**3GPP TSG-RAN WG4 Meeting # 111 R4-2409223**

**Japan, Fukuoka City, May 20 – May 24, 2024**

**Title: TP to TR 37.718-11-21: Addition of DC\_28A\_n78A-n105A**

**Source: Nokia, Spark**

**Agenda item: 6.6.2**

**Document for: Approval**

# 1 Introduction

This is a TP to TR 37.718-11-21 to add DC\_28A\_n78A-n105A as specified in WID [1]. All fallbacks have been analysed. Fallback of DC\_28A\_n105A has been submitted in same meeting as R4-2409219. The combination was previously submitted as R4-2405044 at RAN4#110bis but noted due to missing fallback DC\_28A\_n105A

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## 6.x DC\_28\_n78-n105

### 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\_28\_n78-n105 | 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

| EN-DC  Configuration | Uplink EN-DC  configuration |
| --- | --- |
| DC\_28A\_n78A-n105A | DC\_28A\_n78A |

### 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\_28A\_n78A-n105A | 28 | 15 |  | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 155 |
| n78 | 15 |  |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 |  |  |  |  |  |
| 30 |  |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| 60 |  |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| n105 | 15 |  | 5 | 10 | 15 | 20 | 253 | 303 | 353 |  |  |  |  |  |  |  |  |
| 30 |  |  | 10 | 15 | 20 | 253 | 303 | 353 |  |  |  |  |  |  |  |  |

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

For UE coexistence study of UL DC\_28\_n78, 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 IMD5 of UL DC\_28\_n78 may have an impact on DL Band n105.

Table 6.x.3-1: The harmonic and IMD products caused by UL DC\_28\_n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 758 | 803 | 3300 | 3800 |
| 3rd Band DL | 612 | 652 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 703 | 748 | 3300 | 3800 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1406 | 1496 | 6600 | 7600 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2109 | 2244 | 9900 | 11400 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 2812 | 2992 | 13200 | 15200 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 3515 | 3740 | 16500 | 19000 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2552 | 3097 | 4003 | 4548 |
| 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) | 2394 | 1804 | 5852 | 6897 |
| 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) | 4706 | 5296 | 7303 | 8348 |
| 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) | 1691 | 1056 | 9152 | 10697 |
| 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) | 6194 | 5104 | 8006 | 9096 |
| 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) | 5409 | 6044 | 10603 | 12148 |
| 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) | 14497 | 12452 | 308 | 988 |
| 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) | 9994 | 8404 | 4356 | 5491 |
| 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) | 13903 | 15948 | 6112 | 6792 |
| 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) | 11306 | 12896 | 8709 | 9844 |

### 6.x.4 ∆TIB and ∆RIB values

For DC\_28\_n78-n105, ΔTIB,c and ΔRIB,c values are as follows (from DC\_28\_n78 and CA\_n78-n105).

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\_28\_n78-n105 | 1 | 0.8 | 1 |
| 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\_28\_n78-n105 | 0.7 | 0.5 | 0.7 |
| 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 IMD5 of UL DC\_28\_n78 impact on DL Band n105 is re-used from DC\_12A-71A\_n77A.

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\_28A\_n78A-n105A | 28 | 705.5 | 5 | 25 | 760.5 | N/A | N/A |
| n78 | 3450 | 10 | 50 | 3450 | N/A | N/A |
| n105 | N/A | 5 | N/A | 628 | 3.9 | IMD5 |

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# References

[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