**3GPP TSG-RAN WG4 Meeting #98-e R4-2100944**

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

**Source:** Samsung, KDDI

**Title:** TP for TR 38.717-02-01: CA\_n18-n41

**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\_n18-n41 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\_n18-n41

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 n18+n41

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | |
| n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n411 | 2496 MHz |  | 2690 MHz | 2496 MHz |  | 2690 MHz | TDD |

NOTE 1: The frequency range in band n41 is restricted for this band combination to 2595 – 2645 MHz.

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 n18+n41

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | UL Configuration | NR Band | SCS [kHz] | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | Bandwidth combination set |
| 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n18A-n41A | CA\_n18A-n41A | n18 | 15 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 | 15 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |

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 \_ n18-n41.

**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** |
| **n18** | 815 | 830 | 860 | 875 | 1630 | 1660 | 2445 | 2490 | 3260 | 3320 |
| **n41** | 2595 | 2645 | 2595 | 2645 | 5190 | 5290 | 7785 | 7935 | 10380 | 10580 |

Based on above table, there is no harmonic issue for the band combination of n18 and n41.

**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** |
| **n18** | 815 | 830 | 860 | 875 | 1720 | 1750 | 2580 | 2625 | 3440 | 3500 |
| **n41** | 2595 | 2645 | 2595 | 2645 | 5190 | 5290 | 7785 | 7935 | 10380 | 10580 |

Based on above table, there is n18 3rd harmonic mixing issue to n41.

6.X.1.4 ∆TIB and ∆RIB values

For CA\_n18-n41 , the ∆TIB,c and ∆RIB,c values are given in the tables below which refer to TS 36.101 CA\_8-41 relaxation values.

**Table 6.X.1.4-1:** **ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n18-n41 | n18 | 0.3 |
| n41 | 0.3 |

**Table 6.X.1.4-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n18-n41 | n18 | 0 |
| n41 | 0 |

6.x.1.5 REFSENS requirements

IMD2 may fall in n18 but due to spectrum holding considerations, this IMD2 is not applicable.

The MSD for n18 3rd harmonic mixing issue to n41 can refer to 36.101 CA\_20-41 value.

Table 6.X.1.5-1: Reference sensitivity exceptions due to harmonic mixing for CA in NR FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band / Channel bandwidth of the affected DL band | | | | | | | | | | | | |
| UL band | DL band | 5 MHz  (dB) | 10 MHz  (dB) | 15 MHz  (dB) | 20 MHz  (dB) | 25 MHz  (dB) | 40 MHz  (dB) | 50 MHz  (dB) | 60 MHz  (dB) | 80 MHz  (dB) | 90 MHz  (dB) | 100 MHz  (dB) |
| n413,4 | n18 | [24.3] | [24.3] | [22.5] |  |  |  |  |  |  |  |  |
| NOTE 3: These requirements apply when there is at least one individual RE within the downlink transmission bandwidth of the victim (lower) band for which the 3rd harmonic is within the uplink transmission bandwidth or the uplink adjacent channel's transmission bandwidth of an aggressor (higher) band.  NOTE 4: The requirements should be verified for UL NR-ARFCN of the aggressor (higher) band (superscript HB) such that in MHz and with  the carrier frequency in the victim (lower) band and  the channel bandwidth configured in the higher band. | | | | | | | | | | | | |

Table 6.X.1.5-2: Uplink configuration for reference sensitivity exceptions due to receiver harmonic mixing for CA in NR FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band / SCS / Channel bandwidth of the affected DL band | | | | | | | | | | | | | |
| UL band | DL band | SCS  (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| n41 | n18 | 15 | 25 | 50 | 75 |  |  |  |  |  |  |  |  |
| NOTE 1: The UL configuration applies regardless of the channel bandwidth of the UL band unless the UL resource blocks exceed that specified in Table 7.3.2-3 for the uplink bandwidth in which case the allocation according to Table 7.3.2-3 applies. | | | | | | | | | | | | | |

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\_n18A-n41A | 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 n18 +Band n41 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.x.2.2-1: Band n18 and Band n41 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 815 | 830 | 2595 | 2645 |
| 2nd order IMD products | |f2\_low – f1\_high| | |f2\_high – f1\_low| | |f2\_low + f1\_low| | |f2\_high + f1\_high| |
| IMD frequency limit (MHz) | 1765 | 1830 | 3410 | 3475 |
| 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) | 935 | 1015 | 4360 | 4475 |
| 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) | 4225 | 4305 | 6005 | 6120 |
| 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) | 105 | 200 | 6955 | 7120 |
| 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) | 5040 | 5135 | 8600 | 8765 |
| 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) | 3530 | 3660 | 6820 | 6950 |
| 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) | 9550 | 9765 | 615 | 725 |
| 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) | 11195 | 11410 | 5855 | 5965 |
| 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) | 6125 | 6305 | 2700 | 2845 |
| 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) | 9415 | 9595 | 7635 | 7780 |

Based on the table above, there is no IMD issue for this band combination.

**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\_n18-n41 | E-UTRA Band 1, 3, 34, 42, 65 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 2, 25 | FDL\_low | - | FDL\_high | -50 | 1 | 4 |
| E-UTRA Band 11, 21 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| NR Band n77, n78, n79 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| Frequency range | 758 | - | 799 | -50 | 1 |  |
| Frequency range | 799 | - | 803 | -40 | 1 |  |
| Frequency range | 860 | - | 890 | -40 | 1 |  |
| Frequency range | 945 | - | 960 | -50 | 1 |  |
| Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 3 |
| 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 3: Applicable when co-existence with PHS system operating in 1884.5 -1915.7 MHz  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. | | | | | | | |

6.X.2.3 REFSENS requirements

No additional MSD requirement need to be defined for this band combs since no IMD issue as analysis.

<End of Text Proposal>