3GPP TSG-RAN WG4 Meeting # 102-e R4-2203538

Electronic Meeting, February 21 – March 3, 2022

**Source:** Charter Communications

**Title:** TP to TR 38.717.02-01 for CA\_n46-n96

**Agenda item:** 9.6.1

**Document for:** Approval

# Background

This contribution provides text proposal on the NR CA band combination CA\_n46-n96 as defined in revised WID on Rel-17 NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2) UL RP-212877[1].

# Text Proposal

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

## 6.X CA\_n46-n96

### 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 n48+ n96

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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-n96X,Y,Z,ZZ | n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |
| n96 | 5925 MHz | – | 7125 MHz | 5925 MHz | – | 7125 MHz | TDD |
| NOTE X:   Simultaneous Rx/Tx capability does not apply for UEs supporting CA\_n46-n96. Same restrictions are applied to related higher order configurations  NOTE Y: The minimum requirements for intra-band non-contiguous CA/DC apply for CA\_n46-n96 and related higher order CA/DC configurations.  NOTE Z: The combination is not used alone as fall back mode of other band combinations in which UL in Band 48 is not used.  NOTE ZZ: The minimum requirements for inter-band CA apply when the maximum power spectral density imbalance between downlink carriers is within 6 dB. The power spectral density imbalance condition also applies for these carriers when applicable CA configuration is a subset of a higher order CA configuration. | | | | | | | | |

#### 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 n46 + n96

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA  configuration** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n46A-n96A | - | n46 |  | 10 |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  | 0 |
| n96 |  | 10 |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| CA\_n46B-n96A | - | n46 | See CA\_n46B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n96 |  | 10 |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| CA\_n46C-n96A | - | n46 | See CA\_n46C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n96 |  | 10 |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| CA\_n46D-n96A | - | n46 | See CA\_n46D Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n96 |  | 10 |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| CA\_n46N-n96A | - | n46 | See CA\_n46N Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n96 |  | 10 |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| CA\_n46A-n96B | - | n46 |  | 10 |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  | 0 |
| n96 | See CA\_n96B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |
| CA\_n46B-n96B | - | n46 | See CA\_n46B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n96 | See CA\_n96B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |
| CA\_n46C-n96B | - | n46 | See CA\_n46C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n96 | See CA\_n96B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |
| CA\_n46D-n96B | - | n46 | See CA\_n46D Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n96 | See CA\_n96B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |
| CA\_n46N-n96B | - | n46 | See CA\_n46N Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n96 | See CA\_n96B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |

Note: CA\_n46-n96 with UL is not specified and it is only used on higher order BC’s. Only 1UL in n46 or n96 will be allowed in higher order combos

#### 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-n96.

**Table 6.X.1.3-1: Impact of UL/DL Harmonic**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th Harmonic** | | **6th Harmonic** | | **7th 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 | 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 | 25750 | 29625 | 30900 | 35550 | 36050 | 41475 |
| n96 | 5925 | 7125 | 5925 | 7125 | 11850 | 14250 | 17775 | 21375 | 23700 | 28500 | 29625 | 35625 | 35550 | 42750 | 41475 | 49875 |

Based on above table, there is no harmonic interference.

**Table 5.X.1.3-2: Impact of UL/DL Harmonic mixing**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th harmonic** | | **6th Harmonic** | | **7th 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 | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n46 | 5150 | 5925 | 5150 | 5925 | 10300 | 11850 | 15450 | 17775 | 20600 | 23700 | 25750 | 29625 | 30900 | 35550 | 36050 | 41475 |
| n96 | 5925 | 7125 | 5925 | 7125 | 11850 | 14250 | 17775 | 21375 | 23700 | 28500 | 29625 | 35625 | 35550 | 42750 | 41475 | 49875 |

Based on above table, there is no harmonic issue for CA\_n46-n96.

#### 6.X.1.4 ∆TIB and ∆RIB values

For CA\_n48-n96, 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-n96 | n46 | 0 |
| n96 | 0.5 |

Table 5.X.1.4-2: ΔRIB

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_ n46-n96 | n46 | 0 |
| n96 | 0 |

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

There is no OOB blocking exception requirement for CA\_n48-n96.

#### 7.3G.5.1 Reference sensitivity exceptions due to cross band isolation

The reference sensitivity for the shared access band does not apply when there is at least one individual RE within the shared access downlink transmission bandwidth which falls into the reference sensitivity exclusion region as specified n Table 7.3G.5.1-1.

Table 7.3G.5.1-X: NR-U reference sensitivity measurement exclusion region in MHz.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **NR Band / Harmonic order / Channel BW in UL** | | | | | | |
| **Band** | **Harmonic order** | **5MHz** | **10MHz** | **15MHz** | **20 MHz** | **40MHz** |
| n25 | 3 | +/- 15 | +/- 23 | +/- 35 | +/- 45 | +/- 90 |
| n66 | 3 | +/- 15 | +/- 23 | +/- 35 | +/- 45 | +/- 90 |
| n48 | 2 | +/- 10 | +/- 20 | +/- 30 | +/- 40 | +/- 80 |
| NOTE 1: Even though UL harmonic does not fall directly into NR-U band the exclusion region still applies.  NOTE 2: The center of the exclusion region is obtained by multiplying the UL channel center frequency by the harmonic order. | | | | | | |

#### 7.3G.5.2 Reference sensitivity exceptions due to receiver harmonic mixing

Sensitivity degradation is allowed for a band if it is impacted by receiver harmonic mixing due to another band part of the same CA configuration. Reference sensitivity exceptions are specified in Table 7.3G.5.2-1 with uplink configuration specified in Table 7.3G.5.2-2

Table 7.3G.5.2-X: Reference sensitivity exceptions due to harmonic mixing for CA in NR 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)** |
| n46 | n481 | 22.6 | 19.5 | 17.8 | 16.6 |  |  | 14 | 13.1 | 12.6 | 12 | 12 | 12 | 12 |
| n96 | n482 | 5.8 | 3.7 | 2.7 | 2.2 |  | 1.6 | 1.2 | 1.0 | 0.8 | 0.7 | 0.6 | 0.6 | 0.5 |
| NOTE 1: The requirements should be verified for UL NR-ARFCN of the aggressor (high) band (superscript HB) such that in MHz and with carrier frequency in the victim (lower) band in MHz and the channel bandwidth configured in the higher band.  NOTE 2: | | | | | | | | | | | | | | |

Table 7.3G.5.2-X: Reference sensitivity exceptions due to harmonic mixing for CA in NR FR1

| **Operating band / SCS / Channel bandwidth / Duplex-mode** | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating Band** | **SCS kHz** | **5**  **MHz (dBm)** | **10**  **MHz (dBm)** | **15**  **MHz (dBm)** | **20**  **MHz (dBm)** | **25**  **MHz (dBm)** | **30**  **MHz (dBm)** | **40**  **MHz (dBm)** | **50**  **MHz (dBm)** | **60**  **MHz (dBm)** | **70**  **MHz (dBm)** | **80**  **MHz (dBm)** | **90**  **MHz (dBm)** | **100 MHz (dBm)** | **Duplex Mode** |
| n46 | 15 | 12 | 25 | 36 | 50 |  |  | 100 | 100 | 100 | 100 | 100 | 100 | 100 | TDD |
| n96 | 15 | 25 | 50 | 75 | 100 |  | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | TDD |

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

# Reference

[1] RP-212877, “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