**3GPP TSG- Meeting # *revised***

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *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:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | ZTE Corporation | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Core | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | |  |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Minor corrections to section 5. Some empty rows in Table 5.3A.5-1 and 5.4.3.2-1 should be removed. In addition, some other typos need to be corrected. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Remove empty rows in Table 5.3A.5-1 and 5.4.3.2-1. 2. Minor corrections to section 5.3.3. 3. Minor corrections to Table 5.3.5-1 and 5.4.2.2-1. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The above mentioned problems will be remain. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.3.3, 5.3.5, 5.3A.5, 5.4.2.2, 5.4.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS/TR ... CR ... 38.521-1 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### *<< start of changes >>*

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

## 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 maximum transmission bandwidth configuration is shown in Figure 5.3.1-1.



Figure 5.3.1-1: Definition of the channel bandwidth and the maximum 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) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB |
| 15 | 25 | 52 | 79 | 106 | 133 | 160 | 216 | 270 | N/A | N/A | N/A | N/A |
| 30 | 11 | 24 | 38 | 51 | 65 | 78 | 106 | 133 | 162 | 217 | 245 | 273 |
| 60 | N/A | 11 | 18 | 24 | 31 | 38 | 51 | 65 | 79 | 107 | 121 | 135 |

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

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.

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.

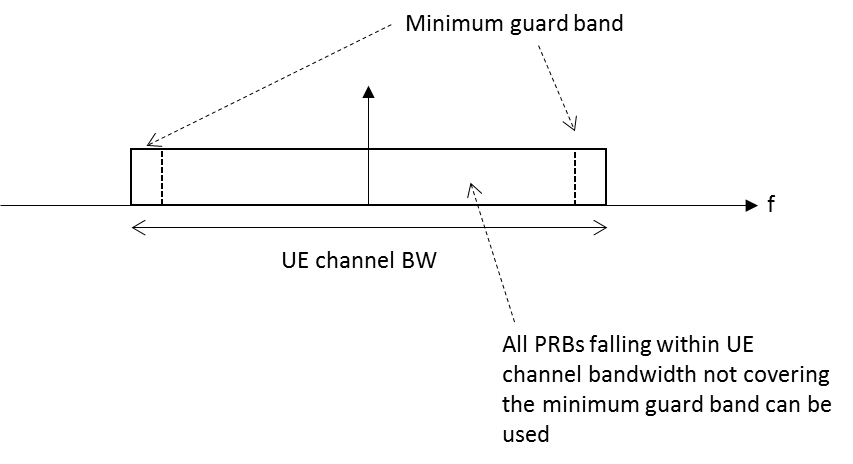


Figure 5.3.3-2: UE PRB utilization

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 received immediately adjacent to the guardband.

If multiple numerologies are multiplexed in the same symbol and the UE channel bandwidth is >50 MHz, the minimum guardband applied adjacent to 15 kHz SCS shall be the same as the minimum guardband defined for 30 kHz SCS for the same UE channel bandwidth.

