**3GPP TSG-RAN WG4 Meeting # 99-e R4-2110452**

**Electronic Meeting, May. 19-May. 27, 2021**

Source: ZTE Corporation

Title: TP for TR 38.717-02-01: CA\_n3A-n34A

Agenda Item: 8.10.2

Document for: Approval

# **Introduction**

This contribution provides a text proposal on 2DL CA band combination of NR band n3+ NR Band n34 for TR38.717-02-01[1] to capture the MSD values.

# **Reference**

1. TR38.717-02-01, Rel-17 NR inter-band Carrier Aggregation/Dual connectivity for 2 bands DL with x bands UL (x=1, 2) v0.3.0

# Text Proposal

**----- Start of TP -----**

6.x CA\_n3-n34

### 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+n34**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **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\_n3-n34 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n34 | 2010 MHz | – | 2025 MHz | 2010 MHz | – | 2025 MHz | TDD |

6.x.1.2 Channel bandwidths per operating band for CA

**Table 6.x.2-1: Supported bandwidths per CA band combination of band n3+n34**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n3A-n34A | CA\_n3A-n34A | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  | 0 |
|  |  | n34 | 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-n34.

**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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 | 8550 | 8925 |
| n34 | 2010 | 2025 | 2010 | 2025 | 4020 | 4050 | 6030 | 6075 | 8020 | 8100 | 10050 | 10125 |

Based on above table, there is no harmonic issue for the band combination of n3 and n34.

**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 | 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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 | 8550 | 8925 |
| n34 | 2010 | 2025 | 2010 | 2025 | 4020 | 4050 | 6030 | 6075 | 8020 | 8100 | 10050 | 10125 |

Based on above table, there is no harmonic mixing issue for the band combination of n3 and n34.

6.x.1.4 ∆TIB and ∆RIB values

For CA\_n3-n34, it is proposed to use the same ΔTIB,c and ΔRIB values of DC\_n3-n34, which are given in the tables below.

**Table 6.x.1.4-1: ΔTIB,c**

| NR CA Combination | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n34 | n3 | 0.5 |
| n34 | 0.5 |

**Table 6.x.1.4-2: ΔRIB,c**

| NR CA Combination | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n34 | n3 | 0 |
| n34 | 0 |

#### 6.x.1.5 REFSEN requirements

According to the analysis in subclause 6.x.1.3, there are no harmonic issues for this combination. However, MSD due to cross band isolation on n3 RX due to insufficient isolation to n34 UL are defined below.

Table 6.x.1.5-1: Reference sensitivity exceptions (MSD) due to cross band isolation for NR CA 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) | 30 MHz (dB) | 40 MHz (dB) | 50 MHz (dB) | 60 MHz (dB) | 70  MHz  (dB) | 80 MHz (dB) | 90 MHz (dB) | 100 MHz (dB) |
| n34 | n3 | 3 | 2.2 | 1.9 | 1.7 | 1.6 | 1.5 |  |  |  |  |  |  |  |

Table 6.x.1.5-2: Uplink configuration for reference sensitivity exceptions due to cross band isolation for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band / SCS / Channel bandwidth of the affected DL band | | | | | | | | | | | | | | | |
| UL band | DL band | SCS of UL band (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 70  MHz | 80 MHz | 90 MHz | 100 MHz |
| n34 | n3 | 15 | 25 | 25 | 25 | 25 | 25 | 25 |  |  |  |  |  |  |  |

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

There is no OOB exception for the CA combination.

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

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

**Table 6.24.2.2-1: UE Power Class for uplink inter-band CA**

|  |  |  |
| --- | --- | --- |
| Uplink CA Configuration | Class 3 (dBm) | Tolerance (dB) |
| CA\_n3A-n34A | 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

For 2UL/2DL UE coexistence study 2nd, 3rd, 4th and 5th order intermodulation products for NR CA n3+n34 band combination are calculated and presented in Table 6.x.2.2-1.

**Table 6.x.2.2-1: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DL frequency** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **1710** | **1785** | **2010** | **2025** |
| 2nd order IMD products | |fy\_low-fx\_high| | |fy\_high-fx\_low| | |fy\_low+fx\_low| | |fy\_high+fx\_high| |
| IMD frequency limits (MHz) | 225 | 315 | 3720 | 3810 |
| Two-tone 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) | 1395 | 1560 | 2235 | 2340 |
| 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) | 5430 | 5595 | 5730 | 5835 |
| 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) | 630 | 450 | 7440 | 7620 |
| 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) | 3105 | 3345 | 4245 | 4365 |
| 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) | 7140 | 7380 | 7740 | 7785 |
| 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) | 6390 | 6255 | 5130 | 4815 |
| 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) | 9750 | 9885 | 8850 | 9165 |
| 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) | 2655 | 2460 | 1335 | 1080 |
| 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) | 9450 | 9645 | 9150 | 9405 |

Based on the above table, there are no harmonic and IMD issue.

Table 6.x.2.2-2 lists the protected bands required for the 2UL bands CA configuration.

**Table 6.x.2.1-2: Protected bands for the 2UL bands CA configuration**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA combination** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
| CA\_n3-n34 | E-UTRA Band 1, 7, 8, 11, 18, 19, 20, 21, 26, 28, 31, 32, 33, 38, 39, 40, 41, 43, 44, 45, 50, 51, 65, 67, 69,72, 73, 74, 75, 76 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 22, 42, 52  NR Band n78, n79 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| E-UTRA Band 3 | FDL\_low | - | FDL\_high | -50 | 1 | 15 |
| Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 3 |
| NOTE 1: FDL\_low and FDL\_high refer to each E-UTRA frequency band specified in Table 5.5-1  NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA 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 (2MHz + 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 15: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW). | | | | | | | |

#### 6.x.2.3 REFSENS requirements

No MSD issues for NR CA n3+n34 band combination.

**----- End of TP -----**