3GPP TR 38.717-03-02 V0.7.0 (2021-11)

Technical Report

3rd Generation Partnership Project;

Technical Specification Group Radio Access Network;

Rel-17 NR inter-band Carrier Aggregation/Dual connectivity for 3 bands DL with 2 bands UL

(Release 17)

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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.

# Scope

The present document is a technical report for NR inter-band CA and DC for 3 bands DL with 2 bands UL under Rel-17 time frame. The purpose is to gather the relevant background information and studies in order to address NR inter-band CA and DC for 3 bands DL with 2 bands UL for the Rel-17 band combinations.

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

# 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".

# Definitions, symbols and abbreviations

## Definitions

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

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

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

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

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

## 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

## Abbreviations

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

BS Base Station

CA Carrier Aggregation

DC Dual Connectivity

DL DownLink

FDD Frequency Division Duplex

IMD Inter-modulation

MSD Maximum Sensitivity Deduction

SCS Subcarrier spacing

TDD Time Division Duplex

UE User Equipment

UL UpLink

# Background

The present document is a technical report for NR inter-band CA and DC for 3 bands DL with 2 bands UL under Rel-17 time frame. The document covers each band combination specific issues (i.e. one sub-clause defined per band combination)

## 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.

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

## Inter-band within FR1

### CA\_n39-n40-n79

#### Operating bands for CA

**Table 5.1.1.1-1: CA band combination of band n39+n40+n41**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n39A-n40A-n79A | n39 | 1880 MHz | – | 1920 MHz | 1880 MHz | – | 1920 MHz | TDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

#### Channel bandwidths per operating band for CA

**Table 5.1.1.2-1: Supported channel bandwidths per CA configuration for band n39+n40+n41**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA  configuration** | **NR Band** | **SCS (kHz)** | **5  MHz** | **10  MHz** | **15  MHz** | **20  MHz** | **25  MHz** | **30  MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n39A-n40A-n79A | CA\_n39A-n40A  CA\_n40A-n79A  CA\_n39A-n79A | n39 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |

#### Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Actually, the co-existence studies for dual uplink operation of two bands, i.e. CA\_n39A-n40A, CA\_n39A-n79A and CA\_n40A-n79A have been captured in TR38.716-02-00, where:

* IMD4 products produced by Band 39 and Band n40 that impact the reference sensitivity of NR band n79.
* No IMD products produced by Band 39 and Band n79 that impact the reference sensitivity of NR band n40.
* IMD4 and IMD5 products produced by Band 40 and Band n79 that impact the reference sensitivity of NR band n39.

#### REFSENS requirements

According to clause 5.1.1.3, some IM3 produces of dual uplink operation of two bands will falling into the DL of the third band. However, considering the requirements for TDD-TDD NR CA combinations of CA\_n39-n40 are defined without simultaneous Rx/Tx capability in TS38.101-1, i.e. synchronous operation. Therefore it is no need to defined MSD requirements for band n39 due to IMD4 and IMD5 products produced by Band 40 and Band n79.

For the MSD for NR band n79 caused by IMD4 products of Band 39 and Band n40, since the CA\_n39-n79 and CA\_n40-n79 are operated with mandatory simultaneous Rx/Tx capability in TS38.101-1, i.e. asynchronous operation. Therefore it is need to defined MSD requirements for band n79 due to IMD4 products produced by Band 39 and Band n40.

The required MSD is shown in the table 5.1.1.4-1, where the MSD of EN-DC\_39A\_n40A-n79A are re-used.

**Table 5.1.1.4-1: MSD due to IMD4**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n39A-n40A-n79A | n39 | 1917.5 | 5 | 25 | 1917.5 | N/A | TDD | N/A |
| n40 | 2302.5 | 5 | 25 | 2302.5 | N/A | TDD | N/A |
| n79 | 4980 | 40 | 216 | 4980 | 5.8 | TDD | IMD4 |

### CA\_n39-n40-n41

#### Operating bands for CA

**Table 5.1.2.1-1: CA band combination of band n39+n40+n41**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n39A-n40A-n41A | n39 | 1880 MHz | – | 1920 MHz | 1880 MHz | – | 1920 MHz | TDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.2.2-1: Supported channel bandwidths per CA configuration for band n39+n40+n41

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA  configuration** | **NR Band** | **SCS (kHz)** | **5  MHz** | **10  MHz** | **15  MHz** | **20  MHz** | **25  MHz** | **30  MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n39A-n40A-n41A | CA\_n39A-n40A  CA\_n39A-n41A  CA\_n40A-n41A | n39 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |

#### Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Actually, the co-existence studies for dual uplink operation of two bands, i.e. CA\_n39A-n40A, CA\_n39A-n41A and CA\_n40A-n41A have been captured in TR38.716-02-00, where:

- IMD3 products produced by Band n39 and n40 that impact the reference sensitivity of NR band n41.

- No IMD3 products produced by Band n39 and n41 that falling into the band n41 Rx.

- 2nd and 5rd products produced by Band n40 and n41 may falling into the band n39 Rx.

#### REFSENS requirements

According to clause 5.1.2.3, some IM3 produces of dual uplink operation of two bands will falling into the DL of the third band. However, considering the requirements for TDD-TDD NR CA combinations of CA\_n39-n40, CA\_n39-n41 and CA\_n40-n41 are defined without simultaneous Rx/Tx capability in TS38.101-1, i.e. synchronous operation. Therefore it is no need to defined MSD requirements due to IMD3 issues, i.e. no specific REFSENS requirements for this combination in 3DL/2UL NR CA operation.

### CA\_n5-n25-n66

#### Operating bands for CA

Table 5.1.3.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n25-n66 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD |

#### Channel bandwidths per operating band for CA

**Table 5.1.3.2-1: Supported bandwidths per CA band combination of band n5+n25+n66**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n5A-n25A-n66A | CA\_n5A-n25A  CA\_n5A-n66A  CA\_n25A-n66A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| CA\_n5A-n25(2A)-n66A | CA\_n5A-n25A  CA\_n5A-n66A  CA\_n25A-n66A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| CA\_n5A-n25A-n66(2A) | CA\_n5A-n25A  CA\_n5A-n66A  CA\_n25A-n66A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| CA\_n5A-n25(2A)-n66(2A) | CA\_n5A-n25A  CA\_n5A-n66A  CA\_n25A-n66A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |

#### UE co-existence studies

For UE coexistence study of Band n5 + Band n25, Band n5 + Band n66, and Band n25 + band n66, the 2nd, 3rd, 4th and 5th order harmonics are already analyzed in 3DL/1UL WI, where no harmonic issue is identified. The 2nd, 3rd, 4th and 5th order intermodulation products are calculated and presented in Table 5.1.3.3-1, 5.1.3.3-2 and 5.1.3.3-3, respectively.

Table 5.1.3.3-1: Harmonic and IMD analysis for n5+n25

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 824 | 849 | 1850 | 1915 |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1648 | 1698 | 3700 | 3830 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2472 | 2547 | 5550 | 5745 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1001 | 1091 | 2674 | 2764 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -267 | -152 | 2851 | 3006 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3498 | 3613 | 4524 | 4679 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 557 | 697 | 4701 | 4921 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4322 | 4462 | 6374 | 6594 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -2182 | -2002 | 5348 | 5528 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -6836 | -6551 | -1546 | -1381 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 8224 | 8509 | 5146 | 5311 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -4097 | -3852 | 1153 | 1358 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 7198 | 7443 | 6172 | 6377 |

Table 5.1.3.3-2: Harmonic and IMD analysis for n5+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 824 | 849 | 1710 | 1780 |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1648 | 1698 | 3420 | 3560 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2472 | 2547 | 5130 | 5340 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 861 | 956 | 2534 | 2629 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -132 | -12 | 2571 | 2736 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3358 | 3478 | 4244 | 4409 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 692 | 837 | 4281 | 4516 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4182 | 4327 | 5954 | 6189 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -1912 | -1722 | 5068 | 5258 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -6296 | -5991 | -1686 | -1516 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 7664 | 7969 | 5006 | 5176 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -3692 | -3432 | 873 | 1088 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6778 | 7038 | 5892 | 6107 |

Table 5.1.3.3-2: Harmonic and IMD analysis for n25+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1780 | 1850 | 1915 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 70 | 205 | 3560 | 3695 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1505 | 1710 | 1920 | 2120 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5270 | 5475 | 5410 | 5610 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 3215 | 3490 | 3770 | 4035 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6980 | 7255 | 7260 | 7525 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -410 | -140 | 7120 | 7390 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -5950 | -5620 | -5270 | -4925 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 9110 | 9440 | 8690 | 9035 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -2325 | -1990 | -1640 | -1300 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8970 | 9305 | 8830 | 9170 |

Co-existence studies shows that

* The 4th IMD generated by dual uplink of Band n5 + Band n25 may fall into own Rx of band n66.
* The 2nd IMD generated by dual uplink of Band n5 + Band n66 may fall into own Rx of band n5.
* The 5th IMD generated by dual uplink of Band n5 + Band n66 may fall into own Rx of band n5.
* The 3rd IMD generated by dual uplink of Band n25 + Band n66 may fall into own Rx of band n25.
* The 3rd IMD generated by dual uplink of Band n25 + Band n66 may fall into own Rx of band n66.
* The 5th IMD generated by dual uplink of Band n25 + Band n66 may fall into own Rx of band n66.

#### REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 4th IMD generated by dual uplink of Band n5 + Band n25 may fall into own Rx of band n66. As this IMD4 issue is similar to CA\_2A-5A-66A, the same MSD value is reused in Table 5.1.3.4-1.

Table 5.1.3.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n25A-n66A | n5 | 834 | 5 | 25 | 879 | N/A | FDD | N/A |
| n25 | 1900 | 5 | 25 | 1980 | N/A | N/A |
| n66 | 1712 | 5 | 25 | 2132 | 7.2 | IMD4 |

### CA\_n5-n25-n78

#### Operating bands for CA

Table 5.1.4.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n25-n78 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.4.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **70**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n5A-n25A-n78A | CA\_n5A-n25A  CA\_n5A-n78A  CA\_n25A-n78A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n78 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n5A-n25(2A)-n78A | CA\_n5A-n25A  CA\_n5A-n78A  CA\_n25A-n78A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | |
| n78 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n5A-n25A-n78(2A) | CA\_n5A-n25A  CA\_n5A-n78A  CA\_n25A-n78A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | | |

#### Co-existence studies

For UE coexistence study of Band n5 + Band n25, Band n5 + Band n78, and Band n25 + band n78, the 2nd, 3rd, 4th and 5th order harmonics are already analyzed in 3DL/1UL WI, where no harmonic issue is identified. The 2nd, 3rd, 4th and 5th order intermodulation products are calculated and presented in Table 5.1.4.3-1, 5.1.4.3-2 and 5.1.4.3-3, respectively.

Table 5.1.4.3-1: Harmonic and IMD analysis for n5+n25

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 824 | 849 | 1850 | 1915 |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1648 | 1698 | 3700 | 3830 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2472 | 2547 | 5550 | 5745 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1001 | 1091 | 2674 | 2764 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -267 | -152 | 2851 | 3006 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3498 | 3613 | 4524 | 4679 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 557 | 697 | 4701 | 4921 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4322 | 4462 | 6374 | 6594 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -2182 | -2002 | 5348 | 5528 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -6836 | -6551 | -1546 | -1381 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 8224 | 8509 | 5146 | 5311 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -4097 | -3852 | 1153 | 1358 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 7198 | 7443 | 6172 | 6377 |

Table 5.1.4.3-2: Harmonic and IMD analysis for n5+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 824 | 849 | 3300 | 3800 |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 1648 | 1698 | 6600 | 7600 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 2472 | 2547 | 9900 | 11400 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 2451 | 2976 | 4124 | 4649 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -2152 | -1602 | 5751 | 6776 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4948 | 5498 | 7424 | 8449 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -1328 | -753 | 9051 | 10576 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5772 | 6347 | 10724 | 12249 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -5952 | -4902 | 8248 | 9298 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -14376 | -12351 | -96 | 504 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 14024 | 16049 | 6596 | 7196 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -9752 | -8202 | 4053 | 5128 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 11548 | 13098 | 9072 | 10147 |

Table 5.1.4.3-2: Harmonic and IMD analysis for n25+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1915 | 3300 | 3800 |
| 2nd harmonic | 2\* f1\_low | 2\*f1\_high | 2\*f2\_low | 2\*f2\_high |
| harmonic frequency limit (MHz) | 3700 | 3830 | 6600 | 7600 |
| 3rd harmonic | 3\* f1\_low | 3\*f1\_high | 3\*f2\_low | 3\*f2\_high |
| harmonic frequency limit (MHz) | 5550 | 5745 | 9900 | 11400 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1385 | 1950 | 5150 | 5715 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -100 | 530 | 4685 | 5750 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7000 | 7630 | 8450 | 9515 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1750 | 2445 | 7985 | 9550 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8850 | 9545 | 11750 | 13315 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -3900 | -2770 | 10300 | 11430 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -13350 | -11285 | -4360 | -3600 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 15050 | 17115 | 10700 | 11460 |

Co-existence studies shows that

* The 3rd IMD generated by dual uplink of Band n5 + Band n25 may fall into own Rx of band n78.
* The 4th IMD generated by dual uplink of Band n5 + Band n78 may fall into own Rx of band n5.
* The 2nd IMD generated by dual uplink of Band n25 + Band n78 may fall into own Rx of band n25.
* The 4th IMD generated by dual uplink of Band n25 + Band n78 may fall into own Rx of band n78.
* The 5th IMD generated by dual uplink of Band n25 + Band n78 may fall into own Rx of band n78.

#### REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 3rd IMD generated by dual uplink of Band n5 + Band n25 may fall into own Rx of band n78. As this IMD issue is similar to CA\_n3A-n8A-n78A where low and high FDD band IMD3 falls into n78, the same MSD value as 16.1 dB is reused.

Table 5.1.4.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n25A-n78A | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n25 | 1900 | 5 | 25 | 1980 | N/A | N/A |
| n78 | 3560 | 10 | 50 | 3560 | 16.1 | TDD | IMD3 |

### CA\_n1-n77-n79

#### Operating bands for CA

Table 5.1.5.1-1: CA band combination of band n1+n77+n79

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.5.2-1: Supported bandwidths per CA band combination of band n1+n77+n79

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n1A-n77A-n79A | CA\_n1A-n77A  CA\_n1A-n79A  CA\_n77A-n79A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |

#### UE co-existence studies

Based on co-existence studies of 2UL/2DL CA\_n1-n77, CA\_n1-n79, and CA\_n77-n79, own Rx impact of the 3rd band is the followings

- 3rd, 4th and 5th order IMD generated by dual uplink of CA\_n1-n77 may fall into part of own band n79.

- 5th order IMD generated by dual uplink of CA\_n1-n79 may fall into part of own band n77.

- 3rd, 4th and 5th order IMD generated by dual uplink of CA\_n77-n79 may fall into part of own band n1.

#### REFSENS requirements

- 3rd, 4th and 5th order IMD generated by dual uplink of CA\_n1-n77 may fall into part of own band n79.

=> There is no need to have MSD added because n77 and n79 are in sync.

- 5th order IMD generated by dual uplink of CA\_n1-n79 may fall into part of own band n77.

=> There is no need to have MSD added because n77 and n79 are in sync.

- 3rd, 4th and 5th order IMD generated by dual uplink of CA\_n77-n79 may fall into part of own band n1.

=> The MSD values are shown in the following table. This MSD value is the average of the analysis results of the two companies. Also, we define only the highest MSD, and omit the MSDs due to IM4 and IM5. This is described in NOTE2 and NOTE1.

Table 5.1.5.4-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n1A-n77A-n79A | n1 | 1950 | 5 | 25 | 2140 | [15.6] | IMD31,2 |
| n77 | 3400 | 10 | 50 | 3400 | N/A | N/A |
| n79 | 4660 | 40 | 216 | 4660 | N/A | 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. | | | | | | | |

### CA\_n1-n78-n79

#### Operating bands for CA

Table 5.1.6.1-1: CA band combination of band n1+n78+n79

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.6.2-1: Supported bandwidths per CA band combination of band n1+n78+n79

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n1A-n78A-n79A | CA\_n1A-n78A  CA\_n1A-n79A  CA\_n78A-n79A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |

#### UE co-existence studies

Based on co-existence studies of 2UL/2DL CA\_n1-n78, CA\_n1-n79, and CA\_n78-n79, own Rx impact of the 3rd band is the followings

- 3rd and 5th order IMD generated by dual uplink of CA\_n1-n78 may fall into part of own band n79.

- 5th order IMD generated by dual uplink of CA\_n1-n79 may fall into part of own band n78.

- 3rd, 4th and 5th order IMD generated by dual uplink of CA\_n78-n79 may fall into part of own band n1.

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- 3rd and 5th order IMD generated by dual uplink of CA\_n1-n78 may fall into part of own band n79.

=>Same MSD apply with DC\_1\_n78-n79 specified in TS 38.101-3. Note that MSD for 5th order IMD are not specified in TS 38.101-3.

This requirement only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability.

- 5th order IMD generated by dual uplink of CA\_n1-n79 may fall into part of own band n78.

=>Same MSD apply with DC\_1\_n78-n79 specified in TS 38.101-3.

This requirement only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability.

- 3rd, 4th and 5th order IMD generated by dual uplink of CA\_n78-n79 may fall into part of own band n1.

=>The MSD values are shown in the following table. This MSD value is the average of the analysis results of the two companies. Also, we define only the highest MSD, and omit the MSDs due to IM4 and IM5. This is described in NOTE2 and NOTE1.

Table 5.1.6.4-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n1A-n78A-n79A | n1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
| n78 | 3410 | 10 | 50 | 3410 | N/A | N/A |
| n79 | 4870 | 40 | 216 | 4870 | 15.9 | IMD31,X1 |
| n1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
| n78 | 3490 | 10 | 50 | 3490 | 4.6 | IMD5X1 |
| n79 | 4670 | 40 | 216 | 4670 | N/A | N/A |
| n1 | 1950 | 5 | 25 | 2140 | 15.6 | IMD31,2 |
| n78 | 3400 | 10 | 50 | 3400 | N/A | N/A |
| n79 | 4660 | 40 | 216 | 4660 | N/A | 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  NOTE X1: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation. | | | | | | | |

### CA\_n2-n66-n77

#### Operating bands for CA

Table 5.1.7.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n66-n77 | 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 |

#### Channel bandwidths per operating band for CA

Table 5.1.7.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **70**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n2A-n66A-n77A | CA\_n2A-n66A  CA\_n66A-n77A  CA\_n2A-n77A | n2 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |

#### Co-existence studies

For UE coexistence study of Band n2 + Band n66, Band n5 + Band n77, and Band n66 + band n77, the 2nd, 3rd, 4th and 5th order harmonics are already analyzed in 3DL/1UL WI. The 2nd, 3rd, 4th and 5th order intermodulation products are calculated and presented in Table 5.1.7.3-1, 5.1.4.3-2 and 5.1.7.3-3, respectively.

Table 5.1.7.3-1: Harmonic and IMD analysis for n2+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1910 | 1710 | 1780 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | -200 | -70 | 3560 | 3690 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1920 | 2110 | 1510 | 1710 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5410 | 5600 | 5270 | 5470 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 3770 | 4020 | 3220 | 3490 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7260 | 7510 | 6980 | 7250 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 140 | 400 | 7120 | 7380 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -5270 | -4930 | -5930 | -5620 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 8690 | 9030 | 9110 | 9420 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -1640 | -1310 | -2310 | -1990 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8830 | 9160 | 8970 | 9290 |

Table 5.1.7.3-2: Harmonic and IMD analysis for n2+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1910 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1390 | 2350 | 5150 | 6110 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -500 | 520 | 4690 | 6550 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7000 | 8020 | 8450 | 10310 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1350 | 2430 | 7990 | 10750 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8850 | 9930 | 11750 | 14510 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -4700 | -2780 | 10300 | 12220 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -14950 | -11290 | -4340 | -3200 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 15050 | 18710 | 10700 | 11840 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -8900 | -6080 | 870 | 2850 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13600 | 16420 | 12150 | 14130 |

Table 5.1.7.3-2: Harmonic and IMD analysis for n66+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1780 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1520 | 2490 | 5010 | 5980 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -780 | 260 | 4820 | 6690 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6720 | 7760 | 8310 | 10180 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 930 | 2040 | 8120 | 10890 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8430 | 9540 | 11610 | 14380 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -4980 | -3040 | 10020 | 11960 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -15090 | -11420 | -3820 | -2640 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 14910 | 18580 | 10140 | 11320 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -9180 | -6340 | 1260 | 3270 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13320 | 16160 | 11730 | 13740 |

Co-existence studies shows that

* The 2nd and 4th order IMD generated by dual uplink of Band n2 + Band n66 may fall into own Rx of band n77.
* The 5th order IMD generated by dual uplink of Band n2 + Band n66 may fall into own Rx of band n66.
* The 2nd, 4th and 5th order IMD generated by dual uplink of Band n2 + Band n77 may fall into own Rx of band n2 and n66.
* The 4th and 5th order IMD generated by dual uplink of Band n2 + Band n77 band may fall into own Rx band of n77.
* The 2nd, 4th and 5th order IMD generated by dual uplink of Band n66 + Band n77 may fall into own Rx of band n2.
* The 2nd and 5th order IMD generated by dual uplink of Band n66 + Band n77 may fall into own Rx of band n66.
* The 4th and 5th order IMD generated by dual uplink of Band n66 + Band n77 may fall into own Rx of band n77.

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The IMD issue specific to 3DL/2UL for dual uplink of Band n2 + Band n66 is that the 2nd and 4th order IMD may fall into own Rx of band n77. As this IMD issue is the same as DC\_2A\_n66A-n78A, these MSD values are reused.

The IMD issue specific to 3DL/2UL for dual uplink of Band n2 + Band n77 is that the 2nd, 4th and 5th order IMD may fall into own Rx of band n66. IMD4 issues is the same as DC\_2A\_n66A-n78A, thus the MSD values are reused. For IMD2 and IMD5, DC\_1A-3A\_n78A MSD values are reused.

The IMD issue specific to 3DL/2UL for dual uplink of Band n66 + Band n77 is that the 2nd, 4th and 5th order IMD may fall into own Rx of band n2. As this IMD issue is the same as DC\_2A\_n66A-n78A, these MSD values are reused.

Table 5.1.7.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n2A-n66A-n77A | n2 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3620 | 10 | 50 | 3620 | 29.4 | TDD | IMD2 |
| CA\_n2A-n66A-n77A | n2 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3340 | 10 | 50 | 3340 | 8.9 | TDD | IMD4 |
| CA\_n2A-n66A-n77A | n2 | 1860 | 5 | 25 | 1940 | N/A | FDD | N/A |
| n66 | 1750 | 5 | 25 | 2150 | 31.2 | FDD | IMD2 |
| n77 | 4010 | 10 | 50 | 4010 | N/A | TDD | N/A |
| CA\_n2A-n66A-n77A | n2 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 10.3 | FDD | IMD4 |
| n77 | 3480 | 10 | 50 | 3480 | N/A | TDD | N/A |
| CA\_n2A-n66A-n77A | n2 | 1860 | 5 | 25 | 1940 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | 2.8 | FDD | IMD5 |
| n77 | 3860 | 10 | 50 | 3860 | N/A | TDD | N/A |
| CA\_n2A-n66A-n77A | n2 | 1880 | 5 | 25 | 1960 | 32.1 | FDD | IMD2 |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3700 | 10 | 50 | 3700 | N/A | TDD | N/A |
| CA\_n2A-n66A-n77A | n2 | 1880 | 5 | 25 | 1960 | 9.1 | FDD | IMD4 |
| n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |
| n77 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |
| CA\_n2A-n66A-n77A | n2 | 1880 | 5 | 25 | 1960 | 2.1 | FDD | IMD5 |
| n66 | 1760 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n77 | 3620 | 10 | 50 | 3620 | N/A | TDD | N/A |

### CA\_n3-n28-n41

#### 5.1.8.1 Operating bands for CA

Table 5.1.8.1-1: CA band combination of band n3+n28+n41

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.8.2-1: Supported bandwidths per CA band combination of band n3+n28+n41

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **70**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n3A-n28A-n41A | CA\_n3A-n28A | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |

#### UE co-existence studies

Co-existence studies of CA\_n3-n28-n41 with 2UL have been covered in the constituent fall-back modes, it can get that

- IMD2 and IMD3 of band n3 UL and band n28 UL falling to band n41 DL

#### REFSENS requirements

Table 5.1.8.4-1 shows the required MSD levels for the CA configuration, its value can reuse the value of DC\_3A-41A\_n28A.

**Table 5.1.8.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n3A-n28A-n41A | n3 | 1715 | 5 | 25 | 1810 | N/A | FDD | N/A |
| n28 | 743 | 5 | 25 | 798 | N/A | FDD | N/A |
| n41 | 2518 | 5 | 25 | 2518 | 27.4 | TDD | IMD2 |
| n3 | 1715 | 5 | 25 | 1810 | N/A | FDD | N/A |
| n28 | 743 | 5 | 25 | 798 | N/A | FDD | N/A |
| n41 | 2687 | 5 | 25 | 2687 | 15.9 | TDD | IMD3 |

### CA\_n3-n28-n78

#### Operating bands for CA

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n28-n78 | n3 | 1710MHz | – | 1780MHz | 1805MHz | – | 1880MHz | FDD |
| n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

#### Channel bandwidths per operating band for CA

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n3A-n28A-n78A | CA\_n3A-n28A | n3 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| n28 | 15 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n3A-n28A-n78(2A) | CA\_n3A-n28A | n3 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| n28 | 15 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 [3] and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

#### Co-existence studies

Co-existence studies of CA\_n3-n28-n78 with 2UL are already covered in the constituent fall-back modes, it can get that:

- IMD5 of band n3 UL and band n28 UL falling to band n78 DL

#### REFSENS requirements

Table 5.1.9.4-1 shows the required MSD levels for the CA configuration, its value can reuse the value for DC\_3A\_n28A-n78A.

**Table 5.1.9.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n3A-n28A-n78A  CA\_n3A-n28A-n78(2A) | n3 | 1750 | 5 | 25 | 1845 | N/A | FDD | N/A |
| n28 | 743 | 5 | 25 | 798 | N/A | N/A |
| n78 | 3764 | 10 | 50 | 3764 | 4.5 | TDD | IMD5 |

### CA\_n5-n66-n77

#### Operating bands for CA

Table 5.1.10.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n66-n77 | 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 |

#### Channel bandwidths per operating band for CA

Table 5.1.10.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **70**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Bandwidth combination set** |
| CA\_n5A-n66A-n77A | CA\_n5A-n66A CA\_n66A-n77A CA\_n5A-n77A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n5A-n66A-n77(2A) | CA\_n5A-n66A CA\_n66A-n77A CA\_n5A-n77A | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | |

#### Co-existence studies

For UE coexistence study of Band n5 + Band n66, Band n5 + Band n77, and Band n66 + band n77, the 2nd, 3rd, 4th and 5th order harmonics are already analyzed in 3DL/1UL WI, where 2nd and 3rd harmonic issues are identified. The 2nd, 3rd, 4th and 5th order intermodulation products are calculated and presented in Table 5.1.10.3-1, 5.1.10.3-2 and 5.1.10.3-3, respectively.

Table 5.1.10.3-1: Harmonic and IMD analysis for n5+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 824 | 849 | 1710 | 1780 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 861 | 956 | 2534 | 2629 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -132 | -12 | 2571 | 2736 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3358 | 3478 | 4244 | 4409 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 692 | 837 | 4281 | 4516 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4182 | 4327 | 5954 | 6189 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -1912 | -1722 | 5068 | 5258 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -6296 | -5991 | -1686 | -1516 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 7664 | 7969 | 5006 | 5176 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -3692 | -3432 | 873 | 1088 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6778 | 7038 | 5892 | 6107 |

Table 5.1.10.3-2: Harmonic and IMD analysis for n5+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 824 | 849 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 2451 | 3376 | 4124 | 5049 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -2552 | -1602 | 5751 | 7576 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4948 | 5898 | 7424 | 9249 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -1728 | -753 | 9051 | 11776 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5772 | 6747 | 10724 | 13449 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -6752 | -4902 | 8248 | 10098 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -15976 | -12351 | -96 | 904 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 14024 | 17649 | 6596 | 7596 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -10952 | -8202 | 4053 | 5928 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 11548 | 14298 | 9072 | 10947 |

Table 5.1.10.3-3: Harmonic and IMD analysis for n66+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1780 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1520 | 2490 | 5010 | 5980 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | -780 | 260 | 4820 | 6690 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6720 | 7760 | 8310 | 10180 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 930 | 2040 | 8120 | 10890 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8430 | 9540 | 11610 | 14380 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | -4980 | -3040 | 10020 | 11960 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | -15090 | -11420 | -3820 | -2640 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 14910 | 18580 | 10140 | 11320 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -9180 | -6340 | 1260 | 3270 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13320 | 16160 | 11730 | 13740 |

Co-existence studies shows that

* The 2nd and 5th order IMD generated by dual uplink of Band n5 + Band n66 may fall into own Rx of band n5.
* The 3rd, 4th, and 5th order IMD generated by dual uplink of Band n5 + Band n66 may fall into own Rx of band n77.
* The 4th and 5th order IMD generated by dual uplink of Band n5 + Band n77 may fall into own Rx of band n5.
* The 2nd order IMD generated by dual uplink of Band n5 + Band n77 may fall into own Rx of band n77.
* The 3rd order IMD generated by dual uplink of Band n5 + Band n77 may fall into own Rx of band n66.
* The 2nd and 5th order IMD generated by dual uplink of Band n66 + Band n77 may fall into own Rx of band n66.
* The 4th and 5th order IMD generated by dual uplink of Band n66 + Band n77 may fall into own Rx of band n77.

#### REFSENS requirements

The IMD issues specific to 3DL/2UL for dual uplink of Band n5 + Band n66 are that the 3rd, 4th and 5th order IMD may fall into own Rx of band n77. As this IMD issue is similar to CA\_n5A-n25A-n78A for IMD3, DC\_1A-8A\_n79A for IMD4 and DC\_1A\_n8A-n78A for IMD5, where low and high FDD band IMD3 falls into C-band, those MSD values are is reused.

The IMD issues specific to 3DL/2UL for dual uplink of Band n5 + Band n77 are that the 3rd IMD may fall into own Rx of band n66. As this IMD issue is similar to DC\_1A-8A\_n77A, where a low FDD and band n77 IMD3 falls into n77, the MSD values are is reused.

Table 5.1.10.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n66A-n77A | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n66 | 1750 | 5 | 25 | 2150 | N/A | FDD | N/A |
| n77 | 3410 | 10 | 50 | 3410 | 16.1 | TDD | IMD3 |
| CA\_n5A-n66A-n77A | n5 | 826.5 | 5 | 25 | 871.5 | N/A | FDD | N/A |
| n66 | 1712.5 | 5 | 25 | 2112.5 | N/A | FDD | N/A |
| n77 | 4192 | 10 | 50 | 4192 | 8.2 | TDD | IMD4 |
| CA\_n5A-n66A-n77A | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n66 | 1750 | 5 | 25 | 2150 | N/A | FDD | N/A |
| n77 | 3590 | 10 | 50 | 3590 | 3.3 | TDD | IMD5 |
| CA\_n5A-n66A-n77A | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n66 | 1730 | 5 | 25 | 2130 | 14.4 | FDD | IMD3 |
| n77 | 3790 | 10 | 50 | 3790 | N/A | TDD | N/A |

### CA\_n8-n40-n41

#### Operating bands for CA

**Table 5.1.11.1-1: CA band combination of band n8+n40+n41**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n8A-n40A-n41A | n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.11.2-1: Supported channel bandwidths per CA configuration for band n8+n40+n41

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA  configuration** | **NR Band** | **SCS (kHz)** | **5  MHz** | **10  MHz** | **15  MHz** | **20  MHz** | **25  MHz** | **30  MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n8A-n40A-n41A | CA\_n8A-n40A  CA\_n8A-n41A  CA\_n40A-n41A | n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |

#### Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Actually, the co-existence studies for dual uplink operation of two bands, i.e. CA\_n8A-n40A, CA\_n8A-n41A and CA\_n40A-n41A have been captured in TR38.716-02-00, where:

- No IMD products produced by Band n40 and n41 that falling into the band n8 Rx.

