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| 3GPP TR 38.719-03-01 V0.6.0 (2025-05) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Network;  Rel-19 NR Inter-band CA/DC configurations including inter band CA for 3 different bands DL with x different bands UL (x=1,2)  (Release 19) | |
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# Foreword

This Technical Report 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.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document is a technical report for power class 3 NR inter-band CA and DC configurations including inter-band CA for 3 different bands DL with x different bands UL (x=1,2) under Rel-19 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 up to 2 bands UL for the Rel-19 band combinations.

This TR contains the RF requirements of 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 of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in 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 TR 21.905 [1].

**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 operation, inter-band NR-DC operation and due to support for SUL operations, for serving cell *c*

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 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 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

## 4.1 Introduction

The present document is a technical report for NR inter-band CA and DC configurations including inter-band CA for 3 different bands DL with x different bands UL (x=1,2) under Rel-19 time frame. The document covers the RF requirements for each band combination specific issues (i.e. one sub-clause defined per band combination) including:

- Common issues for both 1 band UL and 2 bands UL NR CA, including ∆TIB and ∆RIB requirements.

- 2 bands UL NR CA specific issues, including MSD caused by IMD issue, etc.

It shall be noted that no new issue for inter-band NR DC combination, and the 2 bands UL NR CA specific issues shall be re-used.

## 4.2 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.

*Editor's note: It is not recommended to bring TP to TR* *for the following cases:*

*- NR CA configurations with additional BCS other than BCS0 (such as BCS1) if there is no additional technical issue.*

*- High order DL NR CA configurations, such as DL NR CA configuration CA\_nXA-nYA-nZC*

# 5 Three bands within FR1 Carrier Aggregation: Specific Band Combination Part

## 5.0 CA\_nX-nY-nZ

### 5.0.1 Common for 1 band UL and 2 bands UL CA

#### 5.0.1.1 Operating bands for CA

*Editor's note: For band definition, relevant rows can be copied directly from Table 5.2-1 in 38.101-1 to Table 5.x.1.1-1 below.*

Table 5.0.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | xxxx MHz – xxxx MHz | xxxx MHz – xxxx MHz | XXX |
| nY | xxxx MHz – xxxx MHz | xxxx MHz – xxxx MHz | XXX |
| nZ | xxxx MHz – xxxx MHz | xxxx MHz – xxxx MHz | XXX |

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

Table 5.0.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_nXA-nYA-nZA | CA\_nXA-nYA | nX | Channel BWs | X |
|  | CA\_nXA-nZA | nY | Channel BWs |  |
|  | CA\_nYA-nZA | nZ | Channel BWs |  |
| CA\_nXA/B/C/(2A)-nYA/B/C/(2A)- nZA/B/C/(2A) | CA\_nXA/B/C-nYA  CA\_nXA/B/C-nZA  CA\_nYA/B/C-nZA | nX | Channel BW or CA BCS | X |
|  |  | nY | Channel BW or CA BCS |  |
|  |  | nZ | Channel BW or CA BCS |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.0.1.3 ∆TIB,c and ∆RIB,c values

*Editor’s note: For the table of ∆TIB,c and ∆RIB,c values, please use the same table format as in the latest TS 38.101-1.*

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

Table 5.0.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_nx-ny-nz |  |  |  |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.0.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_nx-ny-nz |  |  |  |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.0.2 Specific for 2 bands UL CA

#### 5.0.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.0.2.1.1 Co-existence studies for 2UL band with 1CC per band

*Editor’s Note: Since the IMD tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.0.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_nXA-nYA-nZA with UL CA\_nXA-nYA.

Table 5.0.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | – | | – | |
| 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) | – | | – | |
| 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) | – | | – | |
| 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) | – | | – | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | – | |
| 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) | – | | – | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | – | |
| 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) | – | | – | |
| 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) | – | | – | |
| 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) | – | | – | |
| 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) | – | | – | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

##### 5.0.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

*Editor’s Note: Since the triple beat tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.0.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band nZ interference analysis for CA\_nXA/B/C-nYA/B/C with nX/YB/C transmitting with a XXX MHz maximum instantaneous bandwidth.

Table 5.0.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (nX, nY)** | – | | – | |
| **fDL (nZ)** | – | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| – | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | – | | – | |
| **Analysis** | *Editor’s Note: The analysis conclusion for the two UL band with intra-band UL CA triple beat shall be included here, even if no issues are identified.* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.0.2.2 REFSENS requirements

*Editor's note 1: Text can be added if IMD due to 2 bands UL with 2 UL carriers or triple beat due to 2 bands UL with 3 UL carriers issues are identified in Table 5.0.2.1.1-1 and Table 5.0.2.1.2-1, respectively.*

*Editor's note 2:* *Proponent are encouraged to provide the detailed technical analysis of the MSD requirements. For example: RF architecture, RF components parameter, and etc. In the case where the proponent is missing some elements to calculate the REFSENS exception cases, the TP can be submitted to the “not for block approval” AI for expert support.*

## 5.1 CA\_n28-n41-n79

### 5.1.1 Common for 1 band UL and 2 bands UL CA

#### 5.1.1.1 Operating bands for CA

Table 5.1.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 703 MHz – 748 MHz | 703 MHz – 748MHz | FDD |
| n41 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.1.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration  or single uplink carrier6 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n28A-n41A-n79C | CA\_n79C  CA\_n28A-n41A  CA\_n28A-n79A  CA\_n28A-n79C  CA\_n41A-n79A  CA\_n41A-n79C | n28 | n28 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | n41 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | CA\_n79C\_BCS 4 and 5 |  |
| CA\_n28A-n41C-n79A | CA\_n41C  CA\_n28A-n41A  CA\_n28A-n79A  CA\_n41A-n79A | n28 | n28 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | CA\_n41C\_BCS 4 and 5 |  |
|  |  | n79 | n41 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n28A-n41C-n79C | CA\_n41C  CA\_n79C  CA\_n28A-n41A  CA\_n28A-n79A  CA\_n28A-n79C  CA\_n41A-n79A | n28 | n28 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | CA\_n41C\_BCS 4 and 5 |  |
|  |  | n79 | CA\_n79C\_BCS 4 and 5 |  |

#### 5.1.1.3 ∆TIB,c and ∆RIB,c values

∆TIB,c and ∆RIB,c values have already been defined in the current spec.

### 5.1.2 Specific for 2 bands UL CA

#### 5.1.2.1 UE co-existence studies

The co-existence studies of fallback configurations of 2UL band with one CC per band can be applied.

##### 5.1.2.1.1 Co-existence studies for 2UL band with 1CC per band

For CA\_n28A-n41A/C-n79A/C, the two UL bands with one CC per band IMD interference analysis have already been analysed in the fallback.

##### 5.1.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.1.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n41 interference analysis for CA\_n28A-n79C with n79C transmitting with a 200MHz maximum instantaneous bandwidth.

Table 5.1.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n79C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL(n28, n79)** | 703 -- 748 | | 4400 -- 5000 | |
| **fDL(n41)** | 2496 -- 2690 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -- 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+ max2CCBW |
| **IMD3 (MHz)** | 503 -- 703 | | 748 -- 948 | |
| **Analysis** | There are no triple beat products caused by UL CA\_n28A-n79C falls into band n41. | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.1.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n28 interference analysis for CA\_n41A-n79C with n79C transmitting with a 200MHz maximum instantaneous bandwidth.

Table 5.1.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n79C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL(n41, n79)** | 2496 -- 2690 | | 4400 -- 5000 | |
| **fDL(n28)** | 758 -- 803 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -- 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+ max2CCBW |
| **IMD3 (MHz)** | 2296 -- 2496 | | 2690 -- 2890 | |
| **Analysis** | There are no triple beat products caused by UL CA\_n41A-n79C falls into band n28. | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.1.2.2 REFSENS requirements

There is no need to define additional REFSEN requirements (i.e. MSD) for CA\_n28A-n41A/C-n79C due to there are no additional triple beat co-existence issue.

## 5.2 CA\_n8-n20-n75

### 5.2.1 Common for 1 band UL and 2 bands UL CA

#### 5.2.1.1 Operating bands for CA

Table 5.2.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n8 | 880 MHz – 915 MHz | 925 MHz – 960 MHz | FDD |
| n20 | 832 MHz – 862 MHz | 791 MHz – 821 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |

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

Table 5.2.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n8A-n20A-n75A | CA\_n8A-n20A | n8 | n8 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n20 | n20 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.2.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n8-n20-n75, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.2.2 Specific for 2 bands UL CA

#### 5.2.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.2.2.1.1 Co-existence studies for 2UL band with 1CC per band

*Editor’s Note: Since the IMD tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.2.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n8A-n20A-n75A with UL CA\_n8A-n20A.

Table 5.2.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 18–83 | | 1712–1777 | |
| 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) | 898–998 | | 749–844 | |
| 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) | 2592–2692 | | 2544–2639 | |
| 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) | 1778–1913 | | 1581–1706 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 36–166 | |
| 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) | 3472–3607 | | 3376–3501 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 3424–3554 | |
| 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) | 2413–2568 | | 2658–2828 | |
| 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) | 666–826 | | 916–1081 | |
| 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) | 4208–4363 | | 4352–4522 | |
| 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) | 4256–4416 | | 4304–4469 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, no IMD produced by UL CA\_n8A-n20A will fall into the n75 Rx band.

#### 5.2.2.2 REFSENS requirements

Based on the co-existence studies there is no need to define MSD values.

## 5.3 CA\_n8-n28-n75

### 5.3.1 Common for 1 band UL and 2 bands UL CA

#### 5.3.1.1 Operating bands for CA

Table 5.3.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n8 | 880 MHz – 915 MHz | 925 MHz – 960 MHz | FDD |
| n28 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |

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

Table 5.3.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n8A-n28A-n75A | CA\_n8A-n28A | n8 | n8 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n28 | n28 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.3.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n8-n28-n75, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.3.2 Specific for 2 bands UL CA

#### 5.3.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.3.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.3.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n8A-n28A-n75A with UL CA\_n8A-n28A.

Table 5.3.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 132–212 | | 1583–1663 | |
| 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) | 1012–1127 | | 491–616 | |
| 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) | 2463–2578 | | 2286–2411 | |
| 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) | 1892–2042 | | 1194–1364 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 264–424 | |
| 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) | 3343–3493 | | 2989–3159 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 3166–3326 | |
| 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) | 1897–2112 | | 2772–2957 | |
| 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) | 279–484 | | 1144–1339 | |
| 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) | 3692–3907 | | 4008–4223 | |
| 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) | 3869–4074 | | 4046–4241 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, there is no IMD produced by UL CA\_n8A-n28A will fall into the n75 DL spectrum.

#### 5.3.2.2 REFSENS requirements

Based on the co-existence studies there is no need to define MSD values.

## 5.4 CA\_n20-n28-n75

### 5.4.1 Common for 1 band UL and 2 bands UL CA

#### 5.4.1.1 Operating bands for CA

Table 5.4.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n20 | 832 MHz – 862 MHz | 791 MHz – 821 MHz | FDD |
| n28 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |

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

Table 5.4.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n20A-n28A-n75A | CA\_n20A-n28A | n20 | n20 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n28 | n28 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.4.1.3 ∆TIB,c and ∆RIB,c values

*Editor’s note: For the table of ∆TIB,c and ∆RIB,c values, please use the same table format as in the latest TS 38.101-1.*

For CA\_n8-n28-n75, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.4.2 Specific for 2 bands UL CA

#### 5.4.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.4.2.1.1 Co-existence studies for 2UL band with 1CC per band

*Editor’s Note: Since the IMD tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.4.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n28A-n75A with UL CA\_n20A-n28A.

Table 5.4.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 84–159 | | 1535–1610 | |
| 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) | 916–1021 | | 544–664 | |
| 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) | 2367–2472 | | 2238–2358 | |
| 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) | 1748–1883 | | 1247–1412 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 168–318 | |
| 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) | 3199–3334 | | 2941–3106 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 3070–3220 | |
| 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) | 1950–2160 | | 2580–2745 | |
| 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) | 385–580 | | 1000–1180 | |
| 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) | 3644–3854 | | 4031–4196 | |
| 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) | 3773–3968 | | 3902–4082 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, there is no IMD produced by UL CA\_n20A-n28A will fall inte the n75 DL spectrum.

#### 5.4.2.2 REFSENS requirements

Based on the co-existence studies there is no need to define MSD values.

## 5.5 CA\_n3-n7-n75

### 5.5.1 Common for 1 band UL and 2 bands UL CA

#### 5.5.1.1 Operating bands for CA

Table 5.5.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 – 1880 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |

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

Table 5.5.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | **Bandwidth combination set** |
| CA\_n3A-n7A-n75A | CA\_n3A-n7A | n3 | n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.5.1.3 ∆TIB,c and ∆RIB,c values

*Editor’s note: For the table of ∆TIB,c and ∆RIB,c values, please use the same table format as in the latest TS 38.101-1.*

For CA\_n8-n28-n75, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.5.2 Specific for 2 bands UL CA

#### 5.5.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.5.2.1.1 Co-existence studies for 2UL band with 1CC per band

*Editor’s Note: Since the IMD tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.5.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n7A-n75A with UL CA\_n3A-n7A.

Table 5.5.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 715–860 | | 4210–4355 | |
| 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) | 850–1070 | | 3215–3430 | |
| 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) | 5920–6140 | | 6710–6925 | |
| 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) | 2560–2855 | | 5715–6000 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1430–1720 | |
| 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) | 7630–7925 | | 9210–9495 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8420–8710 | |
| 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) | 8215–8570 | | 4270–4640 | |
| 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) | 3930–4290 | | 10–355 | |
| 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) | 11710–12065 | | 9340–9710 | |
| 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) | 10920–11280 | | 10130–10495 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, 4th order IMD generated by UL CA\_n3A-n7A may fall into own Rx of Band n75

#### 5.5.2.2 REFSENS requirements

Based on the co-existence studies there is no need to define MSD values.

We analyze the amount of IMD using the following component linearity assumptions:

Table 5.5.2.2-1 General linearity parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **IP2 (dBm)** | **IP3 (dBm)** | **IP4 (dBm)** | **IP5 (dBm)** |
| Antenna switch | 112 | 68 | 56 | 53 |
| Diplexer | 115 | 86 | 55 | 53 |
| Triplexer | 113 | 82 | 55 | 53 |
| PA forward mixing | 28 | 32 | 30 | 28 |
| PA reverse mixing | 40 | 30 | 30 | 30 |
| LNA | 5 | -6 | -6 | -10 |

Table 5.5.2.2-2 Attenuation and isolation

|  |  |
| --- | --- |
| **Parameters** | **Values (dB)** |
| Antenna isolation | 10 |
| PCB isolation PA-PA | 60 |
| Diplexer isolation | 15 |
| Triplexer isolation | 15 |
| Tx duplexer rejection at Rx Band | 50 |

Based on these parameters we get the following MSD.

Table 5.5.2.2-3: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n7-n75 | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
|  | n7 | 2505 | 5 | 25 | 2625 | N/A | FDD | N/A |
|  | n75 | N/A | 5 | N/A | 1450 | 10.4 | SDL | IMD4 |

## 5.6 CA\_n3-n75-n78

### 5.6.1 Common for 1 band UL and 2 bands UL CA

#### 5.6.1.1 Operating bands for CA

Table 5.6.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 – 1880 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |

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

Table 5.6.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n75A-n78A | CA\_n3A-n78A | n3 | n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.6.1.3 ∆TIB,c and ∆RIB,c values

*Editor’s note: For the table of ∆TIB,c and ∆RIB,c values, please use the same table format as in the latest TS 38.101-1.*

For CA\_n8-n28-n75, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.6.2 Specific for 2 bands UL CA

#### 5.6.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.6.2.1.1 Co-existence studies for 2UL band with 1CC per band

*Editor’s Note: Since the IMD tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.6.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n75A-n78A with UL CA\_n3A-n78A.

Table 5.6.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515–2090 | | 5010–5585 | |
| 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) | 270–380 | | 4815–5890 | |
| 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) | 6720–7370 | | 8310–9385 | |
| 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) | 1330–2055 | | 8115–9690 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3030–4180 | |
| 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) | 8430–9155 | | 11610–13185 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10020–11170 | |
| 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) | 11415–13490 | | 3040–3840 | |
| 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) | 6330–7980 | | 1245–2470 | |
| 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) | 14910–16985 | | 10140–10940 | |
| 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) | 13320–14970 | | 11730–12955 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, 4th and 5th order IMD generated by UL CA\_n3A-n78A may fall into own Rx of Band n75

#### 5.6.2.2 REFSENS requirements

Based on the co-existence studies there is no need to define MSD values.

We analyze the amount of IMD using the following component linearity assumptions:

Table 5.6.2.2-1 General linearity parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **IP2 (dBm)** | **IP3 (dBm)** | **IP4 (dBm)** | **IP5 (dBm)** |
| Antenna switch | 112 | 68 | 56 | 53 |
| Diplexer | 115 | 86 | 55 | 53 |
| Triplexer | 113 | 82 | 55 | 53 |
| PA forward mixing | 28 | 32 | 30 | 28 |
| PA reverse mixing | 40 | 30 | 30 | 30 |
| LNA | 5 | -6 | -6 | -10 |

Table 5.6.2.2-2 Attenuation and isolation

|  |  |
| --- | --- |
| **Parameters** | **Values (dB)** |
| Antenna isolation | 10 |
| PCB isolation PA-PA | 60 |
| Diplexer isolation | 15 |
| Triplexer isolation | 15 |
| Tx duplexer rejection at Rx Band | 50 |

Based on these parameters we get the following MSD.

Table 5.6.2.2-3: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n75-n78 | n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
|  | n75 | N/A | 5 | N/A | 1450 | 10.8 | SDL | IMD4 |
|  | n78 | 3700 | 10 | 50 | 3700 | N/A | TDD | N/A |
|  | n3 | 1770 | 5 | 25 | 1865 | N/A | FDD | N/A |
|  | n75 | N/A | 5 | N/A | 1490 | 1.0 | SDL | IMD5 |
|  | n78 | 3400 | 10 | 50 | 3400 | N/A | TDD | N/A |

## 5.7 CA\_n7-n75-n78

### 5.7.1 Common for 1 band UL and 2 bands UL CA

#### 5.7.1.1 Operating bands for CA

Table 5.7.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |

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

Table 5.7.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n7A-n75A-n78A | CA\_n7A-n78A | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.7.1.3 ∆TIB,c and ∆RIB,c values

*Editor’s note: For the table of ∆TIB,c and ∆RIB,c values, please use the same table format as in the latest TS 38.101-1.*

For CA\_n7-n75-n78, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.7.2 Specific for 2 bands UL CA

#### 5.7.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.7.2.1.1 Co-existence studies for 2UL band with 1CC per band

*Editor’s Note: Since the IMD tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.7.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n7A-n75A-n78A with UL CA\_n7A-n78A.

Table 5.7.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 730–1300 | | 5800–6370 | |
| 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) | 1200–1840 | | 4030–5100 | |
| 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) | 8300–8940 | | 9100–10170 | |
| 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) | 3700–4410 | | 7330–8900 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1460–2600 | |
| 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) | 10800–11510 | | 12400–13970 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 11600–12740 | |
| 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) | 10630–12700 | | 6200–6980 | |
| 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) | 4760–6400 | | 100–1110 | |
| 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) | 15700–17770 | | 13300–14080 | |
| 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) | 14900–16540 | | 14100–15310 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, 3rd and 4th order IMD generated by UL CA\_n7A-n78A may fall into own Rx of Band n75

#### 5.7.2.2 REFSENS requirements

Based on the co-existence studies there is no need to define MSD values.

We analyze the amount of IMD using the following component linearity assumptions:

Table 5.7.2.2-1 General linearity parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **IP2 (dBm)** | **IP3 (dBm)** | **IP4 (dBm)** | **IP5 (dBm)** |
| Antenna switch | 112 | 68 | 56 | 53 |
| Diplexer | 115 | 86 | 55 | 53 |
| Triplexer | 113 | 82 | 55 | 53 |
| PA forward mixing | 28 | 32 | 30 | 28 |
| PA reverse mixing | 40 | 30 | 30 | 30 |
| LNA | 5 | -6 | -6 | -10 |

Table 5.7.2.2-2 Attenuation and isolation

|  |  |
| --- | --- |
| **Parameters** | **Values (dB)** |
| Antenna isolation | 10 |
| PCB isolation PA-PA | 60 |
| Diplexer isolation | 15 |
| Triplexer isolation | 15 |
| Tx duplexer rejection at Rx Band | 50 |

Based on these parameters we get the following MSD.

Table 5.7.2.2-3: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n75-n78 | n7 | 2510 | 5 | 25 | 2630 | N/A | FDD | N/A |
|  | n75 | N/A | 5 | N/A | 1470 | 16 | SDL | IMD3 |
|  | n78 | 3550 | 10 | 50 | 3550 | N/A | TDD | N/A |
|  | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n75 | N/A | 5 | N/A | 1500 | 10.5 | SDL | IMD4 |
|  | n78 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |

## 5.8 CA\_n1-n7-n75

### 5.8.1 Common for 1 band UL and 2 bands UL CA

#### 5.8.1.1 Operating bands for CA

Table 5.8.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |

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

Table 5.8.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n7A-n75A | CA\_n1A-n7A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.8.1.3 ∆TIB,c and ∆RIB,c values

*Editor’s note: For the table of ∆TIB,c and ∆RIB,c values, please use the same table format as in the latest TS 38.101-1.*

For CA\_n1-n7-n75, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.8.2 Specific for 2 bands UL CA

#### 5.8.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.8.2.1.1 Co-existence studies for 2UL band with 1CC per band

*Editor’s Note: Since the IMD tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.8.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n7A-n75A with UL CA\_n1A-n7A.

Table 5.8.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 520–650 | | 4420–4550 | |
| 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) | 1270–1460 | | 3020–3220 | |
| 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) | 6340–6530 | | 6920–7120 | |
| 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) | 3190–3440 | | 5520–5790 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1040–1300 | |
| 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) | 8260–8510 | | 9420–9690 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8840–9100 | |
| 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) | 8020–8360 | | 5110–5420 | |
| 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) | 3540–3870 | | 620–940 | |
| 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) | 11920–12260 | | 10180–10490 | |
| 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) | 11340–11670 | | 10760–11080 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, 3rd order IMD generated by UL CA\_n1A-n7A may fall into own Rx of Band n75

#### 5.8.2.2 REFSENS requirements

Based on the co-existence studies there is no need to define MSD values.

We analyze the amount of IMD using the following component linearity assumptions:

Table 5.8.2.2-1 General linearity parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Component | IP2 (dBm) | IP3 (dBm) | IP4 (dBm) | IP5 (dBm) |
| Antenna switch | 112 | 68 | 56 | 53 |
| Diplexer | 115 | 86 | 55 | 53 |
| Triplexer | 113 | 82 | 55 | 53 |
| PA forward mixing | 28 | 32 | 30 | 28 |
| PA reverse mixing | 40 | 30 | 30 | 30 |
| LNA | 5 | -6 | -6 | -10 |

Table 5.8.2.2-2 Attenuation and isolation

|  |  |
| --- | --- |
| Parameters | Values (dB) |
| Antenna isolation | 10 |
| PCB isolation PA-PA | 60 |
| Diplexer isolation | 15 |
| Triplexer isolation | 15 |
| Tx duplexer rejection at Rx Band | 50 |

Based on these parameters we get the following MSD.

Table 5.8.2.2-3: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n7-n75 | n1 | 1975 | 5 | 25 | 2165 | N/A | FDD | N/A |
|  | n7 | 2510 | 5 | 25 | 2630 | N/A | FDD | N/A |
|  | n75 | N/A | 5 | N/A | 1450 | 13.2 | SDL | IMD3 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.9 CA\_n1-n3-n7

### 5.9.1 Common for 1 band UL and 2 bands UL CA

#### 5.9.1.1 Operating bands for CA

Table 5.9.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n3 | 1710 MHz – 1785 MHz | 1805 MHz – 1880 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |

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

Table 5.9.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n3A-n7A | CA\_n1A-n3A  CA\_n1A-n7A  CA\_n3A-n7A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n3 | n3 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |

*Editor's note: The valid UL configurations shall refer to the Annex B.*

#### 5.9.1.3 ∆TIB,c and ∆RIB,c values

*Editor’s note: For the table of ∆TIB,c and ∆RIB,c values, please use the same table format as in the latest TS 38.101-1.*

For CA\_n1A-n3A-n7A, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.9.2 Specific for 2 bands UL CA

#### 5.9.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.9.2.1.1 Co-existence studies for 2UL band with 1CC per band

*Editor’s Note: Since the IMD tables have already been calculated for the different two band fallbacks, the tables below may skip the IMD calculations and refer to the relevant two band TP tables. Nonetheless, the IMD issues should be stated, and the related TPs referenced. Only one example table is provided in this template but there may be up to three cases for the victim DL band and as many tables may be needed.*

Table 5.9.2.1.1-1, 5.9.2.1.1-2 and 5.9.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n3A-n7A with UL CA\_n1A-n3A, CA\_n1A-n7A and CA\_n3A-n7A.

Table 5.9.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 730–1300 | | 5800–6370 | |
| 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) | 1200–1840 | | 4030–5100 | |
| 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) | 8300–8940 | | 9100–10170 | |
| 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) | 3700–4410 | | 7330–8900 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1460–2600 | |
| 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) | 10800–11510 | | 12400–13970 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 11600–12740 | |
| 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) | 10630–12700 | | 6200–6980 | |
| 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) | 4760–6400 | | 100–1110 | |
| 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) | 15700–17770 | | 13300–14080 | |
| 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) | 14900–16540 | | 14100–15310 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, no IMD produced by UL CA\_n1A-n3A will fall into the n7 Rx band.

Table 5.9.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 520–650 | | 4420–4550 | |
| 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) | 1270–1460 | | 3020–3220 | |
| 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) | 6340–6530 | | 6920–7120 | |
| 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) | 3190–3440 | | 5520–5790 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1040–1300 | |
| 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) | 8260–8510 | | 9420–9690 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8840–9100 | |
| 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) | 8020–8360 | | 5110–5420 | |
| 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) | 3540–3870 | | 620–940 | |
| 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) | 11920–12260 | | 10490–10180 | |
| 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) | 11340–11670 | | 10760–11080 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, no IMD produced by UL CA\_n1A-n7A will fall into the n3 Rx band.

Table 5.9.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320–1880 | | 5220–5780 | |
| 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) | 40–660 | | 4620–5680 | |
| 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) | 7140–7760 | | 8520–9580 | |
| 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) | 1960–2640 | | 7920–9480 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2640–3760 | |
| 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) | 9060–9740 | | 11820–13380 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10440–11560 | |
| 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) | 11220–13280 | | 3880–4620 | |
| 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) | 5940–7560 | | 660–1840 | |
| 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) | 15120–17180 | | 10980–11720 | |
| 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) | 13740–15360 | | 12360–13540 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above tables, no IMD produced by UL CA\_n3A-n7A will fall into the n1 Rx band.

#### 5.9.2.2 REFSENS requirements

Based on the co-existence studies, there is no need to define MSD values.

## 5.10 CA\_n41-n66-n71

### 5.10.1 Common for 1 band UL and 2 bands UL CA

#### 5.10.1.1 Operating bands for CA.

Table 5.10.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n41 | 2496 MHz – 2690 MHz | 2496 MHz –2690 MHz | TDD |
| n66 | 1710 MHz – 1780 MHz | 2100 MHz – 2200 MHz | FDD |
| n71 | 663 MHz – 698 MHz | 617 MHz – 652 MHz | FDD |

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

Table 5.10.1.2-1: Supported bandwidths per CA band combination of band n25+n41+n77

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR CA configuration | | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n41C-n66A-n71A | n417,9  CA\_n41A-n66A7  CA\_n41C-n66A  CA\_n41A-n71A7  CA\_n41C-n71A  CA\_n41C7  CA\_n66A-n71A | | n41 | CA\_n41C\_BCS0 | 0 |
|  |  | | n66 | 5, 10, 15, 20, 40 |  |
|  |  | | n71 | 5, 10, 15, 20 |  |
|  |  | | n41 | CA\_n41C\_BCS1 | 1 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n71 | 5, 10, 15, 20 |  |
|  |  | | n41 | CA\_n41C BCS 4 and 5 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |

### 5.10.2 Specific for 2 bands UL CA

#### 5.10.2.1 UE co-existence studies

##### 5.10.2.1.1 Co-existence studies for 2UL band with 1CC per band

Co-existence study has been performed in Rel-18.

##### 5.10.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.10.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n71.

Table 5.10.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n41C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n66, n41)** | 1710 MHz – 1780 MHz | | 2496 MHz– 2690 MHz | |
| **fDL (n71)** | 617 MHz – 652 MHz | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 190 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1520 MHz – 1710 MHz | | 1780 MHz – 1970 MHz | |
| **Analysis** | No issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.10.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n66.

Table 5.10.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n41C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n71, n41)** | 663 MHz – 698 MHz | | 2496 MHz– 2690 MHz | |
| **fDL (n66)** | 2110 MHz – 2200 MHz | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 190 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 473 MHz – 663 MHz | | 698 MHz – 888 MHz | |
| **Analysis** | No issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.10.2.2 REFSENS requirements

Based on the triple beat analysis of the added ULCA, 1st order triple beat IMD is not falling into bands n66 and n71, so there is no need to define MSD values.

## 5.11 CA\_n1-n41-n78

### 5.11.1 Common for 1 band UL and 2 bands UL CA

#### 5.11.1.1 Operating bands for CA

When adding CA\_n1-n41-n78 to Table 5.2A.2.2-1 in 38.101-1, it must be marked with Note 3 as CA\_n1-n41-n783.

Table 5.11.1.1-1: CA band combination constituent bands definition

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

This combination supports inter-band carrier aggregation with mandatory simultaneous Rx/Tx capability.

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

Table 5.11.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n41A-n78A | CA\_n1A-n41A  CA\_n1A-n78A  CA\_n41A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n41 | 10, 15, 20, 40, 50, 60, 80, 100 |  |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |

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

Requirements for CA\_n1-n41-n78, for the TIB,c and RIB,c values are given in the tables below following CA\_n1-n41-n77.

Table 5.11.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n41-n78 | 0.5 | 0.5 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.11.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n41-n78 | 0.2 | - | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.11.2 Specific for 2 bands UL CA

#### 5.11.2.1 UE co-existence studies

Table 5.11.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n41A-n78A with UL CA\_n1A-n4A.

Table 5.11.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1540 - 1032 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 9220 - 8952 | |
| 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on Table 5.11.2.1.1-1, 3rd, 4th and 5th order IMD from band n1 and Band n41 may also fall into Rx frequencies of band n78.

Table 5.11.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320 - 1880 | | 5220 - 5780 | |
| 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) | 40 - 660 | | 4620 - 5680 | |
| 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) | 7140 - 7760 | | 8520 - 9580 | |
| 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) | 1960 - 2640 | | 7920 - 9480 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3760 - 2640 | |
| 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) | 9060 - 9740 | | 11820 - 13380 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 11440 - 10560 | |
| 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) | 13280 - 11220 | | 4620 - 3880 | |
| 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) | 7560 - 5940 | | 660 - 1840 | |
| 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) | 13740 - 15360 | | 12360 - 13540 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on Table 5.11.2.1.1-2, 4th order IMD from band n1 and Band n78 may also fall into Rx frequencies of band n41.

