3GPP TSG-RAN WG4 Meeting # 97-e R4-2014876

Electronic Meeting, 2-13 Nov., 2020

Source: Verizon, LGE, Samsung, Qualcomm, Nokia, Ericsson

Title: TP for TR 37.717-02-01: CA\_n5-n48

Agenda item: 10.2.2

Document for: Approval

# **Introduction**

In RAN#89-e meeting, the revised WID “Rel-17 NR Inter-band Carrier Aggregation/Dual Connectivity for 2 bands DL with x bands UL (x=1,2)” [1] was approved. This contribution is a text proposal for TR 37.717-02-01 to include CA\_n5A\_n48A CA band combination.

# **Reference**

[1] RP-201539 [RAN 89e] 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*

# **Text Proposal**

## **6 Both bands within FR1 Carrier Aggregation: Specific Band Combination Part**

**<Start of Text Proposal>**

## 6.x CA\_n5-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 n5+n48**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **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\_n5-n48 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |

#### 6.x.1.2 Channel bandwidths per operating band for CA

**Table 6.x.1.2-1: Supported bandwidths per CA configuration of band n5+n48**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **CA operating / channel bandwidth [MHz]** | | | | | | | | | | | | | | | |
| **NR CA Configuration** | **UL CA Configuration** | **NR Band** | **SCS**  **[kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n5A-n48A | CA\_n5A-n48A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n48 | 15 | Yes5 | Yes | Yes | Yes |  |  | Yes | Yes6 |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 | Yes6 |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes6 | Yes6 |  | Yes6 | Yes6,4 | Yes6 |
| CA\_n5A-n48(2A) | CA\_n5A-n48A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  | |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_48(2A) in Table 5.5A.2-1 in 38.101-1 | | | | | | | | | | | | | |
| CA\_n5A-n48C | CA\_n5A-n48A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  | |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_n48C in Table 5.5A.1-1 in 38.101-1 | | | | | | | | | | | | | |
| 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 5th harmonics for CA\_n5A-n48A. As can be seen there are no harmonic issue.

**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** |
| n5 | 824 | 849 | 869 | 894 | 1648 | 1698 | 2472 | 2547 | 3296 | 3396 | 4120 | 4245 |
| n48 | 3550 | 3700 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14800 | 14800 | 17750 | 18500 |

Table 6.x.1.3-2 list harmonic mixing issue for the 2DL bands CA with 1 UL. As can be seen there are no harmonic mixing issues.

Table 6.x.1.3-2 Harmonic mixing for 2DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **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** | **UL Low Band Edge** | **UL High Band Edge** |
| n5 | 824 | 849 | 869 | 894 | 1738 | 1788 | 2607 | 2682 | 3476 | 3576 | 4345 | 4245 |
| n48 | 3550 | 3700 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14200 | 14800 | 17750 | 18500 |

Based on study above, there is no harmonic issue for this band combination.

#### 6.x.1.4 ∆TIB and ∆RIB values

For CA\_n5-n48, the ΔTIB,c and ΔRIB,c 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\_n5-n48 | n5 | 0.3 |
| n48 | 0.3 |

**Table 6.x.1.4-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n5-n48 | n5 | 0 |
| n48 | 0 |

#### 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.1.6 OOB blocking exception requirements

There is no OOB exception for this CA 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\_n5A-n48A | 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 lists Band n5+Band n48 2UL CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.x.2.2-1: Band n5 and Band n48 2 UL bands IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 3550 | 3700 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 10650 | 11100 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\*fy\_low | 4\*fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 14200 | 14800 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 17750 | 18500 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 2701 | 2876 | 4374 | 4549 |
| 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) | 2052 | 1852 | 6251 | 6576 |
| 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) | 5198 | 5398 | 7924 | 8249 |
| 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) | 1228 | 1003 | 9801 | 10276 |
| 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) | 6022 | 6247 | 11474 | 11949 |
| 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) | 5752 | 5402 | 8748 | 9098 |
| 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) | 13976 | 13351 | 154 | 404 |
| 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) | 15024 | 15649 | 6846 | 7096 |
| 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) | 9452 | 8952 | 4553 | 4928 |
| 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) | 12298 | 12798 | 9572 | 9947 |

Based on the table 6.x.2.2-1, there is no IMD issue for CA\_n5-n48.

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

| NR CA Configuration | Spurious emission | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Protected band | Frequency range (MHz) | | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| CA\_n5A-n48A | E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 65, 66, 70, 71, 73 | | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 41 | | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| E-UTRA Band 11, 21 | | FDL\_low | - | FDL\_high | -50 | 1 |  |
| Frequency range | | 1884.5 | - | 1915.7 | -41 | 0.3 | 8 |
| 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 RBsize 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 8: Applicable when co-existence with PHS system operating in 1884.5 - 1915.7 MHz. | | | | | | | | |

#### 6.x.2.3 REFSENs requirements

Based on above coexistence study, there is no MSD issue for the CA combination.

**<End of Text Proposal>**

## **9 2 bands Dual Connectivity: Specific Band Combination Part**

**<Start of Text Proposal>**

## **9.x DC\_n5-n48**

### 9.x.1 Operating bands for DC\_n5-n48

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

|  |  |
| --- | --- |
| **NR DC Band** | **NR Band** |
| DC\_n5-n48 | N5, n48 |

### 9.x.2 Configurations for DC\_n5-n48

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

| **NR DC**  **configuration** | **Uplink NR DC**  **configuration** |
| --- | --- |
| DC\_n5A-n48A | DC\_n5A-n48A |
| DC\_n5A-n48(2A) | DC\_n5A-n48A |
| DC\_n5A-n48C | DC\_n5A-n48A |

**<End of Text Proposal>**