- No IMD products produced by Band n8 and n40 that falling into the band n41 Rx.

- IMD5 products produced by Band 8 and n41 that impact the reference sensitivity of NR band n40.

#### REFSENS requirements

According to clause 5.1.11.3, IMD5 products produced by Band 8 and n41 that impact the reference sensitivity of NR band n40. However, considering the requirements for TDD-TDD NR CA combinations of CA\_n40-n41 are defined without simultaneous Rx/Tx capability in TS38.101-1, i.e. synchronous operation. Therefore it is no need to defined MSD requirements due to IMD5 issues, i.e. no specific REFSENS requirements for this combination in 3DL/2UL NR CA operation.

### CA\_n25-n41-n77

#### Operating bands for CA

Table 5.1.12.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n41-n77 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.12.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n25A-n41A-n77A | CA\_n25A-n41A  CA\_n25A-n77A  CA\_n41A-n77A | n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n25A-n41(2A)-n77A | CA\_n25A-n41A  CA\_n25A-n77A  CA\_n41A-n77A | n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n41 | See CA\_n41(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n25A-n41C-n77A | CA\_n25A-n41A  CA\_n25A-n77A  CA\_n41A-n77A | n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n41 | See CA\_n41C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
|  | | | | | | | | | | | | | | | | | |

#### UE co-existence studies

IMD3 and IMD5 generated by UL n25-n41 might affect DL n77.

IMD5 generated by UL n25-n77 might affect DL n41.

IMD3 and IMD4 generated by UL n41-n77 might affect DL n25.

#### REFSENS requirements

CA\_n25-n41-n77 need to have the same MSD requirements defined.

MSD values n77 are derived from DC\_2A\_n38A-n78A for IMD3 and DC\_2A\_n7A-n78A for IMD5.

MSD values n41 are derived from DC\_3A-41A\_n77A.

MSD values n25 are derived from DC\_3A-7A\_n77A for IMD3 and DC\_2A-7A\_n78A for IMD4.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.12.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n25A-n41A-n77A  CA\_n25A-n41(2A)-n77A CA\_n25A-n41C-n77A | n25 | 1870 | 5 | 25 | 1950 | N/A | FDD | N/A |
| n41 | 2610 | 5 | 25 | 2610 | N/A | TDD | N/A |
| n77 | 3350 | 10 | 50 | 3350 | 14.8 | TDD | IMD3 |
| n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n41 | 2525 | 5 | 25 | 2645 | N/A | TDD | N/A |
| n77 | 3775 | 10 | 50 | 3775 | 4.2 | TDD | IMD5 |
| n25 | 1870 | 5 | 25 | 1950 | N/A | FDD | N/A |
| n41 | 2640 | 5 | 25 | 2640 | 5.3 | TDD | IMD5 |
| n77 | 4125 | 10 | 50 | 4125 | N/A | TDD | N/A |
| n25 | 1870 | 5 | 25 | 1950 | 17.6 | FDD | IMD3 |
| n41 | 2565 | 5 | 25 | 2565 | N/A | TDD | N/A |
| n77 | 3180 | 10 | 50 | 3310 | N/A | TDD | N/A |
| n25 | 1870 | 5 | 25 | 1950 | 8.6 | FDD | IMD4 |
| n41 | 2550 | 5 | 25 | 2685 | N/A | TDD | N/A |
| n77 | 3525 | 10 | 50 | 3475 | N/A | TDD | N/A |

### CA\_n25-n66-n77

#### Operating bands for CA

Table 5.1.13.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n66-n77 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.13.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n25A-n66A-n77A | CA\_n25A-n66A  CA\_n25A-n77A  CA\_n66A-n77A | n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

#### UE co-existence studies

IMD2 and IMD4 generated by UL n25-n66 might affect DL n77.

IMD2, IMD4 and IMD5 generated by UL n25-n77 might affect DL n66.

IMD2, IMD4 and IMD5 generated by UL n66-n77 might affect DL n25.

#### REFSENS requirements

CA\_n25-n66-n77 need to have the same MSD requirements defined.

MSD values n66 are derived from DC\_2A\_n66A-n77A.

MSD values n25 are derived from DC\_2A-66A\_n78A.

MSD values n77 are derived from DC\_2A\_n66A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.13.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n25A-n66A-n77A | n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 29.2 | FDD | IMD2 |
| n77 | 4060 | 10 | 50 | 4060 | N/A | TDD | N/A |
| n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 10.4 | FDD | IMD4 |
| n77 | 3540 | 10 | 50 | 3540 | 10 | TDD | N/A |
| n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 4.0 | FDD | IMD5 |
| n77 | 3930 | 10 | 50 | 3930 | N/A | TDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | 32.1 | FDD | IMD2 |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3700 | 10 | 50 | 3700 | N/A | TDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | 9.1 | FDD | IMD4 |
| n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |
| n77 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | 2.1 | FDD | IMD5 |
| n66 | 1760 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n77 | 3620 | 10 | 50 | 3620 | N/A | TDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3620 | 10 | 50 | 3620 | 29.4 | TDD | IMD2 |
| n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3340 | 10 | 50 | 3340 | 8.9 | TDD | IMD4 |

### CA\_n25-n71-n77

#### Operating bands for CA

Table 5.1.14.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n71-n77 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.14.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n25A-n71A-n77A | CA\_n25A-n71A  CA\_n25A-n77A  CA\_n71A-n77A | n25 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

#### UE co-existence studies

IMD3, IMD4 and IMD5 generated by UL n25-n71 might affect DL n77.

UL n25-n77 IMD will not affect DL n71.

IMD3 and IMD4 generated by UL n71-n77 might affect DL n25.

#### REFSENS requirements

CA\_n25-n71-n77 need to have the same MSD requirements defined.

MSD values n25 are derived from DC\_2A-71A\_n78A.

MSD values n77 are derived from DC\_2A\_n71A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.14.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n25A-n71A-n77A | n25 | 1907.5 | 5 | 25 | 1987.5 | N/A | FDD | N/A |
| n71 | 695.5 | 5 | 25 | 649.5 | N/A | FDD | N/A |
| n77 | 3305 | 10 | 50 | 3305 | 8.0 | TDD | IMD31,2 |
| n25 | 1874 | 5 | 25 | 1954 | 16.5 | FDD | IMD32 |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 3340 | 10 | 50 | 3340 | 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. | | | | | | | | |

### CA\_n41-n66-n77

#### Operating bands for CA

Table 5.1.x.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41-n66-n77 | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.15.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n41A-n66A-n77A | CA\_n41A-n66A  CA\_n41A-n77A  CA\_n66A-n77A | n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n41(2A)-n66A-n77A | CA\_n41A-n66A  CA\_n41A-n77A  CA\_n66A-n77A | n41 | See CA\_n41(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | 0 |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n41C-n66A-n77A | CA\_n41A-n66A  CA\_n41A-n77A  CA\_n66A-n77A | n41 | See CA\_n41C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | 0 |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

#### UE co-existence studies

IMD3, IMD4 and IMD5 generated by UL n41-n66 might affect DL n77.

IMD4 generated by UL n41-n77 IMD might affect DL n66.

IMD5 generated by UL n66-n77 might affect DL n41.

#### REFSENS requirements

CA\_n41-n66-n77 need to have the same MSD requirements defined.

MSD values n77 are derived from DC\_66A\_n7A-n78A.

MSD values n41 are derived from DC\_3A-7A\_n77A.

MSD values n66 are derived from DC\_7A\_n1A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.15.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n41A-n66A-n77A  CA\_n41(2A)-n66A-n77A CA\_n41C-n66A-n77A | n41 | 2560 | 5 | 25 | 2560 | N/A | TDD | N/A |
| n66 | 1730 | 5 | 25 | 2130 | N/A | FDD | N/A |
| n77 | 3390 | 10 | 50 | 3390 | 16.1 | TDD | IMD31,2 |
| n41 | 2670 | 5 | 25 | 2670 | 5.2 | TDD | IMD5 |
| n66 | 1715 | 5 | 25 | 2115 | N/A | FDD | N/A |
| n77 | 4190 | 10 | 50 | 4190 | N/A | TDD | N/A |
| n41 | 2530 | 5 | 25 | 2530 | N/A | TDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 9.0 | FDD | IMD4 |
| n77 | 3610 | 10 | 50 | 3610 | 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. | | | | | | | | |

### CA\_n41-n71-n77

#### Operating bands for CA

Table 5.1.16.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41-n71-n77 | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.16.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n41A-n71A-n77A | CA\_n41A-n71A  CA\_n41A-n77A  CA\_n71A-n77A | n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n41(2A)-n71A-n77A | CA\_n41A-n71A  CA\_n41A-n77A  CA\_n71A-n77A | n41 | See CA\_n41(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | 0 |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n41C-n71A-n77A | CA\_n41A-n71A  CA\_n41A-n77A  CA\_n71A-n77A | n41 | See CA\_n41C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | 0 |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

#### UE co-existence studies

IMD2, IMD3, IMD4 and IMD5 generated by UL n41-n71 might affect DL n77.

IMD2 generated by UL n41-n77 IMD might affect DL n71.

IMD2 and IMD3 generated by UL n71-n77 might affect DL n41.

#### REFSENS requirements

CA\_n41-n71-n77 need to have the same MSD requirements defined.

MSD values n41 are derived from DC\_71A\_n38A-n78A for IMD2 and DC\_8A\_n41A-n79A for IMD3.

MSD values n77 are derived from DC\_71A\_n38A-n78A for IMD2 and DC\_8A\_n41A-n79A for IMD3.

MSD values n71 are derived from DC\_41A\_n28A-n77A

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.16.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n41A-n71A-n77A  CA\_n41(2A)-n71A-n77A CA\_n41C-n71A-n77A | n41 | 2615 | 5 | 25 | 2615 | N/A | TDD | N/A |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 3308 | 10 | 50 | 3308 | 29.1 | TDD | IMD21 |
| n41 | 2615 | 5 | 25 | 2615 | N/A | TDD | N/A |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 4001 | 10 | 50 | 4001 | 16.3 | TDD | IMD31 |
| n41 | 2580 | 5 | 25 | 2580 | N/A | TDD | N/A |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 3774 | 10 | 50 | 3774 | 10.3 | TDD | IMD41 |
| n41 | 2615 | 5 | 25 | 2615 | 28.7 | TDD | IMD2 |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 3308 | 10 | 50 | 3308 | N/A | TDD | N/A |
| n41 | 2615 | 5 | 25 | 2615 | 15.5 | TDD | IMD3 |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 4001 | 10 | 50 | 4001 | N/A | TDD | N/A |
| 41 | 2642 | 5 | 25 | 2642 | N/A | TDD | N/A |
| n71 | 743 | 5 | 25 | 798 | 30.8 | FDD | IMD2 |
| n77 | 3440 | 10 | 50 | 3440 | 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. | | | | | | | | |

### CA\_n66-n71-n77

#### Operating bands for CA

Table 5.1.17.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n66-n71-n77 | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.1.17.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n66A-n71A-n77A | CA\_n66A-n71A  CA\_n66A-n77A  CA\_n71A-n77A | n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

#### UE co-existence studies

IMD3, IMD4 and IMD5 generated by UL n66-n71 might affect DL n77.

IMD3 generated by UL n66-n77 IMD might affect DL n71.

IMD3 and IMD4 generated by UL n71-n77 might affect DL n66.

#### REFSENS requirements

CA\_n66-n71-n77 need to have the same MSD requirements defined.

MSD values n66 are derived from DC\_71A\_n66A-n78A.

MSD values n77 are derived from DC\_28A\_n3A-n77A.

MSD values n71 are derived from DC\_3A-28A\_n77A

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.17.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n66A-n71A-n77A | n66 | 1720 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n71 | 668 | 5 | 25 | 622 | N/A | FDD | N/A |
| n77 | 4108 | 10 | 50 | 4108 | 15.9 | TDD | IMD31,2 |
| n66 | 1760 | 5 | 25 | 2160 | 15.5 | FDD | IMD32 |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 3546 | 10 | 50 | 3546 | N/A | TDD | N/A |
| n66 | 1720 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n71 | 686 | 5 | 25 | 640 | 15.3 | FDD | IMD3 |
| n77 | 4080 | 10 | 50 | 4080 | 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. | | | | | | | | |

5.1.18 CA\_n25-n41-n71

5.1.18.1 Operating bands for CA

**Table 5.1.18.1-1: CA band combination of band n25+n41+n71**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n41-n71 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

5.1.18.2 Channel bandwidths per operating band for CA

**Table 5.1.18.2-1: Supported channel bandwidths per CA configuration for band n25+n41+n71**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA  configuration** | **NR Band** | **5  MHz** | **10  MHz** | **15  MHz** | **20  MHz** | **25  MHz** | **30  MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n25A-n41A-n71A | CA\_n25A-n41A  CA\_n41A-n71A  CA\_n25A-n71A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n25A-n41(2A)-n71A | CA\_n25A-n41A  CA\_n41A-n71A  CA\_n25A-n71A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
| n41 | See CA\_n41(2A) bandwidth combination set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n25A-n41C-n71A | CA\_n25A-n41A  CA\_n41A-n71A  CA\_n25A-n71A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
| n41 | See CA\_n41C bandwidth combination set 1 in Table 5.5A.1-1 | | | | | | | | | | | | |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |

#### 5.1.18.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

The co-existence studies for dual uplink operation of two bands, i.e. CA\_n25A-n41A, CA\_n25A-n71A and CA\_n41A-n71A have been captured in TR38.716-02-00, where:

* IMD2 and IMD5 products produced by CA\_n25A-n41A impact the reference sensitivity of NR band n71.
* IMD2 and IMD4 products produced by CA\_n25A-n71A impact the reference sensitivity of NR band n41.
* IMD2 products produced by CA\_n41A-n71A impact the reference sensitivity of NR band n25.

#### 5.1.18.4 REFSENS requirements

According to clause 5.1.18.3, MSD specification is necessary. MSD values are re-used from similar band combinations. IMD2 is taken from DC\_1A\_n28A-n41A, DC\_1A-7A\_n28A, DC\_2A-71A\_n38A and IMD5 from DC\_1A-28A\_n7A. It is proposed not to specify MSD for IMD4 as with real channel allocations only part of the IMD hits victim band.

**Table 5.1.18.4-1: MSD**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n25A-n41A-n71A  CA\_n25A-n41(2A)-n71A  CA\_n25A-n41C-n71A | n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n41 | 2525 | 10 | 50 | 2525 | N/A | TDD | N/A |
| n71 | 691 | 5 | 25 | 645 | 29.3 | FDD | IMD2 |
| n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n41 | 2571 | 10 | 50 | 2571 | 30 | TDD | IMD2 |
| n71 | 691 | 5 | 25 | 645 | N/A | FDD | N/A |
| n25 | 1860 | 5 | 25 | 1940 | 26 | FDD | IMD2 |
| n41 | 2620 | 10 | 50 | 2620 | N/A | TDD | N/A |
| n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
| n25 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| n41 | N/A | N/A | N/A | N/A | N/A | N/A | IMD4 |
| n71 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| n25 | 1885 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n41 | 2510 | 10 | 50 | 2510 | N/A | TDD | N/A |
| n71 | 681 | 5 | 25 | 635 | 4.5 | FDD | IMD5 |

### 5.1.19 CA\_n5-n25-n77

5.1.19.1 Operating bands for CA

Table 5.1.19.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n25-n77 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.19.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n5A-n25A-n77A | CA\_n5A-n25A  CA\_n5A-n77A  CA\_n25A-n77A | n5 | 5 | 10 | 15 | 10 |  |  |  |  |  |  |  |  |  | 0 |
| n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.19.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.19.3-1, 5.1.19.3-2 and 5.1.19.3-3, respectively.

Table 5.1.19.3-1: IMD analysis for n5+n25

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 824 | 849 | 1850 | 1915 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1001 | 1091 | 2674 | 2764 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 267 | 152 | 2851 | 3006 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3498 | 3613 | 4524 | 4679 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 557 | 697 | 4701 | 4921 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4322 | 4462 | 6374 | 6594 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 2182 | 2002 | 5348 | 5528 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 6836 | 6551 | 1546 | 1381 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 8224 | 8509 | 5146 | 5311 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 4097 | 3852 | 1153 | 1358 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 7198 | 7443 | 6172 | 6377 |

Table 5.1.19.3-2: IMD analysis for n5+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 824 | 849 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 2451 | 3376 | 4124 | 5049 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 2552 | 1602 | 5751 | 7576 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4948 | 5898 | 7424 | 9249 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1728 | 753 | 9051 | 11776 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5772 | 6747 | 10724 | 13449 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 6752 | 902 | 8248 | 10098 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 15976 | 12351 | 96 | 904 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 14024 | 17649 | 6596 | 7596 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 10952 | 8202 | 4053 | 5928 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 11548 | 14298 | 9072 | 10947 |

Table 5.1.19.3-3: IMD analysis for n25+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1915 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1385 | 2350 | 5150 | 6115 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 500 | 530 | 4685 | 6550 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7000 | 8030 | 8450 | 10315 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1350 | 2445 | 7985 | 10750 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8850 | 9945 | 11750 | 14515 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 4700 | 2770 | 10300 | 12230 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 14950 | 11285 | 4360 | 3200 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 15050 | 18715 | 10700 | 11860 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 8900 | 6070 | 855 | 2850 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13600 | 16430 | 12150 | 14145 |

The above IMD studies shows that

* The 3rd and 5th order IMD generated by dual uplink of n5+n25 may fall into own Rx of n77
* The 2nd order IMD generated by dual uplink of n5+n77 may fall into own Rx of n77
* The 3rd order IMD generated by dual uplink of n5+n77 may fall into own Rx of n25
* The 4th order IMD generated by dual uplink of n5+n77 may fall into own Rx of n5
* The 4th order IMD generated by dual uplink of n5+n77 may fall into own Rx of n5 and n77
* The 5th order IMD generated by dual uplink of n5+n77 may fall into own Rx of n5 and n77
* The 2nd order IMD generated by dual uplink of n25+n77 may fall into own Rx of n25
* The 4th order IMD generated by dual uplink of n25+n77 may fall into own Rx of n77
* The 5th order IMD generated by dual uplink of n25+n77 may fall into own Rx of n5

#### 5.1.19.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

As these 3DL/2UL IMD issues are similar to DC\_2A\_n5A-n77A and DC\_2A-5A\_n77A, these MSD are reused for CA\_n5A-n25A-n77A.

Table 5.1.19.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n25A-n77A | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n77 | 3540 | 10 | 50 | 3540 | 16.0 | TDD | IMD3 |
| n5 | 844 | 5 | 25 | 889 | 3.8 | FDD | IMD5 |
| n25 | 1907 | 5 | 25 | 1987 | N/A | FDD | N/A |
| n77 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
| n5 | 846.5 | 5 | 25 | 891.5 | N/A | FDD | N/A |
| n25 | 1907 | 5 | 25 | 1987 | 16.5 | FDD | IMD3 |
| n77 | 3680 | 10 | 25 | 3680 | N/A | TDD | N/A |

### 5.1.20 CA\_n25-n66-n77

#### 5.1.20.1 Operating bands for CA

Table 5.1.20.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n66-n77 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.20.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n25A-n66A-n77A | CA\_n25A-n66A  CA\_n25A-n77A  CA\_n66A-n77A | n25 | 5 | 10 | 15 | 10 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.20.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.20.3-1, 5.1.20.3-2 and 5.1.20.3-3, respectively.

Table 5.1.20.3-1: IMD analysis for n25+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1780 | 1850 | 1915 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 70 | 205 | 3560 | 3695 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1505 | 1710 | 1920 | 2120 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5270 | 5475 | 5410 | 5610 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 3215 | 3490 | 3770 | 4035 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6980 | 7255 | 7260 | 7525 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 410 | 140 | 7120 | 7390 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 5950 | 5620 | 5270 | 4925 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 9110 | 9440 | 8690 | 9035 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 2325 | 1990 | 1640 | 1300 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8970 | 9305 | 8830 | 9170 |

Table 5.1.20.3-2: IMD analysis for n25+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1915 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1385 | 2350 | 5150 | 6115 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 500 | 530 | 4685 | 6550 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7000 | 8030 | 8450 | 10315 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1350 | 2445 | 7985 | 10750 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8850 | 9945 | 11750 | 14515 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 4700 | 2770 | 10300 | 12230 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 14950 | 11285 | 4360 | 3200 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 15050 | 18715 | 10700 | 11860 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 8900 | 6070 | 855 | 2850 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13600 | 16430 | 12150 | 14145 |

Table 5.1.20.3-3: IMD analysis for n66+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1780 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1520 | 2490 | 5010 | 5980 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 780 | 260 | 4820 | 6690 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6720 | 7760 | 8310 | 10180 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 930 | 2040 | 8120 | 10890 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8430 | 9540 | 11610 | 14380 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 4980 | 3040 | 10020 | 11960 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 15090 | 11420 | 3820 | 2640 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 14910 | 18580 | 10140 | 11320 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 9180 | 6340 | 1260 | 3270 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13320 | 16160 | 11730 | 13740 |

The above IMD studies shows that

* The 2nd and 4th order IMD generated by dual uplink of n25+n66 may fall into own Rx of n77
* The 3rd and 5th order IMD generated by dual uplink of n25+n66 may fall into own Rx of n25 and n66
* The 2nd, 4th and 5th order IMD generated by dual uplink of n25+n77 may fall into own Rx of n25 and n66
* The 4th and 5th order IMD generated by dual uplink of n25+n77 may fall into own Rx of n77
* The 2nd, 4th and 5th order IMD generated by dual uplink of n66+n77 may fall into own Rx of n25 and n66
* The 4th and 5th order IMD generated by dual uplink of n66+n77 may fall into own Rx of n77

#### 5.1.20.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

As these 3DL/2UL IMD issues are similar to CA\_n2A-n66A-n77A, the same MSD are used for CA\_n25A-n66A-n77A.

Table 5.1.20.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n25A-n66A-n77A | n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3620 | 10 | 50 | 3620 | 29.4 | TDD | IMD2 |
| n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3340 | 10 | 50 | 3340 | 8.9 | TDD | IMD4 |
| n25 | 1860 | 5 | 25 | 1940 | N/A | FDD | N/A |
| n66 | 1750 | 5 | 25 | 2150 | 31.2 | FDD | IMD2 |
| n77 | 4010 | 10 | 50 | 4010 | N/A | TDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 10.3 | FDD | IMD4 |
| n77 | 3480 | 10 | 50 | 3480 | N/A | TDD | N/A |
| n25 | 1860 | 5 | 25 | 1940 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | 2.8 | FDD | IMD5 |
| n77 | 3860 | 10 | 50 | 3860 | N/A | TDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | 32.1 | FDD | IMD2 |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n77 | 3700 | 10 | 50 | 3700 | N/A | TDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | 9.1 | FDD | IMD4 |
| n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |
| n77 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | 2.1 | FDD | IMD5 |
| n66 | 1760 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n77 | 3620 | 10 | 50 | 3620 | N/A | TDD | N/A |

### 5.1.21 CA\_n3-n28-n78

#### 5.1.21.1 Operating bands for CA

Table 5.1.21.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n28-n78 | n3 | 1710MHz | – | 1780MHz | 1805MHz | – | 1880MHz | FDD |
| n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

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

Table 5.1.21.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n3A-n28A-n78A | CA\_n3A-n78A  CA\_n28A-n78A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  |
| n78 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |
| CA\_n3A-n28A-n78(2A) | CA\_n3A-n78A  CA\_n28A-n78A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |

#### 5.1.21.3 Co-existence studies

Co-existence studies of CA\_n3-n28-n78 with 2UL are already covered in the constituent fall-back modes, it can get that:

- IMD3 of band n28 UL and band n78 UL falling to band n3 DL

#### 5.1.21.4 REFSENS requirements

Table 5.1.21.4-1 shows the required MSD levels for the CA configuration, its value can reuse the value of DC\_3A-28A\_n78A in TS 38.101-3.

**Table 5.1.21.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n3A-n28A-n78A  CA\_n3A-n28A-n78(2A) | n3 | 1775 | 5 | 25 | 1870 | 17.3 | FDD | IMD3 |
| n28 | 740 | 5 | 25 | 795 | N/A | FDD | N/A |
| n78 | 3350 | 10 | 25 | 3350 | N/A | TDD | N/A |

### 5.1.22 CA\_n3-n18-n41

#### 5.1.22.1 Operating bands for CA

Table 5.1.22.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n18-n41 | n3 | 1710MHz | – | 1780MHz | 1805MHz | – | 1880MHz | FDD |
| n18 | 815MHz | – | 830MHz | 860MHz | – | 875MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

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

Table 5.1.22.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n3A-n18A-n41A | CA\_n3A-n41A  CA\_n3A-n18A  CA\_n18A-n41A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |

#### 5.1.22.3 Co-existence studies

Co-existence studies of CA\_n3-n18-n41 with 2UL are already covered in the constituent fall-back modes, it can get that:

- IMD2 of band n18 UL and band n41 UL falling to band n3 DL

- IMD2 and IMD3 of band n3 UL and band n41 UL falling to band n18 DL.

- IMD2 and IMD3 of band n3 UL and band n18 L falling to band n41 DL.

#### 5.1.22.4 REFSENS requirements

Table 5.1.22.4-1 shows the required MSD levels for the CA configuration, its value can refer to the value of DC\_18A-41A\_n3A in TS 38.101-3 and CA\_3A-5A-7A in TS 36.101 and update with considering n41 changed from 5 to 10MHz.

**Table 5.1.22.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n3A-n18A-n41A | n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |
| n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
| n41 | 2540 | 10 | 50 | 2540 | [N/A]1 | TDD | IMD2 |
| n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |
| n3 | 1725 | 5 | 25 | 1820 | N/A | FDD | N/A |
| n41 | 2630 | 10 | 50 | 2630 | 16.0 | TDD | IMD3 |
| n18 | 820 | 5 | 25 | 865 | 28.9 | FDD | IMD2 |
| n3 | 1765 | 5 | 25 | 1860 | N/A | FDD | N/A |
| n41 | 2630 | 10 | 50 | 2630 | N/A | TDD | N/A |
| n18 | 830 | 5 | 25 | 875 | [19.0] | FDD | IMD3 |
| n3 | 1725 | 5 | 25 | 1820 | N/A | FDD | N/A |
| n41 | 2670 | 5 | 25 | 2670 | N/A | TDD | N/A |
| n3 | 1755 | 5 | 25 | 1850 | 28.8 | FDD | IMD2 |
| n41 | 2670 | 10 | 50 | 2670 | N/A | TDD | N/A |
| n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |

NOTE 1: [N/A] is explained that an IMD2 may fall in band n41, but due to operator's spectrum holding, the MSD is not applicable.

### 5.1.23 CA\_n3-n41-n77

#### 5.1.23.1 Operating bands for CA

Table 5.1.23.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n41-n77 | n3 | 1710MHz | – | 1780MHz | 1805MHz | – | 1880MHz | FDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |

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

Table 5.1.23.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n3A-n41A-n77A  CA\_n3A-n41A-n77(2A) | CA\_n3A-n41A  CA\_n3A-n77A  CA\_n41A-n77A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |

#### 5.1.23.3 Co-existence studies

Co-existence studies of CA\_n3-n41-n77 with 2UL are already covered in the constituent fall-back modes, it can get that:

- IMD3 and IMD4 of band n41 UL and band n77 UL falling to band n3 DL, while for IMD4 it doesn’t need MSD results for lower order IMD.

- IMD5 of band n3 UL and band n77 UL falling to band n41 DL

- IMD3 and IMD5 of band n3 UL and band n41 UL falling to band n77 DL, which IMD5 not specified.

#### 5.1.23.4 REFSENS requirements

Table 5.1.23.4-1 shows the required MSD levels for the CA configuration, its value can reuse the value of DC\_41A\_n3A-n77A and DC\_3A-41A\_n77A in TS 38.101-3.

**Table 5.1.23.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n3A-n41A-n77(2A) | n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A | |
| n77 | 3900 | 10 | 50 | 3900 | N/A | TDD | N/A | |
| n41 | 2640 | 5 | 25 | 2640 | 5.3 | TDD | IMD5 | |
| n41 | 2620 | 5 | 25 | 2620 | N/A | TDD | N/A | |
| n77 | 3400 | 10 | 50 | 3400 | N/A | TDD | N/A | |
| n3 | 1745 | 5 | 25 | 1840 | 16.4 | FDD | IMD3 | |
| n41 | 2580 | 5 | 25 | 2580 | N/A | TDD | N/A | |
| n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A | |
| n77 | 3440 | 10 | 50 | 3440 | 16.8 | TDD | IMD34 | |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.24 CA\_n3-n41-n78

#### 5.1.24.1 Operating bands for CA

Table 5.1.24.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n41-n78 | n3 | 1710MHz | – | 1780MHz | 1805MHz | – | 1880MHz | FDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

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

Table 5.1.24.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n3A-n41A-n78A | CA\_n3A-n41A  CA\_n3A-n78A  CA\_n41A-n78A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n78 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |
| CA\_n3A-n41A-n78(2A) | CA\_n3A-n41A  CA\_n3A-n78A  CA\_n41A-n78A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |

#### 5.1.24.3 Co-existence studies

Co-existence studies of CA\_n3-n41-n78 with 2UL are already covered in the constituent fall-back modes, it can get that:

- IMD3 and IMD 4of band n41 UL and band n78 UL falling to band n3 DL, while for IMD4 it doesn’t need MSD results for lower order IMD.

- IMD2, IMD3 and IMD5 of band n3 UL and band n41 UL falling to band n78 DL, while there was no IMD2 impact to n78 and for IMD5 it doesn’t need MSD results for lower order IMD.

#### 5.1.24.4 REFSENS requirements

Table 5.1.24.4-1 shows the required MSD levels for the CA configuration, its value can reuse the value of DC\_3A-n41A\_n78A and DC\_3A-41A\_n78A in TS 38.101-3.

**Table 5.1.24.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n3A-n41A-n78A  CA\_n3A-n41A-n78(2A) | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
| n41 | 2560 | 10 | 50 | 2560 | N/A | TDD | N/A |
| n78 | 3390 | 10 | 50 | 3390 | 16.4 | TDD | IMD3 |
| n3 | 1745 | 5 | 25 | 1840 | 16.4 | TDD | IMD3 |
| n41 | 2620 | 5 | 25 | 2620 | N/A | FDD | N/A |
| n78 | 3400 | 10 | 52 | 3400 | N/A | TDD | N/A |

### 5.1.25 CA\_n28-n41-n77

#### 5.1.25.1 Operating bands for CA

Table 5.1.25.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n41-n77 | n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |

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

Table 5.1.25.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n28A-n41A-n77A  CA\_n28A-n41A-n77(2A) | CA\_n28A-n41A  CA\_n28A-n77A  CA\_n41A-n77A | n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |

#### 5.1.25.3 Co-existence studies

Co-existence studies of CA\_n28-n41-n77 with 2UL are already covered in the constituent fall-back modes, it can get that:

- IMD2, IMD3 and IMD 5 of band n41 UL and band n77 UL falling to band n28 DL, while for IMD3 it doesn’t need MSD results for lower order IMD.