Table 5.11.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2608 - 1220 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 12592 - 11980 | |
| 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on Table 5.11.2.1.1-3, 4th order IMD from band n41 and Band n78 may also fall into Rx frequencies of band n1.

From the tables it is found that:

- Band n78 may be subject to IMD3, IMD4 and IMD5.

- Band n41 may be subject to IMD4.

- Band n1 may be subject to IMD4.

#### 5.11.2.2 REFSENS requirements

MSD values have been taken from CA\_n1A-n41A-n77A.

Table 5.11.2.2-1: MSD due to IMD issue

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n41-n78 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n41 | 2650 | 10 | 50 | 2650 | N/A | TDD | N/A |
|  | n78 | N/A | 10 | N/A | 3330 | 19.6 | TDD | IMD31,2 |
|  | n1 | 1975 | 5 | 10 | 2165 | N/A | FDD | N/A |
|  | n78 | 3410 | 10 | 50 | 3410 | N/A | TDD | N/A |
|  | n41 | N/A | 10 | N/A | 2515 | 11.5 | TDD | IMD4 |
|  | n1 | N/A | 5 | N/A | 2140 | 9.3 | FDD | IMD4 |
|  | n78 | 3710 | 10 | 50 | 3710 | N/A | TDD | N/A |
|  | n41 | 2640 | 10 | 50 | 2640 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.12 CA\_n1-n5-n8

### 5.12.1 Common for 1 band UL and 2 bands UL CA

#### 5.12.1.1 Operating bands for CA

Table 5.12.1.1-1: CA band combination constituent bands definition

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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-n5-n8 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |

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

Table 5.12.1.2-1: Supported bandwidths per CA band combination of band n1-n5-n8

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n5A-n8A | - | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n5 | 5, 10, 15, 20 |  |
|  |  | n8 | 5, 10, 15, 20 |  |

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

For CA\_n1-n5-n8, since there is only single carrier UL the following ΔTIB,c  values are proposed:

Table 5.12.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n5-n8 | 0.3 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

The ΔRIB,c values are proposed to be defined following CA\_n5-n8 as in the following table

Table 5.12.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n5-n8 | - | 0.4 | 0.4 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.13 CA\_n3-n5-n8

### 5.13.1 Common for 1 band UL and 2 bands UL CA

#### 5.13.1.1 Operating bands for CA

Table 5.13.1.1-1: CA band combination constituent bands definition

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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-n5-n8 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |

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

Table 5.13.1.2-1: Supported bandwidths per CA band combination of band n3-n5-n8

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n5A-n8A | - | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n5 | 5, 10, 15, 20 |  |
|  |  | n8 | 5, 10, 15, 20 |  |

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

For CA\_n1-n5-n8, since there is only single carrier UL the following ΔTIB,c  values are proposed:

Table 5.13.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n5-n8 | 0.3 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

The ΔRIB,c values are proposed to be defined following CA\_n5-n8 as in the following table.

Table 5.13.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n5-n8 | - | 0.4 | 0.4 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.14 CA\_n25-n29-n77

### 5.14.1 Common for 1 band UL and 2 bands UL CA

#### 5.14.1.1 Operating bands for CA

Table 5.14.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n29 | N/A | 717 MHz – 728 MHz | SDL |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.14.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n25A-n29A-n77A | CA\_n25A-n77A | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n29 | n29 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n25A-n29A-n77(2A) | CA\_n25A-n77A  CA\_n77(2A) | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n29 | n29 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |
| CA\_n25A-n29A-n77(3A) | CA\_n25A-n77A  CA\_n77(2A) | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n29 | n29 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | CA\_n77(3A)\_BCS4 and 5 |  |

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

For CA\_n25-n29-n77 the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.14.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n25-n29-n77 | 0.6 | N/A | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.14.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n25-n29-n77 | 0.2 | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.14.2 Specific for 2 bands UL CA

#### 5.14.2.1 UE co-existence studies

##### 5.14.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.14.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n25A-n29A-n77A with UL CA\_n25A-n77A.

Table 5.14.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1385–2350 | | 5150–6115 | |
| 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) | 500–530 | | 4685–6550 | |
| 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) | 7000–8030 | | 8450–10315 | |
| 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) | 1350–2445 | | 7985–10750 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2770–4700 | |
| 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) | 8850–9945 | | 11750–14515 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10300–12230 | |
| 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) | 11285–14950 | | 3200–4360 | |
| 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) | 6070–8900 | | 855–2850 | |
| 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) | 15050–18715 | | 10700–11860 | |
| 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) | 13600–16430 | | 12150–14145 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, there is no IMD generated by UL CA\_n25A-n77A fall into own Rx of Band n29.

In addition, there is no additional MSD due to UL CA\_n77(2A) needs to specified for three bands DL configuration.

#### 5.14.2.2 REFSENS requirements

Based on the co-existence studies, there is no need to define MSD values.

## 5.15 CA\_n1-n75-n78

### 5.15.1 Common for 1 band UL and 2 bands UL CA

#### 5.15.1.1 Operating bands for CA

Table 5.15.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz –1980 MHz | 2110 MHz –2170 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |

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

Table 5.15.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n75A-n78A | CA\_n1A-n78A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n1-n75-n78, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.15.2 Specific for 2 bands UL CA

#### 5.15.2.1 UE co-existence studies

*Editor’s Note: The tables in this section are provided to identify potential issues to be analyzed based on interference frequency range calculations, whether to specify the MSD related to collisions with the victim receiver frequency range should be based on the detailed REFSENS analysis.*

##### 5.15.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.15.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n75A-n78A with UL CA\_n1A-n78A.

Table 5.15.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320–1880 | | 5220–5780 | |
| 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) | 40–660 | | 4620–5680 | |
| 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) | 7140–7760 | | 8520–9580 | |
| 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) | 1960–2640 | | 7920–9480 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 2640–3760 | |  | |
| 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) | 9060–9740 | | 11820–13380 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 10440–11560 | |  | |
| 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) | 11220–13280 | | 3880–4620 | |
| 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) | 5940–7560 | | 660–1840 | |
| 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) | 15120–17180 | | 10980–11720 | |
| 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) | 13740–15360 | | 12360–13540 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 2nd and 5th order IMD generated by UL CA\_n1A-n78A may fall into own Rx of Band n75

#### 5.15.2.2 REFSENS requirements

IMD5 generated by UL CA\_n1A-n78A fall into own Rx of Band n75.However, since the MSD value is 0 dB, there is no need to define MSD of IMD5. Referring to DC\_1A\_n75A-n78A, the MSD requirements can be specified as below:

Table 5.15.2.2-3: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n75-n78 | n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n75 | N/A | 5 | N/A | 1470 | 30.4 | SDL | IMD2 |
|  | n78 | 3400 | 10 | 52 | 3400 | N/A | TDD | N/A |

## 5.16 CA\_n1-n28-n40

### 5.16.1 Common for 1 band UL and 2 bands UL CA

#### 5.16.1.1 Operating bands for CA

Table 5.16.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n28 | 703-748 | 758-803 | FDD |
| n40 | 2300-2400 | 2300-2400 | TDD |

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

Table 5.16.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n28A-n40A | CA\_n1A-n28A  CA\_n1A-n40A  CA\_n28A-n40A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n28 | 5, 10, 15, 20, 25, 30 |  |
|  |  | n40 | 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

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

For CA\_n1-n28-n40, the ΔTIB,c and ΔRIB,c values are already captured in the specification.

### 5.16.2 Specific for 2 bands UL CA

#### 5.16.2.1 UE co-existence studies

##### 5.16.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.16.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n28A-n40A with UL CA\_n1A-n28A.

Table 5.16.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1277 - 1172 | | 2623 - 2728 | |
| 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) | 3092 - 3257 | | 574 - 424 | |
| 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) | 4543 - 4708 | | 3326 - 3476 | |
| 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) | 5012 - 5237 | | 129 - 324 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2344 - 2554 | |
| 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) | 6463 - 6688 | | 4029 - 4224 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5246 - 5456 | |
| 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) | 1072 - 832 | | 7217 - 6932 | |
| 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) | 1596 - 1851 | | 4534 - 4264 | |
| 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) | 4732 - 4972 | | 8383 - 8668 | |
| 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) | 5949 - 6204 | | 7166 - 7436 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.16.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n28A-n40A with UL CA\_n1A-n40A.

Table 5.16.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 320 - 480 | | 4220 - 4380 | |
| 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 - 1660 | | 2620 - 2880 | |
| 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) | 6140 - 6360 | | 6520 - 6780 | |
| 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) | 3360 - 3640 | | 4920 - 5280 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 960 - 640 | |
| 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) | 8060 - 8340 | | 8820 - 9180 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8440 - 8760 | |
| 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) | 7680 - 7220 | | 5620 - 5280 | |
| 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) | 3360 - 2940 | | 1340 - 960 | |
| 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) | 11120 - 11580 | | 9980 - 10320 | |
| 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) | 10740 - 11160 | | 10360 - 10740 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.16.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n28A-n40A with UL CA\_n28A-n40A.

Table 5.16.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1552 - 1697 | | 3003 - 3148 | |
| 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) | 994 - 804 | | 3852 - 4097 | |
| 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) | 3706 - 3896 | | 5303 - 5548 | |
| 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) | 291 - 56 | | 6152 - 6497 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3394 - 3104 | |
| 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) | 4409 - 4644 | | 7603 - 7948 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6006 - 6296 | |
| 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) | 8897 - 8452 | | 692 - 412 | |
| 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) | 5794 - 5404 | | 2356 - 2691 | |
| 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) | 9903 - 10348 | | 5112 - 5392 | |
| 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) | 8306 - 8696 | | 6709 - 7044 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.16.2.1.1-1 there is IMD4 from n1 and n28 into RX band n40.

Based on the analysis in Table 5.16.2.1.1-2 there is IMD4 from n1 and n40 into RX band n28.

#### 5.16.2.2 REFSENS requirements

The MSD value has been taken from CA\_n1-n5-n40.

Table 5.16.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n28-n40 | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n28 | N/A | 5 | N/A | 780 | 8 | FDD | IMD4 |
|  | n40 | 2340 | 5 | 25 | 2340 | N/A | TDD | N/A |
|  | n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n28 | 735 | 5 | 25 | 790 | N/A | FDD | N/A |
|  | n40 | N/A | 5 | N/A | 2390 | 9.0 | TDD | IMD4 |

## 5.17 CA\_n1-n20-n71

### 5.17.1 Common for 1 band UL and 2 bands UL CA

#### 5.17.1.1 Operating bands for CA

Table 5.17.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n20 | 832-862 | 791-821 | FDD |
| n71 | 663-698 | 617-652 | FDD |

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

Table 5.17.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n20A-n71A | CA\_n1A-n20A  CA\_n1A-n71A  CA\_n20A-n71A | n1 | 5, 10, 15, 20, 25, 30, 40, 45, 50 | 0 |
|  |  | n20 | 5, 10, 15, 20 |  |
|  |  | n71 | 5, 10, 15, 20 |  |

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

For CA\_n1-n20-n71, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n1-n5-n105 as given in the tables below.

Table 5.17.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n20-n71 | - | 0.2 | 0.3 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.17.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n20-n71 | 0.3 | 0.6 | 0.6 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.17.2 Specific for 2 bands UL CA

#### 5.17.2.1 UE co-existence studies

##### 5.17.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.17.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n71A with UL CA\_n1A-n20A.

Table 5.17.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1148 - 1058 | | 2752 - 2842 | |
| 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) | 2978 - 3128 | | 316 - 196 | |
| 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) | 4672 - 4822 | | 3584 - 3704 | |
| 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) | 4898 - 5108 | | 516 - 666 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2116 - 2296 | |
| 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) | 6592 - 6802 | | 4416 - 4566 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5504 - 5684 | |
| 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) | 1528 - 1348 | | 7088 - 6818 | |
| 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) | 1254 - 1464 | | 4276 - 4036 | |
| 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) | 5248 - 5428 | | 8512 - 8782 | |
| 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) | 6336 - 6546 | | 7424 - 7664 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.17.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n71A with UL CA\_n1A-n71A.

Table 5.17.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 - 1222 | | 2583 - 2678 | |
| 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) | 3142 - 3297 | | 654 - 524 | |
| 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) | 4503 - 4658 | | 3246 - 3376 | |
| 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) | 5062 - 5277 | | 9 - 174 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2444 - 2634 | |
| 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) | 6423 - 6638 | | 3909 - 4074 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5166 - 5356 | |
| 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) | 872 - 672 | | 7257 - 6982 | |
| 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) | 1746 - 1971 | | 4614 - 4364 | |
| 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) | 4572 - 4772 | | 8343 - 8618 | |
| 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) | 5829 - 6054 | | 7086 - 7336 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.17.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n71A with UL CA\_n20A-n71A.

Table 5.17.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 199 - 134 | | 1495 - 1560 | |
| 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) | 966 - 1061 | | 464 - 564 | |
| 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) | 2327 - 2422 | | 2158 - 2258 | |
| 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) | 1798 - 1923 | | 1127 - 1262 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 268 - 398 | |
| 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) | 3159 - 3284 | | 2821 - 2956 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 2990 - 3120 | |
| 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) | 1960 - 1790 | | 2785 - 2630 | |
| 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) | 430 - 265 | | 1260 - 1100 | |
| 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) | 3484 - 3654 | | 3991 - 4146 | |
| 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) | 3653 - 3818 | | 3822 - 3982 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.17.2.1.1-1 there is IMD4 from n1 and n20 into RX band n71.

Based on the analysis in Table 5.17.2.1.1-2 there is IMD5 from n1 and n71 into RX band n20.

Based on the analysis in Table 5.17.2.1.1-3 there is IMD3 from n20 and n71 into RX band n1.

#### 5.17.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n1-n5-n105.

Table 5.17.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n20-n71 | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n20 | 859 | 5 | 25 | 818 | N/A | FDD | N/A |
|  | n71 | N/A | 5 | N/A | 627 | 9.4 | FDD | IMD4 |
|  | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 806 | 4.6 | FDD | IMD5 |
|  | n71 | 689 | 5 | 25 | 643 | N/A | FDD | N/A |
|  | n1 | N/A | 5 | N/A | 2167 | 16 | FDD | IMD3 |
|  | n20 | 835 | 5 | 25 | 794 | N/A | FDD | N/A |
|  | n71 | 666 | 5 | 25 | 620 | N/A | FDD | N/A |

## 5.18 CA\_n1-n20-n78

### 5.18.1 Common for 1 band UL and 2 bands UL CA

#### 5.18.1.1 Operating bands for CA

Table 5.18.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n20 | 832-862 | 791-821 | FDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.18.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n20A-n78A | CA\_n1A-n20A  CA\_n1A-n78A  CA\_n20A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 45, 50 | 0 |
|  |  | n20 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

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

For CA\_n1-n20-n78, the ΔTIB,c and ΔRIB,c values are already captured in the specification.

### 5.18.2 Specific for 2 bands UL CA

#### 5.18.2.1 UE co-existence studies

##### 5.18.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.18.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n78A with UL CA\_n1A-n20A.

Table 5.18.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1148 - 1058 | | 2752 - 2842 | |
| 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) | 2978 - 3128 | | 316 - 196 | |
| 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) | 4672 - 4822 | | 3584 - 3704 | |
| 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) | 4898 - 5108 | | 516 - 666 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2116 - 2296 | |
| 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) | 6592 - 6802 | | 4416 - 4566 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5504 - 5684 | |
| 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) | 1528 - 1348 | | 7088 - 6818 | |
| 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) | 1254 - 1464 | | 4276 - 4036 | |
| 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) | 5248 - 5428 | | 8512 - 8782 | |
| 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) | 6336 - 6546 | | 7424 - 7664 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.18.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n78A with UL CA\_n1A-n78A.

Table 5.18.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320 - 1880 | | 5220 - 5780 | |
| 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) | 40 - 660 | | 4620 - 5680 | |
| 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) | 7140 - 7760 | | 8520 - 9580 | |
| 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) | 1960 - 2640 | | 7920 - 9480 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3760 - 2640 | |
| 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) | 9060 - 9740 | | 11820 - 13380 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10440 - 11560 | |
| 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) | 13280 - 11220 | | 4620 - 3880 | |
| 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) | 7560 - 5940 | | 660 - 1840 | |
| 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) | 15120 - 17180 | | 10980 - 11720 | |
| 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) | 13740 - 15360 | | 12360 - 13540 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.18.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n78A with UL CA\_n20A-n78A.

Table 5.18.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2438 - 2968 | | 4132 - 4662 | |
| 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) | 2136 - 1576 | | 5738 - 6768 | |
| 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) | 4964 - 5524 | | 7432 - 8462 | |
| 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) | 1304 - 714 | | 9038 - 10568 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 5936 - 4876 | |
| 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) | 5796 - 6386 | | 10732 - 12262 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8264 - 9324 | |
| 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) | 14368 - 12338 | | 148 - 472 | |
| 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) | 9736 - 8176 | | 4014 - 5104 | |
| 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) | 14032 - 16062 | | 6628 - 7248 | |
| 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) | 11564 - 13124 | | 9096 - 10186 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.18.2.1.1-1 there is IMD3 from n1 and n20 into RX band n78.

Based on the analysis in Table 5.18.2.1.1-2 there is IMD5 from n1 and n78 into RX band n20.

Based on the analysis in Table 5.18.2.1.1-3 there is IMD3 from n20 and n78 into RX band n1.

#### 5.18.2.2 REFSENS requirements

The MSD value has been taken from CA\_n1-n26-n78.

Table 5.18.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n20-n78 | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3644 | 15.7 | TDD | IMD3 |
|  | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 806 | 3.1 | FDD | IMD5 |
|  | n78 | 3328 | 10 | 50 | 3328 | N/A | TDD | N/A |
|  | n1 | N/A | 5 | N/A | 2120 | 18.1 | FDD | IMD3 |
|  | n20 | 835 | 5 | 25 | 794 | N/A | FDD | N/A |
|  | n78 | 3790 | 10 | 50 | 3790 | N/A | TDD | N/A |

## 5.19 CA\_n20-n41-n71

### 5.19.1 Common for 1 band UL and 2 bands UL CA

#### 5.19.1.1 Operating bands for CA

Table 5.19.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n20 | 832-862 | 791-821 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n71 | 663-698 | 617-652 | FDD |

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

Table 5.19.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n20A-n41A-n71A | CA\_n20A-n41A  CA\_n20A-n71A  CA\_n41A-n71A | n20 | 5, 10, 15, 20 | 0 |
|  |  | n41 | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |  |
|  |  | n71 | 5, 10, 15, 20 |  |

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

For CA\_n20-n41-n71, the ΔTIB,c values are taken from CA\_n5-n7-n105 as given in the tables below.

Table 5.19.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n20-n41-n71 | 0.5 | 0.3 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

ΔRIB,c values are taken from DC\_5-7\_n71 as given in the tables below

Table 5.19.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n20-n41-n71 | - | - | 0.2 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.19.2 Specific for 2 bands UL CA

#### 5.19.2.1 UE co-existence studies

##### 5.19.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.19.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n71A with UL CA\_n20A-n41A.

Table 5.19.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1634 - 1858 | | 3328 - 3552 | |
| 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) | 1026 - 772 | | 4130 - 4548 | |
| 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) | 4160 - 4414 | | 5824 - 6242 | |
| 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) | 194 - 90 | | 6626 - 7238 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3716 - 3268 | |
| 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) | 4992 - 5276 | | 8320 - 8932 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6656 - 7104 | |
| 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) | 9928 - 9122 | | 952 - 638 | |
| 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) | 6406 - 5764 | | 2406 - 2884 | |
| 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) | 10816 - 11622 | | 5824 - 6138 | |
| 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) | 9152 - 9794 | | 7488 - 7966 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.19.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n71A with UL CA\_n20A-n71A.

Table 5.19.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 199 - 134 | | 1495 - 1560 | |
| 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) | 966 - 1061 | | 464 - 564 | |
| 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) | 2327 - 2422 | | 2158 - 2258 | |
| 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) | 1798 - 1923 | | 1127 - 1262 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 268 - 398 | |
| 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) | 3159 - 3284 | | 2821 - 2956 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 2990 - 3120 | |
| 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) | 1960 - 1790 | | 2785 - 2630 | |
| 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) | 430 - 265 | | 1260 - 1100 | |
| 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) | 3484 - 3654 | | 3991 - 4146 | |
| 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) | 3653 - 3818 | | 3822 - 3982 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.19.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n71A with UL CA\_n41A-n71A.

Table 5.19.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2027 - 1798 | | 3159 - 3388 | |
| 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) | 4294 - 4717 | | 1364 - 1100 | |
| 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) | 5655 - 6078 | | 3822 - 4086 | |
| 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) | 6790 - 7407 | | 701 - 402 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3596 - 4054 | |
| 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) | 8151 - 8768 | | 4485 - 4784 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6318 - 6776 | |
| 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) | 296 - 38 | | 10097 - 9286 | |
| 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) | 2898 - 3391 | | 6744 - 6092 | |
| 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) | 5148 - 5482 | | 10647 - 11458 | |
| 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) | 6981 - 7474 | | 8814 - 9466 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.19.2.1.1-1 there is IMD5 from n20 and n41 into RX band n71.

Based on the analysis in Table 5.19.2.1.1-2 there is IMD5 from n20 and n71 into RX band n41.

##### 5.19.2.2 REFSENS requirements

The MSD requirements are based on CA\_n18-n28-n41.

Table 5.19.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n20-n41-n71 | n20 | 834 | 5 | 25 | 793 | N/A | FDD | N/A |
|  | n41 | 2686 | 10 | 25 | 2686 | N/A | TDD | N/A |
|  | n71 | N/A | 5 | N/A | 650 | 5.9 | FDD | IMD5 |
|  | n20 | 835 | 5 | 25 | 794 | N/A | FDD | N/A |
|  | n41 | N/A | 10 | N/A | 2660 | 6.5 | TDD | IMD5 |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |

## 5.20 CA\_n20-n41-n77

### 5.20.1 Common for 1 band UL and 2 bands UL CA

#### 5.20.1.1 Operating bands for CA

Table 5.20.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n20 | 832-862 | 791-821 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n77 | 3300-4200 | 3300-4200 | TDD |

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

Table 5.20.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n20A-n41A-n77A | CA\_n20A-n41A  CA\_n20A-n77A  CA\_n41A-n77A | n20 | 5,10,15,20 | 0 |
|  |  | n41 | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n20A-n41A-n77(2A) | CA\_n20A-n41A  CA\_n20A-n77A  CA\_n41A-n77A | n20 | 5,10,15,20 | 0 |
|  |  | n41 | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |

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

For CA\_n20-n41-n77, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n5-n41-n77 as given in the tables below.

Table 5.20.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n20-n41-n77 | 0.6 | 0.3 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.20.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n20-n41-n77 | 0.2 | - | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.20.2 Specific for 2 bands UL CA

#### 5.20.2.1 UE co-existence studies

##### 5.20.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.20.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n77A with UL CA\_n20A-n41A.

Table 5.20.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1634 - 1858 | | 3328 - 3552 | |
| 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) | 1026 - 772 | | 4130 - 4548 | |
| 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) | 4160 - 4414 | | 5824 - 6242 | |
| 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) | 194 - 90 | | 6626 - 7238 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3716 - 3268 | |
| 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) | 4992 - 5276 | | 8320 - 8932 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6656 - 7104 | |
| 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) | 9928 - 9122 | | 952 - 638 | |
| 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) | 6406 - 5764 | | 2406 - 2884 | |
| 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) | 10816 - 11622 | | 5824 - 6138 | |
| 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) | 9152 - 9794 | | 7488 - 7966 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.20.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n77A with UL CA\_n20A-n77A.

Table 5.20.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2438 - 3368 | | 4132 - 5062 | |
| 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) | 2536 - 1576 | | 5738 - 7568 | |
| 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) | 4964 - 5924 | | 7432 - 9262 | |
| 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) | 1704 - 714 | | 9038 - 11768 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 6736 - 4876 | |
| 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) | 5796 - 6786 | | 10732 - 13462 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8264 - 10124 | |
| 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) | 15968 - 12338 | | 148 - 872 | |
| 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) | 10936 - 8176 | | 4014 - 5904 | |
| 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) | 14032 - 17662 | | 6628 - 7648 | |
| 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) | 11564 - 14324 | | 9096 - 10986 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.20.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n77A with UL CA\_n41A-n77A.

Table 5.20.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 - 1704 | | 5796 - 6890 | |
| 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) | 792 - 2080 | | 3910 - 5904 | |
| 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 - 9580 | | 9096 - 11090 | |
| 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) | 3288 - 4770 | | 7210 - 10104 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3408 - 1220 | |
| 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 - 12270 | | 12396 - 15290 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 11592 - 13780 | |
| 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) | 14304 - 10510 | | 7460 - 5784 | |
| 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) | 7608 - 4520 | | 1470 - 912 | |
| 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 - 19490 | | 13284 - 14960 | |
| 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 - 17980 | | 14088 - 16470 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.20.2.1.1-1 there are IMD2, IMD3 and IMD4 from n20 and n41 into RX band n77.

Based on the analysis in Table 5.20.2.1.1-2 there are IMD2 and IMD3 from n20 and n77 into RX band n41.

Based on the analysis in Table 5.20.2.1.1-3 there are IMD2 and IMD3 from n41 and n77 into RX band n20.

#### 5.20.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n5-n41-n77.

Table 5.20.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n20-n41-n77 | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | 2593 | 5 | 25 | 2593 | N/A | TDD | N/A |
|  | n77 | N/A | 10 | N/A | 3440 | 29.7 | TDD | IMD22 |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | 2506 | 5 | 25 | 2506 | N/A | TDD | N/A |
|  | n77 | N/A | 10 | N/A | 4165 | 16.1 | TDD | IMD3 |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | N/A | 5 | N/A | 2593 | 30.1 | TDD | IMD2 |
|  | n77 | 3440 | 10 | 50 | 3440 | N/A | TDD | N/A |
|  | n20 | 837 | 5 | 25 | 796 | N/A | FDD | N/A |
|  | n41 | N/A | 5 | N/A | 2516 | 13.2 | TDD | IMD3 |
|  | n77 | 4190 | 10 | 50 | 4190 | N/A | TDD | N/A |
|  | n20 | N/A | 5 | N/A | 806 | 30.2 | FDD | IMD2 |
|  | n41 | 2594 | 5 | 25 | 2594 | N/A | TDD | N/A |
|  | n77 | 3400 | 10 | 50 | 3400 | N/A | TDD | N/A |
|  | n20 | N/A | 5 | N/A | 817 | 15.2 | FDD | IMD3 |
|  | n41 | 2501 | 5 | 25 | 2501 | N/A | TDD | N/A |
|  | n77 | 4185 | 10 | 50 | 4185 | N/A | TDD | N/A |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.21 CA\_n20-n41-n78

### 5.21.1 Common for 1 band UL and 2 bands UL CA

#### 5.21.1.1 Operating bands for CA

Table 5.21.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n20 | 832-862 | 791-821 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.21.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n20A-n41A-n78A | CA\_n20A-n41A  CA\_n20A-n78A  CA\_n41A-n78A | n20 | 5, 10, 15, 20 | 0 |
|  |  | n41 | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

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

For CA\_n20-n41-n78, the ΔTIB,c and ΔRIB,c values are re-used from DC\_20\_n41-n78 as given in the tables below.

Table 5.21.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n20-n41-n78 | 0.5 | 0.3 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.21.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n20-n41-n78 | - | - | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.21.2 Specific for 2 bands UL CA

#### 5.21.2.1 UE co-existence studies

##### 5.21.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.21.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n78A with UL CA\_n20A-n41A.

Table 5.21.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1634 - 1858 | | 3328 - 3552 | |
| 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) | 1026 - 772 | | 4130 - 4548 | |
| 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) | 4160 - 4414 | | 5824 - 6242 | |
| 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) | 194 - 90 | | 6626 - 7238 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3716 - 3268 | |
| 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) | 4992 - 5276 | | 8320 - 8932 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6656 - 7104 | |
| 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) | 9928 - 9122 | | 952 - 638 | |
| 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) | 6406 - 5764 | | 2406 - 2884 | |
| 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) | 10816 - 11622 | | 5824 - 6138 | |
| 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) | 9152 - 9794 | | 7488 - 7966 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.21.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n78A with UL CA\_n20A-n78A.

Table 5.21.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2438 - 2968 | | 4132 - 4662 | |
| 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) | 2136 - 1576 | | 5738 - 6768 | |
| 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) | 4964 - 5524 | | 7432 - 8462 | |
| 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) | 1304 - 714 | | 9038 - 10568 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 5936 - 4876 | |
| 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) | 5796 - 6386 | | 10732 - 12262 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8264 - 9324 | |
| 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) | 14368 - 12338 | | 148 - 472 | |
| 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) | 9736 - 8176 | | 4014 - 5104 | |
| 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) | 14032 - 16062 | | 6628 - 7248 | |
| 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) | 11564 - 13124 | | 9096 - 10186 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.21.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n41A-n78A with UL CA\_n41A-n78A.

Table 5.21.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2608 - 1220 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.21.2.1.1-2 there are IMD2 and IMD4 from n20 and n41 into RX band n78.

Based on the analysis in Table 5.21.2.1.1-2 there is IMD2 from n20 and n78 into RX band n41.

Based on the analysis in Table 5.21.2.1.1-3 there are IMD2 and IMD5 from n41 and n78 into RX band n20.

#### 5.21.2.2 REFSENS requirements

The MSD requirements for IMD2 components are re-used from DC\_20A-n41A-n78A.

The MSD requirements for IMD4 on Rx n78 and IMD5 on Rx n20 are reuse from CA\_n5-n7-n78.

Table 5.21.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n20-n41-n78 | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | 2593 | 10 | 50 | 2593 | N/A | TDD | N/A |
|  | n78 | N/A | 10 | N/A | 3440 | 28.8 | TDD | IMD2 |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | 2601 | 10 | 50 | 2601 | N/A | TDD | N/A |
|  | n78 | N/A | 10 | N/A | 3508 | 9.7 | TDD | IMD4 |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | N/A | 10 | N/A | 2593 | 29.8 | TDD | IMD2 |
|  | n78 | 3440 | 10 | 50 | 3440 | N/A | TDD | N/A |
|  | n20 | N/A | 5 | N/A | 806 | 30.8 | FDD | IMD2 |
|  | n41 | 2593 | 10 | 50 | 2593 | N/A | TDD | N/A |
|  | n78 | 3399 | 10 | 50 | 3399 | N/A | TDD | N/A |
|  | n20 | N/A | 5 | N/A | 806 | 3.3 | FDD | IMD5 |
|  | n41 | 2635 | 10 | 50 | 2635 | N/A | TDD | N/A |
|  | n78 | 3549.5 | 10 | 50 | 3549.5 | N/A | TDD | N/A |

## 5.22 CA\_n20-n71-n78

### 5.22.1 Common for 1 band UL and 2 bands UL CA

#### 5.22.1.1 Operating bands for CA

Table 5.22.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n20 | 832-862 | 791-821 | FDD |
| n71 | 663-698 | 617-652 | FDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.22.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n20A-n71A-n78A | CA\_n20A-n71A  CA\_n20A-n78A  CA\_n71A-n78A | n20 | 5, 10, 15, 20 | 0 |
|  |  | n71 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

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

For CA\_n20-n71-n78, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n5-n78-n105 as given in the tables below.

