3GPP TSG-RAN4 Meeting #110 R4-2400776

Athens, GR, 26 Feb – 01 Mar, 2024

**Source:** Huawei, HiSilicon, Rogers

**Title:** TP for TR 37.718-11-21: to include DC\_7A\_n25A-n71A

**Agenda item:**  7.6.2 [DC\_R18\_xBLTE\_2BNR\_yDL2UL-Core]

**Document for:** Approval

# 1. Introduction

A text proposal for TR 37.718-11-21 to include DC\_7A\_n25A-n71A configuration as specified in WID [1].

# 2. Text Proposal

---Start of changes---

## 6.x DC\_7\_n25-n71

### 6.x.1 Operating bands for DC

Table 6.x.1-1: DC band combination of LTE 1DL/1UL + inter-band NR 2DL/1UL

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA and NR DC Band combination | E-UTRA and NR DC 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 | | |
| DC\_7\_n25-n71 | 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | TDD |

Table 6.x.1-2: Inter-band EN-DC configurations within FR1 (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration |
| --- | --- |
| DC\_7A\_n25A-n71A | DC\_7A\_n25A  DC\_7A\_n71A |

### 6.x.2 Channel bandwidths per operating band for DC

Table 6.x.2-1: Supported bandwidths per DC band combination of LTE 1DL/1UL + NR 2DL/1UL

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | |  | | **DC operating / channel bandwidth** | | | | | | | | | | | | | | | | | |
| **E-UTRA and NR DC Configuration** | | | **E-UTRA and NR Band** | | **Subcarrier spacing**  **[kHz]** | | **3**  **MHz** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25 MHz** | **30 MHz** | **35 MHz** | **40**  **MHz** | **45**  **MHz** | **50**  **MHz** | **60**  **MHz** | **70**  **MHz** | **80**  **MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth**  **[MHz]** |
| DC\_7A\_n25A-n71A | | | 7 | | 15 | |  | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 165 |
| n25 | | 15 | |  | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 453 |  |  |  |  |  |  |
| 30 | |  |  | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 453 |  |  |  |  |  |  |
| 60 | |  |  | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 453 |  |  |  |  |  |  |
| n71 | | 15 | |  | 5 | 10 | 15 | 20 | 2512 | 3012 | 3512 | 40 |  | 50 |  |  |  |  |  |
| 30 | |  |  | 10 | 15 | 20 | 2512 | 3012 | 3512 | 40 |  | 50 | 60 | 704 | 80 | 90 | 100 |

### 6.x.3 Co-existence studies

For UE coexistence study of UL DC\_7\_n25, the 2nd, 3rd, 4th, and 5th order harmonics and the 2nd, 3rd, 4th, and 5th order inter-modulation products are calculated and presented in Table 6.x.3-1.

Based on the calculation, we identify the following interference impact:

- The IMD2 of UL DC\_7\_n25 may have an impact on DL Band n71.

- The IMD5 of UL DC\_7\_n25 may have an impact on DL Band n71.

Table 6.x.3-1: The harmonic and IMD products caused by UL DC\_7\_n25

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 2620 | 2690 | 1930 | 1995 |
| 3rd Band DL | 617 | 652 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2500 | 2570 | 1850 | 1915 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 5000 | 5140 | 3700 | 3830 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7500 | 7710 | 5550 | 5745 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 10000 | 10280 | 7400 | 7660 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 12500 | 12850 | 9250 | 9575 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 720 | 585 | 4350 | 4485 |
| 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) | 3085 | 3290 | 1130 | 1330 |
| 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) | 6850 | 7055 | 6200 | 6400 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 5585 | 5860 | 2980 | 3245 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 9350 | 9625 | 8050 | 8315 |
| 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) | 1170 | 1440 | 8700 | 8970 |
| 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) | 5160 | 4830 | 8430 | 8085 |
| 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) | 745 | 410 | 4010 | 3670 |
| 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) | 9900 | 10230 | 11850 | 12195 |
| 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) | 10550 | 10885 | 11200 | 11540 |

For UE coexistence study of UL DC\_7\_n71, the 2nd, 3rd, 4th, and 5th order harmonics and the 2nd, 3rd, 4th, and 5th order inter-modulation products are calculated and presented in Table 6.x.3-2.

Based on the calculation, we identify the following interference impact:

-The 3rd order harmonic of UL Band n71 may have an impact on DL Band n25

-The 4th order harmonic of UL Band n71 may have an impact on DL Band 7

Table 6.x.3-2: The harmonic and IMD products caused by UL DC\_7\_n71

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 2620 | 2690 | 617 | 652 |
| 3rd Band DL | 1930 | 1995 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2500 | 2570 | 663 | 698 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 5000 | 5140 | 1326 | 1396 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7500 | 7710 | 1989 | 2094 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 10000 | 10280 | 2652 | 2792 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 12500 | 12850 | 3315 | 3490 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1907 | 1802 | 3163 | 3268 |
| 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) | 4302 | 4477 | 1244 | 1104 |
| 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) | 5663 | 5838 | 3826 | 3966 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 6802 | 7047 | 581 | 406 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 8163 | 8408 | 4489 | 4664 |
| 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) | 3604 | 3814 | 6326 | 6536 |
| 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) | 292 | 82 | 9617 | 9302 |
| 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) | 2906 | 3151 | 6384 | 6104 |
| 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) | 5152 | 5362 | 10663 | 10978 |
| 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) | 6989 | 7234 | 8826 | 9106 |

### 6.x.4 ∆TIB and ∆RIB values

For DC\_7\_n25-n71, ΔTIB,c and ΔRIB,c values are as follows.

Table 6.x.4-1: ΔTIB,c

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_7\_n25-n71 | 0.5 | 0.5 | 0.6 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

Table 6.x.4-2: ΔRIB,c

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_7\_n25-n71 | - | - | 0.2 |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

### 6.x.5 MSD requirements

The MSD values for UL harmonic interference of UL Band n71 on DL Band n25 and Band7 are already specified in Table 7.3B.2.3.1-1 of TS 38.101-3.

The MSD values for IMD2 of UL DC\_7\_n25 impact on DL Band n71 can reuse that of DC\_7A\_n2A-n71A. Note that the MSD test points of DC\_7A\_n2A-n71A has an error and a correct CR （R4-2400791）has been submitted this meeting.

The MSD requirements can be specified as follows:

Table 6.x.5-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands) NR or E-UTRA

| 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\_7A\_n25A-n71A | 7 | 2530 | 5 | 25 | 2650 | N/A | N/A |
| n25 | 1900 | 5 | 25 | 1980 | N/A | N/A |
| n71 | N/A | 5 | N/A | 630 | 28.7 | IMD2 |
| 7 | 2550 | 5 | 25 | 2670 | N/A | N/A |
| n25 | 1910 | 5 | 25 | 1990 | N/A | N/A |
| n71 | N/A | 10 | N/A | 645 | 5 | IMD5 |

---End of changes---

# Reference

[1] RP-233488，Rel-18 Dual Connectivity (DC) of x bands (x=1,2,3,4) LTE inter-band CA (xDL/1UL) and 2 bands NR inter-band CA (2DL/1UL)，LG Electronics，RAN#102, December 2023