- IMD2 and IMD3 of band n28 UL and band n77 UL falling to band n41 DL, while for IMD3 it doesn’t need MSD results for lower order IMD.

- IMD2, IMD3 and IMD4 of band n28 UL and band n41 UL falling to band n77 DL, while for IMD3 and IMD4 it doesn’t need MSD results for lower order IMD.

#### 5.1.25.4 REFSENS requirements

Table 5.1.25.4-1 shows the required MSD levels for the CA configuration, its value can reuse the value of DC\_41A\_n28A-n77A, DC\_28A-41A\_n77A and DC\_28A-41A\_n77A in TS 38.101-3.

**Table 5.1.25.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n28A-n41A-n77(2A) | n41 | 2642 | 5 | 25 | 2642 | N/A | TDD | N/A | |
| n77 | 3440 | 10 | 50 | 3440 | N/A | TDD | N/A | |
| n28 | 743 | 5 | 25 | 798 | 30.8 | FDD | IMD21 | |
| n41 | 2567.5 | 10 | 50 | 2567.5 | N/A | TDD | N/A | |
| n77 | 3460 | 10 | 50 | 3460 | N/A | TDD | N/A | |
| n28 | 727.5 | 5 | 25 | 782.5 | 3.0 | FDD | IMD5 | |
| n28 | 738 | 5 | 25 | 793 | N/A | FDD | N/A | |
| n77 | 3380 | 10 | 50 | 3380 | N/A | TDD | N/A | |
| n41 | 2642 | 5 | 25 | 2642 | 29.5 | TDD | IMD2 | |
| n41 | 2580 | 5 | 25 | 2580 | N/A | TDD | N/A | |
| n28 | 743 | 5 | 25 | 798 | N/A | FDD | N/A | |
| n77 | 3323 | 10 | 50 | 3323 | 28.2 | TDD | IMD21 | |
| NOTE 1: This band is subject to IMD3 also which MSD is not specified. | | | | | | | | |

### 5.1.26 CA\_n25-n29-n66

#### 5.1.26.1 Operating bands for CA

Table 5.1.26.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n29-n66 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n29 | N/A | | | 717 MHz | – | 728 MHz | SDL |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.1.26.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n25A-n29A-n66A | CA\_n25-n66A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |

#### 5.1.26.3 Co-existence studies

Co-existence studies of CA\_n25-n29-n66 with 2UL are already covered in the constituent fall-back modes, it can get that:

- no IMD of band n25 UL and band n66 UL falling to band n29 DL

#### 5.1.26.4 REFSENS requirements

There are no additional MSD requirements for this band combination

### 5.1.27 CA\_n13-n25-n66

#### 5.1.27.1 Operating bands for CA

Table 5.1.27.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n13-n25-n66 | n13 | 777 MHz | – | 787 MHz | 746 MHz | – | 757 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.1.27.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n13A-n25A-n66A | CA\_n13A-n25A  CA\_n13A-n66A  CA\_n25A-n66A | n13 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |

#### 5.1.27.3 Co-existence studies

Co-existence studies of CA\_n13-n25-n66 with 2UL are already covered in the constituent fall-back modes, it can get that:

- IMD4 of band n13 UL and band n25 UL falling to band n66 DL

- IMD4 of band n13 UL and band n66 UL falling to band n25 DL

#### 5.1.27.4 REFSENS requirements

Table 5.1.27.4-1 shows the required MSD levels for the CA configuration, its value can reuse the value of DC\_2A-13A\_n66A and DC\_13A-66A\_n2A in TS 38.101-3.

**Table 5.1.27.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n13A-n25A-n66A | n13 | 782 | 5 | 25 | 751 | N/A | FDD | N/A |
| n66 | 1736 | 5 | 25 | 2156 | 7..2 | FDD | IMD4 |
| n25 | 1860 | 5 | 25 | 1940 | N/A | FDD | N/A |
| n13 | 780 | 10 | 50 | 749 | N/A | FDD | N/A |
| n25 | 1860 | 5 | 25 | 1940 | 6.2 | FDD | IMD4 |
| n66 | 1750 | 5 | 25 | 2150 | N/A | FDD | N/A |

### 5.1.28 CA\_n66-n71-n78

#### 5.1.28.1 Operating bands for CA

**Table 5.1.28.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n66-n71-n78 | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

**Table 5.1.28.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **UL config** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **BCS** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n66A-n71A-n78A | CA\_n66A-n78A  CA\_n66A-n71A  CA\_n71A-n78A | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n66A-n71A-n78(2A) | CA\_n66A-n78A  CA\_n66A-n71A  CA\_n71A-n78A | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n66(2A)-n71A-n78A | CA\_n66A-n78A  CA\_n66A-n71A  CA\_n71A-n78A | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n66(2A)-n71A-n78(2A) | CA\_n66A-n78A  CA\_n66A-n71A  CA\_n71A-n78A | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.28.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

* IMD4 and IMD5 interference generated by UL CA\_n66-n71 might affect DL n78.
* IMD3 interference generated by UL CA\_n71-n78 might affect DL n66.

#### 5.1.28.4 REFSENS requirements

For the case MSD values for IMD3 interference affect n66 DL, it is similar to CA\_n66A-n71A-n77A, the same MSD value as 15.5 dB is reused. For the case MSD values for IMD4 interference affect n78 DL, MSD values are derived from DC\_12A\_n7A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

**Table 5.1.28.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n66A-n71A-n78A  CA\_n66A-n71A-n78(2A)  CA\_n66(2A)-n71A-n78A  CA\_n66(2A)-n71A-n78(2A) | n66 | 1720 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n71 | 668 | 5 | 25 | 622 | N/A | FDD | N/A |
| n78 | 3724 | 10 | 50 | 3724 | 9 | TDD | IMD41 |
| n66 | 1760 | 5 | 25 | 2160 | 15.5 | FDD | IMD3 |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n78 | 3546 | 10 | 50 | 3546 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.29 CA\_n38-n66-n78

#### 5.1.29.1 Operating bands for CA

**Table 5.1.29.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n38-n66-n78 | n38 | 2570 MHz | – | 2620 MHz | 2570 MHz | – | 2620 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

**Table 5.1.29.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **UL config** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **BCS** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n38A-n66A-n78A | CA\_n38A-n66A  CA\_n38A-n78A  CA\_n66A-n78A | n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n38A-n66A-n78(2A) | CA\_n38A-n66A  CA\_n38A-n78A  CA\_n66A-n78A | n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n38A-n66(2A)-n78A | CA\_n38A-n66A  CA\_n38A-n78A  CA\_n66A-n78A | n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n38A-n66(2A)-n78(2A) | CA\_n38A-n66A  CA\_n38A-n78A  CA\_n66A-n78A | n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.29.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

* IMD3 interference generated by UL CA\_n38-n66 might affect DL n78.
* IMD4 interference generated by UL CA\_n38-n78 might affect DL n66.

#### 5.1.29.4 REFSENS requirements

For the case MSD values for IMD3 interference affect n66 DL, MSD values are derived from DC\_7A-66A\_n78A. For the case MSD values for IMD3 interference affect n78 DL, MSD values are derived from DC\_66A\_n38A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

**Table 5.1.29.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n38A-n66A-n78A  CA\_n38A-n66A-n78(2A)  CA\_n38A-n66(2A)-n78A  CA\_n38A-n66(2A)-n78(2A) | n38 | 2550 | 5 | 25 | 2550 | N/A | TDD | N/A |
| n66 | 1750 | 5 | 25 | 2150 | 8.7 | FDD | IMD4 |
| n78 | 3625 | 10 | 50 | 3625 | N/A | TDD | N/A |
| n38 | 2610 | 5 | 25 | 2610 | N/A | TDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n78 | 3460 | 10 | 50 | 3460 | 15.0 | TDD | IMD3 |
|  | | | | | | | | |

### 5.1.30 CA\_n25-n38-n78

#### 5.1.30.1 Operating bands for CA

**Table 5.1.30.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n38-n78 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n38 | 2570 MHz | – | 2620 MHz | 2570 MHz | – | 2620 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

**Table 5.1.30.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **UL config** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **BCS** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n25A-n38A-n78A | CA\_n25A-n38A  CA\_n25A-n78A  CA\_n38A-n78A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n25A-n38A-n78(2A) | CA\_n25A-n38A  CA\_n25A-n78A  CA\_n38A-n78A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n25(2A)-n38A-n78A | CA\_n25A-n38A  CA\_n25A-n78A  CA\_n38A-n78A | n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n25(2A)-n38A-n78(2A) | CA\_n25A-n38A  CA\_n25A-n78A  CA\_n38A-n78A | n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.30.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

* IMD3 and IMD4 interference generated by UL CA\_n38-n78 might affect DL n25
* IMD3 interference generated by UL CA\_n25-n38 might affect DL n78

#### 5.1.30.4 REFSENS requirements

For the case MSD values for IMD3 interference affect n78 DL, MSD values are derived from DC\_2A\_n38A-n78A. For the case MSD values for IMD3 interference affect n25 DL, MSD values are derived from DC\_3A-41A\_n78A. For the case MSD values for IMD4 interference affect n25 DL, MSD values are derived from DC\_2A-7A\_n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

**Table 5.1.30.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n25A-n38A-n78A  CA\_n25A-n38A-n78(2A)  CA\_n25(2A)-n38A-n78A  CA\_n25(2A)-n38A-n78(2A) | n25 | 1852.5 | 5 | 25 | 1932.5 | 16.4 | FDD | IMD3 |
| n38 | 2617.5 | 5 | 25 | 2617.5 | N/A | TDD | N/A |
| n78 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
| n25 | 1870 | 5 | 25 | 1950 | N/A | FDD | N/A |
| n38 | 2610 | 5 | 25 | 2610 | N/A | TDD | N/A |
| n78 | 3350 | 10 | 50 | 3350 | 14.8 | TDD | IMD3 |
| n25 | 1880 | 5 | 25 | 1960 | 8.6 | TDD | IMD4 |
| n38 | 2570 | 5 | 25 | 2570 | N/A | FDD | N/A |
| n78 | 3550 | 10 | 50 | 3550 | N/A | TDD | N/A |

### 5.1.31 CA\_n25-n66-n71

#### 5.1.31.1 Operating bands for CA

Table 5.1.31.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n66-n71 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.1.31.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n25A-n66A-n71A | CA\_n25A-n66A  CA\_n25A-n71A  CA\_n66A-n71A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |

#### 5.1.31.3 UE co-existence studies

UL n25-n66 have no IMD towards DL n71.

UL n25-n71 have no IMD towards DL n66.

UL n66-n71 have no IMD towards DL n25.

#### 5.1.31.4 REFSENS requirements

Based on co-existence studies, there are no need to define additional REFSENS requirements.

### 5.1.32 CA\_n41-n66-n71

#### 5.1.32.1 Operating bands for CA

Table 5.1.32.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41-n66-n71 | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.1.32.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n41A-n66A-n71A | CA\_n41A-n71A  CA\_n66A-n71A  CA\_n41A-n66A | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 1 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n41C-n66A-n71A | CA\_n41A-n71A  CA\_n66A-n71A  CA\_n41A-n66A | n41 | See CA\_n41C Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | | 1 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n41(2A)-n66A-n71A | CA\_n41A-n71A  CA\_n66A-n71A  CA\_n41A-n66A | n41 | See CA\_n41(2A) Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.2-1 | | | | | | | | | | | | | 1 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |

#### 5.1.32.3 UE co-existence studies

UL n41-n66 have no IMD towards DL n71.

UL n41-n71 have no IMD towards DL n66.

UL n66-n71 have no IMD towards DL n41.

#### 5.1.32.4 REFSENS requirements

Based on co-existence studies, there are no need to define additional REFSENS requirements.

### 5.1.33 CA\_n25-n41-n66

#### 5.1.33.1 Operating bands for CA

Table 5.1.33.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n41-n66 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.1.33.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n25A-n41A-n66A | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| CA\_n25A-n41(2A)-n66A | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
| n41 | See CA\_n41(2A) Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.2-1 | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| CA\_n25A-n41C-n66A | CA\_n25A-n41A  CA\_n25A-n66A  CA\_n41A-n66A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
| n41 | See CA\_n41C Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |

#### 5.1.33.3 UE co-existence studies

UL n25-n41 have no IMD towards DL n66.

UL n25-n66 have no IMD towards DL n41.

UL n41-n66 have IMD4 towards DL n25.

#### 5.1.33.4 REFSENS requirements

IMD4 MSD values are derived from DC\_2A-4A\_n41A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.33.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n25A-n41A-n66A  CA\_n25A-n41(2A)-n66A  CA\_n25A-n41C-n66A | n25 | 1860 | 5 | 25 | 1940 | 11.0 | FDD | IMD4 |
| n41 | 2685 | 10 | 50 | 2685 | N/A | TDD | N/A |
| n66 | 1715 | 5 | 25 | 2115 | N/A | FDD | N/A |

### 5.1.34 CA\_n7-n66-n77

5.1.34.1 Operating bands for CA

Table 5.1.34.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n66-n77 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.34.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n7A-n66A-n77A | CA\_n7A-n66A  CA\_n7A-n77A  CA\_n66A-n77A | n7 | 5 | 10 | 15 | 10 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n7(2A)-n66A-n77A | CA\_n7A-n66A  CA\_n7A-n77A  CA\_n66A-n77A | n7 | See CA\_n7(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n7A-n66(2A)-n77A | CA\_n7A-n66A  CA\_n7A-n77A  CA\_n66A-n77A | n7 | 5 | 10 | 15 | 10 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n7A-n66A-n77(2A) | CA\_n7A-n66A  CA\_n7A-n77A  CA\_n66A-n77A | n7 | 5 | 10 | 15 | 10 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| CA\_n7(2A)-n66(2A)-n77A | CA\_n7A-n66A  CA\_n7A-n77A  CA\_n66A-n77A | n7 | See CA\_n7(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n7(2A)-n66A-n77(2A) | CA\_n7A-n66A  CA\_n7A-n77A  CA\_n66A-n77A | n7 | See CA\_n7(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| CA\_n7A-n66(2A)-n77(2A) | CA\_n7A-n66A  CA\_n7A-n77A  CA\_n66A-n77A | n7 | 5 | 10 | 15 | 10 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| CA\_n7(2A)-n66(2A)-n77(2A) | CA\_n7A-n66A  CA\_n7A-n77A  CA\_n66A-n77A | n7 | See CA\_n7(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |

CA\_n7(2A)-n66A-n77A, CA\_n7A-n66(2A)-n77A, CA\_n7A-n66A-n77(2A), CA\_n7(2A)-n66(2A)-n77A, CA\_n7(2A)-n66A-n77(2A), CA\_n7A-n66(2A)-n77(2A), and CA\_n7(2A)-n66(2A)-n77(2A)

#### 5.1.34.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.34.3-1, 5.1.34.3-2 and 5.1.34.3-3, respectively.

Table 5.1.34.3-1: IMD analysis for n7+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1780 | 2500 | 2570 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 720 | 860 | 4210 | 4350 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 850 | 1060 | 3220 | 3430 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5920 | 6130 | 6710 | 6920 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 2560 | 2840 | 5720 | 6000 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7630 | 7910 | 9210 | 9490 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 1720 | 1440 | 8420 | 8700 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 8570 | 8220 | 4620 | 4270 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 11710 | 12060 | 9340 | 9690 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 4290 | 3940 | 340 | 10 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 10920 | 11270 | 10130 | 10480 |

Table 5.1.34.3-2: IMD analysis for n7+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 2500 | 2570 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 730 | 1700 | 5800 | 6770 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 800 | 1840 | 4030 | 5900 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8300 | 9340 | 9100 | 10970 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 3300 | 4410 | 7330 | 10100 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 10800 | 11910 | 12400 | 15170 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 3400 | 1460 | 11600 | 13540 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 14300 | 10630 | -6980 | -5800 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 15700 | 19370 | 13300 | 14480 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 7600 | 4760 | 1110 | 900 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 14900 | 17740 | 14100 | 16110 |

Table 5.1.34.3-3: IMD analysis for n66+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1780 | 3300 | 4200 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1520 | 2490 | 5010 | 5980 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 780 | 260 | 4820 | 6690 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6720 | 7760 | 8310 | 10180 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 930 | 2040 | 8120 | 10890 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 8430 | 9540 | 11610 | 14380 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 4980 | 3040 | 10020 | 11960 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 15090 | 11420 | 3820 | 2640 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 14910 | 18580 | 10140 | 11320 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 9180 | 6340 | 1260 | 3270 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 13320 | 16160 | 11730 | 13740 |

The above IMD studies shows that

* The 3rd and 5th order IMD generated by dual uplink of n7+n66 may fall into own Rx of n77
* The 4th order IMD generated by dual uplink of n7+n66 may fall into own Rx of n7
* The 4th order IMD generated by dual uplink of n7+n77 may fall into own Rx of n7, n66 and n77
* The 2nd and 5th order IMD generated by dual uplink of n66+n77 may fall into own Rx of n66
* The 5th order IMD generated by dual uplink of n66+n77 may fall into own Rx of n7
* The 4th and 5th order IMD generated by dual uplink of n66+n77 may fall into own Rx of n77

#### 5.1.34.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

As these 3DL/2UL IMD issues are similar to CA\_n7A-n66A-n78A, DC\_2A-7A\_n77A, and DC\_2A\_n7A-n78A, the same MSD values are resued for the corresponding order of MSD.

Table 5.1.34.4-1: 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  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7A-n66A-n77A | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n66 | 1730 | 5 | 25 | 2130 | N/A | FDD | N/A |
|  | n77 | 3390 | 10 | 50 | 3390 | 16.1 | TDD | IMD3 |
|  | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
|  | n66 | 1750 | 5 | 25 | 2150 | 8.7 | FDD | IMD4 |
|  | n77 | 3625 | 10 | 50 | 3625 | N/A | TDD | N/A |
|  | n7 | 2520 | 5 | 25 | 2640 | 3.4 | FDD | IMD5 |
|  | n66 | 1720 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n77 | 3900 | 10 | 50 | 3900 | N/A | TDD | N/A |
|  | n7 | 2520 | 5 | 25 | 2640 | N/A | FDD | N/A |
|  | n66 | 1760 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n77 | 4040 | 10 | 50 | 4040 | 4.2 | TDD | IMD5 |

5.1.35 CA\_n8-n39-n41

#### 5.1.35.1 Operating bands for CA

**Table 5.1.35.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n8A-n39A-n41A | n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| n39 | 1880 MHz | – | 1920 MHz | 1880 MHz | – | 1920 MHz | TDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

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

Table 5.1.35.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n8A-n39A-n41A | CA\_n8A-n39A  CA\_n8A-n41A  CA\_n39A-n41A | n8 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n39 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n41 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |  |

#### 5.1.35.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Actually, the co-existence studies for dual uplink operation of two bands, i.e. CA\_n8A-n39A, CA\_n8A-n41A and CA\_n39A-n41A have been captured in TR38.716-02-00, where:

* No IMD products produced by Band 8 and Band n39 that impact the reference sensitivity of NR band n41.
* No IMD products produced by Band 8 and Band n41 that impact the reference sensitivity of NR band n39.
* No IMD products produced by Band 39 and Band n41 that impact the reference sensitivity of NR band n8.

#### 5.1.35.4 MSD

According to the co-existence study, no MSD issues need to be specified. Therefore, no additional REFENS requirements need to be specified.

### 5.1.36 CA\_n25A-n71A-n78A

#### 5.1.36.1 Operating bands for CA

Table 5.1.36.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n71-n78 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.36.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  | |
| CA\_n25A-n71A-n78A | CA\_n25A-n71A  CA\_n25A-n78A  CA\_n71A-n78A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 | |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  | |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  | |
|  | CA\_n25A-n71A  CA\_n25A-n78A  CA\_n71A-n78A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 | |
| CA\_n25A-n71A-n78(2A) | n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  | |
| n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | | |  |

#### 5.1.36.3 UE co-existence studies

3rd IMD generated by UL CA\_n25A-n71A might affect DL n78.

3rd IMD generated by UL CA\_n71A-n78A might affect DL n25.

#### 5.1.36.4 REFSENS requirements

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1. The MSD values are derived from CA\_n25A-n71A-n77A.

Table 5.1.36.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n25A-n71A-n78A  CA\_n25A-n71A-n78(2A) | n25 | 1907.5 | 5 | 25 | 1987.5 | N/A | FDD | N/A |
| n71 | 695.5 | 5 | 25 | 649.5 | N/A | FDD | N/A |
| n78 | 3305 | 10 | 50 | 3305 | 8.0 | TDD | IMD3 |
| n25 | 1874 | 5 | 25 | 1954 | 16.5 | FDD | IMD3 |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n78 | 3340 | 10 | 50 | 3340 | N/A | TDD | N/A |

### 5.1.37 CA\_n2A-n5A-n66A

#### 5.1.37.1 Operating bands for CA

Table 5.1.37.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n5-n66 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.1.37.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n2A-n5A-n66A | CA\_n2A-n5A  CA\_n2A-n66A  CA\_n5A-n66A | n2 | 15 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 60 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| n5 | 15 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| CA\_n2(2A)-n5A-n66A | CA\_n2A-n5A  CA\_n2A-n66A  CA\_n5A-n66A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | 0 |
| n5 | 15 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| CA\_n2A-n5A-n66(2A) | CA\_n2A-n5A  CA\_n2A-n66A  CA\_n5A-n66A | n2 | 15 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 60 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| n5 | 15 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | |

#### 5.1.37.3 UE co-existence studies

IMD4 generated by UL n2-n5 might affect DL n66.

#### 5.1.37.4 REFSENS requirements

MSD values n66 are derived from DC\_2A-66A\_n5A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.37.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n2A-n5A-n66A | n2 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | 7.2 | FDD | IMD4 |

### 5.1.38 CA\_n2A-n5A-n30A

#### 5.1.38.1 Operating bands for CA

Table 5.1.38.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n5-n30 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |

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

Table 5.1.38.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n2A-n5A-n30A | CA\_n2A-n5A  CA\_n2A-n30A  CA\_n5A-n30A | n2 | 15 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 60 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| n5 | 15 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n30 | 15 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  | 10 |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n2(2A)-n5A-n30A | CA\_n2A-n5A  CA\_n2A-n30A  CA\_n5A-n30A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | 0 |
| n5 | 15 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n30 | 15 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  | 10 |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |

#### 5.1.38.3 UE co-existence studies

IMD4 generated by UL n2-n30 might affect DL n5.

#### 5.1.38.4 REFSENS requirements

MSD values n5 are derived from DC\_3A-8A\_n77A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.38.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n2A-n5A-n30A | n2 | 1870 | 5 | 25 | 1959 | N/A | FDD | N/A |
| n5 | 835 | 5 | 25 | 880 | 9.7 | FDD | IMD4 |
| n30 | 2310 | 10 | 50 | 2355 | N/A | FDD | N/A |

### 5.1.39 CA\_n13A-n25A-n77A

#### 5.1.39.1 Operating bands for CA

Table 5.1.39.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n13-n25-n77 | n13 | 777 MHz | – | 787 MHz | 746 MHz | – | 756 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.39.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n13A-n25A-n77A | CA\_n13A-n25A  CA\_n13A-n77A  CA\_n25A-n77A | n13 | 15 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | 10 |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n25 | 15 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 | 15 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.39.3 UE co-existence studies

IMD3, IMD4 and IMD5 generated by UL n13-n25 might affect DL n77.

IMD3 generated by UL n13-n77 might affect DL n25.

#### 5.1.39.4 REFSENS requirements

MSD values are derived from DC\_13A\_n2A-n77A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.39.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n13A-n25A-n77A | n13 | 782 | 5 | 25 | 751 | N/A | FDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n771,2 | 3444 | 10 | 50 | 3444 | 17.3 | TDD | IMD3 |
| n13 | 782 | 5 | 25 | 751 | N/A | FDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | 16.0 | FDD | IMD3 |
| n77 | 3524 | 10 | 50 | 3524 | 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. | | | | | | | | |

### 5.1.40 CA\_n13A-n66A-n77A

#### 5.1.40.1 Operating bands for CA

Table 5.1.40.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n13-n66-n77 | n13 | 777 MHz | – | 787 MHz | 746 MHz | – | 756 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.40.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n13A-n66A-n77A | CA\_n13A-n66A  CA\_n13A-n77A  CA\_n66A-n77A | n13 | 15 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | 10 |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 | 15 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |
| 30 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 60 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.40.3 UE co-existence studies

IMD3, IMD4 and IMD5 generated by UL n13-n66 might affect DL n77.

IMD3 generated by UL n13-n77 might affect DL n66.

IMD3 generated by UL n66-n77 might affect DL n13.

#### 5.1.40.4 REFSENS requirements

MSD values n13 and n66 are derived from DC\_13A-66A\_n77A, and MSD values n77 are derived from DC\_18A\_n3A-n77A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.40.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n13A-n66A-n77A | n13 | 782 | 5 | 25 | 751 | N/A | FDD | N/A |
| n66 | 1736 | 5 | 25 | 2136 | 17.1 | FDD | IMD3 |
| n77 | 3700 | 10 | 50 | 3700 | N/A | TDD | N/A |
| n13 | 781 | 5 | 25 | 750 | 15.2 | FDD | IMD3 |
| n66 | 1710 | 5 | 25 | 2110 | N/A | FDD | N/A |
| n77 | 4170 | 10 | 50 | 4170 | N/A | TDD | N/A |
| n13 | 782 | 5 | 25 | 751 | N/A | FDD | N/A |
| n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |
| n771,2 | 3334 | 10 | 50 | 3334 | 16.3 | TDD | 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. | | | | | | | | |

5.1.41 CA\_n2-n5-n66

5.1.41.1 Operating bands for CA

**Table 5.1.41.1-1: CA band combination**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2A-n5A-n66A | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

5.1.41.2 Channel bandwidths per operating band for CA

**Table 5.1.41.2-1: Supported channel bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA  configuration** | **NR Band** | **SCS (kHz)** | **5  MHz** | **10  MHz** | **15  MHz** | **20  MHz** | **25  MHz** | **30  MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n2A-n5A-n66A | CA\_n2A-n5A, CA\_n2A-n66A, CA\_n5A-n66A | n2 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |

#### 5.1.41.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n2A-n5A, CA\_n2A-n66A and CA\_n5A-n66A have been captured in TR 38.716-02-00, where:

* IMD4 products produced by Band n2 and n5 might fall in Rx of band n66.
* No IMD products produced by Band n2 and n66 might fall in Rx of band n5.
* No IMD products produced by Band n5 and n66 might fall in Rx of band n2.

#### 5.1.41.4 REFSENS requirements

The required MSD is based on already completed EN-DC\_2A-66A\_n5A.

Table 5.1.41.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n2A-n5A-n66A | n2 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n5 | 830 | 5 | 25 | 875 | N/A | N/A |
| n66 | 1740 | 5 | 25 | 2140 | 7.2 | IMD4 |

### 5.1.42 CA\_n2-n30-n66

#### 5.1.42.1 Operating bands for CA

Table 5.1.42.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n30-n66 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.1.42.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
|  | CA\_n2A-n30A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| CA\_n2A-n30A-n66A | CA\_n30A-n66A | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n2A-n66A | n66 | 5 | 10 | 15 | 20 |  |  | 40 |  |  |  |  |  |  |  |
|  | CA\_n2A-n30A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |  |
| CA\_n2(2A)-n30A-n66A | CA\_n30A-n66A | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n2A-n66A | n66 | 5 | 10 | 15 | 20 |  |  | 40 |  |  |  |  |  |  |  |
|  | CA\_n2A-n30A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| CA\_n2A-n30A-n66(2A) | CA\_n30A-n66A | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n2A-n66A | n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |  |

#### 5.1.42.3 UE co-existence studies

There is no intermodulation interference to own 3rd downlink.

#### 5.1.42.4 REFSENS requirements

No additional MSD needed.

### 5.1.43 CA\_n5-n30-n66

#### 5.1.43.1 Operating bands for CA

Table 5.1.43.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n30-n66 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.1.43.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
|  | CA\_n5A-n30A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| CA\_n5A-n30A-n66A | CA\_n30A-n66A | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n5A-n66A | n66 | 5 | 10 | 15 | 20 |  |  | 40 |  |  |  |  |  |  |  |
| CA\_n5A-n30A-n66(2A) | CA\_n5A-n30A  CA\_n30A-n66A  CA\_n5A-n66A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |

#### 5.1.43.3 UE co-existence studies

There is 5th order IMD from uplink band CA\_n5-n30 to band n66 DL.

#### 5.1.43.4 REFSENS requirements

Table 5.1.43.4-1 shows the required MSD levels for the CA configuration, it is proposed to reuse the MAS value of DC\_12A-66A\_n25A in TS 38.101-3.

**Table 5.1.43.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n30A-n66A  CA\_n5A-n30A-n66(2A) | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n30 | 2307.5 | 5 | 25 | 2352.5 | N/A | FDD | N/A |
| n66 | 1725 | 5 | 25 | 2125 | 4 | FDD | IMD5 |

### 5.1.44 CA\_n2-n5-n77

#### 5.1.44.1 Operating bands for CA

Table 5.1.44.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n2-n5-n77 | 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 |

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

Table 5.1.44.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n2A-n5A-n77A | CA\_n2A-n5A, CA\_n2A-n77A, CA\_n5A-n77A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.44.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n2A-n5A, CA\_n2A-n77A and CA\_n5A-n77A have been captured in TR 38.716-02-00, where:

- IMD3 and IMD5 products are produced by Band n2 and n5 that might fall in Rx of band n77.

- IMD5 products are produced by Band n2 and n77 that might fall in Rx of band n5.

- IMD3 products are produced by Band n5 and n77 might fall in Rx of band n2.

#### 5.1.44.4 REFSENS requirements

The required MSD is based on already completed EN-DC\_2A-5A\_n77A for band n2 and n5 MSD and CA\_n5A-n25A-n77A for band n77 MSD.

Table 5.1.44.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n2A-n5A-n77A | n2 | 1907.5 | 5 | 25 | 1987.5 | N/A | FDD | N/A |
| n5 | 842.5 | 5 | 25 | 887.5 | 3.8 | FDD | IMD5 |
| n77 | 3305 | 5 | 25 | 3305 | N/A | TDD | N/A |
| n2 | 1907 | 5 | 25 | 1987 | 16.5 | FDD | IMD3 |
| n5 | 846.5 | 5 | 25 | 891.5 | N/A | FDD | N/A |
| n77 | 3680 | 5 | 25 | 3680 | N/A | TDD | N/A |
| n2 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n77 | 3540 | 10 | 50 | 3540 | 16.0 | TDD | IMD31 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.45 CA\_n2-n12-n77

#### 5.1.45.1 Operating bands for CA

Table 5.1.45.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n2-n12-n77 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.45.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n2A-n12A-n77A | CA\_n2A-n12A, CA\_n2A-n77A, CA\_n12A-n77A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.45.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n2A-n12A, CA\_n2A-n77A and CA\_n12A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01 where:

- IMD3, IMD4, and IMD5 products are produced by Band n2 and n12 that might fall in Rx of band n77.

- There are no IMD products produced by Band n2 and n77 that might fall in Rx of band n12.

- IMD3 and IMD4 products are produced by Band n12 and n77 might fall in Rx of band n2.

#### 5.1.45.4 REFSENS requirements

The required MSD values are based on already completed CA\_n5A-n25A-n77A for band n2 and n77 MSD.

