**3GPP TSG-RAN4 Meeting #116bis** **R4-2514197**

**Prague, Czech Republic, 13 October – 17 October 2025**

**Source:** Ericsson, Odido

**Title:** TP for TR 38.719-03-01 adding CA\_n1A-n20A-n28A

**Agenda item:** 5.3.4

**Document for:** Approval

# 1. Introduction

This contribution is a text proposal for TR 38.719-03-01 to include CA\_n1A-n20A-n28A as defined in WID [1].

# ---Start of changes---

## 5.x CA\_n1-n20-n28

### 5.x.1 Common for 1 band UL and 2 bands UL CA

#### 5.x.1.1 Operating bands for CA

Table 5.x.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n20 | 832 MHz – 862 MHz | 791 MHz – 821 MHz | FDD |
| n28 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |

#### 5.x.1.2 Channel bandwidths per operating band for CA

Table 5.x.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n20A-n28A 15 | CA\_n1A-n20A  CA\_n1A-n28A  CA\_n20A-n28A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n20 | n20 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n28 | n28 channel bandwidths in Table 5.3.5-1 |  |
| NOTE 15 For UEs supporting CA between n20 and n28, the minimum requirements are specified for any n28 DL channel bandwidth confined to 758-791 MHz. | | | | |

#### NOTE 15 For UEs supporting CA between n20 and n28, the minimum requirements are specified for any n28 DL channel bandwidth confined to 758-791 MHz.

#### 5.x.1.3 ∆TIB,c and ∆RIB,c values

The ΔTIB,c and ΔRIB,c values are derived from CA\_n1-n5-n28 and given in the tables below.

Table 5.x.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n20-n28 | 0.3 | 0.6 | 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 CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.x.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n20-n28 | - | 0.2 | 0.2 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.x.2 Specific for 2 bands UL CA

#### 5.x.2.1 UE co-existence studies

##### 5.x.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.x.2.1.1-1, Table 5.x.2.1.1-2 and Table 5.x.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n28A with UL CA\_n1A-n20A, UL CA\_n1A-n28A and UL CA\_n20A-n28A.

Table 5.x.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 832 | 862 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1148 | 1058 | 2752 | 2842 |
| 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) | 3128 | 2978 | 316 | 196 |
| 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) | 4672 | 4822 | 3584 | 3704 |
| 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) | 4898 | 5108 | 516 | 666 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| |  |  |
| IMD frequency limits (MHz) | 2296 | 2116 |  |  |
| 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) | 6592 | 6802 | 4416 | 4566 |
| Two-tone 4th order IMD products | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |  |  |
| IMD frequency limits (MHz) | 5504 | 5684 |  |  |
| 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) | 1348 | 1528 | 6818 | 7088 |
| 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) | 1464 | 1254 | 4276 | 4036 |
| 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) | 5248 | 5428 | 8512 | 8782 |
| 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) | 6336 | 6546 | 7424 | 7664 |

Based on the above table, there is no IMD issue generated by UL CA\_n1A-n20A to Band n28.

Table 5.x.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 703 | 748 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1277 | 1172 | 2623 | 2728 |
| 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) | 3257 | 3092 | 574 | 424 |
| 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) | 4543 | 4708 | 3326 | 3476 |
| 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) | 5012 | 5237 | 129 | 324 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| |  |  |
| IMD frequency limits (MHz) | 2554 | 2344 |  |  |
| 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) | 6463 | 6688 | 4029 | 4224 |
| Two-tone 4th order IMD products | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |  |  |
| IMD frequency limits (MHz) | 5246 | 5456 |  |  |
| 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) | 832 | 1072 | 6932 | 7217 |
| 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) | 1851 | 1596 | 4534 | 4264 |
| 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) | 4732 | 4972 | 8383 | 8668 |
| 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) | 5949 | 6204 | 7166 | 7436 |

Based on the above table, there is no IMD issue generated by UL CA\_n1A-n28A to Band n20.

Table 5.x.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 832 | 862 | 703 | 748 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 159 | 84 | 1535 | 1610 |
| 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) | 1021 | 916 | 544 | 664 |
| 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) | 2367 | 2472 | 2238 | 2358 |
| 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) | 1748 | 1883 | 1247 | 1412 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| |  |  |
| IMD frequency limits (MHz) | 318 | 168 |  |  |
| 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) | 3199 | 3334 | 2941 | 3106 |
| Two-tone 4th order IMD products | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |  |  |
| IMD frequency limits (MHz) | 3070 | 3220 |  |  |
| 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) | 1950 | 2160 | 2580 | 2745 |
| 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) | 385 | 580 | 1180 | 1000 |
| 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) | 3644 | 3854 | 4031 | 4196 |
| 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) | 3773 | 3968 | 3902 | 4082 |

Based on the above table, the 5th IMD generated by UL CA\_n20A-n28A may fall into own Rx of Band n1.

#### 5.x.2.2 REFSENS requirements

Based on Table 5.x.2.1.1-3, the 5th IMD generated by UL CA\_n20A-n28A may fall into own Rx of Band n1. MSD value is derived from CA\_n1-n18-n28.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 5.x.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurationsBand / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n20-n28 | n1 | N/A | 5 | N/A | 2110 | 4 | FDD | IMD5 |
|  | n20 | 834 | 5 | 25 | 793 | N/A | FDD | N/A |
|  | n28 | 736 | 5 | 25 | 791 | N/A | FDD | N/A |

---End of changes---

# Reference

[1] RP-252440. Revised WID NR\_CADC\_SUL\_R19, Ericsson