UE power classes.  NOTE 3: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.  NOTE 4: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | | | | | | | |

**Table 7.5-3: Adjacent channel selectivity test parameters, Case 2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rx Parameter | Units | Channel bandwidth | | | | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| Power in Transmission Bandwidth Configuration for band n257, n258, n261 | dBm | -46.5 | -46.5 | -46.5 | -46.5 | N/A | N/A | N/A |
| Power in Transmission Bandwidth Configuration for band n259, n260, n262 | dBm | -45.5 | -45.5 | -45.5 | -45.5 | N/A | N/A | N/A |
| Power in Transmission Bandwidth Configuration for band n263 | dBm | N/A | -44.5 | N/A | -44.5 | -43.5 | -43.5 | -43.5 |
| PInterferer | dBm | -25 | | | | | | |
| BWInterferer | MHz | 50 | 100 | 200 | 400 | 800 | 1600 | 2000 |
| FInterferer (offset) | MHz | 50  /  -50  NOTE 2 | 100  /  -100  NOTE 2 | 200  /  -200  NOTE 2 | 400  /  -400  NOTE 2 | 800  /  -800  NOTE 2 | 1600  /  -1600  NOTE 2 | 2000  /  -2000  NOTE 2 |
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern TDD as described in Annex A and set-up according to Annex C.  NOTE 2: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.  NOTE 3: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | | | | | | | |

## 7.5A Adjacent channel selectivity for DL CA

*< text omitted >*

### 7.5A.1 Adjacent channel selectivity for Intra-band contiguous CA

For intra-band contiguous carrier aggregation, the SCC(s) shall be configured at nominal channel spacing to the PCC. The input power shall be distributed among the active DL CCs so their PSDs are aligned with each other. The UE shall fulfil the minimum requirement specified in Table 7.5A.1-1 for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1). The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

**Table 7.5A.1-1: Adjacent channel selectivity for intra-band contiguous CA**

|  |  |  |
| --- | --- | --- |
| Operating band | Units | Adjacent channel selectivity / CA bandwidth class |
|  |  | All CA bandwidth class |
| n257, n258, n261 | dB | 23 |
| n259, n260, n262 | dB | 22 |
| n263 | dB | 21  for BWChannel\_CA ≤ 400 MHz.  20  for BWChannel\_CA > 400 MHz. |

**Table 7.5A.1-2: Adjacent channel selectivity test parameters for intra-band contiguous CA, Case 1**

|  |  |  |
| --- | --- | --- |
| Rx Parameter | Units | All CA bandwidth Classes |
| Pw in Transmission Bandwidth Configuration, per CC |  | REFSENS + 14 dB |
| PInterferer for band n257, n258, n261 | dBm | Aggregated power + 21.5 |
| PInterferer for band n259, n260, n262 | dBm | Aggregated power + 20.5 |
| PInterferer for band n263 | dBm | Aggregated power + 19.5  for BWChannel\_CA ≤ 400 MHz.  Aggregated power + 18.5  for BWChannel\_CA > 400 MHz. |
| BWInterferer | MHz | BWChannel\_CA |
| FInterferer (offset) | MHz | + BWchannel CA  /  - BWchannel CA  NOTE 3 |
|
|
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern as described in Annex A and set-up according to Annex C.  NOTE 2: The Finterferer (offset) is the frequency separation between the center of the aggregated CA bandwidth and the center frequency of the Interferer signal  NOTE 3: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.  NOTE 4: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | |

**Table 7.5A.1-3: Adjacent channel selectivity test parameters for intra-band contiguous CA, Case 2**

|  |  |  |
| --- | --- | --- |
| Rx Parameter | Units | All CA bandwidth classes |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n257, n258, n261 | dBm | - 46.5 |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n259, n260, n262 | dBm | - 45.5 |
| Pw in Transmission Bandwidth Configuration, aggregated power for band n263 | dBm | -44.5 for BWChannel\_CA ≤ 400 MHz  -43.5 for BWChannel\_CA > 400 MHz. |
| Pinterferer | dBm | - 25 |
| BWInterferer | MHz | BWChannel\_CA |
| FInterferer (offset) | MHz | + BWchannel CA  /  - BWchannel CA  NOTE 3 |
|
|
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE 2: The Finterferer (offset) is the frequency separation between the center of the aggregated CA bandwidth and the center frequency of the Interferer signal  NOTE 3: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.  NOTE 4: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | |

