**3GPP T****SG-RAN WG4 Meeting#99 Rev 2 of R4-2109399**

**E-meeting, 19th – 27th May, 2021**

**Title: TP to TR 38.717-02-01 Addition of CA\_n5A-n12A**

**Source: AT&T, Nokia**

**Agenda item: 8.10.2**

**Document for: Approval**

# 1 Introduction

This contribution is a TP to TR 38.717-02-01 to introduce CA\_n5A-n12A.

# 2 Text Proposal

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of the TP \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

## 6.X CA\_n5-n12

### 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: CA band combination of band CA\_n5 + n12

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Band Combination | 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 | | |
| CA\_n5-n12 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 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 CA\_n5 + n12

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | UL configuration | NR Band | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | Bandwidth combination set |
| CA\_n5A-n12A | CA\_n5A-n12A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n12 | 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\_n5-n12.

Table 6.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 |
| n5 | 824 | 849 | 869 | 894 | 1648 | 1698 | 2472 | 2547 | 3296 | 3396 | 4120 | 4245 |
| n12 | 699 | 716 | 729 | 746 | 1398 | 1432 | 2097 | 2148 | 2796 | 2864 | 3495 | 3580 |

Based on above table, there is no harmonic issue for the band combination CA\_n5-n12.

Table 6.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 |
| n5 | 824 | 849 | 869 | 894 | 1738 | 1788 | 2607 | 2682 | 3476 | 3576 | 4345 | 4245 |
| n12 | 699 | 716 | 729 | 746 | 1458 | 1492 | 2187 | 2238 | 2916 | 2984 | 3645 | 3730 |

Based on above table, there is no harmonic mixing issue for the band combination CA\_n5-n12.

#### 6.X.1.4 ∆TIB and ∆RIB values

For CA\_n5-n12, the ΔTIB,c and ΔRIB,c values are reused from the EN-DC combination DC\_12\_n5, and are given in the tables below.

Table 6.X.1.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n5-n12 | n5 | 0.8 |
| n12 | 0.4 |

Table 6.X.1.4-2: ΔRIB

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_n5-n12 | n5 | 0.5 |
| n12 | 0.3 |

#### 6.X.1.5 REFSENS requirements

There is no harmonic issue for the CA combination.

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

No need to specify OOB exception requirement for CA\_n5-n12.

Table 6.X.1.6-1: CA band combination with exceptions allowed

|  |
| --- |
| CA band combination |
| No exceptions |

### 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\_n5A-n12A | 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

Table 6.X.2.2-1 gives IMD interference analysis for CA\_ n5-n12 with 2 ULs.

Table 6.X.2.2-1: Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 699 | 716 | 824 | 849 |
| DL frequency (MHz) | 729 | 746 | 869 | 894 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1398 | 1432 | 1648 | 1698 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2097 | 2148 | 2472 | 2547 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 2796 | 2864 | 3296 | 3396 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 3495 | 3580 | 4120 | 4245 |
| 2nd order IMD products | |fy\_low - fx\_high| | |fy\_high - fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 108 | 150 | 1523 | 1565 |
| 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 549 | 608 | 932 | 999 |
| 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) | 2222 | 2281 | 2347 | 2414 |
| Two-tone 4th order IMD products | |3\*fx\_low - fy\_high| | |3\*fx\_high - fy\_low| | |3\*fy\_low - fx\_high| | |3\*fy\_high - fx\_low| |
| IMD frequency limits (MHz) | 1248 | 1324 | 1756 | 1848 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2921 | 2997 | 3171 | 3263 |
| 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) | 300 | 216 | 3046 | 3130 |
| 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) | 2697 | 2580 | 2040 | 1947 |
| 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) | 3995 | 4112 | 3620 | 3713 |
| 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) | 1149 | 1040 | 500 | 399 |
| 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) | 3870 | 3979 | 3745 | 3846 |

Based on the table above:

- There are no IMD products that fall into Rx frequencies of band n5.

- There are no IMD products that fall into Rx frequencies of band n12.

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Spurious emission | | | | | | |
| Protected band | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| CA\_n5-n12 | E-UTRA Band 2, 5, 13, 14, 17, 24, 25, 26, 30, 42, 43 50, 71, 74 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 4, 10, 41, 42, 48, 51, 66, 70  NR Band n77 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| E-UTRA Band 12, 85 | FDL\_low | - | FDL\_high | -50 | 1 | 4 |
| 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. | | | | | | | |

#### 6.X.2.3 REFSENS requirements

Based on the co-existence studies for CA\_n5-n12, there is no need to have MSD added.

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# 3 References