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Title: TP for TR 38.191 section 5.3 Channel bandwidth and 5.4 Channel Arrangement

Agenda Item: 7.22.3.2

Document for: Approval

# **Introduction**

This TP will focus on section 5.3 Channel bandwidth and 5.4 Channel Arrangement.

# **Reference**

[1]

# Text Proposal

**----- Start of TP -----**

5.3 *Channel bandwidth*

### 5.3.1 R2D Channel bandwidth

#### 5.3.1.1 General

The *R2D channel bandwidth* supports a single reader RF carrier in R2D link at the reader.

The relationship between the R2D channel bandwidth, the guardband and the *transmission bandwidth* is shown in figure 5.3.1.1-1.

**Figure 5.3.1.1-1: Definition of channel bandwidth and *transmission bandwidth configuration* for one reader channel**

#### 5.3.1.2 R2D Transmission bandwidth

The *transmission bandwidth* NRB for each *reader channel bandwidth* and subcarrier spacing is specified in table 5.3.1.2.-1 .

**Table 5.3.1.2-1: R2D *Transmission bandwidth configuration* NRB for FR1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SCS (kHz)** | **200****kHz** | **400****kHz** | **600****kHz** | **800****kHz** |
|  | NRB | NRB | NRB | NRB |
| 15 | 1 | 2 | 3 | 4 |

NOTE: All BS Tx and device Rx requirements are defined based on *transmission bandwidth configuration* specified in table 5.3.1.2-1.

#### 5.3.1.3 Minimum guardband and R2D transmission bandwidth configuration

The minimum guardband for each *reader channel bandwidth* and SCS is specified in table 5.3.3-1.

**Table 5.3.1.3-1: Minimum guardband (kHz) (FR1)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **R2D CBW** | **200kHz** | **400kHz** | **600kHz** | **800kHz** |
| Minimum guardband(kHz) | 2.5 | 12.5 | 22.5 | 32.5 |

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

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**Figure 5.3.1.3-1: reader PRB utilization**

#### 5.3.1.4 RB alignment

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

#### 5.3.1.5 BS channel bandwidth per operating band

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

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

| **NR Band** | **SCS (kHz)** | ***Reader channel bandwidth* (kHz)** |
| --- | --- | --- |
| **200** | **400** | **600** | **800** |
| n8 | 15 | 200 | 400 | 600 | 800 |

### 5.3.2 D2R Channel bandwidth

#### 5.3.2.1 General

The D2R channel bandwidth supports a single NR RF carrier in the uplink at device or downlink at the BS. From a BS perspective, different device channel bandwidths may be supported within the same spectrum for transmitting to and backscattering from devices connected to the BS.

From a device perspective, the device is configured with its own device channel bandwidth. The device does not need to be aware of the BS transmission channel bandwidth.

The placement of the D2R channel bandwidth for each device carrier is flexible.

#### 5.3.2.2 D2R Transmission bandwidth

The *transmission bandwidth* NRB for each *D2R channel bandwidth* is specified in table 5.3.2.4-1.

#### 5.3.2.3 Minimum guardband and D2R transmission bandwidth

The minimum guardband for each *D2R channel bandwidth* at BS side is specified as 10% *D2R channel bandwidth* at BS side.

#### 5.3.2.4 D2R channel bandwidth per operating band

The requirements in this specification only apply to the *operating band* n8 shown in table 5.3.2.4-1 for device and in table 5.3.2.4-2 for BS.

**Table 5.3.2.4-1: Device D2R channel bandwidth**

|  |
| --- |
| **Device D2R channel bandwidth (kHz)**  |
| **Norminal D2R transmission** **Bandwidth without SFO(kHz)** | **Norminal Small frequency shift without SFO(kHz)** |
| **3.75**  | **7.5**  | **15**  | **30**  | **60** | **120**  | **240** | **480** | **720**  |
| **15** | 17 | 25 | 42 | 75 | 141 | 273 | 534 | 1065 | 　 |
| **30** | 　 | 33 | 50 | 83 | 149 | 281 | 545 | 1073 | 　 |
| **60** | 　 | 　 | 66 | 99 | 165 | 297 | 561 | 1089 | 　 |
| **120** | 　 | 　 | 　 | 132 | 198 | 330 | 594 | 1122 | 　 |
| **240** | 　 | 　 | 　 | 　 | 264 | 396 | 660 | 1188 | 　 |
| **480** | 　 | 　 | 　 | 　 | 　 | 528 | 792 | 1320 | 　 |
| **960** | 　 | 　 | 　 | 　 | 　 | 　 | 1056 | 1584 | 　 |
| **2880** | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 3168 |