Table 5.22.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n20-n71-n78 | 0.7 | 0.7 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.22.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n20-n71-n78 | 0.2 | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.22.2 Specific for 2 bands UL CA

#### 5.22.2.1 UE co-existence studies

##### 5.22.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.22.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n71A-n78A with UL CA\_n20A-n71A.

Table 5.22.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 199 - 134 | | 1495 - 1560 | |
| 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) | 966 - 1061 | | 464 - 564 | |
| 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) | 2327 - 2422 | | 2158 - 2258 | |
| 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) | 1798 - 1923 | | 1127 - 1262 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 268 - 398 | |
| 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) | 3159 - 3284 | | 2821 - 2956 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 2990 - 3120 | |
| 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) | 1960 - 1790 | | 2785 - 2630 | |
| 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) | 430 - 265 | | 1260 - 1100 | |
| 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) | 3484 - 3654 | | 3991 - 4146 | |
| 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) | 3653 - 3818 | | 3822 - 3982 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.22.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n71A-n78A with UL CA\_n20A-n78A.

Table 5.22.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2438 - 2968 | | 4132 - 4662 | |
| 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) | 2136 - 1576 | | 5738 - 6768 | |
| 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) | 4964 - 5524 | | 7432 - 8462 | |
| 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) | 1304 - 714 | | 9038 - 10568 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 5936 - 4876 | |
| 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) | 5796 - 6386 | | 10732 - 12262 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8264 - 9324 | |
| 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) | 14368 - 12338 | | 148 - 472 | |
| 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) | 9736 - 8176 | | 4014 - 5104 | |
| 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) | 14032 - 16062 | | 6628 - 7248 | |
| 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) | 11564 - 13124 | | 9096 - 10186 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.22.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n20A-n71A-n78A with UL CA\_n71A-n78A.

Table 5.22.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 - 3137 | | 3963 - 4498 | |
| 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) | 2474 - 1904 | | 5902 - 6937 | |
| 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) | 4626 - 5196 | | 7263 - 8298 | |
| 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) | 1811 - 1206 | | 9202 - 10737 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 6274 - 5204 | |
| 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) | 5289 - 5894 | | 10563 - 12098 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 7926 - 8996 | |
| 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) | 14537 - 12502 | | 508 - 1148 | |
| 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) | 10074 - 8504 | | 4506 - 5611 | |
| 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) | 13863 - 15898 | | 5952 - 6592 | |
| 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) | 11226 - 12796 | | 8589 - 9694 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.22.2.1.1-1 there is IMD5 from 20 and n71 into RX band n78.

Based on the analysis in Table 5.22.2.1.1-3 there is IMD5 from n71 and n78 into RX band n20.

#### 5.22.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n5-n78-n105.

Table 5.22.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n20-n71-n78 | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3567 | 4 | TDD | IMD5 |
|  | n20 | N/A | 5 | N/A | 808 | 3.8 | FDD | IMD5 |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n78 | 3528 | 10 | 50 | 3528 | N/A | TDD | N/A |

## 5.23 CA\_n3-n20-n71

### 5.23.1 Common for 1 band UL and 2 bands UL CA

#### 5.23.1.1 Operating bands for CA

Table 5.23.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n3 | 1710-1785 | 1805-1880 | FDD |
| n20 | 832-862 | 791-821 | FDD |
| n71 | 663-698 | 617-652 | FDD |

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

Table 5.23.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n20A-n71A | CA\_n3A-n20A  CA\_n3A-n71A  CA\_n20A-n71A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n20 | 5, 10, 15, 20 |  |
|  |  | n71 | 5, 10, 15, 20 |  |

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

For CA\_n3-n20-n71, the ΔTIB,c and ΔRIB,c values are re-used from DC\_3\_n5-n105 as given in the tables below.

Table 5.23.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n20-n71 | 0.3 | 0.3 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.23.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n20-n71 | - | - | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.23.2 Specific for 2 bands UL CA

#### 5.23.2.1 UE co-existence studies

##### 5.23.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.23.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n71A with UL CA\_n3A-n20A.

Table 5.23.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 953 - 848 | | 2542 - 2647 | |
| 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) | 2558 - 2738 | | 121 - 14 | |
| 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) | 4252 - 4432 | | 3374 - 3509 | |
| 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) | 4268 - 4523 | | 711 - 876 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1696 - 1906 | |
| 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) | 5962 - 6217 | | 4206 - 4371 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5084 - 5294 | |
| 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) | 1738 - 1543 | | 6308 - 5978 | |
| 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) | 834 - 1074 | | 3691 - 3406 | |
| 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) | 5038 - 5233 | | 7672 - 8002 | |
| 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) | 5916 - 6156 | | 6794 - 7079 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.23.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n71A with UL CA\_n3A-n71A.

Table 5.23.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 - 1012 | | 2373 - 2483 | |
| 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 - 2907 | | 459 - 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 - 4268 | | 3036 - 3181 | |
| 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) | 4432 - 4692 | | 204 - 384 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2024 - 2244 | |
| 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) | 5793 - 6053 | | 3699 - 3879 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 4746 - 4966 | |
| 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) | 1082 - 867 | | 6477 - 6142 | |
| 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) | 1326 - 1581 | | 4029 - 3734 | |
| 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) | 4362 - 4577 | | 7503 - 7838 | |
| 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 - 5664 | | 6456 - 6751 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.23.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n71A with UL CA\_n20A-n71A.

Table 5.23.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 199 - 134 | | 1495 - 1560 | |
| 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) | 966 - 1061 | | 464 - 564 | |
| 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) | 2327 - 2422 | | 2158 - 2258 | |
| 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) | 1798 - 1923 | | 1127 - 1262 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 268 - 398 | |
| 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) | 3159 - 3284 | | 2821 - 2956 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 2990 - 3120 | |
| 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) | 1960 - 1790 | | 2785 - 2630 | |
| 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) | 430 - 265 | | 1260 - 1100 | |
| 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) | 3484 - 3654 | | 3991 - 4146 | |
| 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) | 3653 - 3818 | | 3822 - 3982 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.23.2.1.1-3 there are IMD4 and IMD5 from n20 and n71 into RX band n3.

#### 5.23.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n3-n20-n28 for IMD4 component and DC\_2A-5A\_n12A for IMD5 component.

Table 5.23.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n20-n71 | n3 | N/A | 5 | N/A | 1843 | 9.4 | FDD | IMD4 |
|  | n20 | 841 | 5 | 25 | 800 | N/A | FDD | N/A |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n3 | N/A | 5 | N/A | 1841 | 5.9 | FDD | IMD5 |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n71 | 672 | 5 | 25 | 626 | N/A | FDD | N/A |

## 5.24 CA\_n3-n20-n77

### 5.24.1 Common for 1 band UL and 2 bands UL CA

#### 5.24.1.1 Operating bands for CA

Table 5.24.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n3 | 1710-1785 | 1805-1880 | FDD |
| n20 | 832-862 | 791-821 | FDD |
| n77 | 3300-4200 | 3300-4200 | TDD |

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

Table 5.24.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n20A-n77A | CA\_n3A-n20A  CA\_n3A-n77A  CA\_n20A-n77A | n3 | 5,10,15,20,25,30,35,40,45,50 | 0 |
|  |  | n20 | 5,10,15,20 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n3A-n20A-n77(2A) | CA\_n3A-n20A  CA\_n3A-n77A  CA\_n20A-n77A | n3 | 5,10,15,20,25,30,35,40,45,50 | 0 |
|  |  | n20 | 5,10,15,20 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |

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

For CA\_n3-n20-n77, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n3-n20-n78 as given in the tables below.

Table 5.24.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n20-n77 | 0.5 | 0.3 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.24.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n20-n77 | 0.2 | - | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.24.2 Specific for 2 bands UL CA

#### 5.24.2.1 UE co-existence studies

##### 5.24.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.24.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n77A with UL CA\_n3A-n20A.

Table 5.24.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 953 - 848 | | 2542 - 2647 | |
| 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) | 2558 - 2738 | | 121 - 14 | |
| 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) | 4252 - 4432 | | 3374 - 3509 | |
| 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) | 4268 - 4523 | | 711 - 876 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1696 - 1906 | |
| 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) | 5962 - 6217 | | 4206 - 4371 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5084 - 5294 | |
| 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) | 1738 - 1543 | | 6308 - 5978 | |
| 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) | 834 - 1074 | | 3691 - 3406 | |
| 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) | 5038 - 5233 | | 7672 - 8002 | |
| 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) | 5916 - 6156 | | 6794 - 7079 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.24.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n77A with UL CA\_n3A-n77A.

Table 5.24.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515 - 2490 | | 5010 - 5985 | |
| 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) | 780 - 270 | | 4815 - 6690 | |
| 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) | 6720 - 7770 | | 8310 - 10185 | |
| 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) | 930 - 2055 | | 8115 - 10890 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 4980 - 3030 | |
| 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) | 8430 - 9555 | | 11610 - 14385 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10020 - 11970 | |
| 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) | 15090 - 11415 | | 3840 - 2640 | |
| 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) | 9180 - 6330 | | 1245 - 3270 | |
| 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) | 14910 - 18585 | | 10140 - 11340 | |
| 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) | 13320 - 16170 | | 11730 - 13755 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.24.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n77A with UL CA\_n20A-n77A.

Table 5.24.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2438 - 3368 | | 4132 - 5062 | |
| 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) | 2536 - 1576 | | 5738 - 7568 | |
| 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) | 4964 - 5924 | | 7432 - 9262 | |
| 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) | 1704 - 714 | | 9038 - 11768 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 6736 - 4876 | |
| 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) | 5796 - 6786 | | 10732 - 13462 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8264 - 10124 | |
| 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) | 15968 - 12338 | | 148 - 872 | |
| 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) | 10936 - 8176 | | 4014 - 5904 | |
| 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) | 14032 - 17662 | | 6628 - 7648 | |
| 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) | 11564 - 14324 | | 9096 - 10986 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.24.2.1.1-1 there are IMD3 and IMD5 from n3 and n20 into RX band n77.

Based on the analysis in Table 5.24.2.1.1-3 there is IMD3 from n20 and n77 into RX band n3.

#### 5.24.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n3-n18-n77.

Table 5.24.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n20-n77 | n3 | 1747 | 5 | 25 | 1842 | N/A | FDD | N/A |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3441 | 16.3 | TDD | IMD31 |
|  | n3 | N/A | 5 | N/A | 1842 | 15.7 | FDD | IMD3 |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n77 | 3536 | 10 | 50 | 3536 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.25 CA\_n1-n3-n71

### 5.25.1 Common for 1 band UL and 2 bands UL CA

#### 5.25.1.1 Operating bands for CA

Table 5.25.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n3 | 1710-1785 | 1805-1880 | FDD |
| n71 | 663-698 | 617-652 | FDD |

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

Table 5.25.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n71A | CA\_n1A-n3A  CA\_n1A-n71A  CA\_n3A-n71A | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n3 | 5,10,15,20,25,30,35,40,45,50 |  |
|  |  | n71 | 5,10,15,20 |  |
| CA\_n1A-n3(2A)-n71A | CA\_n1A-n3A  CA\_n1A-n71A  CA\_n3A-n71A | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n3 | CA\_n3(2A)­\_BCS 4 and 5 |  |
|  |  | n71 | 5,10,15,20 |  |

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

For CA\_n1-n3-n71, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n1-n3-n105 and are given in the tables below.

Table 5.25.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n3-n71 | 0.3 | 0.3 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.25.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n3-n71 | 0.3 | 0.3 | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.25.2 Specific for 2 bands UL CA

#### 5.25.2.1 UE co-existence studies

##### 5.25.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.25.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n3A-n71A with UL CA\_n1A-n3A.

Table 5.25.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 270 - 540 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.25.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n3A-n71A with UL CA\_n1A-n71A.

Table 5.25.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 - 1222 | | 2583 - 2678 | |
| 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) | 3142 - 3297 | | 654 - 524 | |
| 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) | 4503 - 4658 | | 3246 - 3376 | |
| 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) | 5062 - 5277 | | 9 - 174 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2444 - 2634 | |
| 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) | 6423 - 6638 | | 3909 - 4074 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5166 - 5356 | |
| 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) | 872 - 672 | | 7257 - 6982 | |
| 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) | 1746 - 1971 | | 4614 - 4364 | |
| 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) | 4572 - 4772 | | 8343 - 8618 | |
| 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) | 5829 - 6054 | | 7086 - 7336 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.25.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n3A-n71A with UL CA\_n3A-n71A.

Table 5.25.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 - 1012 | | 2373 - 2483 | |
| 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 - 2907 | | 459 - 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 - 4268 | | 3036 - 3181 | |
| 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) | 4432 - 4692 | | 204 - 384 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2024 - 2244 | |
| 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) | 5793 - 6053 | | 3699 - 3879 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 4746 - 4966 | |
| 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) | 1082 - 867 | | 6477 - 6142 | |
| 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) | 1326 - 1581 | | 4029 - 3734 | |
| 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) | 4362 - 4577 | | 7503 - 7838 | |
| 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 - 5664 | | 6456 - 6751 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.25.2.1.1-2 there is IMD5 from n1 and n71 into RX band n3.

Based on the analysis in Table 5.25.2.1.1-3 there is IMD4 from n3 and n71 into RX band n1.

#### 5.25.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n1-n3-n105.

Table 5.25.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n3-n71 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n3 | N/A | 5 | N/A | 1855 | 4 | FDD | IMD5 |
|  | n71 | 695 | 5 | 25 | 649 | N/A | FDD | N/A |
|  | n1 | N/A | 5 | N/A | 2160 | 5 | FDD | IMD4 |
|  | n3 | 1775 | 5 | 25 | 1870 | N/A | FDD | N/A |
|  | n71 | 695 | 5 | 25 | 649 | N/A | FDD | N/A |

## 5.26 CA\_n1-n3-n8

### 5.26.1 Common for 1 band UL and 2 bands UL CA

#### 5.26.1.1 Operating bands for CA

Table 5.26.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n3 | 1710-1785 | 1805-1880 | FDD |
| n8 | 880-915 | 925-960 | FDD |

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

Table 5.26.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n8A | CA\_n1A-n3A  CA\_n1A-n8A  CA\_n3A-n8A | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n3 | 5,10,15,20,25,30,35,40,45,50 |  |
|  |  | n8 | 5,10,15,20 |  |
| CA\_n1A-n3(2A)-n8A | CA\_n1A-n3A  CA\_n1A-n8A  CA\_n3A-n8A | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n3 | CA\_n3(2A) BCS 4 & 5 |  |
|  |  | n8 | 5,10,15,20 |  |

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

For CA\_n1-n3-n8, the TIB,c and RIB,c values have already been specified.

### 5.26.2 Specific for 2 bands UL CA

#### 5.26.2.1 UE co-existence studies

##### 5.26.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.26.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n3A-n8A with UL CA\_n1A-n3A.

Table 5.26.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 270 - 540 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.26.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n3A-n8A with UL CA\_n1A-n8A.

Table 5.26.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1100 - 1005 | | 2800 - 2895 | |
| 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) | 2925 - 3080 | | 220 - 90 | |
| 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) | 4720 - 4875 | | 3680 - 3810 | |
| 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) | 4845 - 5060 | | 660 - 825 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2010 - 2200 | |
| 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) | 6640 - 6855 | | 4560 - 4725 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5600 - 5790 | |
| 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) | 1740 - 1540 | | 7040 - 6765 | |
| 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) | 1095 - 1320 | | 4180 - 3930 | |
| 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) | 5440 - 5640 | | 8560 - 8835 | |
| 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) | 6480 - 6705 | | 7520 - 7770 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.26.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n3A-n8A with UL CA\_n3A-n8A.

Table 5.26.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 905 - 795 | | 2590 - 2700 | |
| 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) | 2505 - 2690 | | 25 - 120 | |
| 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) | 4300 - 4485 | | 3470 - 3615 | |
| 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) | 4215 - 4475 | | 855 - 1035 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1590 - 1810 | |
| 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) | 6010 - 6270 | | 4350 - 4530 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5180 - 5400 | |
| 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) | 1950 - 1735 | | 6260 - 5925 | |
| 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) | 675 - 930 | | 3595 - 3300 | |
| 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) | 5230 - 5445 | | 7720 - 8055 | |
| 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) | 6060 - 6315 | | 6890 - 7185 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

The analysis of the intermodulation products show that the added uplink CA combinations create no intermodulation products inside the third receiver band.

#### 5.26.2.2 REFSENS requirements

No new requirements needed.

## 5.27 CA\_n1-n41-n71

### 5.27.1 Common for 1 band UL and 2 bands UL CA

#### 5.27.1.1 Operating bands for CA

Table 5.27.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n71 | 663-698 | 617-652 | FDD |

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

Table 5.27.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n41A-n71A | CA\_n1A-n41A  CA\_n1A-n71A  CA\_n41A-n71A | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n41 | 5,10,15,20,25,30,35,40,45,50,60,70,80,90,100 |  |
|  |  | n71 | 5,10,15,20 |  |

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

For CA\_n1-n41-n71, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n1-n40-n105 and are given in the tables below.

Table 5.27.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n41-n71 | 0.5 | 0.5 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.27.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n41-n71 | - | - | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.27.2 Specific for 2 bands UL CA

#### 5.27.2.1 UE co-existence studies

##### 5.27.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.27.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n41A-n71A with UL CA\_n1A-n41A.

Table 5.27.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1540 - 1032 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.27.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n41A-n71A with UL CA\_n1A-n71A.

Table 5.27.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 - 1222 | | 2583 - 2678 | |
| 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) | 3142 - 3297 | | 654 - 524 | |
| 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) | 4503 - 4658 | | 3246 - 3376 | |
| 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) | 5062 - 5277 | | 9 - 174 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2444 - 2634 | |
| 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) | 6423 - 6638 | | 3909 - 4074 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5166 - 5356 | |
| 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) | 872 - 672 | | 7257 - 6982 | |
| 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) | 1746 - 1971 | | 4614 - 4364 | |
| 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) | 4572 - 4772 | | 8343 - 8618 | |
| 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) | 5829 - 6054 | | 7086 - 7336 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.27.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n41A-n71A with UL CA\_n41A-n71A.

Table 5.27.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2027 - 1798 | | 3159 - 3388 | |
| 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) | 4294 - 4717 | | 1364 - 1100 | |
| 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) | 5655 - 6078 | | 3822 - 4086 | |
| 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) | 6790 - 7407 | | 701 - 402 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3596 - 4054 | |
| 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) | 8151 - 8768 | | 4485 - 4784 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6318 - 6776 | |
| 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) | 296 - 38 | | 10097 - 9286 | |
| 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) | 2898 - 3391 | | 6744 - 6092 | |
| 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) | 5148 - 5482 | | 10647 - 11458 | |
| 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) | 6981 - 7474 | | 8814 - 9466 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.27.2.1.1-1 there is IMD2 and IMD5 from n1 and n41 into RX band n71.

Based on the analysis in Table 5.27.2.1.1-2 there is IMD2 and IMD4 from n1 and n71 into RX band n41.

#### 5.27.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n1-n7-n105.

Table 5.27.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n41-n71 | n1 | 1935 | 5 | 25 | 2125 | N/A | FDD | N/A |
|  | n41 | 2565 | 10 | 50 | 2565 | N/A | TDD | N/A |
|  | n71 | N/A | 5 | N/A | 630 | 28.7 | FDD | IMD2 |
|  | n1 | 1925 | 5 | 25 | 2115 | N/A | FDD | N/A |
|  | n41 | 2565 | 10 | 50 | 2565 | N/A | FDD | N/A |
|  | n71 | N/A | 5 | N/A | 645 | 1 | FDD | IMD5 |
|  | n1 | 1968.5 | 5 | 25 | 2158.5 | N/A | FDD | N/A |
|  | n41 | N/A | 10 | N/A | 2634.5 | 27 | FDD | IMD22 |
|  | n71 | 666 | 5 | 25 | 620 | N/A | FDD | N/A |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.28 CA\_n1-n8-n41

### 5.28.1 Common for 1 band UL and 2 bands UL CA

#### 5.28.1.1 Operating bands for CA

Table 5.28.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n8 | 880-915 | 925-960 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |

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

Table 5.28.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n8A-n41A | CA\_n1A-n8A  CA\_n1A-n41A  CA\_n8A-n41A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n8 | 5, 10, 15, 20 |  |
|  |  | n41 | 10, 15, 20, 40, 50, 60, 80, 100 |  |

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

For CA\_n1-n8-n41, the ΔTIB,c and ΔRIB,c values are given in the tables below following CA\_n1-n8-n40.

Table 5.28.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n8-n41 | 0.3 | 0.3 | 0.5 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.28.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n8-n41 | - | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.28.2 Specific for 2 bands UL CA

#### 5.28.2.1 UE co-existence studies

##### 5.28.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.28.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n8A-n41A with UL CA\_n1A-n8A.

Table 5.28.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1100 - 1005 | | 2800 - 2895 | |
| 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) | 2925 - 3080 | | 220 - 90 | |
| 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) | 4720 - 4875 | | 3680 - 3810 | |
| 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) | 4845 - 5060 | | 660 - 825 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2010 - 2200 | |
| 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) | 6640 - 6855 | | 4560 - 4725 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5600 - 5790 | |
| 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) | 1740 - 1540 | | 7040 - 6765 | |
| 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) | 1095 - 1320 | | 4180 - 3930 | |
| 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) | 5440 - 5640 | | 8560 - 8835 | |
| 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) | 6480 - 6705 | | 7520 - 7770 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.28.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n8A-n41A with UL CA\_n1A-n41A.

Table 5.28.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1540 - 1032 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.28.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n8A-n41A with UL CA\_n8A-n41A.

Table 5.28.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1581 - 1810 | | 3376 - 3605 | |
| 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) | 930 - 666 | | 4077 - 4500 | |
| 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) | 4256 - 4520 | | 5872 - 6295 | |
| 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) | 50 - 249 | | 6573 - 7190 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3620 - 3162 | |
| 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) | 5136 - 5435 | | 8368 - 8985 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6752 - 7210 | |
| 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) | 9880 - 9069 | | 1164 - 830 | |
| 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) | 6310 - 5658 | | 2247 - 2740 | |
| 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) | 10864 - 11675 | | 6016 - 6350 | |
| 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) | 9248 - 9900 | | 7632 - 8125 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

From the tables it is found that:

- Band n8 may be subject to IMD5 from n1+n41.

#### 5.28.2.2 REFSENS requirements

The MSD value has been taken from CA\_n1A-n7A-n8A.

Table 5.28.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n8-n41 | n1 | 1977.5 | 5 | 25 | 2167.5 | N/A | FDD | N/A |
|  | n8 | N/A | 5 | N/A | 927.5 | 1.0 | FDD | IMD5 |
|  | n41 | 2502.5 | 10 | 50 | 2502.5 | N/A | TDD | N/A |

## 5.29 CA\_n3-n41-n71

### 5.29.1 Common for 1 band UL and 2 bands UL CA

#### 5.29.1.1 Operating bands for CA

Table 5.29.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n3 | 1710-1785 | 1805-1880 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n71 | 663-698 | 617-652 | FDD |

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

Table 5.29.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n41A-n71A | CA\_n3A-n41A  CA\_n3A-n71A  CA\_n41A-n71A | n3 | 5,10,15,20,25,30,35,40,45,50 | 0 |
|  |  | n41 | 5,10,15,20,25,30,35,40,45,50,60,70,80,90,100 |  |
|  |  | n71 | 5,10,15,20 |  |

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

For CA\_n3-n41-n71, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n3-n7-n105 and aregiven in the tables below.

Table 5.29.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n41-n71 | 0.5 | 0.5 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.29.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n41-n71 | - | - | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.29.2 Specific for 2 bands UL CA

#### 5.29.2.1 UE co-existence studies

##### 5.29.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.29.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n41A-n71A with UL CA\_n3A-n41A.

Table 5.29.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1960 - 1422 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.29.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n41A-n71A with UL CA\_n3A-n71A.

Table 5.29.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 - 1012 | | 2373 - 2483 | |
| 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 - 2907 | | 459 - 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 - 4268 | | 3036 - 3181 | |
| 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) | 4432 - 4692 | | 204 - 384 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2024 - 2244 | |
| 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) | 5793 - 6053 | | 3699 - 3879 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 4746 - 4966 | |
| 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) | 1082 - 867 | | 6477 - 6142 | |
| 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) | 1326 - 1581 | | 4029 - 3734 | |
| 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) | 4362 - 4577 | | 7503 - 7838 | |
| 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 - 5664 | | 6456 - 6751 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.29.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n41A-n71A with UL CA\_n41A-n71A.

Table 5.29.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2027 - 1798 | | 3159 - 3388 | |
| 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) | 4294 - 4717 | | 1364 - 1100 | |
| 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) | 5655 - 6078 | | 3822 - 4086 | |
| 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) | 6790 - 7407 | | 701 - 402 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3596 - 4054 | |
| 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) | 8151 - 8768 | | 4485 - 4784 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6318 - 6776 | |
| 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) | 296 - 38 | | 10097 - 9286 | |
| 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) | 2898 - 3391 | | 6744 - 6092 | |
| 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) | 5148 - 5482 | | 10647 - 11458 | |
| 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) | 6981 - 7474 | | 8814 - 9466 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.29.2.1.1-1 there is IMD2 from n41 and n71 into RX band n3.

#### 5.29.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n3-n7-n105.

Table 5.29.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n41-n71 | n3 | N/A | 5 | N/A | 1875 | 16.5 | FDD | IMD2 |
|  | n41 | 2550 | 10 | 50 | 2550 | N/A | FDD | N/A |
|  | n71 | 675 | 5 | 25 | 629 | N/A | FDD | N/A |

## 5.30 CA\_n1-n7-n20

### 5.30.1 Common for 1 band UL and 2 bands UL CA

#### 5.30.1.1 Operating bands for CA

Table 5.30.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz –2170 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n20 | 832 MHz – 862 MHz | 791 MHz – 821 MHz | FDD |

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

Table 5.30.1.2-1: Supported bandwidths per CA band combination of band n25+n41+n77

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR CA configuration | | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n7A-n20A | CA\_n1A-n7A  CA\_n1A-n20A  CA\_n7A-n20A | | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n20 | n20 channel bandwidths in Table 5.3.5-1 |  |

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

Requirements for CA\_n1-n7-n20, for the TIB,c and RIB,c values are given in the tables below following CA\_n1-n7, CA\_n1-n20 and Ca\_n7-n20 values.

Table 5.30.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n7-n20 | 0.5 | 0.6 | 0.3 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.30.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n7-n20 | - | 0.5 | - |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.30.2 Specific for 2 bands UL CA

#### 5.30.2.1 UE co-existence studies

##### 5.30.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.30.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n7A-n20A with UL CA\_n1A-n7A.

Table 5.30.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 650 – 520 | | 4420 - 4550 | |
| 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) | 1270- 1460 | | 3020 - 3220 | |
| 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) | 6340 - 6530 | | 6920 - 7120 | |
| 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) | 3190- 3440 | | 5508 - 6150 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1300 - 1040 | |
| 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) | 8260 - 8510 | | 9420 - 9100 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5504 - 5684 | |
| 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) | 7088- 6818 | | 1528 - 1348 | |
| 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) | 3870 - 3540 | | 940 - 620 | |
| 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) | 4276 - 4036 | | 1254 - 1464 | |
| 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) | 7424 - 7664 | | 6336 - 6546 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on Table 5.30.2.1.1-1, 5th order IMD from Band n1 and Band n7 may fall into Rx frequencies of band n20.

Table 5.30.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n7A-n20A with UL CA\_n1A-n20A.

Table 5.30.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1148 - 1058 | | 2752 - 2842 | |
| 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) | 316 - 196 | | 2978 - 3128 | |
| 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) | 3584 - 3704 | | 4672 - 4822 | |
| 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) | 516 - 666 | | 4898 - 5108 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2296 - 2116 | |
| 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) | 4416 - 4566 | | 6592 - 6802 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 11440 - 10560 | |
| 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) | 13280 - 11220 | | 4620 - 3880 | |
| 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) | 7560 - 5940 | | 660 - 1840 | |
| 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) | 13740 - 15360 | | 12360 - 13540 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on Table 5.30.2.1.1-2, there is no IMD impact from UL CA\_n1A-n20A into Rx frequencies of band n7.

Table 5.30.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n7A-n20A with UL CA\_n7A-n20A.

Table 5.30.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1738 - 1638 | | 3332 - 3432 | |
| 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) | 906 - 776 | | 4138 - 4308 | |
| 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) | 4164 - 4294 | | 5832 - 6002 | |
| 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) | 74 - 86 | | 6638 - 6878 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3476 - 3276 | |
| 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) | 4996 - 5156 | | 8332 - 8572 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6664 - 6864 | |
| 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) | 9448 - 9138 | | 948 - 758 | |
| 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) | 6046 - 5776 | | 2414 - 2644 | |
| 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) | 10832 - 11142 | | 5828 - 6018 | |
| 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) | 9164 - 9434 | | 7496 - 7726 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on Table 5.30.2.1.1-3, there is no IMD impact from UL CA\_n7A-n20A into Rx frequencies of band n1.

From the tables above it is found that:

- Band n20 may be subject to IMD5.

#### 5.30.2.2 REFSENS requirements

MSD values have been taken from CA\_n1A-n7A-n28A.

Table 5.30.2.2-1: MSD due to IMD issue

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n7-n20 | n1 | 1940 | 5 | 25 | 2130 | N/A | FDD | N/A |
|  | n7 | 2510 | 10 | 50 | 2630 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 800 | 4.5 | FDD | IMD5 |

## 5.31 CA\_n1-n3-n75

### 5.31.1 Common for 1 band UL and 2 bands UL CA

#### 5.31.1.1 Operating bands for CA

Table 5.31.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n3 | 1710 MHz – 1785 MHz | 1805 MHz – 1880 MHz | FDD |
| n75 | N/A | 1432 MHz – 1517 MHz | SDL19 |

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

Table 5.31.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n3A-n75A | CA\_n1A-n3A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n3 | n3 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n75 | n75 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n1-n3-n75, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.31.2 Specific for 2 bands UL CA

#### 5.31.2.1 UE co-existence studies

##### 5.31.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.31.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n3A-n75A with UL CA\_n1A-n3A.

Table 5.31.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_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) | 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 270–540 | |  | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 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) | 4860–5220 | | 5895–6210 | |
| 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) | 1170–1515 | | 2190–2520 | |
| 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 3rd and 5th order IMD generated by UL CA\_n1A-n3A may fall into own Rx of Band n75.

#### 5.31.2.2 REFSENS requirements

We analyze the IMD using the following component linearity assumptions:

Table 5.31.2.2-1 General linearity parameters

|  |  |
| --- | --- |
| **Component** | **IP3 (dBm)** |
| Antenna switch | 68 |
| Diplexer | 86 |
| Triplexer | 82 |
| PA forward mixing | 30 |
| PA reverse mixing | 28 |
| LNA | -6 |

Based on these parameters we get the following MSD.

Table 5.31.2.2-2: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n3-n75 | n1 | 1960 | 5 | 25 | 2150 | N/A | FDD | N/A |
|  | n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
|  | n75 | N/A | 5 | N/A | 1480 | 24.2 | SDL | IMD34 |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.32 CA\_n1-n7-n78

### 5.32.1 Common for 1 band UL and 2 bands UL CA

#### 5.32.1.1 Operating bands for CA

Table 5.32.1.1-1: CA band combination constituent bands definition

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

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

Table 5.32.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n7A-n78A | CA\_n1A-n7A  CA\_n1A-n78A  CA\_n7A-n78A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n1A-n7A-n78A, the ΔTIB,c and ΔRIB,c values have already been specified in TS 38.101-1.

