**3GPP TSG-RAN WG4 Meeting # 112 *R4-241***

**Maastricht, Netherland, August 19 – 23, 2024**

**Source:** Huawei, HiSilicon

**Title:** TP for TR 38.719-00-00 on introduction of CA\_n1A-n3A\_n78A-n80A

**Agenda item:** 7.3.6

**Document for:** Approval

# 1 Background

This contribution provides text proposal on the NR SUL band combination CA\_n1A-n3A\_n78A-n80A.

# 2 Text Proposal

##### ---Start of changes---

## 5.X CA\_n1-n3\_n78-n80

### 5.X.1 Operating bands

**Table 5.X.1-1: SUL band combination**

|  |  |
| --- | --- |
| NR Band combination for SUL | NR Band  (Table 5.2-1 from TS 38.101-1) |
| CA\_n1-n3\_n78-n80 | n1, n3, n78, n80 |
|  | |

### 5.X.2 Configuration

**Table 5.X.2-1: Supported bandwidths per SUL band combination**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SUL band combination with CA** | **UL configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | **Bandwidth combination set** |
| CA\_n1A-n3A\_n78A-n80A | SUL\_n78A-n80A | n1 | See n1 channel bandwidths in Table 5.3.5-1 for each carrier | 4 and 5 |
| n3 | See n3 channel bandwidths in Table 5.3.5-1 for each carrier |
| n78 | See n78 channel bandwidths in Table 5.3.5-1 for each carrier |
| n80 | See n80 channel bandwidths in Table 5.3.5-1 for each carrier |
| NOTE 1: The SCS of each channel bandwidth for NR band refers to Table 5.3.5-1 from TS 38.101-1. | | | | |

### 5.X.3 Maximum output power

There is only single UL in uplink so the requirement for each band in clause 6.2.1 from 38.101-1 is applicable.

### 5.X.4 UE co-existence studies for 1 band UL

Table 5.X.4-1 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n1-n3\_n78-n80.

Table 5.X.4-1: Harmonic/Harmonic mixing analysis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL/DL harmonics** | | **n80** | **UL12** | **UL2** | **UL33** | **UL4** | **UL5** | **MSD type** |
| **fLow** | 1710 | 3420 | 5130 | 6840 | 8550 |
| **n78** | **fLow** | **fHigh** | 1785 | 3570 | 5355 | 7140 | 8925 |
| **DL1** | 3300 | 3800 | N/A | D | No | No | No | **UL harmonic** |
| **DL23** | 6600 | 7600 | No | N/A | No | N/A | N/A | **Harmonic mixing** |
| **DL34** | 9900 | 11400 | No | No | N/A | No | N/A |
| **DL4** | 13200 | 15200 | No | N/A | N/A | N/A | N/A |
| **DL54** | 16500 | 19000 | No | No | N/A | N/A | N/A |
| **Analysis** | | | **The 2nd harmonic interference from band n80 may fall into band n78.** | | | | | |
| **UL/DL harmonics** | | **n80** | **UL14** | **UL2** | **UL33** | **UL4** | **UL5** | **MSD type** |
| **fLow** | 1710 | 3420 | 5130 | 6840 | 8550 |
| **n1** | **fLow** | **fHigh** | 1785 | 3570 | 5355 | 7140 | 8925 |
| **DL1** | 2110 | 2170 | N/A | No | No | No | No | **UL harmonic** |
| **DL23** | 4220 | 4340 | No | N/A | No | N/A | N/A | **Harmonic mixing** |
| **DL34** | 6330 | 6510 | No | No | N/A | No | N/A |
| **DL4** | 8440 | 8680 | No | N/A | N/A | N/A | N/A |
| **DL54** | 10550 | 10850 | No | No | N/A | N/A | N/A |
| **Analysis** | | | **There is no interference issues between UL band n80 and DL band n1.** | | | | | |
| Note 1: ULx means UL xth harmonic frequency, and DLy means DL yth harmonic frequency range  Note 2: When a collision is detected with an overlap >0Hz between the ULx with DLy frequency ranges, the ULx/DLy cell is marked “D” for direct hit.  When the gap between ULx and DLy frequency range is from 0Hz to n\*MinULCBW, the ULx/DLy cell is marked “N” for Near miss.  Note 3: UL3/DL2 harmonic mixing direct hit case for PC3/5 only apply for DL>3GHz  Note 4: For harmonic mixing, near-miss cases only apply for UL1 and odd DLy orders. | | | | | | | | |

Table 5.X.4-2 summarizes frequency ranges where cross band isolation may occur for CA\_n1-n3\_n78-n80.