### 7.5A.2 Adjacent channel selectivity for Intra-band non-contiguous CA

*< text omitted >*

7.6.2 In-band blocking

In-band blocking is a measure of a receiver's ability to receive a NR signal at its assigned channel frequency in the presence of an interferer at a given frequency offset from the centre frequency of the assigned channel.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1). The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

**Table 7.6.2-1: In band blocking requirements**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rx parameter** | **Units** | **Channel bandwidth** | | | | | | | |
|  |  | **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **800 MHz** | **1600 MHz** | **2000 MHz** | | |
| Power in Transmission Bandwidth Configuration | dBm | REFSENS + 14 dB | | | | | | | |
| BWInterferer | MHz | 50 | 100 | 200 | 400 | 800 | 1600 | 2000 | | |
| PInterferer  for bands n257, n258, n261 | dBm | REFSENS + 35.5 dB | REFSENS + 35.5 dB | REFSENS + 35.5 dB | REFSENS + 35.5 dB | N/A | N/A | N/A | | |
| PInterferer  for bands n259, n260, n262 | dBm | REFSENS + 34.5 dB | REFSENS + 34.5 dB | REFSENS + 34.5 dB | REFSENS + 34.5 dB | N/A | N/A | N/A | | |
| PInterferer  for band n263 | dBm | N/A | REFSENS + 33.5 dB | N/A | REFSENS + 33.5 dB | REFSENS + 33.5 dB | REFSENS + 33.5 dB | REFSENS + 33.5 dB | | |
| FIoffset | MHz | ≤ -100 & ≥ 100  NOTE 5 | ≤ -200 & ≥ 200  NOTE 5 | ≤ -400 & ≥ 400  NOTE 5 | ≤ -800 & ≥ 800  NOTE 5 | ≤ -1600 & ≥ 1600  NOTE 5 | ≤ -3200 & ≥ 3200 | ≤ -4000 & ≥ 4000 | | |
| FInterferer | MHz | FDL\_low + 25  to  FDL\_high - 25 | FDL\_low + 50  to  FDL\_high - 50 | FDL\_low + 100  to  FDL\_high - 100 | FDL\_low + 200  to  FDL\_high - 200 | FDL\_low + 400  to  FDL\_high - 400 | FDL\_low + 800  to  FDL\_high - 800 | FDL\_low + 1600  to  FDL\_high - 1600 | | |
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1. TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE2: The REFSENS power level is specified in Clause 7.3.2, which are applicable according to different UE power classes.  NOTE 3: The wanted signal consists of the reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE 4: FIoffset is the frequency separation between the center of the channel bandwidth and the center frequency of the Interferer signal.  NOTE 5: The absolute value of the interferer offset FIoffset shall be further adjusted (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have same SCS.  NOTE 6: FInterferer range values for unwanted modulated interfering signals are interferer center frequencies.  NOTE 7: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | | | | | | | |

7.6.3 Void

*< text omitted >*

7.6A.2 In-band blocking

**Table 7.6A.2-1: Void**

**Table 7.6A.2-2: Void**

7.6A.2.1 In-band blocking for Intra-band contiguous CAFor intra-band contiguous carrier aggregation, the SCC(s) shall be configured at nominal channel spacing to the PCC. The input power shall be distributed among the active DL CCs so their PSDs are aligned with each other. The UE shall fulfil the minimum requirement specified in Table 7.6A.2-1 for in the presence of an interferer at a given frequency offset from the centre frequency of the assigned channel and an interferer power shall not exceed -25 dBm. The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1). The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