### 5.32.2 Specific for 2 bands UL CA

#### 5.32.2.1 UE co-existence studies

##### 5.32.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.32.2.1.1-1, Table 5.32.2.1.1-2 and Table 5.32.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n7A-n78A with UL CA\_n1A-n7A, UL CA\_n1A-n78A and UL CA\_n7A-n78A.

Table 5.32.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 520–650 | | 4420–4550 | |
| 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) | 1270–1460 | | 3020–3220 | |
| 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) | 6340–5745 | | 6920–7120 | |
| 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) | 3190–3440 | | 5520–5790 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1040–1300 | |  | |
| 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) | 8260–8510 | | 9420–9690 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 8840–9100 | |  | |
| 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) | 8020–8360 | | 5110–5420 | |
| 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) | 3540–3870 | | 620–940 | |
| 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) | 11920–12260 | | 10180–10490 | |
| 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) | 11340–11670 | | 10760–11080 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 4th and 5th order IMD generated by UL CA\_n1A-n7A may fall into own Rx of Band n78

Table 5.32.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320–1880 | | 5520–5780 | |
| 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) | 40–660 | | 4620–5680 | |
| 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) | 7140–7760 | | 8520–9580 | |
| 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) | 1960–2640 | | 7920–79480 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 2640–3760 | |  | |
| 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) | 9060–9740 | | 11820–13380 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 10440–11560 | |  | |
| 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) | 11220–13280 | | 3880–4620 | |
| 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) | 5940–7560 | | 660–1840 | |
| 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) | 15120–17180 | | 10980–11720 | |
| 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) | 13740–15360 | | 12360–13540 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 4th order IMD generated by UL CA\_n1A-n78A may fall into own Rx of Band n7.

Table 5.32.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 730–1300 | | 5800–6370 | |
| 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) | 1200–1840 | | 4030–5100 | |
| 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) | 8300–8940 | | 9100–10170 | |
| 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) | 3700–4410 | | 7330–8900 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1460–2600 | |  | |
| 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) | 10800–11510 | | 12400–13970 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 11600–12740 | |  | |
| 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) | 10630–12700 | | 6200–6980 | |
| 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) | 4760–6400 | | 100–1110 | |
| 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) | 15700–17770 | | 13300–14080 | |
| 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) | 14900–16540 | | 14100–15310 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 4th order IMD generated by UL CA\_n7A-n78A may fall into own Rx of Band n1.

#### 5.32.2.2 REFSENS requirements

For CA\_n1-n7-n78, the MSD values have already been specified in TS 38.101-1. However，the IMD5 from CA\_n1A-n7A to Rx n78 is missing. Here IMD5 to n78 is added.

Table 5.32.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n1-n7-n78 | n1 | 1977.5 | 5 | 25 | 2167.5 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2627.5 | 9.1 | FDD | IMD4 |
|  | n78 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
|  | n1 | N/A | 5 | N/A | 2140 | 8.7 | FDD | IMD4 |
|  | 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 | N/A | 10 | N/A | 3390 | 10.1 | TDD | IMD4 |
|  | n1 | 1940 | 5 | 25 | 2130 | N/A | FDD | N/A |
|  | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3770 | 1.3 | TDD | IMD5 |

## 5.33 CA\_n7-n25-n29

### 5.33.1 Common for 1 band UL and 2 bands UL CA

#### 5.33.1.1 Operating bands for CA

Table 5.33.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n29 | N/A | 717 MHz – 728 MHz | SDL |

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

Table 5.33.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n7A-n25A-n29A | CA\_n7A-n25A | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n25 | n25 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n29 | n29 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n7-n25-n29, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.33.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n25-n29 | 0.5 | 0.5 | N/A |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.33.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n25-n29 | - | - | - |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.33.2 Specific for 2 bands UL CA

#### 5.33.2.1 UE co-existence studies

##### 5.33.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.33.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n7A-n25A-n29A with UL CA\_n7A-n25A.

Table 5.33.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 585–720 | | 4350–4485 | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 3085–3290 | | 1130–1330 | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 6850–7055 | | 6200–6400 | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 5585–5860 | | 2980–3245 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1170–1440 | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 9350–9625 | | 8050–8315 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8700–8970 | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 4830–5160 | | 8085–8430 | |
| 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) | 410–745 | | 3670–4010 | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 9900–10230 | | 11850–12195 | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 10550–10885 | | 11200–11540 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, 2nd and 5th order IMD generated by UL CA\_n7A-n25A may fall into own Rx of Band n29.

#### 5.33.2.2 REFSENS requirements

Based on the co-existence studies, there is a need to define MSD values. MSD values are specified as following.

Table 5.33.2.2-3: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc (MHz)** | **UL/DL BW (MHz)** | **UL CLRB** | **DL Fc (MHz)** | **MSD (dB)** | **Duplex mode** |  |
| CA\_n7-n25-n29 | n7 | 2567.5 | 5 | 25 | 2687.5 | N/A | FDD | N/A |
|  | n25 | 1852.5 | 5 | 25 | 1932.5 | N/A | FDD | N/A |
|  | n29 | N/A | 5 | N/A | 719.5 | 26 | SDL | IMD2 |
|  | n7 | 2503 | 5 | 25 | 2623 | N/A | FDD | N/A |
|  | n25 | 1910 | 5 | 25 | 1990 | N/A | FDD | N/A |
|  | n29 | N/A | 5 | N/A | 724 | 4.5 | SDL | IMD5 |

## 5.34 CA\_n7-n29-n66

### 5.34.1 Common for 1 band UL and 2 bands UL CA

#### 5.34.1.1 Operating bands for CA

Table 5.34.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n29 | N/A | 717 MHz – 728 MHz | SDL |
| n66 | 1710 MHz – 1780 MHz | 2110 MHz – 2200 MHz | FDD |

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

Table 5.34.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n7A-n29A-n66A | CA\_n7A-n66A | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n29 | n29 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n7-n29-n66, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.34.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n29-n66 | 0.5 | N/A | 0.5 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.34.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n29-n66 | 0.5 | - | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.34.2 Specific for 2 bands UL CA

#### 5.34.2.1 UE co-existence studies

##### 5.34.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.34.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n7A-n29A-n66A with UL CA\_n7A-n66A.

Table 5.34.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 720–860 | | 4210–4350 | |
| 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) | 3220–3430 | | 850–1060 | |
| 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) | 6710–6920 | | 5920–6130 | |
| 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) | 5720–6000 | | 2560–2840 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1440–1720 | |
| 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) | 9210–9490 | | 7630–7910 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8420–8700 | |
| 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) | 4270–4620 | | 8220–8570 | |
| 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) | 10–340 | | 3940–4290 | |
| 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) | 9340–9690 | | 11710–12060 | |
| 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) | 10130–10480 | | 10920–11270 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, 2nd order IMD generated by UL CA\_n7A-n66A may fall into own Rx of Band n29.

#### 5.34.2.2 REFSENS requirements

Based on the co-existence studies, there is a need to define MSD values. MSD values from DC\_12-66\_n7 are reused as below.

Table 5.34.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n7-n29-n66 | n7 | 2502.5 | 5 | 25 | 2622.5 | N/A | FDD | N/A |
|  | n29 | N/A | 5 | N/A | 725 | 31 | SDL | IMD2 |
|  | n66 | 1777.5 | 5 | 25 | 2197.5 | N/A | FDD | N/A |

## 5.35 CA\_n7-n29-n77

### 5.35.1 Common for 1 band UL and 2 bands UL CA

#### 5.35.1.1 Operating bands for CA

Table 5.35.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n29 | N/A | 717 MHz – 728 MHz | SDL |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.35.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n7A-n29A-n77A | CA\_n7A-n77A | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n29 | n29 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n7A-n29A-n77(2A) | CA\_n7A-n77A  CA\_n77(2A) | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n29 | n29 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |
| CA\_n7A-n29A-n77(3A) | CA\_n7A-n77A  CA\_n77(2A) | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n29 | n29 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | CA\_n77(3A)\_BCS4 and 5 |  |

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

For CA\_n7-n29-n77 the ΔTIB,c and ΔRIB,c values are given in the tables below, reusing from CA\_n7-n12-n77.

Table 5.35.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n29-n77 | 0.5 | N/A | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.35.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n29-n77 | 0.2 | 0.5 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.35.2 Specific for 2 bands UL CA

#### 5.35.2.1 UE co-existence studies

##### 5.35.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.35.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n7A-n29A-n77A with UL CA\_n7A-n77A.

Table 5.35.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 730–1700 | | 5800–6770 | |
| 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) | 800–1840 | | 4030–5900 | |
| 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) | 8300–9340 | | 9100–10970 | |
| 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) | 3300–4410 | | 7330–10100 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1460-3400 | |
| 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) | 10800–11910 | | 12400–15170 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 11600–13540 | |
| 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) | 10630–14300 | | 5800–6980 | |
| 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) | 4760–7600 | | 690–1110 | |
| 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) | 15700–19370 | | 13300–14480 | |
| 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) | 14900–17740 | | 14100–16110 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, IMD5 generated by UL CA\_n7A-n77A fall into own Rx of Band n29.

In addition, there is no additional MSD due to UL CA\_n77(2A) needs to be specified for three bands DL configuration.

#### 5.35.2.2 REFSENS requirements

Based on the co-existence studies, MSD for IMD5 is introduced as following, the values are reused from DC\_7A-29A\_n78A.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n29-n77 | n7 | 2540 | 5 | 25 | 2660 | N/A | FDD | N/A |
|  | n29 | N/A | 5 | N/A | 720 | 3.0 | SDL | IMD5 |
|  | n77 | 3450 | 10 | 50 | 3450 | N/A | TDD | N/A |

## 5.36 CA\_n3-n40-n79

### 5.36.1 Common for 1 band UL and 2 bands UL CA

#### 5.36.1.1 Operating bands for CA

Table 5.36.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n40 | 2300 MHz – 2400 MHz | 2300 MHz – 2400 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.36.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n40A-n79A | CA\_n3A-n40A  CA\_n3A-n79A  CA\_n40A-n79A | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n40 | See n40 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n3-n40-n79, the ΔTIB,c and ΔRIB,c values are proposed in the following tables:

Table 5.36.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n40-n79 | 0.5 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.36.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n40-n79 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n3 the band order from left to right is n1, n3 and n3. | | | |

### 5.36.2 Specific for 2 bands UL CA

#### 5.36.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n3A-n40A, CA\_n3A-n79A and CA\_n40A-n79A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD5 issue caused by n3+n40, i.e. fn40-4\*fn3, fall into the its own band n79 Rx;

IMD5 issue caused by n3+n79, i.e. fn79-4\*fn3, fall into the its own band n40 Rx;

IMD5 issue caused by n40+n79, i.e. 2\*fn79-3\*fn40, fall into the its own band n3 Rx;

#### 5.36.2.2 REFSENS requirements

Based on co-existence studies additional MSD is needed to be defined. The MSD values are proposed in table 5.36.2.2-1.

Table 5.36.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| CA\_n3-n40-n79 | n3 | 1782.5 | 5 | 25 | 1877.5 | N/A | N/A |
|  | n40 | 2310 | 5 | 25 | 2310 | N/A | N/A |
|  | n79 | N/A | 40 | N/A | 4820 | 3.3 | IMD5 |
|  | n3 | 1782.5 | 5 | 25 | 1877.5 | N/A | N/A |
|  | n40 | N/A | 5 | N/A | 2310 | 5.9 | IMD5 |
|  | n79 | 4820 | 40 | 216 | 4820 | N/A | N/A |
|  | n3 | N/A | 5 | N/A | 1850 | 4.7 | IMD5 |
|  | n40 | 2350 | 5 | 25 | 2350 | N/A | N/A |
|  | n79 | 4450 | 40 | 216 | 4450 | N/A | N/A |

## 5.37 CA\_n3-n7-n77

### 5.37.1 Common for 1 band UL and 2 bands UL CA

#### 5.37.1.1 Operating bands for CA

Table 5.37.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 1710-1785 | 1805-1880 | FDD |
| n7 | 2500-2570 | 2620-2690 | FDD |
| n77 | 3300-4200 | 3300-4200 | TDD |

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

Table 5.37.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n7A-n77A | CA\_n3A-n7A CA\_n3A-n77A CA\_n7A-n77A | n3 | n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n3A-n7A-n77(2A) | CA\_n77(2A)  CA\_n3A-n7A CA\_n3A-n77A CA\_n7A-n77A | n3 | n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |

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

For CA\_n3-n7-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below as taken from CA\_n3-n7-n78.

Table 5.37.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n7-n77 | 0.6 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5 | | | |

Table 5.37.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n7-n77 | 0.2 | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.37.2 Specific for 2 bands UL CA

#### 5.37.2.1 UE co-existence studies

##### 5.37.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.37.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n7A-n77A with UL CA\_n3A-n7A.

Table 5.37.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 715 - 860 | | 4210 - 4355 | |
| 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) | 850 - 1070 | | 3215 - 3430 | |
| 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) | 5920 - 6140 | | 6710 - 6925 | |
| 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) | 2560 - 2855 | | 5715 - 6000 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1720 - 1430 | |
| 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) | 7630 - 7925 | | 9210 - 9495 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8420 - 8710 | |
| 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) | 8570 - 8215 | | 4640 - 4270 | |
| 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) | 4290 - 3930 | | 355 - 10 | |
| 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) | 11710 - 12065 | | 9340 - 9710 | |
| 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) | 10920 - 11280 | | 10130 - 10495 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.37.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n7A-n77A with UL CA\_n3A-n77A.

Table 5.37.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515 - 2490 | | 5010 - 5985 | |
| 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) | 780 - 270 | | 4815 - 6690 | |
| 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) | 6720 - 7770 | | 8310 - 10185 | |
| 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) | 930 - 2055 | | 8115 - 10890 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 4980 - 3030 | |
| 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) | 8430 - 9555 | | 11610 - 14385 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10020 - 11970 | |
| 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) | 15090 - 11415 | | 3840 - 2640 | |
| 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) | 9180 - 6330 | | 1245 - 3270 | |
| 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) | 14910 - 18585 | | 10140 - 11340 | |
| 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) | 13320 - 16170 | | 11730 - 13755 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.37.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n7A-n77A with UL CA\_n7A-n77A.

Table 5.37.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 730 - 1700 | | 5800 - 6770 | |
| 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) | 800 - 1840 | | 4030 - 5900 | |
| 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) | 8300 - 9340 | | 9100 - 10970 | |
| 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) | 3300 - 4410 | | 7330 - 10100 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3400 - 1460 | |
| 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) | 10800 - 11910 | | 12400 - 15170 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 11600 - 13540 | |
| 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) | 14300 - 10630 | | 6980 - 5800 | |
| 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) | 7600 - 4760 | | 1110 - 900 | |
| 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) | 15700 - 19370 | | 13300 - 14480 | |
| 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) | 14900 - 17740 | | 14100 - 16110 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.37.2.1.1-1 there is IMD3 and IMD5 from n3 and n7 into RX band n77.

Based on the analysis in Table 5.37.2.1.1-2 there is IMD5 from n3 and n77 into RX band n7.

Based on the analysis in Table 5.37.2.1.1-3 there is IMD3 and IMD4 from n7 and n77 into RX band n3.

##### 5.37.2.2 REFSENS requirements

The MSD requirements are based on CA\_n3-n7-n78 and DC\_3-7\_n77.

Table 5.37.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n7-n77 | n3 | N/A | 5 | N/A | 1820 | 17.6 | FDD | IMD3 |
|  | n7 | 2565 | 5 | 25 | 2685 | N/A | FDD | N/A |
|  | n77 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |
|  | n3 | N/A | 5 | N/A | 1820 | 8.6 | FDD | IMD4 |
|  | n7 | 2565 | 5 | 25 | 2685 | N/A | FDD | N/A |
|  | n77 | 3475 | 10 | 50 | 3475 | N/A | TDD | N/A |
|  | n3 | 1715 | 5 | 25 | 1810 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2685 | 3.4 | FDD | IMD5 |
|  | n77 | 4175 | 10 | 50 | 4175 | N/A | TDD | N/A |
|  | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3390 | 16.1 | TDD | IMD31 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.38 CA\_n1-n20-n41

### 5.38.1 Common for 1 band UL and 2 bands UL CA

#### 5.38.1.1 Operating bands for CA

Table 5.38.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n20 | 832-862 | 791-821 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |

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

Table 5.38.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n20A-n41A | CA\_n1A-n20A  CA\_n1A-n41A  CA\_n20A-n41A | n1 | 5, 10, 15, 20, 25, 30, 40, 45, 50 | 0 |
|  |  | n20 | 5, 10, 15, 20 |  |
|  |  | n41 | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |  |

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

For CA\_n1-n20-n41, the ΔTIB,c values are reused from CA\_n1-n18-n41 which are given in the tables below.

Table 5.38.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n20-n41 | 0.5 | 0.3 | 0.5 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

ΔRIB,c values are reused from CA\_n1-n28-n41 which are given in the tables below.

Table 5.38.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n20-n41 | - | 0.2 | - |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.38.2 Specific for 2 bands UL CA

#### 5.38.2.1 UE co-existence studies

##### 5.38.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.38.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n41A with UL CA\_n1A-n20A.

Table 5.38.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1148 - 1058 | | 2752 - 2842 | |
| 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) | 2978 - 3128 | | 316 - 196 | |
| 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) | 4672 - 4822 | | 3584 - 3704 | |
| 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) | 4898 - 5108 | | 516 - 666 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2116 - 2296 | |
| 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) | 6592 - 6802 | | 4416 - 4566 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5504 - 5684 | |
| 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) | 1528 - 1348 | | 7088 - 6818 | |
| 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) | 1254 - 1464 | | 4276 - 4036 | |
| 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) | 5248 - 5428 | | 8512 - 8782 | |
| 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) | 6336 - 6546 | | 7424 - 7664 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.38.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n41A with UL CA\_n1A-n41A.

Table 5.38.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1540 - 1032 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.38.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n41A with UL CA\_n20A-n41A.

Table 5.38.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1634 - 1858 | | 3328 - 3552 | |
| 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) | 1026 - 772 | | 4130 - 4548 | |
| 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) | 4160 - 4414 | | 5824 - 6242 | |
| 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) | 194 - 90 | | 6626 - 7238 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3716 - 3268 | |
| 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) | 4992 - 5276 | | 8320 - 8932 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6656 - 7104 | |
| 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) | 9928 - 9122 | | 952 - 638 | |
| 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) | 6406 - 5764 | | 2406 - 2884 | |
| 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) | 10816 - 11622 | | 5824 - 6138 | |
| 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) | 9152 - 9794 | | 7488 - 7966 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.38.2.1.1-2 there is IMD5 from n1 and n41 into RX band n20.

#### 5.38.2.2 REFSENS requirements

The MSD value has been taken from CA\_n1-n18-n41.

Table 5.38.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n20-n41 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 810 | 3.3 | FDD | IMD5 |
|  | n41 | 2550 | 10 | 50 | 2550 | N/A | TDD | N/A |

## 5.39 CA\_n1-n20-n77

### 5.39.1 Common for 1 band UL and 2 bands UL CA

#### 5.39.1.1 Operating bands for CA

Table 5.39.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n20 | 832-862 | 791-821 | FDD |
| n77 | 3300-4200 | 3300-4200 | TDD |

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

Table 5.39.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n20A-n77A | CA\_n1A-n20A  CA\_n1A-n77A  CA\_n20A-n77A | n1 | 5,10,15,20,25,30,40,45,50 | 4 and 5 |
|  |  | n20 | 5,10,15,20 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n1A-n20A-n77(2A) | CA\_n1A-n20A  CA\_n1A-n77A  CA\_n20A-n77A | n1 | 5,10,15,20,25,30,40,45,50 | 4 and 5 |
|  |  | n20 | 5,10,15,20 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |

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

For CA\_n1-n20-n77, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n1-n20-n78 as given in the tables below.

Table 5.39.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n20-n77 | 0.3 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.39.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n20-n77 | - | - | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.39.2 Specific for 2 bands UL CA

#### 5.39.2.1 UE co-existence studies

##### 5.39.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.39.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n77A with UL CA\_n1A-n20A.

Table 5.39.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1148 - 1058 | | 2752 - 2842 | |
| 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) | 2978 - 3128 | | 316 - 196 | |
| 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) | 4672 - 4822 | | 3584 - 3704 | |
| 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) | 4898 - 5108 | | 516 - 666 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2116 - 2296 | |
| 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) | 6592 - 6802 | | 4416 - 4566 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5504 - 5684 | |
| 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) | 1528 - 1348 | | 7088 - 6818 | |
| 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) | 1254 - 1464 | | 4276 - 4036 | |
| 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) | 5248 - 5428 | | 8512 - 8782 | |
| 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) | 6336 - 6546 | | 7424 - 7664 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.39.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n77A with UL CA\_n1A-n77A.

Table 5.39.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320 - 2280 | | 5220 - 6180 | |
| 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) | 360 - 660 | | 4620 - 6480 | |
| 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) | 7140 - 8160 | | 8520 - 10380 | |
| 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) | 1560 - 2640 | | 7920 - 10680 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 4560 - 2640 | |
| 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) | 9060 - 10140 | | 11820 - 14580 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10440 - 12360 | |
| 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) | 14880 - 11220 | | 4620 - 3480 | |
| 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) | 8760 - 5940 | | 660 - 2640 | |
| 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) | 15120 - 18780 | | 10980 - 12120 | |
| 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) | 13740 - 16560 | | 12360 - 14340 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.39.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n20A-n77A with UL CA\_n20A-n77A.

Table 5.39.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2438 - 3368 | | 4132 - 5062 | |
| 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) | 2536 - 1576 | | 5738 - 7568 | |
| 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) | 4964 - 5924 | | 7432 - 9262 | |
| 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) | 1704 - 714 | | 9038 - 11768 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 6736 - 4876 | |
| 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) | 5796 - 6786 | | 10732 - 13462 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8264 - 10124 | |
| 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) | 15968 - 12338 | | 148 - 872 | |
| 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) | 10936 - 8176 | | 4014 - 5904 | |
| 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) | 14032 - 17662 | | 6628 - 7648 | |
| 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) | 11564 - 14324 | | 9096 - 10986 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.39.2.1.1-1 there are IMD3 and IMD5 from n1 and n20 into RX band n77.

Based on the analysis in Table 5.39.2.1.1-2 there is IMD5 from n1 and n77 into RX band n20.

Based on the analysis in Table 5.39.2.1.1-3 there is IMD3 from n20 and n77 into RX band n1.

#### 5.39.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n1-n18-n77.

Table 5.39.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n20-n77 | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3644 | 15.7 | TDD | IMD31 |
|  | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 806 | 3.5 | FDD | IMD5 |
|  | n77 | 3328 | 10 | 50 | 3328 | N/A | TDD | N/A |
|  | n1 | N/A | 5 | N/A | 2140 | 16.4 | FDD | IMD3 |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n77 | 3834 | 10 | 50 | 3834 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.40 CA\_n1-n71-n77

### 5.40.1 Common for 1 band UL and 2 bands UL CA

#### 5.40.1.1 Operating bands for CA

Table 5.40.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n71 | 663-698 | 617-652 | FDD |
| n77 | 3300-4200 | 3300-4200 | TDD |

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

Table 5.40.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n71A-n77A | CA\_n1A-n71A  CA\_n1A-n77A  CA\_n71A-n77A | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n77 | 10,15,20,25,30,40,50,60,70,80,90,100 |  |
| CA\_n1A-n71A-n77(2A) | CA\_n1A-n71A  CA\_n1A-n77A  CA\_n71A-n77A | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n77 | CA\_n77(2A)\_BCS 4 and 5 |  |

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

For CA\_n1-n71-n77, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n1-n78-n105 and are given in the tables below.

Table 5.40.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n71-n77 | 0.3 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.40.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n71-n77 | - | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.40.2 Specific for 2 bands UL CA

#### 5.40.2.1 UE co-existence studies

##### 5.40.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.40.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n71A-n77A with UL CA\_n1A-n71A.

Table 5.40.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 - 1222 | | 2583 - 2678 | |
| 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) | 3142 - 3297 | | 654 - 524 | |
| 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) | 4503 - 4658 | | 3246 - 3376 | |
| 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) | 5062 - 5277 | | 9 - 174 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2444 - 2634 | |
| 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) | 6423 - 6638 | | 3909 - 4074 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5166 - 5356 | |
| 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) | 872 - 672 | | 7257 - 6982 | |
| 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) | 1746 - 1971 | | 4614 - 4364 | |
| 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) | 4572 - 4772 | | 8343 - 8618 | |
| 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) | 5829 - 6054 | | 7086 - 7336 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.40.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n71A-n77A with UL CA\_n1A-n77A.

Table 5.40.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320 - 2280 | | 5220 - 6180 | |
| 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) | 360 - 660 | | 4620 - 6480 | |
| 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) | 7140 - 8160 | | 8520 - 10380 | |
| 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) | 1560 - 2640 | | 7920 - 10680 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 4560 - 2640 | |
| 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) | 9060 - 10140 | | 11820 - 14580 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10440 - 12360 | |
| 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) | 14880 - 11220 | | 4620 - 3480 | |
| 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) | 8760 - 5940 | | 660 - 2640 | |
| 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) | 15120 - 18780 | | 10980 - 12120 | |
| 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) | 13740 - 16560 | | 12360 - 14340 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.40.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n71A-n77A with UL CA\_n71A-n77A.

Table 5.40.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 - 3537 | | 3963 - 4898 | |
| 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) | 2874 - 1904 | | 5902 - 7737 | |
| 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) | 4626 - 5596 | | 7263 - 9098 | |
| 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) | 2211 - 1206 | | 9202 - 11937 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 7074 - 5204 | |
| 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) | 5289 - 6294 | | 10563 - 13298 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 7926 - 9796 | |
| 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) | 16137 - 12502 | | 508 - 1548 | |
| 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) | 11274 - 8504 | | 4506 - 6411 | |
| 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) | 13863 - 17498 | | 5952 - 6992 | |
| 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) | 11226 - 13996 | | 8589 - 10494 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.40.2.1.1-1 there is IMD3 and IMD4 from n1 and n71 into RX band n77.

Based on the analysis in Table 5.40.2.1.1-2 there is IMD3 from n1 and n77 into RX band n71.

Based on the analysis in Table 5.40.2.1.1-3 there is IMD3 and IMD4 from n71 and n77 into RX band n1.

#### 5.40.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n1-n78-n105.

Table 5.40.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n71-n77 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n71 | N/A | 5 | N/A | 635 | 15.2 | FDD | IMD3 |
|  | n77 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
|  | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n71 | 686 | 5 | 25 | 640 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3342 | 15.7 | TDD | IMD3 |
|  | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3992 | 9.4 | TDD | IMD4 |
|  | n1 | N/A | 5 | N/A | 2160 | 15.7 | FDD | IMD3 |
|  | n71 | 686 | 5 | 25 | 640 | N/A | FDD | N/A |
|  | n77 | 3532 | 10 | 50 | 3532 | N/A | TDD | N/A |
|  | n1 | N/A | 5 | N/A | 2141 | 10.1 | FDD | IMD4 |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n77 | 4181 | 10 | 50 | 4181 | N/A | TDD | N/A |

## 5.41 CA\_n3-n20-n41

### 5.41.1 Common for 1 band UL and 2 bands UL CA

#### 5.41.1.1 Operating bands for CA

Table 5.41.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n3 | 1710-1785 | 1805-1880 | FDD |
| n20 | 832-862 | 791-821 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |

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

Table 5.41.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n20A-n41A | CA\_n3A-n20A  CA\_n3A-n41A  CA\_n20A-n41A | n3 | 5, 10, 15, 20, 25, 30, 45, 40, 45, 50 | 0 |
|  |  | n20 | 5, 10, 15, 20 |  |
|  |  | n41 | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 |  |

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

For CA\_n3-n20-n41, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n3-n18-n41 as given in the tables below.

Table 5.41.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n20-n41 | 0.5 | 0.3 | 0.31 / 0.82 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5.  NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2515-2690 MHz.  NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496-2515 MHz. | | | |

Table 5.41.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n20-n41 | - | - | 01 / 0.52 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8.  NOTE 1: Applicable for the frequency range of 2515-2690 MHz.  NOTE 2: Applicable for the frequency range of 2496-2515 MHz. | | | |

### 5.41.2 Specific for 2 bands UL CA

#### 5.41.2.1 UE co-existence studies

##### 5.41.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.41.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n41A with UL CA\_n3A-n20A.

Table 5.41.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 953 - 848 | | 2542 - 2647 | |
| 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) | 2558 - 2738 | | 121 - 14 | |
| 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) | 4252 - 4432 | | 3374 - 3509 | |
| 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) | 4268 - 4523 | | 711 - 876 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1696 - 1906 | |
| 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) | 5962 - 6217 | | 4206 - 4371 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5084 - 5294 | |
| 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) | 1738 - 1543 | | 6308 - 5978 | |
| 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) | 834 - 1074 | | 3691 - 3406 | |
| 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) | 5038 - 5233 | | 7672 - 8002 | |
| 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) | 5916 - 6156 | | 6794 - 7079 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.41.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n41A with UL CA\_n3A-n41A.

Table 5.41.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1960 - 1422 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.41.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n20A-n41A with UL CA\_n20A-n41A.

Table 5.41.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1634 - 1858 | | 3328 - 3552 | |
| 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) | 1026 - 772 | | 4130 - 4548 | |
| 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) | 4160 - 4414 | | 5824 - 6242 | |
| 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) | 194 - 90 | | 6626 - 7238 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3716 - 3268 | |
| 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) | 4992 - 5276 | | 8320 - 8932 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6656 - 7104 | |
| 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) | 9928 - 9122 | | 952 - 638 | |
| 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) | 6406 - 5764 | | 2406 - 2884 | |
| 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) | 10816 - 11622 | | 5824 - 6138 | |
| 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) | 9152 - 9794 | | 7488 - 7966 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.41.2.1.1-2 there are IMD2 and IMD3 from n3 and n20 into RX band n41.

Based on the analysis in Table 5.41.2.1.1-2 there are IMD2 and IMD3 from n3 and n41 into RX band n20.

Based on the analysis in Table 5.41.2.1.1-3 there is IMD2 from n20 and n41 into RX band n3.

#### 5.41.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n3-n18-n41, excepts for IMD2 from n3 and n20 into RX band n41 where MSD requirement is re-used from CA\_n5-n41-n66.

