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Technical Report

3rd Generation Partnership Project;

Technical Specification Group Radio Access Network;

NR inter-band Carrier Aggregation/Dual connectivity for 3 bands DL with 2 bands UL

(Release 16)



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# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

The present document is a technical report for NR inter-band CA and DC for 3 bands DL with 2 bands UL under Rel-16 time frame. The purpose is to gather the relevant background information and studies in order to address NR inter-band CA and DC for 3 bands DL with 2 bands UL for the Rel-16 band combinations in Table 1-1 to Table 1-3

Table 1-1: Release 16 Inter-band NR CA for 3 bands DL with 2 band UL

|  |  |
| --- | --- |
| CA combination | REL independent from |
| n1-n3-n41 | Rel-15 |
| n1-n3-n78 | Rel-15 |
| n1-n7-n28 | Rel-15 |
| n3-n8-n78 | Rel-15 |
| n3-n77-n257 | Rel-15 |
| n3-n28-n77 | Rel-15 |
| n3-n78-n257 | Rel-15 |
| n3-n40-n41 | Rel-15 |
| n28-n77-n257 | Rel-15 |
| n28-n78-n257 | Rel-15 |
| n40-n41-n79 | Rel-15 |
| n66-n70-n71 | Rel-15 |
| n77-n79-n257 | Rel-15 |
| n78-n79-n257 | Rel-15 |
|  |  |

Table 1-2: Release 16 Inter-band NR DC for 3 bands DL

|  |  |
| --- | --- |
| DC combination | REL independent from |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

This TR contains a general part and band specific combination part. The actual requirements are added to the corresponding technical specifications.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[3] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[4] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**Aggregated Channel Bandwidth:** The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

**Carrier aggregation:** Aggregation of two or more component carriers in order to support wider transmission bandwidths.

**Inter-band carrier aggregation:** Carrier aggregation of component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

ΔRIB,c Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell *c*.

ΔTIB,c Allowed maximum configured output power relaxation due to support for inter-band CA

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

BS Base Station

CA Carrier Aggregation

DC Dual Connectivity

DL DownLink

FDD Frequency Division Duplex

IMD Inter-modulation

MSD Maximum Sensitivity Deduction

SCS Subcarrier spacing

TDD Time Division Duplex

UE User Equipment

UL UpLink

# 4 Background

The present document is a technical report for NR inter-band CA and DC for 3 bands DL with 32 bands UL under Rel-16 time frame. The document covers each band combination specific issues (i.e. one sub-clause defined per band combination)

The specific band combination parts are independent and therefore, the working speed also differs.

## 4.1 TR Maintenance

A single company is responsible for introducing all approved TPs in the current TR, i.e. TR editor. However, it is the responsibility of the contact person of each band combination to ensure that the TPs related to the band combination have been implemented.

# 5 inter-band Carrier Aggregation for 3 bands DL with 2 bands UL: Specific Band Combination Part

## 5.1 inter-band within FR1

### 5.1.1 CA\_n1-n3-n78

#### 5.1.1.1 Operating bands for CA

Table 5.1.1.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n78 | n1 | 1920MHz | – | 1980MHz | 2110MHz | – | 2170MHz | FDD |
| n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

#### 5.1.1.2 Channel bandwidths per operating band for CA

Table 5.1.1.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n1A-n3A-n78A | CA\_n1A-n3A  CA\_n1A-n78A  CA\_n3A-n78A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| NOTE 1: This UE channel bandwidth is optional in this release of the specification. | | | | | | | | | | | | | | | | |

#### 5.1.1.3 Co-existence studies

For UE coexistence study of Band n1 + Band n3, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.1.1.3-1

Table 5.1.1.3-1: Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1710 | 1785 | 1920 | 1980 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3570 | 3840 | 3960 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 | 5760 | 5940 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 6840 | 7140 | 7680 | 7920 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 8550 | 8925 | 9600 | 9900 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 135 | 270 | 3630 | 3765 |
| 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) | 1440 | 1650 | 2055 | 2250 |
| 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) | 5340 | 5550 | 5550 | 5745 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | 3\*fy\_low – fx\_high | 3\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 3150 | 3435 | 3975 | 4230 |
| Two-tone 4th order IMD products | 3\*fx\_low + fy\_low | 3\*fx\_high + fy\_high | 3\*fy\_low + fx\_low | 3\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 7050 | 7335 | 7470 | 7725 |
| Two-tone 4th order IMD products | 2\*fy\_low – 2\*fx\_high | 2\*fy\_high – 2\*fx\_low | 2\*fx\_low + 2\*fy\_low | 2\*fx\_high + 2\*fy\_high |
| IMD frequency limits (MHz) | 270 | 540 | 7260 | 7530 |
| Two-tone 5th order IMD products | |4\*fx\_low – fy\_high| | |4\*fx\_high – fy\_low| | 4\*fy\_low – fx\_high | 4\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 4860 | 5220 | 5895 | 6210 |
| Two-tone 5th order IMD products | 4\*fx\_low + fy\_low | 4\*fx\_high + fy\_high | 4\*fy\_low + fx\_low | 4\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 8760 | 9120 | 9390 | 9705 |
| Two-tone 5th order IMD products | |3\*fx\_low – 2\*fy\_high| | |3\*fx\_high – 2\*fy\_low| | 3\*fy\_low – 2\*fx\_high | 3\*fy\_high – 2\*fx\_low |
| IMD frequency limits (MHz) | 1170 | 1515 | 2190 | 2520 |
| 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) | 9180 | 9510 | 8970 | 9315 |

Co-existence study for UL Band n1 + Band n79 as presented in the table 5.1.1.3-1, and co-existence study for the case of UL Band n1 + Band n78 or UL Band n3 + Band n78 are quite similar as study for EN-DC with same band numbers captured in TR 37.863-02-01. The own Rx impact of the 3rd band is shown as the followings.

* 2nd, 4th order IMD generated by dual uplink of Band n1 + Band n3 may fall into own Rx of Band n78
* 2nd, 3rd and 5th order IMD generated by dual uplink of Band n1 + Band n78 may fall into own Rx of Band n3.
* 5th order IMD generated by dual uplink of Band n3 + Band n78 may fall into own Rx of Band n1.

#### 5.1.1.4 ∆TIB,c and ∆RIB,c values

For three DLs and two ULs of Band n1, n3 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 5.1.1.4-1 and table 5.1.1.4-2, respectively. The requirements are reused from that for DC\_1A\_n3A-n78A in table 6.7.4 in TR 37.716-21-21

Table 5.1.1.4-1: ΔTIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n78 | n1 | 0.6 |
| n3 | 0.6 |
| n78 | 0.8 |

Table 5.1.1.4-2: ΔRIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n78 | n1 | 0.2 |
| n3 | 0.2 |
| n78 | 0.5 |

#### 5.1.1.5 REFSENS requirements

Based on Table 5.3.5 in TR 37.716-21-21, The MSD requirements for CA\_n1-n3-n78 are shown in table Table 5.1.1.5-1.

Table 5.1.1.5-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n1A-n3A-n78A | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n3 | 1750 | 5 | 25 | 1845 | N/A | N/A |
| n78 | 3700 | 10 | 52 | 3700 | 28.4 | TDD | IMD2 |
| n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n3 | 1770 | 5 | 25 | 1865 | N/A | N/A |
| n78 | 3360 | 10 | 52 | 3360 | 11.2 | TDD | IMD4 |
| n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n3 | 1735 | 5 | 25 | 1830 | 27.9 | IMD2 |
| n78 | 3780 | 10 | 52 | 3780 | N/A | TDD | N/A |
| n1 | 1940 | 5 | 25 | 2130 | 3.5 | FDD | IMD5 |
| n3 | 1770 | 5 | 25 | 1865 | N/A | N/A |
| n78 | 3720 | 10 | 52 | 3720 | N/A | TDD | N/A |

### 5.1.2 CA\_n40-n41-n79

#### 5.1.2.1 Operating bands for CA

Table 5.1.2.1-1: CA band combination of band n40+n41+n79

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n40-n41-n791,2 | n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| NOTE 1: The frequency range below 2506 MHz for Band n41 is not used in this band combination.  NOTE 2: Applicable for frequency range above 4800 MHz for Band n79 in this band combination. | | | | | | | | |

#### 5.1.2.2 Channel bandwidths per operating band for CA

Table 5.1.2.2-1: Supported bandwidths per CA band combination of band n40+n41+n79

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n40A-n41A-n79A | CA\_n40A-n41A  CA\_n40A-n79A  CA\_n41A-n79A | n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes |  | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| CA\_n40A-n41A  CA\_n40A-n79A  CA\_n41A-n79A | n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 1 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |

#### 5.1.2.3 UE co-existence studies

Based on co-existence studies of Band n40 + Band n41, Band n40 + Band n79 and Band 41 + Band n79 captured in TR 38.716-02-00, own Rx impact of the 3rd band is the followings

* 2nd order IMD (4796 MHz – 5090 MHz) generated by 2UL of bands n40 + n41 fall into part of own band n79.

- 3rd order IMD (4210 MHz – 4704 MHz) generated by dual uplink of Band n40 + Band n41 may fall into part of own band n79. However, since this band combination will only be used in China where the frequency range above 4800 MHz for band n79 is allocated to IMT in China, there are no MSD issue

- As only inter-band carrier aggregation without simultaneous Rx/Tx between n40 and n41 is supported, there are no MSD issue for band n40 and n41 due to dual uplink operation in Band n40 + Band n79 or Band 41 + Band n79.