Table 5.1.45.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n2A-n12A-n77A | n2 | 1880 | 5 | 25 | 1960 | 16.5 | FDD | IMD32 |
| n12 | 707.5 | 5 | 25 | 737.5 | N/A | FDD | N/A |
| n77 | 3375 | 10 | 50 | 3375 | N/A | TDD | N/A |
| n2 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n12 | 707.5 | 5 | 25 | 737.5 | N/A | FDD | N/A |
| n77 | 3315 | 10 | 50 | 3315 | 16.0 | TDD | IMD31,2 |
| 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. | | | | | | | | |

### 5.1.46 CA\_n2-n14-n77

#### 5.1.46.1 Operating bands for CA

Table 5.1.46.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n2-n14-n77 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n14 | 788 MHz | – | 798 MHz | 758 MHz | – | 768 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.46.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n2A-n14A-n77A | CA\_n2A-n14A, CA\_n2A-n77A, CA\_n14A-n77A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.46.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n2A-n14A, CA\_n2A-n77A and CA\_n14A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01 where:

- IMD3 and IMD5 products are produced by Band n2 and n14 that might fall in Rx of band n77.

- There are no IMD products produced by Band n2 and n77 that might fall in Rx of band n14.

- IMD3 products are produced by Band n14 and n77 might fall in Rx of band n2.

#### 5.1.46.4 REFSENS requirements

The required MSD values are based on already completed CA\_n5A-n25A-n77A for band n2 and n77 MSD.

Table 5.1.46.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n2A-n14A-n77A | n2 | 1880 | 5 | 25 | 1960 | 16.5 | FDD | IMD3 |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n77 | 3546 | 10 | 50 | 3546 | N/A | TDD | N/A |
| n2 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n77 | 3466 | 10 | 50 | 3466 | 16.0 | TDD | IMD31 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.47 CA\_n2-n30-n77

#### 5.1.47.1 Operating bands for CA

Table 5.1.47.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n2-n30-n77 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.47.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n2A-n30A-n77A | CA\_n2A-n30A, CA\_n2A-n77A, CA\_n30A-n77A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.47.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n2A-n30A, CA\_n2A-n77A and CA\_n30A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01, where:

- IMD2 and IMD4 products are produced by Band n2 and n30 that might fall in Rx of band n77.

- IMD4 and IMD5 products are produced by Band n2 and n77 that might fall in Rx of band n30.

- IMD4 products are produced by Band n30 and n77 might fall in Rx of band n2.

#### 5.1.47.4 REFSENS requirements

The required MSD values for n2 are derived from DC\_2A-7A\_n77A. The required MSD values for n30 are derived from DC\_1A-40A\_n78A. The required MSD values for n77 are derived from CA\_n2A-n66A-n77A.

Table 5.1.47.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n2A-n30A-n77A | n2 | 1906 | 5 | 25 | 1986 | 8.6 | FDD | IMD4 |
| n30 | 2312 | 5 | 25 | 2357 | N/A | FDD | N/A |
| n77 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
| n2 | 1905 | 5 | 25 | 1985 | N/A | FDD | N/A |
| n30 | 2309 | 5 | 25 | 2354 | 10.6 | FDD | IMD41 |
| n77 | 3361 | 10 | 50 | 3361 | N/A | TDD | N/A |
| n2 | 1870 | 5 | 25 | 1950 | N/A | FDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n77 | 4180 | 10 | 50 | 4180 | 29.4 | TDD | IMD22 |
| 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. | | | | | | | | |

### 5.1.48 CA\_n5-n14-n77

#### 5.1.48.1 Operating bands for CA

Table 5.1.48.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n5-n14-n77 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n14 | 788 MHz | – | 798 MHz | 758 MHz | – | 768 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.48.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n5A-n14A-n77A | CA\_n5A-n14A, CA\_n5A-n77A, CA\_n14A-n77A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.48.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n5A-n14A, CA\_n5A-n77A and CA\_n14A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01 where:

- IMD4 and IMD5 products are produced by Band n5 and n14 that might fall in Rx of band n77.

- IMD4 and IMD5 products are produced by Band n5 and n77 that might fall in Rx of band n14.

- IMD5 products are produced by Band n14 and n77 might fall in Rx of band n5.

#### 5.1.48.4 REFSENS requirements

The required MSD values are based on already completed DC\_18A\_n28A-n77A for band n5 and DC\_8A\_n28A-n77A for n14 and n77 MSD.

Table 5.1.48.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n14A-n77A | n5 | 835 | 5 | 25 | 880 | 3.9 | FDD | IMD5 |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n77 | 4052 | 10 | 50 | 4052 | N/A | TDD | N/A |
| n5 | 846.5 | 5 | 25 | 891.5 | N/A | FDD | N/A |
| n14 | 795.5 | 5 | 25 | 765.5 | 11.6 | FDD | IMD41 |
| n77 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
| n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n77 | 3298 | 10 | 50 | 3298 | 10.3 | TDD | IMD41 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.49 CA\_n5-n30-n77

#### 5.1.49.1 Operating bands for CA

Table 5.1.49.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n5-n30-n77 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.49.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n5A-n30A-n77A | CA\_n5A-n30A, CA\_n5A-n77A, CA\_n30A-n77A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.49.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n5A-n30A, CA\_n5A-n77A and CA\_n30A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01, where:

- IMD3 products are produced by Band n5 and n30 that might fall in Rx of band n77.

- IMD3 products are produced by Band n5 and n77 that might fall in Rx of band n30.

- IMD3 products are produced by Band n30 and n77 might fall in Rx of band n5.

#### 5.1.49.4 REFSENS requirements

The required MSD values for n5 are derived from DC\_13A-66A\_n77A. The required MSD values for n30 are derived from DC\_5A-66A\_n77A. The required MSD values for n77 are derived from CA\_n5-n25-n78.

Table 5.1.49.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n30A-n77A | n5 | 835 | 5 | 25 | 880 | 15.2 | FDD | IMD3 |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n77 | 3740 | 10 | 50 | 3740 | N/A | TDD | N/A |
| n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | 13.2 | FDD | IMD3 |
| n77 | 4025 | 10 | 50 | 4025 | N/A | TDD | N/A |
| n5 | 840 | 5 | 25 | 885 | N/A | FDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n77 | 3780 | 10 | 50 | 3780 | 16.1 | TDD | IMD3 |

### 5.1.50 CA\_n12-n30-n77

#### 5.1.50.1 Operating bands for CA

Table 5.1.50.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n12-n30-n77 | n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.50.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n12A-n30A-n77A | CA\_n12A-n30A, CA\_n12A-n77A, CA\_n30A-n77A | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
| n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.50.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n12A-n30A, CA\_n12A-n77A and CA\_n30A-n77A have been captured in TR 38.717-02-01, where:

- IMD3 products are produced by Band n12 and n30 that might fall in Rx of band n77.

- IMD3 products are produced by Band n12 and n77 that might fall in Rx of band n30.

- IMD3 and IMD5 products are produced by Band n30 and n77 might fall in Rx of band n12.

#### 5.1.50.4 REFSENS requirements

The required MSD values for n12 are derived from DC\_13A-66A\_n77A. The required MSD values for n30 are derived from DC\_5A-66A\_n77A. The required MSD values for n77 are derived from CA\_n5-n25-n77.

Table 5.1.50.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n12A-n30A-n77A | n12 | 710 | 5 | 25 | 740 | 15.2 | FDD | IMD31 |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n77 | 3880 | 10 | 50 | 3880 | N/A | TDD | N/A |
| n12 | 707.5 | 5 | 25 | 737.5 | N/A | FDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | 13.2 | FDD | IMD3 |
| n77 | 3770 | 10 | 50 | 3770 | N/A | TDD | N/A |
| n12 | 707 | 5 | 25 | 737 | N/A | FDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n77 | 3913 | 10 | 50 | 3913 | 16.0 | TDD | IMD3 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.51 CA\_n12-n66-n77

#### 5.1.51.1 Operating bands for CA

Table 5.1.51.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n12-n66-n77 | n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.51.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n12A-n66A-n77A | CA\_n12A-n66A, CA\_n12A-n77A, CA\_n66A-n77A | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 |  |  | 40 |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.51.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n12A-n66A, CA\_n12A-n77A and CA\_n66A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01, where:

- IMD3, IMD4, and IMD5 products are produced by Band n12 and n66 that might fall in Rx of band n77.

- IMD3 products are produced by Band n12 and n77 that might fall in Rx of band n66.

- IMD3 products are produced by Band n66 and n77 might fall in Rx of band n12.

#### 5.1.51.4 REFSENS requirements

The required MSD values for n12 are derived from DC\_13A-66A\_n77A. The required MSD values for n66 are derived from DC\_5A-66A\_n77A. The required MSD values for n77 are derived from CA\_n5-n25-n77.

Table 5.1.51.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n12A-n66A-n77A | n12 | 710 | 5 | 25 | 740 | 15.2 | FDD | IMD3 |
| n66 | 1720 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n77 | 4180 | 10 | 50 | 4180 | N/A | TDD | N/A |
| n12 | 707 | 5 | 25 | 737 | N/A | FDD | N/A |
| n66 | 1746 | 5 | 25 | 2146 | 13.2 | FDD | IMD3 |
| n77 | 3560 | 10 | 50 | 3560 | N/A | TDD | N/A |
| n12 | 704 | 5 | 25 | 734 | N/A | FDD | N/A |
| n66 | 1723 | 5 | 25 | 2123 | N/A | FDD | N/A |
| n77 | 4150 | 10 | 50 | 4150 | 16.0 | TDD | IMD31,2 |
| 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. | | | | | | | | |

### 5.1.52 CA\_n14-n30-n77

#### 5.1.52.1 Operating bands for CA

Table 5.1.52.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n14-n30-n77 | n14 | 788 MHz | – | 798 MHz | 758 MHz | – | 768 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.52.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n14A-n30A-n77A | CA\_n14A-n30A, CA\_n14A-n77A, CA\_n30A-n77A | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.52.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n14A-n30A, CA\_n14A-n77A and CA\_n30A-n77A have been captured in TR 38.717-02-01, where:

- IMD3 products are produced by Band n14 and n30 that might fall in Rx of band n77.

- IMD3 products are produced by Band n14 and n77 that might fall in Rx of band n30.

- IMD3 and IMD5 products are produced by Band n30 and n77 might fall in Rx of band n14.

#### 5.1.52.4 REFSENS requirements

The required MSD values for n14 are derived from DC\_13A-66A\_n77A. The required MSD values for n30 are derived from DC\_5A-66A\_n77A. The required MSD values for n77 are derived from CA\_n5-n25-n77.

Table 5.1.52.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n14A-n30A-n77A | n14 | 793 | 5 | 25 | 763 | 15.2 | FDD | IMD31 |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n77 | 3857 | 10 | 50 | 3857 | N/A | TDD | N/A |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | 13.2 | FDD | IMD3 |
| n77 | 3941 | 10 | 50 | 3941 | N/A | TDD | N/A |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n77 | 3896 | 10 | 50 | 3896 | 16.0 | TDD | IMD3 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.53 CA\_n14-n66-n77

#### 5.1.53.1 Operating bands for CA

Table 5.1.53.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n14-n66-n77 | n14 | 788 MHz | – | 798 MHz | 758 MHz | – | 768 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.53.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n14A-n66A-n77A | CA\_n14A-n66A, CA\_n14A-n77A, CA\_n66A-n77A | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.53.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n14A-n66A, CA\_n14A-n77A and CA\_n66A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01, where:

- IMD3, IMD4, and IMD5 products are produced by Band n14 and n66 that might fall in Rx of band n77.

- IMD3 products are produced by Band n14 and n77 that might fall in Rx of band n66.

- IMD3 products are produced by Band n66 and n77 might fall in Rx of band n14.

#### 5.1.53.4 REFSENS requirements

The required MSD values for n14 are derived from DC\_13A-66A\_n77A. The required MSD values for n66 are derived from DC\_5A-66A\_n77A. The required MSD values for n77 are derived from CA\_n5-n25-n77.

Table 5.1.53.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n14A-n66A-n77A | n14 | 793 | 5 | 25 | 763 | 15.2 | FDD | IMD3 |
| n66 | 1712.5 | 5 | 25 | 2112.5 | N/A | FDD | N/A |
| n77 | 4188 | 10 | 50 | 4188 | N/A | TDD | N/A |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n66 | 1755 | 5 | 25 | 2155 | 13.2 | FDD | IMD3 |
| n77 | 3741 | 10 | 50 | 3741 | N/A | TDD | N/A |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n66 | 1755 | 5 | 25 | 2155 | N/A | FDD | N/A |
| n77 | 3341 | 10 | 50 | 3341 | 16.0 | TDD | IMD31,2 |
| 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. | | | | | | | | |

### 5.1.54 CA\_n30-n66-n77

#### 5.1.54.1 Operating bands for CA

Table 5.1.54.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n30-n66-n77 | n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.54.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n30A-n66A-n77A | CA\_n30A-n66A, CA\_n30A-n77A, CA\_n66A-n77A | n30 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n30A-n66A-n77(2A) | CA\_n30A-n66A, CA\_n30A-n77A, CA\_n66A-n77A | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | |

#### 5.1.54.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n30A-n66A, CA\_n30A-n77A and CA\_n66A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01, where:

- IMD2 and IMD5 products are produced by Band n30 and n66 that might fall in Rx of band n77.

- IMD4 products are produced by Band n30 and n77 that might fall in Rx of band n66.

- IMD2 and IMD5 products are produced by Band n66 and n77 might fall in Rx of band n30.

#### 5.1.54.4 REFSENS requirements

The required MSD values for n30 are derived from DC\_2A-66A\_n77A. The required MSD values for n66 are derived from CA\_7A-66A\_n77A. The required MSD values for n77 are derived from DC\_1A\_n3A-n77A.

Table 5.1.54.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n30A-n66A-n77A  CA\_n30A-n66A-n77(2A) | n30 | 2310 | 5 | 25 | 2355 | 29.2 | FDD | IMD21 |
| n66 | 1745 | 5 | 25 | 2145 | N/A | FDD | N/A |
| n77 | 4100 | 10 | 50 | 4100 | N/A | TDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 8.7 | FDD | IMD4 |
| n77 | 3390 | 10 | 50 | 3390 | N/A | TDD | N/A |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n66 | 1745 | 5 | 25 | 2145 | N/A | FDD | N/A |
| n77 | 4055 | 10 | 50 | 4055 | 28.4 | TDD | IMD21 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.55 CA\_n3-n28-n79

#### 5.1.55.1 Operating bands for CA

Table 5.1.55.1-1: CA band combination of band n3+n28+n79

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.1.55.2-1: Supported bandwidths per CA band combination of band n3+n28+n79

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n3A-n28A-n79A | CA\_n3A-n28A  CA\_n3A-n79A  CA\_n28A-n79A | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  | 0 |
| n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |
| NOTE 3: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | |

#### 5.1.55.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.55.3-1, 5.1.55.3-2 and 5.1.55.3-3, respectively.

Table 5.1.55.3-1: IMD analysis for n3+n28

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 1710 | 1785 | 703 | 748 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 962 | 1082 | 2413 | 2533 |
| 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) | 2672 | 2867 | 379 | 214 |
| 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) | 4123 | 4318 | 3116 | 3281 |
| 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) | 4382 | 4652 | 324 | 534 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 1924 | 2164 |  |  |
| 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) | 5833 | 6103 | 3819 | 4029 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 4826 | 5066 |  |  |
| 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) | 1282 | 1027 | 6437 | 6092 |
| 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) | 1176 | 1461 | 3949 | 3634 |
| 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) | 4522 | 4777 | 7543 | 7888 |
| 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) | 5529 | 5814 | 6536 | 6851 |

Table 5.1.55.3-2: IMD analysis for n3+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 1710 | 1785 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3290 | 2615 | 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) | 1580 | 830 | 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) | 6580 | 5230 |  |  |
| 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) | 18290 | 15815 | 2740 | 1840 |
| 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) | 11580 | 9630 | 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 |

Table 5.1.55.3-3: IMD analysis for n28+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 703 | 748 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4297 | 3652 | 5103 | 5748 |
| 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) | 3594 | 2904 | 8052 | 9297 |
| 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) | 5806 | 6496 | 9503 | 10748 |
| 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) | 2891 | 2156 | 12452 | 14297 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 8594 | 7304 |  |  |
| 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) | 6509 | 7244 | 13903 | 15748 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 10206 | 11496 |  |  |
| 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) | 19297 | 16852 | 1408 | 2188 |
| 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) | 13594 | 11704 | 6556 | 7891 |
| 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) | 18303 | 20748 | 7212 | 7992 |
| 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) | 14606 | 16496 | 10909 | 12244 |

According to the above analysis, the own Rx impact of the 3rd band is shown as the followings.

* 4th and 5th order IMD generated by dual uplink of Band n3 + Band n28 may fall into own Rx of Band n79
* 4th order IMD generated by dual uplink of Band n3 + Band n79 may fall into own Rx of Band n28.
* 5th order IMD generated by dual uplink of Band n28 + Band n79 may fall into own Rx of Band n3.

#### 5.1.55.4 REFSENS requirements

Table 5.1.55.4-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. Considering the MSD analysis for DC\_3A-28A\_n79A and 3A\_n28A-n79A, the following values ar proposed.

Table 5.1.55.4-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n3A-n28A-n79A | n3 | 1770 | 5 | 25 | 1865 | N/A | N/A |
| n28 | 725 | 5 | 25 | 780 | N/A | N/A |
| n79 | 4585 | 40 | 216 | 4585 | 9.4 | IMD41  |2\*fBn3+fBn28| |
| CA\_n3A-n28A-n79A | n3 | 1770 | 5 | 25 | 1865 | N/A | N/A |
| n79 | 4530 | 40 | 216 | 4530 | N/A | N/A |
| n28 | 725 | 5 | 25 | 780 | 10.3 | IMD4  |2\*fBn3+fBn79| |
| CA\_n3A-n28A-n79A | n28 | 725 | 5 | 25 | 780 | N/A | N/A |
| n79 | 4770 | 40 | 216 | 4770 | N/A | N/A |
| n3 | 1775 | 5 | 25 | 1870 | 5.7 | IMD5  |2\*fBn28+fBn79| |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

### 5.1.56 CA\_n28-n77-n79

#### 5.1.56.1 Operating bands for CA

Table 5.1.56.1-1: CA band combination of band n28+n77+n79

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

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

Table 5.1.56.2-1: Supported bandwidths per CA band combination of band n28+n77+n79

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n28A-n77A-n79A4 | CA\_n28A-n77A  CA\_n28A-n79A  CA\_n77A-n79A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |
| CA\_n28A-n77(2A)-n79A4 | CA\_n28A-n77A  CA\_n28A-n79A  CA\_n77A-n79A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |
| NOTE 3: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1.  NOTE 4: The minimum requirements only apply for non simultaneous Tx/Rx between all carriers for TDD combinations. | | | | | | | | | | | | | | | | |

#### 5.1.56.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.56.3-1, 5.1.56.3-2 and 5.1.56.3-3, respectively.

Table 5.1.56.3-1: IMD analysis for n28+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 703 | 748 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3497 | 2552 | 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 |

Table 5.1.56.3-2: IMD analysis for n28+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 703 | 748 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4297 | 3652 | 5103 | 5748 |
| 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) | 3594 | 2904 | 8052 | 9297 |
| 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) | 5806 | 6496 | 9503 | 10748 |
| 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) | 2891 | 2156 | 12452 | 14297 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 8594 | 7304 |  |  |
| 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) | 6509 | 7244 | 13903 | 15748 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 10206 | 11496 |  |  |
| 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) | 19297 | 16852 | 1408 | 2188 |
| 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) | 13594 | 11704 | 6556 | 7891 |
| 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) | 18303 | 20748 | 7212 | 7992 |
| 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) | 14606 | 16496 | 10909 | 12244 |

Table 5.1.56.3-3: IMD analysis for n77+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 3300 | 4200 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1700 | 200 | 7700 | 9200 |
| 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 | 4000 | 4600 | 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 | 13400 | 12100 | 14200 |
| 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 | 8200 | 9000 | 11700 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3400 | 400 |  |  |
| 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 | 17600 | 16500 | 19200 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 15400 | 18400 |  |  |
| 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) | 16700 | 13400 | 12400 | 8200 |
| 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 | 4800 | 3800 | 100 |
| 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 | 24200 | 17600 | 21800 |
| 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 | 23400 | 18700 | 22600 |

According to the above analysis, the own Rx impact of the 3rd band is shown as the followings.

* 2nd, 3rd and 5th order IMD generated by dual uplink of band n28 + band n77 may fall into own Rx of band n79
* 2nd and 3rd order IMD generated by dual uplink of band n28 + band n79 may fall into own Rx of band n77
* 2nd, 4th and 5th order IMD generated by dual uplink of band n77 + band n79 may fall into own Rx of band n28.

But considering the synchronization of band n77 and n79, the own Rx impact of the 3rd band is updated as the followings.

* 2nd, 4th and 5th order IMD generated by dual uplink of band n77 + band n79 may fall into own Rx of band n28.

#### 5.1.56.4 REFSENS requirements

Table 5.1.56.4-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. From the MSD analysis of DC\_28-42\_n79, the following is proposed.

Table 5.1.56.4-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n28A-n77A-n79A | n77 | 3620 | 10 | 52 | 3620 | N/A | N/A |
| n79 | 4420 | 40 | 216 | 4420 | N/A | N/A |
| n28 | 745 | 5 | 25 | 800 | 16.2 | IMD21,2 |
| 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. | | | | | | | |

### 5.1.57 CA\_n25-n48-n665.1.57.1 Operating bands for CA

|  |  |
| --- | --- |
| Table 5.2A.2.2-1: Inter-band CA operating bands involving FR1 (three bands)NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n25-n48-n66 | n25, n48, n66 |

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

Table 5.1.57.2-1: Supported bandwidths per CA\_n25-n48-n66

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n25A-n48A-n66A | CA\_n25A-n48A  CA\_n25A-n66A  CA\_n48A-n66A | n25 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n48 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |  |
|  |  | n66 | 5 | 10 | 15 | 20 |  |  | 40 |  |  |  |  |  |  |  |
|  | CA\_n25A-n48A  CA\_n25A-n66A  CA\_n48A-n66A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
|  |  | n48 | 5 | 10 | 15 | 20 |  |  | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n25A-n48(2A)-n66A | CA\_n25A-n48A  CA\_n25A-n66A  CA\_n48A-n66A | n25 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
|  |  | n66 | 5 | 10 | 15 | 20 |  |  | 40 |  |  |  |  |  |  |  |
|  |  | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n25A-n48C-n66A | CA\_n25A-n48A  CA\_n25A-n66A  CA\_n48A-n66A | n25 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n48 | See CA\_n48C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
|  |  | n66 | 5 | 10 | 15 | 20 |  |  | 40 |  |  |  |  |  |  |  |
|  |  | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
|  |  | n48 | See CA\_n48C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |

#### 5.1.57.3 UE co-existence study

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n25A-n66A and CA\_n48A-n66A have been captured in TS 38.101-1, Table 7.3A.5-1, where:

* IMD3 products produced by Band n25 and n66 might fall in Rx of band n25 and n66. Also, IMD5 products of n25 may fall into band n66
* IMD5 products produced by Band n48 might fall in Rx of band n66.

Co-existence studies for dual uplink operation of two bands CA\_n25A-n48A is captured in provided TP R4-2110696

* For 2UL CA\_n25A-n48A into n66A the 4th order IMD product may fall inside band n66 as seen in Table 5.1.57.3-1

**Table 5.1.57.3-1: Band n25 and Band n48 UL harmonics and IMD products into Band n66**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1850 | 1915 | 3550 | 3700 |
| DL Frequency [MHz] | 1930 | 1995 | 3550 | 3700 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3830 | 7100 | 7400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5745 | 10650 | 11100 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 7400 | 7660 | 14200 | 14800 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 9250 | 9575 | 17750 | 18500 |
| 6th harmonics frequency limits | 6\*fx\_low | 6\*fx\_high | 6\* fy\_low | 6\* fy\_high |
| 6th harmonics frequency limits (MHz) | 11100 | 11490 | 21300 | 22200 |
| 7th harmonics frequency limits | 7\*fx\_low | 7\*fx\_high | 7\* fy\_low | 7\* fy\_high |
| 7th harmonics frequency limits (MHz) | 12950 | 13405 | 24850 | 25900 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1635 | 1850 | 5400 | 5615 |
| 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 | 280 | 5185 | 5550 |
| 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) | 7250 | 7530 | 8950 | 9315 |
| 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) | 1850 | 2195 | 8735 | 9250 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3700 | 3270 | 10800 | 11230 |
| 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) | 9100 | 9445 | 12500 | 13015 |
| 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) | 12950 | 12285 | 4110 | 3700 |
| 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) | 7400 | 6820 | 1355 | 1850 |
| 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) | 16050 | 16715 | 10950 | 11360 |
| 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) | 14350 | 14930 | 12650 | 13145 |

* For 2UL CA\_n25A-n66A into n48A the 2nd order harmonic is captured in 38.101-1 for the combination CA\_n48A-n66A, while the 2nd order IMD product may fall inside band n66 as seen in Table 5.1.57.3-2

**Table 5.1.57.3-2: Band n25 and Band n66 UL harmonics and IMD products into Band n48**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1850 | 1915 | 1710 | 1780 |
| DL Frequency [MHz] | 1930 | 1995 | 2110 | 2200 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3830 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5745 | 5130 | 5340 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 7400 | 7660 | 6840 | 7120 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 9250 | 9575 | 8550 | 8900 |
| 6th harmonics frequency limits | 6\*fx\_low | 6\*fx\_high | 6\* fy\_low | 6\* fy\_high |
| 6th harmonics frequency limits (MHz) | 11100 | 11490 | 10260 | 10680 |
| 7th harmonics frequency limits | 7\*fx\_low | 7\*fx\_high | 7\* fy\_low | 7\* fy\_high |
| 7th harmonics frequency limits (MHz) | 12950 | 13405 | 11970 | 12460 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 205 | 70 | 3560 | 3695 |
| 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) | 1920 | 2120 | 1505 | 1710 |
| 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) | 5410 | 5610 | 5270 | 5475 |
| 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) | 3770 | 4035 | 3215 | 3490 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 140 | 410 | 7120 | 7390 |
| 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) | 7260 | 7525 | 6980 | 7255 |
| 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) | 5270 | 4925 | 5950 | 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) | 1640 | 1300 | 2325 | 1990 |
| 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) | 8690 | 9035 | 9110 | 9440 |
| 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) | 8830 | 9170 | 8970 | 9305 |

* For 2UL CA\_n48A-n66A into n25A the 2nd and the 5th order IMD product may fall inside band n25 as seen in Table 5.1.57.3-3

**Table 5.1.57.3-3: Band n48 and Band n66 UL harmonics and IMD products into Band n25**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3550 | 3700 | 1710 | 1780 |
| DL Frequency [MHz] | 3550 | 3700 | 2110 | 2200 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 7100 | 7400 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 10650 | 11100 | 5130 | 5340 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 14200 | 14800 | 6840 | 7120 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 17750 | 18500 | 8550 | 8900 |
| 6th harmonics frequency limits | 6\*fx\_low | 6\*fx\_high | 6\* fy\_low | 6\* fy\_high |
| 6th harmonics frequency limits (MHz) | 21300 | 22200 | 10260 | 10680 |
| 7th harmonics frequency limits | 7\*fx\_low | 7\*fx\_high | 7\* fy\_low | 7\* fy\_high |
| 7th harmonics frequency limits (MHz) | 24850 | 25900 | 11970 | 12460 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1990 | 1770 | 5260 | 5480 |
| 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) | 5320 | 5690 | 280 | 10 |
| 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) | 8810 | 9180 | 6970 | 7260 |
| 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) | 8870 | 9390 | 1430 | 1790 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3540 | 3980 | 10520 | 10960 |
| 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) | 12360 | 12880 | 8680 | 9040 |
| 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) | 3570 | 3140 | 13090 | 12420 |
| 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 | 2270 | 7680 | 7090 |
| 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) | 10390 | 10820 | 15910 | 16580 |
| 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) | 12230 | 12740 | 14070 | 14660 |

#### 5.1.57.4 REFSENS requirements

The required MSD is based on already completed CA\_n25A-n66A-n77A, since n48 is a subset of the frequency ranges in n77. This is also considered in the table as this reduces some of the 2nd 4th and 5th order IMD products of the reference combination when replacing n77 with n48.

**5.1.57.4-1: MSD due to IMD issue**

| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **Source of IMD** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n25-n48-n66 | n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n48 | 3540 | 10 | 50 | 3540 | N/A | TDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 10.4 | FDD | IMD4 |
| n25 | 1880 | 5 | 25 | 1960 | N/A | FDD | N/A |
| n48 | 3620 | 10 | 50 | 3620 | 29.4 | TDD | IMD2 |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n25 | 1880 | 5 | 25 | 1960 | 32.1 | FDD | IMD21 |
| n48 | 3700 | 10 | 50 | 3700 | N/A | TDD | N/A |
| n66 | 1740 | 5 | 25 | 2140 | N/A | FDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.58 CA\_n7-n25-n78

#### 5.1.58.1 Operating bands for CA

Table 5.1.58.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n25-n78 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.58.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n7A-n25A-n78A | CA\_n7A-n25A  CA\_n7A-n78A  CA\_n25A-n78A | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 704 | 80 | 904 | 100 |  |
| CA\_n7A-n25A-n78(2A) | CA\_n7A-n25A  CA\_n7A-n78A  CA\_n25A-n78A | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n78 | See CA\_n78(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| NOTE 4: This UE channel bandwidth is optional in this release of the specification | | | | | | | | | | | | | | | | |

#### 5.1.58.3 UE co-existence studies

IMD4 generated by UL n7-n78 might affect DL n25.

IMD5 generated by UL n7-n25 might affect DL n78.

#### 5.1.58.4 REFSENS requirements

MSD value n25 are derived from DC\_7A-25A\_n78A.

MSD value n78 are derived from CA\_n3A-8A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.58.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n7A-n25A-n78A | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
| n25 | 1870 | 5 | 25 | 1950 | 8.6 | FDD | IMD4 |
| n78 | 3525 | 10 | 50 | 3525 | N/A | TDD | N/A |
| n7 | 2520 | 5 | 25 | 2640 | N/A | FDD | N/A |
| n25 | 1905 | 5 | 25 | 1985 | N/A | FDD | N/A |
| n78 | 3750 | 10 | 50 | 3750 | 4.5 | TDD | IMD5 |

### 5.1.59 CA\_n5-n12-n77

#### 5.1.59.1 Operating bands for CA

Table 5.1.59.1-1: CA band combination

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_n5-n12-n77 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.59.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA  configuration | NR Band | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz | Bandwidth combination set |
| CA\_n5A-n12A-n77A | CA\_n5A-n12A, CA\_n5A-n77A, CA\_n12A-n77A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.59.3 Co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n5A-n12A, CA\_n5A-n77A and CA\_n12A-n77A have been captured in TR 38.716-02-00 and TR 38.717-02-01 where:

- IMD5 products are produced by Band n5 and n12 that might fall in Rx of band n77.

- IMD5 products are produced by Band n5 and n77 that might fall in Rx of band n12.

- IMD5 products are produced by Band n12 and n77 might fall in Rx of band n5.

#### 5.1.59.4 REFSENS requirements

The required MSD values are based on already completed DC\_18A\_n28A-n77A for band n5 and n12 MSD and DC\_5A-48A\_n12A for band n77 MSD.