Table 5.41.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n20-n41 | n3 | 1735 | 5 | 25 | 1830 | N/A | FDD | N/A |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | N/A | 10 | N/A | 2623 | 29 | TDD | IMD2 |
|  | n3 | 1747 | 5 | 25 | 1842 | N/A | FDD | N/A |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | N/A | 10 | N/A | 2594 | 16 | TDD | IMD3 |
|  | n3 | 1747 | 5 | 25 | 1842 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 806 | 28.9 | FDD | IMD2 |
|  | n41 | 2553 | 10 | 50 | 2553 | N/A | TDD | N/A |
|  | n3 | 1715 | 5 | 25 | 1810 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 806 | 19 | FDD | IMD3 |
|  | n41 | 2624 | 10 | 50 | 2624 | N/A | TDD | N/A |
|  | n3 | N/A | 5 | N/A | 1831 | 28.9 | FDD | IMD2 |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n41 | 2678 | 10 | 50 | 2678 | N/A | TDD | N/A |

## 5.42 CA\_n3-n71-n77

### 5.42.1 Common for 1 band UL and 2 bands UL CA

#### 5.42.1.1 Operating bands for CA

Table 5.42.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 1710-1785 | 1805-1880 | FDD |
| n71 | 663-698 | 617-652 | FDD |
| n77 | 3300-4200 | 3300-4200 | TDD |

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

Table 5.42.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n71A-n77A | CA\_n3A-n71A  CA\_n3A-n77A  CA\_n71A-n77A | n3 | 5,10,15,20,25,30,35,40,45,50 | 0 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n77 | 10,15,20,25,30,40,50,60,70,80,90,100 |  |
| CA\_n3A-n71A-n77(2A) | CA\_n3A-n71A  CA\_n3A-n77A  CA\_n71A-n77A | n3 | 5,10,15,20,25,30,35,40,45,50 | 0 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n77 | CA\_n77(2A)\_BCS\_4 and 5 |  |

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

For CA\_n3-n71-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below(Re-use CA\_n3-n78-n105).

Table 5.42.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n71-n77 | 0.6 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.42.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n71-n77 | 0.2 | 0.3 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.42.2 Specific for 2 bands UL CA

#### 5.42.2.1 UE co-existence studies

##### 5.42.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.42.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n71A-n77A with UL CA\_n3A-n71A.

Table 5.42.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 - 1012 | | 2373 - 2483 | |
| 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 - 2907 | | 459 - 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 - 4268 | | 3036 - 3181 | |
| 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) | 4432 - 4692 | | 204 - 384 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2024 - 2244 | |
| 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) | 5793 - 6053 | | 3699 - 3879 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 4746 - 4966 | |
| 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) | 1082 - 867 | | 6477 - 6142 | |
| 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) | 1326 - 1581 | | 4029 - 3734 | |
| 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) | 4362 - 4577 | | 7503 - 7838 | |
| 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 - 5664 | | 6456 - 6751 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.42.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n71A-n77A with UL CA\_n3A-n77A.

Table 5.42.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515 - 2490 | | 5010 - 5985 | |
| 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) | 780 - 270 | | 4815 - 6690 | |
| 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) | 6720 - 7770 | | 8310 - 10185 | |
| 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) | 930 - 2055 | | 8115 - 10890 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 4980 - 3030 | |
| 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) | 8430 - 9555 | | 11610 - 14385 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10020 - 11970 | |
| 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) | 15090 - 11415 | | 3840 - 2640 | |
| 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) | 9180 - 6330 | | 1245 - 3270 | |
| 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) | 14910 - 18585 | | 10140 - 11340 | |
| 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) | 13320 - 16170 | | 11730 - 13755 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.42.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n71A-n77A with UL CA\_n71A-n77A.

Table 5.42.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 - 3537 | | 3963 - 4898 | |
| 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) | 2874 - 1904 | | 5902 - 7737 | |
| 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) | 4626 - 5596 | | 7263 - 9098 | |
| 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) | 2211 - 1206 | | 9202 - 11937 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 7074 - 5204 | |
| 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) | 5289 - 6294 | | 10563 - 13298 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 7926 - 9796 | |
| 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) | 16137 - 12502 | | 508 - 1548 | |
| 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) | 11274 - 8504 | | 4506 - 6411 | |
| 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) | 13863 - 17498 | | 5952 - 6992 | |
| 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) | 11226 - 13996 | | 8589 - 10494 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.42.2.1.1-1 there is IMD3, IMD4 and IMD5 from n3 and n71 into RX band n77.

Based on the analysis in Table 5.42.2.1.1-2 there is IMD3 from n3 and n77 into RX band n71.

Based on the analysis in Table 5.42.2.1.1-3 there is IMD4 from n71 and n77 into RX band n3.

#### 5.42.2.2 REFSENS requirements

The MSD values are re-used from CA\_n66-n71-n77 for IMD3 into n77 and n71 and DC\_71A\_n25A-n77A for the IMD4 into n3.

Table 5.42.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n71-n77 | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 4140 | 15.9 | TDD | IMD31 |
|  | n3 | 1747 | 5 | 25 | 1842 | N/A | FDD | N/A |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3787 | 10.1 | TDD | IMD4 |
|  | n3 | 1748 | 5 | 25 | 1843 | N/A | FDD | N/A |
|  | n71 | N/A | 5 | N/A | 632 | 15.3 | FDD | IMD3 |
|  | n77 | 4128 | 10 | 50 | 4128 | N/A | TDD | N/A |
|  | n3 | N/A | 5 | N/A | 1843 | 12.5 | FDD | IMD4 |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n77 | 3883 | 10 | 50 | 3883 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.43 CA\_n1-n41-n78

### 5.43.1 Common for 1 band UL and 2 bands UL CA

#### 5.43.1.1 Operating bands for CA

Table 5.43.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.43.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n41A-n78C | CA\_n78C  CA\_n1A-n41A  CA\_n1A-n78A  CA\_n1A-n78C  CA\_n41A-n78A  CA\_n41A-n78C | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n41 | 5,10,15,20,25,30,35,40,45,50,60,70,80,90,100 |  |
|  |  | n78 | CA\_n78C\_BSC4 & 5 |  |

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

Already completed in R4-2414365 of RAN4#112.

### 5.43.2 Specific for 2 bands UL CA

#### 5.43.2.1 UE co-existence studies

##### 5.43.2.1.1 Co-existence studies for 2UL band with 1CC per band

Already completed in R4-2414365 of RAN4#112.

##### 5.43.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.43.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n41 interference analysis for CA\_n1A-n78C with n1A/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.43.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n1, n78)** | 1920-1980 | | 3300-3800 | |
| **fDL (n41)** | 2496-2690 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1720-1920 | | 1980-2180 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.43.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n1 interference analysis for CA\_n41A-n78C with n41A/78C transmitting with a 200 MHz maximum instantaneous bandwidth

Table 5.43.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n41, n78)** | 2496-2690 | | 3300-3800 | |
| **fDL (n1)** | 2110-2170 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 2296-2496 | | 2690-2890 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.43.2.2 REFSENS requirements

No additional Refsens requirements needed.

## 5.44 CA\_n1-n71-n78

### 5.44.1 Common for 1 band UL and 2 bands UL CA

#### 5.44.1.1 Operating bands for CA

Table 5.44.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n71 | 663-698 | 617-652 | FDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.44.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n71A-n78A | CA\_n1A-n71A  CA\_n1A-n78A  CA\_n71A-n78A | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n78 | 10,15,20,25,30,40,50,60,70,80,90,100 |  |
| CA\_n1A-n71A-n78C | CA\_n78C  CA\_n1A-n71A  CA\_n1A-n78A  CA\_n1A-n78C  CA\_n71A-n78A  CA\_n71A-n78C | n1 | 5,10,15,20,25,30,40,45,50 | 0 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n78 | CA\_n78C\_BCS 4 and 5 |  |

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

For CA\_n1-n71-n78, the ΔTIB,c and ΔRIB,c values are re-used from CA\_n1-n78-n105 given in the tables below.

Table 5.44.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n71-n78 | 0.3 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.44.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n71-n78 | - | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.44.2 Specific for 2 bands UL CA

#### 5.44.2.1 UE co-existence studies

##### 5.44.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.44.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n71A-n78A with UL CA\_n1A-n71A.

Table 5.44.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 - 1222 | | 2583 - 2678 | |
| 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) | 3142 - 3297 | | 654 - 524 | |
| 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) | 4503 - 4658 | | 3246 - 3376 | |
| 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) | 5062 - 5277 | | 9 - 174 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2444 - 2634 | |
| 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) | 6423 - 6638 | | 3909 - 4074 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 5166 - 5356 | |
| 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) | 872 - 672 | | 7257 - 6982 | |
| 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) | 1746 - 1971 | | 4614 - 4364 | |
| 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) | 4572 - 4772 | | 8343 - 8618 | |
| 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) | 5829 - 6054 | | 7086 - 7336 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.44.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n71A-n78A with UL CA\_n1A-n78A.

Table 5.44.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320 - 1880 | | 5220 - 5780 | |
| 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) | 40 - 660 | | 4620 - 5680 | |
| 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) | 7140 - 7760 | | 8520 - 9580 | |
| 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) | 1960 - 2640 | | 7920 - 9480 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3760 - 2640 | |
| 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) | 9060 - 9740 | | 11820 - 13380 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10440 - 11560 | |
| 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) | 13280 - 11220 | | 4620 - 3880 | |
| 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) | 7560 - 5940 | | 660 - 1840 | |
| 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) | 15120 - 17180 | | 10980 - 11720 | |
| 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) | 13740 - 15360 | | 12360 - 13540 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.44.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n71A-n78A with UL CA\_n71A-n78A.

Table 5.44.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 - 3137 | | 3963 - 4498 | |
| 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) | 2474 - 1904 | | 5902 - 6937 | |
| 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) | 4626 - 5196 | | 7263 - 8298 | |
| 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) | 1811 - 1206 | | 9202 - 10737 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 6274 - 5204 | |
| 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) | 5289 - 5894 | | 10563 - 12098 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 7926 - 8996 | |
| 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) | 14537 - 12502 | | 508 - 1148 | |
| 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) | 10074 - 8504 | | 4506 - 5611 | |
| 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) | 13863 - 15898 | | 5952 - 6592 | |
| 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) | 11226 - 12796 | | 8589 - 9694 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.44.2.1.1-1 there is IMD3 from n1 and n71 into RX band n78.

Based on the analysis in Table 5.44.2.1.1-2 there is IMD3 from n1 and n78 into RX band n71.

Based on the analysis in Table 5.44.2.1.1-3 there is IMD3 from n71 and n78 into RX band n1.

##### 5.44.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.44.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n71 interference analysis for CA\_n1A-n78C with n1/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.44.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n1, n78)** | 1920-1980 | | 3300-3800 | |
| **fDL (n71)** | 617-652 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1720-1920 | | 1980-2180 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.44.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n1 interference analysis for CA\_n71A -n78C with n71/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.44.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n71, n78)** | 663-698 | | 3300-3800 | |
| **fDL (n1)** | 2110-2170 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 463-663 | | 698-898 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.44.2.2 REFSENS requirements

The MSD requirements are re-used from CA\_n1-n78-n105.

Table 5.44.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n71-n78 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n71 | N/A | 5 | N/A | 635 | 15.2 | FDD | IMD3 |
|  | n78 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
|  | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n71 | 686 | 5 | 25 | 640 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3342 | 15.7 | TDD | IMD3 |
|  | n1 | N/A | 5 | N/A | 2160 | 15.7 | FDD | IMD3 |
|  | n71 | 686 | 5 | 25 | 640 | N/A | FDD | N/A |
|  | n78 | 3532 | 10 | 50 | 3532 | N/A | TDD | N/A |

## 5.45 CA\_n1-n8-n78

### 5.45.1 Common for 1 band UL and 2 bands UL CA

#### 5.45.1.1 Operating bands for CA

Table 5.45.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920-1980 | 2110-2170 | FDD |
| n8 | 880-915 | 925-960 | FDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.45.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n8A-n78C | CA\_n78C  CA\_n1A-n78C  CA\_n8A-n78C | n1 | See n1 channel bandwidths in Table 5.3.5-1 | 0 |
|  |  | n8 | See n8 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | CA\_n78C\_BCS 4 and 5 |  |

### 5.45.2 Specific for 2 bands UL CA

#### 5.45.2.1 UE co-existence studies

##### 5.45.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.45.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n8 interference analysis for CA\_n1A -n78C with n1/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.45.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n1, n78)** | 1920-1980 | | 3300-3800 | |
| **fDL (n8)** | 925-960 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1720-1920 | | 1980-2180 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.45.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n1 interference analysis for CA\_n8A-n78C with n8/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.45.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n8, n78)** | 880-915 | | 3300-3800 | |
| **fDL (n1)** | 2110-2170 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 680-880 | | 915-1115 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.45.2.2 REFSENS requirements

No requirements since the bands are of different band groups [1].

## 5.46 CA\_n3-n41-n78

### 5.46.1 Common for 1 band UL and 2 bands UL CA

#### 5.46.1.1 Operating bands for CA

Table 5.46.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 1710-1785 | 1805-1880 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.46.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n41A-n78C | CA\_n78C  CA\_n3A-n41A  CA\_n3A-n78A  CA\_n3A-n78C  CA\_n41A-n78A  CA\_n41A-n78C | n3 | 5,10,15,20,25,30,35,40,45,50 | 4 and 5 |
|  |  | n41 | 5,10,15,20,25,30,35,40,45,50,60,70,80,90,100 |  |
|  |  | n78 | CA\_n78C\_BSC4 & 5 |  |
| CA\_n3(2A)-n41A-n78C | CA\_n3A-n41A  CA\_n3A-n78A  CA\_n41A-n78A | n3 | CA\_n3(2A)\_BSC0 | 4 and 5 |
|  |  | n41 | 5,10,15,20,25,30,35,40,45,50,60,70,80,90,100 |  |
|  |  | n78 | CA\_n78C\_BSC4 & 5 |  |

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

Already captured in fallback.

### 5.46.2 Specific for 2 bands UL CA

#### 5.46.2.1 UE co-existence studies

##### 5.46.2.1.1 Co-existence studies for 2UL band with 1CC per band

Already captured in fallback.

##### 5.46.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.46.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n41 interference analysis for CA\_n3A-n78C with n3/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.46.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n3, n78)** | 1710-1785 | | 3300-3800 | |
| **fDL (n41)** | 2496-2690 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1510-1710 | | 1785-1985 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.46.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n3 interference analysis for CA\_n41A-n78C with n41/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.46.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n41, n78)** | 2496-2690 | | 3300-3800 | |
| **fDL(n3)** | 1805-1880 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 2296-2496 | | 2690-2890 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.46.2.2 REFSENS requirements

No additional Refsens requirements needed.

## 5.47 CA\_n3-n71-n78

### 5.47.1 Common for 1 band UL and 2 bands UL CA

#### 5.47.1.1 Operating bands for CA

Table 5.47.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 1710-1785 | 1805-1880 | FDD |
| n71 | 663-698 | 617-652 | FDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.47.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n71A-n78A | C A\_n3A-n71A  CA\_n3A-n78A  CA\_n71A-n78A | n3 | 5,10,15,20,25,30,35,40,45,50 | 4 and 5 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n78 | 10,15,20,25,30,40,50,60,70,80,90,100 |  |
| CA\_n3(2A)-n71A-n78A | C A\_n3A-n71A  CA\_n3A-n78A  CA\_n71A-n78A | n3 | CA\_n3(2A)\_BCS 4 and 5 | 4 and 5 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n78 | 10,15,20,25,30,40,50,60,70,80,90,100 |  |
| CA\_n3A-n71A-n78C | CA\_n78C  CA\_n3A-n71A  CA\_n3A-n78A  CA\_n3A-n78C  CA\_n71A-n78A  CA\_n71A-n78C | n3 | 5,10,15,20,25,30,35,40,45,50 | 4 and 5 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n78 | CA\_n78C\_BCS 4 and 5 |  |

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

For CA\_n3-n71-n78, the ΔTIB,c and ΔRIB,c values are given in the tables below(Re-use CA\_n3-n78-n105).

Table 5.47.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n71-n78 | 0.6 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.47.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n71-n78 | 0.2 | 0.3 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.47.2 Specific for 2 bands UL CA

#### 5.47.2.1 UE co-existence studies

##### 5.47.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.47.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n71A-n78A with UL CA\_n3A-n71A.

Table 5.47.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 - 1012 | | 2373 - 2483 | |
| 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 - 2907 | | 459 - 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 - 4268 | | 3036 - 3181 | |
| 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) | 4432 - 4692 | | 204 - 384 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2024 - 2244 | |
| 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) | 5793 - 6053 | | 3699 - 3879 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 4746 - 4966 | |
| 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) | 1082 - 867 | | 6477 - 6142 | |
| 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) | 1326 - 1581 | | 4029 - 3734 | |
| 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) | 4362 - 4577 | | 7503 - 7838 | |
| 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 - 5664 | | 6456 - 6751 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.47.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n71A-n78A with UL CA\_n3A-n78A.

Table 5.47.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515 - 2090 | | 5010 - 5585 | |
| 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) | 380 - 270 | | 4815 - 5890 | |
| 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) | 6720 - 7370 | | 8310 - 9385 | |
| 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) | 1330 - 2055 | | 8115 - 9690 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 4180 - 3030 | |
| 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) | 8430 - 9155 | | 11610 - 13185 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 10020 - 11170 | |
| 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) | 13490 - 11415 | | 3840 - 3040 | |
| 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) | 7980 - 6330 | | 1245 - 2470 | |
| 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) | 14910 - 16985 | | 10140 - 10940 | |
| 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) | 13320 - 14970 | | 11730 - 12955 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.47.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n71A-n78A with UL CA\_n71A-n78A.

Table 5.47.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 - 3137 | | 3963 - 4498 | |
| 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) | 2474 - 1904 | | 5902 - 6937 | |
| 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) | 4626 - 5196 | | 7263 - 8298 | |
| 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) | 1811 - 1206 | | 9202 - 10737 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 6274 - 5204 | |
| 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) | 5289 - 5894 | | 10563 - 12098 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 7926 - 8996 | |
| 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) | 14537 - 12502 | | 508 - 1148 | |
| 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) | 10074 - 8504 | | 4506 - 5611 | |
| 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) | 13863 - 15898 | | 5952 - 6592 | |
| 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) | 11226 - 12796 | | 8589 - 9694 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.47.2.1.1-1 there is IMD4 and IMD5 from n3 and n71 into RX band n78.

Based on the analysis in Table 5.47.2.1.1-3 there is IMD4 from n71 and n78 into RX band n3.

##### 5.47.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.47.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n71 interference analysis for CA\_n3A-n78C with n3/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.47.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n3, n78)** | 1710-1785 | | 3300-3800 | |
| **fDL (n71)** | 617-652 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1510-1710 | | 1785-1985 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.47.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n3 interference analysis for CA\_n71A-n78C with n71/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.47.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n71, n78)** | 663-698 | | 3300-3800 | |
| **fDL (n3)** | 1805-1880 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 463-663 | | 698-898 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.47.2.2 REFSENS requirements

The MSD values are re-used from CA\_n3-n78-n105, where the IMD4 into n3 has been omitted, since the test frequencies cannot form an interferer inside the full band n3.

Table 5.47.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n71-n78 | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n71 | 670 | 5 | 25 | 624 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3740 | 17.3 | TDD | IMD41 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.48 CA\_n3-n8-n78

### 5.48.1 Common for 1 band UL and 2 bands UL CA

#### 5.48.1.1 Operating bands for CA

Table 5.48.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 1710-1785 | 1805-1880 | FDD |
| n8 | 880-915 | 925-960 | FDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.48.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n8A-n78C | CA\_n78C  CA\_n3A-n8A  CA\_n3A-n78A  CA\_n3A-n78C  CA\_n8A-n78A  CA\_n8A-n78C | n3 | 5,10,15,20,25,30,35,40,45,50 | 4 and 5 |
|  |  | n8 | 5,10,15,20 |  |
|  |  | n78 | CA\_n78C\_BCS 4 and 5 |  |

### 5.48.2 Specific for 2 bands UL CA

#### 5.48.2.1 UE co-existence studies

##### 5.48.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.48.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n8 interference analysis for CA\_n3A -n78C with n3/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.48.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n3, n78)** | 1710-1785 | | 3300-3800 | |
| **fDL (n8)** | 925-960 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1510-1710 | | 1785-1985 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.48.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n3 interference analysis for CA\_n8A-n78C with n8/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.48.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n8, n78)** | 880-915 | | 3300-3800 | |
| **fDL (n3)** | 1805-1880 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 680-880 | | 915-1115 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.48.2.2 REFSENS requirements

There are no additional requirements.

## 5.49 CA\_n41-n71-n78

### 5.49.1 Common for 1 band UL and 2 bands UL CA

#### 5.49.1.1 Operating bands for CA

Table 5.49.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n71 | 663-698 | 617-652 | FDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.49.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n41A-n71A-n78C | CA\_n78C  CA\_n41A-n71A  CA\_n41A-n78A  CA\_n41A-n78C  CA\_n71A-n78A  CA\_n71A-n78C | n41 | 5,10,15,20,25,30,35,40,45,50,60,70,80,90,100 | 4 and 5 |
|  |  | n71 | 5,10,15,20 |  |
|  |  | n78 | CA\_n78C\_BCS 4 and 5 |  |

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

Already provided in fallback.

### 5.49.2 Specific for 2 bands UL CA

#### 5.49.2.1 UE co-existence studies

##### 5.49.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.49.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n71 interference analysis for CA\_n41A -n78C with n41/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.49.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n41, n78)** | 2496-2690 | | 3300-3800 | |
| **fDL (n71)** | 617-652 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 2296-2496 | | 2690-2890 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

5.49.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n41 interference analysis for CA\_n71A-n78C with n71/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.49.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n71, n78)** | 663-698 | | 3300-3800 | |
| **fDL (n41)** | 2496-2690 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 463-663 | | 698-898 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.49.2.2 REFSENS requirements

There are no additional Refsens requirements.

## 5.50 CA\_n8-n41-n78

### 5.50.1 Common for 1 band UL and 2 bands UL CA

#### 5.50.1.1 Operating bands for CA

Table 5.50.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n8 | 880-915 | 925-960 | FDD |
| n41 | 2496-2690 | 2496-2690 | TDD |
| n78 | 3300-3800 | 3300-3800 | TDD |

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

Table 5.50.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n8A-n41A-n78A | CA\_n8A-n41A  CA\_n8A-n78A  CA\_n41A-n78A | n8 | 5, 10, 15, 20 | 4 and 5 |
|  |  | n41 | 5,10,15,20,25,30,35,40,45,50,60,70,80,90,100 |  |
|  |  | n78 | 10,15,20,25,30,40,50,60,70,80,90,100 |  |
| CA\_n8A-n41A-n78C | CA\_n78C  CA\_n8A-n41A  CA\_n8A-n78A  CA\_n8A-n78C  CA\_n41A-n78A  CA\_n41A-n78C | n8 | 5, 10, 15, 20 | 4 and 5 |
|  |  | n41 | 5,10,15,20,25,30,35,40,45,50,60,70,80,90,100 |  |
|  |  | n78 | CA\_n78C\_BCS 4 and 5 |  |

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

For CA\_n8-n41-n78, the ΔTIB,c and ΔRIB,c values are given in the tables below, as they are not found in current fallback.

Table 5.50.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n8-n41-n78 | 0.6 | 0.3 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.50.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n8-n41-n78 | 0.2 | 0.4 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.50.2 Specific for 2 bands UL CA

#### 5.50.2.1 UE co-existence studies

##### 5.50.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.50.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n8A-n41A-n78A with UL CA\_n8A-n41A.

Table 5.50.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1581 - 1810 | | 3376 - 3605 | |
| 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) | 930 - 666 | | 4077 - 4500 | |
| 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) | 4256 - 4520 | | 5872 - 6295 | |
| 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) | 50 - 249 | | 6573 - 7190 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 3620 - 3162 | |
| 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) | 5136 - 5435 | | 8368 - 8985 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 6752 - 7210 | |
| 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) | 9880 - 9069 | | 1164 - 830 | |
| 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) | 6310 - 5658 | | 2247 - 2740 | |
| 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) | 10864 - 11675 | | 6016 - 6350 | |
| 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) | 9248 - 9900 | | 7632 - 8125 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.50.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n8A-n41A-n78A with UL CA\_n8A-n78A.

Table 5.50.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2385 - 2920 | | 4180 - 4715 | |
| 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) | 2040 - 1470 | | 5685 - 6720 | |
| 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) | 5060 - 5630 | | 7480 - 8515 | |
| 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) | 1160 - 555 | | 8985 - 10520 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 5840 - 4770 | |
| 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) | 5940 - 6545 | | 10780 - 12315 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8360 - 9430 | |
| 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) | 14320 - 12285 | | 360 - 280 | |
| 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) | 9640 - 8070 | | 3855 - 4960 | |
| 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) | 14080 - 16115 | | 6820 - 7460 | |
| 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) | 11660 - 13230 | | 9240 - 10345 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.50.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n8A-n41A-n78A with UL CA\_n41A-n78A.

Table 5.50.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 2608 - 1220 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

For Table 5.50.2.1.1-1 there is IMD2 and IMD4 into band n78

For Table 5.50.2.1.1-2 there is IMD2 into band n41

For Table 5.50.2.1.1-3 there is IMD2 and IMD5 into band n8

##### 5.50.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.50.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n41 interference analysis for CA\_n8A -n78C with n8/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.50.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78B/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n8, n78)** | 880-915 | | 3300-3800 | |
| **fDL (n41)** | 2496-2690 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 680-880 | | 915-1115 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.50.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n8 interference analysis for CA\_n41A-n78C with n41/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.50.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78B/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n41, n78)** | 2496-2690 | | 3300-3800 | |
| **fDL (n8)** | 925-960 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 2296-2496 | | 2690-2890 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.50.2.2 REFSENS requirements

The MSD values are taken from DC\_8-41\_n78 and DC\_7A\_n8A-n78A.

Table 5.50.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n8-n41-n78 | n8 | N/A | 10 | N/A | 950 | 29.1 | FDD | IMD2 |
|  | n41 | 2630 | 10 | 50 | N/A | N/A | TDD | N/A |
|  | n78 | 3580 | 10 | 50 | N/A | N/A | TDD | N/A |
|  | n8 | N/A | 10 | N/A | 940 | 4.0 | FDD | IMD5 |
|  | n41 | 2680 | 10 | 50 | N/A | N/A | TDD | N/A |
|  | n78 | 3550 | 10 | 50 | N/A | N/A | TDD | N/A |
|  | n8 | 895 | 5 | 25 | 940 | N/A | FDD | N/A |
|  | n41 | N/A | 10 | N/A | 2650 | 28.0 | TDD | IMD2 |
|  | n78 | 3545 | 10 | 50 | N/A | N/A | TDD | N/A |
|  | n8 | 900 | 5 | 25 | 945 | N/A | FDD | N/A |
|  | n41 | 2555 | 10 | 50 | N/A | N/A | TDD | N/A |
|  | n78 | N/A | 10 | N/A | 3455 | 28.5 | TDD | IMD22 |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.51 CA\_n1-n3-n78

### 5.51.1 Common for 1 band UL and 2 bands UL CA

#### 5.51.1.1 Operating bands for CA

Table 5.51.1.1-1: CA band combination constituent bands definition

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.51.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n78C | CA\_n78C  CA\_n1A-n3A  CA\_n1A-n78A  CA\_n1A-n78C  CA\_n3A-n78A  CA\_n3A-n78C | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 4 and 5 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n78 | CA\_n78C\_BCS4 & 5 |  |
| CA\_n1A-n3(2A)-n78A | CA\_n1A-n3A  CA\_n1A-n78A  CA\_n3A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 4 and 5 |
|  |  | n3 | CA\_n3(2A)\_BSC0 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n1A-n3(2A)-n78C | CA\_n78C  CA\_n1A-n3A  CA\_n1A-n78A  CA\_n1A-n78C  CA\_n3A-n78A  CA\_n3A-n78C | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 4 and 5 |
|  |  | n3 | CA\_n3(2A)\_BSC0 |  |
|  |  | n78 | CA\_n78C\_BCS4 & 5 |  |

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

Already in spec. Only triple beat analysis is required.

### 5.51.2 Specific for 2 bands UL CA

Only triple beat analysis is required.

##### 5.51.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.51.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n3 interference analysis for CA\_n1A-n78C with n1/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.51.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n1, n78)** | 1920-1980 | | 3300-3800 | |
| **fDL (n3)** | 1805-1880 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1720-1920 | | 1980-2180 | |
| **Analysis** | *There is an issue of IMD3* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.51.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n1 interference analysis for CA\_n3A -n78C with n3/78C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.51.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n78C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n3, n78)** | 1710-1785 | | 3300-3800 | |
| **fDL (n1)** | 2110-2170 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 -200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1510-1710 | | 1785-1985 | |
| **Analysis** | *There is no overlap* | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.51.2.2 REFSENS requirements

Refsens requirements are provided in Table 5.51.2.2-1.

Table 5.51.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n3-n78 | n1 | 1925 | 5 | 25 | 2115 | N/A | FDD | N/A |
|  | n3 | N/A | 5 | 25 | 1875 | N/A | 15.3 | IMD3 |
|  | n78 | 3300 | 100 | 1 (RBstart=203) | 3300 | N/A | TDD | N/A |
|  |  | 3400 | 100 | 1 (RBstart=67) | 3400 |  |  |  |

## 5.52 CA\_n1-n40-n41

### 5.52.1 Common for 1 band UL and 2 bands UL CA

#### 5.52.1.1 Operating bands for CA

Table 5.52.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n40 | 2300 MHz – 2400 MHz | 2300 MHz – 2400 MHz | TDD |
| n41 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 MHz | TDD |

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

Table 5.52.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n40A-n41A | CA\_n1A-n40A  CA\_n1A-n41A  CA\_n40A-n41A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n40 | n40 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n41 | n41 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n1-n40-n41, the ΔTIB,c values are given in the tables below, which are the existing requirements for DC\_1-7\_n40. Reasons are:

- With existing requirements for CA\_n1-n40 and CA\_n1-n41, all bands are allowed to have 0.5dB relaxation, respectively.

- It is noticeable the requirements for DC\_1-7\_n40 provide 0.6dB relaxation for band 1, 0.8dB relaxation for band 7 and 0.9dB relaxation for band n40.

Table 5.52.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n40-n41 | 0.6 | 0.9 | 0.8 |

As for the ΔRIB,c values, the existing requirements for CA\_n1-n7-n40 can be reused here.

Table 5.52.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n40-n41 | - | 0.8 | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0. | | | |

### 5.52.2 Specific for 2 bands UL CA

#### 5.52.2.1 UE co-existence studies

##### 5.52.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.52.2.1.1-1~3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n40A-n41A with UL CA\_n1A-n40A, CA\_n1A-n41A and CA\_n40A-n41A respectively.

Table 5.52.2.1.1-1: UL CA\_n1A-n40A IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 320 – 480 | | 4220 – 4380 | |
| 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 – 1660 | | 2620 – 2880 | |
| 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) | 6140 – 6360 | | 6520 – 6780 | |
| 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) | 3360 – 3640 | | 4920 – 5280 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 640 – 840 | |
| 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) | 8060 – 8340 | | 8820 – 9180 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 8440 – 8760 | |
| 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) | 7220 – 7680 | | 5280 – 5620 | |
| 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) | 2940 – 3360 | | 960 – 1340 | |
| 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) | 11120 – 11580 | | 9980 –10320 | |
| 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) | 10740 – 11160 | | 10360 – 10740 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above analysis, 3rd order IMD generated by UL CA\_n1A-n40A may fall into the Rx of Band n41.

Table 5.52.2.1.1-2: UL CA\_n1A-n41A IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 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 | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 1032 – 1420 | |
| 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\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 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) | 8004 – 8840 | | 4990 – 5424 | |
| 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) | 3528 – 4230 | | 380 – 948 | |
| 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 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above analysis, no IMD generated by UL CA\_n1A-n41A would fall into the Rx of concerned bands.