Table 5.X.4-2: Cross-band isolation analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Bands3** | **n78** | | **n80** | |
| **Frequency limit** | **flow** | **fhigh** | **flow** | **fhigh** |
| **fUL (MHz)** | 3300 | 3800 | 1710 | 1785 |
| **fDL (MHz)** | 3300 | 3800 | NA | NA |
| **UL CBW (MHz)2** | Minimum CBW | Maximum CBW | Minimum CBW | Maximum CBW |
| 10 | 100 | 5 | 50 |
| **ACLR1 range** | fxULlow-maxULCBWx | fxULhigh+maxULCBWx | fyULlow-maxULCBWy | fyULhigh+maxULCBWy |
| **ACLR1 (MHz)** | 3200 | 3900 | 1660 | 1835 |
| **ACLR2 range** | fxULlow-2\*maxULCBWx | fxULhigh+2\*maxULCBWx | fyULlow-2\*maxULCBWy | fyULhigh+2\*maxULCBWy |
| **ACLR2 (MHz)** | 3100 | 4000 | 1610 | 1885 |
| **ACLR3 range** | fxULlow-3\*maxULCBWx | fxULhigh+3\*maxULCBWx | fyULlow-3\*maxULCBWy | fyULhigh+3\*maxULCBWy |
| **ACLR3 (MHz)** | 3000 | 4100 | 1560 | 1935 |
| **ACLR4 range** | fxULlow-4\*maxULCBWx | fxULhigh+4\*maxULCBWx | fyULlow-4\*maxULCBWy | fyULhigh+4\*maxULCBWy |
| **ACLR4 (MHz)** | 2900 | 4200 | 1510 | 1985 |
| **ACLR5 range1** | fxULlow-5\*maxULCBWx | fxULhigh+5\*maxULCBWx | fyULlow-5\*maxULCBWy | fyULhigh+5\*maxULCBWy |
| **ACLR5 (MHz)** | 2800 | 4300 | 1460 | 2035 |
| **Analysis** | **There is no cross band isolation issue for this combo when UL band is band n78.** | | **There is no cross band isolation issue for this combo when UL band is band n80.** | |
| Note 1: Even if there is no overlap up to ACLR5, MSD beyond the ACLR5 range should be evaluated further if:   * The UL aggressor band and DL aggressor band are part of the same or adjacent band group as described in table A.1. * If the DL band is above the UL band, it’s lower frequency edge must be below the UL lowest 2nd harmonic frequency * As an indicative threshold, if >45dB UL rejection at the DL band frequency can be guaranteed, assuming a -130dBm/Hz TX noise floor level, the transmitter noise floor related MSD should be negligible   Note 2: The maximum UL channel bandwidth of the BCS (noted maxULCBW) is used to calculate the band ACLR ranges  while the minimum DL channel bandwidth of the BCS (noted minDLCBW) is used for the DL band victim channel bandwidth. | | | | |

### 5.X.5 REFSENS requirements

The 2nd harmonic MSD requirements for DL band n78 affected by UL band n80 have been specified in the spec.

### 5.X.6 ∆TIB and ∆RIB values

**Table 5.X.6-1: ΔTIB,c due to SUL band combination**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SUL Band combination | ΔTIB,c for NR bands (dB)\* | | | |
| Component band in order of bands in configuration\*\* | | | |
| CA\_n1-n3\_n78-n80 | 0.6 | 0.6 | 0.8 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for SUL\_n41-n81 the order of band is n41 and n81. | | | | |

**Table 5.X.6-2: ΔRIB,c due to SUL band combination**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SUL Band combination | ΔRIB,c for NR bands (dB)\* | | | |
| Component band in order of bands in configuration\*\* | | | |
| CA\_n1-n3\_n78-n80 | 0.2 | 0.2 | 0.5 | N/A |
| NOTE \*: “-” denotes ΔRIB,c = 0 and ΔRIB,c is not applicable to SUL band(s).  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for SUL\_n41-n80 the order of band is n41 and n80. | | | | |

### 5.X.7 Out-of-band blocking exception

There is no Out-of-band blocking exception for this band combination.

##### ---End of changes---

# Reference

[1] RP-241674, “New WID: Rel-19 NR Carrier Aggregation (CA)/Dual Connectivity (DC) for x bands DL with y bands UL (x<7, y<3) and Supplementary Uplink (SUL) band combinations/CA band combinations with a single SUL or two SUL cells”, Moderator (RAN4 Chair, Huawei)