#### 5.1.2.4 ∆TIB and ∆RIB values

The same ΔTIB,c and ΔRIB,c values specified for 1 band UL for CA\_n40-n41-n79 are used as below.

Table 5.1.2.4-1: ΔTIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n40-n41-n79 | n40 | 0.51 |
| n41 | 0.51 |
| n79 | 0.8 |
| NOTE 1: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band 40 and 41. | | |

Table 5.1.2.4-2: ΔRIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n40-n41-n79 | n40 | 01 |
| n41 | 0.51 |
| n79 | 0.5 |
| NOTE 1: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band 40 and 41. | | |

#### 5.1.2.5 REFSENS requirements

Based on the analysis in the UE-coexistence studies, compared to its fall back mode, there is additional MSD issue due to dual uplink CA\_n40A-n41A operation falling into n79 DL of the third band for this band combination. The required MSD are shown in the following table.

**Table 5.1.2.5-1 MSD exception for 3DL/2UL NR CA configuration**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n40A-n41A-n79A | n40 | 2340 | 5 | 25 | 2340 | N/A | TDD | N/A |
| n41 | 2600 | 10 | 50 | 2600 | N/A | TDD | N/A |
| n79 | 4940 | 40 | 216 | 4940 | 30.5 | TDD | IMD2 |

### 5.1.3 CA\_n3-n8-n78

#### 5.1.3.1 Operating bands for CA

Table 5.1.3.1-1: CA band combination of band n3+n8+n78

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n8-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

#### 5.1.3.2 Channel bandwidths per operating band for CA

Table 5.1.3.2-1: Supported bandwidths per CA band combination of band n3+n8+n78

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n3A-n8A-n78A | CA\_n3A-n8A  CA\_n3A-n78A  CA\_n8A-n78A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes |  | Yes |

#### 5.1.3.3 UE co-existence studies

The harmonic issue for Band n3+Band n8 + Band n78 has already addressed in TR38.716-03-01.

Based on co-existence studies of Band n3 + Band n8, Band n3 + Band n78 and Band 8 + Band n78 captured in TR 38.716-02-00 and TR37.866-00-02, own Rx impact of the 3rd band is the followings

- 3rd and 5th order IMD generated by dual uplink of Band n3 + Band n8 may fall into part of own band n78.

- 3rd order IMD generated by dual uplink of Band n8 + Band n78 may fall into part of own band n3.

- no IMD issue due to dual uplink of Band n3 + Band n78 falling into own band n8.

#### 5.1.3.4 ∆TIB and ∆RIB values

The same ΔTIB,c and ΔRIB,c values specified for 1 band UL for CA\_n3-n8-n78 are used as below.

Table 5.1.3.4-1: ΔTIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n8-n78 | n3 | 0.6 |
| n8 | 0.6 |
| n78 | 0.8 |

Table 5.1.x.4-2: ΔRIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n8-n78 | n3 | 0.2 |
| n8 | 0.2 |
| n78 | 0.5 |

#### 5.1.3.5 REFSENS requirements

Table 5.1.3.5-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. Since Band n8 and Band n20 have similar frequency range, the IMD3 and IMD5 values due to n3+n8 falling into n78 and IMD3 value due to n8+n78 falling into n3 are derived from the similar band combination DC\_20A\_n3A-n78A in TR 37.864-41-21.

Table 5.1.3.5-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n3A-n8A-n78A | n3 | 1730 | 5 | 25 | 1825 | N/A | N/A |
| n8 | 910 | 5 | 25 | 955 | N/A | N/A |
| n78 | 3550 | 10 | 50 | 3550 | 16.1 | IMD3  |fBn3+2\*fn8| |
| CA\_n3A-n8A-n78A | n3 | 1730 | 5 | 25 | 1825 | N/A | N/A |
| n8 | 910 | 5 | 25 | 955 | N/A | N/A |
| n78 | 3370 | 10 | 50 | 3370 | 4.5 | IMD5  |3\*fBn3 -2\*fn8| |
| CA\_n3A-n8A-n78A | n8 | 910 | 5 | 25 | 955 | N/A | N/A |
| n78 | 3640 | 10 | 50 | 3640 | N/A | N/A |
| n3 | 1725 | 5 | 25 | 1820 | 15.7 | IMD3  |2\*fBn20-fn78| |

### 5.1.4 CA\_n3A\_n40A-n41A

#### 5.1.4.1 Operating bands for CA

**Table 5.1.4.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR 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** | | |
| CA\_n3A\_n40A-n41A | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

#### 5.1.4.2 Channel bandwidths per operating band for CA

Table 5.1.4.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **Uplink configuration** | **NR Band** | **SCS**  **[kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **Maximum aggregated bandwidth**  **[MHz]** |
| CA\_n3A\_n40A-n41A | CA\_n3A\_n40A  CA\_n3A\_n41A  CA\_n40A\_n41A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 210 |
| n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |

#### 5.1.4.3 Co-existence studies

The harmonic issue for Band n3+Band n40 + Band n41 has already addressed in TR38.716-03-01, where there are no hormonic interference and harmonic mixing problem for CA\_n3A\_n40A-n41A.

Based on co-existence studies of Band n3 + Band n40, Band n3 + Band n41 and Band 40 + Band n41 captured in TR 38.716-02-00, own Rx impact of the IMD5 is the followings:

* 5th order IMD (1520MHz - 2208MHz) generated by dual uplink of Band n40 + Band n41 may fall into part of own band n3.

#### 5.1.4.4 ∆TIB and ∆RIB values

For CA\_n3A\_n40A-n41A, the ΔTIB,c and ΔRIB values are given in the tables below.

**Table 5.1.4.4-1: ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3A\_n40A-n41A | n3 | 0.5 |
| n40 | 0.5 |
| n41 | 0.51 |
| 0.82 |
| NOTE 1: Applicable for the frequency range of 2515-2690 MHz.  NOTE 2: Applicable for the frequency range of 2496-2515 MHz.  NOTE 3: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band n40 and n41. | | |

**Table 5.1.4.4-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_n3A\_n40A-n41A | n3 | 0 |
| n40 | 0 |
| n41 | 01 |
| 0.52 |
| NOTE 1: Applicable for the frequency range of 2515-2690 MHz.  NOTE 2: Applicable for the frequency range of 2496-2515 MHz.  NOTE 3: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band n40 and n41. | | |

5.1.4.5 REFSENS requirements

Based on the analysis in the UE-coexistence studies, compared to its fall back mode, there is additional MSD issue due to dual uplink CA\_40A\_n41A operation falling into n3 DL of the third band for this band combination. The required MSD are shown in the following table.

**Table 5.1.4.5-1 MSD exception for 3DL/2UL NR CA configuration**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n3-40A-n41A | n3 | 1747.5 | 5 | 25 | 1842.5 | 1.0 | FDD | IMD5 |
| n40 | 2347.5 | 5 | 25 | 2347.5 | N/A | TDD | N/A |
| n41 | 2600 | 10 | 50 | 2600 | N/A | TDD | N/A |

### 5.1.5 CA\_n1A-n3A-n41A

5.1.5.1 Operating bands for CA

Table 5.1.5.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n41 | n1 | 1920MHz | – | 1980MHz | 2110MHz | – | 2170MHz | FDD |
| n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |

5.1.5.2 Channel bandwidths per operating band for CA

Table 5.1.5.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n3A-n41A | CA\_n1A-n3A  CA\_n1A-n41A  CA\_n3A-n41A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

5.1.5.3 Co-existence studies

For UE coexistence study of Band n1 + Band n3, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.1.5.3-1

Table 5.1.5.3-1: Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 1710 | 1785 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | 3420 | 3570 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 5130 | 5355 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 7680 | 7920 | 6840 | 7140 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 9600 | 9900 | 8550 | 8925 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 270 | 135 | 3630 | 3765 |
| 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) | 2055 | 2250 | 1440 | 1650 |
| 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) | 5550 | 5745 | 5340 | 5550 |
| 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) | 3975 | 4230 | 3150 | 3435 |
| 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) | 7470 | 7725 | 7050 | 7335 |
| 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) | 270 | 540 | 7260 | 7530 |
| 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) | 5220 | 4860 | 6210 | 5895 |
| 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) | 1515 | 1170 | 2520 | 2190 |
| 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) | 8760 | 9120 | 9390 | 9705 |
| 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) | 8970 | 9315 | 9180 | 9510 |

For UE coexistence study of Band n1 + Band n41, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.1.5.3-2.

Table 5.1.5.3-2 Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 2496 | 2690 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | 4992 | 5380 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 7488 | 8070 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 7680 | 7920 | 9984 | 10760 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 9600 | 9900 | 12480 | 13450 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 516 | 770 | 4416 | 4670 |
| 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) | 1150 | 1464 | 3012 | 3460 |
| 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) | 6336 | 6650 | 6912 | 7360 |
| 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) | 3070 | 3444 | 5508 | 6150 |
| 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) | 8256 | 8630 | 9408 | 10050 |
| 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) | 1540 | 1032 | 8832 | 9340 |
| 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) | 8840 | 8004 | 5424 | 4990 |
| 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) | 4230 | 3528 | 948 | 380 |
| 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) | 11904 | 12740 | 10176 | 10610 |
| 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) | 11328 | 12030 | 10752 | 11320 |

For UE coexistence study of Band n3 + Band n41, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.1.5.3-3.