Table 5.52.2.1.1-3: UL CA\_n40A-n41A IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 96 –390 | | 4796 – 5090 | |
| 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) | 1910 – 2304 | | 2592 – 3080 | |
| 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) | 7096 – 7490 | | 7292 – 7780 | |
| 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) | 4210 – 4704 | | 5088 – 5770 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  | |
| IMD frequency limits (MHz) | 192 – 580 | |
| 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) | 9396 – 9890 | | 9788 – 10470 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  | |
| IMD frequency limits (MHz) | 9592 - 10180 | |
| 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) | 7584 - 8460 | | 6510 – 7104 | |
| 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) | 2688 – 3470 | | 1520 – 2208 | |
| 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) | 12284 – 13160 | | 11696 –12290 | |
| 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) | 12088 – 12870 | | 11892 – 12580 | |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above analysis, 3rd order IMD and 5th order IMD generated by UL CA\_n40A-n41A may fall into the Rx of Band n1.

#### 5.52.2.2 REFSENS requirements

Based on the co-existence studies, there is a need to define MSD. The defined requirements for DC\_1A\_7A-n40A and DC\_7A\_n1A-n40A are taken into consideration here in conjunction with worst duplexer performance that would be expected from band n41 (comparing with the one for band 7).

Table 5.52.2.2-3: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc (MHz)** | **UL/DL BW (MHz)** | **UL CLRB** | **DL Fc (MHz)** | **MSD (dB)** | **Duplex mode** |  |
| CA\_n1-n40-n41 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n40 | 2390 | 5 | 25 | 2390 | N/A | TDD | N/A |
|  | n41 | N/A | 5 | N/A | 2630 | 23 | TDD | IMD3 |
|  | n1 | N/A | 5 | N/A | 2130 | 25.2 | FDD | IMD3\* |
|  | n40 | 2335 | 5 | 25 | 2335 | N/A | TDD | N/A |
|  | n41 | 2540 | 5 | 25 | 2660 | N/A | TDD | N/A |
| Note \*: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.53 CA\_n3-n77-n79

### 5.53.1 Common for 1 band UL and 2 bands UL CA

#### 5.53.1.1 Operating bands for CA

Table 5.53.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 – 1880 MHz | FDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.53.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n77(2A)-n79A4 | n777,9  n797,9  CA\_n77(2A)  CA\_n3A-n77A7  CA\_n3A-n79A7  CA\_n77A-n79A7 | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n77 | CA\_n77(2A)\_BCS0 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |
| CA\_n3A-n77(3A)-n79A4 | CA\_n77(2A)  CA\_n3A-n77A  CA\_n3A-n79A  CA\_n77A-n79A | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n77 | CA\_n77(3A)\_BCS0 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |

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

For CA\_n3-n77-n79, the ∆TIB,c and ∆RIB,c values have already been specified in TS 38.101-1.

### 5.53.2 Specific for 2 bands UL CA

#### 5.53.2.1 UE co-existence studies

##### 5.53.2.1.1 Co-existence studies for 2UL band with 1CC per band

Based on Reference sensitivity exceptions due to intermodulation interference due to 2UL CA for CA in TS38.101-1[2], no MSD is needed for UL CA\_n77(2A).

5.53.2.2 REFSENS requirements

Based on co-existence studies on 5.53.2.1, no need to define exceptional REFSENS requirements.

## 5.54 CA\_n28-n77-n79

### 5.54.1 Common for 1 band UL and 2 bands UL CA

#### 5.54.1.1 Operating bands for CA

Table 5.54.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.54.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n28A-n77(2A)-n79A4 | n777,9  n797,9  CA\_n77(2A)  CA\_n28A-n77A7  CA\_n28A-n79A7  CA\_n77A-n79A7 | n28 | 5, 10, 15, 20 | 0 |
|  |  | n77 | CA\_n77(2A)\_BCS1 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |
| CA\_n28A-n77(3A)-n79A4 | CA\_n77(2A)  CA\_n28A-n77A  CA\_n28A-n79A  CA\_n77A-n79A | n28 | 5, 10, 15, 20 | 0 |
|  |  | n77 | CA\_n77(3A)\_BCS0 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |

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

For CA\_n28-n77-n79, the ∆TIB,c and ∆RIB,c values have already been specified in TS 38.101-1.

### 5.54.2 Specific for 2 bands UL CA

#### 5.54.2.1 UE co-existence studies

##### 5.54.2.1.1 Co-existence studies for 2UL band with 1CC per band

Based on Reference sensitivity exceptions due to intermodulation interference due to 2UL CA for CA in TS38.101-1[2], no MSD is needed for UL CA\_n77(2A).

#### 5.54.2.2 REFSENS requirements

Based on co-existence studies on 5.54.2.1, no need to define exceptional REFSENS requirements.

## 5.55 CA\_n40-n78-n79

### 5.55.1 Common for 1 band UL and 2 bands UL CA

#### 5.55.1.1 Operating bands for CA

Table 5.55.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n40 | 2300 MHz – 2400 MHz | 2300 MHz – 2400 MHz | TDD |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.55.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n40A-78A-n79A | CA\_n40A-n78A  CA\_n40A-n79A  CA\_n78A-n79A | n40 | n40 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | n79 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n40-78-n79, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.55.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_ n40-78-n79 | 0.3 | 0.5 / 1.58 | 0.5 / 1.58 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5.  NOTE 8: The requirements only apply for UE supporting inter-band carrier aggregation with simultaneous Rx/Tx capability, and NR UL carrier frequencies are confined to 3700 MHz-3800MHz for n78 and 4400 MHz-4500MHz for n79. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation. | | | |

Table 5.55.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_ n40-78-n79 | 0.4 | 0.5 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.55.2 Specific for 2 bands UL CA

#### 5.55.2.1 UE co-existence studies

##### 5.55.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.55.2.1.1-1, Table 5.55.2.1.1-2 and Table 5.55.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n40A-78A-n79A with UL CA\_n40A-n78A, UL CA\_n40A-n79A and UL CA\_n78A-n79A.

Table 5.55.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 900–1500 | | 5600–6200 | |
| 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) | 800–1500 | | 4200–5300 | |
| 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) | 7900–8600 | | 8900–10000 | |
| 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) | 3100–3900 | | 7500–9100 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1800–3000 | |  | |
| 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) | 10200–11000 | | 12200–13800 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 11200–12400 | |  | |
| 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) | 10800–12900 | | 5400–6300 | |
| 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) | 5100–6800 | | 600–700 | |
| 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) | 15500–17600 | | 12500–13400 | |
| 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) | 14500–16200 | | 13500–14800 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 3rd IMD generated by UL CA\_n40A-n78A may fall into own Rx of Band n79.

Table 5.55.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2000–2700 | | 6700–7400 | |
| 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) | 400 | | 6400–7700 | |
| 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) | 9000–9800 | | 11100–12400 | |
| 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) | 1900–2800 | | 10800–12700 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 4000–5400 | |  | |
| 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) | 11300–12200 | | 15500–17400 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 13400–14800 | |  | |
| 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) | 15200–17700 | | 4200–5200 | |
| 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) | 8400–10400 | | 1600–3100 | |
| 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) | 19900–22400 | | 13600–14600 | |
| 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) | 17800–19800 | | 15700–17200 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, no IMD generated by UL CA\_n40A-n79A may fall into own Rx of Band n78.

Table 5.55.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 600–1700 | | 7700–8800 | |
| 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) | 1600–3200 | | 5000–6700 | |
| 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) | 11000–12600 | | 12100–13800 | |
| 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) | 4900–7000 | | 9400–11700 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1200–3400 | |  | |
| 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) | 14300–16400 | | 16500–18800 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 15400–17600 | |  | |
| 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) | 13800–16700 | | 8200–10800 | |
| 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) | 5600–8400 | | 100–2600 | |
| 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) | 20900–23800 | | 17600–20200 | |
| 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) | 19800–22600 | | 18700–21400 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 3rd,4th and 5th order IMD generated by UL CA\_n78A-n79A may fall into own Rx of Band n40.

#### 5.55.2.2 REFSENS requirements

For CA\_n40-78-n79, the MSD values are given in the tables below.

Table 5.55.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n40-n78-n79 | n40 | 2350 | 5 | 25 | 2350 | N/A | TDD | N/A |
|  | n78 | 3400 | 10 | 50 | 3400 | N/A | TDD | N/A |
|  | n79 | N/A | 10 | N/A | 4450 | 23 | TDD | IMD3 |
|  | n40 | N/A | 5 | N/A | 2350 | 12 | TDD | IMD31 |
|  | n78 | 3400 | 10 | 50 | 3400 | N/A | TDD | N/A |
|  | n79 | 4450 | 10 | 50 | 4450 | N/A | TDD | N/A |
|  | n40 | N/A | 5 | N/A | 2320 | 6 | TDD | IMD4 |
|  | n78 | 3400 | 10 | 50 | 3400 | N/A | TDD | N/A |
|  | n79 | 4560 | 10 | 50 | 4560 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.56 CA\_n1-n40-n79

### 5.56.1 Common for 1 band UL and 2 bands UL CA

#### 5.56.1.1 Operating bands for CA

Table 5.56.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n40 | 2300 MHz – 2400 MHz | 2300 MHz – 2400 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.56.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n40A-n79A | CA\_n1A-n40A  CA\_n1A-n79A  CA\_n40A-n79A | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n40 | n40 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | n79 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n1-n40-n79, the ΔTIB,c and ΔRIB,c values can reuse that of CA\_n1-n41-n79, and are given in the tables below.

Table 5.56.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n40-n79 | 0.5 | 0.5 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5.  NOTE 8: The requirements only apply for UE supporting inter-band carrier aggregation with simultaneous Rx/Tx capability, and NR UL carrier frequencies are confined to 3700 MHz-3800MHz for n78 and 4400 MHz-4500MHz for n79. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation. | | | |

Table 5.56.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n40-n79 | - | 0.5 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.56.2 Specific for 2 bands UL CA

#### 5.56.2.1 UE co-existence studies

##### 5.56.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.56.2.1.1-1, Table 5.56.2.1.1-2 and Table 5.56.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n1A-n40A-n79A with UL CA\_n1A-n40A, UL CA\_n1A-n79A and UL CA\_n40A-n79A.

Table 5.56.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 320–480 | | 4220–4380 | |
| 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) | 1440–1660 | | 2620–2880 | |
| 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) | 6140–6360 | | 6520–6780 | |
| 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) | 3360–3640 | | 4920–5280 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 640–960 | |  | |
| 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) | 8060–8340 | | 8820–9180 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 8440–8760 | |  | |
| 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) | 7220–7680 | | 5280–5620 | |
| 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) | 2940–3360 | | 960–1340 | |
| 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) | 11120–11580 | | 9980–10320 | |
| 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) | 10740–11160 | | 10360–10740 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 4th IMD generated by UL CA\_n1A-n40A may fall into own Rx of Band n79.

Table 5.56.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2420–3080 | | 6320–6980 | |
| 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) | 440-1160 | | 6820–8080 | |
| 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) | 8240–8960 | | 10720–11980 | |
| 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) | 760–1540 | | 11220–13080 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 4840–6160 | |  | |
| 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) | 10160–10940 | | 15120–16980 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 12640–13960 | |  | |
| 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) | 15620–18080 | | 2680–3520 | |
| 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) | 9240–11160 | | 2860–4240 | |
| 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) | 19520–21980 | | 12080–12920 | |
| 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) | 17040–18960 | | 14560–15940 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, no IMD generated by UL CA\_n1A-n79A may fall into own Rx of Band n40.

Table 5.56.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2000–2700 | | 6700–7400 | |
| 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) | 400 | | 6400–7700 | |
| 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) | 9000–9800 | | 11100–12400 | |
| 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) | 1900–2800 | | 10800–12700 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 4000–5400 | |  | |
| 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) | 11300–12200 | | 15500–17400 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 13400–14800 | |  | |
| 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) | 15200–17700 | | 4200–5200 | |
| 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) | 8400–10400 | | 1600–3100 | |
| 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) | 19900–22400 | | 13600–14600 | |
| 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) | 17800–19800 | | 15700–17200 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 2nd, 4th and 5th order IMD generated by UL CA\_n40A-n79A may fall into own Rx of Band n1.

#### 5.56.2.2 REFSENS requirements

For CA\_n1-n40-n79, the MSD values are given in the tables below. Among them, the n79 MSD value 19dB and n1 MSD 29.4dB reused from CA\_n1-n41-n79.

Table 5.56.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n1-n40-n79 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
|  | n79 | N/A | 10 | N/A | 4960 | 19 | TDD | IMD4 |
|  | n1 | N/A | 5 | N/A | 2150 | 29.4 | FDD | IMD22 |
|  | n40 | 2380 | 5 | 25 | 2380 | N/A | TDD | N/A |
|  | n79 | 4530 | 10 | 50 | 4530 | N/A | TDD | N/A |
|  | n1 | N/A | 5 | N/A | 2150 | [0] | FDD | IMD5 |
|  | n40 | 2350 | 5 | 25 | 2350 | N/A | TDD | N/A |
|  | n79 | 4600 | 10 | 50 | 4600 | N/A | TDD | N/A |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.57 CA\_n3-n40-n78

### 5.57.1 Common for 1 band UL and 2 bands UL CA

#### 5.57.1.1 Operating bands for CA

Table 5.57.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 – 1880 MHz | FDD |
| n40 | 2300 MHz – 2400 MHz | 2300 MHz – 2400 MHz | TDD |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |

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

Table 5.57.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n40A-n78A | CA\_n3A-n40A  CA\_n3A-n78A  CA\_n40A-n78A | n3 | n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n40 | n40 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |

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

∆TIB,c and ∆RIB,c values have already been defined in the current spec.

### 5.57.2 Specific for 2 bands UL CA

#### 5.57.2.1 UE co-existence studies

##### 5.57.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.57.2.1.1-1, Table 5.57.2.1.1-2 and Table 5.57.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n40A-n78A with UL CA\_n3A-n40A, UL CA\_n3A-n78A and UL CA\_n40A-n78A.

Table 5.57.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 320–480 | | 4220–4380 | |
| 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) | 1440–1660 | | 2620–2880 | |
| 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) | 6140–6360 | | 6520–6780 | |
| 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) | 3360–3640 | | 4920–5280 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 640–960 | |  | |
| 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) | 8060–8340 | | 8820–9180 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 8440–8760 | |  | |
| 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) | 7220–7680 | | 5280–5620 | |
| 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) | 2940–3360 | | 960–1340 | |
| 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) | 11120–11580 | | 9980–10320 | |
| 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) | 10740–11160 | | 10360–10740 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 4th and 5th IMD generated by UL CA\_n3A-n40A may fall into own Rx of Band n78.

Table 5.57.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515–2090 | | 5010–5585 | |
| 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) | 270- 380 | | 4815–5890 | |
| 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) | 6720–7370 | | 8310–9690 | |
| 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) | 1330–2055 | | 8115–13080 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3030–4180 | |  | |
| 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) | 8430–9155 | | 11610–13185 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 10020–11170 | |  | |
| 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) | 11415–13490 | | 3040–3840 | |
| 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) | 6330–7980 | | 1245–2470 | |
| 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) | 14910–16985 | | 10140–10940 | |
| 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) | 13320–14970 | | 11730–12955 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 5th IMD generated by UL CA\_n3A-n78A may fall into own Rx of Band n40.

Table 5.57.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 900–1500 | | 5600–6200 | |
| 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) | 800-1500 | | 4200–5300 | |
| 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) | 7900–8600 | | 8900–10000 | |
| 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) | 3100–3900 | | 7500–9100 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1800–3000 | |  | |
| 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) | 10200–11000 | | 12200–13800 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 11200–12400 | |  | |
| 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) | 10800–12900 | | 5400–6300 | |
| 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) | 5100–6800 | | 600–700 | |
| 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) | 15500–17600 | | 12500–13400 | |
| 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) | 14500–16200 | | 13500–14800 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 4th order IMD generated by UL CA\_n40A-n78A may fall into own Rx of Band n3.

#### 5.57.2.2 REFSENS requirements

For CA\_n3-n40-n78, the MSD values are given in the tables below.Among them, n78 MSD value 16.8dB due to IMD4, and n40 MSD value 5.3 dB due to IMD5 are referenced with that of CA\_n3-n41-n77.

Table 5.57.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n3-n40-n78 | n3 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n40 | 2350 | 5 | 25 | 2350 | N/A | TDD | N/A |
|  | n78 | N/A | 10 | N/A | 3440 | 16.8 | TDD | IMD4 |
|  | n3 | 1925 | 5 | 25 | 2115 | N/A | FDD | N/A |
|  | n40 | 2395 | 5 | 25 | 2395 | N/A | TDD | N/A |
|  | n78 | N/A | 10 | N/A | 3335 | 0.8 | TDD | IMD5 |
|  | n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
|  | n40 | N/A | 5 | N/A | 2360 | 5.3 | TDD | IMD5 |
|  | n78 | 3760 | 10 | 50 | 3760 | N/A | TDD | N/A |
|  | n3 | N/A | 5 | N/A | 1860 | 14 | FDD | IMD4 |
|  | n40 | 2390 | 5 | 25 | 2390 | N/A | TDD | N/A |
|  | n78 | 3320 | 10 | 50 | 3320 | N/A | TDD | N/A |

## 5.58 CA\_n7-n40-n79

### 5.58.1 Common for 1 band UL and 2 bands UL CA

#### 5.58.1.1 Operating bands for CA

Table 5.58.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n40 | 2300 MHz – 2400 MHz | 2300 MHz – 2400 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.58.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n7A-n40A-n79A | CA\_n7A-n40A  CA\_n7A-n79A  CA\_n40A-n79A | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n40 | n40 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | n79 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n7-n40-n79, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.58.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n40-n79 | 0.5 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.58.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n40-n79 | - | 0.5 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.58.2 Specific for 2 bands UL CA

#### 5.58.2.1 UE co-existence studies

##### 5.58.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.58.2.1.1-1, Table 5.58.2.1.1-2 and Table 5.58.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n7A-n40A-n79A with UL CA\_n7A-n40A, UL CA\_n7A-n79A and UL CA\_n40A-n79A.

Table 5.58.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 100–270 | | 4800–4970 | |
| 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) | 2600–2840 | | 2030–2300 | |
| 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) | 7300–7540 | | 7100–7370 | |
| 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) | 5100–5410 | | 4330–4700 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 200–540 | |  | |
| 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) | 9800–10110 | | 9400–9770 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 9600–9940 | |  | |
| 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) | 6630–7100 | | 7600–7980 | |
| 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) | 1760–2200 | | 2700–3110 | |
| 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) | 11700–12170 | | 12300–12680 | |
| 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) | 11900–12340 | | 12100–12510 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 2rd and 4th IMD generated by UL CA\_n7A-n40A may fall into own Rx of Band n79.

Table 5.58.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1830–2500 | | 6900–7570 | |
| 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) | 0- 740 | | 6230–7500 | |
| 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) | 9400–10140 | | 11300–12570 | |
| 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) | 2500–3310 | | 10630–12500 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3660–5000 | |  | |
| 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) | 11900–12710 | | 15700–17570 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 13800–15140 | |  | |
| 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) | 15030–17500 | | 5000–5880 | |
| 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) | 8060–10000 | | 1090–2500 | |
| 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) | 20100–22570 | | 14400–15280 | |
| 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) | 18200–20140 | | 16300–17710 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 2rd and 5th IMD generated by UL CA\_n7A-n79A may fall into own Rx of Band n40.

Table 5.58.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2000–2700 | | 6700–7400 | |
| 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) | 400 | | 6400–7700 | |
| 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) | 9000–9800 | | 11100–12400 | |
| 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) | 1900–2800 | | 10800–12700 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 4000–5400 | |  | |
| 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) | 11300–12200 | | 15500–17400 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 13400–14800 | |  | |
| 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) | 15200–17700 | | 4200–5200 | |
| 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) | 8400–10400 | | 1600–3100 | |
| 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) | 19900–22400 | | 13600–14600 | |
| 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) | 17800–19800 | | 15700–17200 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 2rd, 4th and 5th order IMD generated by UL CA\_n40A-n79A may fall into own Rx of Band n7.

#### 5.58.2.2 REFSENS requirements

For CA\_n7-n40-n79, the MSD values are given in the tables below.

Table 5.58.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n7-n40-n79 | n7 | 2520 | 5 | 25 | 2640 | N/A | FDD | N/A |
|  | n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
|  | n79 | N/A | 10 | N/A | 4830 | 30.5 | TDD | IMD22 |
|  | n7 | 2530 | 5 | 25 | 2650 | N/A | FDD | N/A |
|  | n40 | N/A | 5 | N/A | 2320 | 25 | TDD | IMD2 |
|  | n79 | 4850 | 10 | 50 | 4850 | N/A | FDD | N/A |
|  | n7 | 2510 | 5 | 25 | 2630 | N/A | FDD | N/A |
|  | n40 | N/A | 5 | N/A | 2370 | 6 | TDD | IMD5 |
|  | n79 | 4950 | 10 | 50 | 4950 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2630 | 29.4 | FDD | IMD2 |
|  | n40 | 2320 | 5 | 25 | 2320 | N/A | TDD | N/A |
|  | n79 | 4950 | 10 | 50 | 4950 | N/A | TDD | N/A |
|  | n7 | N/A | 5 | N/A | 2650 | 3 | FDD | IMD5 |
|  | n40 | 2350 | 5 | 25 | 2350 | N/A | TDD | N/A |
|  | n79 | 4850 | 10 | 50 | 4850 | N/A | TDD | N/A |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.59 CA\_n7-n78-n79

### 5.59.1 Common for 1 band UL and 2 bands UL CA

#### 5.59.1.1 Operating bands for CA

Table 5.59.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.59.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n7A-n78A-n79A | CA\_n7A-n78A  CA\_n7A-n79A  CA\_n78A-n79A | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | n79 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n7-n78-n79, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.59.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n78-n79 | 0.5 | 0.5 / 1.58 | 0.5 / 1.58 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5.  NOTE 8: The requirements only apply for UE supporting inter-band carrier aggregation with simultaneous Rx/Tx capability, and NR UL carrier frequencies are confined to 3700 MHz-3800MHz for n78 and 4400 MHz-4500MHz for n79. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation. | | | |

Table 5.59.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7-n78-n79 | 0.5 | 0.5 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.59.2 Specific for 2 bands UL CA

#### 5.59.2.1 UE co-existence studies

##### 5.59.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.59.2.1.1-1, Table 5.59.2.1.1-2 and Table 5.59.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n7A-n78A-n79A with UL CA\_n7A-n78A, UL CA\_n7A-n79A and UL CA\_n78A-n79A.

Table 5.59.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 730–1300 | | 5800–6370 | |
| 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) | 1200–1840 | | 4030–5100 | |
| 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) | 8300–8940 | | 9100–10170 | |
| 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) | 3700–4410 | | 7330–8900 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1460–2600 | |  | |
| 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) | 10800–11510 | | 12400–13970 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 11600–12740 | |  | |
| 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) | 10630–12700 | | 6200–6980 | |
| 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) | 4760–6400 | | 100–1110 | |
| 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) | 15700–17770 | | 13300–14080 | |
| 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) | 14900–16540 | | 14100–15310 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 3rd ,4th and 5th IMD generated by UL CA\_n7A-n78A may fall into own Rx of Band n79.

Table 5.59.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1830–2500 | | 6900–7570 | |
| 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) | 0- 740 | | 6230–7500 | |
| 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) | 9400–10140 | | 11300–12570 | |
| 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) | 2500–3310 | | 10630–12500 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3660–5000 | |  | |
| 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) | 11900–12710 | | 15700–17570 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 13800–15140 | |  | |
| 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) | 15030–17500 | | 5000–5880 | |
| 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) | 8060–10000 | | 1090–2500 | |
| 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) | 20100–22570 | | 14400–15280 | |
| 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) | 18200–20140 | | 16300–17710 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 4th IMD generated by UL CA\_n7A-n79A may fall into own Rx of Band n78.

Table 5.59.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 600–1700 | | 7700–8800 | |
| 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) | 1600-3200 | | 5000–6700 | |
| 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) | 11000–12600 | | 12100–13800 | |
| 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) | 4900–7000 | | 9400–11700 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1200–3400 | |  | |
| 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) | 14300–16400 | | 16500–18800 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 15400–17600 | |  | |
| 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) | 13800–16700 | | 8200–10800 | |
| 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) | 5600–8400 | | 100–2600 | |
| 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) | 20900–23800 | | 17600–20200 | |
| 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) | 19800–22600 | | 18700–21400 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 3rd and 4th order IMD generated by UL CA\_n78A-n79A may fall into own Rx of Band n7.

#### 5.59.2.2 REFSENS requirements

For CA\_n7-n78-n79, the MSD values are given in the tables below.

Table 5.59.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n7-n78-n79 | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
|  | n78 | 3500 | 10 | 50 | 3500 | N/A | TDD | N/A |
|  | n79 | N/A | 10 | N/A | 4450 | 20.6 | TDD | IMD31 |
|  | n7 | 2567.5 | 5 | 25 | 2687.5 | N/A | FDD | N/A |
|  | n78 | 3302.5 | 10 | 50 | 3302.5 | N/A | TDD | N/A |
|  | n79 | N/A | 10 | N/A | 4400 | 14 | TDD | IMD4 |
|  | n7 | 2525 | 5 | 25 | 2645 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3760 | 6.4 | TDD | IMD4 |
|  | n79 | 4405 | 10 | 50 | 4405 | N/A | TDD | N/A |
|  | n7 | N/A | 5 | N/A | 1860 | 19 | FDD | IMD3 |
|  | n78 | 3320 | 10 | 50 | 3320 | N/A | TDD | N/A |
|  | n79 | 4780 | 10 | 50 | 4780 | N/A | TDD | N/A |
|  | n7 | N/A | 5 | N/A | 2660 | 8 | FDD | IMD4 |
|  | n78 | 3500 | 10 | 50 | 3500 | N/A | TDD | N/A |
|  | n79 | 4830 | 10 | 50 | 4830 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.60 CA\_n1-n3-n77

### 5.60.1 Common for 1 band UL and 2 bands UL CA

#### 5.60.1.1 Operating bands for CA

Table 5.60.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD |
| n3 | 1710 MHz – 1785 MHz | 1805 MHz – 1880 MHz | FDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.60.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n3A-n77(2A) | n777,9  CA\_n1A-n3A  CA\_n1A-n77A7  CA\_n3A-n77A7  CA\_n77(2A) | n1 | 5, 10, 15, 20 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30 |  |
|  |  | n77 | CA\_n77(2A) BCS1 |  |
|  | CA\_n1A-n3A  CA\_n1A-n77A  CA\_n3A-n77A  CA\_n77(2A) | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n3 | n3 channel bandwidths in Table 5 3 5-1 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |
| CA\_n1A-n3A-n77(3A) | CA\_n1A-n3A  CA\_n1A-n77A  CA\_n3A-n77A  CA\_n77(2A) | n1 | 5, 10, 15, 20 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30 |  |
|  |  | n77 | CA\_n77(3A)\_BCS1 |  |
| NOTE 7: Minimum requirements for Power Class 2 are applicable for this uplink combination or single uplink carrier in this downlink/uplink combination.  NOTE 9: Minimum requirements for Power Class 1.5 are applicable for single uplink carrier in this downlink/uplink combination. | | | | |

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

For CA\_n1-n3-n77, ΔTIB,c and ΔRIB,c values have already been defined in TS38.101-1[2].

### 5.60.2 Specific for 2 bands UL CA

#### 5.60.2.1 UE co-existence studies

##### 5.60.2.1.1 Co-existence studies for 2UL band with 1CC per band

Based on the exception to the reference sensitivity due to intermodulation interference by 2UL CA in TS38.101-1[2], no MSD is needed for UL CA\_n77(2A).

#### 5.60.2.2 REFSENS requirements

Based on co-existence studies on 5.60.2.1, no need to define exceptional REFSENS requirements.

## 5.61 CA\_n3-n40-n41

### 5.61.1 Common for 1 band UL and 2 bands UL CA

#### 5.61.1.1 Operating bands for CA

Table 5.61.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n34 | 2010 MHz – 2025 MHz | 2010 MHz – 2025 MHz | TDD |
| n41 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 MHz | TDD |

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

Table 5.61.1.2-1: Supported bandwidths per CA band combination of band n3+n34+n41

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n34A-n41A | CA\_n3A-n34A  CA\_n3A-n41A  CA\_n34A-n41A | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n34 | See n34 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n41 | See n41 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n3A-n34A-n41C | CA\_n3A-n34A  CA\_n3A-n41A  CA\_n34A-n41A | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n34 | See n34 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n41 | CA\_n41C\_BCS 4 and 5 |  |

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

For CA\_n3-n34-n41, the ΔTIB,c and ΔRIB,c values are proposed in the following tables:

Table 5.61.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n34-n41 | 0.5 | 0.5 | 0.34 / 0.85 |
| NOTE 4: The requirement is applied for UE transmitting on the frequency range of 2515-2690 MHz.  NOTE 5: The requirement is applied for UE transmitting on the frequency range of 2496-2515 MHz.  NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.61.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n34-n41 | - | - | 04 / 0.55 |
| NOTE 4: The requirement is applied for UE transmitting on the frequency range of 2515 – 2690 MHz.  NOTE 5: The requirement is applied for UE transmitting on the frequency range of 2496 – 2515 MHz.  NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n3 the band order from left to right is n1, n3 and n3. | | | |

### 5.61.2 Specific for 2 bands UL CA

#### 5.61.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n3A-n34A, CA\_n3A-n41A and CA\_n34A-n41A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD5 issue caused by n3+n34, i.e. 2\*fn3-3\*fn34, fall into the its own band n41 Rx;

No IMD issue caused by n34+n41 falls into the its own band n3 Rx;

No IMD issue caused by n3+n41 fallx into the its own band n34 Rx;

#### 5.61.2.2 REFSENS requirements

Based on co-existence studies additional MSD is needed to be defined. The MSD values are proposed in table 5.61.2.2-1.

Table 5.61.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n3-n34-n41 | n3 | 1742.5 | 5 | 25 | 1837.5 | N/A | N/A |
|  | n34 | 2020 | 5 | 25 | 2020 | N/A | N/A |
|  | n41 | N/A | 5 | N/A | 2550 | 1.0 | IMD5 |

## 5.62 CA\_n3-n40-n79

### 5.62.1 Common for 1 band UL and 2 bands UL CA

#### 5.62.1.1 Operating bands for CA

Table 5.62.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n34 | 2010 MHz – 2025 MHz | 2010 MHz – 2025 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.62.1.2-1: Supported bandwidths per CA band combination of band n3+n34+n39

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n34A-n79A | CA\_n3A-n34A  CA\_n3A-n79A  CA\_n34A-n79A | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n34 | See n34 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n3-n34-n79, the ΔTIB,c and ΔRIB,c values are proposed in the following tables:

Table 5.62.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n34-n79 | 0.5 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.62.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n34-n79 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n3 the band order from left to right is n1, n3 and n3. | | | |

### 5.62.2 Specific for 2 bands UL CA

#### 5.62.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n3A-n34A, CA\_n3A-n79A and CA\_n34A-n79A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD5 issue caused by n3+n34, i.e. 4\*fn34-fn3, fall into the its own band n79 Rx;

No IMD issue caused by n34+n79 falls into the its own band n3 Rx;

IMD5 issue caused by n3+n79, i.e. 4\*fn3-fn79, falls into the its own band n34 Rx.

#### 5.62.2.2 REFSENS requirements

Based on co-existence studies additional MSD is needed to be defined. The MSD values are proposed in table 5.62.2.2-1.

