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**Source:** Nokia, Nokia Shanghai Bell, [Bell Mobility]

**Title:** TP to TR 37.717-21-11 DC\_25-66\_n78

**Agenda Item:** 9.4.2 [DC\_R17\_2BLTE\_1BNR\_3DL2UL]

**Document for:** Approval

# Introduction

In this contribution, a text proposal to complete 3DL/2UL EN-DC configurations, DC\_25A-66A\_n78A and DC\_25A-25A-66A\_n78A, is provided.

# TP to TR 37.717-21-11

## 5.X DC\_25-66\_n78

5.X.1 Operating bands for DC

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

| DC  configuration | Uplink configuration |
| --- | --- |
| DC\_25A-66A\_n78A  DC\_25A-25A-66A\_n78A | DC\_25A\_n78A  DC\_66A\_n78A |

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

For UE coexistence study of Band 25 + Band n78, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.X.2-1.

**Table 5.X.2-1: Harmonic and IMD analysis for DC\_25\_n78**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1915 | 3300 | 3800 |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 3700 | 3830 | 6600 | 7600 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 5550 | 5745 | 9900 | 11400 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1385 | 1950 | 5150 | 5715 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 100 | 530 | 4685 | 5750 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7000 | 7630 | 8450 | 9515 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1750 | 2445 | 7985 | 9550 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8850 | 9545 | 11750 | 13315 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 3900 | 2770 | 10300 | 11430 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 13350 | 11285 | 4360 | 3600 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 15050 | 17115 | 10700 | 11460 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 7700 | 6070 | 855 | 2050 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13600 | 15230 | 12150 | 13345 |

For UE coexistence study of Band 66 + Band n78, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.X.2-2.

**Table 5.X.2-2: Harmonic and IMD analysis for DC\_66\_n78**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1780 | 3300 | 3800 |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 3420 | 3560 | 6600 | 7600 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 5130 | 5340 | 9900 | 11400 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1520 | 2090 | 5010 | 5580 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 380 | 260 | 4820 | 5890 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6720 | 7360 | 8310 | 9380 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1330 | 2040 | 8120 | 9690 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8430 | 9140 | 11610 | 13180 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 4180 | 3040 | 10020 | 11160 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 13490 | 11420 | 3820 | 3040 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 14910 | 16980 | 10140 | 10920 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 980 | 6340 | 1260 | 2470 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13320 | 14960 | 11730 | 12940 |

Based on co-existence study as presented in the table 5.X.2-1 and 5.X.2-2, own Rx impact is shown in the following.

* The 2nd harmonic of band 25 may fall into own Rx of band n78
* The 2nd, 4th and 5th order IMD generated by dual uplink of 25+n78 may fall into own Rx of band 25
* The 4th and 5th order IMD generated by dual uplink of 25+n78 may fall into own Rx of band 66
* The 4th and 5th order IMD generated by dual uplink of 25+n78 may fall into own Rx of n78
* The 2nd harmonic of band 66 may fall into own Rx of band n78
* The 2nd, 4th and 5th order IMD generated by dual uplink of 66+n78 may fall into own Rx of band 25 and 66
* The 4th and 5th order IMD generated by dual uplink of 66+n78 may fall into own Rx of band n78

### 5.X.3 ∆TIB and ∆RIB values

The same relaxation values as DC\_2-66\_n78 is used for DC\_25-66\_n78.

Table 5.X.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_25-66\_n78  DC\_25-25-66\_n78 | 25 | 0.6 |
| 66 | 0.6 |
| n78 | 0.8 |

**Table 5.X.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_25-66\_n78  DC\_25-25-66\_n78 | 25 | 0.2 |
| 66 | 0.2 |
| n78 | 0.5 |

### 5.X.4 Reference sensitivity exceptions

The IMD issues specifc to 3DL/2UL is the IMD4/5 for 25+n78 falling into band 66 and IMD2/4/5 for 66+n78 falling into band 25. This issues are similar to DC\_2-66\_n78 and the same MSD is used.

Table 5.X.4-1: MSD test points 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\_25A-66A\_n78A  DC\_25A-25A-66A\_n78A | 25 | 1880 | 5 | 25 | 1960 | M/A | N/A |
| 66 | 1760 | 5 | 25 | 2160 | 10.3 | IMD4 |
| n78 | 3480 | 10 | 50 | 3480 | N/A | N/A |
| 25 | 1885 | 5 | 25 | 1965 | M/A | N/A |
| 66 | 1775 | 5 | 25 | 2195 | 4.0 | IMD5 |
| n78 | 3925 | 5 | 25 | 3925 | N/A | N/A |
| 25 | 1880 | 5 | 25 | 1960 | 32.1 | IMD2 |
| 66 | 1740 | 5 | 25 | 2140 | N/A | N/A |
| n78 | 3700 | 10 | 50 | 3700 | N/A | N/A |
| 25 | 1880 | 5 | 25 | 1960 | 9.1 | IMD4 |
| 66 | 1770 | 5 | 25 | 2170 | N/A | N/A |
| n78 | 3350 | 10 | 50 | 3350 | N/A | N/A |
| 25 | 1880 | 5 | 25 | 1960 | 2.1 | IMD5 |
| 66 | 1760 | 5 | 25 | 2160 | N/A | N/A |
| n78 | 3620 | 10 | 50 | 3620 | N/A | N/A |