3GPP TSG-RAN WG4 Meeting # 100-e Rev. 2 of R4-2113715

**Electronic Meeting, August. 16-27, 2021**

**Title: TP to TR 38.717-02-01: Addition of CA\_n48-n66**

**Source: Nokia, DISH Network**

**Agenda item: 8.8.2**

**Document for: Approval**

# 1 Introduction

This is a TP to TR 38.717-02-01 to add CA\_n48-n66 including new BCS and DC\_n48A-n66A

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## 6.x CA\_n48-n66

### 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 and n66

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

#### 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 n48 and n66

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | UL CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | | BCS |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | | 90 | 100 |  |
| CA\_n48A-n66A | CA\_n48A-n66A | n48 | 5 | 10 | 15 | 20 |  | 30 | 40 | 501 | 601 | 701 | 801 | | 901 | 1001 | 2 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  | |  |  |
| CA\_n48B-n66(2A) | CA\_n48A-n66A | n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | 0 |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | |  |
| CA\_n48B-n66A | CA\_n48A-n66A | n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | 2 |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  | |  |  |
| CA\_n48(2A)-n66A | CA\_n48A-n66A | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | 2 |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  | |  |  |
| CA\_n48A-n66(2A) | CA\_n48A-n66A | n48 | 5 | 10 | 15 | 20 |  | 30 | 40 | 501 | 601 | 701 | | 801 | 901 | 1001 | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | |
| CA\_n48(2A)-n66(2A) | CA\_n48A-n66A | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | |

#### 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\_n48-n66.

**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** |
| n48 | 3550 | 3700 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14200 | 14800 |
| n66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | 6840 | 7120 |

**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** |
| n48 | 3550 | 3700 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14200 | 14800 |
| n66 | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 8440 | 8800 |

Based on above table 6.x.1.3-1, the n66 UL may fall inside the n48 downlink.

Based on above table 6.x.1.3-2, there is no harmonic mixing issue for the band combination of n48 and n66.

#### 6.x.1.4 ∆TIB and ∆RIB values

For CA\_n48-n66, the DTIB,c and DRIB,c values are given in the tables below (taken from CA\_n3-n77).

Table 6.x.1.4-1: ΔTIB,c

|  |  |  |
| --- | --- | --- |
| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| CA\_n48-n66 | n48 | 0.8 |
| n66 | 0.6 |

Table 6.x.4-2: ΔRIB,c

|  |  |  |
| --- | --- | --- |
| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| CA\_n48-n66 | n48 | 0.5 |
| n66 | 0.2 |

#### 6.x.1.5 REFSENS requirements

As can be seen in the co-existence studies in 6.x.1.3 there are 2nd harmonics issues from n66 UL into the n48 DL. This MSD exception is included in Table 7.3A.4-1 and Table 7.3A.4-2 of 38.101-1.

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

No need to specify OOB exception requirement for CA\_n48-n66 since it belongs to H-H configuration-

### 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\_n48A-n66A | 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 lists Band n48 +Band n66 2UL bands CA 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.x.2.2-1: Band n48 and Band n66 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3550 | 3700 | 1710 | 1780 |
| DL Frequency [MHz] | 3550 | 3700 | 2110 | 2200 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1990 | 1770 | 5260 | 5480 |
| 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) | 5320 | 5690 | 280 | 10 |
| 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) | 8810 | 9180 | 6970 | 7260 |
| 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) | 8870 | 9390 | 1430 | 1790 |
| 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) | 3540 | 3980 | 10520 | 10960 |
| 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) | 12360 | 12880 | 8680 | 9040 |
| 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) | 3570 | 3140 | 13090 | 12420 |
| 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) | 1760 | 2270 | 7680 | 7090 |
| 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) | 10390 | 10820 | 15910 | 16580 |
| 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) | 12230 | 12740 | 14070 | 14660 |

Based on the table above, the 5th order IMD may fall into Rx frequencies of band n66

Table 6.x.2.2-2 lists the protected bands required for the 2UL bands CA configuration. (Requirements taken from CA\_n66-n77)

**Table 6.x.2.2-2: Protected bands for the 2UL bands CA configuration**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UL NR CA Configuration** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
| CA\_n48-n66 | E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 26, 29, 30, 41, 50, 51, 66, 70, 71, 74, 85 | FDL\_low | - | FDL\_high | -50 | 1 |  |

#### 6.x.2.3 REFSENS requirements

As seen in the coexistence study the 5th IMD might fall in own Rx band why MSD is needed for 2 band UL. Values from CA\_n66A-n77A is reused due to similar frequency range.

**Table 6.x.2.3-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operating band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | Source of IMD |
| CA  Configuration | Operating band | UL Fc (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | |
| CA\_n48-n66 | n66 | 1730 | 5 | 25 | 2130 | 5.0 | | FDD | IMD5 |
|  | n48 | 3660 | 10 | 50 | 3660 | N/A | | TDD | N/A |

## 9.x DC\_n48-n66

### 9.x.1 Operating bands for DC\_n48-n66

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

|  |  |
| --- | --- |
| **NR DC Band** | **NR Band** |
| DC\_n48-n66 | n48, n66 |

### 9.x.2 Configurations for DC\_n48-n66

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

|  |  |
| --- | --- |
| **NR DC**  **configuration** | **Uplink NR DC**  **configuration** |
| DC\_n48A-n66A | DC\_n48A-n66A |
| DC\_n48(2A)-n66A | DC\_n48A-n66A |
| DC\_n48A-n66(2A) | DC\_n48A-n66A |
| DC\_n48(2A)-n66(2A) | DC\_n48A-n66A |
| DC\_n48B-n66A | DC\_n48A-n66A |
| DC\_n48B-n66(2A) | DC\_n48A-n66A |

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

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

|  |  |  |
| --- | --- | --- |
| Uplink CA Configuration | Class 3 (dBm) | Tolerance (dB) |
| DC\_n48A-n66A | 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 TP\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*