**3GPP TSG-RAN WG4 Meeting #94 draft revision R4-2000191**

**Athens, Greece 24 February – 28 February 2020**

**Source:** Charter Communications

**Title:** TP for CA\_n48-n46

**Agenda item:** 8.1.2

**Document for:** Approval

# 1. Introduction

This contribution is a text proposal to include CA\_n48-n46 as defined in WID [1].

# 2. Text Proposal

# ---Start of changes---

## 6.x n46-n48

### 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 n46 and n48

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | |
| n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz |

#### 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 and n48

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25 MHz** | **30 MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n46A-n48A | CA\_n46A-n48A | N46 | 15 |  | Yes6 |  | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  |  |  | Yes |  |  | Yes |  | Yes | Yes |  |  |
| 60 |  |  |  | [Yes] |  |  | [Yes] |  | [Yes] | [Yes] |  |  |
| N48 | 15 | Yes5 | Yes | Yes | Yes |  |  | Yes | Yes6 |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| CA\_n48A-n46B | CA\_n48A-n46A | N46 | 15 |  | Yes6 |  | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  |  |  | Yes |  |  | Yes |  | Yes | Yes |  |  |
| 60 |  |  |  | [Yes] |  |  | [Yes] |  | [Yes] | [Yes] |  |  |
| N48 | 15 | Yes5 | Yes | Yes | Yes |  |  | Yes | Yes6 |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| CA\_n48A-n46C | CA\_n48A-n46A | N46 | 15 |  | Yes6 |  | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  |  |  | Yes |  |  | Yes |  | Yes | Yes |  |  |
| 60 |  |  |  | [Yes] |  |  | [Yes] |  | [Yes] | [Yes] |  |  |
| N48 | 15 | Yes5 | Yes | Yes | Yes |  |  | Yes | Yes6 |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| CA\_n48A-n46D | CA\_n48A-n46A | N46 | 15 |  | Yes6 |  | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  |  |  | Yes |  |  | Yes |  | Yes | Yes |  |  |
| 60 |  |  |  | [Yes] |  |  | [Yes] |  | [Yes] | [Yes] |  |  |
| N48 | 15 | Yes5 | Yes | Yes | Yes |  |  | Yes | Yes6 |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| CA\_n48A-n46E | CA\_n48A-n46A | N46 | 15 |  | Yes6 |  | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  |  |  | Yes |  |  | Yes |  | Yes | Yes |  |  |
| 60 |  |  |  | [Yes] |  |  | [Yes] |  | [Yes] | [Yes] |  |  |
| N48 | 15 | Yes5 | Yes | Yes | Yes |  |  | Yes | Yes6 |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 |
| NOTE 4: This UE channel bandwidth is optional in this release of the specification.  NOTE 5: For this bandwidth, the minimum requirements are restricted to operation when carrier is configured as an SCell part of DC or CA configuration.  NOTE 6: For this bandwidth, the minimum requirements are restricted to operation when carrier is configured as an downlink SCell part of CA configuration. | | | | | | | | | | | | | | | | |

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

Table 6.x.1.3-1 lists up to 7th harmonics for n46A-n48A.

**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** | **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 | 10300 | 11850 | 15450 | 17775 | 20600 | 23700 | 25750 | 29625 | 30900 | 35550 | 36050 | 41475 |
| n48 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14200 | 14800 | 17750 | 18500 | 21300 | 22200 | 24850 | 25900 |

#### 6.x.1.4 ∆TIB and ∆RIB values

For CA\_n46-n48, the ΔTIB,c and ΔRIB,c values are derived from LTE combination CA\_1-3 and are given in the tables below. The ΔTIB,c and ΔRIB,c is defined for applicable bands in Table 6.1.x.5-1 and Table 6.1.x.5-2 respectively assuming separate antenna architecture without HTF:

**Table 6.x.1.4-1: ΔTIB,c**

| E-UTRA and NR DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n46-n48 | n46 | 0 |
| n48 | 0.8 |

**Table 6.x.1.4-2: ΔRIB,c**

| E-UTRA and NR DC Configuration | E-UTRA and NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n46-n48 | n46 | 0 |
| n48 | 0.5 |

#### 6.x.1.5 REFSENS requirements

As can be seen in the co-existence studies in 6.x.1.3 there are no harmonics issues.