Table 5.1.59.4-1: MSD for the CA configuration

| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | IMD order |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n12A-n77A | n5 | 835 | 5 | 25 | 880 | 3.9 | FDD | IMD5 |
| n12 | 707.5 | 5 | 25 | 737.5 | N/A | FDD | N/A |
| n77 | 3710 | 10 | 50 | 3710 | N/A | TDD | N/A |
| n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
| n12 | 710 | 5 | 25 | 740 | 4.4 | FDD | IMD5 |
| n77 | 4080 | 10 | 50 | 4080 | N/A | TDD | N/A |
| n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n12 | 707.5 | 5 | 25 | 737.5 | N/A | FDD | N/A |
| n77 | 3905 | 10 | 50 | 3905 | 4.4 | TDD | IMD5 |

### 5.1.60 CA\_n2-n14-n30

#### 5.1.60.1 Operating bands for CA

Table 5.1.60.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n14-n30 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n14 | 788 MHz | – | 798 MHz | 758 MHz | – | 768 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |

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

Table 5.1.60.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n2A-n14A-n30A | CA\_n2A-n14A  CA\_n2A-n30A  CA\_n14A-n30A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n2(2A)-n14A-n30A | CA\_n2A-n14A  CA\_n2A-n30A  CA\_n14A-n30A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |

5.1.60.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.60.3-1, 5.1.60.3-2 and 5.1.60.3-3, respectively.

Table 5.1.60.3-1: IMD analysis for n2+n14

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1910 | 788 | 798 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1122 | 1052 | 2638 | 2708 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 2902 | 3032 | 334 | 254 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4488 | 4618 | 3426 | 3506 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 4752 | 4942 | 454 | 544 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6338 | 6528 | 4214 | 4304 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 2104 | 2244 | 5276 | 5416 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 1342 | 1242 | 6852 | 6602 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 5002 | 5102 | 8188 | 8438 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 1306 | 1456 | 4154 | 3954 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6064 | 6214 | 7126 | 7326 |

Table 5.1.60.3-2: IMD analysis for n2+n30

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1910 | 2305 | 2315 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 395 | 465 | 4155 | 4225 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1385 | 1515 | 2700 | 2780 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6005 | 6135 | 6460 | 6540 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 3235 | 3425 | 5005 | 5095 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7855 | 8045 | 8765 | 8855 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 930 | 790 | 8310 | 8450 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 7410 | 7310 | 5335 | 5085 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 11070 | 11170 | 9705 | 9955 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 3245 | 3095 | 1120 | 920 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 10615 | 10765 | 10160 | 10360 |

Table 5.1.60.3-3: IMD analysis for n14+n30

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 788 | 798 | 2305 | 2315 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1507 | 1527 | 3093 | 3113 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 739 | 709 | 3812 | 3842 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3881 | 3911 | 5398 | 5428 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 49 | 89 | 6117 | 6157 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4669 | 4709 | 7703 | 7743 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 3054 | 3014 | 6186 | 6226 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 8472 | 8422 | 887 | 837 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 10008 | 10058 | 5457 | 5507 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 5369 | 5319 | 2216 | 2266 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8491 | 8541 | 6974 | 7024 |

The above IMD studies show that there is no intermodulation issue.

#### 5.1.60.4 REFSENS requirements

There is no REFSENS exception.

### 5.1.61 CA\_n2-n14-n66

#### 5.1.61.1 Operating bands for CA

Table 5.1.61.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n14-n66 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n14 | 788 MHz | – | 798 MHz | 758 MHz | – | 768 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.1.61.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n2A-n14A-n66A | CA\_n2A-n14A  CA\_n2A-n66A  CA\_n14A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n2(2A)-n14A-n66A | CA\_n2A-n14A  CA\_n2A-n66A  CA\_n14A-n66A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n2A-n14A-n66(2A) | CA\_n2A-n14A  CA\_n2A-n66A  CA\_n14A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.61.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.61.3-1, 5.1.61.3-2 and 5.1.61.3-3, respectively.

Table 5.1.61.3-1: IMD analysis for n2+n14

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1910 | 788 | 798 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1122 | 1052 | 2638 | 2708 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 2902 | 3032 | 334 | 254 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4488 | 4618 | 3426 | 3506 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 4752 | 4942 | 454 | 544 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 6338 | 6528 | 4214 | 4304 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 2104 | 2244 | 5276 | 5416 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 1342 | 1242 | 6852 | 6602 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 5002 | 5102 | 8188 | 8438 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 1306 | 1456 | 4154 | 3954 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6064 | 6214 | 7126 | 7326 |

Table 5.1.61.3-2: IMD analysis for n2+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1850 | 1910 | 1710 | 1780 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 200 | 70 | 3560 | 3690 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1920 | 2110 | 1510 | 1710 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5410 | 5600 | 5270 | 5470 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 3770 | 4020 | 3220 | 3490 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7260 | 7510 | 6980 | 7250 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 140 | 400 | 7120 | 7380 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 5270 | 4930 | 5930 | 5620 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 8690 | 9030 | 9110 | 9420 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 1640 | 1310 | 2310 | 1990 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8830 | 9160 | 8970 | 9290 |

Table 5.1.61.3-3: IMD analysis for n14+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 788 | 798 | 1710 | 1780 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 912 | 992 | 2498 | 2578 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 204 | 114 | 2622 | 2772 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3286 | 3376 | 4208 | 4358 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 584 | 684 | 4332 | 4552 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4074 | 4174 | 5918 | 6138 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 1984 | 1824 | 4996 | 5156 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 6332 | 6042 | 1482 | 1372 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 7628 | 7918 | 4862 | 4972 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 3764 | 3534 | 1026 | 1196 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6706 | 6936 | 5784 | 5954 |

The above IMD studies show that

* The 4th order IMD generated by dual uplink of n2+n14 may fall into own Rx of n66
* The 3rd and 5th order IMD generated by dual uplink of n2+n66 may fall into own Rx of n66
* The 4th order IMD generated by dual uplink of n14+n66 may fall into own Rx of n2

#### 5.1.61.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

As these 3DL/2UL IMD issues are similar to DC\_2A-14A\_n66A, and DC\_14A-66A\_n2A, the corresponding MSDs are reused.

Table 5.1.61.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n2A-n14A-n66A | n2 | 1874 | 5 | 25 | 1954 | N/A | FDD | N/A |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n66 | 1762 | 5 | 25 | 2162 | 7.6 | FDD | IMD4 |
| n2 | 1874 | 5 | 25 | 1954 | 7.2 | FDD | IMD4 |
| n14 | 793 | 5 | 25 | 763 | N/A | FDD | N/A |
| n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |

### 5.1.62 CA\_n14-n30-n66

#### 5.1.62.1 Operating bands for CA

Table 5.1.62.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n14-n30-n66 | n14 | 788 MHz | – | 798 MHz | 758 MHz | – | 768 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.1.62.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n14A-n30A-n66A | CA\_n14A-n30A  CA\_n14A-n66A  CA\_n30A-n66A | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n14A-n30A-n66(2A) | CA\_n14A-n30A  CA\_n14A-n66A  CA\_n30A-n66A | n14 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.62.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.62.3-1, 5.1.62.3-2 and 5.1.62.3-3, respectively.

Table 5.1.62.3-1: IMD analysis for n14+n30

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 788 | 798 | 2305 | 2315 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1507 | 1527 | 3093 | 3113 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 739 | 709 | 3812 | 3842 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3881 | 3911 | 5398 | 5428 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 49 | 89 | 6117 | 6157 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4669 | 4709 | 7703 | 7743 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 3054 | 3014 | 6186 | 6226 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 8472 | 8422 | 887 | 837 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 10008 | 10058 | 5457 | 5507 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 5369 | 5319 | 2216 | 2266 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8491 | 8541 | 6974 | 7024 |

Table 5.1.62.3-2: IMD analysis for n14+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 788 | 798 | 1710 | 1780 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 912 | 992 | 2498 | 2578 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 204 | 114 | 2622 | 2772 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3286 | 3376 | 4208 | 4358 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 584 | 684 | 4332 | 4552 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4074 | 4174 | 5918 | 6138 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 1984 | 1824 | 4996 | 5156 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 6332 | 6042 | 1482 | 1372 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 7628 | 7918 | 4862 | 4972 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 3764 | 3534 | 1026 | 1196 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6706 | 6936 | 5784 | 5954 |

Table 5.1.62.3-3: IMD analysis for n14+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 788 | 798 | 1710 | 1780 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 912 | 992 | 2498 | 2578 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 204 | 114 | 2622 | 2772 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3286 | 3376 | 4208 | 4358 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 584 | 684 | 4332 | 4552 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4074 | 4174 | 5918 | 6138 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 1984 | 1824 | 4996 | 5156 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 6332 | 6042 | 1482 | 1372 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 7628 | 7918 | 4862 | 4972 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 3764 | 3534 | 1026 | 1196 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6706 | 6936 | 5784 | 5954 |

The above IMD studies show that there is no intermodulation issue.

#### 5.1.62.4 REFSENS requirements

There is no REFSENS exception.

### 5.1.63 CA\_n1-n3-n7

#### 5.1.63.1 Operating bands for CA

Table 5.1.63.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1A-n3A-n7A | 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 |

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

Table 5.1.63.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n3A-n7A | CA\_n1A-n3A  CA\_n1A-n7A  CA\_n3A-n7A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
|  |  | n7 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 1 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
| CA\_n1A-n3A-n7B | CA\_n1A-n3A  CA\_n1A-n7A  CA\_n3A-n7A  CA\_n7B | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
|  |  | n7 | See CA\_n7B Bandwidth Combination Set 0 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | |  |

#### 5.1.63.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products shown in Table 5.1.63.3-1, Table 5.1.63.3-2 and Table 5.1.63.3-3 and show no IMD products falling into third RX band.

**Table 5.1.63.3-1: Band n1 and Band n3 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 1710 | 1785 |
| DL Frequency [MHz] | 2110 | 2170 | 1805 | 1880 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 270 | 540 | 7260 | 7530 |
| 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 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 |

**Table 5.1.63.3-2: Band n1 and Band n7 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 2500 | 2570 |
| DL Frequency [MHz] | 2110 | 2170 | 2620 | 2690 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1300 | 1040 | 8840 | 9100 |
| 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 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) | 8360 | 8020 | 5420 | 5110 |
| 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) | 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 |

**Table 5.1.63.3-3: Band n3 and Band n7 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 2500 | 2570 |
| DL Frequency [MHz] | 1805 | 1880 | 2620 | 2690 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1720 | 1430 | 8420 | 8710 |
| 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 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 |

#### 5.1.63.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

There are no additional IMD products falling inside the third Rx band for the case CA\_n1A-n3A-n7A

### 5.1.64 CA\_n1-n3-n28

#### 5.1.64.1 Operating bands for CA

Table 5.1.64.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1A-n3A-n28A | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

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

Table 5.1.64.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n3A-n28A | CA\_n1A-n3A  CA\_n1A-n28A  CA\_n3A-n28A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 1 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 2 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
|  |  | n28 | 5 | 10 | 15 | 201 |  | 301 |  |  |  |  |  |  |  |  |
| NOTE 1: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz. For the 30MHz bandwidth, the minimum requirements are specified for NR UL transmission bandwidth configuration confined to either 703-733 or 718-748 MHz. | | | | | | | | | | | | | | | | |

#### 5.1.64.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products shown in Table 5.1.64.3-1, Table 5.1.64.3-2 and Table 5.1.64.3-3.

**Table 5.1.64.3-1: Band n1 and Band n3 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 1710 | 1785 |
| DL Frequency [MHz] | 2110 | 2170 | 1805 | 1880 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 270 | 540 | 7260 | 7530 |
| 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 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 |

**Table 5.1.64.3-2: Band n1 and Band n28 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 703 | 748 |
| DL Frequency [MHz] | 2110 | 2170 | 758 | 803 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 2344 | 2554 | 5246 | 5456 |
| 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 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 |

**Table 5.1.64.3-3: Band n3 and Band n28 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 703 | 748 |
| DL Frequency [MHz] | 1805 | 1880 | 758 | 803 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1082 | 962 | 2413 | 2533 |
| 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) | 2672 | 2867 | 379 | 214 |
| 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) | 4123 | 4318 | 3116 | 3281 |
| 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) | 4382 | 4652 | 324 | 534 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1924 | 2164 | 4826 | 5066 |
| 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) | 5833 | 6103 | 3819 | 4029 |
| 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) | 1282 | 1027 | 6437 | 6092 |
| 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) | 1176 | 1461 | 3949 | 3634 |
| 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) | 4522 | 4777 | 7543 | 7888 |
| 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) | 5529 | 5814 | 6536 | 6851 |

The analysis of Table 5.1.64.3-2 shows that for the case of 2UL CA\_n1A-n28A the 5th order IMD product falls inside band n3 RX.

The analysis of Table 5.1.64.3-3 shows that for the case of 2UL CA\_n3A-n28A the 4th order IMD product falls inside band n1 RX.

#### 5.1.64.4 REFSENS requirements

MSD value n3 are derived from CA\_1A-3A-28A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n1-n3-n28 | n1 | 1975 | 5 | 25 | 2165 | N/A | FDD | N/A |
| n28 | 710.5 | 5 | 25 | 765.5 | N/A | FDD | N/A |
| n3 | 1723.5 | 5 | 25 | 1818.5 | 4.0 | FDD | IMD5 |
| n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
| n28 | 710.5 | 5 | 25 | 765.5 | N/A | FDD | N/A |
| n1 | 1949 | 5 | 25 | 2139 | 11.0 | FDD | IMD4 |

### 5.1.65 CA\_n3-n7-n28

#### 5.1.65.1 Operating bands for CA

Table 5.1.65.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n7-n28 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

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

Table 5.1.65.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n3A-n7A-n28A | CA\_n3A-n7A  CA\_n7A-n28A  CA\_n7A-n28A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 1 |
|  |  | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 2 |
|  |  | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| CA\_n3A-n7B-n28A | CA\_n3A-n7A  CA\_n3A-n28A  CA\_n7A-n28A  CA\_n7B | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 1 |
|  |  | n7 | See CA\_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |

#### 5.1.65.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.65.3-1, 5.1.65.3-2 and 5.1.65.3-3, respectively.

Table 5.1.65.3-1: IMD analysis for n3+n7

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 1710 | 1785 | 2500 | 2570 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 715 | 860 | 4210 | 4355 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 850 | 1070 | 3215 | 3430 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 5920 | 6140 | 6710 | 6925 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 2560 | 2855 | 5715 | 6000 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 7630 | 7925 | 9210 | 9495 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 1720 | 1430 | 8420 | 8710 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 8570 | 8215 | 4640 | 4270 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 11710 | 12065 | 9340 | 9710 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 4290 | 3930 | 355 | 10 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 10920 | 11280 | 10130 | 10495 |

Table 5.1.65.3-2: IMD analysis for n7+n28

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 703 | 748 | 2500 | 2570 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 1752 | 1867 | 3203 | 3318 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 1164 | 1004 | 4252 | 4437 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3906 | 4066 | 5703 | 5888 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 461 | 256 | 6752 | 7007 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 4609 | 4814 | 8203 | 8458 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 3734 | 3504 | 6406 | 6636 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 9577 | 9252 | 492 | 242 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 10703 | 11028 | 5312 | 5562 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | 6304 | 6004 | 2756 | 3031 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 8906 | 9206 | 7109 | 7384 |

Table 5.1.65.3-3: IMD analysis for n3+n28

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | f1\_low | f1\_high | f2\_low | f2\_high |
| UL frequencies (MHz) | 703 | 748 | 1710 | 1785 |
| 2nd order IMD products | f2\_low – f1\_high | f2\_high – f1\_low | f2\_low + f1\_low | f2\_high + f1\_high |
| IMD frequency limit (MHz) | 962 | 1082 | 2413 | 2533 |
| 3rd order IMD products | 2\*f1\_low – f2\_high | 2\*f1\_high – f2\_low | 2\*f2\_low – f1\_high | 2\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 379 | 214 | 2672 | 2867 |
| 3rd order IMD products | 2\*f1\_low + f2\_low | 2\*f1\_high + f2\_high | 2\*f2\_low + f1\_low | 2\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3116 | 3281 | 4123 | 4318 |
| 4th order IMD products | 3\*f1\_low – f2\_high | 3\*f1\_high – f2\_low | 3\*f2\_low – f1\_high | 3\*f2\_high – f1\_low |
| IMD frequency limit (MHz) | 324 | 534 | 4382 | 4652 |
| 4th order IMD products | 3\*f1\_low + f2\_low | 3\*f1\_high + f2\_high | 3\*f2\_low + f1\_low | 3\*f2\_high + f1\_high |
| IMD frequency limit (MHz) | 3819 | 4029 | 5833 | 6103 |
| 4th order IMD products | 2\*f1\_low – 2\*f2\_high | 2\*f1\_high – 2\*f2\_low | 2\*f1\_low + 2\*f2\_low | 2\*f1\_high + 2\*f2\_high |
| IMD frequency limit (MHz) | 2164 | 1924 | 4826 | 5066 |
| 5th order IMD products | f1\_low – 4\*f2\_high | f1\_high – 4\*f2\_low | f2\_low – 4\*f1\_high | f2\_high – 4\*f1\_low |
| IMD frequency limit (MHz) | 6437 | 6092 | 1282 | 1027 |
| 5th order IMD products | f1\_low + 4\*f2\_low | f1\_high + 4\*f2\_high | f2\_low + 4\*f1\_low | f2\_high + 4\*f1\_high |
| IMD frequency limit (MHz) | 7543 | 7888 | 4522 | 4777 |
| 5th order IMD products | 2\*f1\_low – 3\*f2\_high | 2\*f1\_high - 3\*f2\_low | 2\*f2\_low – 3\*f1\_high | 2\*f2\_high – 3\*f1\_low |
| IMD frequency limit (MHz) | -3949 | -3634 | 1176 | 1461 |
| 5th order IMD products | 2\*f1\_low + 3\*f2\_low | 2\*f1\_high + 3\*f2\_high | 2\*f2\_low + 3\*f1\_low | 2\*f2\_high + 3\*f1\_high |
| IMD frequency limit (MHz) | 6536 | 6851 | 5529 | 5814 |

The above IMD studies show that

* The 2nd order IMD generated by dual uplink of n3+n7 may fall into own Rx of n28
* The 4th order IMD generated by dual uplink of n3+n7 may fall into own Rx of n7
* The 2nd order IMD generated by dual uplink of n7+n28 may fall into own Rx of n3
* The 3rd order IMD generated by dual uplink of n3+n28 may fall into own Rx of n7

#### 5.1.65.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

As these 3DL/2UL IMD issues are similar to E-UTRA CA\_3A\_n7A-n28A, the corresponding MSDs are reused.

Table 5.1.65.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n3A-n7A-n28A | n3 | 1747 | 5 | 25 | 1842 | N/A | FDD | N/A |
| n7 | 2543 | 5 | 25 | 2663 | N/A | FDD | N/A |
| n28 | 741 | 5 | 25 | 796 | 20.0 | FDD | IMD2 |
| n3 | 1712.5 | 5 | 25 | 1807.5 | N/A | FDD | N/A |
| n7 | 2562 | 5 | 25 | 2682 | 17.0 | FDD | IMD3 |
| n28 | 743 | 5 | 25 | 798 | N/A | FDD | N/A |
| n3 | 1737.5 | 5 | 25 | 1832.5 | 16.5 | FDD | IMD2 |
| n7 | 2543 | 5 | 25 | 2663 | N/A | FDD | N/A |
| n28 | 710.5 | 5 | 25 | 765.5 | N/A | FDD | N/A |

### 5.1.66 CA\_n3-n77-n79

#### 5.1.66.1 Operating bands for CA

Table 5.1.66.1-1: CA band combination of band n3+n77+n79

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

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

Table 5.1.66.2-1: Supported bandwidths per CA band combination of band n3+n77+n79

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | Bandwidth combination set | |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |  |
| CA\_n3A-n77A-n79A | CA\_n3A-n77A  CA\_n3A-n79A  CA\_n77A-n79A | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  | | 0 |
|  |  | n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 | |  |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 | |  |
| CA\_n3A-n77(2A)-n79A | CA\_n3A-n77A  CA\_n3A-n79A  CA\_n77A-n79A | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  | | 0 |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | |  |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 | |  |
| NOTE 3: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | |

#### 5.1.66.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.66.3-1, 5.1.66.3-2 and 5.1.66.3-3, respectively.

Table 5.1.66.3-1: IMD analysis for n3+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 1710 | 1785 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2490 | 1515 | 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 |

Table 5.1.66.3-2: IMD analysis for n3+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 1710 | 1785 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3290 | 2615 | 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) | 1580 | 830 | 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) | 6580 | 5230 |  |  |
| 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) | 18290 | 15815 | 2740 | 1840 |
| 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) | 11580 | 9630 | 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 |

Table 5.1.66.3-3: IMD analysis for n77+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 3300 | 4200 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1700 | 200 | 7700 | 9200 |
| 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 | 4000 | 4600 | 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 | 13400 | 12100 | 14200 |
| 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 | 8200 | 9000 | 11700 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3400 | 400 |  |  |
| 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 | 17600 | 16500 | 19200 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 15400 | 18400 |  |  |
| 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) | 16700 | 13400 | 12400 | 8200 |
| 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 | 4800 | 3800 | 100 |
| 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 | 24200 | 17600 | 21800 |
| 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 | 23400 | 18700 | 22600 |

According to the above analysis, the own Rx impact of the 3rd band is shown as the followings.

* 3rd and 4th order IMD generated by dual uplink of Band n3 + Band n77 may fall into own Rx of Band n79
* 5th order IMD generated by dual uplink of Band n3 + Band n79 may fall into own Rx of Band n77
* 3rd, 4th and 5th order IMD generated by dual uplink of Band n77 + Band n79 may fall into own Rx of Band n3.

But considering the synchronization of band n77 and n79, the own Rx impact of the 3rd band is updated as the followings.

* 3rd, 4th and 5th order IMD generated by dual uplink of Band n77 + Band n79 may fall into own Rx of Band n3.

#### 5.1.66.4 REFSENS requirements

Table 5.1.66.4-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band.

Table 5.1.66.4-1: MSD for the CA configuration

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n3A-n77A-n79A | n77 | 3350 | 10 | 50 | 3350 | N/A | N/A |
| n79 | 4840 | 40 | 216 | 4840 | N/A | N/A |
| n3 | 1765 | 5 | 25 | 1860 | 15.7 | IMD31, 2  |2\*fBn77-fBn79| |
| 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. | | | | | | | |

### 5.1.67 CA\_n1-n5-n78

#### 5.1.67.1 Operating bands for CA

Table 5.1.67.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n5-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.67.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **BCS** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n5A-n78A | CA\_n1A-n5A  CA\_n1A-n78A  CA\_n5A-n78A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |

#### 5.1.67.3 UE co-existence studies

IMD3 generated by UL n5-n78 might affect DL n1.

IMD3 generated by UL n1-n5 might affect DL n78.

IMD5 generated by UL n1-n78 might affect DL n5.

#### 5.1.67.4 REFSENS requirements

MSD values n5 and n1 are derived from DC\_1A-5A\_n78A.

MSD value n78 is derived from DC\_1A\_n28A-n78A

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n1-n5-n78 | n1 | 1932 | 5 | 25 | 2122 | 18.1 | FDD | IMD3 |
| n5 | 829 | 5 | 25 | 874 | N/A | FDD | N/A |
| n78 | 3780 | 10 | 50 | 3780 | N/A | TDD | N/A |
| n1 | 1975 | 5 | 25 | 2165 | N/A | FDD | N/A |
| n5 | 840 | 5 | 25 | 885 | 3.1 | FDD | IMD5 |
| n78 | 3405 | 10 | 50 | 3405 | N/A | TDD | N/A |
| n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
| n78 | 3610 | 10 | 50 | 3610 | 15.7 | TDD | IMD3 |

### 5.1.68 CA\_n1-n3-n5

#### 5.1.68.1 Operating bands for CA

Table 5.1.68.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n5 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |

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

Table 5.1.68.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **BCS** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n3A-n5A | CA\_n1A-n3A  CA\_n1A-n5A  CA\_n3A-n5A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |

#### 5.1.68.3 UE co-existence studies

UL n1-n3 have no IMD towards DL n5.

UL n1-n5 have no IMD towards DL n3.

UL n3-n5 have no IMD towards DL n1.

#### 5.1.68.4 REFSENS requirements

Based on co-existence studies, there are no need to define additional REFSENS requirements.

### 5.1.69 CA\_n1-n5-n7

#### 5.1.69.1 Operating bands for CA

Table 5.1.69.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n5-n7 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |

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

Table 5.1.69.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **BCS** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n5A-n7A | CA\_n1A-n5A  CA\_n1A-n7A  CA\_n5A-n7A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
| CA\_n1A-n5A-n7B | CA\_n1A-n5A  CA\_n1A-n7A  CA\_n5A-n7A  CA\_n7B | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| n7 | See CA\_n7B Bandwidth Combination Set 0 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | |

#### 5.1.69.3 UE co-existence studies

IMD5 generated by UL n1-n7 might affect DL n5.

#### 5.1.69.4 REFSENS requirements

MSD value n5 are derived from CA\_1A-5A-7A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n1-n5-n7 | n1 | 1968 | 5 | 25 | 2158 | N/A | FDD | N/A |
| n7 | 2512 | 10 | 50 | 2632 | N/A | FDD | N/A |
| n5 | 835 | 5 | 25 | 880 | 1.0 | FDD | IMD5 |

### 5.1.70 CA\_n28-n41-n79

#### 5.1.70.1 Operating bands for CA

**Table 5.1.70.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28A-n41A-n79A3 | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | TDD |
| n41 | 2496 MHz | – | 2690MHz | 2496 MHz | – | 2690 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| NOTE 3: Applicable for UE supporting inter-band carrier aggregation with mandatory simultaneous Rx/Tx capability | | | | | | | | |

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

Table 5.1.70.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) | | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n28A-n41A-n79A | CA\_n28A-n41A  CA\_n28A-n79A  CA\_n41A-n79A | n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  | 0 |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |

#### 5.1.70.3 Co-existence studies

The co-existence studies for the UL CA configurations of CA\_n28A-n41A, CA\_n28A-n79A, CA\_n41A-n79A have already captured in TR 38.716-02-00, where:

- 3rd and 5th intermodulations caused by 2UL CA\_n41A-n79A may fall into band n28 own DL Rx range.

- 3rd and 4th intermodulations caused by 2UL CA\_n28A-n41A may fall into band n79 own DL Rx range.

- 4th intermodulations caused by 2UL CA\_n28A-n79A may fall into band n41 own DL Rx range.

#### 5.1.70.4 MSD

The MSD values caused by the intemodulation are defined as:

Table 5.1.70.4-1 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n28-n41-n79 | n28 | 725 | 5 | 25 | 780 | 13.0 | FDD | IMD31 |
|  | n41 | 2600 | 10 | 50 | 2600 | N/A | TDD | N/A |
|  | n79 | 4600 | 40 | 216 | 4600 | N/A | TDD | N/A |
|  | n28 | 720 | 5 | 25 | 780 | N/A | FDD | N/A |
|  | n41 | 2600 | 10 | 50 | 2600 | N/A | TDD | N/A |
|  | n79 | 4480 | 40 | 216 | 4600 | 10.1 | TDD | IMD32 |
|  | n28 | 735 | 5 | 25 | 790 | N/A | FDD | N/A |
|  | n41 | 2645 | 10 | 50 | 2645 | 10.4 | TDD | IMD4 |
|  | n79 | 4850 | 40 | 216 | 4850 | 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. | | | | | | | | |

### 5.1.71 CA\_n25-n38-n66

#### 5.1.71.1 Operating bands for CA

**Table 5.1.71.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25A-n38A-n66A  CA\_n25(2A)-n38A-n66A  CA\_n25A-n38A-n66(2A)  CA\_n25(2A)-n38A-n66(2A) | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n38 | 2570 MHz | – | 2620 MHz | 2570 MHz | – | 2620 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD |

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

**Table 5.1.71.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n25A-n38A-n66A | CA\_n25A-n38A  CA\_n25A-n66A  CA\_n38A-n66A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n25(2A)-n38A-n66A | CA\_n25A-n38A  CA\_n25A-n66A  CA\_n38A-n66A | n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| n38 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  | CA\_n25A-n38A  CA\_n25A-n66A  CA\_n38A-n66A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| CA\_n25A-n38A-n66(2A) | n38 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
|  | CA\_n25A-n38A  CA\_n25A-n66A  CA\_n38A-n66A | n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| CA\_n25(2A)-n38A-n66(2A) | n38 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.71.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

* No IMD products produced by Band n25 and n38 that falling into the band n66 Rx.
* No IMD products produced by Band n25 and n66 that falling into the band n38 Rx.
* No IMD products produced by Band n38 and n66 that falling into the band n25 Rx.

#### 5.1.71.4 REFSENS requirements

There is no additional IMD issue for the combination.

### 5.1.72 CA\_n3-n5-n7

#### 5.1.72.1 Operating bands for CA

Table 5.1.72.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n5-n7 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |

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

Table 5.1.72.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n3A-n5A-n7A | CA\_n3A-n5A  CA\_n3A-n7A  CA\_n5A-n7A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 1 |
|  |  | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
| CA\_n3A-n5A-n7B | CA\_n3A-n5A  CA\_n3A-n7A  CA\_n5A-n7A  CA\_n7B | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 1 |
|  |  | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n7 | See CA\_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |  |

#### 5.1.72.3 UE co-existence studies

IMD3 generated by UL n3-n7 might affect DL n5.

IMD2 and IMD3 generated by UL n3-n5 might affect DL n7.

#### 5.1.72.4 REFSENS requirements

MSD value n5 are derived from DC\_3A-18A\_n41A.

MSD value n7 are derived from DC\_3A-7A\_n5A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.72.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n3-n5-n7 | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
| n5 | 845 | 5 | 25 | 890 | N/A | FDD | N/A |
| n7 | 2505 | 10 | 50 | 2625 | 30.0 | FDD | IMD24 |
| n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
| n5 | 835 | 5 | 25 | 880 | 19.0 | FDD | IMD3 |
| n7 | 2560 | 10 | 50 | 2680 | N/A | FDD | N/A |
| NOTE 4: This band is subject to IMD3 also which MSD is not specified. | | | | | | | | |

### 5.1.73 CA\_n3-n5-n78

#### 5.1.73.1 Operating bands for CA

Table 5.1.73.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n5-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.73.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n3A-n5A-n78A | CA\_n3A-n5A  CA\_n3A-n78A  CA\_n5A-n78A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |

#### 5.1.73.3 UE co-existence studies

IMD3 generated by UL n5-n78 might affect DL n3.

IMD3 and IMD5 generated by UL n3-n5 might affect DL n78.

#### 5.1.73.4 REFSENS requirements

MSD value n5 are derived from CA\_n3-n8-n78.

