**3GPP TSG-RAN WG4 Meeting # 110 R4-2402102**

**Athens, Greece, February 26 – March 01, 2024**

**Title: TP to TR 37.718-03-01: Addition of CA\_n25A-n41C-n66A w. ULCA**

**Source: Nokia, T-Mobile**

**Agenda item: 7.11.2**

**Document for: Approval**

# 1 Introduction

This is a TP to TR 37.718-03-01 to include ULCA for CA\_n25-n41-n66. Sections unaffected by the ULCA configuration have been omitted from the analysis

Note this TP may be dependent on R4-2401482 and R4-2401483 also submitted for this meeting.

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## 5.x CA\_n25-n41-n66

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

Table 5.x.1.2-1: Supported bandwidths per CA band combination of band n25+n41+n66

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR CA configuration | | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n25A-n41A-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7 | | n25 | 5, 10, 15, 20 | 0 |
|  |  | | n41 | 10, 15, 20, 30, 40, 50, 60, 80, 90, 100 |  |
|  |  | | n66 | 5, 10, 15, 20, 40 |  |
|  |  | | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | | n41 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | n41 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25A-n41A-n66(2A) | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7 | | n25 | 5, 10, 15, 20 | 0 |
|  |  | | n41 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n66 | CA\_n66(2A)\_BCS1 |  |
|  |  | | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | | n41 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n66 | CA\_n66(2A)\_BCS1 |  |
|  |  | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | n41 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n66 | CA\_n66(2A) BCS 4 and 5 |  |
| CA\_n25A-n41C-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7  CA\_n41C7  CA\_n25A-n41C  CA\_n41C-n66A | | n25 | 5, 10, 15, 20 | 0 |
|  |  | | n41 | CA\_n41C\_BCS0 |  |
|  |  | | n66 | 5, 10, 15, 20, 40 |  |
|  |  | | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | | n41 | CA\_n41C\_BCS1 |  |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41C BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25A-n41(2A)-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7 | | n25 | 5, 10, 15, 20 | 0 |
|  |  | | n41 | CA\_n41(2A)\_BCS1 |  |
|  |  | | n66 | 5, 10, 15, 20, 40 |  |
|  |  | | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | | n41 | CA\_n41(2A)\_BCS1 |  |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41(2A) BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25A-n41(2A)-n66(2A) | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7 | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41(2A) BCS 4 and 5 |  |
|  |  | | n66 | CA\_n66(2A) BCS 4 and 5 |  |
| CA\_n25A-n41(3A)-n66(2A) | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41(3A) BCS 4 and 5 |  |
|  |  | | n66 | CA\_n66(2A) BCS 4 and 5 |  |
| CA\_n25A-n41(3A)-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7 | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41(3A) BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25A-n41C-n66(2A) | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7  CA\_n41C7 | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41C BCS 4 and 5 |  |
|  |  | | n66 | CA\_n66(2A) BCS 4 and 5 |  |
| CA\_n25A-n41(A-C)-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7  CA\_n41C7 | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41(A-C) BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25A-n41(A-C)-n66(2A) | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A  CA\_n41C | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41(A-C) BCS 4 and 5 |  |
|  |  | | n66 | CA\_n66(2A) BCS 4 and 5 |  |
| CA\_n25(2A)-n41A-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7 | | n25 | CA\_n25(2A)\_BCS1 | 0 |
|  |  | | n41 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n66 | 5, 10, 15, 20, 40 |  |
|  |  | | n25 | CA\_n25(2A)\_BCS1 | 1 |
|  |  | | n41 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n66 | 5, 10, 15, 20, 30, 40 |  |
|  |  | | n25 | CA\_n25(2A) BCS 4 and 5 | 4 and 5 |
|  |  | | n41 | n41 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25(2A)-n41A-n66(2A) | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A | | n25 | CA\_n25(2A)\_BCS 4 and 5 | 4 and 5 |
|  |  | | n41 | n41 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n66 | CA\_n66(2A)\_BCS 4 and 5 |  |
| CA\_n25(2A)-n41(2A)-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7 | | n25 | CA\_n25(2A) BCS 4 and 5 | 4 and 5 |
|  |  | | n41 | CA\_n41(2A) BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25(2A)-n41(3A)-n66A | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A | | n25 | CA\_n25(2A) BCS 4 and 5 | 4 and 5 |
|  |  | | n41 | CA\_n41(3A) BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25(2A)-n41(2A)-n66(2A) | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A | | n25 | CA\_n25(2A) BCS 4 and 5 | 4 and 5 |
|  |  | | n41 | CA\_n41(2A) BCS 4 and 5 |  |
|  |  | | n66 | CA\_n66(2A) BCS 4 and 5 |  |
| CA\_n25(2A)-n41C-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7  CA\_n41C7 | | n25 | CA\_n25(2A) BCS 4 and 5 | 4 and 5 |
|  |  | | n41 | CA\_n41C BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25(2A)-n41C-n66(2A) | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A  CA\_n41C | | n25 | CA\_n25(2A) BCS 4 and 5 | 4 and 5 |
|  |  | | n41 | CA\_n41C BCS 4 and 5 |  |
|  |  | | n66 | CA\_n66(2A) BCS 4 and 5 |  |
| CA\_n25(2A)-n41(A-C)-n66A | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A  CA\_n41C | | n25 | CA\_n25(2A)\_BCS 4 and 5 | 4 and 5 |
|  |  | | n41 | CA\_n41(A-C) BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |

### 5.x.2 Specific for 2 bands UL CA

#### 5.x.2.1 UE co-existence studies

Based on Table 5.x.2.1-1, 3rd order IMD from band n25 and Band n41 may also fall into Rx frequencies of band n66.

Table 5.x.2.1-1 lists Band n25A + Band n41C 2UL bands CA 1st order triple beat (IMD3) related to 2UL band 3CC (one band support intra-band ULCA) for the UE-to-UE coexistence analysis into the third receive band of Band n66, where Band n41C is the uplink band supporting two uplink carriers and Band n25 is the single uplink carrier.

**Table 5.x.2.1-1: Band n25 and Band n41 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 2496 | 2506 | 2686 | 2690 |  | 10 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 1850 | 1915 | 2680 | 2500 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 1660 | 1860 | 1905 | 2105 |  | 190 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 3087 | 3520 | 6852 | 7285 |  |  |

Based on Table 5.x.2.1-1, 1st order triple beat IMD is falling inside band n66.

Based on Table 5.x.2.1-2, 3rd order IMD from band n41 and Band n66 may also fall into Rx frequencies of band n25.

Table 5.x.2.1-2 lists Band n66A + Band n41C 2UL bands CA 1st order triple beat (IMD3) related to 2UL band 3CC (one band support intra-band ULCA) for the UE-to-UE coexistence analysis into the third receive band of Band n25, where Band n41C is the uplink band supporting two uplink carriers and Band n66 is the single uplink carrier.

**Table 5.x.2.1-2: Band n41 and Band n66 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 2496 | 2506 | 2686 | 2690 |  | 10 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 1710 | 1780 | 2680 | 2500 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 1520 | 1720 | 1770 | 1970 |  | 190 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 3222 | 3660 | 6712 | 7150 |  |  |

Based on Table 5.x.2.1-2, 1st order triple beat IMD is falling inside band n25.

#### 5.x.2.2 REFSENS requirements

Based on the triple beat analysis of the added ULCA Table 5.x.2.2-1 has been added with the additional REFSENS requirements.

Table 5.x.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n25-n41-n66 | n25 | N/A | 5 | 25 | 1950 | 15.3 | FDD | IMD3 |
|  | n41 | 2546 | 100 | 1 (RBstart=24) | 2546 | N/A | TDD | N/A |
|  |  | 2641 | 90 | 1 (RBstart=232) | 2641 |  |  |  |
|  | n66 | 1775 | 5 | 25 | 2195 | N/A | FDD | N/A |
|  | n25 | 1912.5 | 5 | 25 | 1992.5 | N/A | FDD | N/A |
|  | n41 | 2546 | 100 | 1 (RBstart=260) | 2546 | N/A | TDD | N/A |
|  |  | 2641 | 90 | 1 (RBstart=121) | 2641 |  |  |  |
|  | n66 | N/A | 5 | 25 | 1962.5 | 15.3 | FDD | IMD3 |

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