Table 5.1.5.3-3 Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1710 | 1785 | 2496 | 2690 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3570 | 4992 | 5380 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 | 7488 | 8070 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 6840 | 7140 | 9984 | 10760 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 8550 | 8925 | 12480 | 13450 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 711 | 980 | 4206 | 4475 |
| 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) | 730 | 1074 | 3207 | 3670 |
| 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) | 5916 | 6260 | 6702 | 7165 |
| 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) | 2440 | 2859 | 5703 | 6360 |
| 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) | 7626 | 8045 | 9198 | 9855 |
| 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) | 1960 | 1422 | 8412 | 8950 |
| 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) | 9050 | 8199 | 4644 | 4150 |
| 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) | 4650 | 3918 | 363 | 250 |
| 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) | 11694 | 12545 | 9336 | 9830 |
| 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) | 10908 | 11640 | 10122 | 10735 |

5th order IMD generated by dual uplink of Band n1 + Band n3 may fall into own Rx of Band n41.

5.1.5.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and two ULs of Band n1, n3 and n41, the ΔTIB,c and ΔRIB,c values are shown in table 5.1.5.4-1 and table 5.1.5.4-2, respectively.

Table 5.1.5.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n41 | n1 | 0.5 |
| n3 | 0.5 |
| n41 | 0.31 |
| 0.82 |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545 - 2690 MHz.  NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496 - 2545 MHz. | | |

Table 5.1.5.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n41 | n1 | 0 |
| n3 | 0 |
| n41 | 01 |
| 0.52 |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545 – 2690 MHz.  NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496 – 2545 MHz. | | |

5.1.5.5 REFSENS requirements

MSD requirements for CA\_n1-n3-n41 with UL bands n1 and n3 are shown below. The LTE requirements of CA\_1A-3A-41A can be reused.

Table 5.1.5.5-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n1A-n3A-n41A | n1 | 1977.5 | 5 | 25 | 2167.5 | N/A | FDD | N/A |
| n3 | 1712.5 | 5 | 25 | 1807.5 | N/A | FDD | N/A |
| n41 | 2507.5 | 10 | 25 | 2507.5 | 5.0 | TDD | IMD5 |

### **5.1.6 CA\_n66-n70-n71**

#### **5.1.6.1 Operating bands for CA**

Table 5.1.6.1-1: CA band combination of band n66+n70+n71

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n66-n70-n71 | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
|  | | | | | | | | |

#### **5.1.6.2 Channel bandwidths per operating band for CA**

Table 5.1.6.2-1: Supported bandwidths per CA band combination of band n66+n70+n71

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_66A-n70A-n71A | CA\_n66A-n71A  CA\_n70A-n71A | n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_66B-n70A-n71A | CA\_n66A-n71A  CA\_n70A-n71A | n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_66(2A)-n70A-n71A | CA\_n66A-n71A  CA\_n70A-n71A | n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| NOTE 1 This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | |

#### **5.1.2.3 UE co-existence studies**

For UE coexistence study of Band n66 + Band n71, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.1.6.3-1

Table 5.1.6.3-1: Harmonic and IMD analysis for n66+n71

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1710 | 1780 | 663 | 698 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3560 | 1326 | 1396 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5340 | 1989 | 2094 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 6840 | 7120 | 2652 | 2792 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 8550 | 8900 | 3315 | 3490 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 1117 | 1012 | 2373 | 2478 |
| 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) | 2722 | 2897 | 454 | 314 |
| 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) | 4083 | 4258 | 3036 | 3176 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | 3\*fy\_low – fx\_high | 3\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 4432 | 4677 | 209 | 384 |
| Two-tone 4th order IMD products | 3\*fx\_low + fy\_low | 3\*fx\_high + fy\_high | 3\*fy\_low + fx\_low | 3\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 5793 | 6038 | 3036 | 3874 |
| Two-tone 4th order IMD products | 2\*fy\_low – 2\*fx\_high | 2\*fy\_high – 2\*fx\_low | 2\*fx\_low + 2\*fy\_low | 2\*fx\_high + 2\*fy\_high |
| IMD frequency limits (MHz) | 2234 | 2024 | 4746 | 4956 |
| Two-tone 5th order IMD products | |4\*fx\_low – fy\_high| | |4\*fx\_high – fy\_low| | 4\*fy\_low – fx\_high | 4\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 6142 | 6457 | 872 | 1082 |
| Two-tone 5th order IMD products | 4\*fx\_low + fy\_low | 4\*fx\_high + fy\_high | 4\*fy\_low + fx\_low | 4\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 7503 | 7818 | 4362 | 4572 |
| Two-tone 5th order IMD products | |3\*fx\_low – 2\*fy\_high| | |3\*fx\_high – 2\*fy\_low| | 3\*fy\_low – 2\*fx\_high | 3\*fy\_high – 2\*fx\_low |
| IMD frequency limits (MHz) | 3734 | 4014 | 1571 | 1326 |
| 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) | 5409 | 5654 | 6456 | 6736 |

Based on the table above, there are no harmonics or intermodulations falling on top of n70. Note that IMD4 between bands n66 and n71 is treated in TR38.716-02-00. Hence no additional requirements are needed.

For UE coexistence study of Band n70 + Band n71, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.1.6.3-2

Table 5.1.6.3-2: Harmonic and IMD analysis for n70+n71

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1695 | 1710 | 663 | 698 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3390 | 3420 | 1326 | 1396 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5085 | 5130 | 1989 | 2094 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 6780 | 6840 | 2652 | 2792 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 8475 | 8550 | 3315 | 3490 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 1047 | 997 | 2358 | 2408 |
| 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) | 2692 | 2757 | 384 | 299 |
| 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) | 4053 | 4118 | 3021 | 3106 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | 3\*fy\_low – fx\_high | 3\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 4387 | 4467 | 279 | 399 |
| Two-tone 4th order IMD products | 3\*fx\_low + fy\_low | 3\*fx\_high + fy\_high | 3\*fy\_low + fx\_low | 3\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 5748 | 5828 | 3021 | 3804 |
| Two-tone 4th order IMD products | 2\*fy\_low – 2\*fx\_high | 2\*fy\_high – 2\*fx\_low | 2\*fx\_low + 2\*fy\_low | 2\*fx\_high + 2\*fy\_high |
| IMD frequency limits (MHz) | 2094 | 1994 | 4716 | 4816 |
| Two-tone 5th order IMD products | |4\*fx\_low – fy\_high| | |4\*fx\_high – fy\_low| | 4\*fy\_low – fx\_high | 4\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 6082 | 6177 | 942 | 1097 |
| Two-tone 5th order IMD products | 4\*fx\_low + fy\_low | 4\*fx\_high + fy\_high | 4\*fy\_low + fx\_low | 4\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 7443 | 7538 | 4347 | 4502 |
| Two-tone 5th order IMD products | |3\*fx\_low – 2\*fy\_high| | |3\*fx\_high – 2\*fy\_low| | 3\*fy\_low – 2\*fx\_high | 3\*fy\_high – 2\*fx\_low |
| IMD frequency limits (MHz) | 3689 | 3804 | 1431 | 1296 |
| 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) | 5379 | 5514 | 6411 | 6526 |

Based on the table above, there are no harmonics or intermodulations falling on top of n66. Note that 3rd harmonic and IMD4 between bands n70 and n71 is treated in TR38.716-02-00. Hence no additional requirements are needed.

#### **5.1.6.4 ∆TIB and ∆RIB values**

The DTIB,c and DRIB,c are already defined in DL CA\_n66A-n70A-n71A in TR38.716-03-01.

#### **5.1.6.5 REFSENS requirements**

Based on the analysis in the UE-coexistence studies, compared to its fall back mode, there are no additional MSD issue due to dual uplink operation falling into DL of the third band for this band combination.

### **5.1.7 CA\_n3-n28-n77**

#### **5.1.7.1 Operating bands for CA**

Table 5.1.7.1-1: CA band combination of band n3+n28+n77

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

#### **5.1.7.2 Channel bandwidths per operating band for CA**

Table 5.1.7.2-1: Supported bandwidths per CA band combination of band n3+n28+n77

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n3A-n28A-n77A | CA\_n3A-n28A  CA\_n3A-n77A  CA\_n28A-n77A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |

#### **5.1.7.3 UE co-existence studies**

The coexistence studies of UL Band n3 + Band n28, Band n3 + Band n77 and Band n28 + Band n77 have already been captured in the constituent fallback modes in TR 38.716-02-00. According to the coexistence studies in TR 38.716-02-00, the own Rx impact of the 3rd band is shown as the followings.

* 3rd, 4th and 5th order IMD generated by dual uplink of Band n3 + Band n28 may fall into own Rx of Band n77
* 3rd and 4th order IMD generated by dual uplink of Band n28 + Band n77 may fall into own Rx of Band n3.
* 3rd order IMD generated by dual uplink of Band n3 + Band n77 may fall into own Rx of Band n28.

#### **5.1.7.4 ∆TIB and ∆RIB values**

For three DLs and two ULs of Band n3, n28 and n77, the same DTIB,c and DRIB,c values specified for 1 band UL for CA\_n3-n28-n77 are used as below.