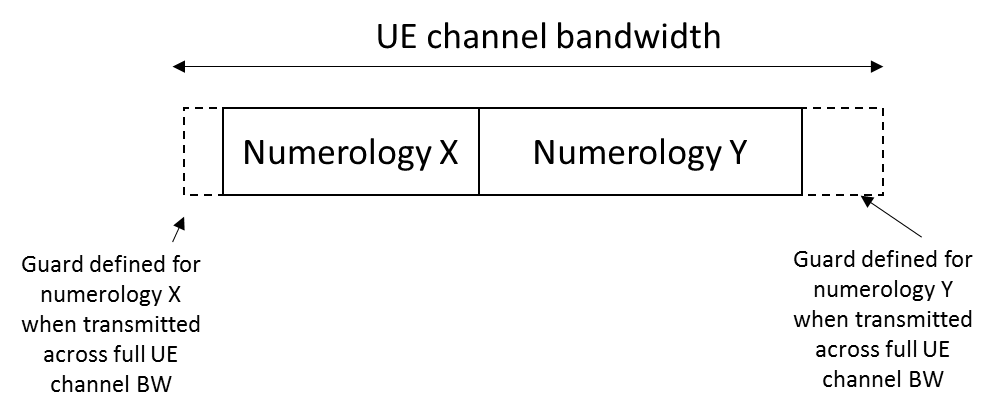


Figure 5.3.3-3 Guardbanddefinition when transmitting multiple numerologies

NOTE: Figure 5.3.3-3 is not intended to imply the size of any guard between the two numerologies. Inter-numerology guardbandwithin 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 TS 38.211 [6], 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* [7] and will fulfil the minimum UE guardband requirement specified in Clause 5.3.3.

### 5.3.5 UE 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

|  | NR band / SCS / UE Channel bandwidth | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | SCS  (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 904 MHz | 100 MHz |
| n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n2 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n7 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n12 | 15 | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n20 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes5 |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes5 |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n34 | 15 | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes |  |  |  |  |  |  |  |  |  |
| n38 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n39 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| n50 | 15 | Yes | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes3 |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes3 |  |  |
| n51 | 15 | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n70 | 15 | Yes | Yes | Yes | Yes3 | Yes3 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes3 | Yes3 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes3 | Yes3 |  |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n74 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n75 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n76 | 15 | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| n80 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n81 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n82 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n83 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n84 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n86 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| NOTE 1: void  NOTE 2: void  NOTE 3: This UE channel bandwidth is applicable only to downlink.  NOTE 4: This UE channel bandwidth is optional in this release of the specification.  NOTE 5: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz. | | | | | | | | | | | | | |

### 5.3.6 Asymmetric channel bandwidths

The UE channel bandwidth can be asymmetric in downlink and uplink. In asymmetric channel bandwidth operation, the narrower carrier shall be confined within the frequency range of the wider channel bandwidth.

In FDD, the confinement is defined as a deviation to the default Tx-Rx carrier center frequency separation (defined in table 5.4.4-1) as following:

ΔFTX-RX = | (BWDL – BWUL)/2 |

The operating bands and supported asymmetric channel bandwidth combinations are defined in table 5.3.6-1.

Table 5.3.6-1: FDD asymmetric UL and DL channel bandwidth combinations

|  |  |  |
| --- | --- | --- |
| NR Band | Channel bandwidths for UL (MHz) | Channel bandwidths for DL (MHz) |
| n66 | 5, 10 | 20, 40 |
| 20 | 40 |
| n70 | 5 | 10, 15 |
| 5, 10, 15 | 20, 25 |
| n71 | 5 | 10 |
| 10 | 15 |
| 15 | 20 |

In TDD, the operating bands and supported asymmetric channel bandwidth combinations are defined in table 5.3.6-2.

Table 5.3.6-2: TDD asymmetric UL and DL channel bandwidth combinations

|  |  |  |
| --- | --- | --- |
| NR Band | Channel bandwidths for UL (MHz) | Channel bandwidths for DL (MHz) |
| n50 | 60 | 80 |

## 5.3A UE channel bandwidth for CA

### 5.3A.1 General

Figure 5.3A.1-1: Void

Figure 5.3A.1-2: Void

### 5.3A.2 Maximum transmission bandwidth configuration for CA

For carrier aggregation, the maximum transmission bandwidth configuration is defined per component carrier and the requirement is specified in clause 5.3.2.

### 5.3A.3 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.3-1.

**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.3-1: 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))

BWGB,Channel(k) is the minimum guard band defined in clause 5.3.3 of carrier k, while 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.

For intra-band non-contiguous carrier aggregation *Sub-block Bandwidth* and *Sub-block edges* are defined as follows, see Figure 5.3A.3-2.

Figure 5.3A.3-2: Definition of sub-block bandwidth for intra-band non-contiguous spectrum

...

