3GPP TSG-RAN WG4 Meeting # 97-e R4-2015428

Electronic Meeting, 2nd – 13th November, 2020

**Source:** Huawei, HiSilicon

**Title:** TP to TR 38.717.02-01 to add UL configuration for CA\_n78A-n79A and CA\_n78(2A)-n79A\_BCS0

**Agenda item:** 10.2.2

**Document for:** Approval

# Background

This contribution provides text proposal on the NR CA band combination CA\_n78A-n79A and CA\_n78(2A)-n79A as defined in New WID on NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2) RP-201539 [1].

# Text Proposal

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

## 6.7 CA\_n78-n79

### 6.7.1 Common for 1 band UL and 2 bands UL CA

#### 6.7.1.1 Operating bands for CA

**Table 6.7.1.1-1: CA band combination of band n78+n79**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

#### 6.7.1.2 Channel bandwidths per operating band for CA

**Table 6.7.1.2-1: Supported bandwidths per CA band combination of band n78+n79**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | SCS  (kHz) | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25 MHz | 30 MHz | 40  MHz | 50  MHz | 60  MHz | 70  MHz | 80  MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n78A-n79AX | CA\_n78A-n79AY | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  | 0 |
| 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 |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 1 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |
| CA\_ n78(2A)-n79A | CA\_n78A-n79A | n78 | See CA\_n78(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | 0 |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |
| NOTE X: Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.  NOTE Y: Simultaneous Rx/Tx capability does not apply to uplink CA transmission, and only apply to single uplink transmission. | | | | | | | | | | | | | | | | | |

#### 6.7.1.3 UE co-existence studies

This section is skipped since CA\_n78-n79 without 2UL CA has been already specified in TS 38.101-1, and impact of harmonic issue has been discussed in TR 37.865-01-01.

Furthermore, ΔTIB and ΔRIB and MSD requirements have been specified for asynchronous operation in TS 38.101-1.

#### 6.7.1.4 ∆TIB and ∆RIB values

For CA\_n77-n79 , the ΔTIB,c and ΔRIB,c values are given in the tables below. The same values are shown as what are specified in TS 38.101-1.

**Table 6.7.1.4-1: ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n78-n79 | n78 | 0.5 |
| 1.58 |
| n79 | 0.5 |
| 1.58 |
| NOTE 8: The requirements only apply for UE supporting inter-band carrier aggregation with simultaneous Rx/Tx capability, and NR UL carrier frequencies are confined to 3700 MHz-3800MHz for n78 and 4400 MHz-4500MHz for n79. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation. | | |

**Table 6.7.1.4-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n78-n79 | n78 | 0 |
| n79 | 0 |

#### 6.7.1.5 REFSENS requirements

The MSD due to cross band isolation are specified below for n78 25MHz and 30MHz.

Table 6.7.1.5-1: Reference sensitivity exceptions (MSD) due to cross band isolation for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band / Channel bandwidth of the affected DL band | | | | | | | | | | | | | | |
| UL band | DL band | 5 MHz (dB) | 10 MHz (dB) | 15 MHz (dB) | 20 MHz (dB) | 25 MHz (dB) | 30 MHz (dB) | 40 MHz (dB) | 50 MHz (dB) | 60 MHz (dB) | 70  MHz  (dB) | 80 MHz (dB) | 90 MHz (dB) | 100 MHz (dB) |
| n781 | n79 |  |  |  |  |  |  | 2 | 2 | 2 |  | 2 |  | 2 |
| n79 | n781 |  | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 |  | 2.6 | 2.6 | 2.6 |
| NOTE 1: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation. | | | | | | | | | | | | | | |

Table 6.7.1.5-2: Uplink configuration for reference sensitivity exceptions due to cross band isolation for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band / SCS / Channel bandwidth of the affected DL band | | | | | | | | | | | | | | | |
| UL band | DL band | SCS of UL band (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 70  MHz | 80 MHz | 90 MHz | 100 MHz |
| n783 | n79 | 30 |  |  |  |  |  | 270 | 270 | 270 | 270 |  | 270 |  | 270 |
| n79 | n783 | 30 |  | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 |  | 270 | 270 | 270 |
| NOTE 1: The UL configuration applies regardless of the channel bandwidth of the UL band unless the UL resource blocks exceed that specified in Table 7.3.2-3 for the uplink bandwidth in which case the allocation according to Table 7.3.2-3 applies.  NOTE 2: Refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth in Table 5.3.2-1.  NOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation. | | | | | | | | | | | | | | | |

This section is skipped since CA\_n78-n79 without 2UL CA has been already specified in TS 38.101-1, and impact of harmonic issue has been discussed in TR 37.865-01-01.

