**3GPP T****SG-RAN WG4 Meeting#99 Rev. 3 of R4-2110701**

**E-meeting, 19th – 27th May, 2021**

**Title: TP to TR 38.717-02-01 Addition of CA\_n5A-n14A**

**Source: Nokia, AT&T**

**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-n14A.

# 2 Text Proposal

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

## 6.X CA\_n5-n14

### 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\_n2 + n14

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA Band Combination | 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 |
| CA\_n5-n14 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n14 | 788 MHz | – | 798 MHz | 758 MHz | – | 768 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\_n2 + n14

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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-n14A | CA\_n5A-n14A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |

#### 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-n14.

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 |
| n14 | 788 | 798 | 758 | 768 | 1576 | 1596 | 2364 | 2394 | 3152 | 3192 | 3940 | 3990 |

Based on above table, there is no harmonic issue for the band combination CA\_n5-n14.

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 |
| n14 | 788 | 798 | 758 | 768 | 1516 | 1536 | 2274 | 2304 | 3032 | 3072 | 3790 | 3840 |

Based on above table, there is no harmonic mixing issue for the band combination CA\_n5-n14.

#### 6.X.1.4 ∆TIB and ∆RIB values

For CA\_n5-n14, the ΔTIB,c and ΔRIB,c values are reused from CA\_5\_13 due to similarity in frequency range, 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-n14 | n5 | 0.5 |
| n14 | 0.5 |

Table 6.X.1.4-2: ΔRIB

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_n5-n14 | n5 | 0 |
| n14 | 0 |

#### 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-n14.

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-n14A | 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-n14 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) | 788 | 798 | 824 | 849 |
| DL frequency (MHz) | 758 | 768 | 869 | 894 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz)  | 1576 | 1596 | 1648 | 1698 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2364 | 2394 | 2472 | 2547 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz)  | 3152 | 3192 | 3296 | 3396 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 3940 | 3990 | 4120 | 4245 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 26 | 61 | 1612 | 1647 |
| Two-tone 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) | 727 | 772 | 850 | 910 |
| Two-tone 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) | 2400 | 2445 | 2436 | 2496 |
| 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) | 1515 | 1570 | 1674 | 1759 |
| 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) | 122 | 52 | 3224 | 3294 |
| 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) | 3188 | 3243 | 3260 | 3345 |
| 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) | 2608 | 2498 | 2368 | 2303 |
| 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) | 971 | 876 | 746 | 666 |
| 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) | 4084 | 4194 | 3976 | 4041 |
| 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) | 4048 | 4143 | 4012 | 4092 |

Based on the table above:

- 3rd and 5th IMD products might fall into Rx frequencies of band n5.

- 3rd IMD products might fall into Rx frequencies of band n14.

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-n14 | E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 24, 25, 26, 29, 30, 48, 66, 70, 71, 85 | FDL\_low  | - | FDL\_high | -50 | 1 |  |
| E-UTRA band 41, 53 | FDL\_low  | - | FDL\_high | -50 | 1 | 2 |
| 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. |

#### 6.X.2.3 REFSENS requirements

Based on the co-existence studies for CA\_n5-n14, MSD is needed.

**Table 6.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\_n5-n14 | n5 | 833 | 5 | 25 | 873 | 14.3 | FDD | IMD34 |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n5 | 834 | 5 | 25 | 879 | N/A | FDD | N/A |
| n14 | 793 | 5 | 25 | 753 | 12.1 | FDD | IMD3 |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. |

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# 3 References