**Table 7.6A.2.1-1: In band blocking minimum requirements for intra-band contiguous CA**

|  |  |  |
| --- | --- | --- |
| **Rx Parameter** | **Units** | **All CA bandwidth classes** |
| Power in Transmission Bandwidth Configuration, per CC |  | REFSENS + 14 dB |
| Pinterferer for bands n257, n258, n261 | dBm | Aggregated power + 21.5 |
| Pinterferer for bands n260, n262 | dBm | Aggregated power + 20.5 |
| Pinterferer for band n263 | dBm | Aggregated power + 19.5 |
| BWInterferer | MHz | BWChannel\_CA |
| FIoffset | MHz | +2\*BWChannel\_CA / -2\*BWChannel\_CA  NOTE 5 |
| FInterferer | MHz | FDL\_low + 0.5\*BWChannel\_CA  To  FDL\_high - 0.5\*BWChannel\_CA |
|
|
| NOTE 1: The interferer consists of the Reference measurement channel specified in Annex A.3.3.2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1. and set-up according to Annex C.  NOTE 2: The REFSENS power level is specified in Table 7.3.2-1.  NOTE 3: The wanted signal consists of the reference measurement channel specified in Annex A.3.3.2 QPSK, R=1/3 with one sided dynamic OCNG pattern OP.1 TDD as described in Annex A.5.2.1 and set-up according to Annex C.  NOTE 4: The FInterferer (offset) is the frequency separation between the center of the aggregated CA bandwidth and the center frequency of the Interferer signal.  NOTE 5: The absolute value of the interferer offset FInterferer (offset) shall be further adjusted to (CEIL(|FInterferer|/SCS) + 0.5)\*SCS MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interfering signal has the same SCS as that of the closest carrier.  NOTE 6: FInterferer range values for unwanted modulated interfering signals are interferer center frequencies.  NOTE 7: The transmitter shall be set to 4 dB below the PUMAX,f,c as defined in clause 6.2.4, with uplink configuration specified in Table 7.3.2.1-2. | | |

7.6A.2.2 In-band blocking for Intra-band non-contiguous CA

*< text omitted >*

## 7.9 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver. The spurious emissions power level is measured as TRP.

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9-1. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

Table 7.9-1: General receiver spurious emission requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency range | Measurement  bandwidth | Maximum level | NOTE |
| 30MHz ≤ f < 1GHz | 100 kHz | -57 dBm  (NOTE 2) | 1 |
| 1GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the DL operating band in GHz | 1 MHz | -47 dBm  (NOTE 3) |  |
| NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH as defined in Annex C.3.1.  NOTE 2: This maximum level does not apply for Band n263 for which -36 dBm applies.  NOTE 3: This maximum level does not apply for Band n263 for which -30 dBm applies. | | | |

## 7.10 Void

*< end of changes >*

**---------------------------------------- < End of changes to Clause 7 > ---------------------------------------**

**--------------------------------------- < Start of changes to Annex A > ---------------------------------------**

*< start of changes >*

Annex A (normative):  
Measurement channels

# A.1 General

# A.2 UL reference measurement channels

## A.2.1 General

## A.2.2 Void

## A.2.3 Reference measurement channels for TDD

For UL RMCs defined below, TDD slot pattern defined in Table A.2.3-1 will be used for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, TDD slot patterns defined for reference sensitivity tests in Table A.3.3.1-1 will be used.

Table A.2.3-1: Additional reference channels parameters for TDD



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Value | | | |
|  | | SCS 60 kHz (µ=2) | SCS 120 kHz (µ=3) | SCS 480 kHz (µ=5) | SCS 960 kHz (µ=6) |
| TDD Slot Configuration pattern (Note 1) | | DDDSUUUU | 7DS8U | 31DS32U | 63DS64U |
| Special Slot Configuration (Note 2) | | S=4D+6G+4U | S=12D+2G | S=2D+12G | S=2D+12G |
| *referenceSubcarrierSpacing* | | 60 kHz | 120 kHz | 480 kHz | 960 kHz |
| UL-DL configuration | *dl-UL-TransmissionPeriodicity* | 2 ms | 2 ms | 2 ms | 2ms |
|  | *nrofDownlinkSlots* | 3 | 7 | 31 | 63 |
|  | *nrofDownlinkSymbols* | 4 | 12 | 2 | 2 |
|  | *nrofUplinkSlot* | 4 | 8 | 32 | 64 |
|  | *nrofUplinkSymbols* | 4 | 0 | 0 | 0 |
| Indexes of active UL slots | | mod(slot index, 40) = {36,…,39} | mod(slot index, 80) = {72,…,79} | mod(slot index, 320) = {288,…,319} | mod(slot index, 640) = {576,…,639} |
| NOTE 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information.  NOTE 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information. | | | | | |