Table 5.1.7.4-1: ΔTIB,c

|  |  |  |
| --- | --- | --- |
| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| CA\_n3-n28-n77 | n3 | 0.6 |
| n28 | 0.5 |
| n77 | 0.8 |

Table 5.1.7.4-2: ΔRIB,c

|  |  |  |
| --- | --- | --- |
| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| CA\_n3-n28-n77 | n3 | 0.2 |
| n28 | 0.2 |
| n77 | 0.5 |

#### **5.1.7.5 REFSENS requirements**

Table 5.1.7.5-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. For the exception by dual uplink of Band n28 + Band n77, the same exception value in DC\_3A-28A\_n77A is used and for the exception by dual uplink of Band n3 + Band n28 and Band n3 + Band n77, the same exception values in DC\_3A\_n28A-n77A is used.

Table 5.1.7.5-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | | |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** | |
| CA\_n3A-n28A-n77A | n3 | 1720 | 5 | 25 | 1815 | N/A | N/A | |
| n28 | 733 | 5 | 25 | 788 | N/A | N/A | |
| n77 | 4173 | 10 | 50 | 4173 | 15.9 | IMD3  |2\*fBn3+fn28| | |
| CA\_n3A-n28A-n77A | n28 | 735 | 5 | 25 | 790 | N/A | N/A | |
| n77 | 3320 | 10 | 50 | 3320 | N/A | N/A | |
| n3 | 1755 | 5 | 25 | 1850 | 17.0 | IMD3  |2\*fBn28+fnn77| | |
| CA\_n3A-n28A-n77A | n3 | 1712.5 | 5 | 25 | 1807.5 | N/A | N/A |
| n77 | 4195 | 10 | 50 | 4195 | N/A | N/A |
| n28 | 715 | 5 | 25 | 770 | 15.3 | IMD3  |2\*fBn3+fnn77| |

### **5.1.8 CA\_n1A-n7A-n28A**

#### **5.1.8.1 Operating bands for CA**

Table 5.1.8.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n7-n28 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n28 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |

#### **5.1.8.2 Channel bandwidths per operating band for CA**

Table 5.1.8.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n7A-n28A | CA\_n1A-n7A  CA\_n1A- n28A  CA\_n7A-n28A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes2 |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes2 |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| NOTE 1: This UE channel bandwidth is optional in this release of the specification.  NOTE 2: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz | | | | | | | | | | | | | | | | |

#### **5.1.8.3 UE co-existence studies**

The harmonic issue for Band n1+Band n7 + Band n28 has already been addressed in TR38.716-03-01, where there are no harmonic interference and harmonic mixing problem for CA\_n1A\_n7A-n28A.

Based on co-existence studies of Band n1 + Band n7, Band n1 + Band n28 and Band n7 + Band n28 captured in TR 38.716-02-00, own Rx impact of the IMD5 is the followings:

* 2nd order IMD generated by dual uplink of Band n1 + Band n28 may fall into part of own band n7.
* 5th order IMD generated by dual uplink of Band n1 + Band n7 may fall into part of own band n28.

#### **5.1.8.4 ∆TIB and ∆RIB values**

For three simultaneous DLs and one UL of Band n1, n7 and n28, the DTIB,c and DRIB,c  values are shown in table 5.1.8.4-1 and table 5.1.8.4-2, respectively. Values are derived from DC\_1-7\_n28.

Table 5.1.8.4-1: ΔTIB,c for 3DL aggregation

|  |  |  |
| --- | --- | --- |
| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| CA\_n1-n7-n28 | n1 | 0.5 |
| n7 | 0.6 |
| n28 | 0.6 |

Table 5.1.8.4-2: ΔRIB,c for 3DL aggregation

|  |  |  |
| --- | --- | --- |
| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| CA\_n1-n7-n28 | n1 | 0 |
| n7 | 0 |
| n28 | 0.2 |

#### **5.1.8.5 REFSENS requirements**

CA\_n1-n7-n28 need to have the same MSD requirements as DC\_1-7\_n28. Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.8.5-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n1A-n7A-n28A | n1 | 1935 | 5 | 25 | 2125 | N/A | FDD | N/A |
| n7 | 2533 | 10 | 50 | 2653 | 30.0 | FDD | IMD2 |
| n28 | 718 | 5 | 25 | 773 | N/A | FDD | N/A |
| n1 | 1935 | 5 | 25 | 2125 | N/A | FDD | N/A |
| n7 | 2510 | 10 | 50 | 2630 | N/A | FDD | N/A |
| n28 | 730 | 10 | 50 | 785 | 4.5 | FDD | IMD5 |

### **5.1.9 CA\_n1A-n7A-n78A**

#### **5.1.9.1 Operating bands for CA**

Table 5.1.9.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n7-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

#### **5.1.9.2 Channel bandwidths per operating band for CA**

Table 5.1.9.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n7A-n78A | CA\_n1A-n7A  CA\_n1A- n78A  CA\_n7A-n78A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| CA\_n1A-n7A-n78(2A) | CA\_n1A-n7A  CA\_n1A- n78A  CA\_n7A-n78A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |
| NOTE 1: This UE channel bandwidth is optional in this release of the specification.  NOTE 2: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz | | | | | | | | | | | | | | | | |

#### **5.1.9.3 UE co-existence studies**

The harmonic issue for Band n1+Band n7 + Band n78 has already been addressed in TR38.716-03-01, where there are no harmonic interference and harmonic mixing problem for CA\_n1A\_n7A-n78A.

Based on co-existence studies of Band n1 + Band n7, Band n1 + Band n78 and Band n7 + Band n78 captured in TR 38.716-02-00, own Rx impact of the IMD5 is the followings:

* 4e and 5th order IMD generated by dual uplink of Band n1 + Band n7 may fall into part of own band n78.
* 4th order IMD generated by dual uplink of Band n1 + Band n78 may fall into part of own band n7.
* 4th order IMD generated by dual uplink of Band n7 + Band n78 may fall into part of own band n1.

#### **5.1.9.4 ∆TIB and ∆RIB values**

For three simultaneous DLs and one UL of Band n1, n7 and n78, the DTIB,c and DRIB,c  values are shown in table 5.1.9.4-1 and table 5.1.9.4-2, respectively. Values are derived from DC\_1-7\_n78.

Table 5.1.9.4-1: ΔTIB,c for 3DL aggregation

|  |  |  |
| --- | --- | --- |
| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| CA\_n1-n7-n78 | n1 | 0.6 |
| n7 | 0.6 |
| n78 | 0.8 |

Table 5.1.9.4-2: ΔRIB,c for 3DL aggregation

|  |  |  |
| --- | --- | --- |
| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| CA\_n1-n7-n78 | n1 | 0.2 |
| n7 | 0.2 |
| n78 | 0.5 |

#### **5.1.9.5 REFSENS requirements**

CA\_n1-n7-n78 need to have the same MSD requirements as DC\_1-7\_n78 and DC\_1\_n7-n78. Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 7.3A.5-2: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n1A-n7A-n78A | n1 | 1977.5 | 5 | 25 | 2167.5 | N/A | FDD | N/A |
| n7 | 2507.5 | 5 | 25 | 2627.5 | 9.1 | FDD | IMD4  |fn78-3\*fB1| |
| n78 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
| n1 | 1950 | 5 | 25 | 2140 | 8.7 | FDD | IMD4  |2\*fn78-2\*fB7| |
| n7 | 2510 | 10 | 50 | 2630 | N/A | FDD | N/A |
| n78 | 3580 | 10 | 50 | 3580 | N/A | TDD | N/A |
| n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n7 | 2520 | 5 | 25 | 2640 | N/A | FDD | N/A |
| n78 | 3390 | 10 | 50 | 3390 | 10.1 | TDD | IMD4  |fB7 -3\*fB1| |

### 5.1.10 CA\_n3-n28-n78

#### 5.1.10.1 Operating bands for CA

Table 5.1.10.1-1: CA band combination of band n3+n28+n78

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

#### 5.1.10.2 Channel bandwidths per operating band for CA

Table 5.1.10.2-1: Supported bandwidths per CA band combination of band n3+n28+n78

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n3A-n28A-n78A | CA\_n3A-n28A  CA\_n3A-n78A  CA\_n28A-n78A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes |  | Yes |

#### 5.1.10.3 UE co-existence studies

The coexistence studies of UL Band n3 + Band n28, Band n3 + Band n78 and Band n28 + Band n78 have already been captured in the constituent fallback modes in TR 38.716-02-00. According to the coexistence studies in TR 38.716-02-00, the own Rx impact of the 3rd band is shown as the followings.

* 5th order IMD generated by dual uplink of Band n3 + Band n28 may fall into own Rx of Band n78
* 3rd order IMD generated by dual uplink of Band n28 + Band n78 may fall into own Rx of Band n3.

#### 5.1.10.4 ∆TIB and ∆RIB values

For three DLs and two ULs of Band n3, n28 and n78, the same ΔTIB,c and ΔRIB,c values specified for 1 band UL for CA\_n3-n28-n78 are used as below.

Table 5.1.10.4-1: ΔTIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n28-n78 | n3 | 0.5 |
| n28 | 0.3 |
| n78 | 0.8 |

Table 5.1.10.4-2: ΔRIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n28-n78 | n3 | 0 |
| n28 | 0.2 |
| n78 | 0.5 |

#### 5.1.10.5 REFSENS requirements

Table 5.110.5-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band, it could reuse the MSD value of DC\_3A-28A\_n78A.

