3GPP TSG-RAN WG4 Meeting # 95-e R4-2006693

Electronic Meeting, 25th May – 5th June, 2020

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

Title: TP for TR 38.716-02-00: CA\_n5-n77

Agenda item: 8.2.2

Document for: Approval

# **Introduction**

In RAN#87-e meeting, the revised WID ” Rel-16 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 38.716-02-00 to include CA\_n5A-n77A CA band combination.

# **Reference**

[1] RP-200168 [RAN 87-e] Revised WID for NR CA\_DC 2 band DL with up to 2 band UL, ZTE

# **Text Proposal**

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

**<Start of Text Proposal>**

## 6.x CA\_n5-n77

### 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+n77**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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-n77 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

**Table 6.x.1.2-1: Supported NR bandwidths per CA configuration of band n5+n77**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **CA operating / channel bandwidth** | | | | | | | | | | | | | | | |
| **NR CA Configuration** | **UL CA Configuration** | **Band** | **Subcarrier spacing**  **[kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **70**  **MHz** | **80**  **MHz** | **90 MHz** | **100 MHz** | **BCS** |
| CA\_n5A-n77A | CA\_n5A-n77A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

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

Table 6.x.1.3-1 and Table 6.x.1.3-2 capture the UL 2nd, 3rd, 4th, 5th harmonics and harmonic mixing for CA\_n5A-n77A.

**Table 6.x.1.3-1: Band n5 and Band n77 UL harmonics products**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **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 |
| n77 | 3300 | 4200 | 3300 | 4200 | 6600 | 8400 | 9900 | 12600 | 13200 | 16800 | 16500 | 21000 |

**Table 6.x.1.3-2: Band n5 and Band n77 Harmonic mixing products**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **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** |
| n5 | 824 | 849 | 869 | 894 | 1738 | 1788 | 2607 | 2682 | 3476 | 3576 | 4345 | 4470 |
| n77 | 3300 | 4200 | 3300 | 4200 | 6600 | 8400 | 9900 | 12600 | 13200 | 16800 | 16500 | 21000 |

In analysis, it could be seen,

* Both 4th and 5th harmonic interferences from band n5 UL to band n77 DL is out of the US C-band frequency range
* The 4nd harmonic mixing products from band n5 to band n77 DL is out of the US C-band frequency range

Therefore, there is no MSD considering the US deployment range (3700-3980MHz) inside the n77 band.

#### 6.x.1.4 ∆TIB and ∆RIB values

For CA\_n5-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below.

**Table 6.x.1.4-1: ΔTIB,c**

| Inter-band DA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n5-n77 | n5 | 0.6 |
| n77 | 0.8 |

**Table 6.x.1.4-2: ΔRIB,c**

| Inter-band DC Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n5-n77 | n5 | 0.2 |
| n77 | 0.5 |

#### 6.x.1.5 REFSENS requirements

As there is no harmonic issue, there are no need for additional REFSENS requirements for this configuration.

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### 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 n5 +Band n77 2UL CA 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 6.x.2.1-1: Band n5 and Band n77 2 UL bands IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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) | 2451 | 3376 | 4124 | 5049 |
| 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) | 2552 | 1602 | 5751 | 7576 |
| 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) | 4948 | 5898 | 7424 | 9249 |
| 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) | 1728 | 753 | 9051 | 11776 |
| 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) | 5772 | 6747 | 10724 | 13449 |
| 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) | 6752 | 4902 | 8248 | 10098 |
| 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) | 15976 | 12351 | 96 | 904 |
| 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) | 14024 | 17649 | 6596 | 7596 |
| 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) | 10952 | 8202 | 4053 | 5928 |
| 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) | 11548 | 14298 | 9072 | 10947 |

Based on the Table 6.x.2.1-1, all of IMD products are out of the US C-band frequency range. Therefore, there is no MSD considering the US deployment range (3700-3980MHz) inside the n77 band

Table 6.x.2.1-2 lists the protected bands required for the 2UL bands CA configuration.

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA combination | Spurious emission | | | | | | |
| Protected Band | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| CA\_n5-n77 | E-UTRA Band 2, 4, 12, 13, 14, 17, 25, 26, 28, 29, 30, 65, 66, 70, 71 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 41 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 3 |
| 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 3: 15 kHz SCS is assumed when RB is mentioned in the note when channel bandwidth is less than or equal to 50 MHz, lowest SCS is assumed when channel bandwidth is larger than 50 MHz. The transmission bandwidth in terms of RB position and range is not limited to 15 kHz SCS and shall scale with SCS accordingly. | | | | | | | |

#### 6.x.2.2 REFSENs requirements

As IMD is not an issue for the band combination, there are no need for additional REFSENS requirements for this configuration.

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

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## **9.x DC\_n5-n77**

### 9.x.1 Operating bands for DC\_n5-n77

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

|  |  |
| --- | --- |
| **NR DC Band** | **NR Band** |
| DC\_n5-n77 | n5, n77 |

### 9.x.2 Configurations for DC\_n5-n77

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

| **NR DC**  **configuration** | **Uplink NR DC**  **configuration** |
| --- | --- |
| DC\_n5A-n77A | DC\_n5A-n77A |
|

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