MSD values n78 are derived from CA\_n3-n8-n78.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.73.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n3-n5-n78 | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
| n5 | 839 | 5 | 25 | 884 | N/A | FDD | N/A |
| n78 | 3408 | 10 | 50 | 3408 | 16.1 | TDD | IMD3 |
| n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
| n5 | 839 | 5 | 25 | 884 | N/A | FDD | N/A |
| n78 | 3512 | 10 | 50 | 3512 | 4.5 | TDD | IMD5 |
| n3 | 1767 | 5 | 25 | 1862 | 15.7 | FDD | IMD3 |
| n5 | 839 | 5 | 25 | 884 | N/A | FDD | N/A |
| n78 | 3540 | 10 | 50 | 3540 | N/A | TDD | N/A |

### 5.1.74 CA\_n3-n7-n78

#### 5.1.74.1 Operating bands for CA

Table 5.1.74.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n7-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.74.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | | **10** | **15** | | **20** | **25** | | **30** | | | **40** | **50** | | **60** | | | **70** | **80** | | | **90** | | **100** |  |
| CA\_n3A-n7A-n78A | CA\_n3A-n7A  CA\_n3A-n78A  CA\_n7A-n78A | n3 | 5 | | 10 | 15 | | 20 | 25 | | 30 | | | 40 |  | |  | | |  |  | | |  | |  | 1 |
|  |  | n7 | 5 | | 10 | 15 | | 20 | 25 | | 30 | | | 40 | 50 | |  | | |  |  | | |  | |  |  |
|  |  | n78 |  | | 10 | 15 | | 20 | 25 | | 30 | | | 40 | 50 | | 60 | | | 704 | 80 | | | 90 | | 100 |  |
| CA\_n3A-n7B-n78A | CA\_n3A-n7A  CA\_n3A-n78A  CA\_n7A-n78A  CA\_n7B | n3 | 5 | | 10 | 15 | | 20 | 25 | | 30 | | | 40 |  | |  | | |  |  | | |  | |  | 1 |
|  |  | n7 | See CA\_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | | | | | | | | | | |  |
|  |  | n78 |  | 10 | | 15 | 20 | | | 25 | | 30 | 40 | | | 50 | | 60 | 704 | | | 80 | 90 | | 100 | |  |
| CA\_n3A-n7A-n78(2A) | CA\_n3A-n7A  CA\_n3A-n78A  CA\_n7A-n78A | n3 | 5 | | 10 | 15 | | 20 | 25 | | 30 | | | 40 |  | |  | | |  |  | | |  | |  | 0 |
|  |  | n7 | 5 | | 10 | 15 | | 20 | 25 | | 30 | | | 40 | 50 | |  | | |  |  | | |  | |  |  |
|  |  | n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | | | | | | | | | | | | |  |
| NOTE 4: This UE channel bandwidth is optional in this release of the specification. | | | | | | | | | | | | | | | | | | | | | | | | | | | |

#### 5.1.74.3 UE co-existence studies

IMD3 generated by UL n3-n7 might affect DL n78.

IMD3 and IMD4 generated by UL n7-n78 might affect DL n3.

#### 5.1.74.4 REFSENS requirements

MSD value n3 are derived from DC\_3A-7A\_n78A.

MSD value n78 are derived from DC\_3A\_n7A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.74.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n3-n7-n78 | n3 | 1725 | 5 | 25 | 1820 | 17.6 | FDD | IMD3 |
| n7 | 2565 | 5 | 25 | 2685 | N/A | FDD | N/A |
| n78 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |
| n3 | 1725 | 5 | 25 | 1820 | 8.6 | FDD | IMD4 |
| n7 | 2565 | 5 | 25 | 2685 | N/A | FDD | N/A |
| n78 | 3475 | 10 | 50 | 3475 | 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 |
| n78 | 3390 | 10 | 50 | 3390 | 16.1 | TDD | IMD3 |

### 5.1.75 CA\_n5-n7-n78

#### 5.1.75.1 Operating bands for CA

Table 5.1.75.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n7-n78 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.75.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | | **10** | | **15** | | **20** | **25** | | **30** | | | **40** | | **50** | **60** | | | **70** | **80** | | | **90** | | **100** |  |
| CA\_n5A-n7A-n78A | CA\_n5A-n7A  CA\_n5A-n78A  CA\_n7A-n78A | n5 | 5 | | 10 | | 15 | | 20 |  | |  | | |  | |  |  | | |  |  | | |  | |  | 1 |
|  |  | n7 | 5 | | 10 | | 15 | | 20 | 25 | | 30 | | | 40 | | 50 |  | | |  |  | | |  | |  |  |
|  |  | n78 |  | | 10 | | 15 | | 20 | 25 | | 30 | | | 40 | | 50 | 60 | | | 704 | 80 | | | 90 | | 100 |  |
| CA\_n5A-n7B-n78A | CA\_n5A-n7A  CA\_n5A-n78A  CA\_n7A-n78A  CA\_n7B | n5 | 5 | | 10 | | 15 | | 20 |  | |  | | |  | |  |  | | |  |  | | |  | |  | 1 |
|  |  | n7 | See CA\_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | | | | | | | | | | | |  |
|  |  | n78 |  | 10 | | 15 | | 20 | | | 25 | | 30 | 40 | | 50 | | | 60 | 704 | | | 80 | 90 | | 100 | |  |
| NOTE 4: This UE channel bandwidth is optional in this release of the specification. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

#### 5.1.75.3 UE co-existence studies

IMD2 and IMD4 generated by UL n5-n7 might affect DL n78.

IMD2 generated by UL n5-n78 might affect DL n7.

IMD2 and IMD5 generated by UL n7-n78 might affect DL n5.

#### 5.1.75.4 REFSENS requirements

MSD value n5 is derived from DC\_5A-7A\_n78A.

MSD value n7 is derived from DC\_5A-7A\_n78A

IMD2 MSD value n78 is derived from DC\_5A\_n7A-n78A.

IMD4 MSD value n78 is derived from DC\_7A\_n71A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.75.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n5-n7-n78 | n5 | 834 | 5 | 25 | 879 | 30.2 | FDD | IMD2 |
| n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
| n78 | 3429 | 10 | 50 | 3429 | N/A | TDD | N/A |
| n5 | 830 | 5 | 25 | 875 | 3.3 | FDD | IMD5 |
| n7 | 2525 | 5 | 25 | 2645 | N/A | FDD | N/A |
| n78 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |
| n5 | 844 | 5 | 25 | 889 | N/A | FDD | N/A |
| n7 | 2525 | 5 | 25 | 2645 | 30.1 | FDD | IMD2 |
| n78 | 3489 | 10 | 50 | 3489 | N/A | TDD | N/A |
| n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
| n7 | 2540 | 5 | 25 | 2660 | N/A | FDD | N/A |
| n78 | 3375 | 10 | 50 | 3375 | 29.7 | TDD | IMD2 |
| n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
| n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
| n78 | 3430 | 10 | 50 | 3430 | 9.7 | TDD | IMD4 |

### 5.1.76 CA\_n7-n28-n78

#### 5.1.76.1 Operating bands for CA

Table 5.1.76.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n28-n78 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.76.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n7A-n28A-n78A | CA\_n7A-n28A  CA\_n7A-n78A  CA\_n28A-n78A | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 1 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 704 | 80 | 90 | 100 |  |
| CA\_n7B-n28A-n78A | CA\_n7A-n28A  CA\_n7A-n78A  CA\_n28A-n78A  CA\_n7B | n7 | See CA\_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 1 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 704 | 80 | 90 | 100 |  |
| NOTE 4: This UE channel bandwidth is optional in this release of the specification. | | | | | | | | | | | | | | | | |

#### 5.1.76.3 UE co-existence studies

IMD2 and IMD4 generated by UL n7-n28 might affect DL n78.

IMD2 generated by UL n28-n78 might affect DL n7.

IMD2 and IMD5 generated by UL n7-n78 might affect DL n28.

#### 5.1.76.4 REFSENS requirements

MSD value n28 is derived from DC\_7A-28A\_n78A.

MSD value n7 is derived from DC\_7A-28A\_n78A

IMD2 MSD value n78 is derived from DC\_7A\_n28A-n78A.

IMD4 MSD value n78 is derived from DC\_7A\_n71A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.76.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n7-n28-n78 | n7 | 2567.5 | 5 | 25 | 2687.5 | N/A | FDD | N/A |
| n28 | 727.5 | 5 | 25 | 782.5 | 28.8 | FDD | IMD2 |
| n78 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |
| n7 | 2567.5 | 5 | 25 | 2687.5 | N/A | FDD | N/A |
| n28 | 727.5 | 5 | 25 | 782.5 | 3.0 | FDD | IMD5 |
| n78 | 3460 | 10 | 50 | 3460 | N/A | TDD | N/A |
| n7 | 2530 | 5 | 25 | 2650 | 30.5 | FDD | IMD2 |
| n28 | 740 | 5 | 25 | 795 | N/A | FDD | N/A |
| n78 | 3390 | 10 | 50 | 3390 | N/A | TDD | N/A |
| n7 | 2565 | 5 | 25 | 2685 | N/A | FDD | N/A |
| n28 | 745 | 5 | 25 | 800 | N/A | FDD | N/A |
| n78 | 3310 | 10 | 50 | 3310 | 29.7 | TDD | IMD2 |
| n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
| n28 | 720 | 5 | 25 | 775 | N/A | FDD | N/A |
| n78 | 3714 | 10 | 50 | 3714 | 9.7 | TDD | IMD4 |

### 5.1.77 CA\_n1-n28-n78

#### 5.1.77.1 Operating bands for CA

Table 5.1.77.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n28-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.77.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n28A-n78A | CA\_n1A-n28A  CA\_n1A-n78A  CA\_n28A-n78A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 |  | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |  |
|  |  | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 1 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n1A-n28A-n78(2A) | CA\_n1A-n28A  CA\_n1A-n78A  CA\_n28A-n78A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
|  |  | n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |

#### 5.1.77.3 UE co-existence studies

IMD3 generated by UL n1-n28 might affect DL n78.

IMD5 generated by UL n1-n78 might affect DL n28.

IMD3 generated by UL n28-n78 might affect DL n1.

#### 5.1.77.4 REFSENS requirements

MSD values are derived from DC\_1A-28A\_n78A and DC\_1A\_n28A-n78A.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.77.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n1-n28-n78 | n1 | 1960 | 5 | 25 | 2150 | 15.7 | FDD | IMD3 |
| n28 | 740 | 5 | 25 | 795 | N/A | FDD | N/A |
| n78 | 3630 | 10 | 50 | 3630 | N/A | TDD | N/A |
| n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n28 | 739 | 5 | 25 | 794 | 4.2 | FDD | IMD5 |
| n78 | 3352 | 10 | 50 | 3352 | N/A | TDD | N/A |
| n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n28 | 733 | 5 | 25 | 788 | N/A | FDD | N/A |
| n78 | 3416 | 10 | 50 | 3416 | 15.7 | TDD | IMD3 |

### 5.1.78 CA\_n25-n41-n78

#### 5.1.78.1 Operating bands for CA

Table 5.1.78.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n41-n78 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.78.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n25A-n41A-n78A | CA\_n25A-n41A  CA\_n25A-n78A  CA\_n41A-n78A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
|  |  | n41 | 5 | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n25A-n41A-n78(2A) | CA\_n25A-n41A  CA\_n25A-n78A  CA\_n41A-n78A | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
|  |  | n41 | 5 | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.78.3 UE co-existence studies

IMD3 and IMD5 generated by UL n25-n41 might affect DL n78.

IMD3 and IMD4 generated by UL n41-n78 might affect DL n25.

#### 5.1.78.4 REFSENS requirements

MSD values are derived from CA\_n25-n41-n77.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.78.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n25-n41-n78 | n25 | 1870 | 5 | 25 | 1950 | N/A | FDD | N/A |
| n41 | 2610 | 5 | 25 | 2610 | N/A | TDD | N/A |
| n78 | 3350 | 10 | 50 | 3350 | 14.8 | TDD | IMD3 |
| n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
| n41 | 2525 | 5 | 25 | 2645 | N/A | TDD | N/A |
| n78 | 3775 | 10 | 50 | 3775 | 4.2 | TDD | IMD5 |
| n25 | 1870 | 5 | 25 | 1950 | 17.6 | FDD | IMD3 |
| n41 | 2565 | 5 | 25 | 2565 | N/A | TDD | N/A |
| n78 | 3180 | 10 | 50 | 3310 | N/A | TDD | N/A |
| n25 | 1870 | 5 | 25 | 1950 | 8.6 | FDD | IMD4 |
| n41 | 2550 | 5 | 25 | 2685 | N/A | TDD | N/A |
| n78 | 3525 | 10 | 50 | 3475 | N/A | TDD | N/A |

### 5.1.79 CA\_n41-n71-n78

#### 5.1.79.1 Operating bands for CA

Table 5.1.79.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41-n71-n78 | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.79.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n41A-n71A-n78A | CA\_n41A-n71A  CA\_n41A-n78A  CA\_n71A-n78A | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
|  |  | n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n41A-n71A-n78(2A) | CA\_n41A-n71A  CA\_n41A-n78A  CA\_n71A-n78A | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
|  |  | n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n78 | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.79.3 UE co-existence studies

IMD2, IMD4 and IMD5 generated by UL n41-n71 might affect DL n78.

IMD2 generated by UL n71-n78 might affect DL n41.

IMD2 and IMD5 generated by UL n41-n78 might affect DL n71.

#### 5.1.79.4 REFSENS requirements

MSD values are derived from CA\_n41-n71-n77.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.79.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n41-n71-n78 | n41 | 2615 | 5 | 25 | 2615 | N/A | TDD | N/A |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n78 | 3308 | 10 | 50 | 3308 | 29.1 | TDD | IMD21 |
| n41 | 2580 | 5 | 25 | 2580 | N/A | TDD | N/A |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 3774 | 10 | 50 | 3774 | 10.3 | TDD | IMD41 |
| n41 | 2615 | 5 | 25 | 2615 | 28.7 | TDD | IMD2 |
| n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
| n77 | 3308 | 10 | 50 | 3308 | N/A | TDD | N/A |
| 41 | 2642 | 5 | 25 | 2642 | N/A | TDD | N/A |
| n71 | 743 | 5 | 25 | 798 | 30.8 | FDD | IMD2 |
| n77 | 3440 | 10 | 50 | 3440 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.80 CA\_n41-n66-n78

#### 5.1.80.1 Operating bands for CA

Table 5.1.80.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41-n66-n78 | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.80.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | | **Uplink CA configuration** | | **NR Band** | | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | | | | | | | | | | | | | | **Bandwidth combination set** | |
|  | |  | |  | | **5** | | **10** | | **15** | | **20** | | **25** | | **30** | | **40** | | **50** | | **60** | | **70** | | **80** | | **90** | | **100** | |  | |
| CA\_n41A-n66A-n78A | | CA\_n41A-n66A  CA\_n41A-n78A  CA\_n66A-n78A | | n41 | |  | | 10 | | 15 | | 20 | |  | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | | 100 | | 0 | |
|  | |  | | n66 | | 5 | | 10 | | 15 | | 20 | | 25 | | 30 | | 40 | |  | |  | |  | |  | |  | |  | |  | |
|  | |  | | n78 | |  | | 10 | | 15 | | 20 | | 25 | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | | 100 | |  | |
| CA\_n41A-n66A-n78(2A) | | CA\_n41A-n66A  CA\_n41A-n78A  CA\_n66A-n78A | | n41 | |  | | 10 | | 15 | | 20 | |  | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | | 100 | | 0 | |
|  | |  | | n66 | | 5 | | 10 | | 15 | | 20 | | 25 | | 30 | | 40 | |  | |  | |  | |  | |  | |  | |  | |
|  | |  | | n78 | | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | | | | | | | | | | | | | | |  | |
| CA\_n41A-n66(2A)-n78A | | CA\_n41A-n66A  CA\_n41A-n78A  CA\_n66A-n78A | | n41 | |  | | 10 | | 15 | | 20 | |  | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | | 100 | | 0 | |
|  | |  | | n66 | | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | | | | | | | | | | | | |  | |
|  | |  | | n78 | |  | | 10 | | 15 | | 20 | | 25 | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | | 100 | |  | |
| CA\_n41A-n66(2A)-n78(2A) | | CA\_n41A-n66A  CA\_n41A-n78A  CA\_n66A-n78A | | n41 | |  | | 10 | | 15 | | 20 | |  | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | | 100 | | 0 | |
|  | |  | | n66 | | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | | | | | | | | | | | | |  | |
|  | |  | | n78 | | See CA\_n78(2A) Bandwidth Combination Set 2 in Table 5.5A.2-1 | | | | | | | | | | | | | | | | | | | | | | | | | |  | |

#### 5.1.80.3 UE co-existence studies

IMD3 and IMD5 generated by UL n41-n66 might affect DL n78.

IMD4 generated by UL n41-n78 might affect DL n66.

#### 5.1.80.4 REFSENS requirements

MSD values are derived from CA\_n41-n66-n77.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

Table 5.1.80.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n41-n66-n78 | n41 | 2560 | 5 | 25 | 2560 | N/A | TDD | N/A |
| n66 | 1730 | 5 | 25 | 2130 | N/A | FDD | N/A |
| n77 | 3390 | 10 | 50 | 3390 | 16.1 | TDD | IMD31 |
| n41 | 2530 | 5 | 25 | 2530 | N/A | TDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 9.0 | FDD | IMD4 |
| n77 | 3610 | 10 | 50 | 3610 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.81 CA\_n26-n66-n70

#### 5.1.81.1 Operating bands for CA

Table 5.1.81.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n66-n70 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |

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

Table 5.1.81.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n26A-n66A-n70A | CA\_n26A-n66A  CA\_n26A-n70A | n26 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| CA\_n26A-n66(2A)-n70A | CA\_n26A-n66A  CA\_n26A-n70A | n26 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | |

#### 5.1.81.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall backs for CA\_n26-n66 and CA\_n26-n70.

#### 5.1.81.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

There are no additional IMD products falling inside the third Rx band for the case CA\_n26A-n66A-n70A.

### 5.1.82 CA\_n48-n66-n70

5.1.82.1 Operating bands for CA

Table 5.1.82.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n48-n66-n70 | n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |

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

Table 5.1.82.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n48A-n66A-n70A | CA\_n48A-n66A  CA\_n48-n70A | n48 | 5 | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| CA\_n48A-n66(2A)-n70A | CA\_n48A-n66A  CA\_n48-n70A | n48 | 5 | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| CA\_n48(2A)-n66A-n70A | CA\_n48A-n66A  CA\_n48-n70A | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| CA\_n48B-n66A-n70A | CA\_n48A-n66A  CA\_n48-n70A | n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | |

#### 5.1.82.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall backs for CA\_n48-n66 and CA\_n66-n71 is in the specification 38.101.

For CA\_n48-n70 the 5th order IMD product is falling inside band n66 as shown in the following analysis.

**Table 5.1.82.3-1: Band n48 and Band n70 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3550 | 3700 | 1695 | 1710 |
| DL Frequency [MHz] | 3550 | 3700 | 1995 | 2020 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2005 | 1840 | 5245 | 5410 |
| 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) | 5390 | 5705 | 310 | 130 |
| 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) | 8795 | 9110 | 6940 | 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) | 8940 | 9405 | 1385 | 1580 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3680 | 4010 | 10490 | 10820 |
| 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) | 12345 | 12810 | 8635 | 8830 |
| 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) | 3290 | 3080 | 13105 | 12490 |
| 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) | 1970 | 2315 | 7710 | 7230 |
| 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) | 10330 | 10540 | 15895 | 16510 |
| 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) | 12185 | 12530 | 14040 | 14520 |

Based on the table above, the 5th order IMD may fall into Rx frequencies of band n66.

#### 5.1.82.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs. For CA\_n48-n70 hitting n66 the values of CA\_n2-n66-n77 IMD5 are reused.

Table 5.1.82.4-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc**  **(MHz)** | **UL/DL BW**  **(MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD**  **(dB)** | **Duplex mode** | **IMD order** |
| CA\_n48A-n66A-n70A | n48 | 3625 | 10 | 50 | 3625 | N/À | TDD | N/A |
| n66 | 1742.5 | 5 | 25 | 2142.5 | 2.8 | FDD | IMD5 |
| n70 | 1702.5 | 5 | 25 | 2002.5 | N/A | FDD | N/A |

### 5.1.83 CA\_n48-n66-n71

5.1.83.1 Operating bands for CA

Table 5.1.83.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n48-n66-n71 | n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.1.83.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n48A-n66A-n71A | CA\_n48A-n71A  CA\_n66A-n71A  CA\_n48A-n66A | n48 | 5 | 10 | 15 | 20 | 0 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48A-n66(2A)-n71A | CA\_n48A-n71A  CA\_n66A-n71A  CA\_n48A-n66A | n48 | 5 | 10 | 15 | 20 | 0 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48(2A)-n66A-n71A | CA\_n48A-n71A  CA\_n66A-n71A  CA\_n48A-n66A | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48B-n66A-n71A | CA\_n48A-n71A  CA\_n66A-n71A  CA\_n48A-n66A | n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48A-n66A-n71(2A) | CA\_n48A-n71A  CA\_n66A-n71A  CA\_n48A-n66A | n48 | 5 | 10 | 15 | 20 | 0 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n71 | See CA\_n71(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |

#### 5.1.83.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall backs for CA\_n48-n66.

For CA\_n48-n71 The 3rd order IMD product is falling inside band n66 as shown in the following analysis.

**Table 5.1.83.3-1: Band n48 and Band n71 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3550 | 3700 | 663 | 698 |
| DL Frequency [MHz] | 3550 | 3700 | 617 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3037 | 2852 | 4213 | 4398 |
| 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) | 6402 | 6737 | 2374 | 2154 |
| 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) | 7763 | 8098 | 4876 | 5096 |
| 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) | 9952 | 10437 | 1711 | 1456 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 5704 | 6074 | 8426 | 8796 |
| 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) | 11313 | 11798 | 5539 | 5794 |
| 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) | 758 | 1048 | 14137 | 13502 |
| 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) | 5006 | 5411 | 9774 | 9254 |
| 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) | 6202 | 6492 | 14863 | 15498 |
| 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) | 9089 | 9494 | 11976 | 12496 |

Based on the table above, the 3rd order IMD may fall into Rx frequencies of band n66.

For CA\_n66-n71 the 4th order IMD product is falling inside band n66 as shown in the following analysis, but only at 3699MHz. Since 3\*fy\_low+ 1\*fx\_low using 5MHz BW would be at 3709MHz subtracting half of the IMD4 BW would hit 3699MHz.

**Table 5.1.83.3-2: Band n66 and Band n71 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1780 | 663 | 698 |
| DL Frequency [MHz] | 2110 | 2200 | 617 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1117 | 1012 | 2373 | 2478 |
| 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2722 | 2897 | 454 | 314 |
| 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4083 | 4258 | 3036 | 3176 |
| Two-tone 4th order IMD products | |3\*fx\_low –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 | 4677 | 209 | 384 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 2024 | 2234 | 4746 | 4956 |
| 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 | 6038 | 3699 | 3874 |
| 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 | 872 | 6457 | 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 | 1571 | 4014 | 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 | 4572 | 7503 | 7818 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 5409 | 5654 | 6456 | 6736 |

Based on the table above, the 4th order IMD may fall into Rx frequencies of band n48.

#### 5.1.83.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs. Requirements taken from CA\_n5-n66-n77, but in the case of IMD4 in n48 at upper band edge the requirement is relaxed by 3dB compared to CA\_n5-n66-n77.

Table 5.1.83.4-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc**  **(MHz)** | **UL/DL BW**  **(MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD**  **(dB)** | **Duplex mode** | **IMD order** |
| CA\_n48A-n66A-n71A | n48 | 3552.5 | 10 | 50 | 3552.5 | N/A | TDD | N/A |
| n66 | 1761.5 | 5 | 25 | 2161.5 | 14.4 | FDD | IMD3 |
| n71 | 695.5 | 5 | 25 | 649.5 | N/A | FDD | N/A |
| n48 | 3695 | 10 | 50 | 3695 | 5.2 | TDD | IMD4 |
| n66 | 1712.5 | 5 | 25 | 2112.5 | N/A | FDD | N/A |
| n71 | 665.5 | 5 | 25 | 619.5 | N/A | FDD | N/A |

### 5.1.84 CA\_n48-n66-n71

5.1.84.1 Operating bands for CA

Table 5.1.84.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n48-n70-n71 | n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.1.84.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n48A-n70A-n71A | CA\_n48A-n71A  CA\_n70A-n71A  CA\_n48A-n70A | n48 | 5 | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48(2A)-n70A-n71A | CA\_n48A-n71A  CA\_n70A-n71A  CA\_n48A-n70A | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48B-n70A-n71A | CA\_n48A-n71A  CA\_n70A-n71A  CA\_n48A-n70A | n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| n71 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |
| CA\_n48A-n70A-n71(2A) | CA\_n48A-n71A  CA\_n70A-n71A  CA\_n48A-n70A | n48 | 5 | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |
| n71 | See CA\_n71(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |
| NOTE 1: This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | |

#### 5.1.84.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall backs for CA\_n48-n70 and CA\_n48-n71.

For CA\_n70-n71 the 4th and 5th order IMD products are falling inside band n48 as shown in the following analysis.

**Table 5.1.84.3-1: Band n70 and Band n71 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1695 | 1710 | 663 | 698 |
| DL Frequency [MHz] | 1995 | 2020 | 617 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1047 | 997 | 2358 | 2408 |
| 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2692 | 2757 | 384 | 299 |
| 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4053 | 4118 | 3021 | 3106 |
| Two-tone 4th order IMD products | |3\*fx\_low –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) | 4387 | 4467 | 279 | 399 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1994 | 2094 | 4716 | 4816 |
| 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) | 5748 | 5828 | 3684 | 3804 |
| 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) | 1097 | 942 | 6177 | 6082 |
| 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) | 1296 | 1431 | 3804 | 3689 |
| 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) | 4347 | 4502 | 7443 | 7538 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 5379 | 5514 | 6411 | 6526 |

Based on the table above, the 4th and 5th order IMD may fall into Rx frequencies of band n48.

#### 5.1.84.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs. Requirements taken from existing fallbacks except CA\_n48A-n70A-n71A with CA-n70A-n71A UL creating a potential IMD4 and IMD5 product inside band n48. This requirement is taken from CA\_n66-n71-n78 which has similar issue.

Table 5.1.84.4-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc**  **(MHz)** | **UL/DL BW**  **(MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD**  **(dB)** | **Duplex mode** | **IMD order** |
| CA\_n48A-n70A-n71A | n48 | 3694 | 10 | 50 | 3694 | 9 | TDD | IMD41 |
| n70 | 1697.5 | 5 | 25 | 1997.5 | N/A | FDD | N/A |
| n71 | 665.5 | 5 | 25 | 619.5 | N/A | FDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.85 CA\_n66-n70-n71

5.1.85.1 Operating bands for CA

Table 5.1.85.1-1: Inter-band CA operating bands

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

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

Table 5.1.85.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n66A-n70A-n71(2A) | CA\_n66A-n71A CA\_n70A-n71A | n66 | 15 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
|  |  | n70 | 15 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |  |
|  |  | n71 | See CA\_n71(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | | |

#### 5.1.85.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall backs for CA\_n66-n71 and for CA\_n70-n71.

#### 5.1.85.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the third Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

There are no additional IMD products falling inside the third Rx band for the case CA\_n66A-n70A-n71A.

5.1.86 CA\_n24-n41-n77

#### 5.1.86.1 Operating bands for CA

**Table 5.1.86.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | | |
| n24 | 1626.5 MHz | – | 1660.5 MHz | 1525 MHz | – | 1559 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

**Table 5.1.86.2-1: Supported bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n24A-n41A-n77A | CA\_n24A-n41A  CA\_n24A\_n77A  CA\_n41\_n77A | n24 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n24A-n41(2A)-n77A | CA\_n24A-n41A  CA\_n24A\_n77A  CA\_n41\_n77A | n24 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 | See CA\_n41(2A) BCS1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n24A-n41A-n77(2A) | CA\_n24A-n41A  CA\_n24A\_n77A  CA\_n41\_n77A | n24 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n77 | See CA\_n77(2A) BCS0 in Table 5.5A.2-1 | | | | | | | | | | | | |
| CA\_n24A-n41(2A)-n77(2A) | CA\_n24A-n41A  CA\_n24A\_n77A  CA\_n41\_n77A | n24 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 | See CA\_n41(2A) BCS1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n77 | See CA\_n77(2A) BCS0 in Table 5.5A.2-1 | | | | | | | | | | | | |

5.1.86.3 Co-existence studies

The harmonic issues has been analyzed in 3DL/1UL submission [2] as part of the NR\_CADC\_R17\_3BDL\_1BUL assessment. For inter-modulation issues, the 2nd, 3rd, 4th, and 5th order intermodulation products are calculated in Tables 5.1.86.3-1, 5.1.86.3-2 and 5.1.86.3-3 respectively

Table 5.1.86.3-1 summarizes frequency ranges where harmonics occur for CA\_n24-n41-n77.

**Table 5.1.86.3-1: Band n24 and Band n41 UL harmonic and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1626.5 | 1660.5 | 2496 | 2690 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 835.5 | 1063.5 | 4122.5 | 4350.5 |
| 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) | 563 | 825 | 3331.5 | 3753.5 |
| 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) | 5749 | 6011 | 6618.5 | 7040.5 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | 3\*fy\_low – fx\_high | 3\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 2189.5 | 2485.5 | 5827.5 | 6443.5 |
| Two-tone 4th order IMD products | 3\*fx\_low + fy\_low | 3\*fx\_high + fy\_high | 3\*fy\_low + fx\_low | 3\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 7375.5 | 7671.5 | 9114.5 | 9730.5 |
| Two-tone 4th order IMD products | 2\*fy\_low – 2\*fx\_high | 2\*fy\_high – 2\*fx\_low | 2\*fx\_low + 2\*fy\_low | 2\*fx\_high + 2\*fy\_high |
| IMD frequency limits (MHz) | 1671 | 2127 | 8245 | 8701 |
| Two-tone 5th order IMD products | |4\*fx\_low – fy\_high| | |4\*fx\_high – fy\_low| | 4\*fy\_low – fx\_high | 4\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 3816 | 4146 | 8323.5 | 9133.5 |
| Two-tone 5th order IMD products | 4\*fx\_low + fy\_low | 4\*fx\_high + fy\_high | 4\*fy\_low + fx\_low | 4\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 9002 | 9332 | 11610.5 | 12420.5 |
| Two-tone 5th order IMD products | |3\*fx\_low – 2\*fy\_high| | |3\*fx\_high – 2\*fy\_low| | 3\*fy\_low – 2\*fx\_high | 3\*fy\_high – 2\*fx\_low |
| IMD frequency limits (MHz) | 500.5 | 10.5 | 4167 | 4817 |
| 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) | 10741 | 11391 | 9871.5 | 10361.5 |

**Table 5.1.86.3-2: Band n24 and Band n77 UL harmonic and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1626.5 | 1660.5 | 3300 | 4200 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 1639.5 | 2573.5 | 4926.5 | 5860.5 |
| 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) | 947 | 21 | 4939.5 | 6773.5 |
| 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) | 6553 | 7521 | 8226.5 | 10060.5 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | 3\*fy\_low – fx\_high | 3\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 679.5 | 1681.5 | 8239.5 | 10973.5 |
| Two-tone 4th order IMD products | 3\*fx\_low + fy\_low | 3\*fx\_high + fy\_high | 3\*fy\_low + fx\_low | 3\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 8179.5 | 9181.5 | 11526.5 | 14260.5 |
| Two-tone 4th order IMD products | 2\*fy\_low – 2\*fx\_high | 2\*fy\_high – 2\*fx\_low | 2\*fx\_low + 2\*fy\_low | 2\*fx\_high + 2\*fy\_high |
| IMD frequency limits (MHz) | 3279 | 5147 | 9853 | 11721 |
| Two-tone 5th order IMD products | |4\*fx\_low – fy\_high| | |4\*fx\_high – fy\_low| | 4\*fy\_low – fx\_high | 4\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 2306 | 3342 | 11539.5 | 15173.5 |
| Two-tone 5th order IMD products | 4\*fx\_low + fy\_low | 4\*fx\_high + fy\_high | 4\*fy\_low + fx\_low | 4\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 9806 | 10842 | 14826.5 | 18460.5 |
| Two-tone 5th order IMD products | |3\*fx\_low – 2\*fy\_high| | |3\*fx\_high – 2\*fy\_low| | 3\*fy\_low – 2\*fx\_high | 3\*fy\_high – 2\*fx\_low |
| IMD frequency limits (MHz) | 3520.5 | 1618.5 | 6579 | 9347 |
| 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) | 13153 | 15921 | 11479.5 | 13381.5 |

**Table 5.1.86.3-3: Band n41 and Band n77 UL harmonic and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2496 | 2690 | 3300 | 4200 |
| Two tone 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 - fy\_high| | |3\*fx\_high - fy\_low| | |3\*fy\_low - fx\_high| | |3\*fy\_high - fx\_low| |
| IMD frequency limits (MHz) | 3288 | 4770 | 7210 | 10104 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 10788 | 12270 | 12396 | 15290 |
| Two-tone 4th order IMD products | |2\*fx\_low - 2\*fy\_high| | |2\*fx\_high - 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limits (MHz) | 3408 | 1220 | 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 | |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\_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 | |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 |

The above IMD studies shows that

* The 2nd, 3rd and 5th order order IMDs generated by dual uplink of n24+n41 may fall into own Rx of n77. However, the 2nd order IMD is not expected for the operating frequency range of n77 within USA (3450 – 3550 MHz, 3700 – 3980 MHz).
* The 2nd and 5th order IMD generated by dual uplink of n24+n77 may fall into own Rx of n41. However, 2nd order IMD is not expected for the operating frequency range of n77 within USA (3450 – 3550 MHz, 3700 – 3980 MHz).
* The 2nd, 3rd and 4th order IMD generated by dual uplink of n41+n77 may fall into own Rx of n24. However, 2nd order IMD is not expected for the operating frequency range of n77 within USA (3450 – 3550 MHz, 3700 – 3980 MHz).

