**3GPP TSG-RAN WG4 Meeting #100-e R4-** **2114008**

**Electronic Meeting, 16 – 30 April, 2020**

**Source:** Huawei, HiSilicon, BT

**Title:** TP to TR 38.717-02-01 for CA\_n28-n46 and DC\_n28-n46

**Agenda item:** 8.8.2

**Document for:** Approval

# Background

This contribution provides text proposal on the NR CA/DC band combination CA\_n28-n46 and DC\_n28-n46 as defined in Revised WID on NR inter-band Carrier Aggregation/Dual connectivity for 2 bands DL with x bands UL (x=1, 2) [1].

# Text Proposal

##### ---Start of changes---

## 6.x CA\_n28-n46

### 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 CA\_n28-n46

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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\_n28-n46 | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |

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

Table 6.x.1.2-1: Supported bandwidths per CA band combination CA\_n28-n46

|  |  |  |  |
| --- | --- | --- | --- |
| **NR CA Configuration** | **UL CA Configuration** | **NR Band** | **Channel bandwidth [MHz]** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n28A-n46A | n28ACA\_n28A-n46A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n46 |  |  |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| CA\_n28A-n46C | n28ACA\_n28A-n46A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n46 | See CA\_n46C Bandwidth Combination Set 0 in Table 5.5A.1-1 |
| CA\_n28A-n46D | n28ACA\_n28A-n46A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n46 | See CA\_n46D Bandwidth Combination Set 0 in Table 5.5A.1-1 |

#### 6.x.1.3 UE Co-existence studies

Table 6.x.1.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n28-n46.

**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 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n46 | 5150 | 5925 | 5150 | 5925 | 10300 | 11850 | 15450 | 17775 | 20600 | 23700 |

Based on above table, there is no harmonic interference.

**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 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n46 | 5150 | 5925 | 5150 | 5925 | 10300 | 11850 | 15450 | 17775 | 20600 | 23700 |

Based on above table, there is no harmonic mixing issue.

#### 6.x.1.4 ∆TIB and ∆RIB values

For CA\_n28-n46, the ΔTIB,c and ΔRIB are given in the tables below.

Table 6.x.1.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n28-n46 | n28 | 0 |
| n46 | 0 |

Table 6.x.1.4-2: ΔRIB

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_n28-n46 | n28 | 0 |
| n46 | 0 |

#### 6.x.1.5 REFSENs requirements

There is no MSD exception requirement.

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

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

|  |
| --- |
| CA band combination |
| CA\_n28-n46 |

### 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\_n28A-n46A | 23 | +2/-3 |

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

Table 6.x.2.2-1 gives IMD interference analysis for CA\_n28-n46 with 2 ULs.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 703 | 748 | 5150 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz)  | 1406 | 1496 | 10300 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2109 | 2244 | 15450 | 17775 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 2812 | 2992 | 20600 | 23700 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 3515 | 3740 | 25750 | 29625 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4402 | 5222 | 5853 | 6673 |
| 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) | 4519 | 3654 | 9552 | 11147 |
| 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) | 6556 | 7421 | 11003 | 12598 |
| 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) | 3816 | 2906 | 14702 | 17072 |
| 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) | 7259 | 8169 | 16153 | 18523 |
| 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) | 10444 | 8804 | 11706 | 13346 |
| 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) | 22997 | 19852 | 2158 | 3113 |
| 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) | 16369 | 13954 | 8056 | 9741 |
| 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) | 21303 | 24448 | 7962 | 8917 |
| 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) | 16856 | 19271 | 12409 | 14094 |

For band combination CA\_n28-n46, no IMD interference will fall into Rx.

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\_n28-n46 | E-UTRA Band 4, 22, 32, 42, 43, 50, 51, 65, 66, 73, 74, 75, 76NR Band n77, n78 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| E-UTRA Band 1 | FDL\_low | - | FDL\_high | -50 | 1 | 19, 25 |
| E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 20, 25, 26, 27, 31, 34, 38, 40, 41, 52, 72, 87, 88NR Band n79 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 11, 21 | FDL\_low | - | FDL\_high | -50 | 1 | 19, 24 |
| Frequency range | 470 | - | 694 | -42 | 8 | 15, 35 |
| Frequency range | 470 | - | 710 | -26.2 | 6 | 34 |
| Frequency range | 662 | - | 694 | -26.2 | 6 | 15 |
| Frequency range | 758 | - | 773 | -32 | 1 | 15 |
| Frequency range | 773 | - | 803 | -50 | 1 |  |
| Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 8, 19 |
| 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 8:Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.NOTE 15:These requirements also apply for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.NOTE 19:Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 2nd 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 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).NOTE 25: 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).NOTE 34: This requirement is applicable for 5 and 10 MHz E-UTRA channel bandwidth allocated within 718-728MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and RBstart<48.NOTE 35: This requirement is applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies. |

#### 6.x.2.3 REFSENS requirements

There is no additional MSD requirements for two UL CA\_n28-n46

## **9.x DC\_n28-n46**

### 9.x.1 Operating bands for DC\_n28-n46

**Table 9.x.1-1: Inter-band NR DC operating bands**

|  |  |
| --- | --- |
| **NR DC Band** | **NR Band** |
| DC\_n28-n46 | n28, n46 |

### 9.x.2 Configurations for DC\_n28-n46

**Table 9.x.2-1: Inter-band NR DC configurations**

| **NR DC****configuration** | **Uplink NR DC****configuration** |
| --- | --- |
| DC\_n28A-n46ADC\_n28A-n46CDC\_n28A-n46D | DC\_n28A-n46A |

### 9.x.3 Maximum output power for NR-DC

**Table 9.x.3-1: UE Power Class for uplink inter-band DC**

|  |  |  |
| --- | --- | --- |
| Uplink DC Configuration | Class 3 (dBm) | Tolerance (dB)  |
| DC\_n28A-n46A | 23 | +2/-31 |
| NOTE 1: 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 |

##### ---End of changes---

# Reference

[1] RP-211058, “Revised WID on Rel-17 NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2)”, ZTE Corporation