Table 5.1.10.5-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n3A-n28A-n78A | n28 | 735 | 5 | 25 | 790 | N/A | N/A |
| n78 | 3320 | 10 | 50 | 3320 | N/A | N/A |
| n3 | 1755 | 5 | 25 | 1850 | 17.3 | IMD3  |2\*fBn28-fnn78| |
| CA\_n3A-n28A-n78A | n3 | 1750 | 5 | 25 | 1845 | N/A | N/A |
| n28 | 743 | 5 | 25 | 798 | N/A | N/A |
| n78 | 3764 | 10 | 50 | 3764 | 4.5 | IMD5  |3\*fn3 -2\*fn28| |

### 5.1.11 CA\_n5-n66-n78

#### 5.1.11.1 Operating bands for CA

Table 5.1.11.1-1: CA band combination of band n5+n66+n78

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

#### 5.1.11.2 Channel bandwidths per operating band for CA

Table 5.1.11.2-1: Supported bandwidths per CA band combination of band n5+n66+n78

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **CA operating / channel bandwidth [MHz]** | | | | | | | | | | | | | | | | |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n5A-n66A-n78A | CA\_n5A-n66A, CA\_n5A-n78A, CA\_n66A-n78A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

#### 5.1.11.3 UE co-existence studies

The harmonic and intermodulation issues have been studied for the constituent fall-back modes and the reference sensitivity exceptions have been define in TS 38.101-1.

Based on co-existence studies of Band n5 + Band n78, Band n66 + Band n78 and Band 5 + Band n66 captured in TR 38.716-02-00, own Rx impact of the 3rd band is the followings

- 3rd and 5th order IMD generated by dual uplink of Band n5 + Band n66 may fall into part of own band n78.

- 3rd order IMD generated by dual uplink of Band n5 + Band n78 may fall into part of own band n66.

- no IMD issue due to dual uplink of Band n66 + Band n78 falling into own band n5.

#### 5.1.11.4 ∆TIB and ∆RIB values

The same ΔTIB,c and ΔRIB,c values specified for 1 band UL for CA\_n3-n8-n78 are used as below.

Table 5.1.11.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n5-n66-n78 | n5 | 0.6 |
| n66 | 0.6 |
| n78 | 0.8 |

Table 5.1.11.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n5-n66-n78 | n5 | 0.5 |
| n66 | 0.2 |
| n78 | 0.5 |

#### 5.1.11.5 REFSENS requirements

Table 5.11.5-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD due to IMD3 of n5+n78 falling into n66 is reused from DC\_5A-66A\_n78A. Since Band n5 and Band n66 have similar UL frequency ranges to those of Band n8 and n3, respectively, the MSD values due to IMD3 and IMD5 of n5+n66 falling into n78 are derived from the CA\_n3-n8-n78 in TR 38.716-03-02.

Table 5.1.11.5-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n5A-n66A-n78A | n5 | 830 | 5 | 25 | 875 | N/A | N/A |
| n66 | 1720 | 5 | 25 | 2120 | N/A | N/A |
| n78 | 3380 | 10 | 50 | 3380 | 16.1 | IMD3  |fn66+2\*fn5| |
| CA\_n5A-n66A-n78A | n5 | 830 | 5 | 25 | 875 | N/A | N/A |
| n66 | 1720 | 5 | 25 | 2120 | N/A | N/A |
| n78 | 3500 | 10 | 50 | 3500 | 4.5 | IMD5  |3\*fn66 -2\*fn5| |
| CA\_n5A-n66A-n78A | n5 | 830 | 5 | 25 | 875 | N/A | N/A |
| n66 | 1720 | 5 | 25 | 2120 | 13.2 | IMD3  |2\*fn5-fn78| |
| n78 | 3780 | 10 | 50 | 3780 | N/A | N/A |

### 5.1.12 CA\_n7-n25-n66

#### 5.1.12.1 Operating bands for CA

Table 5.1.12.1-1: CA band combination of band n7+n25+n66

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

#### 5.1.12.2 Channel bandwidths per operating band for CA

Table 5.1.12.2-1: Supported bandwidths per CA band combination of band n7+n25+n66

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA operating / channel bandwidth [MHz]** | | | | | | | | | | | | | | | | |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n7A-n25A-n66A | CA\_n7A-n25A, CA\_n7A-n66A, CA\_n25A-n66A | n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |

#### 5.1.12.3 UE co-existence studies

Based on co-existence studies of Band n7 + Band n25, Band n7 + Band n66 and Band n25 + Band n66 captured in TR 38.716-02-00, there is no own Rx impact on the 3rd band.

#### 5.1.12.4 ∆TIB and ∆RIB values

For CA\_n7-n25-n66, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.1.12.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n7-n25-n66 | n7 | 0.5 |
| n25 | 0.5 |
| n66 | 0.5 |

Table 5.1.12.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n7-n25-n66 | n7 | 0.5 |
| n25 | 0.3 |
| n66 | 0.5 |

#### 5.1.12.5 REFSENS requirements

There is no additional requirement for this band combination.

### 5.1.13 CA\_n7-n66-n78

#### 5.1.13.1 Operating bands for CA

Table 5.1.13.1-1: CA band combination of band n7+n66+n78

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

#### 5.1.13.2 Channel bandwidths per operating band for CA

Table 5.1.13.2-1: Supported bandwidths per CA band combination of band n7+n66+n78

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **CA operating / channel bandwidth [MHz]** | | | | | | | | | | | | | | | | | | |
| **NR CA Configuration** | | **UL Configuration** | **NR Band** | **SCS [kHz]** | | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n7A-n66A-n78A | | CA\_n7A-n66A, CA\_n7A-n78A, CA\_n66A-n78A | n7 | 15 | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 0 |
| 30 | |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 | |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n66 | 15 | | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 | |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 | |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n78 | 15 | |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 | |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 | |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n7A-n66A-n78(2A) | | CA\_n7A-n66A, CA\_n7A-n78A, CA\_n66A-n78A | n7 | 15 | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 0 |
| 30 | |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 | |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n66 | 15 | | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 | |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 | |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n78 |  | See CA\_n78(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | |

#### 5.1.13.3 UE co-existence studies

The coexistence study for DC\_66\_n7-n78 has been presented in TR 37.716-21-21 and the coexistence study for DC\_7-66\_n78 has been included in TR 37.716-21-11. It can be seen that:

* the IMD3 product of UL CA\_n7A-n66A may fall into the Rx frequency of n78,
* the IMD4 product of UL CA\_n7A-n78A may fall into the Rx frequency of n66.

#### 5.1.13.4 ∆TIB and ∆RIB values

For CA\_n7-n66-n78 , the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.1.13.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n7-n66-n78 | n7 | 0.5 |
| n66 | 0.6 |
| n78 | 0.8 |

Table 5.1.13.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n7-n66-n78 | n7 | 0.5 |
| n66 | 0.2 |
| n78 | 0.5 |

#### 5.1.13.5 REFSENS requirements

The n78 DL is affected by the IMD3 of UL CA\_n7A-n66A and the MSD value for DC\_66\_n7-n78 in TR 37.716-21-21 is reused. Moreover, the n66 DL is affected by the IMD4 of UL CA\_n7A-n78A and the MSD value for DC\_7-66\_n78 in TR 37.716-21-11 is reused.

Table 5.1.13.5-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n7A-n66A-n78A, CA\_n7A-n66A-n78(2A) | n7 | 2560 | 5 | 25 | 2680 | N/A | N/A |
| n66 | 1730 | 5 | 25 | 2130 | N/A | N/A |
| n78 | 3390 | 10 | 50 | 3390 | 16.1 | IMD3  | 2\*fn7- fn66| |
| CA\_n7A-n66A-n78A, CA\_n7A-n66A-n78(2A) | n7 | 2550 | 5 | 25 | 2670 | N/A | N/A |
| n66 | 1750 | 5 | 25 | 2150 | 8.7 | IMD4  |2\*fn7 -2\*fn78| |
| n78 | 3625 | 10 | 50 | 3625 | N/A | N/A |

### 5.1.14 CA\_n25-n66-n78

#### 5.1.14.1 Operating bands for CA

Table 5.1.14.1-1: CA band combination of band n25+n66+n78

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

#### 5.1.14.2 Channel bandwidths per operating band for CA

Table 5.1.14.2-1: Supported bandwidths per CA band combination of band n25+n66+n78

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **CA operating / channel bandwidth [MHz]** | | | | | | | | | | | | | | | | |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n25A-n66A-n78A | CA\_n25A-n66A, CA\_n25A-n78A, CA\_n66A-n78A | n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

#### 5.1.14.3 UE co-existence studies

Based on co-existence studies of Band n25 + Band n66, Band n25 + Band n78 and Band n66 + Band n78 captured in TR 38.716-02-00, the IM2 and IM4 products of n25 and n66 UL may fall into the RX frequency of n78.

#### 5.1.14.4 ∆TIB and ∆RIB values

For CA\_n25-n66-n78 , the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.1.14.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n66-n78 | n25 | 0.6 |
| n66 | 0.6 |
| n78 | 0.8 |

Table 5.1.14.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n66-n78 | n25 | 0.2 |
| n66 | 0.2 |
| n78 | 0.5 |

#### 5.1.14.5 REFSENS requirements

Based on Table 5.1.14.3-1, there are IMD2 & IMD4 products produced by Band n25 and n66 that impact the reference sensitivity of band n78. The required MSD are shown in the following table, which is the same as the MSD for DC\_2\_n66-n78 in TR 37.716-21-21.