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

#### 6.x.2.1 UE co-existence studies

Table 6.x.2.1-1 lists Band n46 + Band n48 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.x.2.1-1: Band n46 and Band n48 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 5150 | 5925 | 3550 | 3700 |
| 2nd harmonics frequency limits | 2\* fy\_low | 2\* fy\_high | 2\*fx\_low | 2\*fx\_high |
| 2nd harmonics frequency limits (MHz) | 10300 | 11850 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\* fy\_low | 3\* fy\_high | 3\*fx\_low | 3\*fx\_high |
| 3rd harmonics frequency limits (MHz) | 15450 | 17775 | 10650 | 11100 |
| 4th harmonics frequency limits | 4\* fy\_low | 4\* fy\_high | 4\*fx\_low | 4\*fx\_high |
| 4th harmonics frequency limits (MHz) | 20600 | 23700 | 14200 | 14800 |
| 5th harmonics frequency limits | 5\* fy\_low | 5\* fy\_high | 5\*fx\_low | 5\*fx\_high |
| 5th harmonics frequency limits (MHz) | 25750 | 29625 | 17750 | 18500 |
| 6th harmonics frequency limits | 6\* fy\_low | 6\* fy\_high | 6\*fx\_low | 6\*fx\_high |
| 6th harmonics frequency limits (MHz) | 30900 | 35550 | 21300 | 22200 |
| 7th harmonics frequency limits | 7\* fy\_low | 7\* fy\_high | 7\*fx\_low | 7\*fx\_high |
| 7th harmonics frequency limits (MHz) | 36050 | 41475 | 24850 | 25900 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1450 | 2375 | 8700 | 9625 |
| 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) | 6600 | 8300 | 1175 | 2250 |
| 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) | 13850 | 15550 | 12250 | 13325 |
| 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) | 2900 | 4750 | 17400 | 19250 |
| 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) | 9525 | 14225 | 4725 | 5950 |
| 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) | 19000 | 21475 | 15800 | 17025 |
| 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) | 9650 | 10500 | 20150 | 16900 |
| 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) | 19350 | 20725 | 24150 | 27400 |
| 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) | 800 | 1200 | 10675 | 8050 |
| 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) | 20950 | 22950 | 22550 | 25175 |

Based on Table 6.x.2.1-1 there are no IMD issues affecting own Rx frequencies of either band n46 or band n48.

Table 6.x.2.1-2 lists the protected bands required for the 2UL bands CA configuration as to be used in Table 6.5A.3.2.3-1 of TS 38.101-1

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA and NR CA Configuration** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
| CA\_n48\_n46 | E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 50, 51, 66, 70, 71, 74, 85 | FDL\_low | - | FDL\_high | -50 | 1 |  |
|  | | | | | | | |

##### 7.3x.x.x.1 Reference sensitivity exceptions due to Cross Band isolation for NR-CA in NR FR1

Table 7.3x.x.x.1-1: Reference sensitivity exceptions (MSD) due to cross band isolation for NR-CA in NR FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | E-UTRA or 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) | 80 MHz  (dB) | 90 MHz  (dB) | 100 MHz  (dB) |
| n48 | | n46 | - | 9.3 | - | 7 | - | - | 5.7 | - | 5.1 | 4.7 | - |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Table 7.3x.x.x.1-2: 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 | 80 MHz | 90 MHz | 100 MHz |
| n48 | n46 | 30 |  | 270 |  | 270 |  |  | 270 |  | 270 | 270 |  |  |

---End of changes---

# Reference

[1] RP-192615, “Band combination proposals for NR-U WI in Rel-16”, Ericsson