**3GPP TSG-RAN WG4 Meeting #98-e R4-2100943**

**Online, 25th Jan - 5th Feb, 2021**

**Source:** Samsung, KDDI

**Title:** TP for TR 38.717-02-01: CA\_n3-n18

**Agenda item:**  9.2.2

**Document for:** Approval

1. Introduction

This contribution is a text proposal for TR 38.717-02-01 to include CA\_n3-n18 according to the request in [1].

# 2. Reference

1. RP-202199, Revised WID on Rel-17 NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2).

3. Text Proposal

**<Start of Text Proposal>**

6.x CA\_n3-n18

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+n18

|  |  |  |  |
| --- | --- | --- | --- |
|  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 |
| n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 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+n18

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n3A-n18A | CA\_n3A-n18A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |

6.x.1.3 Co-existence studies

Table 6.X.1.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n3-n18.

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | **3rd Harmonic** | **4th Harmonic** |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL 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 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| **n18** | 815 | 830 | 860 | 875 | 1630 | 1660 | 2445 | 2490 | 3260 | 3320 |

Based on above table, there is no harmonic issue for the band combination of n3 and n18.

**Table 6.X.1.3-2: Impact of UL/DL Harmonic mixing**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **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 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| **n18** | 815 | 830 | 860 | 875 | 1720 | 1750 | 2580 | 2625 | 3440 | 3500 |

Based on above table, there is no harmonic mixing issue for the band combination of n3 and n18.

#### 6.X.1.4 ∆TIB and ∆RIB values

For CA\_n3-n18 , the ∆TIB,c and ∆RIB,c values are given in the tables below which refer to TS 36.101 CA\_3-18 relaxation values.

**Table 6.X.1.4-1:** **ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n18 | n3 | 0.3 |
| n18 | 0.3 |

**Table 6.X.1.4-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n18 | n3 | 0 |
| n18 | 0 |

#### 6.X.1.5 REFSENS requirements

There are no specific REFSENS requirements for 1 band UL.

#### 6.X.1.6 OOB blocking exception requirements

There is no OOB blocking exception for this CA band combination.

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

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

**Table 6.X.2.2-1: UE Power Class for uplink inter-band CA**

|  |  |  |
| --- | --- | --- |
| Uplink CA Configuration | Class 3 (dBm) | Tolerance (dB)  |
| CA\_n3A-n18A | 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.2.1-1 lists Band n3 +Band n18 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.X.2.2-1: Band n3 and Band n18 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 815 | 830 | 1710 | 1785 |
| 2nd order IMD products | |f2\_low – f1\_high| | |f2\_high – f1\_low| | |f2\_low + f1\_low| | |f2\_high + f1\_high| |
| IMD frequency limit (MHz) | 880 | 970 | 2525 | 2615 |
| 3rd order IMD products | |f2\_low – 2\*f1\_high| | |f2\_high – 2\*f1\_low| | |2\*f2\_low – f1\_high| | |2\*f2\_high – f1\_low| |
| IMD frequency limit (MHz) | 50 | 155 | 2590 | 2755 |
| 3rd order IMD products | |2\*f1\_low + f2\_low| | |2\*f1\_high + f2\_high| | |2\*f2\_low + f1\_low| | |2\*f2\_high + f1\_high| |
| IMD frequency limit (MHz) | 3340 | 3445 | 4235 | 4400 |
| 4th order IMD products | |3\*f1\_low – f2\_high| | |3\*f1\_high – f2\_low| | |3\*f2\_low – f1\_high| | |3\*f2\_high –f1\_low| |
| IMD frequency limit (MHz) | 660 | 780 | 4300 | 4540 |
| 4th order IMD products | |3\*f1\_low +f2\_low| | |3\*f1\_high + f2\_high| | |3\*f2\_low+f1\_low| | |3\*f2\_high +f1\_high| |
| IMD frequency limit (MHz) | 4155 | 4275 | 5945 | 6185 |
| 4th order IMD products | |2\*f1\_low –2\*f2\_high| | |2\*f1\_high –2\*f2\_low| | |2\*f1\_low +2\*f2\_low| | |2\*f1\_high +2\*f2\_high| |
| IMD frequency limit (MHz) | 1760 | 1940 | 5050 | 5230 |
| 5th order IMD products | |f1\_low –4\*f2\_high| | |f1\_high –4\*f2\_low| | |f2\_low –4\*f1\_high| | |f2\_high –4\*f1\_low| |
| IMD frequency limit (MHz) | 6010 | 6325 | 1475 | 1610 |
| 5th order IMD products | |f1\_low +4\*f2\_low| | |f1\_high +4\*f2\_high| | |f2\_low+4\*f1\_low| | |f2\_high +4\*f1\_high| |
| IMD frequency limit (MHz) | 7655 | 7970 | 4970 | 5105 |
| 5th order IMD products | |2\*f1\_low –3\*f2\_high| | |2\*f1\_high –3\*f2\_low| | |2\*f2\_low -3\*f1\_high| | |2\*f2\_high -3\*f1\_low| |
| IMD frequency limit (MHz) | 3470 | 3725 | 930 | 1125 |
| 5th order IMD products | |2\*f1\_low +3\*f2\_low| | |2\*f1\_high +3\*f2\_high| | |2\*f2\_low+3\*f1\_low| | |2\*f2\_high +3\*f1\_high| |
| IMD frequency limit (MHz) | 6760 | 7015 | 5865 | 6060 |

Based on the table above, the 4th order IMD may fall into Rx frequencies of band n3.

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-n18 | E-UTRA Band 1, 3, 11, 21, 28, 34, 65NR Band n77, n78, n79 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| NR Band n77, n78 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| Frequency range | 945 | - | 960 | -50 | 1 |  |
| Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 3 |
| Frequency range | 2545 | - | 2575 | -50 | 1 |  |
| Frequency range | 2595 | - | 2645 | -50 | 1 |  |
| 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 RBsize kHz), 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 3: Applicable when co-existence with PHS system operating in 1884.5 -1915.7 MHz |

#### 6.X.2.3 REFSENS requirements

Table 6.X.2.3-1 lists the MSD required due to the 4th IMD for the dual uplink configuration The MSD value is reused from TS 38.101-3 DC\_18A\_n3A.

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

|  |  |
| --- | --- |
| Operating band / Channel bandwidth / NRB / Duplex mode | Source of IMD |
| CAConfiguration | Operating band | UL Fc(MHz) | UL/DL BW (MHz) | UL LCRB | DL Fc (MHz) | MSD (dB) | Duplex mode |
| CA\_n3A-n18A | n18 | 823 | 5 | 25 | 868 | N/A | FDD | N/A |
| n3 | 1731 | 5 | 25 | 1826 | 4 | FDD | IMD4 |

<End of Text Proposal>