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**

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. BWGB,Channel(k) is the minimum guard band defined in clause 5.3.3 of carrier k within a sub-block.

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.4 Void

### 5.3A.5 UE channel bandwidth per operating band for CA

The requirements for carrier aggregation in this specification are defined for carrier aggregation configurations.

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, a UE can indicate support of several bandwidth combination sets per carrier aggregation configuration. 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.

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.5-1: NR CA bandwidth classes

|  |  |  |  |
| --- | --- | --- | --- |
| NR CA bandwidth class | Aggregated channel bandwidth | Number of contiguous CC | Fallback group |
| A | BWChannel ≤ BWChannel,max | 1 | 1, 2 |
| B | 20 MHz ≤ BWChannel\_CA ≤ 100 MHz | 2 | 2 |
| C | 100 MHz < BWChannel\_CA ≤ 2 x BWChannel,max | 2 | 1 |
| D | 200 MHz < BWChannel\_CA ≤ 3 x BWChannel,max | 3 |
| E | 300 MHz < BWChannel\_CA ≤ 4 x BWChannel,max | 4 |
|  |  |  | 2 |
| G | 100 MHz < BWChannel\_CA ≤ 150 MHz | 3 |
| H | 150 MHz < BWChannel\_CA ≤ 200 MHz | 4 |
| I | 200 MHz < BWChannel\_CA ≤ 250 MHz | 5 |
| J | 250 MHz < BWChannel\_CA ≤ 300 MHz | 6 |
| K | 300 MHz < BWChannel\_CA ≤ 350 MHz | 7 |
| L | 350 MHz < BWChannel\_CA ≤ 400 MHz | 8 |
| NOTE 1: BWChannel, max is maximum channel bandwidth supported among all bands in a release  NOTE 2: It is mandatory for a UE to be able to fallback to lower order NR CA bandwidth class configuration within a fallback group. It is not mandatory for a UE to be able to fallback to lower order NR CA bandwidth class configuration that belong to a different fallback group | | | |

## 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 100 kHz channel raster,

Nominal Channel spacing = (BWChannel(1) + BWChannel(2))/2

- For NR operating bands with 15 kHz channel raster,

Nominal Channel spacing = (BWChannel(1) + BWChannel(2))/2+{-5 kHz, 0 kHz, 5 kHz} for ∆FRaster equals 15 kHz

Nominal Channel spacing = (BWChannel(1) + BWChannel(2))/2+{-10 kHz, 0 kHz, 10 kHz} for ∆FRaster equals 30 kHz

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 channel raster defines a set of RF reference frequencies FREF. The RF reference frequency is used in signalling to identify the position of RF channels, SS blocks and other elements.

The global frequency raster is defined for all frequencies from 0 to 100 GHz. The granularity of the global frequency raster is ΔFGlobal.

RF reference frequencies are designated by an NR Absolute Radio Frequency Channel Number (NR-ARFCN) in the range (0…2016666) 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 |
| 0 – 3000 | 5 | 0 | 0 | 0 – 599999 |
| 3000 – 24250 | 15 | 3000 | 600000 | 600000 – 2016666 |

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

For SUL bands and for the uplink of all FDD bands defined in Table 5.2-1.

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

where Δshift is signalled by the network in higher layer parameter *frequencyShift7p5khz* [7].

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

Table 5.4.2.2-1: Channel raster to resource element mapping

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

, *nPRB*, *NRB* are as defined in TS 38.211[6].

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

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

For NR operating bands with 15 kHz channel raster above 3GHz, 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 is equal to or larger than the higher ΔFRaster and SSB SCS is equal to the higher ∆FRaster.