Table 5.1.14.5-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n25A-n66A-n78A | n25 | 1880 | 5 | 25 | 1960 | N/A | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | N/A |
| n78 | 3620 | 10 | 50 | 3620 | 29.4 | IMD2  |fn25+fn66| |
| CA\_n25A-n66A-n78A | n25 | 1880 | 5 | 25 | 1960 | N/A | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | N/A |
| n78 | 3340 | 10 | 50 | 3340 | 8.9 | IMD4  |fn25 -3\*fn66| |

### 5.1.15 CA\_n28A-n41A-n78A

#### 5.1.15.1 Operating bands for CA

Table 5.1.15.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n41-n78 | n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

#### 5.1.15.2 Channel bandwidths per operating band for CA

Table 5.1.15.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n28A-n41A-n78A | CA\_n28A-n41A  CA\_n41A-n78A  CA\_n28A-n78A | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

#### 5.1.15.3 Co-existence studies

For UE coexistence study of Band n28 + Band n41, the 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.1.15.3-1

Table 5.1.15.3-1: Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 703 | 748 | 2496 | 2690 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1406 | 1496 | 4992 | 5380 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2109 | 2244 | 7488 | 8070 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 2812 | 2992 | 9984 | 10760 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 3515 | 3740 | 12480 | 13450 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1748 | 1987 | 3199 | 3438 |
| 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) | 1284 | 1000 | 4244 | 4677 |
| 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) | 3902 | 4186 | 5695 | 6128 |
| 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) | 581 | 252 | 6740 | 7367 |
| 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) | 4605 | 4934 | 8191 | 8818 |
| 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) | 3974 | 3496 | 6398 | 6876 |
| 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) | 10057 | 9236 | 496 | 122 |
| 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) | 6664 | 5992 | 2748 | 3271 |
| 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) | 10687 | 11508 | 5308 | 5682 |
| 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) | 8894 | 9566 | 7101 | 7624 |

For UE coexistence study of Band n28 + 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 5.1.15.3-2.

Table 5.1.15.3-2 Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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 | |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 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 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 |

For UE coexistence study of Band n41 + 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 5.1.15.3-3.

Table 5.1.15.3-3 Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2496 | 2690 | 3300 | 3800 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 4992 | 5380 | 6600 | 7600 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7488 | 8070 | 9900 | 11400 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 9984 | 10760 | 13200 | 15200 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 12480 | 13450 | 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) | 610 | 1304 | 5796 | 6490 |
| 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) | 1192 | 2080 | 3910 | 5104 |
| 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) | 8292 | 9180 | 9096 | 10290 |
| 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) | 3688 | 4770 | 7210 | 8904 |
| 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) | 10788 | 11870 | 12396 | 14090 |
| 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) | 2608 | 1220 | 11592 | 12980 |
| 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) | 12704 | 10510 | 7460 | 6184 |
| 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) | 6408 | 4520 | 1470 | 112 |
| 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) | 15696 | 17890 | 13284 | 14560 |
| 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) | 14892 | 16780 | 14088 | 15670 |

2nd, 4th order IMD generated by dual uplink of Band n28 + Band n41 may fall into own Rx of Band n78.

2nd order IMD generated by dual uplink of Band n28 + Band n78 may fall into own Rx of Band n41.

2nd, 5th order IMD generated by dual uplink of Band n41 + Band n78 may fall into own Rx of Band n28.

#### 5.1.15.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and two ULs of Band n28, n41 and n78, the ΔTIB,c and ΔRIB,c values are shown in table 5.1.15.4-1 and table 5.1.15.4-2, respectively.

Table 5.1.15.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n41-n78 | n28 | 0.5 |
| n41 | 0.3 |
| n78 | 0.8 |
|  | | |

Table 5.1.15.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n41-n78 | n28 | 0.2 |
| n41 | 0 |
| n78 | 0.5 |
|  | | |

#### 5.1.15.5 REFSENS requirements

MSD requirements for CA\_n28-n41-n78 are shown below. The ENDC requirements of DC\_28A-41A\_n78A and DC\_7A\_n28A-n78A can be reused.

Table 5.1.15.5-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n28A-n41A-n78A | n28 | 738 | 5 | 25 | 793 | N/A | FDD | N/A |
| n78 | 3380 | 10 | 50 | 3380 | N/A | TDD | N/A |
| n41 | 2642 | 5 | 25 | 2642 | 29.5 | TDD | IMD2 |
| n41 | 2642 | 5 | 25 | 2642 | N/A | TDD | N/A |
| n78 | 3440 | 10 | 50 | 3440 | N/A | TDD | N/A |
| n28 | 743 | 5 | 25 | 798 | 30.8 | FDD | IMD2y |
| n41 | 2565 | 5 | 25 | 2565 | N/A | TDD | N/A |
| n28 | 745 | 5 | 25 | 800 | N/A | FDD | N/A |
| n78 | 3310 | 10 | 50 | 3310 | 29.7 | TDD | IMD2z |
| NOTE y: This band is subject to IMD5 also which MSD is not specified.  NOTE z: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.2 inter-band within FR2

### 5.2.x CA\_nX-nY-nZ

#### 5.2.x.1 Operating bands for CA

Table 5.2.x.1-1: CA band combination of band nX+nY+nZ

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| nX |  | – |  |  | – |  |  |
| nY |  | – |  |  | – |  |  |
| nZ |  | – |  |  | – |  |  |

#### 5.2.x.2 Channel bandwidths per operating band for CA

Table 5.2.x.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration / Bandwidth combination set** | | | | | | | | | |
| **NR CA configuration** | **Uplink configuration** | **NR Band** | **SCS**  **(kHz)** | **50**  **MHz** | **100**  **MHz** | **200**  **MHz** | **400**  **MHz** | **Maximum Aggregated bandwidth**  **[MHz]** | **Bandwidth combination set** |
| CA\_nXA-nYA-nZA | CA\_nXA-nYA | nX | 60 |  |  |  |  |  | 0 |
| 120 |  |  |  |  |
| nY | 60 |  |  |  |  |
| 120 |  |  |  |  |
| nZ | 60 |  |  |  |  |
| 120 |  |  |  |  |

#### 5.2.x.3 UE co-existence studies

< Edtor's note: Text will be added on whether there are IMD issues due to dual uplink operation falling into the DL of the third band. For example: for CA\_nXA-nYA-nZA with 2UL CA\_nXA-nYA, intermodulation due to Band nX and Band nY falling into Band nZ shall be verified.>

#### 5.2.x.4 ∆TIB and ∆RIB values

For CA\_nX-nY-nZ , the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.2.x.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_nX-nY-nZ | nX |  |
| nY |  |
| nZ |  |

Table 5.2.x.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_nX-nY-nZ | nX |  |
| nY |  |
| nZ |  |

#### 5.2.x.5 REFSENS requirements

< Editor's note: Text will be added on reference sensitivity exceptions if IMD issue due to dual uplink operation falling into DL of the third band are identified. >

## 5.3 inter-band between FR1 and FR2

### 5.3.1 CA\_n28-n77-n257

#### 5.3.1.1 Operating bands for CA

Table 5.3.1.1-1: CA band combination of band n28+n77+n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

#### 5.3.1.2 Channel bandwidths per operating band for CA

Table 5.3.1.2-1: Supported bandwidths per CA band combination of band n28+n77+n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **Bandwidth combination set** |
| CA\_n28A-n77A-n257A | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n77A-n257A | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n28A-n77A-n257D | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n28A-n257D  CA\_n77A-n257A  CA\_n77A-n257D | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257D in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n77A-n257G | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n77A-n257A  CA\_n77A-n257G | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n77A-n257H | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n77A-n257I | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n28A-n257I  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H  CA\_n77A-n257I | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | |

#### 5.3.1.3 UE co-existence studies

The coexistence studies of UL Band n28 + Band n77, Band n28 + Band n257 and Band n77 + Band n257 have been captured in the constituent fallback modes in TR 38.716-02-00. According to the coexistence studies in TR 38.716-02-00, there is no own Rx impact of the 3rd band for this combination.

#### 5.3.1.4 ∆TIB and ∆RIB values

For three DLs and two ULs of Band n28, n77 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 5.3.1.4-1 and table 5.3.1.4-2, respectively.

Table 5.3.1.4-1: ΔTIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n77-n257 | n28 | 0.5 |
| n77 | 0.8 |
| n257 | 0 |

Table 5.3.1.4-2: ΔRIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n77-n257 | n28 | 0.2 |
| n77 | 0.5 |
| n257 | 0 |

#### 5.3.1.5 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.2 CA\_n28-n78-n257

#### 5.3.2.1 Operating bands for CA

Table 5.3.2.1-1: CA band combination of band n28+n78+n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

#### 5.3.2.2 Channel bandwidths per operating band for CA

Table 5.3.2.2-1: Supported bandwidths per CA band combination of band n28+n78+n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **Bandwidth combination set** |
| CA\_n28A-n78A-n257A | CA\_n28A-n78A  CA\_n28A-n257A  CA\_n78A-n257A | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n28A-n78A-n257D | CA\_n28A-n78A  CA\_n28A-n257A  CA\_n28A-n257D  CA\_n78A-n257A  CA\_n78A-n257D | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257D in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n78A-n257G | CA\_n28A-n78A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n78A-n257A  CA\_n78A-n257G | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n78A-n257H | CA\_n28A-n78A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n78A-n257H | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n78A-n257I | CA\_n28A-n78A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n28A-n257I  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n78A-n257H  CA\_n78A-n257I | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | |

#### 5.3.2.3 UE co-existence studies

The coexistence studies of UL Band n28 + Band n78, Band n28 + Band n257 and Band n78 + Band n257 have been captured in the constituent fallback modes in TR 38.716-02-00. According to the coexistence studies in TR 38.716-02-00, there is no own Rx impact of the 3rd band for this combination.