Table 5.62.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n3-n34-n79 | n3 | 1730 | 5 | 25 | 1825 | N/A | N/A |
|  | n34 | 2020 | 5 | 25 | 2020 | N/A | N/A |
|  | n79 | N/A | 40 | N/A | 4900 | 3.2 | IMD5 |
|  | n3 | 1730 | 5 | 25 | 1825 | N/A | N/A |
|  | n79 | 4900 | 40 | 216 | 4900 | N/A | N/A |
|  | n34 | N/A | 5 | N/A | 2020 | 9.7 | IMD5 |

## 5.63 CA\_n2-n66-n77

### 5.63.1 Common for 1 band UL and 2 bands UL CA

#### 5.63.1.1 Operating bands for CA

Table 5.63.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n2 | 1850 MHz – 1910 MHz | 1930 MHz –1990 MHz | FDD |
| n66 | 1710 MHz –1780 MHz | 2110 MHz – 2200 MHz | FDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.63.1.2-1: Supported bandwidths per CA band combination of band n2+n66+n77

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n2A-n66A-n77C | n777,9  CA\_n2A-n66A  CA\_n2A-n77A7  CA\_n66A-n77A7 | | n2 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n2 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n77C  CA\_n2A-n66A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n66A-n77A  CA\_n66A-n77C | | n2 | n2 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2(2A)-n66A-n77C | CA\_n2A-n66A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n66A-n77A  CA\_n66A-n77C CA\_n77C | | n2 | CA\_n2(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2A-n66(2A)-n77C | CA\_n2A-n66A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n66A-n77A  CA\_n66A-n77C CA\_n77C | | n2 | n2 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n66 | CA\_n66(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2(2A)-n66(2A)-n77C | CA\_n2A-n66A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n66A-n77A  CA\_n66A-n77C CA\_n77C | | n2 | CA\_n2(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | CA\_n66(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |

### 5.63.2 Specific for 2 bands UL CA

#### 5.63.2.1 UE co-existence studies

##### 5.63.2.1.1 Co-existence studies for 2UL band with 1CC per band

Co-existence study has been performed in Rel-18.

##### 5.63.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.63.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n66 interference analysis for CA\_n2A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.63.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n2, n77)** | 1850 – 1910 | | 3300 – 4200 | |
| **fDL (n66)** | 2110 – 2200 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1650 – 1850 | | 1910 – 2110 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.63.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n2 interference analysis for CA\_n66A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.63.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n66, n77)** | 1710 – 1780 | | 3300 – 4200 | |
| **fDL (n2)** | 1930 – 1990 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1510 – 1710 | | 1780 – 1980 | |
| **Analysis** | Triple beat IMD may fall into band n2. | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.63.2.2 REFSENS requirements

Based on the triple beat analysis of the added ULCA, triple beat IMD of UL CA\_ n66-n77 may fall into RX of band n2 and need to define new MSD value for IMD3. MSD value for CA\_n1-n3-n78 is reused.

Table 5.63.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n2-n66-n77 | n2 | N/A | 5 | 25 | 1950 | 15.3 | FDD | IMD3 |
|  | n66 | 1775 | 5 | 25 | 2195 | N/A | FDD | N/A |
|  | n77 | 3300 | 100 | 1 (RBstart=203) | 3300 | N/A | TDD | N/A |
|  |  | 3400 | 100 | 1 (RBstart=67) | 3400 |  |  |  |

## 5.64 CA\_n2-n48-n77

### 5.64.1 Common for 1 band UL and 2 bands UL CA

#### 5.64.1.1 Operating bands for CA

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Table 5.64.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n2 | 1850 MHz – 1910 MHz | 1930 MHz –1990 MHz | FDD |
| n48 | 3550 MHz – 3700 MHz | 3550 MHz – 3700 MHz | TDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.64.1.2-1: Supported bandwidths per CA band combination of band n2+n48+n77

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n2A-n48A-n77C | n777,9  CA\_n2A-n48A  CA\_n2A-n77A7  CA\_n77C | | n2 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | | n48 | 5, 10, 15, 20, 30, 40, 5012, 6012, 7012, 8012, 9012, 10012 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n2 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | | n48 | 5, 10, 15, 20, 30, 40, 5012, 6012, 7012, 8012, 9012, 10012 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n2A-n48A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n77C | | n2 | n2 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n48 | n48 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2A-n48(2A)-n77C | n777,9  CA\_n2A-n48A  CA\_n2A-n77A7 | | n2 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | | n48 | CA\_n48(2A)\_BCS1 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n77C  CA\_n2A-n48A  CA\_n2A-n77A  CA\_n2A-n77C | | n2 | n2 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n48 | CA\_n48(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2A-n48B-n77A | n777,9  CA\_n48B  CA\_n2A-n48A  CA\_n2A-n77A7 | | n2 | 5, 10, 15, 20 | 0 |
|  |  | | n48 | CA\_n48B\_BCS0 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n2 | 5, 10, 15, 20 | 1 |
|  |  | | n48 | CA\_n48B\_BCS1 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n2 | 5, 10, 15, 20 | 2 |
|  |  | | n48 | CA\_n48B\_BCS2 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  | CA\_n48B  CA\_n2A-n48A  CA\_n2A-n48B  CA\_n2A-n77A | | n2 | n2 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n48 | CA\_n48B\_BCS4 and 5 |  |
|  |  | | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n2A-n48B-n77C | n777,9  CA\_n48B  CA\_n2A-n48A  CA\_n2A-n77A7 | | n2 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | | n48 | CA\_n48B\_BCS2 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n48B  CA\_n77C  CA\_n2A-n48A  CA\_n2A-n48B  CA\_n2A-n77A  CA\_n2A-n77C | | n2 | n2 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n48 | CA\_n48B\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2(2A)-n48B-n77A | CA\_n2A-n48A  CA\_n2A-n48B  CA\_n2A-n77A  CA\_n48B | | n2 | CA\_n2(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n48 | CA\_n48B\_BCS4 and 5 |  |
|  |  | | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n2(2A)-n48A-n77C | CA\_n2A-n48A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n77C | | n2 | CA\_n2(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n48 | n48 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2(2A)-n48(2A)-n77C | CA\_n2A-n48A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n77C | | n2 | CA\_n2(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n48 | CA\_n48(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2(2A)-n48B-n77C | CA\_n2A-n48A  CA\_n2A-n48B  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n48B  CA\_n77C | | n2 | CA\_n2(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n48 | CA\_n48B\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |

### 5.64.2 Specific for 2 bands UL CA

#### 5.64.2.1 UE co-existence studies

##### 5.64.2.1.1 Co-existence studies for 2UL band with 1CC per band

Co-existence study has been performed in Rel-18.

##### 5.64.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.64.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n48 interference analysis for CA\_n2A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.64.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n2, n77)** | 1850 – 1910 | | 3300 – 4200 | |
| **fDL (n48)** | 3550 – 3700 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1650 – 1850 | | 1910 – 2110 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.64.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n77 interference analysis for CA\_n2A-n48B with n48B transmitting with a 40 MHz maximum instantaneous bandwidth.

Table 5.64.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n48B** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n2, n48)** | 1850 – 1910 | | 3550 – 3700 | |
| **fDL (n77)** | 3300 – 4200 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 150 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1810 – 1850 | | 1910 – 1950 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.64.2.2 REFSENS requirements

Based on the triple beat analysis of the added UL CA\_n2A-n77C and CA\_n2A-n48B, there are no triple beat issues and no need to define new MSD values.

## 5.65 CA\_n5-n66-n77

### 5.65.1 Common for 1 band UL and 2 bands UL CA

#### 5.65.1.1 Operating bands for CA

Table 5.65.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.65.1.2-1: Supported bandwidths per CA band combination of band n5+n66+n77

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n5A-n66A-n77C | n777,9  CA\_n5A-n66A  CA\_n5A-n77A7  CA\_n66A-n77A7  CA\_n77C | | n5 | 5, 10, 15, 20, 251 | 0 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n5 | 5, 10, 15, 20, 251 | 1 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n5A-n66A  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n66A-n77A  CA\_n66A-n77C  CA\_n77C | | n5 | n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n5A-n66(2A)-n77C | CA\_n5A-n66A  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n66A-n77A  CA\_n66A-n77C  CA\_n77C | | n5 | n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n66 | CA\_n66(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n5B-n66A-n77C | CA\_n5A-n66A  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n5B  CA\_n66A-n77A  CA\_n66A-n77C  CA\_n77C | | n5 | CA\_n5B\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n5B-n66(2A)-n77C | CA\_n5A-n66A  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n5B  CA\_n66A-n77A  CA\_n66A-n77C CA\_n77C | | n5 | CA\_n5B\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | CA\_n66(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |

### 5.65.2 Specific for 2 bands UL CA

#### 5.65.2.1 UE co-existence studies

##### 5.65.2.1.1 Co-existence studies for 2UL band with 1CC per band

Co-existence study has been performed in Rel-18.

##### 5.65.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.65.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n66 interference analysis for CA\_n5A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.65.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n5, n77)** | 824 – 849 | | 3300 – 4200 | |
| **fDL (n66)** | 2110 – 2200 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 624 – 824 | | 849 – 1049 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.65.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n5 interference analysis for CA\_n66A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.65.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n66, n77)** | 1710 – 1780 | | 3300 – 4200 | |
| **fDL (n5)** | 869 – 894 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1510 – 1710 | | 1780 – 1980 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.65.2.2 REFSENS requirements

Based on the triple beat analysis of the added ULCA, there are no triple beat IMD issues and no need to define MSD values.

## 5.66 CA\_n48-n66-n77

### 5.66.1 Common for 1 band UL and 2 bands UL CA

#### 5.66.1.1 Operating bands for CA

Table 5.66.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n48 | 3550 MHz – 3700MHz | 3550 MHz – 3700MHz | TDD |
| n66 | 1710 MHz –1780 MHz | 2110 MHz – 2200 MHz | FDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.66.1.2-1: Supported bandwidths per CA band combination of band n48+n66+n77

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n48A-n66A-n77C | n777,9  CA\_n48A-n66A  CA\_n66A-n77A7  CA\_n77C | | n48 | 5, 10, 15, 20, 30, 40, 5012, 6012, 7012, 8012, 9012, 10012 | 0 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n48 | 5, 10, 15, 20, 30, 40, 5012, 6012, 7012, 8012, 9012, 10012 | 1 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n48A-n66A  CA\_n66A-n77A  CA\_n66A-n77C CA\_n77C | | n48 | n48 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n48B-n66A-n77A | n777,9  CA\_n48A-n66A  CA\_n66A-n77A7 | | n48 | CA\_n48B\_BCS0 | 0 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n48 | CA\_n48B\_BCS1 | 1 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n48 | CA\_n48B\_BCS2 | 2 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  | CA\_n48A-n66A  CA\_n48B-n66A  CA\_n66A-n77A  CA\_n48B | | n48 | CA\_n48B\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n48B-n66A-n77C | n777,9  CA\_n48A-n66A  CA\_n66A-n77A7  CA\_n77C | | n48 | CA\_n48B\_BCS2 | 0 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n48A-n66A  CA\_n48B-n66A  CA\_n66A-n77A  CA\_n66A-n77C  CA\_n48B  CA\_n77C | | n48 | CA\_n48B\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n48(2A)-n66A-n77C | n777,9  CA\_n77C  CA\_n48A-n66A  CA\_n66A-n77A7 | | n48 | CA\_n48(2A)\_BCS0 | 0 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n48 | CA\_n48(2A)\_BCS0 | 1 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  |  | | n48 | CA\_n48(2A)\_BCS1 | 2 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n48 | CA\_n48(2A)\_BCS1 | 3 |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n77C  CA\_n48A-n66A  CA\_n66A-n77A CA\_n66A-n77C | | n48 | CA\_n48(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n48B-n66(2A)-n77A | CA\_n48B  CA\_n48A-n66A  CA\_n48B-n66A CA\_n66A-n77A | | n48 | CA\_n48B\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | CA\_n66(2A)\_BCS4 and 5 |  |
|  |  | | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n48A-n66(2A)-n77C | CA\_n77C  CA\_n48A-n66A  CA\_n66A-n77A CA\_n66A-n77C | | n48 | n48 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n66 | CA\_n66(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
|  |  | |  |  |  |
| CA\_n48(2A)-n66(2A)-n77C | CA\_n77C  CA\_n48A-n66A  CA\_n66A-n77A CA\_n66A-n77C | | n48 | CA\_n48(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | CA\_n66(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n48B-n66(2A)-n77C | CA\_n48B  CA\_n77C  CA\_n48A-n66A  CA\_n48B-n66A  CA\_n66A-n77A CA\_n66A-n77C | | n48 | CA\_n48B\_BCS4 and 5 | 4 and 5 |
|  |  | | n66 | CA\_n66(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |

### 5.66.2 Specific for 2 bands UL CA

#### 5.66.2.1 UE co-existence studies

##### 5.66.2.1.1 Co-existence studies for 2UL band with 1CC per band

Co-existence study has been performed in Rel-18.

##### 5.66.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.66.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n48 interference analysis for CA\_n66A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.66.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n66, n77)** | 1710 – 1780 | | 3300 – 4200 | |
| **fDL (n48)** | 3550 – 3700 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1510 – 1710 | | 1780 – 1980 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.66.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n48 interference analysis for CA\_n48B-n66A with n48B transmitting with a 40 MHz maximum instantaneous bandwidth.

Table 5.66.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n48B** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n48, n66)** | 1710 – 1780 | | 3550 – 3700 | |
| **fDL (n77)** | 3300 – 4200 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 150 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1670 – 1710 | | 1780 – 1820 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.66.2.2 REFSENS requirements

Based on the triple beat analysis of the added ULCA, there are no triple beat IMD issues and no need to define MSD values.

## 5.67 CA\_n3-n78-n79

### 5.67.1 Common for 1 band UL and 2 bands UL CA

#### 5.67.1.1 Operating bands for CA

Table 5.67.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 – 1880 MHz | FDD |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.67.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n78A-n79A5 | n787,9  CA\_n3A-n78A  CA\_n3A-n79A  CA\_n78A-n79A5 | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |
| CA\_n3A-n78A-n79A | CA\_n3A-n78A CA\_n3A-n79A  CA\_n78A-n79A | n3 | n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | n79 channel bandwidths in Table 5.3.5-1 |  |
| NOTE 5: Simultaneous Rx/Tx capability for TDD combinations does not apply for UEs supporting band n78 with an n77 implementation.  NOTE 7: Minimum requirements for Power Class 2 are applicable for this uplink combination or single uplink carrier in this downlink/uplink combination.  NOTE 9: Minimum requirements for Power Class 1.5 are applicable for single uplink carrier in this downlink/uplink combination. | | | | |

Note that the single uplink carrier with note 7 or 9 is already supported in the specification.

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

For CA\_n3-n78-n79, the ∆TIB,c and ∆RIB,c values have already been defined in the current specification.

### 5.67.2 Specific for 2 bands UL CA

#### 5.67.2.1 UE co-existence studies

##### 5.67.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.67.2.1.1-1, Table 5.67.2.1.1-2 and Table 5.67.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n3A-n78A-n79A with UL CA\_n3A-n78A, UL CA\_n3A-n79A A and UL CA\_n78A-n79A.

Table 5.67.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515–2090 | | 5010–5585 | |
| 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) | 270–380 | | 4815–5890 | |
| 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) | 6720–7370 | | 8310–9385 | |
| 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) | 1330–2055 | | 8115–9690 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3030–4180 | |  | |
| 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) | 8430–9155 | | 11610–13185 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 10020–11170 | |  | |
| 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) | 11415–13490 | | 3040–3840 | |
| 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) | 6330–7980 | | 1245–2470 | |
| 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) | 14910–16985 | | 10140–10940 | |
| 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) | 13320–14970 | | 11730–12955 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 3rd IMD generated by UL CA\_n3A-n78A may fall into own Rx of Band n79.

Table 5.67.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2615–3290 | | 6110–6785 | |
| 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) | 830 -1580 | | 7015–8290 | |
| 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) | 7820–8570 | | 10510–11785 | |
| 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) | 130–955 | | 11415–13290 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 5230–6580 | |  | |
| 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) | 9530–10355 | | 14910–16785 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 12220–13570 | |  | |
| 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) | 15815–18290 | | 1840–2740 | |
| 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) | 9630–11580 | | 3445–4870 | |
| 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) | 19310–21785 | | 11240–12140 | |
| 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) | 16620–18570 | | 13930–15355 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 5th IMD generated by UL CA\_n3A-n79A may fall into own Rx of Band n78.

Table 5.67.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 600–1700 | | 7700–8800 | |
| 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) | 1600–3200 | | 5000–6700 | |
| 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) | 11000–12600 | | 12100–13800 | |
| 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) | 4900–7000 | | 9400–11700 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1200–3400 | |  | |
| 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) | 14300–16400 | | 16500–18800 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 15400–17600 | |  | |
| 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) | 13800–16700 | | 8200–10800 | |
| 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) | 5600–8400 | | 100–2600 | |
| 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) | 20900–23800 | | 17600–20200 | |
| 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) | 19800–22600 | | 18700–21400 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 3rd, 4th and 5th IMD generated by UL CA\_n78A-n79A may fall into own Rx of Band n3.

#### 5.67.2.2 REFSENS requirements

For CA\_n3-n78-n79, the MSD values are given as follows. Among them, IMD3 MSD value of n3 is reused from that of CA\_n3-n77-n79.

Table 5.67.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n3-n78-n79 | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
|  | n78 | 3320 | 10 | 52 | 3320 | N/A | TDD | N/A |
|  | n79 | N/A | 10 | N/A | 4860 | 13.1 | TDD | IMD3 |
|  | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3480 | 1 | TDD | IMD5 |
|  | n79 | 4410 | 10 | 52 | 4410 | N/A | TDD | N/A |
|  | n3 | 1765 | 5 | 25 | 1860 | 15.7 | FDD | IMD31 |
|  | n78 | 3350 | 10 | 52 | 3350 | N/A | TDD | N/A |
|  | n79 | 4840 | 10 | 52 | 4840 | N/A | TDD | N/A |
|  | n3 | 1745 | 5 | 25 | 1840 | 3 | FDD | IMD4 |
|  | n78 | 3780 | 10 | 52 | 3780 | N/A | TDD | N/A |
|  | n79 | 4700 | 10 | 52 | 4700 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.68 CA\_n28-n40-n71

### 5.68.1 Common for 1 band UL and 2 bands UL CA

#### 5.68.1.1 Operating bands for CA

Table 5.68.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n28 | 703 MHz - 748 MHz | 758 MHz - 803 MHz | FDD |
| n40 | 2300 MHz - 2400 MHz | 2300 MHz - 2400 MHz | TDD |
| n71 | 663 MHz - 698 MHz | 617 MHz - 652 MHz | FDD |

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

Table 5.68.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n28A-n40A-n71A | CA\_n40A-n71A  CA\_n28A-n40A | n28 | n28 channel bandwidths in Table 5.3.5-1 | 4&5 |
|  |  | n40 | n40 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n28-n40-n71, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.68.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n28-n40-n71 | 1.1 | 0.3 | 1.1 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3 the band order from left to right is n1 and n3. | | | |

Table 5.68.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n28-n40-n71 | 0.7 | - | 0.7 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n77 the band order from left to right is n1 and n77. | | | |

### 5.68.2 Specific for 2 bands UL CA

#### 5.68.2.1 UE co-existence studies

##### 5.68.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.68.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n28A-n40A-n71A with UL CA\_n40A-n71A.

Table 5.68.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1737 | 1602 | 2963 | 3098 |
| 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) | 3902 | 4137 | 1074 | 904 |
| 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) | 5263 | 5498 | 3626 | 3796 |
| 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) | 6202 | 6537 | 411 | 206 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3204 | 3474 |  |  |
| 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) | 7563 | 7898 | 4289 | 4494 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 5926 | 6196 |  |  |
| 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) | 492 | 252 | 8937 | 8502 |
| 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) | 2506 | 2811 | 5874 | 5504 |
| 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) | 4952 | 5192 | 9863 | 10298 |
| 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) | 6589 | 6894 | 8226 | 8596 |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.68.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n28A-n40A-n71A with UL CA\_n28A-n40A.

Table 5.68.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1552 | 1697 | 3003 | 3148 |
| 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) | 994 | 804 | 3852 | 4097 |
| 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) | 3706 | 3896 | 5303 | 5548 |
| 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) | 291 | 56 | 6152 | 6497 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3394 | 3104 |  |  |
| 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) | 4409 | 4644 | 7603 | 7948 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 6006 | 6296 |  |  |
| 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) | 8897 | 8452 | 692 | 412 |
| 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) | 5794 | 5404 | 2356 | 2691 |
| 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) | 9903 | 10348 | 5112 | 5392 |
| 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) | 8306 | 8696 | 6709 | 7044 |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.68.2.1.1-1 there is no IMD issue when both n40 and n71 are transmitting signal.

Based on the analysis in Table 5.68.2.1.1-2 there is IMD5 from n28 and n40 into RX band n71.

#### 5.68.2.2 REFSENS requirements

The MSD values are proposed below based on the existing CA\_n18-n28-n41.

Table 5.68.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n28-n40-n71 | n28 | 743 | 5 | 25 | 798 | N/A | FDD | N/A |
|  | n40 | 2350 | 5 | 25 | 2350 | N/A | TDD | N/A |
|  | n71 | N/A | 5 | N/A | 622 | 3.9 | FDD | IMD5 |

## 5.69 CA\_n28-n71-n77

### 5.69.1 Common for 1 band UL and 2 bands UL CA

#### 5.69.1.1 Operating bands for CA

Table 5.69.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n28 | 703 MHz - 748 MHz | 758 MHz - 803 MHz | FDD |
| n71 | 663 MHz - 698 MHz | 617 MHz - 652 MHz | FDD |
| n77 | 3300 MHz - 4200 MHz | 3300 MHz - 4200 MHz | TDD |

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

Table 5.69.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n28A-n71A-n77A | CA\_n28A-n77A  CA\_n71A-n77A | n28 | n28 channel bandwidths in Table 5.3.5-1 | 4&5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n28A-n71A-n77(2A) | CA\_n28A-n77A  CA\_n71A-n77A | n28 | n28 channel bandwidths in Table 5.3.5-1 | 4&5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |

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

For CA\_n28-n71-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.69.1.4-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n28-n71-n77 | 1.1 | 1.1 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3 the band order from left to right is n1 and n3. | | | |

Table 5.69.1.4-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n28-n71-n77 | 0.7 | 0.7 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n77 the band order from left to right is n1 and n77. | | | |

### 5.69.2 Specific for 2 bands UL CA

5.69.2.1 UE co-existence studies

##### 5.69.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.69.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n28A-n71A-n77A with UL CA\_n28A-n77A.

Table 5.69.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 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 | 3497 | 4003 | 4948 |
| 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) | 2794 | 1804 | 5852 | 7697 |
| 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 | 5696 | 7303 | 9148 |
| 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) | 2091 | 1056 | 9152 | 11897 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 6994 | 5104 |  |  |
| 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 | 6444 | 10603 | 13348 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 8006 | 9896 |  |  |
| 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) | 16097 | 12452 | 308 | 1388 |
| 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) | 11194 | 8404 | 4356 | 6291 |
| 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 | 17548 | 6112 | 7192 |
| 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 | 14096 | 8709 | 10644 |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.69.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n28A-n71A-n77A with UL CA\_n71A-n77A.

Table 5.69.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 | 3537 | 3963 | 4898 |
| 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) | 2874 | 1904 | 5902 | 7737 |
| 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) | 4626 | 5596 | 7263 | 9098 |
| 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) | 2211 | 1206 | 9202 | 11937 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 7074 | 5204 |  |  |
| 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) | 5289 | 6294 | 10563 | 13298 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 7926 | 9796 |  |  |
| 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) | 16137 | 12502 | 508 | 1548 |
| 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) | 11274 | 8504 | 4506 | 6411 |
| 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) | 13863 | 17498 | 5952 | 6992 |
| 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) | 11226 | 13996 | 8589 | 10494 |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.69.2.1.1-1 there is IMD5 from n28 and n77 into RX band n71.

Based on the analysis in Table 5.69.2.1.1-2 there is IMD5 from n71 and n77 into RX band n28.

5.69.2.2 REFSENS requirements

The MSD values are proposed below based on the existing CA\_n5-n28-n78 and CA\_n5-n12-n77

Table 5.69.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n28-n71-n77 | n28 | 713 | 5 | 25 | 768 | N/A | FDD | N/A |
|  | n71 | N/A | 5 | N/A | 628 | 4.7 | FDD | IMD5 |
|  | n77 | 3480 | 10 | 50 | 3480 | N/A | TDD | N/A |
|  | n28 | N/A | 5 | N/A | 778 | 4.3 | FDD | IMD5 |
|  | n71 | 688 | 5 | 25 | 642 | N/A | FDD | N/A |
|  | n77 | 3530 | 10 | 50 | 3530 | N/A | TDD | N/A |

## 5.70 CA\_n40-n71-n77

### 5.70.1 Common for 1 band UL and 2 bands UL CA

#### 5.70.1.1 Operating bands for CA

Table 5.70.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | **Downlink (DL) band** | **Duplex** |
| **BS receive / UE transmit** | **BS transmit / UE receive** | **mode** |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |  |
| n40 | 2300 MHz - 2400 MHz | 2300 MHz - 2400 MHz | TDD |
| n71 | 663 MHz - 698 MHz | 617 MHz - 652 MHz | FDD |
| n77 | 3300 MHz - 4200 MHz | 3300 MHz - 4200 MHz | TDD |

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

Table 5.70.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n40A-n71A-n77A | CA\_n40A-n71A  CA\_n40A-n77A  CA\_n71A-n77A | n40 | n40 channel bandwidths in Table 5.3.5-1 | 4&5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n40A-n71A-n77(2A) | CA\_n40A-n71A  CA\_n40A-n77A  CA\_n71A-n77A | n40 | n40 channel bandwidths in Table 5.3.5-1 | 4&5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | CA\_n77(2A)\_BCS4 and 5 |  |

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

For CA\_n40-n71-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.70.1.4-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n40-n71-n77 | 0.3 | 0.5 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3 the band order from left to right is n1 and n3. | | | |

Table 5.70.1.4-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n40-n71-n77 | - | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n77 the band order from left to right is n1 and n77. | | | |

### 5.70.2 Specific for 2 bands UL CA

#### 5.70.2.1 UE co-existence studies

##### 5.70.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.70.2.1.1-1 provides the two UL bands with one CC per band IMD interference analysis for CA\_n40A-n71A-n77A with UL CA\_n40A-n71A.

Table 5.70.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1737 | 1602 | 2963 | 3098 |
| 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) | 3902 | 4137 | 1074 | 904 |
| 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) | 5263 | 5498 | 3626 | 3796 |
| 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) | 6202 | 6537 | 411 | 206 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3204 | 3474 |  |  |
| 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) | 7563 | 7898 | 4289 | 4494 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 5926 | 6196 |  |  |
| 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) | 492 | 252 | 8937 | 8502 |
| 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) | 2506 | 2811 | 5874 | 5504 |
| 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) | 4952 | 5192 | 9863 | 10298 |
| 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) | 6589 | 6894 | 8226 | 8596 |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.70.2.1.1-2 provides the two UL bands with one CC per band IMD interference analysis for CA\_n40A-n71A-n77A with UL CA\_n40A-n77A.

Table 5.70.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 900 | 1900 | 5600 | 6600 |
| 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) | 400 | 1500 | 4200 | 6100 |
| 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) | 7900 | 9000 | 8900 | 10800 |
| 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) | 2700 | 3900 | 7500 | 10300 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3800 | 1800 |  |  |
| 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) | 10200 | 11400 | 12200 | 15000 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 11200 | 13200 |  |  |
| 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) | 14500 | 10800 | 6300 | 5000 |
| 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) | 8000 | 5100 | 600 | 1500 |
| 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) | 15500 | 19200 | 12500 | 13800 |
| 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) | 14500 | 17400 | 13500 | 15600 |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Table 5.70.2.1.1-3 provides the two UL bands with one CC per band IMD interference analysis for CA\_n40A-n71A-n77A with UL CA\_n71A-n77A.

Table 5.70.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 | 3537 | 3963 | 4898 |
| 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) | 2874 | 1904 | 5902 | 7737 |
| 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) | 4626 | 5596 | 7263 | 9098 |
| 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) | 2211 | 1206 | 9202 | 11937 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 7074 | 5204 |  |  |
| 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) | 5289 | 6294 | 10563 | 13298 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 7926 | 9796 |  |  |
| 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) | 16137 | 12502 | 508 | 1548 |
| 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) | 11274 | 8504 | 4506 | 6411 |
| 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) | 13863 | 17498 | 5952 | 6992 |
| 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) | 11226 | 13996 | 8589 | 10494 |
| NOTE : For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the analysis in Table 5.70.2.1.1-1 there are IMD3 and IMD4 from n40 and n71 into RX band n77.

Based on the analysis in Table 5.70.2.1.1-2 there are IMD3 and IMD5 from n40 and n77 into RX band n71.

Based on the analysis in Table 5.70.2.1.1-3 there is IMD3 from n71 and n77 into RX band n40.

#### 5.70.2.2 REFSENS requirements

The MSD values are proposed below based on the existing CA\_n41-n71-n77.

Table 5.70.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n40-n71-n77 | n40 | 2320 | 5 | 25 | 2320 | N/A | TDD | N/A |
|  | n71 | N/A | 5 | N/A | 630 | 18.7 | FDD | IMD32 |
|  | n77 | 3580 | 10 | 50 | 3580 | N/A | TDD | N/A |
|  | n40 | 2330 | 5 | 25 | 2330 | N/A | TDD | N/A |
|  | n71 | 688 | 5 | 25 | 642 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3706 | 16.3 | TDD | IMD31 |
|  | n40 | N/A | 5 | N/A | 2354 | 15.5 | TDD | IMD3 |
|  | n71 | 688 | 5 | 25 | 642 | N/A | FDD | N/A |
|  | n77 | 3730 | 10 | 50 | 3530 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.71 CA\_n8-n78-n79

### 5.71.1 Common for 1 band UL and 2 bands UL CA

#### 5.71.1.1 Operating bands for CA

Table 5.71.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n8 | 880 MHz – 915 MHz | 925 MHz – 960 MHz | FDD |
| n78 | 3300 MHz – 3800 MHz | 3300 MHz – 3800 MHz | TDD |
| n79 | 4400 MHz – 5000 MHz | 4400 MHz – 5000 MHz | TDD |

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

Table 5.71.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CA operating/channel bandwidth (MHz)** | | | | |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n8A-n78A-n79A | CA\_n8A-n78A CA\_n8A-n79A  CA\_n78A-n79A | n8 | n8 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | n79 channel bandwidths in Table 5.3.5-1 |  |

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

For CA\_n8-n78-n79, the ∆TIB,c and ∆RIB,c values have already been defined in the current specification.

### 5.71.2 Specific for 2 bands UL CA

#### 5.71.2.1 UE co-existence studies

##### 5.71.2.1.1 Co-existence studies for 2UL band with 1CC per band

Table 5.71.2.1.1-1, Table 5.71.2.1.1-2 and Table 5.71.2.1.1-3 provide the two UL bands with one CC per band IMD interference analysis for CA\_n8A-n78A-n79A with UL CA\_n8A-n78A, UL CA\_n8A-n79A A and UL CA\_n78A-n79A.

