**3GPP TSG-RAN WG4 Meeting #100-e R4-** **2114007**

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

**Source:** Huawei, HiSilicon, BT

**Title:** TP to TR 38.717-02-01 for CA\_n46-n78 and DC\_n46-n78

**Agenda item: 8.8.2**

**Document for:** Approval

# Background

This contribution provides text proposal on the NR CA/DC band combination CA\_n46-n78 and DC\_n46-n78 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\_n46-n78

### 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\_n46-n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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\_n46-n781,6 | n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz |
| NOTE 1: Applicable for UE supporting inter-band carrier aggregation with mandatory simultaneous Rx/Tx capability.NOTE 6: The PCell is allocated in the licensed band in this combination. |

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

Table 6.x.1.2-1: Supported bandwidths per CA band combination CA\_n46-n78

|  |  |
| --- | --- |
|  | **CA operating / channel bandwidth [MHz]** |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n46A-n78A | n78ACA\_n46A-n78A | n78 | 15 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| n46 | 15 |  |  |  | 20 |  |  | 40 |  |  |  |  |  |  |
| 30 |  |  |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| 60 |  |  |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| CA\_n46C-n78A | n78ACA\_n46A-n78A | n78 | 15 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| n46 | See CA\_n46C Bandwidth Combination Set 0 in Table 5.5A.1-1 |
| CA\_n46D-n78A | n78ACA\_n46A-n78A | n78 | 15 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 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\_n46-n78.

**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 |
| n46 | 5150 | 5925 | 5150 | 5925 | 10300 | 11850 | 15450 | 17775 | 20600 | 23700 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Based on above table, harmonic mixing of n46 DL H2 with n78 UL H3 and harmonic mixing of n78 DL H3 with n46 UL H2 could happen.

#### 6.x.1.4 ∆TIB and ∆RIB values

For CA\_n46-n78, 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\_n46-n78 | n46 | 0 |
| n78 | 0.8 |

Table 6.x.1.4-2: ΔRIB

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_n46-n78 | n46 | 0 |
| n78 | 0.5 |

#### 6.x.1.5 REFSENs requirements

The MSD due to cross band isolation is reused from CA\_n46-n48.

**Table 6.x.2.3-1: Reference sensitivity exceptions (MSD) due to cross band isolation for NR-CA in NR FR1**

|  |  |  |
| --- | --- | --- |
|   |  | **NR Band / Channel bandwidth of the affected DL band / MSD** |
| **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)** |
| n78 | n46 | - | - | - | 7 | - | - | 5.7 | - | 5.1 |  - | 4.7 | - | - |
| n46 | n78 | - | 10.4 | 8.8 | 7.8 | 7.8 | 7.8 | 7.8 | 7 | 6.5 |  6.0 | 5.7 | 5.4 | 5.1 |

**Table 6.x.2.3-2: Uplink configuration for reference sensitivity exceptions due to cross band isolation for NR-CA**

|  |  |
| --- | --- |
|  | **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** |   |
| n78 | n46 | 15 |  |  |  | 216 |  |  | 216 |  | 216 |  | 216 |  |  |   |
| n46 | n78 | 30 |  | 216 | 216 | 216 | 216 | 216 | 216 | 216 | 216 | 216 | 216 | 216 | 216 |   |

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

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

|  |
| --- |
| CA band combination |
| CA\_n46-n78 |

### 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\_n46-n78 | 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

Table 6.x.2.2-1 gives IMD interference analysis for CA\_n46-n78 with 2 ULs.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 5150 | 5925 | 3300 | 3800 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 10300 | 11850 | 6600 | 7600 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 15450 | 17775 | 9900 | 11400 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 20600 | 23700 | 13200 | 15200 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 25750 | 29625 | 16500 | 19000 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2625 | 1350 | 8450 | 9725 |
| 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) | 6500 | 8550 | 675 | 2450 |
| 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) | 13600 | 15650 | 11750 | 13525 |
| 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) | 11650 | 14475 | 3975 | 6250 |
| 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) | 18750 | 21575 | 15050 | 17325 |
| 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) | 2700 | 5250 | 16900 | 19450 |
| 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) | 10050 | 7275 | 20400 | 16800 |
| 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) | 1100 | 1950 | 11175 | 7850 |
| 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) | 18350 | 21125 | 23900 | 27500 |
| 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) | 20200 | 23250 | 22050 | 25375 |

For band combination CA\_n46-n78, no IMD interference will affect own Rx because both bands are TDD.

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\_n46-n78 | E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 26, 28, 34, 39, 40, 41, 65 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 8 |
| NOTE 8: Applicable when co-existence with PHS system operating in 1884.5 - 1915.7 MHz. |

#### **6.x.2.3** **REFSENS requirements**

## **9.x DC\_n46-n78**

### 9.x.1 Operating bands for DC\_n46-n78

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

|  |  |
| --- | --- |
| **NR DC Band** | **NR Band** |
| DC\_n46-n78 | n46, n78 |

### 9.x.2 Configurations for DC\_n46-n78

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

| **NR DC****configuration** | **Uplink NR DC****configuration** |
| --- | --- |
| DC\_n46A-n78ADC\_n46C-n78ADC\_n46D-n78A | DC\_n46A-n78A |

### 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\_n46A-n78A | 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