**Table 5.3.2.4-2: BS D2R channel bandwidth**

|  |
| --- |
| **BS D2R channel bandwidth (kHz)**  |
| **Norminal D2R transmission** **Bandwidth without SFO (kHz)** | **Norminal Small frequency shift without SFO(kHz)** |
| **3.75**  | **7.5**  | **15**  | **30**  | **60** | **120**  | **240** | **480** | **720**  |
| **15** | 19 | 28 | 46 | 83 | 156 | 303 | 596 | 1183 | 　 |
| **30** | 　 | 37 | 55 | 92 | 165 | 312 | 605 | 1192 | 　 |
| **60** | 　 | 　 | 74 | 110 | 184 | 330 | 624 | 1210 | 　 |
| **120** | 　 | 　 | 　 | 147 | 220 | 367 | 660 | 1247 | 　 |
| **240** | 　 | 　 | 　 | 　 | 294 | 440 | 734 | 1320 | 　 |
| **480** | 　 | 　 | 　 | 　 | 　 | 587 | 880 | 1467 | 　 |
| **960** | 　 | 　 | 　 | 　 | 　 | 　 | 1174 | 1760 | 　 |
| **2880** | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 3520 |

## 5.4 Channel arrangement

### 5.4.1 R2D Channel raster

#### 5.4.1.1 AIoT-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 and other elements. The granularity of the global frequency raster is ΔFGlobal.

*RF reference frequencies* are designated by an A-IoT Absolute Radio Frequency Channel Number (AIoT-ARFCN) in the range [0…3279165] on the global frequency raster. The relation between the AIoT-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 5.4.1.1-1 and NREF is the AIoT-ARFCN.

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

Table 5.4.1.1-1: AIoT-ARFCN parameters for the global frequency raster

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Range of frequencies (MHz) | ΔFGlobal (kHz) | FREF-Offs (MHz) | NREF-Offs | Range of NREF |
| 0 – 3000 | 5 | 0 | 0 | 0 – 599999 |

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 5.4.1.2. The applicable entries for each *operating band* are defined in clause 5.4.1.3.

#### 5.4.1.2 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 5.4.1.2-1 and can be used to identify the RF channel position. The mapping depends on the total number of RBs that are allocated in the channel and applies to both UL and DL. The mapping must apply to at least one numerology supported by the BS.

Table 5.4.1.2-1: Channel Raster to Resource Element Mapping

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

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

#### 5.4.1.3 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 5.4.1.3-1, using the channel raster to resource element mapping in clause 5.4.1.2.

Channel raster is defined with ΔFRaster = 2 × ΔFGlobal. In this case every 2th 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 5.4.1.3‑1 is given as <2>.

Table 5.4.1.3-1: Applicable NR-ARFCN per operating band for enhanced channel raster

|  |  |  |  |
| --- | --- | --- | --- |
| NR operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) |
| n8 | 10 | 176000 – <2> – 183000 | 185000 – <2> – 192000 |
| NOTE 1: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. These channel numbers shall also be such that the minimum guard band for each channel bandwidth and SCS specified in Table 5.3.3-1 are met for carriers located at the upper or lower edge of an operating band. |

---End of change---

---Start of change---

Annex TBD (informative):
D2R channel bandwidth

The following describes the equation to derive D2R channel bandwidth and BS D2R channel bandwidth.

For BS D2R CBW:

D2R CBW for BS (kHz)

= ceiling ((2SB Transmission BW\_without SFO× (1/2) +2× Small frequency shift\_without SFO)/0.9)

=ceiling ((2000×(1+R)/Tb) × (1+∣SFO∣)/0.9)

=ceiling ((1000×(R+1)/ (Tc ×R)) × (1+∣SFO∣)/0.9) (Eq. 4)

The transmission bandwidth (BW) and small frequency shift are in kHz, while Tc and Tb are in μs.

The 0.9 divisor presents the 90% BS filter spectrum utility (10% guard band).

For device D2R CBW

D2R CBW for device (kHz)

=ceiling (2SB Transmission BW\_without SFO× (1/2) +2× Small frequency shift\_without SFO)

=ceiling ((2000×(1+R)/Tb) × (1+∣SFO∣))

=ceiling ((1000×(R+1)/ (Tc ×R)) × (1+∣SFO∣)) (Eq. 5)

The transmission bandwidth (BW) and small frequency shift are in kHz, while Tc and Tb are in μs.