5.1.86.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the 3rd Rx band; otherwise, IMD issues are already specified in 2DL/2UL CAs.

As these 3DL/2UL IMD issues are similar to CA\_n3-n41-n77, these MSD are reused for CA\_n24-n41-n77.

**Table 5.1.86.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n24A-n41A-n77A  CA\_n24A-n41(2A)-n77A  CA\_n24-n41A-n77(2A)  CA\_n24-n41(2A)-n77(2A) | n24 | 1630 | 5 | 25 | 1528.5 | N/A | FDD | N/A |
| n41 | 2685 | 5 | 25 | 2685 | N/A | TDD | N/A |
| n77 | 3735 | 10 | 50 | 3735 | 16.8 | TDD | IMD33,5 |
| n24 | 1630 | 5 | 25 | 1528.5 | N/A | FDD | N/A |
| n41 | 2610 | 5 | 25 | 2610 | 5.3 | TDD | IMD55 |
| n77 | 3755 | 10 | 50 | 3755 | N/A | TDD | N/A |
| n24 | 1630 | 5 | 25 | 1528.5 | 16.4 | FDD | IMD34,5 |
| n41 | 2500 | 5 | 25 | 2500 | N/A | TDD | N/A |
| n77 | 3465 | 10 | 50 | 3465 | N/A | TDD | N/A |
| Note 3: This band is subject to IMD5 which is not specified  Note 4: This band is subject to IMD4 which is not specified  Note 5: This band is subjected to 2nd order IMD but is not expected for the operating frequency range of n77 within USA (3450 – 3550 MHz, 3700 – 3980 MHz). | | | | | | | | |

5.1.87 CA\_n24-n41-n48

#### 5.1.87.1 Operating bands for CA

**Table 5.1.87.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | | |
| n24 | 1626.5 MHz | – | 1660.5 MHz | 1525 MHz | – | 1559 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |

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

**Table 5.1.87.2-1: Supported bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n24A-n41A-n48A | CA\_n24A-n41A  CA\_n24A\_n48A  CA\_n41\_n48A | n24 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n48 | 5 | 10 | 15 | 20 |  |  | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n24A-n41(2A)-n48A | CA\_n24A-n41A  CA\_n24A\_n48A  CA\_n41\_n48A | n24 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 | See CA\_n41(2A) BCS1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n48 | 5 | 10 | 15 | 20 |  |  | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n24A-n41A-n48(2A) | CA\_n24A-n41A  CA\_n24A\_n48A  CA\_n41\_n48A | n24 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n48 | See CA\_n48(2A) BCS0 in Table 5.5A.2-1 | | | | | | | | | | | | |
| CA\_n24A-n41(2A)-n48(2A) | CA\_n24A-n41A  CA\_n24A\_n48A  CA\_n41\_n48A | n24 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 | See CA\_n41(2A) BCS1 in Table 5.5A.2-1 | | | | | | | | | | | | |
| n48 | See CA\_n48(2A) BCS0 in Table 5.5A.2-1 | | | | | | | | | | | | |

5.1.87.3 Co-existence studies

The harmonic issues has been analyzed in 3DL/1UL submission [2] as part of the NR\_CADC\_R17\_3BDL\_1BUL assessment. For inter-modulation issues, the 2nd, 3rd, 4th, and 5th order intermodulation products are calculated in Tables 5.1.87.3-1, 5.1.87.3-2 and 5.1.87.3-3 respectively

Table 5.1.87.3-1 summarizes frequency ranges where harmonics occur for CA\_n24-n41-n48.

**Table 5.1.87.3-1: Band n24 and Band n41 UL harmonic and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1626.5 | 1660.5 | 2496 | 2690 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 835.5 | 1063.5 | 4122.5 | 4350.5 |
| 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) | 563 | 825 | 3331.5 | 3753.5 |
| 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) | 5749 | 6011 | 6618.5 | 7040.5 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | 3\*fy\_low – fx\_high | 3\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 2189.5 | 2485.5 | 5827.5 | 6443.5 |
| Two-tone 4th order IMD products | 3\*fx\_low + fy\_low | 3\*fx\_high + fy\_high | 3\*fy\_low + fx\_low | 3\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 7375.5 | 7671.5 | 9114.5 | 9730.5 |
| Two-tone 4th order IMD products | 2\*fy\_low – 2\*fx\_high | 2\*fy\_high – 2\*fx\_low | 2\*fx\_low + 2\*fy\_low | 2\*fx\_high + 2\*fy\_high |
| IMD frequency limits (MHz) | 1671 | 2127 | 8245 | 8701 |
| Two-tone 5th order IMD products | |4\*fx\_low – fy\_high| | |4\*fx\_high – fy\_low| | 4\*fy\_low – fx\_high | 4\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 3816 | 4146 | 8323.5 | 9133.5 |
| Two-tone 5th order IMD products | 4\*fx\_low + fy\_low | 4\*fx\_high + fy\_high | 4\*fy\_low + fx\_low | 4\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 9002 | 9332 | 11610.5 | 12420.5 |
| Two-tone 5th order IMD products | |3\*fx\_low – 2\*fy\_high| | |3\*fx\_high – 2\*fy\_low| | 3\*fy\_low – 2\*fx\_high | 3\*fy\_high – 2\*fx\_low |
| IMD frequency limits (MHz) | 500.5 | 10.5 | 4167 | 4817 |
| 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) | 10741 | 11391 | 9871.5 | 10361.5 |

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**Table 5.1.87.3-2: Band n24 and Band n48 UL harmonic and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1626.5 | 1660.5 | 3550 | 3700 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 1889.5 | 2073.5 | 5176.5 | 5360.5 |
| 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) | 447 | 229 | 5439.5 | 5773.5 |
| 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) | 6803 | 7021 | 8726.5 | 9060.5 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | 3\*fy\_low – fx\_high | 3\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 1179.5 | 1431.5 | 8989.5 | 9473.5 |
| Two-tone 4th order IMD products | 3\*fx\_low + fy\_low | 3\*fx\_high + fy\_high | 3\*fy\_low + fx\_low | 3\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 8429.5 | 8681.5 | 12276.5 | 12760.5 |
| Two-tone 4th order IMD products | 2\*fy\_low – 2\*fx\_high | 2\*fy\_high – 2\*fx\_low | 2\*fx\_low + 2\*fy\_low | 2\*fx\_high + 2\*fy\_high |
| IMD frequency limits (MHz) | 3779 | 4147 | 10353 | 10721 |
| Two-tone 5th order IMD products | |4\*fx\_low – fy\_high| | |4\*fx\_high – fy\_low| | 4\*fy\_low – fx\_high | 4\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 2806 | 3092 | 12539.5 | 13173.5 |
| Two-tone 5th order IMD products | 4\*fx\_low + fy\_low | 4\*fx\_high + fy\_high | 4\*fy\_low + fx\_low | 4\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 10056 | 10342 | 15826.5 | 16460.5 |
| Two-tone 5th order IMD products | |3\*fx\_low – 2\*fy\_high| | |3\*fx\_high – 2\*fy\_low| | 3\*fy\_low – 2\*fx\_high | 3\*fy\_high – 2\*fx\_low |
| IMD frequency limits (MHz) | 2520.5 | 2118.5 | 7329 | 7847 |
| 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) | 13903 | 14421 | 11979.5 | 12381.5 |

**Table 5.1.87.3-3: Band n41 and Band n48 UL harmonic and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2496 | 2690 | 3550 | 3700 |
| Two tone 2nd order IMD products | fy\_low – fx\_high | fy\_high – fx\_low | fx\_low + fy\_low | fx\_high + fy\_high |
| IMD frequency limits (MHz) | 860 | 1204 | 6046 | 6390 |
| 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) | 1292 | 1830 | 4410 | 4904 |
| 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) | 8542 | 9080 | 9596 | 10090 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | 3\*fy\_low – fx\_high | 3\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 3788 | 4520 | 7960 | 8604 |
| Two-tone 4th order IMD products | 3\*fx\_low + fy\_low | 3\*fx\_high + fy\_high | 3\*fy\_low + fx\_low | 3\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 11038 | 11770 | 13146 | 13790 |
| Two-tone 4th order IMD products | 2\*fy\_low – 2\*fx\_high | 2\*fy\_high – 2\*fx\_low | 2\*fx\_low + 2\*fy\_low | 2\*fx\_high + 2\*fy\_high |
| IMD frequency limits (MHz) | 1720 | 2408 | 12092 | 12780 |
| Two-tone 5th order IMD products | |4\*fx\_low – fy\_high| | |4\*fx\_high – fy\_low| | 4\*fy\_low – fx\_high | 4\*fy\_high – fx\_low |
| IMD frequency limits (MHz) | 6284 | 7210 | 11510 | 12304 |
| Two-tone 5th order IMD products | 4\*fx\_low + fy\_low | 4\*fx\_high + fy\_high | 4\*fy\_low + fx\_low | 4\*fy\_high + fx\_high |
| IMD frequency limits (MHz) | 13534 | 14460 | 16696 | 17490 |
| Two-tone 5th order IMD products | |3\*fx\_low – 2\*fy\_high| | |3\*fx\_high – 2\*fy\_low| | 3\*fy\_low – 2\*fx\_high | 3\*fy\_high – 2\*fx\_low |
| IMD frequency limits (MHz) | 88 | 970 | 5270 | 6108 |
| 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) | 15642 | 16480 | 14588 | 15470 |

The above IMD studies shows that

* The 3rd order IMD generated by dual uplink of n24+n41 may fall into own Rx of n48
* The 5th order IMD generated by dual uplink of n24+n48 may fall into own Rx of n41
* The 3rd order IMD generated by dual uplink of n41+n48 may fall into own Rx of n24

5.1.87.4 REFSENS requirements

The IMD issues specific to 3DL/2UL are the cases that IMDs generated by dual uplink fall into the 3rd Rx band; otherwise, IMD issues are already specified in 2DL/2UL Cas.

As these 3DL/2UL IMD issues are similar to CA\_n3-n41-n77, these MSD are reused for CA\_n24-n41-n48.

**Table 5.1.87.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n24A-n41A-n48A  CA\_n24A-n41(2A)-n48A  CA\_n24-n41A-n48(2A)  CA\_n24-n41(2A)-n48(2A) | n24 | 1649 | 5 | 25 | 1528.5 | N/A | FDD | N/A |
| n41 | 2610 | 5 | 25 | 2610 | N/A | TDD | N/A |
| n48 | 3571 | 10 | 50 | 3571 | 16.8 | TDD | IMD3 |
| n24 | 1630 | 5 | 25 | 1528.5 | N/A | FDD | N/A |
| n41 | 2500 | 5 | 25 | 2500 | 5.3 | TDD | IMD5 |
| n48 | 3695 | 10 | 50 | 3695 | N/A | TDD | N/A |
| n24 | 1631.5 | 5 | 25 | 1530 | 16.4 | FDD | IMD3 |
| n41 | 2592.5 | 5 | 25 | 2592.5 | N/A | TDD | N/A |
| n48 | 3655 | 10 | 50 | 3655 | N/A | TDD | N/A |

5.1.88 CA\_n1-n3-n77

5.1.88.1 Operating bands for CA

**Table 5.1.88.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n77 | 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 |

5.1.88.2 Channel bandwidths per operating band for CA

**Table 5.1.88.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n3A-n77A | CA\_n1A-n3A  CA\_n1A-n77A  CA\_n3A-n77A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |

5.1.88.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD2 and IMD4 generated by dual Tx n1 and n3 fall into the third band n77 Rx

IMD2, IMD4 and IMD5 generated by dual Tx n1 and n77 fall into the third band n3 Rx

IMD2 and IMD5 generated by dual Tx n3 and n77 fall into the third band n1 Rx.

5.1.88.4 REFSENS requirements

Based on co-existence studies on 5.1.88.3, MSD values are defined below, reused from DC\_1A-3A\_n77 and DC\_1A\_n3A-n77A.

**Table 5.1.88.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n1-n3-n77 | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n3 | 1750 | 5 | 25 | 1845 | N/A | FDD | N/A |
| n77 | 3700 | 10 | 50 | 3700 | 28.4 | TDD | IMD22 |
| n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n3 | 1712.5 | 5 | 25 | 1807.5 | 31.5 | FDD | IMD21,2 |
| n77 | 3757.5 | 10 | 50 | 3757.5 | N/A | TDD | N/A |
| n1 | 1950 | 5 | 25 | 2140 | 31.0 | FDD | IMD21 |
| n3 | 1775 | 5 | 25 | 1870 | N/A | FDD | N/A |
| n77 | 3915 | 10 | 50 | 3915 | 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. | | | | | | | | |

5.1.89 CA\_n28-n40-n79

5.1.89.1 Operating bands for CA

**Table 5.1.89.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28A-n40A-n79A3 | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| NOTE 3: Applicable for UE supporting inter-band carrier aggregation with mandatory simultaneous Rx/Tx capability | | | | | | | | |

5.1.89.2 Channel bandwidths per operating band for CA

Table 5.1.89.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) | | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n28A-n40A-n79A | CA\_n28A-n40A  CA\_n28A-n79A  CA\_n40A-n79A | n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  | 0 |
|  |  | n40 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |

5.1.89.3 Co-existence studies

The co-existence studies for the UL CA configurations of CA\_n28A-n40A, CA\_n28A-n79A, CA\_n40A-n79A have already captured in TR 38.716-02-00, where:

- No intermodulations caused by 2UL CA\_n40A-n79A may fall into band n28 own DL Rx range.

- 4th intermodulations caused by 2UL CA\_n28A-n40A may fall into band n79 own DL Rx range.

- 4th intermodulations caused by 2UL CA\_n28A-n79A may fall into band n40 own DL Rx range.

5.1.89.4 MSD

It is proposed to reuse the same MSD values of DC\_8A\_n40A-n79A, which are defined as:

Table 5.1.89.4-1 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA  Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n28-n40-n79 | n28 | 730 | 5 | 25 | 785 | N/A | FDD | N/A |
|  | n40 | 2350 | 5 | 50 | 2350 | N/A | TDD | N/A |
|  | n79 | 4540 | 40 | 216 | 4540 | 10.7 | TDD | IMD4 |
|  | n28 | 720 | 5 | 25 | 775 | N/A | FDD | N/A |
|  | n40 | 2340 | 5 | 50 | 2340 | 9.2 | TDD | IMD4 |
|  | n79 | 4500 | 40 | 216 | 4500 | N/A | TDD | N/A |

### 5.1.90 CA\_n28-n46-n78

#### 5.1.90.1 Operating bands for CA

Table 5.1.90.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band Combination** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n46-n78 | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

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

Table 5.1.90.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL CA Configuration** | **NR Band** | **Channel bandwidth [MHz]** | | | | | | | | | | | | | |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n28A-n46A-n78A | CA\_n28A-n46A  CA\_n28A-n78A  CA\_n46A-n78A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n46 |  |  |  | 20 |  |  | 40 |  | 60 |  | 80 |  |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n28A-n46C-n78A | CA\_n28A-n46A  CA\_n28A-n78A  CA\_n46A-n78A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n46 | See CA\_n46C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n28A-n46D-n78A | CA\_n28A-n46A  CA\_n28A-n78A  CA\_n46A-n78A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
| n46 | See CA\_n46D Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

#### 5.1.90.3 Co-existence studies

It can be seen from the co-existence studies of the lower order CA configurations that the IMD products of the dual-UL may fall into the DL of the 3rd band in the following cases:

- IMD3 of band n46 UL and band n78 UL falls into band n28 DL

- IMD3 and IMD4 of band n28 UL and n46 UL fall into band n78 DL

- IMD3, IMD4 and IMD5 of band n28 UL and n78 UL fall into band n46 DL

#### 5.1.90.4 REFSENs requirements

**Table 5.1.90.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n28A-n46A-n78A  CA\_n28A-n46C-n78A CA\_n28A-n46D-n78A | n28 | 710 | 5 | 25 | 765 | N/A | FDD | N/A |
| n46 | 5170 | 20 | 100 | 5170 | N/A | FDD | N/A |
| n78 | 3750 | 10 | 50 | 3750 | 17 | TDD | IMD31 |
| n28 | 725 | 5 | 25 | 780 | 16 | FDD | IMD3 |
| n46 | 5900 | 20 | 100 | 5900 | N/A | FDD | N/A |
| n78 | 3340 | 10 | 50 | 3340 | N/A | TDD | N/A |
| n28 | 740 | 5 | 25 | 795 | N/A | FDD | N/A |
| n46 | 5900 | 20 | 100 | 5900 | 22 | TDD | IMD31,2 |
| n78 | 3320 | 10 | 50 | 3320 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD4 also which MSD is not specified.  NOTE 2: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.91 CA\_n1-n40-n78

5.1.91.1 Operating bands for CA

Table 5.1.91.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n40-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.91.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 |  |
| CA\_n1A-n40A-n78A | CA\_n1A-n40A  CA\_n1A-n78A  CA\_n40A-n78A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  | 0 |
|  |  | n40 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 | 80 | 90 | 100 |  |

#### 5.1.91.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are studied below.

**Table 5.1.91.3-1: Band n1 and Band n40 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 2300 | 2400 |
| DL Frequency [MHz] | 2110 | 2170 | 2300 | 2400 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 960 | 640 | 8440 | 8760 |
| 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 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 |

For CA\_n1-n40 UL, the 4th and 5th order IMD products are falling inside band n78 DL as shown in above analysis.

**Table 5.1.91.3-2: Band n1 and Band n78 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 3300 | 3800 |
| DL Frequency [MHz] | 2110 | 2170 | 3300 | 3800 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3760 | 2640 | 10440 | 11560 |
| 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 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 |

For CA\_n1-n78 UL, the 4th order IMD product is falling inside band n40 DL as shown in above analysis.

**Table 5.1.91.3-3: Band n40 and Band n78 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2300 | 2400 | 3300 | 3800 |
| DL Frequency [MHz] | 2300 | 2400 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1000 | 1500 | 5600 | 6100 |
| 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 | 1300 | 4300 | 5300 |
| 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 | 8400 | 8900 | 9900 |
| 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 | 3600 | 7600 | 9100 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3000 | 2000 | 11200 | 12200 |
| 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 | 10700 | 12200 | 13700 |
| 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) | 12900 | 10900 | 5900 | 5400 |
| 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) | 6800 | 5300 | 300 | 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 | 17500 | 12500 | 13000 |
| 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 | 16000 | 13500 | 14500 |

For CA\_n40-n78 UL, the 4th order IMD product is falling inside band n1 DL as shown in above analysis.

#### 5.1.91.4 REFSENS requirements

MSD values be reused from DC\_1A-40A\_n78A, and DC\_1A\_n40A-n78A

Table 5.1.91.4-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc**  **(MHz)** | **UL/DL BW**  **(MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD**  **(dB)** | **Duplex mode** | **IMD order** |
| CA\_n1A-n40A-n78A | n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
| n78 | 3480 | 10 | 50 | 3480 | 9.8 | TDD | IMD41 |
| n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n40 | 2340 | 5 | 25 | 2340 | 10.6 | TDD | IMD4 |
| n78 | 3450 | 10 | 50 | 3450 | N/A | TDD | N/A |
| n1 | 1950 | 5 | 25 | 2140 | 9.1 | FDD | IMD4 |
| n40 | 2380 | 5 | 25 | 2380 | N/A | TDD | N/A |
| n78 | 3450 | 10 | 50 | 3450 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.92 CA\_n28-n40-n78

#### 5.1.92.1 Operating bands for CA

Table 5.1.92.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n40-n78 | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.1.92.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 |  |
| CA\_n28A-n40A-n78A | CA\_n28A-n40A  CA\_n28A-n78A  CA\_n40A-n78A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  | 0 |
|  |  | n40 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 | 80 | 90 | 100 |  |
| CA\_n28A-n40A-n78A | CA\_n28A-n40A  CA\_n28A-n78A  CA\_n40A-n78A | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  | 1 |
|  |  | n40 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 |  | 100 |  |
|  |  | n78 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 | 80 | 90 | 100 |  |

#### 5.1.92.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are studied below.

**Table 5.1.92.3-1: Band n28 and Band n40 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 703 | 748 | 2300 | 2400 |
| DL Frequency [MHz] | 758 | 803 | 2300 | 2400 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3394 | 3104 | 6006 | 6296 |
| 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 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 |

For CA\_n28-n40 UL, the 3rd and 4th order IMD products are falling inside band n78 DL as shown in above analysis.

**Table 5.1.92.3-2: Band n28 and Band n78 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 703 | 748 | 3300 | 3800 |
| DL Frequency [MHz] | 758 | 803 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2552 | 3097 | 4003 | 4548 |
| 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2394 | 1804 | 5852 | 6897 |
| 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4706 | 5296 | 7303 | 8348 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 1691 | 1056 | 9152 | 10697 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6194 | 5104 | 8006 | 9096 |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 5409 | 6044 | 10603 | 12148 |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 14497 | 12452 | 308 | 988 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 9994 | 8404 | 4356 | 5491 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 13903 | 15948 | 6112 | 6792 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 11306 | 12896 | 8709 | 9844 |

For CA\_n28-n78 UL, the 4th order IMD product is falling inside band n40 DL as shown in above analysis.

**Table 5.1.92.3-3: Band n40 and Band n78 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2300 | 2400 | 3300 | 3800 |
| DL Frequency [MHz] | 2300 | 2400 | 3300 | 3800 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3000 | 1800 | 11200 | 12400 |
| 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 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) | 12900 | 10800 | 6300 | 5400 |
| 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) | 6800 | 5100 | 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 |

For CA\_n40-n78 UL, the 3rd order IMD product is falling inside band n28 DL as shown in above analysis.

#### 5.1.92.4 REFSENS requirements

IMD3 MSD of DC\_28\_40\_n78 is reused for bands n28 and n40 and IMD3 MSD of CA\_n12-n30-n77 for n77 is reused for n78.

Table 5.1.92.4-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **EUTRA/NR band** | **UL Fc**  **(MHz)** | **UL/DL BW**  **(MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD**  **(dB)** | **Duplex mode** | **IMD order** |
| CA\_n28A-n40A-n78A | n28 | N/A | 5 | 25 | 800.5 | 11 | IMD3 | IMD3 |
| n40 | 2302.5 | 5 | 25 | 2302.5 | N/A | N/A | N/A |
| n78 | 3795 | 10 | 50 | 3795 | N/A | N/A | N/A |
| n28 | 708 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
| n78 | 3736 | 10 | 50 | 3736 | 16.0 | TDD | IMD32 |
| n28 | 708 | 5 | 25 | 763 | N/A | FDD | N/A |
| n40 | 2134 | 5 | 25 | 2134 | 15.7 | TDD | IMD3 |
| n78 | 3550 | 10 | 50 | 3550 | N/A | TDD | N/A |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified | | | | | | | | |

### 5.1.93 CA\_n7-n25-n77

5.1.93.1 Operating bands for CA

Table 5.1.93.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7A-n25A-n77A | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.93.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n7A-n25A-n77A | CA\_n7A-n25A CA\_n7A\_n77A CA\_n25A-n77A | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n7(2A)-n25A-n77A | CA\_n7A-n25A CA\_n7A\_n77A CA\_n25A-n77A | n7 | See CA\_n7(2A) Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
|  |  | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n7A-n25(2A)-n77A | CA\_n7A-n25A CA\_n7A\_n77A CA\_n25A-n77A | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |
| CA\_n7A-n25A-n77(2A) | CA\_n7A-n25A CA\_n7A\_n77A CA\_n25A-n77A | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
| CA\_n7(2A)-n25(2A)-n77A | CA\_n7A-n25A CA\_n7A\_n77A CA\_n25A-n77A | n7 | See CA\_n7(2A) Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
|  |  | n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n7(2A)-n25A-n77(2A) | CA\_n7A-n25A CA\_n7A\_n77A CA\_n25A-n77A | n7 | See CA\_n7(2A) Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
|  |  | n25 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
| CA\_n7A-n25(2A)-n77(2A) | CA\_n7A-n25A CA\_n7A\_n77A CA\_n25A-n77A | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
| CA\_n7(2A)-n25(2A)-n77(2A) | CA\_n7A-n25A CA\_n7A\_n77ACA\_n25A-n77A | n7 | See CA\_n7(2A) Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
|  |  | n25 | See CA\_n25(2A) Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | |  |

#### 5.1.93.3 UE co-existence studies

For UE coexistence study of Band n7 + Band n25 Band n7 + Band n77 and Band n25 + band n77 the 2nd 3rd 4th and 5th order harmonics are already analyzed in 3DL/1UL WI. The 2nd 3rd 4th and 5th order intermodulation products are calculated and presented in Table 5.1.93.3-1 5.1.93.3-2 and 5.1.93.3-3 respectively.

For CA\_n7-n25 the 5th IMD product is falling inside n77 as shown in the following analysis.

**Table 5.1.93.3-1: Band n7 and Band n25 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 1850 | 1915 |
| DL Frequency [MHz] | 2620 | 2690 | 1930 | 1995 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 720 | 585 | 4350 | 4485 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1170 | 1440 | 8700 | 8970 |
| 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 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5160 | 4830 | 8430 | 8085 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 745 | 410 | 4010 | 3670 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 9900 | 10230 | 11850 | 12195 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 10550 | 10885 | 11200 | 11540 |

For CA\_n7-n77 the 4th IMD product is falling inside n25 as shown in the following analysis.

**Table 5.1.93.3-2: Band n7 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 3300 | 4200 |
| DL Frequency [MHz] | 2620 | 2690 | 3300 | 4200 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3400 | 1460 | 11600 | 13540 |
| 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 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 |

For CA\_n25-n77 the 5th IMD product is falling inside n7 as shown in the following analysis.

**Table 5.1.93.3-3: Band n25 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1850 | 1915 | 3300 | 4200 |
| DL Frequency [MHz] | 1930 | 1995 | 3300 | 4200 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 4700 | 2770 | 10300 | 12230 |
| 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 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) | 14950 | 11285 | 4360 | 3200 |
| 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) | 8900 | 6070 | 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 |

Co-existence studies shows that

* The 5th IMD generated by dual uplink of Band n7 + Band n25 may fall into own Rx of band n77.
* The 4th IMD generated by dual uplink of Band n7 + Band n77 may fall into own Rx of band n25.
* The 5th IMD generated by dual uplink of Band n25 + Band n77 may fall into own Rx of band n7

#### 5.1.93.4 REFSENS requirements

The IMD issue specific to 3DL/2UL for dual uplink of Band n7 + Band n25 is that the 5th order IMD may fall into own Rx of band n77. As this IMD issue is the same as CA\_n7A-n25A-n78A these MSD values are reused.

The IMD issue specific to 3DL/2UL for dual uplink of Band n7 + Band n77 is that the 4th order IMD may fall into own Rx of band n25. As this IMD issue is the same as CA\_n7A-n25A-n78A these MSD values are reused.

The IMD issue specific to 3DL/2UL for dual uplink of Band n25 + Band n77 is that the 5th order IMD may fall into own Rx of band n77. IMD5 issues is the same as CA\_n25A-n41A-n77A (n41 and n7 same range) thus the MSD values are reused.

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | n7 | 2520 | 5 | 25 | 2640 | 5.3 | FDD | IMD5 |
| CA\_n7A-n25A-n77A | n25 | 1870 | 5 | 25 | 1950 | N/A | FDD | N/A |
|  | n77 | 4125 | 10 | 50 | 4125 | N/A | TDD | N/A |
|  | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
| n25 | 1870 | 5 | 25 | 1950 | 8.6 | FDD | IMD4 |
| n77 | 3525 | 10 | 50 | 3525 | N/A | TDD | N/A |
|  | n7 | 2520 | 5 | 25 | 2640 | N/A | FDD | N/A |
|  | n25 | 1905 | 5 | 25 | 1985 | N/A | FDD | N/A |
|  | n77 | 3750 | 10 | 50 | 3750 | 4.5 | TDD | IMD5 |

### 5.1.94 CA\_n2-n29-n77

5.1.94.1 Operating bands for CA

Table 5.1.94.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2A-n29A-n77A | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n29 |  | N/A |  | 717 MHz | – | 728 MHz | SDL |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.94.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n2A-n29A-n77A | CA\_n2-n77 | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n2(2A)-n29A-n77A | CA\_n2-n77 | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n2A-n29A-n77(2A) | CA\_n2-n77 | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 1in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.94.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall back for CA\_n2-n77 in the specification 38.101.

For CA\_n2-n77 there is no IMD falling inside n29 as shown in the following analysis.

**Table 5.1.94.3-1: Band n2 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1850 | 1910 | 3300 | 4200 |
| DL Frequency [MHz] | 1930 | 1990 | 3300 | 4200 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1390 | 2350 | 5150 | 6110 |
| 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 | 520 | 4690 | 6550 |
| 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 | 8020 | 8450 | 10310 |
| 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 | 2430 | 7990 | 10750 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 4700 | 2780 | 10300 | 12220 |
| 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 | 9930 | 11750 | 14510 |
| 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) | 14950 | 11290 | 4340 | 3200 |
| 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) | 8900 | 6080 | 870 | 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 | 18710 | 10700 | 11840 |
| 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 | 16420 | 12150 | 14130 |

#### 5.1.94.4 REFSENS requirements

There are no additional MSD requirements for this band combination

### 5.1.95 CA\_n5-n29-n77

5.1.95.1 Operating bands for CA

Table 5.1.95.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5A-n29A-n77A | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n29 |  | N/A |  | 717 MHz | – | 728 MHz | SDL |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.95.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n5A-n29A-n77A | CA\_n5A-n77A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n5A-n29A-n77(2A) | CA\_n5A-n77A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.95.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall back for CA\_n5-n77 in the specification 38.101.

For CA\_n5-n77 the 5th IMD product is falling inside n29 as shown in the following analysis.

**Table 5.1.95.3-1: Band n5 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 824 | 849 | 3300 | 4200 |
| DL Frequency [MHz] | 869 | 894 | 3300 | 4200 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2451 | 3376 | 4124 | 5049 |
| 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) | 2552 | 1602 | 5751 | 7576 |
| 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) | 4948 | 5898 | 7424 | 9249 |
| 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) | 1728 | 753 | 9051 | 11776 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6752 | 4902 | 8248 | 10098 |
| 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) | 5772 | 6747 | 10724 | 13449 |
| 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) | 15976 | 12351 | 96 | 904 |
| 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) | 10952 | 8202 | 4053 | 5928 |
| 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) | 14024 | 17649 | 6596 | 7596 |
| 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) | 11548 | 14298 | 9072 | 10947 |

Co-existence studies shows that

* The 5th IMD generated by dual uplink of Band n5 + Band n77 may fall into own Rx of band n29.

