3GPP TSG-RAN4 Meeting #110 R4-2400784

Athens, GR, 26 Feb – 01 Mar, 2024

**Source:** Huawei, HiSilicon, Rogers

**Title:** TP for TR 38.718-03-01: to include band combination CA\_n5-n7-n66

**Agenda item:**  7.11.2 [NR\_CADC\_R18\_3BDL\_xBUL-Core]

**Document for:** Approval

# 1. Introduction

A text proposal for TR 38.718-03-01 to add CA\_n5-n7-n66 configuration as specified in WID [1].

# 2. Text Proposal

---Start of changes---

## 5.x CA\_n5-n7-n66

### 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: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| NR Band | Uplink (UL) band | Downlink (DL) band | Duplexmode |
| BS receive / UE transmit | BS transmit / UE receive |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| n5 | 824 MHz – 849 MHz | 869 MHz – 894 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n66 | 1710 MHz – 1780 MHz | 2110 MHz – 2200 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 of band n5+n7+n25

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n7A-n66A | CA\_n5A-n7ACA\_n5A-n66ACA\_n7A-n66A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 |  |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 35, 40, 45 |  |

#### 5.x.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5A-n7A-n66A, the ΔTIB,c and ΔRIB,c values are 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)8** |
| **Component band in order of bands in configuration9** |
| CA\_n5-n7-n66 | 0.3 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.NOTE 9: 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)9** |
| **Component band in order of bands in configuration10** |
| CA\_n5-n7-n66 | - | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.NOTE 10: 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

Table 5.x.2.2-1 lists Band n5 + Band n7 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.x.2.2-2 lists Band n5 + Band n66 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.x.2.2-3 lists Band n7 + Band n66 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Based on Table 5.x.2.2-1, it can be seen that there is no impact on the 3rd RX band.

Based on Table 5.x.2.2-2, it can be seen that

- IMD2, IMD3 and IMD5 of band n5 UL and n66 UL falls into band n7 DL

 Based on Table 5.x.2.2-3, it can be seen that

- IMD3 of band n7 UL and n66 UL falls into band n5 DL

**Table 5.x.2.2-1: Band n5 and Band n7 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 2620 | 2690 |
| 3rd Band DL | 2110 | 2200 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 2500 | 2570 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz)  | 1648 | 1698 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 7500 | 7710 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 10000 | 10280 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 12500 | 12850 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1651 | 1746 | 3324 | 3419 |
| 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) | 922 | 802 | 4151 | 4316 |
| 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) | 4148 | 4268 | 5824 | 5989 |
| 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) | 98 | 47 | 6651 | 6886 |
| 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) | 4972 | 5117 | 8324 | 8559 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3492 | 3302 | 6648 | 6838 |
| 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) | 9456 | 9151 | 896 | 726 |
| 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) | 6062 | 5802 | 2453 | 2668 |
| 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) | 10824 | 11129 | 5796 | 5966 |
| 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) | 9148 | 9408 | 7472 | 7687 |

**Table 5.x.2.2-2: Band n5 and Band n66 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 2110 | 2200 |
| 3rd Band DL | 2620 | 2690 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz)  | 1648 | 1698 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 5130 | 5340 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 6840 | 7120 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 8550 | 8900 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 861 | 956 | 2534 | 2629 |
| 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) | 132 | 12 | 2571 | 2736 |
| 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) | 3358 | 3478 | 4244 | 4409 |
| 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) | 692 | 837 | 4281 | 4516 |
| 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) | 4182 | 4327 | 5954 | 6189 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1912 | 1722 | 5068 | 5258 |
| 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) | 6296 | 5991 | 1686 | 1516 |
| 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) | 3692 | 3432 | 873 | 1088 |
| 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) | 7664 | 7969 | 5006 | 5176 |
| 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) | 6778 | 7038 | 5892 | 6107 |

**Table 5.x.2.2-3: Band n7 and Band n66 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 2620 | 2690 | 2110 | 2200 |
| 3rd Band DL | 869 | 894 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2500 | 2570 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz)  | 5000 | 5140 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7500 | 7710 | 5130 | 5340 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 10000 | 10280 | 6840 | 7120 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 12500 | 12850 | 8550 | 8900 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 860 | 720 | 4210 | 4350 |
| 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) | 3220 | 3430 | 850 | 1060 |
| 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) | 6710 | 6920 | 5920 | 6130 |
| 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) | 5720 | 6000 | 2560 | 2840 |
| 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) | 9210 | 9490 | 7630 | 7910 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1440 | 1720 | 8420 | 8700 |
| 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) | 4620 | 4270 | 8570 | 8220 |
| 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) | 340 | 10 | 4290 | 3940 |
| 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) | 9340 | 9690 | 11710 | 12060 |
| 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) | 10130 | 10480 | 10920 | 11270 |

#### 5. x.2.2 REFSENS requirements

Table 5.x.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n5-n41-n66 are reused for IMD2.

Table 5.x.2.2-1: MSD for the CA configuration

|  |  |
| --- | --- |
| Band / 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\_n5-n7-n66 | n5 | 846.5 | 5 | 25 | 891.5 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2624 | 29.0 | FDD | IMD2 |
|  | n66 | 1777.5 | 5 | 25 | 2177.5 | N/A | FDD | N/A |
|  | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2670 | 13 | FDD | IMD3 |
|  | n66 | 1750 | 5 | 25 | 2150 | N/A | FDD | N/A |
|  | n5 | N/A | 5 | N/A | 880 | 13 | FDD | IMD3 |
|  | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n66 | 1720 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  |

---End of changes---

# Reference

[1] RP-233231, Rel-18 NR Inter-band Carrier Aggregation/Dual Connectivity for 3 bands DL with x bands UL (x=1,2), ZTE , RAN#102, December 2023