### A.2.3.1 DFT-s-OFDM Pi/2-BPSK

Table A.2.3.1-1: Reference Channels for DFT-s-OFDM pi/2-BPSK

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits9 |  |
|  | 1 | 11 | pi/2 BPSK | 0 | 24 | 16 | 2 | 1 | 132 | 132 |
|  | 16 | 11 | pi/2 BPSK | 0 | 504 | 16 | 2 | 1 | 2112 | 2112 |
|  | 32 | 11 | pi/2 BPSK | 0 | 1032 | 16 | 2 | 1 | 4224 | 4224 |
|  | 60 | 11 | pi/2 BPSK | 0 | 1864 | 16 | 2 | 1 | 7920 | 7920 |
|  | 64 | 11 | pi/2 BPSK | 0 | 2024 | 16 | 2 | 1 | 8448 | 8448 |
|  | 120 | 11 | pi/2 BPSK | 0 | 3752 | 16 | 2 | 1 | 15840 | 15840 |
|  | 128 | 11 | pi/2 BPSK | 0 | 3976 | 24 | 2 | 2 | 16896 | 16896 |
|  | 144 | 11 | pi/2 BPSK | 0 | 4488 | 24 | 2 | 2 | 19008 | 19008 |
|  | 243 | 11 | pi/2 BPSK | 0 | 7560 | 24 | 2 | 2 | 32076 | 32076 |
|  | 256 | 11 | pi/2 BPSK | 0 | 7944 | 24 | 2 | 3 | 33792 | 33792 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.1-2: Void

### A.2.3.2 DFT-s-OFDM QPSK

Table A.2.3.2-1: Reference Channels for DFT-s-OFDM QPSK

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | QPSK | 2 | 48 | 16 | 2 | 1 | 264 | 132 |
|  | 16 | 11 | QPSK | 2 | 808 | 16 | 2 | 1 | 4224 | 2112 |
|  | 20 | 11 | QPSK | 2 | 1032 | 16 | 2 | 1 | 5280 | 2640 |
|  | 32 | 11 | QPSK | 2 | 1608 | 16 | 2 | 1 | 8448 | 4224 |
|  | 60 | 11 | QPSK | 2 | 2976 | 16 | 2 | 1 | 15840 | 7920 |
|  | 64 | 11 | QPSK | 2 | 3240 | 16 | 2 | 1 | 16896 | 8448 |
|  | 120 | 11 | QPSK | 2 | 5896 | 24 | 2 | 2 | 31680 | 15840 |
|  | 128 | 11 | QPSK | 2 | 6408 | 24 | 2 | 2 | 33792 | 16896 |
|  | 144 | 11 | QPSK | 2 | 7176 | 24 | 2 | 2 | 38016 | 19008 |
|  | 243 | 11 | QPSK | 2 | 12040 | 24 | 2 | 4 | 64152 | 32076 |
|  | 256 | 11 | QPSK | 2 | 12808 | 24 | 2 | 4 | 67584 | 33792 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.2-2: Void

### A.2.3.3 DFT-s-OFDM 16QAM

Table A.2.3.3-1: Reference Channels for DFT-s-OFDM 16QAM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | 16QAM | 10 | 176 | 16 | 2 | 1 | 528 | 132 |
|  | 16 | 11 | 16QAM | 10 | 2792 | 16 | 2 | 1 | 8448 | 2112 |
|  | 32 | 11 | 16QAM | 10 | 5632 | 24 | 1 | 1 | 16896 | 4224 |
|  | 60 | 11 | 16QAM | 10 | 10504 | 24 | 1 | 2 | 31680 | 7920 |
|  | 64 | 11 | 16QAM | 10 | 11272 | 24 | 1 | 2 | 33792 | 8448 |
|  | 120 | 11 | 16QAM | 10 | 21000 | 24 | 1 | 3 | 63360 | 15840 |
|  | 128 | 11 | 16QAM | 10 | 22536 | 24 | 1 | 3 | 67584 | 16896 |
|  | 144 | 11 | 16QAM | 10 | 25104 | 24 | 1 | 3 | 76032 | 19008 |
|  | 243 | 11 | 16QAM | 10 | 43032 | 24 | 1 | 6 | 128304 | 32076 |
|  | 256 | 11 | 16QAM | 10 | 45096 | 24 | 1 | 6 | 135168 | 33792 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.3-2: Void

