3GPP TSG-RAN WG4 Meeting # 100-e Rev. 1 of R4-2113716

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

**Title: TP to TR 38.717-02-01: Addition of CA\_n48-n70**

**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-n70 and DC\_n48A-n70A.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of TP\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

## 6.x CA\_n48-n70

### 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 n70

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 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 n70

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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-n70A |  | n48 | 5 | 10 | 15 | 20 |  | | 30 | | 40 | | 501 | | 601 | | 701 | | 801 | | 901 | 1001 | 0 |
|  |  | n70 | 5 | 10 | 15 | 201 | 251 | |  | |  | |  | |  | |  | |  | |  |  |  |
| CA\_n48A-n70A | CA\_n48A-n70A | n48 | 5 | 10 | 15 | 20 |  | | 30 | | 40 | | 501 | | 601 | | 701 | | 801 | | 901 | 1001 | 0 |
|  | n70 | 5 | 10 | 15 | 201 | 251 | |  | |  | |  | |  | |  | |  | |  |  |
| CA\_n48(2A)-n70A | CA\_n48A-n70A | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | | | | | | | 0 |
| n70 | 5 | 10 | 15 | 20 | 25 | |  | |  | |  | |  | |  | |  | |  |  |
| CA\_n48B-n70A | CA\_n48A-n70A | n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | | | | | | | 0 |
| n70 | 5 | 10 | 15 | 201 | 251 |  | |  | |  | |  | |  | |  | |  | |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | | | | | | | | |

#### 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-n70.

**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 |
| n70 | 1695 | 1710 | 1995 | 2020 | 3390 | 3420 | 5085 | 5130 | 6780 | 6840 |

**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 |
| n70 | 1695 | 1710 | 1995 | 2020 | 3990 | 4040 | 5985 | 6060 | 7980 | 8080 |

Based on above table, there is no harmonic issue for the band combination of n48 and n70.

Based on above table, there is no harmonic mixing issue for the band combination of n48 and n70.

#### 6.x.1.4 ∆TIB and ∆RIB values

For CA\_n48-n70, 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-n70 | n48 | 0.8 |
| n70 | 0.6 |

Table 6.x.4-2: ΔRIB,c

|  |  |  |
| --- | --- | --- |
| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| CA\_n48-n70 | n48 | 0.5 |
| n70 | 0.2 |

#### 6.x.1.5 REFSENS requirements

There are no specific REFSENS requirements for 1 band UL.

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

There is no OOB blocking exception for this CA band combination.

### 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-n70A | 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 n70 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.x.2.2-1: Band n48 and Band n70 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3550 | 3700 | 1695 | 1710 |
| DL Frequency [MHz] | 3550 | 3700 | 1995 | 2020 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2005 | 1840 | 5245 | 5410 |
| 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) | 5390 | 5705 | 310 | 130 |
| 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) | 8795 | 9110 | 6940 | 7120 |
| 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) | 8940 | 9405 | 1385 | 1580 |
| 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) | 3680 | 4010 | 10490 | 10820 |
| 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) | 12345 | 12810 | 8635 | 8830 |
| 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) | 3290 | 3080 | 13105 | 12490 |
| 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) | 1970 | 2315 | 7710 | 7230 |
| 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) | 10330 | 10540 | 15895 | 16510 |
| 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) | 12185 | 12530 | 14040 | 14520 |

Based on Table 6.x.2.2-1, there is 2nd and 5th order IMD issue for CA\_n48-n70

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**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UL NR CA Configuration** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
| CA\_n48-n70 | E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 66, 70, 71, 85 | FDL\_low | - | FDL\_high | -50 | 1 |  |
|  | E-UTRA Band 41 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| 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. | | | | | | | |

#### 6.x.2.3 REFSENS requirements

As seen in the coexistence study the 2nd, 4th and 5th IMD might fall in own Rx band why MSD is needed for 2 band UL. Values from CA\_n3A-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-n70 | n70 | 1697.5 | 25/15 | 25 | 1997.5 | 26 | FDD | IMD24 |
| 28.75 |
| n48 | 3695 | 10 | 50 | 3695 | N/A | TDD | N/A |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified.  NOTE 5: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured. | | | | | | | | |

## 9.x DC\_n48-n70

### 9.x.1 Operating bands for DC\_n48-n70

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

|  |  |
| --- | --- |
| **NR DC Band** | **NR Band** |
| DC\_n48-n70 | n48, n70 |

### 9.x.2 Configurations for DC\_n48-n70

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

|  |  |
| --- | --- |
| **NR DC**  **Configuration** | **Uplink NR DC**  **configuration** |
| DC\_n48A-n70A | DC\_n48A-n70A |
| DC\_n48(2A)-n70A | DC\_n48A-n70A |
| DC\_n48B-n70A | DC\_n48A-n70A |

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