#### 5.3.2.4 ∆TIB and ∆RIB values

For three DLs and two ULs of Band n28, n78 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 5.3.2.4-1 and table 5.3.2.4-2, respectively.

Table 5.3.2.4-1: ΔTIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n78-n257 | n28 | 0.5 |
| n78 | 0.8 |
| n257 | 0 |

Table 5.3.2.4-2: ΔRIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n78-n257 | n28 | 0.2 |
| n78 | 0.5 |
| n257 | 0 |

#### 5.3.2.5 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.3 CA\_n28-n77-n257

#### 5.3.3.1 Operating bands for CA

Table 5.3.3.1-1: CA band combination of band n28+n77+n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

#### 5.3.3.2 Channel bandwidths per operating band for CA

Table 5.3.3.2-1: Supported bandwidths per CA band combination of band n28+n77+n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **Bandwidth combination set** |
| CA\_n28A-n77(2A)-n257A | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n77A-n257A | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n28A-n77(2A)-n257D | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n28A-n257D  CA\_n77A-n257A  CA\_n77A-n257D | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | |
| n257 | See CA\_n257D in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n77(2A)-n257G | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n77A-n257A  CA\_n77A-n257G | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n77(2A)-n257H | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n28A-n77(2A)-n257I | CA\_n28A-n77A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n28A-n257I  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H  CA\_n77A-n257I | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

#### 5.3.3.3 UE co-existence studies

The coexistence studies of UL Band n28 + Band n77, Band n28 + Band n257 and Band n77 + Band n257 have been captured in the constituent fallback modes in TR 38.716-02-00. According to the coexistence studies in TR 38.716-02-00, there is no own Rx impact of the 3rd band for this combination.

#### 5.3.3.4 ∆TIB and ∆RIB values

For three DLs and two ULs of Band n28, n77 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 5.3.3.4-1 and table 5.3.3.4-2, respectively.

Table 5.3.3.4-1: ΔTIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n77-n257 | n28 | 0.5 |
| n77 | 0.8 |
| n257 | 0 |

Table 5.3.3.4-2: ΔRIB,c

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n77-n257 | n28 | 0.2 |
| n77 | 0.5 |
| n257 | 0 |

#### 5.3.3.5 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.4 CA\_n77-n79-n257

#### 5.3.4.1 Operating bands for CA

Table 5.3.4.1-1: CA band combination of band CA\_n77-n79-n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

#### 5.3.4.2 Channel bandwidths per operating band for CA

Table 5.3.4.2-1: Supported bandwidths per CA band combination of band CA\_n77-n79-n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25 MHz** | **30 MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **Bandwidth combination set** |
| CA\_n77-n79A-n257A | CA\_n77A-n257A  CA\_n79A-n257A | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n77-n79A-n257G | CA\_n77A-n257A CA\_n77A-n257G  CA\_n79A-n257A CA\_n79A-n257G | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n77-n79A-n257H | CA\_n77A-n257A CA\_n77A-n257G CA\_n77A-n257H CA\_n79A-n257A CA\_n79A-n257G CA\_n79A-n257H | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G and n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n77-n79A-n257I | CA\_n77A-n257A CA\_n77A-n257G CA\_n77A-n257H CA\_n77A-n257I CA\_n79A-n257A CA\_n79A-n257G CA\_n79A-n257H CA\_n79A-n257I | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G, n257H, and n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

#### 5.3.4.3 UE co-existence studies

Co-existence studies can be omitted because harmonic interference from n77 to n79 and from n79 to n77 have been already studied for NR CA n77-n79 as described in TR 37.865-01-01, and interference between FR1 bands and FR2 band are negligible.

#### 5.3.4.4 ∆TIB and ∆RIB values

For three simultaneous DLs and one UL of Band n77, n79 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 5.3.4.4-1 and table 5.3.4.4-2, respectively. The ΔTIB,c and ΔRIB,c  values are derived from TR 37.865-01-01.

Table 5.3.4.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n77-n79-n257 | n77 | 0 |
| n79 | 0 |
| n257 | 0 |

Table 5.3.4.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n78-n79-n257 | n77 | 0 |
| n79 | 0 |
| n257 | 0 |

#### 5.3.4.5 REFSENS requirements

MSD studies can be omitted because harmonic interference from n77 to n79 and from n79 to n77 have been already studied for NR CA n77-n79 as described in TR 37.865-01-01, and interference between FR1 bands and FR2 band are negligible.

### 5.3.5 CA\_n78-n79-n257

#### 5.3.5.1 Operating bands for CA

Table 5.3.5.1-1: CA band combination of band CA\_n78-n79-n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

#### 5.3.5.2 Channel bandwidths per operating band for CA

Table 5.3.5.2-1: Supported bandwidths per CA band combination of band CA\_n78-n79-n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25 MHz** | **30 MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **Bandwidth combination set** |
| CA\_n78-n79A-n257A | CA\_n78A-n257A  CA\_n79A-n257A | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n78-n79A-n257G | CA\_n78A-n257A CA\_n78A-n257G  CA\_n79A-n257A CA\_n79A-n257G | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n78-n79A-n257H | CA\_n78A-n257A CA\_n78A-n257G CA\_n78A-n257H CA\_n79A-n257A CA\_n79A-n257G CA\_n79A-n257H | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G and n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n78-n79A-n257I | CA\_n78A-n257A CA\_n78A-n257G CA\_n78A-n257H CA\_n78A-n257I CA\_n79A-n257A CA\_n79A-n257G CA\_n79A-n257H CA\_n79A-n257I | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G, n257H, and n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

#### 5.3.5.3 UE co-existence studies

Co-existence studies can be omitted because harmonic interference from n78 to n79 and from n79 to n78 have been already studied for NR CA n78-n79 as described in TR 37.865-01-01, and interference between FR1 bands and FR2 band are negligible.

#### 5.3.5.4 ∆TIB and ∆RIB values

For three simultaneous DLs and one UL of Band n78, n79 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 6.x.4-1 and table 6.x.4-2, respectively. The ΔTIB,c and ΔRIB,c  values are derived from TR 37.865-01-01.

Table 6.x.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n78-n79-n257 | n78 | 0.5 |
| n79 | 0.5 |
| n257 | 0 |

Table 6.x.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n78-n79-n257 | n78 | 0 |
| n79 | 0 |
| n257 | 0 |

#### 5.3.5.5 REFSENS requirements

MSD studies can be omitted because harmonic interference from n78 to n79 and from n79 to n78 have been already studied for NR CA n78-n79 as described in TR 37.865-01-01, and interference between FR1 bands and FR2 band are negligible.

### 5.3.6 CA\_n3-n78-n257

#### 5.3.6.1 Operating bands for CA

Table 5.3.6.1-1: CA band combination of band n3+n78+n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

#### 5.3.6.2 Channel bandwidths per operating band for CA

Table 5.3.6.2-1: Supported bandwidths per CA band combination of band n3+n78+n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | NR Uplink CA configuration | NR Band | SCS  (kHz) | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40  MHz | 50  MHz | 60  MHz | 80  MHz | 90  MHz | 100 MHz | 200 MHz | 400 MHz | Bandwidth combination set |
| CA\_n3A-n78A-n257A | CA\_n3A-n78A  CA\_n3A-n257A  CA\_n78A-n257A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n3A-n78A-n257D | CA\_n3A-n78A  CA\_n3A-n257A  CA\_n3A-n257D  CA\_n78A-n257A  CA\_n78A-n257D | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257D in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n78A-n257G | CA\_n3A-n78A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n78A-n257A  CA\_n78A-n257G | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n78A-n257H | CA\_n3A-n78A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n78A-n257H | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n78A-n257I | CA\_n3A-n78A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n3A-n257I  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n78A-n257H  CA\_n78A-n257I | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

#### 5.3.6.3 UE co-existence studies

The coexistence studies of UL Band n3 + Band n78, Band n3 + Band n257 and Band n78 + Band n257 have been captured in the constituent fallback modes in TR 38.716-02-00. According to the coexistence studies in TR 38.716-02-00, there is no own Rx impact of the 3rd band for this combination.

#### 5.3.6.4 ∆TIB and ∆RIB values

For three DLs and two ULs of Band n3, n78 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 5.3.6.4-1 and table 5.3.6.4-2, respectively.