### A.2.3.4 DFT-s-OFDM 64QAM

Table A.2.3.4-1: Reference Channels for DFT-s-OFDM 64QAM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | 64QAM | 18 | 408 | 16 | 2 | 1 | 792 | 132 |
|  | 16 | 11 | 64QAM | 18 | 6400 | 24 | 1 | 1 | 12672 | 2112 |
|  | 32 | 11 | 64QAM | 18 | 12808 | 24 | 1 | 2 | 25344 | 4224 |
|  | 60 | 11 | 64QAM | 18 | 24072 | 24 | 1 | 3 | 47520 | 7920 |
|  | 64 | 11 | 64QAM | 18 | 25608 | 24 | 1 | 4 | 50688 | 8448 |
|  | 120 | 11 | 64QAM | 18 | 48168 | 24 | 1 | 6 | 95040 | 15840 |
|  | 128 | 11 | 64QAM | 18 | 51216 | 24 | 1 | 7 | 101376 | 16896 |
|  | 144 | 11 | 64QAM | 18 | 57376 | 24 | 1 | 7 | 114048 | 19008 |
|  | 243 | 11 | 64QAM | 18 | 96264 | 24 | 1 | 12 | 192456 | 32076 |
|  | 256 | 11 | 64QAM | 18 | 102416 | 24 | 1 | 13 | 202752 | 33792 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.4-2: Void

### A.2.3.5 CP-OFDM QPSK

Table A.2.3.5-1: Reference Channels for CP-OFDM QPSK

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | QPSK | 2 | 48 | 16 | 2 | 1 | 264 | 132 |
|  | 16 | 11 | QPSK | 2 | 808 | 16 | 2 | 1 | 4224 | 2112 |
|  | 32 | 11 | QPSK | 2 | 1608 | 16 | 2 | 1 | 8448 | 4224 |
|  | 33 | 11 | QPSK | 2 | 1672 | 16 | 2 | 1 | 8712 | 4356 |
|  | 62 | 11 | QPSK | 2 | 3104 | 16 | 2 | 1 | 16368 | 8184 |
|  | 66 | 11 | QPSK | 2 | 3368 | 16 | 2 | 1 | 17424 | 8712 |
|  | 124 | 11 | QPSK | 2 | 6152 | 24 | 2 | 2 | 32736 | 16368 |
|  | 132 | 11 | QPSK | 2 | 6536 | 24 | 2 | 2 | 34848 | 17424 |
|  | 148 | 11 | QPSK | 2 | 7304 | 24 | 2 | 2 | 39072 | 19536 |
|  | 248 | 11 | QPSK | 2 | 12296 | 24 | 2 | 4 | 65472 | 32736 |
|  | 264 | 11 | QPSK | 2 | 13064 | 24 | 2 | 4 | 69696 | 34848 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.5-2: Void

### A.2.3.6 CP-OFDM 16QAM

Table A.2.3.6-1: Reference Channels for CP-OFDM 16QAM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | 16QAM | 10 | 176 | 16 | 2 | 1 | 528 | 132 |
|  | 16 | 11 | 16QAM | 10 | 2792 | 16 | 2 | 1 | 8448 | 2112 |
|  | 32 | 11 | 16QAM | 10 | 5632 | 24 | 1 | 1 | 16896 | 4224 |
|  | 33 | 11 | 16QAM | 10 | 5760 | 24 | 1 | 1 | 17424 | 4356 |
|  | 62 | 11 | 16QAM | 10 | 10760 | 24 | 1 | 2 | 32736 | 8184 |
|  | 66 | 11 | 16QAM | 10 | 11528 | 24 | 1 | 2 | 34848 | 8712 |
|  | 124 | 11 | 16QAM | 10 | 21504 | 24 | 1 | 3 | 65472 | 16368 |
|  | 132 | 11 | 16QAM | 10 | 23040 | 24 | 1 | 3 | 69696 | 17424 |
|  | 148 | 11 | 16QAM | 10 | 26120 | 24 | 1 | 4 | 78144 | 19536 |
|  | 248 | 11 | 16QAM | 10 | 43032 | 24 | 1 | 6 | 130944 | 32736 |
|  | 264 | 11 | 16QAM | 10 | 46104 | 24 | 1 | 6 | 139392 | 34848 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.6-2: Void