Table 5.4.2.3-1: Applicable NR-ARFCN per operating band

|  |  |  |  |
| --- | --- | --- | --- |
| NR operating band | ΔFRaster  (kHz) | Uplink  Range of NREF  (First – <Step size> – Last) | Downlink  Range of NREF  (First – <Step size> – Last) |
| n1 | 100 | 384000 – <20> – 396000 | 422000 – <20> – 434000 |
| n2 | 100 | 370000 – <20> – 382000 | 386000 – <20> – 398000 |
| n3 | 100 | 342000 – <20> – 357000 | 361000 – <20> – 376000 |
| n5 | 100 | 164800 – <20> – 169800 | 173800 – <20> – 178800 |
| n7 | 100 | 500000 – <20> – 514000 | 524000 – <20> – 538000 |
| n8 | 100 | 176000 – <20> – 183000 | 185000 – <20> – 192000 |
| n12 | 100 | 139800 – <20> – 143200 | 145800 – <20> – 149200 |
| n20 | 100 | 166400 – <20> – 172400 | 158200 – <20> – 164200 |
| n25 | 100 | 370000 – <20> – 383000 | 386000 – <20> – 399000 |
| n28 | 100 | 140600 – <20> – 149600 | 151600 – <20> – 160600 |
| n34 | 100 | 402000 – <20> – 405000 | 402000 – <20> – 405000 |
| n38 | 100 | 514000 – <20> – 524000 | 514000 – <20> – 524000 |
| n39 | 100 | 376000 – <20> – 384000 | 376000 – <20> – 384000 |
| n40 | 100 | 460000 – <20> – 480000 | 460000 – <20> – 480000 |
| n41 | 15 | 499200 – <3> – 537999 | 499200 – <3> – 537999 |
| 30 | 499200 – <6> – 537996 | 499200 – <6> – 537996 |
| n50 | 100 | 286400 – <20> – 303400 | 286400 – <20> – 303400 |
| n51 | 100 | 285400 – <20> – 286400 | 285400 – <20> – 286400 |
| n66 | 100 | 342000 – <20> – 356000 | 422000 – <20> – 440000 |
| n70 | 100 | 339000 – <20> – 342000 | 399000 – <20> – 404000 |
| n71 | 100 | 132600 – <20> – 139600 | 123400 – <20> – 130400 |
| n74 | 100 | 285400 – <20> – 294000 | 295000 – <20> – 303600 |
| n75 | 100 | N/A | 286400 – <20> – 303400 |
| n76 | 100 | N/A | 285400 – <20> – 286400 |
| n77 | 15 | 620000 – <1> – 680000 | 620000 – <1> – 680000 |
| 30 | 620000 – <2> – 680000 | 620000 – <2> – 680000 |
| n78 | 15 | 620000 – <1> – 653333 | 620000 – <1> – 653333 |
| 30 | 620000 – <2> – 653332 | 620000 – <2> – 653332 |
| n79 | 15 | 693334 – <1> – 733333 | 693334 – <1> – 733333 |
| 30 | 693334 – <2> – 733332 | 693334 – <2> – 733332 |
| n80 | 100 | 342000 – <20> – 357000 | N/A |
| n81 | 100 | 176000 – <20> – 183000 | N/A |
| n82 | 100 | 166400 – <20> – 172400 | N/A |
| n83 | 100 | 140600 – <20> –149600 | N/A |
| n84 | 100 | 384000 – <20> – 396000 | N/A |
| n86 | 100 | 342000 – <20> – 356000 | N/A |

### 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 freqeuncy 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 |
| 0 – 3000 MHz | N \* 1200kHz + M \* 50 kHz,  N=1:2499, M ϵ {1,3,5} (Note 1) | 3N + (M-3)/2 | 2 – 7498 |
| 3000 – 24250 MHz | 3000 MHz + N \* 1.44 MHz  N = 0:14756 | 7499 + N | 7499 – 22255 |
| NOTE 1: The default value for operating bands with SCS spaced channel raster is M=3. | | | |

#### 5.4.3.2 Synchronization raster to synchronization block resource element mapping

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

Table 5.4.3.2-1: Synchronization raster to SS block resource element mapping

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

 is the subcarrier number of SS/PBCH block defined in TS 38.211 clause 7.4.3.1 [6].

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### *<< End of changes >>*