**3GPP TSG-RAN WG4 Meeting #100-e R4-2112743**

**Electronic Meeting, 16 August – 27 August 2021**

**Source:** Ericsson, Telstra

**Title:** TP for TR 38.717-02-01: CA\_n3-n5

**Agenda item:** 8.8.2

**Document for:** Approval

# 1. Introduction

This contribution is a text proposal for TR 38.717-02-01 to include CA\_n3A -n5A as defined in WID [1].

# ---Start of changes---

## 6.X n3-n5

### 6.X.1 Common for 1 band UL and 2 bands UL CA

#### 6.X.1.1 Operating bands for CA

Table 6.X.1.1-1: CA band combination of band n3 and n5

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |

#### 6.X.1.2 Channel bandwidths per operating band for CA

Table 6.X.1.2-1: Supported bandwidths per CA band combination of band n5 and n3

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25 MHz** | **30 MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n3A-n5A | CA\_n3A-n5A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |

#### 6.X.1.3 UE co-existence studies

Table 6.X.1.3-1 lists up to 7th harmonics for n3-n5. As can be seen there are no harmonic issues.

**Table 6.X.1.3-1: Impact of UL/DL Harmonic**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th Harmonic** | | **6th Harmonic** | | **7th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| n5 | 824 | 849 | 1648 | 1698 | 2472 | 2547 | 3296 | 3396 | 4120 | 4245 | 4944 | 5094 | 5768 | 5943 |
| n3 | 1710 | 1785 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 | 8550 | 8925 | 10260 | 10710 | 11970 | 12495 |

Table 6.X.1.3-2 list harmonic mixing issue for the 2DL bands CA with 1 UL. As can be seen there are no harmonic mixing issues.

Table 6.X.1.3-2 Harmonic mixing for 2DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n5 | 824 | 849 | 869 | 894 | 1738 | 1788 | 2607 | 2682 | 3476 | 3576 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |

#### 6.X.1.4 ∆TIB and ∆RIB values

For CA\_n3-n5, the ΔTIB,c and ΔRIB,c values are same as for CA\_3-5 and are given in the tables below.

**Table 6.X.1.4-1: ΔTIB,c**

| NR CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n5 | n3 | 0.3 |
| n5 | 0.3 |

**Table 6.X.1.4-2: ΔRIB,c**

| NR CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n5 | n3 | 0 |
| n5 | 0 |

#### 6.X.1.5 REFSENS requirements

As can be seen in the co-existence studies in 6.X.1.3 there are no harmonics issues.

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

#### 6.x.2.1 Maximum output power for inter-band CA

**Table 6.x.2.1-1: UE Power Class for uplink inter-band CA**

|  |  |  |
| --- | --- | --- |
| Uplink CA Configuration | Class 3 (dBm) | Tolerance (dB) |
| CA\_n3A-n5A | 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.x.2.2 UE co-existence studies

Table 6.x.2.2-1 lists Band n3 + Band n5 bands CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.x.2.2-1: Band n5 and Band n3 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 961 | 861 | 2534 | 2634 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 137 | 12 | 2571 | 2746 |
| 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 | 3483 | 4244 | 4419 |
| 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) | 1922 | 1722 | 5068 | 5268 |
| 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) | 687 | 837 | 4281 | 4531 |
| 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 | 4332 | 5954 | 6204 |
| 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) | 6316 | 5991 | 1686 | 1511 |
| 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 | 7989 | 5006 | 5181 |
| 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) | 3707 | 3432 | 873 | 1098 |
| 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 | 7053 | 5892 | 6117 |

Based on the table above:

IMD4 generated by UL n5 might affect DL n3.

IMD2 and IMD5 generated by UL n3 might affect DL n5.

Table 6.x.2.2-2 lists the protected bands required for the 2UL bands CA configuration.

**Table 6.x.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\_n3-n5 | E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 21, 26, 28, 31, 38, 40, 43, 50, 51, 65, 73, 74  NR Band n79 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA band 3,34 | FDL\_low | - | FDL\_high | -50 | 1 | 5 |
| E-UTRA Band 22, 42, 52  Band n77, n78 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1-2 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2 MHz + N x LCRB x 180kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval. | | | | | | | |

#### 6.x.2.3 REFSENS requirements

Based on the co-existence studies for CA\_n3-n5, MSD is needed. Frequencies and MSD value are same as in DC\_3\_n5.

**Table 6.x.2.3-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operating 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\_n3-n5 | n3 | 1771 | 10 | 50 | 1866 | 4 | FDD | IMD4 |
| n5 | 838 | 5 | 25 | 883 | N/A | FDD | N/A |
|  | n3 | 1721 | 10 | 50 | 1816 | N/A | FDD | N/A |
|  | n5 | 838 | 5 | 25 | 883 | 24 | FDD | IMD23 |
| NOTE 3: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 6.6.1.6 OOB blocking exception requirements

Table 6.11.1.6-1: CA band combination with exceptions allowed

|  |
| --- |
| CA band combination |
| No exception |
|  |
|  |

---End of changes---

# Reference

[1] RP-211058, Rel-17 NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2), ZTE