Furthermore, ΔTIB and ΔRIB and MSD requirements have been specified for asynchronous operation in TS 38.101-1.

#### 6.7.1.6 OOB blocking exception requirements

This section is skipped since CA\_n78-n79 without 2UL CA has been already specified.

### 6.7.2 Specific for 2 bands UL CA

#### 6.7.2.1 Maximum output power for inter-band CA

**Table 6.7.2.1-1: UE Power Class for uplink inter-band CA**

|  |  |  |
| --- | --- | --- |
| Uplink CA Configuration | Class 3 (dBm) | Tolerance (dB) |
| CA\_n78A-n79A | 23 | +2/-32 |
| NOTE 2: 2 refers to the transmission bandwidths confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high – 4 MHz and FUL\_high, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB | | |

#### 6.7.2.2 UE co-existence studies

Table 6.7.2.2-1 lists Band n78 +Band n79 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.7.2.2-1: Band n78 and Band n79 UL IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fy\_low** | **fy\_high** | |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | | |fy\_low + fx\_low| | |fy\_high + fx\_high| | |
| IMD frequency limits (MHz) | 600 – 1700 | | | 7700 – 8800 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| | |
| IMD frequency limits (MHz) | 1600 – 3200 | | | 5000 – 6700 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| | |
| IMD frequency limits (MHz) | 11000 – 12600 | | | 12100 – 13800 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fy) | | (fx\_high + max BW fy) | (fy\_low – max BW fx) | | (fy\_high + max BW fx) |
| IMD frequency limits (MHz) | 3200 – 3900 | | | 4300 – 5100 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4900 – 7000 | | | 9400 – 11700 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | | |2\*fx\_high –2\* fy\_low| |  | |  |
| IMD frequency limits (MHz) | 1200 – 3400 | | |  | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 14300 – 16400 | | | 16500 – 18800 | | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | | |2\*fx\_high +2\* fy\_high| |  | |  |
| IMD frequency limits (MHz) | 15400 – 17600 | | |  | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 13800 – 16700 | | | 8200 – 10800 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 5600 – 8400 | | | 100 – 2600 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 20900 – 23800 | | | 17600 – 20200 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 19800 – 22600 | | | 18700 – 21400 | | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. | | | | | | |

Based on above Table, it can be seen that

* 2nd order IMD products may fall into Rx frequencies of bands 5, 6, 8, 11, 12, 13, 14, 17, 18, 19, 20, 21, 24, 26, 27, 28, 29, 32, 44, 45, 50, 51, 67, 68, 71, 74, 75, 76, 85, n91, n92, n93, n94
* 3rd order IMD products may fall into Rx frequencies of bands 1, 2, 3, 4, 7, 9, 10, 22, 23, 25, 30, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 46, 47, 48, 49, 52, 53, 65, 66, 69, 70, n77, n78, n79, n90
* 4th order IMD products may fall into Rx frequencies of bands 1, 2, 3, 4, 7, 9, 10, 11, 21, 23, 24, 25, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 45, 46, 47, 50, 51, 52, 53, 65, 66, 69, 70, 74, 75, 76, n77, n78, n79, n90, n91, n92, n93, n94
* 5th order IMD products may fall into Rx frequencies of bands 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 44, 45, 46, 47, 50, 51, 53, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 85, n87, n88, n90, n91, n92, n93, n94

**Table 6.7.2.2-2: Protected bands for the 2UL bands CA configuration**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UL NR CA Configuration** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
| CA\_n78-n79 | E-UTRA Band 1, 3, 5, 8, 11, 18, 19, 21, 28, 34, 40, 41, 65, 74 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 3 |
| NOTE 3: Applicable when co-existence with PHS system operating in 1884.5 - 1915.7 MHz. | | | | | | | |

#### 6.7.2.3 REFSENS requirements

For harmonic, MSD studies can be omitted since MSD studies have been already conducted in 1UL/2DL NR CA fallback combinations.

For IMD, Considering both n78 and n79 are TDD bands and IMD occurs when UE transmit in both n77 and n79 and receive in neither n77 and n79, no MSD are needed for dual UL of CA\_n78-n79.

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

# Reference

[1] RP-201539, “Rel-17 NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2)”, ZTE Corporation