Table 5.71.2.1.1-1: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2385–2920 | | 4180–4715 | |
| 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) | 1470–2040 | | 5685–6720 | |
| 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) | 5060–5630 | | 7480–8515 | |
| 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) | 555–1160 | | 8985–10520 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 4770–5840 | |  | |
| 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) | 5940–6545 | | 10780–12315 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 8360–9430 | |  | |
| 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) | 12285–14320 | | 280–360 | |
| 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) | 8070–9640 | | 3855–4960 | |
| 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) | 14080–16115 | | 6820–7460 | |
| 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) | 11660–13230 | | 9240–10345 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 2nd,4th and 5th IMD generated by UL CA\_n8A-n78A may fall into own Rx of Band n79.

Table 5.71.2.1.1-2: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3485–4120 | | 5280–5915 | |
| 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) | 2570 -3240 | | 7885–9120 | |
| 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) | 6160–6830 | | 9680–10915 | |
| 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) | 1655–2360 | | 12285–14120 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 6970–8240 | |  | |
| 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) | 7040–7745 | | 14080–15915 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 10560–11830 | |  | |
| 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) | 16685–19120 | | 740–1480 | |
| 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) | 11370–13240 | | 6055–7360 | |
| 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) | 18480–20915 | | 7920–8660 | |
| 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) | 14960–16830 | | 11440–12745 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 2nd IMD generated by UL CA\_n8A-n79A may fall into own Rx of Band n78.

Table 5.71.2.1.1-3: Two UL bands IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 600–1700 | | 7700–8800 | |
| 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) | 1600–3200 | | 5000–6700 | |
| 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) | 11000–12600 | | 12100–13800 | |
| 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) | 4900–7000 | | 9400–11700 | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1200–3400 | |  | |
| 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) | 14300–16400 | | 16500–18800 | |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 15400–17600 | |  | |
| 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) | 13800–16700 | | 8200–10800 | |
| 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) | 5600–8400 | | 100–2600 | |
| 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) | 20900–23800 | | 17600–20200 | |
| 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) | 19800–22600 | | 18700–21400 | |
| NOTE: For each IMD item, when two bound values before taking absolute have different signs, the relevant IMD range shall be set such that (1) the lower bound is 0 and (2) the upper bound is the bigger value of the two after taking absolute. The lowest even order and lowest odd order IMD MSDs shall be considered. | | | | |

Based on the above table, the 2nd and 5th IMD generated by UL CA\_n78A-n79A may fall into own Rx of Band n8.

#### 5.71.2.2 REFSENS requirements

For CA\_n8-n78-n79, the MSD values are given as follows.

Table 5.71.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n8-n78-n79 | n8 | 900 | 5 | 25 | 945 | N/A | FDD | N/A |
|  | n78 | 3700 | 10 | 52 | 3700 | N/A | TDD | N/A |
|  | n79 | N/A | 10 | N/A | 4600 | 25 | TDD | IMD22 |
|  | n8 | 900 | 5 | 25 | 945 | N/A | FDD | N/A |
|  | n78 | 3700 | 10 | 52 | 3700 | N/A | TDD | N/A |
|  | n79 | N/A | 10 | N/A | 4700 | 2 | TDD | IMD5 |
|  | n8 | 827 | 5 | 25 | 872 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3593 | 25 | TDD | IMD2 |
|  | n79 | 4420 | 40 | 216 | 4420 | N/A | TDD | N/A |
|  | n8 | N/A | 5 | N/A | 930 | 20.3 | FDD | IMD2 |
|  | n78 | 3600 | 10 | 50 | 3600 | N/A | TDD | N/A |
|  | n79 | 4530 | 40 | 216 | 4530 | N/A | TDD | N/A |
|  | n8 | N/A | 5 | N/A | 940 | 3 | FDD | IMD5 |
|  | n78 | 3600 | 10 | 50 | 3600 | N/A | TDD | N/A |
|  | n79 | 4930 | 40 | 216 | 4930 | N/A | TDD | N/A |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.72 CA\_n2-n5-n77

### 5.72.1 Common for 1 band UL and 2 bands UL CA

#### 5.72.1.1 Operating bands for CA

Table 5.72.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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** |
| n2 | 1850 MHz – 1910 MHz | 1930 MHz –1990 MHz | FDD |
| n5 | 824 MHz – 849 MHz | 869 MHz – 894 MHz | FDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.72.1.2-1: Supported bandwidths per CA band combination of band n2+n5+n77

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n2A-n5A-n77C | n777,9  CA\_n2A-n5A  CA\_n2A-n77A7  CA\_n5A-n77A7  CA\_n77C | | n2 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | | n5 | 5, 10, 15, 20, 251 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n2 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | | n5 | 5, 10, 15, 20, 251 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n2A-n5A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n77C | | n2 | n2 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n5 | n5 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2A-n5B-n77C | CA\_n2A-n5A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n5B  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n77C | | n2 | n2 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n5 | CA\_n5B\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n2(2A)-n5A-n77C | CA\_n2A-n5A  CA\_n2A-n77A  CA\_n2A-n77C  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n77C | | n2 | CA\_n2(2A)\_BCS4 and 5 | 4 and 5 |
|  |  | | n5 | n5 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |

### 5.72.2 Specific for 2 bands UL CA

#### 5.72.2.1 UE co-existence studies

##### 5.72.2.1.1 Co-existence studies for 2UL band with 1CC per band

Co-existence study has been performed in Rel-18.

##### 5.72.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.72.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n5 interference analysis for CA\_n2A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.72.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n2, n77)** | 1850 – 1910 | | 3300 – 4200 | |
| **fDL (n5)** | 869 – 894 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 1650 – 1850 | | 1910 – 2110 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.72.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n2 interference analysis for CA\_n5A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.72.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n5, n77)** | 824 – 849 | | 3300 – 4200 | |
| **fDL (n2)** | 1930 – 1990 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 624 – 824 | | 849 – 1049 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.72.2.2 REFSENS requirements

Based on the triple beat analysis of the added ULCA, there are no triple beat IMD issue and no need to define MSD values.

## 5.73 CA\_n5-n48-n77

### 5.73.1 Common for 1 band UL and 2 bands UL CA

#### 5.73.1.1 Operating bands for CA

Table 5.73.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| n48 | 3550 MHz – 3700 MHz | 3550 MHz – 3700 MHz | TDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.73.1.2-1: Supported bandwidths per CA band combination of band n5+n48+n77

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n5A-n48A-n77C | n777,9  CA\_n5A-n48A  CA\_n5A-n77A7  CA\_n77C | | n5 | 5, 10, 15, 20, 251 | 0 |
|  |  | | n48 | 5, 10, 15, 20, 30, 40, 5012, 6012, 7012, 8012, 9012, 10012 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n5 | 5, 10, 15, 20, 251 | 1 |
|  |  | | n48 | 5, 10, 15, 20, 30, 40, 5012, 6012, 7012, 8012, 9012, 10012 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n5A-n48A  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n77C | | n5 | n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n48 | n48 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n5A-n48B-n77A | n777,9  CA\_n5A-n48A  CA\_n5A-n77A7 | | n5 | 5, 10, 15, 20 | 0 |
|  |  | | n48 | CA\_n48B\_BCS0 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n5 | 5, 10, 15, 20 | 1 |
|  |  | | n48 | CA\_n48B\_BCS1 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | | n5 | 5, 10, 15, 20 | 2 |
|  |  | | n48 | CA\_n48B\_BCS2 |  |
|  |  | | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  | CA\_n5A-n48A  CA\_n5A-n48B  CA\_n5A-n77A  CA\_n48B | | n5 | n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n48 | CA\_n48B\_BCS4 and 5 |  |
|  |  | | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n5A-n48B-n77C | n777,9  CA\_n5A-n48A  CA\_n5A-n77A7  CA\_n77C | | n5 | 5, 10, 15, 20 | 0 |
|  |  | | n48 | CA\_n48B\_BCS0 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n5 | 5, 10, 15, 20 | 1 |
|  |  | | n48 | CA\_n48B\_BCS0 |  |
|  |  | | n77 | CA\_n77C BCS1 |  |
|  |  | | n5 | 5, 10, 15, 20 | 2 |
|  |  | | n48 | CA\_n48B\_BCS1 |  |
|  |  | | n77 | CA\_n77C BCS0 |  |
|  |  | | n5 | 5, 10, 15, 20 | 3 |
|  |  | | n48 | CA\_n48B\_BCS1 |  |
|  |  | | n77 | CA\_n77C BCS1 |  |
|  | CA\_n5A-n48A  CA\_n5A-n48B  CA\_n5A-n77A  CA\_n5A-n77C CA\_n48B  CA\_n77C | | n5 | n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n48 | CA\_n48B\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n5A-n48(2A)-n77C | n777,9  CA\_n5A-n48A  CA\_n5A-n77A7  CA\_n77C | | n5 | 5, 10, 15, 20 | 0 |
|  |  | | n48 | CA\_n48(2A)\_BCS0 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n5 | 5, 10, 15, 20 | 1 |
|  |  | | n48 | CA\_n48(2A)\_BCS0 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  |  | | n5 | 5, 10, 15, 20 | 2 |
|  |  | | n48 | CA\_n48(2A)\_BCS1 |  |
|  |  | | n77 | CA\_n77C\_BCS0 |  |
|  |  | | n5 | 5, 10, 15, 20 | 3 |
|  |  | | n48 | CA\_n48(2A)\_BCS1 |  |
|  |  | | n77 | CA\_n77C\_BCS1 |  |
|  | CA\_n5A-n48A  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n77C | | n5 | n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n48 | CA\_n48(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n5B-n48(2A)-n77C | CA\_n5A-n48A  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n5B  CA\_n77C | | n5 | CA\_n5B\_BCS4 and 5 | 4 and 5 |
|  |  | | n48 | CA\_n48(2A)\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n5B-n48A-n77C | CA\_n5A-n48A  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n5B  CA\_n77C | | n5 | CA\_n5B\_BCS4 and 5 | 4 and 5 |
|  |  | | n48 | n48 channel bandwidths in Table 5.3.5-1 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |
| CA\_n5B-n48B-n77A | CA\_n5A-n48A  CA\_n5A-n48B  CA\_n5A-n77A  CA\_n5B  CA\_n48B | | n5 | CA\_n5B\_BCS4 and 5 | 4 and 5 |
|  |  | | n48 | CA\_n48B\_BCS4 and 5 |  |
|  |  | | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n5B-n48B-n77C | CA\_n5A-n48A  CA\_n5A-n48B  CA\_n5A-n77A  CA\_n5A-n77C  CA\_n5B  CA\_n48B  CA\_n77C | | n5 | CA\_n5B\_BCS4 and 5 | 4 and 5 |
|  |  | | n48 | CA\_n48B\_BCS4 and 5 |  |
|  |  | | n77 | CA\_n77C\_BCS4 and 5 |  |

### 5.73.2 Specific for 2 bands UL CA

#### 5.73.2.1 UE co-existence studies

##### 5.73.2.1.1 Co-existence studies for 2UL band with 1CC per band

Co-existence study has been performed in Rel-18.

##### 5.73.2.1.2 Co-existence studies for 2UL band with 3CC (2CC intra-band in one band)

Table 5.73.2.1.2-1 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n48 interference analysis for CA\_n5A-n77C with n77C transmitting with a 200 MHz maximum instantaneous bandwidth.

Table 5.73.2.1.2-1: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_nYB/C** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n5, n77)** | 824 – 849 | | 3300 – 4200 | |
| **fDL (n48)** | 3550 – 3700 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 200 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 624 – 824 | | 849 – 1049 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

Table 5.73.2.1.2-2 provides the two UL band with one band, along with 2CC intra-band uplink CA triple beat products into band n48 interference analysis for CA\_n5A-n48B with n48B transmitting with a 40 MHz maximum instantaneous bandwidth.

Table 5.73.2.1.2-2: Two UL band with intra-band ULCA Triple beat analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Band / CA1** | **Single Carrier** | | **CA\_n48B** | |
| **Frequency limit (all MHz)** | **flow** | **fhigh** | **fy\_low** | **fy\_high** |
| **fUL (n5, n48)** | 824 – 849 | | 3550 – 3700 | |
| **fDL (n77)** | 3300 – 4200 | | N/A | N/A |
| **2CCBW2** | N/A | N/A | Minimum | Maximum |
| 0 – 150 | |
| **IMD3 products** | fxUL\_low-max2CCBW | fxUL\_low | fxUL\_high | fxUL\_high+max2CCBW |
| **IMD3 (MHz)** | 784 – 824 | | 849 – 889 | |
| **Analysis** | No Issue | | | |
| Note 1: If the third band (nZ) are not part of the same or adjacent band groups, as defined in Table A-1, of band one (nX) or band two (nY), the analysis can be ignored.  Note 2: For contiguous intra-band ULCA, the minimum and maximum separation BW are 0MHz and Min(fy\_high-fy\_low, maximum aggregated BW) respectively. | | | | |

#### 5.73.2.2 REFSENS requirements

Based on the triple beat analysis of the added UL CA\_n5A-n77C and CA\_n5A-n48B, there are no triple beat issues and no need to define new MSD values.

## 5.74 CA\_n28-n74-n77

### 5.74.1 Common for 1 band UL and 2 bands UL CA

#### 5.74.1.1 Operating bands for CA

Table 5.74.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |
| n74 | 1427 MHz – 1470 MHz | 1475 MHz – 1518 MHz | FDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.74.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n28A-n74A-n77A | CA\_n28A-n77A  CA\_n74A-n77A | n28 | 5, 10, 15, 20, 30 | 0 |
|  |  | n74 | 5, 10, 15, 20 |  |
|  |  | n77 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |

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

The ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.74.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n28-n74-n77 | 0.6 | 0.4 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.74.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n28-n74-n77 | 0.2 | - | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.74.2 Specific for 2 bands UL CA

#### 5.74.2.1 UE co-existence studies

##### 5.74.2.1.1 Co-existence studies for 2UL band with 1CC per band

Based on co-existence calculation,

- IMD4 due to UL CA\_n28A-n77A falls into n74 DL

- IMD3/4 due to UL CA\_n74A-n77A falls into n28 DL

#### 5.74.2.2 REFSENS requirements

Based on clause 5.74.2.1.1, the MSD values are given as follows, which are reused from DC\_19-21\_n77.

Table 5.74.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n28-n74-n77 | n28 | 730 | 5 | 25 | 785 | N/A | FDD | N/A |
|  | n74 | N/A | 5 | 25 | 1500 | 9.0 | FDD | IMD4 |
|  | n77 | 3690 | 10 | 50 | 3690 | N/A | TDD | N/A |
|  | n28 | N/A | 5 | 25 | 785 | 18.7 | FDD | IMD3 |
|  | n74 | 1452 | 5 | 25 | 1500 | N/A | FDD | N/A |
|  | n77 | 3689 | 10 | 50 | 3689 | N/A | TDD | N/A |
|  | n28 | N/A | 5 | 25 | 785 | 13.2 | FDD | IMD4 |
|  | n74 | 1458 | 5 | 25 | 1506 | N/A | FDD | N/A |
|  | n77 | 3589 | 10 | 50 | 3589 | N/A | TDD | N/A |

## 5.75 CA\_n28-n41-n74

### 5.75.1 Common for 1 band UL and 2 bands UL CA

#### 5.75.1.1 Operating bands for CA

Table 5.75.1.1-1: CA band combination constituent bands definition

|  |  |  |  |
| --- | --- | --- | --- |
| **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 | 703 MHz – 748 MHz | 758 MHz – 803 MHz | FDD |
| n41 | 2496 MHz – 2690MHz | 2496 MHz – 2690MHz | TDD |
| n74 | 1427 MHz – 1470 MHz | 1475 MHz – 1518 MHz | FDD |

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

Table 5.75.1.2-1: Supported bandwidths per CA band combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA operating/channel bandwidth (MHz) | | | | |
| NR CA configuration | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n28A-n41A-n74A | CA\_n28A-n41A  CA\_n41A-n74A | n28 | 5, 10, 15, 20 | 0 |
|  |  | n41 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n74 | 5, 10, 15, 20 |  |

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

The ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.75.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n28-n41-n74 | 0.6 | 0.3 | 0.4 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.75.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n28-n41-n74 | 0.2 | - | - |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.75.2 Specific for 2 bands UL CA

#### 5.75.2.1 UE co-existence studies

##### 5.75.2.1.1 Co-existence studies for 2UL band with 1CC per band

Based on co-existence calculation,

- No IMD due to UL CA\_n28A-n41A falls into 74 DL

- IMD5 due to UL CA\_n41A-n74A falls into n28 DL

#### 5.75.2.2 REFSENS requirements

Based on clause 5.75.2.1.1, the MSD values are given as follows.

Table 5.75.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n28-n41-n74 | n28 | N/A | 5 | N/A | 782 | 3.5 | FDD | IMD5 |
|  | n41 | 2569 | 10 | 50 | 2569 | N/A | TDD | N/A |
|  | n74 | 1452 | 5 | 25 | 1500 | N/A | FDD | N/A |

# 6 Dual Connectivity: Specific Band Combination Part

## 6.0 DC\_nX-nY-nZ

*Editor’s note: The texts for NR DC can only be added associated with the texts for the corresponding inter-band 2 bands UL CA above, which means pure TP to TR to included NR DC configuration is not allowed.*

### 6.0.1 Configurations for DC\_nX-nY-nZ

Table 6.0.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_nXA-nYA-nZ | DC\_nXA-nYA  DC\_nXA-nZA  DC\_nYA-nZA |
| DC\_nXA/B/C/(2A)-nYA/B/C/(2A)- nZA/B/C/(2A) | DC\_nXA/B/C-nYA  DC\_nXA/B/C-nZA  DC\_nYA/B/C-nZA |

Annex <A> (normative):  
Band group definition

For three DL and 2UL/3CC triple beat MSD to be considered, the victim band should be part of the same or adjacent band group than one of the UL band as defined in Table A-1.

Table A-1: Band group definition for same or adjacent band-group criterion

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| FR1 band group range | | | | | |
| Name | **FR1-a** | **FR1-b** | **FR1-c** | **FR1-d** | **FR1-e** |
| Range (MHz) | 600-1000 | 1400-2200 | 2300-2700 | 3300-5000 | 5150-7125 |
| Duplex mode | Mostly FDD | Mostly FDD | FDD and TDD | TDD only | TDD only |

Annex <B> (normative):  
Valid UL configurations

For CA\_nX-nY-nZ three band DL inter band combinations with two UL bands, the following UL configurations are applicable:

- Two band UL with one CC per band: CA\_nXA-nYA.

- Two band UL with two CC in one band: CA\_nXB-nYA, CA\_nXC-nYA, CA\_nXA-nYB, CA\_nXA-nYC.

- The following three UL cluster cases are not supported: CA\_nX(2A)-nYA, CA\_nXA-nY(2A).

- Combinations with four UL CCs are not supported.

Annex <C> (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Change history | | | | | | | |
| Date | Meeting | Tdoc | CR | Rev | Cat | Subject/Comment | New version |
| 2024-08 | RAN4 #112 | R4-2411825 |  |  |  | TR skeleton for TR 38.719-03-01 | 0.0.0 |
| 2024-08 | RAN4 #112 | R4-2411826 |  |  |  | (1) [R4-2414340](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414340.zip), TP for TR38.719-03-01\_CA\_n28A-n41A/C-n79A/C, ZTE Corporation, Sanechips.  (2) [R4-2414355](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414355.zip), TP to TR 38.719-03-01 include CA\_n8A-n20A-n75A, Huawei, HiSilicon, DT.  (3) [R4-2414356](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414356.zip), TP to TR 38.719-03-01 include CA\_n8A-n28A-n75A, Huawei, HiSilicon, DT.  (4) [R4-2414357](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414357.zip), TP to TR 38.719-03-01 include CA\_n20A-n28A-n75A, Huawei, HiSilicon, DT.  (5) [R4-2414358](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414358.zip), TP to TR 38.719-03-01 include CA\_n3A-n7A-n75A, Huawei, HiSilicon, DT.  (6) [R4-2414359](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414359.zip), TP to TR 38.719-03-01 include CA\_n3A-n75A-n78A, Huawei, HiSilicon, DT.  (7) [R4-2414360](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414360.zip), TP to TR 38.719-03-01 include CA\_n7A-n75A-n78A, Huawei, HiSilicon, DT.  (8) [R4-2414361](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414361.zip), TP to TR 38.719-03-01 include CA\_n1A-n7A-n75A, Huawei, HiSilicon, DT.  (9) [R4-2414362](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414362.zip), TP to TR 38.719-03-01 include CA\_n1A-n3A-n7A, Huawei, HiSilicon, DT.  (10) [R4-2414364](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414364.zip), TP for 38.719-03-01 to add UL CA\_n41C-n71A and CA\_n41C-n66A for CA\_n41C-n66-n71A, Ericsson, T-Mobile USA.  (11) [R4-2414365](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414365.zip), TP to TR 38.719-03-01 Addition of CA\_n1A-n41A-n78A, Nokia, Etisalat.  (12) [R4-2414366](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414366.zip), TP to TR 38.719-03-01 Addition of CA\_n1A-n5A-n8A, Nokia.  (13) [R4-2414367](http://10.10.10.10/ftp/RAN/RAN4/Inbox/R4-2414367.zip), TP to TR 38.719-03-01 Addition of CA\_n3A-n5A-n8A, Nokia. | 0.1.0 |
| 2024-10 | RAN4 #112bis | R4-2416096 |  |  |  | (1) R4-2414961, TP for TR 38.719-03-01 CA\_n25-n29-n77, Samsung, TELUS, Bell Mobility  (2) R4-2414972, TP to TR 38.719-03-01 to add CA\_n1A-n75A-n78A, Huawei, Hisilicon, Deutsche Telekom  (3) R4-2415400 TP to TR 38.719-03-01 CA\_n1-n28-n40, Nokia, STC  (4) R4-2415404 TP to TR 38.719-03-01 CA\_n1-n20-n71, Nokia, Mobily  (5) R4-2415406, TP to TR 38.719-03-01 CA\_n1-n20-n78, Nokia, Mobily  (6) R4-2415408, TP to TR 38.719-03-01 CA\_n20-n41-n71, Nokia, Mobily  (7) R4-2415409, TP to TR 38.719-03-01 CA\_n20-n41-n77, Nokia, Mobily  (8) R4-2415410, TP to TR 38.719-03-01 CA\_n20-n41-n78, Nokia, Mobily  (9) R4-2415411, TP to TR 38.719-03-01 CA\_n20-n71-n78, Nokia, Mobily  (10) R4-2415413, TP to TR 38.719-03-01 CA\_n3-n20-n71, Nokia, Mobily  (11) R4-2415414, TP to TR 38.719-03-01 CA\_n3-n20-n77, Nokia, Mobily  (12) R4-2415419, TP to TR 38.719-03-01 CA\_n1-n3-n71, Nokia, Etisalat UAE  (13) R4-2415420, TP to TR 38.719-03-01 CA\_n1-n3-n8, Nokia, Etisalat UAE  (14) R4-2415421, TP to TR 38.719-03-01 CA\_n1-n41-n71, Nokia, Etisalat UAE  (15) R4-2415424, TP to TR 38.719-03-01 CA\_n1-n8-n41, Nokia, Mobily  (16) R4-2415426, TP to TR 38.719-03-01 CA\_n3-n41-n71, Nokia, Etisalat UAE, Mobily  (17) R4-2416219, TP for 38.719-03-01 to add CA\_n1A-n7A-n20A, Ericsson, BT plc  (18) R4-2417132, TP to TR 38.719-03-01 include CA\_n1A-n3A-n75A, Huawei, Hisilicon, Deutsche Telekom  (19) R4-2417133, TP to TR 38.719-03-01 include CA\_n1A-n7A-n78A, Huawei, Hisilicon, Deutsche Telekom  (20) R4-2417134, TP for TR 38.719-03-01 CA\_n7-n25-n29, Samsung, TELUS, Bell Mobility, Qualcomm, Skyworks  (21) R4-2417135, TP for TR 38.719-03-01 CA\_n7-n29-n66, Samsung, TELUS, Bell Mobility  (22) R4-2417136, TP for TR 38.719-03-01 CA\_n7-n29-n77, Samsung, TELUS, Bell Mobility  (23) R4-2417154, TP for TR38.719-03-01\_3DL\_2UL CA\_n3A-n40A-n79A, ZTE Corporation, Sanechips  (24) R4-2417137, Corrections of TR 38.719-03-01, Nokia  (25) R4-2417138, TP to TR 38.719-03-01 CA\_n3-n7-n77, Nokia, BT plc  (26) R4-2417154, TP for TR38.719-03-01\_3DL\_2UL CA\_n3A-n40A-n79A, ZTE Corporation, Sanechips  (27) R4-2417140, TP to TR 38.719-03-01 CA\_n1-n20-n41, Nokia, BT plc  (28) R4-2417141, TP to TR 38.719-03-01 CA\_n1-n20-n77, Nokia, Mobily  (29) R4-2417142, TP to TR 38.719-03-01 CA\_n1-n71-n77, Nokia, Mobily  (30) R4-2417143, TP to TR 38.719-03-01 CA\_n3-n20-n41, Nokia, Mobily  (31) R4-2417144, TP to TR 38.719-03-01 CA\_n3-n71-n77, Nokia, Mobily  (32) R4-2417145 TP to TR 38.719-03-01 CA\_n1-n41-n78 w ULCA, Nokia, Etisalat UAE  (33) R4-2417146, TP to TR 38.719-03-01 CA\_n1-n71-n78 w ULCA, Nokia, Etisalat UAE  (34) R4-2417147, TP to TR 38.719-03-01 CA\_n1-n8-n78 w ULCA, Nokia, Etisalat UAE  (35) R4-2417148, TP to TR 38.719-03-01 CA\_n3-n41-n78 w ULCA, Nokia, Etisalat UAE  (36) R4-2417149, TP to TR 38.719-03-01 CA\_n3-n71-n78 w ULCA, Nokia, Etisalat UAE  (37) R4-2417150, TP to TR 38.719-03-01 CA\_n3-n8-n78 w ULCA, Nokia, Etisalat UAE  (38) R4-2417151, TP to TR 38.719-03-01 CA\_n41-n71-n78 w ULCA, Nokia, Etisalat UAE  (40) R4-2417152, TP to TR 38.719-03-01 CA\_n8-n41-n78 w ULCA, Nokia, Etisalat UAE  (41) R4-2417153, TP to TR 38.719-03-01 Uplink additions of CA\_n1A-n3A-n78C, Nokia, Etisalat UAE | 0.2.0 |
| 2024-11 | RAN4 #113 | R4-2419559 |  |  |  | (1) R4-2419571, TP for TR 38.719-03-01 on corrections for two UL band with intra-band ULCA triple beat analysis table, ZTE Corporation, Sanechips  (2) R4-2420421, TP to TR 38.719-03-01 to add CA\_n1A-n40A-n41A, Huawei, Hisilicon | 0.3.0 |
| 2025-02 | RAN4 #114 | R4-2501626 |  |  |  | (1) R4-2502907, TP for TR38.719-03-01 Support of CA\_n3-n77-n79 and CA\_n28\_n77\_n79, Softbank  (2) R4-2502908, TP to TR 38.719-03-01 include CA\_n40A-78A-n79A, Huawei, Hisilicon  (3) R4-2502909, TP to TR 38.719-03-01 to include CA\_n1-n40-n79, Huawei, Hisilicon  (4) R4-2502910, TP to TR 38.719-03-01 to include CA\_n3-n40-n78, Huawei, Hisilicon  (5) R4-2502912, TP to TR 38.719-03-01 to include CA\_n7-n40-n79, Huawei, Hisilicon  (6) R4-2502913, TP to TR 38.719-03-01 to include CA\_n7-n78-n79, Huawei, Hisilicon | 0.4.0 |
| 2025-04 | RAN4 #114bis | R4-2504486 |  |  |  | (1) R4-2503211, TP for TR38.719-03-01 addition of UL CA\_n77(2A) to CA\_n1-n3-n77, Softbank  (2) R4-2503978, TP for TR38.719-03-01\_3DL\_xUL CA\_n3A-n34A-n41A, ZTE Corporation, Sanechips  (3) R4-2503979, TP for TR38.719-03-01\_3DL\_xUL CA\_n3A-n34A-n79A, ZTE Corporation, Sanechips  (4) R4-2504272, TP for TR 38.719-03-01 to add UL CA\_n2A-n77C and CA\_n66A-n77C for CA\_n2A-n66A-n77C, Ericsson, Verizon  (5) R4-2504273, TP for TR 38.719-03-01 to add UL CA\_n2A-n77C for CA\_n2-n48-n77, Ericsson, Verizon  (6) R4-2504274, TP for TR 38.719-03-01 to add UL CA\_n5A-n77C and CA\_n66A-n77C for CA\_n5-n66-n77, Ericsson, Verizon  (7) R4-2504276, TP for TR 38.719-03-01 to add UL CA\_n66A-n77C for CA\_n48-n66-n77, Ericsson, Verizon  (8) R4-2505176, draft TP to TR 38.719-03-01 to include CA\_n3A-n78A-n79A, Huawei, Hisilicon, SoftBank, LG Electronics  (9) R4-2505178, TP for TR 38.719-03-01 on introduction of CA\_n28A-n40A-n71A, Huawei, HiSilicon  (10) R4-2505179, TP for TR 38.719-03-01 on introduction of CA\_n28A-n71A-n77A CA\_n28A-n71A-n77(2A), Huawei, HiSilicon  (11) R4-2505180, TP for TR 38.719-03-01 on introduction of CA\_n40A-n71A-n77A CA\_n40A-n71A-n77(2A), Huawei, HiSilicon  (12) R4-2505182, draft TP to TR 38.719-03-01 to include CA\_n8A-n78A-n79A, Huawei, HiSilicon  (13) R4-2505184, TP for TR 38.719-03-01 to add UL CA\_n2AC-n77C and CA\_n5A-n77C for CA\_n2-n5-n77, Ericsson, Verizon  (14) R4-2505185, TP for TR 38.719-03-01 to add UL CA\_n5A-n77C for CA\_n5-n48-n77, Ericsson, Verizon | 0.5.0 |
| 2025-05 | RAN4 #115 | R4-2507398 |  |  |  | (1) R4-2507398, TR 38.719-03-01 v0.5.1 on Rel-19 NR Inter-band CA DC configurations including inter band CA for 3 different bands DL with x different bands UL (x=1,2), ZTE | 0.5.1 |
| 2025-05 | RAN4 #115 | R4-2507399 |  |  |  | (1) R4-2506271, TP to TR 38.719-03-01 to include CA\_n28A-n74A-n77A, Samsung, KDDI, Qualcomm  (2) R4-2506272, TP to TR 38.719-03-01 to include CA\_n28A-n41A-n74A, Samsung, KDDI, Qualcomm  (3) R4-2507978, TP for TR 38.719-03-01 to add UL CA\_n2A-n77C and CA\_n2A-n48B for CA\_n2-n48-n77, Ericsson, Verizon  (4) R4-2507979, TP for TR 38.719-03-01 to add UL CA\_n5A-n77C and CA\_n5A-n48B for CA\_n5-n48-n77, Ericsson, Verizon  (5) R4-2507980, TP for TR 38.719-03-01 to add UL CA\_n66A-n77C and CA\_n48B-n66A for CA\_n48-n66-n77, Ericsson, Verizon | 0.6.0 |