3GPP TSG-RAN WG4 Meeting # 95-e R4-2007625

**Electronic Meeting, 25 May – 5 June, 2020**

**Source:** Ericsson, Telstra, BT plc

**Title:** TP for TR 38.716-02-00: CA\_n3-n7

**Agenda item:** 8.2.2

**Document for:** Approval

# 1. Introduction

This contribution is a text proposal for TR 38.716-02-00 to include CA\_n3A-n7A and CA\_n3A-n7B as defined in WID [1].

# 2. Text Proposal

# ---Start of changes---

## 6.x n3-n7

### 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 n7

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 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 n3 and n7

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **80****MHz** | **90****MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n3A-n7A | CA\_n3A-n7A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| CA\_n3A-n7B | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n7 | See CA\_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 |

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

Table 6.x.1.3-1 lists up to 7th harmonics for n3-n7. 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** |
| n3 | 1710 | 1785 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 | 8550 | 8925 | 10260 | 10710 | 11970 | 12495 |
| n7 | 2500 | 2570 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 | 12500 | 12850 | 15000 | 15420 | 17500 | 17990 |

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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |

#### 6.x.1.4 ∆TIB and ∆RIB values

For CA\_n3-n7, the ΔTIB,c and ΔRIB,c values are same as for DC\_3\_n7 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-n7 | n3 | 0.5 |
| n7 | 0.5 |

**Table 6.x.1.4-2: ΔRIB,c**

| NR CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n7 | n3 | 0 |
| n7 | 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 UE co-existence studies

Table 6.x.2.1-1 lists Band n3 + Band n7 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.x.2.1-1: Band n3 and Band n7 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1710 | 1785 | 2500 | 2570 |
| 2nd harmonics frequency limits | 2\* fy\_low | 2\* fy\_high | 2\*fx\_low | 2\*fx\_high |
| 2nd harmonics frequency limits (MHz)  | 3420 | 3570 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\* fy\_low | 3\* fy\_high | 3\*fx\_low | 3\*fx\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 | 7500 | 7710 |
| 4th harmonics frequency limits | 4\* fy\_low | 4\* fy\_high | 4\*fx\_low | 4\*fx\_high |
| 4th harmonics frequency limits (MHz) | 6840 | 7140 | 10000 | 10280 |
| 5th harmonics frequency limits | 5\* fy\_low | 5\* fy\_high | 5\*fx\_low | 5\*fx\_high |
| 5th harmonics frequency limits (MHz) | 8550 | 8925 | 12500 | 12850 |
| 6th harmonics frequency limits | 6\* fy\_low | 6\* fy\_high | 6\*fx\_low | 6\*fx\_high |
| 6th harmonics frequency limits (MHz) | 10260 | 10710 | 15000 | 15420 |
| 7th harmonics frequency limits | 7\* fy\_low | 7\* fy\_high | 7\*fx\_low | 7\*fx\_high |
| 7th harmonics frequency limits (MHz) | 11970 | 12495 | 17500 | 17990 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 860 | 715 | 4210 | 4355 |
| 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) | 850 | 1070 | 3215 | 3430 |
| 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) | 5920 | 6140 | 6710 | 6925 |
| 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) | 1720 | 1430 | 8420 | 8710 |
| 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) | 2560 | 2855 | 5715 | 6000 |
| 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) | 7630 | 7925 | 9210 | 9495 |
| 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) | 8570 | 8215 | 4640 | 4270 |
| 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) | 11710 | 12065 | 9340 | 9710 |
| 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) | 4290 | 3930 | 355 | 10 |
| 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) | 10920 | 11280 | 10130 | 10495 |

Based on Table 6.x.2.1-1 there are IMD4 affecting own Rx frequencies of band n7.

Table 6.x.2.1-2 lists the protected bands required for the 2UL bands CA configuration as to be used in Table 6.5A.3.2.3-1 of TS 38.101-1, and with same bands as for DC\_3\_n7 in TS 38.101-3.

**Table 6.x.2.1-2: 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-n7 | E-UTRA Band 1, 5, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 40, 43, 44, 50, 51, 65, 67, 72, 74, 75, 76 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA band 3 | FDL\_low | - | FDL\_high | -50 | 1 | 4 |
| E-UTRA band 22, 42, 52NR-band n77, n78 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| Frequency range | 2570  | -  | 2575 | +1.6 | 5 | 4, 7, 18 |
| Frequency range | 2575 | - | 2595 | -15.5 | 5 | 4, 7, 18 |
| Frequency range | 2595 | - | 2620 | -40 | 1 | 4, 18 |
| 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.NOTE 4: These requirements also apply for the frequency ranges that are less than FOOB (MHz) in Table 6.5.3.1-1 from the edge of the channel bandwidth.NOTE 7: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.NOTE 18: This requirement is applicable for any channel bandwidths within the range 2500 – 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 – 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. |

#### 6.x.2.2 REFSENS requirements

There is a need to define IMD4 MSD for CA\_n3-n7. Same MSD values as for DC\_3\_n7.

**Table 6.x.2.2-1: 2DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |
| --- | --- |
|  **Band / Channel bandwidth / NRB / Duplex mode** | **Source of IMD** |
| **NR CA****Configuration** | **NR band** | **UL Fc (MHz)** | **UL/DL BW (MHz)** | **UL CLRB** | **DL Fc (MHz)** | **MSD (dB)** | **Duplex mode** |
| CA\_n3A-n7A | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
| n7 | 2535 | 10 | 50 | 2655 | 10.2 | FDD | IMD4 |

---End of changes---

# Reference

[1] RP-200168, “Revised WID on Rel-16 NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2)”, ZTE Corporation