**3GPP TSG-RAN WG4 Meeting #102-e R4-2203630**

**Online, 21st February – 3rd March, 2022**

**Source:** Vodafone

**Title:** TP for TR 37.717-21-11: DC\_28-38\_n1

**Agenda item:** 9.15.2

**Document for:** Approval

1. Introduction

This contribution is a text proposal for TR 37.717-21-11 to include DC\_28-38\_n1.

The proposed ΔTIB,c and ΔRIB values were derived from those present in 36101 for CA\_1-28-38. MSD is based on values used for DC\_1A\_n28A-n41A.

# 2. Reference

3. Text Proposal

**<Start of Text Proposal>**

## 5.x DC\_28-38\_n1

### 5.x.1 Configurations for DC

Table 5.x.1-1: Inter-band DC configurations (three bands)

| DC  configuration | Uplink configuration |
| --- | --- |
| DC\_28A-38A\_n1A | DC\_28A\_n1A  DC\_38A\_n1A |

### 5.x.2 Co-existence studies

Table 5.x.2-1 lists the Band 28A + Band n1A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.x.2-1: Band 28 and Band n1 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 703 | 748 | | 1920 | 1980 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1406 – 1496 | | | 3840 – 3960 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2109 – 2244 | | | 5760 – 5940 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1172 – 1277 | | | 2623 – 2728 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 424 – 574 | | | 3092 – 3257 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 3326 – 3476 | | | 4543 – 4708 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 653 – 798 | | | 1900 – 2000 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 129 – 324 | | | 5012 – 5237 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 2344 – 2554 | | | 5246 – 5456 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 4029 – 4224 | | | 6463 – 6688 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6932 – 7217 | | | 832 – 1072 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4264 – 4534 | | | 1596 – 1851 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 8383 – 8668 | | | 4732 – 4972 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 7166 – 7436 | | | 5949 – 6204 | | |

Based on Table 5.x.2-1,

- 2nd order harmonics may fall into Rx frequencies of bands 11, 21, 32, 45, 46, 47, 50, 51, 74, 75, 76, 91, 92, 93 and 94.

- 3rd order harmonics may fall into Rx frequencies of band 1, 4, 10, 23, 65, 66 and 77.

- 2nd order IMD may fall into Rx frequencies of bands 7, 41 and 90

- 3rd order IMD may fall into Rx frequencies of bands 31, 42, 52, 72, 73, 77, 78, 79, 87 and 88.

- 4th order IMD may fall into Rx frequencies of bands 30, 40, 41, 46, 53, 77 and 90.

- 5th order IMD may fall into Rx frequencies of bands 3, 5, 6, 8, 9, 18, 19, 26, 27, 35 and 79.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.x.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.x.2-2: 2UL Band 28 + Band n1 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD5 |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD4 |
| 2400 | - | 2494 | Yes | Asia | IMD4 |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd Harmonic, IMD4 |
| 5150 | - | 5350 | Yes | Europe | IMD4 |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | Yes | Asia | 2nd Harmonic, IMD4 |

The requirements for spurious emission band UE coexistence exist for DC\_28\_n1 in 38.101-3.

Table 5.x.2-3 lists the Band 38A + Band n1A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.x.2-3: Band 38 and Band n1 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 2570 | 2620 | | 1920 | 1980 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 5140 – 5240 | | | 3840 – 3960 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 7710 – 7860 | | | 5760 – 5940 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 590 – 700 | | | 4490 – 4600 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 3160 – 3320 | | | 1220 – 1390 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 7060 – 7220 | | | 6410 – 6580 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 2520 – 2670 | | | 1900 – 2000 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 5730 – 5940 | | | 3140 – 3370 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 1180 – 1400 | | | 8980 – 9200 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 9630 – 9840 | | | 8330 – 8560 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5060 – 5350 | | | 8300 – 8560 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 520 – 800 | | | 3750 – 4020 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 10250 – 10540 | | | 12200 – 12460 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 10900 – 11180 | | | 11550 – 11820 | | |

Based on Table 5.x.2-3,

- 2nd order harmonics may fall into Rx frequencies of bands 46 and 47.

- 3rd order harmonics may fall into Rx frequencies of band 77.

- 2nd order IMD may fall into Rx frequencies of bands 71 and 79.

- 3rd order IMD may fall into Rx frequencies of bands 52, 77 and 78.

- 4th order IMD may fall into Rx frequencies of bands 46, 47, 52, 77 and 78.

- 5th order IMD may fall into Rx frequencies of bands 12, 13, 14, 17, 20, 28, 29, 43, 44, 46, 67, 68, 71, 77, 78 and 85

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.x.2-4 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.x.2-4: 2UL Band 38 + Band n1 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd Harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | 2nd Harmonic, IMD5 |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | Yes | Asia | 2nd Harmonic, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence exist for DC\_38\_n1 in 38.101-3.

### 5.x.3 ∆TIB and ∆RIB values

Table 5.X.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_28A-38A\_n1 | 28 | 0.6 |
| 38 | 0.5 |
| n1 | 0.5 |

**Table 5.X.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_28A-38A\_n1 | 28 | 0.2 |
| 38 | 0 |
| n1 | 0 |

### 5.x.4 Reference sensitivity exceptions

The following MSD test point (based on DC\_1A\_n28A-n41A) is proposed for the band 20 IMD5 hit from 38A\_n1A uplink:Table 5.x.4-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_28A-38A\_n1A | n1 | 1975 | 5 | 25 | 2165 | N/A | N/A |
|  | 28 | 720 | 5 | 25 | 775 | 4.5 | IMD5 |
|  | 38 | 2575 | 5 | 25 | 2575 | N/A | N/A |

<End of Text Proposal>