**3GPP T****SG-RAN WG4 Meeting#100 Revision of R4-2112032**

**E-meeting, 16th – 27th** **August, 2021**

**Title: TP to TR 38.717-02-01: CA\_n48-n71 and DC\_n48-n71**

**Source: CableLabs, Comcast, DISH, Nokia**

**Agenda item: 8.8.2**

**Document for: Approval**

# Introduction

This is a TP into TR 38.717-02-01 to introduce CA\_n48A-n71A, CA\_n48A-n71(2A), CA\_n48(2A)-n71A, CA\_n48(2A)-n71(2A), CA\_n48(3A)-n71A, CA\_n48(4A)-n71A, CA\_n48B-n71A, CA\_n48B-n71(2A), CA\_n48C-n71A, DC\_n48A-n71A, DC\_n48A-n71(2A), DC\_n48(2A)-n71A, DC\_n48(2A)-n71(2A), DC\_n48(3A)-n71A and DC\_n48(4A)-n71A , DC\_n48B-n71A, DC\_n48B-n71(2A), DC\_n48C-n71A.

CableLabs and Comcast submitted R4-2112032 for some CA/DC combinations between bands n48 and n71. DISH Network and Nokia submitted R4-2113717 and R4-2113722 for many other CA/DC combinations between bands n48 and n71. This revision of R4-2112032 merges all these combinations into one TP.

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

## 6.X CA\_n48-n71

### 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: CA band combination of band n48 + n71

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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\_n48-n71 | n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 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 + n71

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **UL configuration** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n48A-n71A | CA\_n48A-n71A | n48 | 5 | 10 | 15 | 20 |  | 30 | 40 | 501 | 601 | 701 | 801 | 901 | 1001 | 0 |
|  |  | n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| CA\_n48A-n71A(2A) | CA\_n48A-n71A | n48 | 5 | 10 | 15 | 20 |  | 30 | 40 | 501 | 601 | 701 | 801 | 901 | 1001 | 0 |
|  |  | n71 | See CA\_n71(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n48(2A)-n71A | CA\_n48A-n71A | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| CA\_n48(2A)-n71A(2A) | CA\_n48A-n71A | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n71 | See CA\_n71(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n48(3A)-n71A | CA\_n48A-n71A | n48 | See CA\_n48(3A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | 0 |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48(4A)-n71A | CA\_n48A-n71A | n48 | See CA\_n48(4A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | 0 |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48B-n71A | CA\_n48A-n71A |  | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
|  |  | n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| CA\_n48B-n71A(2A) | CA\_n48A-n71A | n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
|  |  | n71 | See CA\_n71(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n48C-n71A | CA\_n48A-n71A | n48 | See CA\_n48C Bandwidth Combination Set 0 in Table 5.5A.1-1 in TS 38.101-1 | | | | | | | | | | | | | 0 |
|  |  | n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlink. | | | | | | | | | | | | | | | | |

#### 6.X.1.3 Co-existence studies

Table 6.X.1.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n48-n71.

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th 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** |
| **n48** | 3550 | 3700 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14200 | 14800 | 17750 | 18500 |
| **n71** | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | 2652 | 2756 | 3315 | 3490 |

Based on above table, there is no UL harmonic issue for CA\_n48-n71.

**Table 6.X.1.3-2: Impact of UL/DL Harmonic mixing**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th 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** |
| **n48** | 3550 | 3700 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14200 | 14800 | 17750 | 18500 |
| **n71** | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | 2468 | 2608 | 3085 | 3260 |

Based on above table, there is no harmonics mixing issue for CA\_n48-n71.

#### 6.X.1.4 ∆TIB and ∆RIB values

For CA\_n48-n71, the ΔTIB,c and ΔRIB values are given in the tables below.

Table 6.X.1.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n48-n71 | n48 | 0.3 |
| n71 | 0.3 |

Table 6.X.1.4-2: ΔRIB

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_n48-n71 | n48 | 0 |
| n71 | 0 |

#### 6.X.1.5 REFSENs requirements

There is no REFSENS exceptions needed.

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

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

|  |
| --- |
| CA band combination |
| CA\_n48-n71 |

### 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-n71A | 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

Table 6.X.2.2-1 gives IMD interference analysis for CA\_ n48-n71 with 2 ULs.

Table 6.X.2.2-1: Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 3550 | 3700 | 663 | 698 |
| DL frequency (MHz) | 3550 | 3700 | 617 | 652 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | **7100** | **7400** | **1326** | **1396** |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | **10650** | **11100** | **1989** | **2094** |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | **14200** | **14800** | **2652** | **2792** |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | **17750** | **18500** | **3315** | **3490** |
| Two tone 2nd order IMD products | |fy\_low - fx\_high| | |fy\_high - fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | **3037** | **2852** | **4213** | **4398** |
| 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) | **6402** | **6737** | **2374** | **2154** |
| 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) | **7763** | **8098** | **4876** | **5096** |
| Two-tone 4th order IMD products | |3\*fx\_low - fy\_high| | |3\*fx\_high - fy\_low| | |3\*fy\_low - fx\_high| | |3\*fy\_high - fx\_low| |
| IMD frequency limits (MHz) | **9952** | **10437** | **1711** | **1456** |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | **11313** | **11798** | **5539** | **5794** |
| 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) | **5704** | **6074** | **8426** | **8796** |
| 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) | **758** | **1048** | **14137** | **13502** |
| 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) | **6202** | **6492** | **14863** | **15498** |
| 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) | **5006** | **5411** | **9774** | **9254** |
| 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) | **9089** | **9494** | **11976** | **12496** |

Based on the table above:

- The are no IMD that fall into Rx frequencies of band n48.

- The are no IMD that fall into Rx frequencies of band n71.

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA and NR DC Configuration** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
| CA\_48\_n71 | E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 30, 50, 51, 53, 66, 74, 85 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 2, 25, 41, 70 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| E-UTRA Band 29 | FDL\_low | - | FDL\_high | -38 | 1 | 15 |
| E-UTRA Band 71 | FDL\_low | - | FDL\_high | -50 | 1 | 15 |
| NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA 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 180 kHz), 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.  NOTE 15: These requirements also apply for the frequency ranges that are less than FOOB (MHz) in Table 6.5.3.1-1 from the edge of the channel bandwidth. | | | | | | | |

#### 6.X.2.3 REFSENS requirements

There is no REFSENS exceptions needed.

## 9.X DC\_n48-n71

### 9.X.1 Operating bands for DC\_n48-n71

**Table 9.X.1-2: Inter-band NR DC operating bands**

|  |  |
| --- | --- |
| **NR DC Band** | **NR Band** |
| DC\_n48-n71 | n48, n71 |

### 9.X.2 Configurations for DC\_n48-n71

Table 9.X.2-2: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n48A-n71A  DC\_n48A-n71(2A)  DC\_n48(2A)-n71A  DC\_n48(2A)-n71(2A)  DC\_n48(3A)-n71A  DC\_n48(4A)-n71A  DC\_n48B-n71A  DC\_n48B-n71(2A)  DC\_n48C-n71A | DC\_n48A-n71A |

### 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-n71A | 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 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*