### A.2.3.7 CP-OFDM 64QAM

Table A.2.3.7-1: Reference Channels for CP-OFDM 64QAM

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | Allocated resource blocks (LCRB) | DFT-s-OFDM Symbols per slot (Note 1) | Modulation | MCS Index (Note 2) | Payload size | Transport block CRC | LDPC Base Graph | Number of code blocks per slot (Note 3) | Total number of bits per slot | Total modulated symbols per slot |
| Unit |  |  |  |  | Bits | Bits |  |  | Bits |  |
|  | 1 | 11 | 64QAM | 19 | 408 | 16 | 2 | 1 | 792 | 132 |
|  | 16 | 11 | 64QAM | 19 | 6400 | 24 | 1 | 1 | 12672 | 2112 |
|  | 32 | 11 | 64QAM | 19 | 12808 | 24 | 1 | 2 | 25344 | 4224 |
|  | 33 | 11 | 64QAM | 19 | 13064 | 24 | 1 | 2 | 26136 | 4356 |
|  | 62 | 11 | 64QAM | 19 | 24576 | 24 | 1 | 3 | 49104 | 8184 |
|  | 66 | 11 | 64QAM | 19 | 26120 | 24 | 1 | 4 | 52272 | 8712 |
|  | 124 | 11 | 64QAM | 19 | 49176 | 24 | 1 | 6 | 98208 | 16368 |
|  | 132 | 11 | 64QAM | 19 | 53288 | 24 | 1 | 7 | 104544 | 17424 |
|  | 148 | 11 | 64QAM | 19 | 59432 | 24 | 1 | 8 | 117216 | 19536 |
|  | 248 | 11 | 64QAM | 19 | 98376 | 24 | 1 | 12 | 196416 | 32736 |
|  | 264 | 11 | 64QAM | 19 | 106576 | 24 | 1 | 13 | 209088 | 34848 |
| NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.  NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in 38.214.  NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)  NOTE 4: Indexes of active UL slots are given by Table A.2.3-1 with TDD UL-DL configuration specified in A2.3 for the requirements requiring at least one sub frame (1ms) for the measurement period. For other requirements, indexes of active UL slots are given by the slots satisfying mod(slot index+1, 5) = 0 with TDD UL-DL configuration specified in A.3.3.1.  NOTE 5: The RMCs apply to all channel bandwidth where LCRB ≤ NRB. | | | | | | | | | | |

Table A.2.3.7-2: Void

*< Unchanged Text Skipped >*

## A.3.2 Void

## A.3.3 DL reference measurement channels for TDD

#### A.3.3.1 General

Table A.3.3.1-1. Additional test parameters for TDD



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Value | | | |
|  | | SCS 60 kHz (µ=2) | SCS 120 kHz (µ=3)) | SCS 480 kHz (µ=5) | SCS 960 kHz (µ=6) |
| TDD Slot Configuration pattern (Note 1) | | DDDSU | DDDSU | DDDSU | DDDSU |
| Special Slot Configuration (Note 2) | | S=4D+6G+4U | S=10D+2G+2U | S=10D+2G+2U | S=10D+2G+2U |
| referenceSubcarrierSpacing | | 60 kHz | 120 kHz | 480 kHz | 960 kHz |
| UL-DL configuration | *dl-UL-TransmissionPeriodicity* | 1.25 ms | 0.625 ms | 0.3125 ms | 0.15625 ms |
|  | *nrofDownlinkSlots* | 3 | 3 | 3 | 3 |
|  | *nrofDownlinkSymbols* | 4 | 10 | 10 | 10 |
|  | *nrofUplinkSlot* | 1 | 1 | 1 | 1 |
|  | *nrofUplinkSymbols* | 4 | 2 | 2 | 2 |
| Number of HARQ Processes | | 8 | 8 | 8 | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information (Note 3) | | K1 = 4 if mod(i,5) = 0 K1 =3 if mod(i,5) = 1 K1 =7 if mod(i,5) = 2 where i is slot index per frame; i = {0,…,39} | K1 = 4 if mod(i,5) = 0 K1 =3 if mod(i,5) = 1 K1 =7 if mod(i,5) = 2 where i is slot index per frame; i = {0,…,79} | K1 = 4 if mod(i,5) = 0 K1 =3 if mod(i,5) = 1 K1 =7 if mod(i,5) = 2 where i is slot index per frame; i = {0,…,319} | K1 = 4 if mod(i,5) = 0 K1 =3 if mod(i,5) = 1 K1 =7 if mod(i,5) = 2 where i is slot index per frame; i = {0,…,639} |
| NOTE 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information.  NOTE 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information.  NOTE 3: i is the slot index per frame. | | | | | |

*< end of changes >*

**---------------------------------------- < End of changes to Annex A > ---------------------------------------**