**3GPP TSG-RAN WG4 Meeting # 116-bis Rev R4-2514226**

**Prague Meeting, Oct. 13th – Oct. 17th, 2025**

**Title: TP to TR 38.719-03-01 CA\_n1-n7-n77**

**Source: Nokia, BT PLC**

**Agenda item: 5.3.4**

**Document for: Approval**

# 1 Introduction

This is a TP to TR 38.719-03-01 to add CA\_n1-n7-n77. The CA\_n1A-n77(2A) has been submitted in same meeting and contains the analysis of n77(2A) UL as R4-2514221.

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## 5.x CA\_n1-n7-n77

### 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 |
| n7 | 2500 MHz - 2570 MHz | 2620 MHz - 2690 MHz | FDD |
| n77 | 3300 MHz - 4200 MHz | 3300 MHz - 4200 MHz | TDD |

#### 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-n7A-n77A | CA\_n1A-n7ACA\_n1A-n77ACA\_n7A-n77A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n1A-n7A-n77(2A) | CA\_n77(2A)CA\_n1A-n7ACA\_n1A-n77ACA\_n7A-n77A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |

#### 5.x.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n7-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below, reusing CA\_n1-n7-n78.

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-n7-n77 | 0.6 | 0.6 | 0.8 |
| 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-n7-n77 | 0.2 | 0.2 | 0.5 |
| 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 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n7A-n77A with UL CA\_n1A-n7A.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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) | 520 - 650 | 4420 - 4550 |
| 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) | 1270 - 1460 | 3020 - 3220 |
| 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) | 6340 - 6530 | 6920 - 7120 |
| 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) | 3190 - 3440 | 5520 - 5790 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |   |
| IMD frequency limits (MHz) | 1040 - 1300 |
| 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) | 8260 - 8510 | 9420 - 9690 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |   |
| IMD frequency limits (MHz) | 8840 - 9100 |
| 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) | 8020 - 8360 | 5110 - 5420 |
| 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) | 3540 - 3870 | 620 - 940 |
| 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) | 11920 - 12260 | 10180 - 10490 |
| 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) | 11340 - 11670 | 10760 - 11080 |
| 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. The lowest even order and lowest odd order IMD MSDs shall be considered. |

Table 5.x.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n7A-n77A with UL CA\_n1A-n77A.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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) | 1320 - 2280 | 5220 - 6180 |
| 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) | 360 - 660 | 4620 - 6480 |
| 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) | 7140 - 8160 | 8520 - 10380 |
| 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) | 1560 - 2640 | 7920 - 10680 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |   |
| IMD frequency limits (MHz) | 2640 - 4560 |
| 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) | 9060 - 10140 | 11820 - 14580 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |   |
| IMD frequency limits (MHz) | 10440 - 12360 |
| 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) | 11220 - 14880 | 3480 - 4620 |
| 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) | 5940 - 8760 | 660 - 2640 |
| 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) | 15120 - 18780 | 10980 - 12120 |
| 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) | 13740 - 16560 | 12360 - 14340 |
| 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. The lowest even order and lowest odd order IMD MSDs shall be considered. |

Table 5.x.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n7A-n77A with UL CA\_n7A-n77A.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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) | 730 - 1700 | 5800 - 6770 |
| 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) | 800 - 1840 | 4030 - 5900 |
| 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) | 8300 - 9340 | 9100 - 10970 |
| 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) | 3300 - 4410 | 7330 - 10100 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |   |
| IMD frequency limits (MHz) | 1460 - 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) | 10800 - 11910 | 12400 - 15170 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |   |
| IMD frequency limits (MHz) | 11600 - 13540 |
| 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) | 10630 - 14300 | 5800 - 6980 |
| 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) | 4760 - 7600 | 900 - 1110 |
| 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) | 15700 - 19370 | 13300 - 14480 |
| 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) | 14900 - 17740 | 14100 - 16110 |
| 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. The lowest even order and lowest odd order IMD MSDs shall be considered. |

From the tables it is found that:

- Band n77 may be subject to IMD4 and IMD5.

- Band n7 may be subject to IMD4 and IMD5.

- Band n1 may be subject to IMD4.

#### 5.x.2.2 REFSENS requirements

The MSD values have been taken from CA\_n1-n7-n78 and adding the IMD5 in n7.

**Table 5.x.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |
| --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | Source of IMD |
| NR CA band combination | NR band | UL Fc (MHz) | UL/DL BW (MHz) | UL LCRB | DL Fc (MHz) | MSD (dB) | Duplex mode |  |
| CA\_n1-n7-n77 | n1 | 1977.5 | 5 | 25 | 2167.5 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2627.5 | 9.1 | FDD | IMD4 |
|  | n77 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
|  | n1 | 1922.5 | 5 | 25 | 2112.5 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2622.5 | 1.3 | FDD | IMD5 |
|  | n77 | 4195 | 10 | 50 | 4195 | N/A | TDD | N/A |
|  | n1 | N/A | 5 | N/A | 2140 | 8.7 | FDD | IMD4 |
|  | n7 | 2510 | 10 | 50 | 2630 | N/A | FDD | N/A |
|  | n77 | 3580 | 10 | 50 | 3580 | N/A | TDD | N/A |
|  | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n7 | 2520 | 5 | 25 | 2640 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3390 | 10.1 | TDD | IMD4 |
|  | n1 | 1940 | 5 | 25 | 2130 | N/A | FDD | N/A |
|  | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3770 | 1.3 | TDD | IMD5 |

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