**3GPP TSG-RAN WG4 Meeting #104-e R4-2215018**

**Electronic Meeting, 15 August – 26 August 2022**

**Source:** Ericsson, Telstra

**Title:** TP for TR 38.818-02-01: CA\_n7-n26

**Agenda item:** 10.10.2

**Document for:** Approval

# 1. Introduction

This contribution is a text proposal for TR 38.818-02-01 to include CA\_n7A-n26A as defined in WID [1].

# 2. Text Proposal

# ---Start of changes---

## 5.x n7-n26

### 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 of band n7 and n26

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |

#### 5.x.1.2 Channel bandwidths per operating band for CA

Table 5.x.1.2-1: Supported bandwidths per CA band combination of band n7+n26

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n26A | CA\_n7A-n26A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n26 | 5, 10, 15, 20 |  |
| CA\_n7B-n26A | CA\_n7A-n26A  CA\_n7B | n7 | CA\_n7B\_BCS0 | 0 |
|  |  | n26 | 5, 10, 15, 20 |  |

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

Table 5.x.1.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_ n7-n26. It is shown that there are no harmonic issues to consider.

**Table 5.x.1.3-1: Impact of UL/DL Harmonic**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th 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 | UL Low Band Edge | UL High Band Edge |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 | 12500 | 12850 |
| n26 | 814 | 849 | 859 | 894 | 1628 | 1698 | 2442 | 2547 | 3256 | 3396 | 4070 | 4245 |

**Table 5.x.1.3-2: Impact of UL/DL Harmonic mixing**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th 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 | DL Low Band Edge | DL High Band Edge |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 | 13100 | 13450 |
| n26 | 814 | 849 | 859 | 894 | 1718 | 1788 | 2577 | 2682 | 3436 | 3576 | 4295 | 4470 |

#### 5.x.1.4 ∆TIB and ∆RIB values

For CA\_n7-n26, the ΔTIB,c and ΔRIB,c values are same as for CA\_3-26 and are given in the tables below.

**Table 5.x.1.4-1: ΔTIB,c**

| NR CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n7-n26 | n7 | 0.3 |
| n26 | 0.3 |

**Table 5.x.1.4-2: ΔRIB,c**

| NR CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n7-n26 | n7 | 0 |
| n26 | 0 |

#### 5.x.1.5 REFSENS requirements

As can be seen in the co-existence studies in 5.x.1.3 there are no harmonics issues.

#### 5.x.1.6 OOB blocking exception requirements

There is no OOB exception for this CA combination.

Table 5.x.1.6-1: CA band combination with exceptions allowed

|  |
| --- |
| CA band combination |
|  |

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

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

**Table 5.x.2.1-1: UE Power Class for uplink inter-band CA**

|  |  |  |
| --- | --- | --- |
| Uplink CA Configuration | Class 3 (dBm) | Tolerance (dB) |
| CA\_n7A-n26A | 23 | +2/-3 |

#### 5.x.2.2 UE co-existence studies

Table 5.x.2.2-1 lists Band n7 + Band n26 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 5.x.2.2-1: Band n7 and Band n26 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 814 | 849 | 2500 | 2570 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1756 | 1651 | 3314 | 3419 |
| 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) | 942 | 802 | 4151 | 4326 |
| 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) | 4128 | 4268 | 5814 | 5989 |
| 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) | 3512 | 3302 | 6628 | 6838 |
| 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) | 128 | 47 | 6651 | 6896 |
| 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) | 4942 | 5117 | 8314 | 8559 |
| 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) | 9466 | 9151 | 896 | 686 |
| 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) | 10814 | 11129 | 5756 | 5966 |
| 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) | 6082 | 5802 | 2453 | 2698 |
| 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) | 9128 | 9408 | 7442 | 7687 |

Based on the table above it can be seen that IMD5 may affect own Rx frequencies of band n7 and that IMD3 and IMD5 may affect band n26.

**Table 5.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\_n7-n26 | E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 22, 26, 29, 30, 31, 40, 42, 43, 65, 66, 85, 103 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| NR Band n77, n78, n79 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| Frequency range | 2570 | - | 2575 | +1.6 | 5 | 4, 7, 8 |
| Frequency range | 2575 | - | 2595 | -15.5 | 5 | 4, 7, 8 |
| Frequency range | 2595 | - | 2620 | -40 | 1 | 4, 14 |
| Frequency range | 703 | - | 799 | -50 | 1 |  |
| Frequency range | 799 | - | 803 | -40 | 1 | 4 |
| 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.  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 8: This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 - 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 1892.5 - 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 1895 - 1903 MHz. | | | | | | | |

#### 5.x.2.3 REFSENS requirements

Based on the co-existence there are potential IMD5 issues into band n7 and potential IMD3 and IMD5 issues into band n26. MSD values are reused from CA\_3A-26A.

**Table 5.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\_n7-n26 | n7 | 2556 | 5 | 25 | 2676 | N/A | FDD | N/A |
| n26 | 837 | 5 | 25 | 882 | 16.0 | FDD | IMD311 |
|  | n7 | 2567.5 | 5 | 25 | 2687.5 | 2.5 | FDD | IMD5 |
| n26 | 816.5 | 5 | 25 | 861.5 | N/A | FDD | N/A |
| NOTE 11: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

Based on the co-existence studies there are 3rd harmonic mixing from band n26 DL into band n7 UL. MSD value to be discussed further at upcoming meetings.

Table 5.x.2.3-2: Reference sensitivity exceptions and uplink/downlink configurations due to harmonic mixing from a PC3 aggressor NR UL band for DL NR CA FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| n7 | n26 | 5 | 15 | 75 (RBstart=0) | 5 | [TBD] | FDL=861.5 MHz FUL=2562 MHz | UL1/DL3 Near miss |

---End of changes---

# Reference

[1] RP-221876, New WID: Rel-18 NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2), ZTE