Table 5.3.6.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n78-n257 | n3 | 0.6 |
| n78 | 0.8 |
| n257 | 0 |

Table 5.3.6.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n78-n257 | n3 | 0.2 |
| n78 | 0.5 |
| n257 | 0 |

#### 5.3.6.5 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.7 CA\_n3-n77-n257

#### 5.3.7.1 Operating bands for CA

Table 5.3.7.1-1: CA band combination of band n3+n77+n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

#### 5.3.7.2 Channel bandwidths per operating band for CA

Table 5.3.7.2-1: Supported bandwidths per CA band combination of band n3+n77+n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | NR Uplink CA configuration | NR Band | SCS  (kHz) | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40  MHz | 50  MHz | 60  MHz | 80  MHz | 90  MHz | 100 MHz | 200 MHz | 400 MHz | Bandwidth combination set |
| CA\_n3A-n77(2A)-n257A | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n77A-n257A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 0 | | | | | | | | | | | | | | |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n3A-n77(2A)-n257D | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n3A-n257D  CA\_n77A-n257A  CA\_n77A-n257D | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 0 | | | | | | | | | | | | | | |
| n257 | See CA\_n257D in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n77(2A)-n257G | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n3A-n257D  CA\_n3A-n257G  CA\_n77A-n257A  CA\_n77A-n257G | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 0 | | | | | | | | | | | | | | |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n77(2A)-n257H | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 0 | | | | | | | | | | | | | | |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n77(2A)-n257I | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n3A-n257I  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H  CA\_n77A-n257I | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 0 | | | | | | | | | | | | | | |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

#### 5.3.7.3 UE co-existence studies

The coexistence studies of UL Band n3 + Band n77, Band n3 + Band n257 and Band n77 + Band n257 have been captured in the constituent fallback modes in TR 38.716-02-00. According to the coexistence studies in TR 38.716-02-00, there is no own Rx impact of the 3rd band for this combination.

#### 5.3.7.4 ∆TIB and ∆RIB values

For three DLs and two ULs of Band n3, n77 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 5.3.7.4-1 and table 5.3.7.4-2, respectively.

Table 5.3.7.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n77-n257 | n3 | 0.6 |
| n77 | 0.8 |
| n257 | 0 |

Table 5.3.7.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n77-n257 | n3 | 0.2 |
| n77 | 0.5 |
| n257 | 0 |

#### 5.3.7.5 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.8 CA\_n3-n77-n257

#### 5.3.8.1 Operating bands for CA

Table 5.3.8.1-1: CA band combination of band n3+n77+n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR 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 | | |
| n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

#### 5.3.8.2 Channel bandwidths per operating band for CA

Table 5.3.8.2-1: Supported bandwidths per CA band combination of band n3+n77+n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | NR Uplink CA configuration | NR Band | SCS  (kHz) | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40  MHz | 50  MHz | 60  MHz | 80  MHz | 90  MHz | 100 MHz | 200 MHz | 400 MHz | Bandwidth combination set |
| CA\_n3A-n77A-n257A | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n77A-n257A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n3A-n77A-n257D | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n3A-n257D  CA\_n77A-n257A  CA\_n77A-n257D | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257D in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n77A-n257G | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n77A-n257A  CA\_n77A-n257G | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n77A-n257H | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n77A-n257I | CA\_n3A-n77A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n3A-n257I  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H  CA\_n77A-n257I | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

#### 5.3.8.3 UE co-existence studies

The coexistence studies of UL Band n3 + Band n77, Band n3 + Band n257 and Band n77 + Band n257 have been captured in the constituent fallback modes in TR 38.716-02-00. According to the coexistence studies in TR 38.716-02-00, there is no own Rx impact of the 3rd band for this combination.

#### 5.3.8.4 ∆TIB and ∆RIB values

For three DLs and two ULs of Band n3, n77 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 5.3.8.4-1 and table 5.3.8.4-2, respectively.

Table 5.3.8.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n77-n257 | n3 | 0.6 |
| n77 | 0.8 |
| n257 | 0 |

Table 5.3.8.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n77-n257 | n3 | 0.2 |
| n77 | 0.5 |
| n257 | 0 |

#### 5.3.8.5 REFSENS requirements

There is no additional REFSENS requirement for this combination.

# 6 2 bands Dual Connectivity with 3 bands DL: Specific Band Combination Part

## 6.X DC\_nX-nY-nZ

< Edtor's note: Text will be added. >

Annex A:  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2019-04 | RAN4#90bis | R4-1903829 |  |  |  | TR skeleton | 0.0.1 |
| 2019-08 | RAN4#92 | R4-1909516 |  |  |  | Implemented TP´s from RAN4 #91:  R4-1906107 TP for TR 38.716-03-02: CA\_n1A-n3A-n78A with 2UL, China Telecom,  R4-1905624 TP for TR38.716-03-02:2 bands UL for CA\_40A-n41A-n79A, ZTE Corporation | V0.1.0 |
| 2019-10 | RAN4#92bis | R4-1910834 |  |  |  | Implemented TP´s from RAN4 #92:  R4-1908271 TP for TR 38.716-03-02: CA\_n28A-n77A-n257, KDDI  R4-1908273 TP for TR 38.716-03-02: CA\_n28A-n78A-n257,KDDI  R4-1908567 TP for TR38.716-03-02 2 bands UL for CA\_n3-n8-n78, ZTE Corporation | V0.2.0 |
| 2019-11 | RAN4#93 | [R4-1913238](file:///D:\RAN4\TSGRAN4_93\Docs\R4-1913238.zip) |  |  |  | Implemented TP´s from RAN4 #92bis:  [R4-1911248](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911248.zip) TP for TR38.716-03-02\_ CA\_n3A\_n40A-n41A, ZTE Corporation  [R4-1912577](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1912577.zip) TP for TR 38.716-03-02 CA\_n28A-n77(2A)-n257, KDDI  [R4-1911710](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911710.zip) TP for CA\_n77-n79-n257 for TR 38.716-03-02,NTT DOCOMO, INC.  [R4-1911712](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911712.zip) TP for CA\_n78-n79-n257 for TR 38.716-03-02,NTT DOCOMO, INC. | V0.3.0 |
| 2020-02 | RAN4#94-e | R4-2000804 |  |  |  | Implemented TP´s from RAN4 #93:  [R4-1915684](file:///D:\RAN4\TSGRAN4_93\Docs\R4-1915684.zip), TP for TR 38.716-03-02 CA\_n3A-n78A-n257, KDDI  [R4-1915685](file:///D:\RAN4\TSGRAN4_93\Docs\R4-1915685.zip), TP for TR 38.716-03-02 CA\_n3A-n77(2A)-n257, KDDI  [R4-1915686](file:///D:\RAN4\TSGRAN4_93\Docs\R4-1915686.zip), TP for TR 38.716-03-02 CA\_n3A-n77A-n257, KDDI  [R4-1915687](file:///D:\RAN4\TSGRAN4_93\Docs\R4-1915687.zip), TP for TR 38.716-03-02: CA\_n1A-n3A-n41A with two UL bands,Huawei, HiSilicon | V0.4.0 |
| 2020-04 | RAN4#94bis-e |  |  |  |  | Implemented TP´s from RAN4 #94-e:   1. R4-2002669, TP for TR38.716-03-02: UL CA Requirements for CA\_n66A-n70A-n71A, CA\_n66B-n70A-n71A, and CA\_n66(2A)-n70A-n71A, Dish Network 2. [R4-2000475](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000475.zip), TP for TR38.716-03-02: updated the MSD value for CA\_n3-n40A-n41A,ZTE Corporation 3. [R4-2000476](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_94_e/Docs/R4-2000475.zip), TP for TR38.716-03-02: updated the MSD value for CA\_n40A-n41A-n79A, ZTE Corporation 4. R4-2002670, TP for TR 38.716-03-02: CA\_n3-n28-n77, SoftBank Corp. 5. R4-2002671, TP for TR 38.716-03-02 to include CA\_n1-n7-n28, Ericsson, BT plc 6. R4-2001523, TP for TR 38.716-03-02: CA\_n1-n7-n78, Ericsson, BT plc | V0.5.0 |
| 2020-05 | RAN4#95 |  |  |  |  | Implemented TP´s from RAN4 #94-e-Bis:  1, R4-2005080 TP for TR 38.716-03-02: CA\_n3A-n28A-n78A, Samsung, KDDI  2, R4-2003460 TP update for TR 38.716-03-02: CA\_n3-n28-n77,  SoftBank Corp. | V0.6.0 |
| 2020-06 | RAN4#95 | R4-2006873 |  |  |  | Implemented TP´s from RAN4-95-e:  1, R4-2008372 TP to TR 38.716-03-02 for CA\_n7-n25-n66, Huawei, HiSilicon, Bell Mobility, Telus  2, R4-2008373 TP to TR 38.716-03-02 for CA\_n7-n66-n78, Huawei, HiSilicon, Bell Mobility, Telus  3, R4-2008374 TP to TR 38.716-03-02 for CA\_n25-n66-n78, Huawei, HiSilicon, Bell Mobility, Telus  4, R4-2006610 TP to TR 38.716-03-02 for CA\_n5-n66-n78, Huawei, HiSilicon, Bell Mobility, Telus  5, R4-2006929 TP for TR 38.716-03-02 CA\_n1A-n3A-n78A with 2UL, China Telecom  6, R4-2008375 TP for TR 38.716-03-02: CA\_n28A-n41A-n78A with two UL bands, Huawei, HiSilicon,Etisalat  7, R4-2006068 Correction to n29-n66-n70 CA combination, Dish Network | V0.7.0 |
| 2020-06 | RAN#88 | RP-200675 |  |  |  | v1.0.0 submitted for plenary approval | V1.0.0a |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-06 | RAN#88 |  |  |  |  | Approved by plenary – Rel-16 spec under change control | 16.0.0 |