#### 5.1.95.4 REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 5th IMD generated by dual uplink of Band n5 + Band n77 may fall into own Rx of band n29. As this IMD issue is similar to CA\_n5A-n12A-n77A the same MSD value as 4.4 dB is reused.

Table 5.1.95.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n5A-n29A-n77A | n5 | 845 | 5 | 25 | 890 | N/A | FDD | N/A |
| n29 | N/A | 5 | N/A | 720 | 4.4 | SDL | IMD5zz |
| n77 | 4100 | 10 | 50 | 4100 | N/A | TDD | N/A |
| NOTE ZZ: The MSD test points cannot be verified for the band combination in US due to the Band n77 frequency range restriction. | | | | | | | | |

### 5.1.96 CA\_n29-n30-n77

5.1.96.1 Operating bands for CA

Table 5.1.96.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n29A-n30A-n77A | n29 |  | N/A |  | 717 MHz | – | 728 MHz | SDL |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.96.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n29A-n30A-n77A | CA\_n30A-n77A | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n29A-n30A-n77(2A) | CA\_n30A-n77A | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.96.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall back for CA\_n30-n77 in the specification 38.101.

For CA\_n30-n77 the 3rd and 5th IMD products are falling inside n29 as shown in the following analysis.

**Table 5.1.96.3-1: Band n30 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2305 | 2315 | 3300 | 4200 |
| DL Frequency [MHz] | 2350 | 2360 | 3300 | 4200 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 985 | 1895 | 5605 | 6515 |
| 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) | 410 | 1330 | 4285 | 6095 |
| 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) | 7910 | 8830 | 8905 | 10715 |
| 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) | 2715 | 3645 | 7585 | 10295 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3790 | 1970 | 11210 | 13030 |
| 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) | 10215 | 11145 | 12205 | 14915 |
| 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) | 14495 | 10885 | 5960 | 5020 |
| 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) | 7990 | 5270 | 345 | 1485 |
| 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) | 15505 | 19115 | 12520 | 13460 |
| 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) | 14510 | 17230 | 13515 | 15345 |

Co-existence studies shows that

* The 3rd IMD generated by dual uplink of Band n30 + Band n77 may fall into own Rx of band n29.
* The 5th IMD generated by dual uplink of Band n30 + Band n77 may fall into own Rx of band n29.

#### 5.1.96.4 REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 3rd and 5th IMD generated by dual uplink of Band n30 + Band n77 may fall into own Rx of band n29. The same MSD value as DC\_29-30\_n77 of 15.2 dB is reused.

Table 5.1.96.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n29A-n30A-n77A | n29 | N/A | 5 | N/A | 722 | 15.2 | SDL | IMD31 |
| n30 | 2310 | 5 | 25 | 2355 | N/A | FDD | N/A |
| n77 | 3898 | 10 | 50 | 3898 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

### 5.1.97 CA\_n29-n66-n77

5.1.97.1 Operating bands for CA

Table 5.1.97.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n29A-n66A-n77A | n29 |  | N/A |  | 717 MHz | – | 728 MHz | SDL |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.1.97.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n29A-n66A-n77A | CA\_n66A-n77A | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n29A-n66(2A)-n77A | CA\_n66A-n77A | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n29A-n66A-n77(2A) | CA\_n66A-n77A | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

#### 5.1.97.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues the IMD products are already addressed in 2DL 2UL fall back for CA\_n66-n77 in the specification 38.101.

For CA\_n66-n77 the 3rd IMD product is falling inside n29 as shown in the following analysis.

**Table 5.1.97.3-1: Band n66 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1780 | 3300 | 4200 |
| DL Frequency [MHz] | 2110 | 2200 | 3300 | 4200 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1520 | 2490 | 5010 | 5980 |
| 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 | 260 | 4820 | 6690 |
| 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 | 7760 | 8310 | 10180 |
| 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 | 2040 | 8120 | 10890 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 4980 | 3040 | 10020 | 11960 |
| 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 | 9540 | 11610 | 14380 |
| 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 | 11420 | 3820 | 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 | 6340 | 1260 | 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 | 18580 | 10140 | 11320 |
| 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 | 16160 | 11730 | 13740 |

Co-existence studies shows that

* The 3rd IMD generated by dual uplink of Band n66 + Band n77 may fall into own Rx of band n29.

#### 5.1.97.4 REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 3rd IMD generated by dual uplink of Band n66 + Band n77 may fall into own Rx of band n29. The same MSD value as DC\_29-66\_n77 of 15.2 dB is reused.

Table 5.1.97.4-1: MSD for the CA configuration

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n29A-n66A-n77A | n29 | N/A | 5 | N/A | 722 | 15.2 | SDL | IMD3zz |
| n66 | 1734 | 5 | 25 | 2134 | N/A | FDD | N/A |
| n77 | 4190 | 10 | 50 | 4190 | N/A | TDD | N/A |
| NOTE ZZ: The MSD test points cannot be verified for the band combination in US due to the Band n77 frequency range restriction. | | | | | | | | |

### 5.1.98 CA\_n1-n3-n79

#### 5.1.98.1 Operating bands for CA

Table 5.1.98.1-1: CA band combination of band n1+n3+n79

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | |
| n79 | 4400 MHz | – | 5000 MHz | | 4400 MHz | – | 5000 MHz | TDD | |

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

Table 5.1.98.2-1: Supported bandwidths per CA band combination of band n1+n3+n79

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | Bandwidth combination set | |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |  |
| CA\_n1A-n3A-n79A | CA\_n1A-n3A  CA\_n1A-n79A  CA\_n3A-n79A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  | |  |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 | |  |
| NOTE 3: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | |

#### 5.1.98.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.X.3-1, 5.1.X.3-2 and 5.1.X.3-3, respectively.

Table 5.1.98.3-1: IMD analysis for n1+n3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 1710 | 1785 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |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) | 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 |

Table 5.1.98.3-2: IMD analysis for n1+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3080 | 2420 | 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) | 1160 | 440 | 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) | 6160 | 4840 |  |  |
| 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) | 18080 | 15620 | 3520 | 2680 |
| 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) | 11160 | 9240 | 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 |

Table 5.1.98.3-3: IMD analysis for n3+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1710 | 1785 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3290 | 2615 | 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) | 1580 | 830 | 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) | 6580 | 5230 |  |  |
| 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) | 18290 | 15815 | 2740 | 1840 |
| 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) | 11580 | 9630 | 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 |

According to the above analysis, the own Rx impact of the 3rd band is shown as the followings.

* 5th order IMD generated by dual uplink of Band n1 + Band n3 may fall into own Rx of Band n79
* 5th order IMD generated by dual uplink of Band n3 + Band n79 may fall into own Rx of Band n1.

#### 5.1.98.4 REFSENS requirements

Table 5.1.x.4-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. For the exception, the same exception values in DC\_1A-3A\_n79A and DC\_1A\_n3A-n79A are used.

Table 5.1.98.4-1: MSD for the CA configuration

| NR Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| CA\_n1A-n3A-n79A | n1 | 1930 | 5 | 25 | 2120 | N/A | N/A |
| n3 | 1720 | 5 | 25 | 1815 | N/A | N/A |
| n79 | 4950 | 40 | 216 | 4950 | 4.7 | IMD5 |
| n3 | 1750 | 5 | 25 | 1845 | N/A | N/A |
| n79 | 4860 | 40 | 216 | 4860 | N/A | N/A |
| n1 | 1950 | 5 | 25 | 2140 | 3.6 | IMD5 |

### 5.1.99 CA\_n1-n28-n41

#### 5.1.99.1 Operating bands for CA

Table 5.1.99.1-1: CA band combination of band n1+n28+n41

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

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

Table 5.1.99.2-1: Supported bandwidths per CA band combination of band n1+n28+n41

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 3) | | | | | | | | | | | | | Bandwidth combination set | |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |  |
| CA\_n1A-n28A-n41A | CA\_n1A-n28A  CA\_n1A-n41A  CA\_n28A-n41A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | |  |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 | |  |
| NOTE 3: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | |

#### 5.1.99.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.99.3-1, 5.1.99.3-2 and 5.1.99.3-3, respectively.

Table 5.1.99.3-1: IMD analysis for n1+n28

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1172 | 1277 | 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 |

Table 5.1.99.3-2: IMD analysis for n1+n41

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 770 | 516 | 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 |

Table 5.1.99.3-3: IMD analysis for n28+n41

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1987 | 1748 | 3199 | 3438 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 1284 | 1000 | 4244 | 4677 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3902 | 4186 | 5695 | 6128 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 581 | 252 | 6740 | 7367 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 3974 | 3496 |  |  |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 4605 | 4934 | 8191 | 8818 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 6398 | 6876 |  |  |
| Two-tone 5th order IMD products | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 10057 | 9236 | 496 | 122 |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fy\_high| | |2\*fx\_high - 3\*fy\_low| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 6664 | 5992 | 2748 | 3271 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 10687 | 11508 | 5308 | 5682 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 8894 | 9566 | 7101 | 7624 |

According to the above analysis, the own Rx impact of the 3rd band is shown as the followings.

* 2nd and 4th order IMDs generated by dual uplink of Band n1 + Band n28 may fall into own Rx of Band n41.
* 2nd and 5th order IMDs generated by dual uplink of Band n1 + Band n41 may fall into own Rx of Band n28.

#### 5.1.99.4 REFSENS requirements

Table 5.1.99.4-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. For the exception, the same exception value in DC\_1A\_n28A-n41A is used.

Table 5.1.99.4-1: MSD for the CA configuration

| NR Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| CA\_n1A-n28A-n41A | n1 | 1935 | 5 | 25 | 2125 | N/A | N/A |
| n28 | 718 | 5 | 25 | 773 | N/A | N/A |
| n41 | 2653 | 10 | 50 | 2653 | 30.1 | IMD22 |
| n1 | 1923 | 5 | 25 | 2113 | N/A | N/A |
| n41 | 2685 | 10 | 50 | 2685 | N/A | N/A |
| n28 | 707 | 5 | 25 | 762 | 29.3 | IMD21 |
| 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. | | | | | | | |

* 5.1.100 CA\_n1-n28-n77
* 5.1.100.1 Operating bands for CA

**Table 5.1.100.1-1: CA band combination of band n1+n28+n77**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

* 5.1.100.2 Channel bandwidths per operating band for CA

**Table 5.1.100.2-1: Supported bandwidths per CA band combination of band n1+n28+n77**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** | |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | |  |
| CA\_n1A-n28A-n77A | CA\_n1A-n28A  CA\_n1A-n77A  CA\_n28A-n77A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | |  |
|  |  | n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 | |  |
| NOTE 3: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | |

* 5.1.100.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.100.3-1, 5.1.100.3-2 and 5.1.100.3-3, respectively.

**Table 5.1.100.3-1: IMD analysis for n1+n28**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 703 | 748 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1172 | 1277 | 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 |

**Table 5.1.100.3-2: IMD analysis for n1+n77**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2280 | 1320 | 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 |

**Table 5.1.100.3-3: IMD analysis for n28+n77**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 703 | 748 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3497 | 2552 | 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 |

According to the above analysis, the own Rx impact of the 3rd band is shown as the followings.

* 3rd and 4th order IMD generated by dual uplink of Band n1 + Band n28 may fall into own Rx of Band n77.
* 5th order IMD generated by dual uplink of Band n1 + Band n77 may fall into own Rx of Band n28.
* 3rd order IMD generated by dual uplink of Band n28 + Band n77 may fall into own Rx of Band n1.
* 5.1.100.4 REFSENS requirements

Table 5.1.100.4-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. For the exception, the same values in DC\_1A-28A\_n77A and DC\_1A\_n28A-n78A are used.

**Table 5.1.100.4-1: MSD for the CA configuration**

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n1A-n28A-n77A | n1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
| n28 | 733 | 5 | 25 | 788 | N/A | N/A |
| n77 | 3416 | 10 | 50 | 3416 | 15.7 | IMD32 |
| n1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
| n77 | 3320 | 10 | 50 | 3320 | N/A | N/A |
| n28 | 735 | 5 | 25 | 790 | 4.2 | IMD5 |
| n28 | 740 | 5 | 25 | 795 | N/A | N/A |
| n77 | 3630 | 10 | 50 | 3630 | N/A | N/A |
| n1 | 1960 | 5 | 25 | 2150 | 15.7 | IMD3 |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | |

* 5.1.101 CA\_n1-n28-n79
* 5.1.101.1 Operating bands for CA

**Table 5.1.101.1-1: CA band combination of band n1+n28+n79**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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 |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

* 5.1.x.2 Channel bandwidths per operating band for CA

**Table 5.1.101.2-1: Supported bandwidths per CA band combination of band n1+n28+n79**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** | |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | |  |
| CA\_n1A-n28A-n79A | CA\_n1A-n28A  CA\_n1A-n79A  CA\_n28A-n79A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | |  |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 | |  |
| NOTE 3: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | |

* 5.1.x.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.101.3-1, 5.1.101.3-2 and 5.1.101.3-3, respectively.

**Table 5.1.101.3-1: IMD analysis for n1+n28**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 703 | 748 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1172 | 1277 | 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 |

**Table 5.1.101.3-2: IMD analysis for n1+n79**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3080 | 2420 | 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) | 1160 | 440 | 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) | 6160 | 4840 |  |  |
| 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) | 18080 | 15620 | 3520 | 2680 |
| 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) | 11160 | 9240 | 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 |

**Table 5.1.101.3-3: IMD analysis for n28+n79**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 703 | 748 | 4400 | 5000 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4297 | 3652 | 5103 | 5748 |
| 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) | 3594 | 2904 | 8052 | 9297 |
| 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) | 5806 | 6496 | 9503 | 10748 |
| 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) | 2891 | 2156 | 12452 | 14297 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| |  |  |
| IMD frequency limits (MHz) | 8594 | 7304 |  |  |
| 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) | 6509 | 7244 | 13903 | 15748 |
| Two-tone 4th order IMD products | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |  |  |
| IMD frequency limits (MHz) | 10206 | 11496 |  |  |
| 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) | 19297 | 16852 | 1408 | 2188 |
| 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) | 13594 | 11704 | 6556 | 7891 |
| 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) | 18303 | 20748 | 7212 | 7992 |
| 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) | 14606 | 16496 | 10909 | 12244 |

According to the above analysis, the own Rx impact of the 3rd band is shown as the followings.

* 3rd and 5th order IMD generated by dual uplink of Band n1 + Band n28 may fall into own Rx of Band n79
* 3rd and 4th order IMD generated by dual uplink of Band n1 + Band n79 may fall into own Rx of Band n28
* 4th and 5th order IMD generated by dual uplink of Band n28 + Band n79 may fall into own Rx of Band n1.
* 5.1.101.4 REFSENS requirements

Table 5.1.101.4-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. For the exception, the same exception values in DC\_1A-28A\_n79A and DC\_1A\_n28A-n79A are used.

**Table 5.1.101.4-1: MSD for the CA configuration**

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n1A-n28A-n79A | n1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
| n28 | 730 | 5 | 25 | 785 | N/A | N/A |
| n79 | 4630 | 40 | 216 | 4630 | 14.9 | IMD31 |
| n1 | 1930 | 5 | 25 | 2120 | N/A | N/A |
| n79 | 4648 | 40 | 216 | 4648 | N/A | N/A |
| n28 | 733 | 5 | 25 | 788 | 15.2 | IMD32 |
| n28 | 745.5 | 5 | 25 | 800.5 | N/A | N/A |
| n79 | 4420 | 40 | 216 | 4420 | N/A | N/A |
| n1 | 1977.5 | 5 | 25 | 2167.5 | 1.2 | IMD41 |
| 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. | | | | | | | |

* 5.1.102 CA\_n1-n41-n77
* 5.1.102.1 Operating bands for CA

**Table 5.1.102.1-1: CA band combination of band n1+n41+n77**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

* 5.1.102.2 Channel bandwidths per operating band for CA

**Table 5.1.102.2-1: Supported bandwidths per CA band combination of band n1+n41+n77**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** | |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | |  |
| CA\_n1A-n41A-n77A | CA\_n1A-n41A  CA\_n1A-n77A  CA\_n41A-n77A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 | |  |
|  |  | n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 | |  |
| NOTE 3: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | |

* 5.1.x.3 UE co-existence studies

The harmonic issues have been already analyzed in 3DL/1UL WI. For inter-modulation issues, the 2nd, 3rd, 4th and 5th order intermodulation products are calculated in Table 5.1.102.3-1, 5.1.102.3-2 and 5.1.102.3-3, respectively.

**Table 5.1.102.3-1: IMD analysis for n1+n41**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 2496 | 2690 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 770 | 516 | 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 |

**Table 5.1.102.3-2: IMD analysis for n1+n77**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2280 | 1320 | 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 |

**Table 5.1.102.3-3: IMD analysis for n41+n77**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2496 | 2690 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1704 | 610 | 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 |

According to the above analysis, the own Rx impact of the 3rd band is shown as the followings.

* 3rd, 4th and 5th order IMD generated by dual uplink of Band n1 + Band n41 may fall into own Rx of Band n77
* 4th and 5th order IMD generated by dual uplink of Band n1 + Band n77 may fall into own Rx of Band n41
* 4th order IMD generated by dual uplink of Band n41 + Band n77 may fall into own Rx of Band n1.
* 5.1.102.4 REFSENS requirements

Table 5.1.102.4-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. For the exception, the same exception values in DC\_1A-41A\_n77A and DC\_1A\_n41A-n77A are used.

**Table 5.1.102.4-1: MSD for the CA configuration**

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n1A-n41A-n77A | n1 | 1970 | 5 | 25 | 2160 | N/A | N/A |
| n41 | 2650 | 10 | 50 | 2650 | N/A | N/A |
| n77 | 3330 | 10 | 50 | 3330 | 19.6 | IMD31, 2 |
| n1 | 1975 | 5 | 10 | 2165 | N/A | N/A |
| n77 | 3410 | 10 | 50 | 3410 | N/A | N/A |
| n41 | 2515 | 10 | 50 | 2515 | 11.5 | IMD41 |
| n41 | 2640 | 10 | 50 | 2640 | N/A | N/A |
| n77 | 3710 | 10 | 50 | 3710 | N/A | N/A |
| n1 | 1950 | 5 | 25 | 2140 | 9.3 | IMD4 |
| 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. | | | | | | | |

* 5.1.103 CA\_n28-n78-n79
* 5.1.103.1 Operating bands for CA

**Table 5.1.103.1-1: CA band combination of band n28+n78+n79**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | | |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

* 5.1.103.2 Channel bandwidths per operating band for CA

**Table 5.1.103.2-1: Supported bandwidths per CA band combination of band n28+n78+n79**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
| **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
| CA\_n28A-n78A-n79A | CA\_n28A-n78A  CA\_n28A-n79A  CA\_n78A-n79A | n28 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 |  | 80 |  | 100 |
| n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |

* 5.1.x.3 UE co-existence studies

Based on co-existence studies of 2UL/2DL CA\_n28-n78, CA\_n28-n79, and CA\_n78-n79, own Rx impact of the 3rd band is the followings

- 2nd, 3rd and 5th order IMD generated by dual uplink of CA\_n28-n78 may fall into part of own band n79.

- 2nd and 3rd order IMD generated by dual uplink of CA\_n28-n79 may fall into part of own band n78.

- 2nd and 5th order IMD generated by dual uplink of CA\_n78-n79 may fall into part of own band n28.

* 5.1.103.4 REFSENS requirements

- 2nd, 3rd and 5th order IMD generated by dual uplink of CA\_n28-n78 may fall into part of own band n79.

=> The MSD value is shown in the following table. This MSD value is the average of the analysis results of the two companies. Also, we define only the highest MSD, and omit the MSDs due to IM3 and IM5. This is described in NOTE4 and NOTE1.

This requirement only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. This is described in NOTE3.

- 2nd and 3rd order IMD generated by dual uplink of CA\_n28-n79 may fall into part of own band n78.

=> The MSD value is shown in the following table. This MSD value is the average of the analysis results of the two companies. Also, we define only the highest MSD, and omit the MSD due to IM3. This is described in NOTE4.

This requirement only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. This is described in NOTE3.

- 2nd and 5th order IMD generated by dual uplink of CA\_n78-n79 may fall into part of own band n28.

=> Same MSD apply with CA\_n28\_n77-n79 specified in TS 38.101-1. Also, we define only the highest MSD, and omit the MSD due to IM5. This is described in NOTE1.

**Table 5.1.103.4-1: MSD for the CA configuration**

| **NR Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| CA\_n28A-n78A-n79A | n28 | 740 | 5 | 25 | 795 | N/A | N/A |
| n78 | 3700 | 10 | 50 | 3700 | N/A | N/A |
| n79 | 4440 | 40 | 216 | 4440 | 26.2 | IMD21,3,4 |
| n28 | 740 | 5 | 25 | 795 | N/A | N/A |
| n78 | 3700 | 10 | 50 | 3700 | 26.9 | IMD23,4 |
| n79 | 4440 | 40 | 216 | 4440 | N/A | N/A |
| n28 | 745 | 5 | 25 | 800 | 16.2 | IMD21 |
| n78 | 3620 | 10 | 50 | 3620 | N/A | N/A |
| n79 | 4420 | 40 | 216 | 4420 | N/A | 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.  NOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.  NOTE 4: This band is subject to IMD3 also which MSD is not specified. | | | | | | | |

5.1.104 CA\_n1-n3-n18

5.1.104.1 Operating bands for CA

**Table 5.1.104.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n18 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |

5.1.104.2 Channel bandwidths per operating band for CA

**Table 5.1.104.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n3A-n18A | CA\_n1A-n3A  CA\_n1A-n18A  CA\_n3A-n18A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |
| n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |

5.1.104.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

Based on the calculation, there is no IMD issues.

5.1.104.4 REFSENS requirements

Based on co-existence studies on 5.1.x.3, there is no additional IMD issue for the combination.

5.1.105 CA\_n1-n18-n28

5.1.105.1 Operating bands for CA

**Table 5.1.105.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n18-n28 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

5.1.105.2 Channel bandwidths per operating band for CA

**Table 5.1.105.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n18A-n28A | CA\_n1A-n18A  CA\_n1A-n28A  CA\_n18A-n28A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |
| n28 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |

5.1.105.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

No IMD generated by dual Tx n1 and n18 fall into the third band n28 Rx

IMD5 generated by dual Tx n1 and n28 fall into the third band n18 Rx

IMD5 generated by dual Tx n18 and n28 fall into the third band n1 Rx.

5.1.105.4 REFSENS requirements

Based on co-existence studies on 5.1.x.3, MSD values are defined below.

**Table 5.1.105.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n1-n18-n28 | n1 | 1965 | 5 | 25 | 2155 | N/A | FDD | N/A |
| n28 | 708 | 5 | 25 | 763 | N/A | FDD | N/A |
| n18 | 822 | 5 | 25 | 867 | 4.6 | FDD | IMD5 |
| n18 | 825 | 5 | 25 | 870 | N/A | FDD | N/A |
| n28 | 738 | 5 | 25 | 793 | N/A | FDD | N/A |
| n1 | 1937 | 5 | 25 | 2127 | 4 | FDD | IMD5 |

5.1.106 CA\_n1-n18-n41

5.1.106.1 Operating bands for CA

**Table 5.1.106.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n18-n41 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

5.1.106.2 Channel bandwidths per operating band for CA

**Table 5.1.106.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n18A-n41A | CA\_n1A-n18A  CA\_n1A-n41A  CA\_n18A-n41A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |

5.1.106.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

No IMD generated by dual Tx n1 and n18 fall into the third band n41 Rx

IMD5 generated by dual Tx n1 and n41 fall into the third band n18 Rx

No IMD generated by dual Tx n18 and n41 fall into the third band n1 Rx.

5.1.106.4 REFSENS requirements

Based on co-existence studies on 5.1.106.3, MSD values are defined below.

**Table 5.1.106.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n1-n18-n41 | n1 | 1960 | 5 | 25 | 2150 | N/A | FDD | N/A |
| n41 | 2505 | 10 | 50 | 2505 | N/A | TDD | N/A |
| n18 | 825 | 5 | 25 | 870 | 3.3 | FDD | IMD5 |

5.1.107 CA\_n1-n18-n77

5.1.107.1 Operating bands for CA

**Table 5.1.107.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n18-n77 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

5.1.107.2 Channel bandwidths per operating band for CA

**Table 5.1.107.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n18A-n77A | CA\_n1A-n18A  CA\_n1A-n77A  CA\_n18A-n77A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
| n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |

5.1.107.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD3 and IMD5 generated by dual Tx n1 and n18 fall into the third band n77 Rx

IMD5 generated by dual Tx n1 and n77 fall into the third band n18 Rx

IMD3 generated by dual Tx n18 and n77 fall into the third band n1 Rx.

5.1.107.4 REFSENS requirements

Based on co-existence studies on 5.1.107.3, MSD values are defined below.

**Table 5.1.107.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n1-n18-n77 | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
| n18 | 825 | 5 | 25 | 870 | N/A | FDD | N/A |
| n77 | 3600 | 10 | 50 | 3600 | 15.7 | TDD | IMD31 |
| n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n77 | 3390 | 10 | 50 | 3390 | N/A | TDD | N/A |
| n18 | 825 | 5 | 25 | 870 | 3.5 | FDD | IMD5 |
| n1 | 1930 | 5 | 25 | 2120 | 16.4 | FDD | IMD3 |
| n18 | 825 | 5 | 25 | 870 | N/A | FDD | N/A |
| n77 | 3770 | 10 | 50 | 3770 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

5.1.108 CA\_n3-n18-n28

5.1.x108.1 Operating bands for CA

**Table 5.1.108.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n18-n28 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

5.1.108.2 Channel bandwidths per operating band for CA

**Table 5.1.108.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n3A-n18A-n28A | CA\_n3A-n18A  CA\_n3A-n28A  CA\_n18A-n28A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |
| n28 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |

5.1.108.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD4 generated by dual Tx n3 and n18 fall into the third band n28 Rx

No IMD generated by dual Tx n3 and n28 fall into the third band n18 Rx

No IMD generated by dual Tx n18 and n28 fall into the third band n3 Rx.

5.1.108.4 REFSENS requirements

Based on co-existence studies on 5.1.108.3, MSD values are defined below.

**Table 5.1.108.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n3-n18-n28 | n3 | 1712.5 | 5 | 25 | 1807.5 | N/A | FDD | N/A |
| n28 | 715 | 5 | 25 | 770 | 9.4 | FDD | IMD4 |
| n18 | 827.5 | 5 | 25 | 872.5 | N/A | FDD | N/A |

5.1.109 CA\_n3-n18-n77

5.1.109.1 Operating bands for CA

**Table 5.1.109.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n18-n77 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

5.1.109.2 Channel bandwidths per operating band for CA

**Table 5.1.109.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n3A-n18A-n77A | CA\_n3A-n18A  CA\_n3A-n77A  CA\_n18A-n77A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
| n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |

5.1.109.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD3, IMD4 and IMD5 generated by dual Tx n3 and n18 fall into the third band n77 Rx

No IMD generated by dual Tx n3 and n77 fall into the third band n18 Rx

IMD3 generated by dual Tx n18 and n77 fall into the third band n3 Rx.

5.1.109.4 REFSENS requirements

Based on co-existence studies on 5.1.109.3, MSD values are defined below, reuse from DC\_18A\_n3A-n77A.

**Table 5.1.109.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n3-n18-n77 | n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |
| n3 | 1770 | 5 | 25 | 1865 | N/A | FDD | N/A |
| n77 | 3410 | 10 | 50 | 3410 | 16.3 | TDD | IMD31,2 |
| n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |
| n3 | 1770 | 5 | 25 | 1865 | 15.7 | FDD | IMD3 |
| n77 | 3505 | 10 | 50 | 3505 | 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. | | | | | | | | |

5.1.110 CA\_n18-n28-n41

5.1.110.1 Operating bands for CA

**Table 5.1.110.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n18-n28-n41 | n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n41 | 2496 MHz | – | 2690MHz | 2496 MHz | – | 2690 MHz | TDD |

5.1.110.2 Channel bandwidths per operating band for CA

**Table 5.1.110.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n18A-n28A-n41A | CA\_n18A-n28A  CA\_n18A-n41A  CA\_n28A-n41A | n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
| n28 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |

5.1.110.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD5 generated by dual Tx n18 and n28 fall into the third band n41 Rx

IMD5 generated by dual Tx n18 and n41 fall into the third band n28 Rx

No IMD generated by dual Tx n28 and n41 fall into the third band n18 Rx.

5.1.110.4 REFSENS requirements

Based on co-existence studies on 5.1.110.3, MSD values are defined below.

**Table 5.1.110.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n18-n28-n41 | n18 | 825 | 5 | 25 | 870 | N/A | FDD | N/A |
| n28 | 738 | 5 | 25 | 793 | N/A | FDD | N/A |
| n41 | 2562 | 10 | 50 | 2562 | 4.4 | TDD | IMD5 |
| n18 | 825 | 5 | 25 | 870 | N/A | FDD | N/A |
| n41 | 2505 | 10 | 50 | 2505 | N/A | TDD | N/A |
| n28 | 740 | 5 | 25 | 795 | 3.9 | FDD | IMD5 |

5.1.111 CA\_n18-n28-n77

5.1.111.1 Operating bands for CA

**Table 5.1.111.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n18-n28-n77 | n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n77 | 3300 MHz | – | 4200MHz | 3300 MHz | – | 4200 MHz | TDD |

5.1.111.2 Channel bandwidths per operating band for CA

**Table 5.1.111.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n18A-n28A-n77A | CA\_n18A-n28A  CA\_n18A-n77A  CA\_n28A-n77A | n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
| n28 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |

5.1.111.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD5 generated by dual Tx n18 and n28 fall into the third band n77 Rx

IMD5 generated by dual Tx n18 and n77 fall into the third band n28 Rx

IMD5 generated by dual Tx n28 and n77 fall into the third band n18 Rx.

5.1.111.4 REFSENS requirements

Based on co-existence studies on 5.1.111.3, MSD values are defined below, reused from DC\_18A\_n28A-n77A and DC\_18A-28A\_n77A.

**Table 5.1.111.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n18-n28-n77 | n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |
| n28 | 710 | 5 | 25 | 765 | N/A | FDD | N/A |
| n77 | 3770 | 10 | 50 | 3770 | 4.0 | TDD | IMD5 |
| n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |
| n28 | 723 | 5 | 25 | 778 | 4.4 | FDD | IMD5 |
| n77 | 4058 | 10 | 50 | 4058 | N/A | TDD | N/A |
| n18 | 820 | 5 | 25 | 865 | 3.9 | FDD | IMD5 |
| n28 | 723 | 5 | 25 | 778 | N/A | FDD | N/A |
| n77 | 3757 | 10 | 50 | 3757 | N/A | TDD | N/A |

5.1.112 CA\_n18-n41-n77

5.1.112.1 Operating bands for CA

**Table 5.1.112.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n18-n41-n77 | n18 | 815 MHz | – | 830 MHz | 860 MHz | – | 875 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n77 | 3300 MHz | – | 4200MHz | 3300 MHz | – | 4200 MHz | TDD |

5.1.112.2 Channel bandwidths per operating band for CA

**Table 5.1.112.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n18A-n41A-n77A | CA\_n18A-n41A  CA\_n18A-n77A  CA\_n41A-n77A | n18 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
| n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |
| n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |

5.1.112.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD2, IMD3, IMD4 generated by dual Tx n18 and n41 fall into the third band n77 Rx

IMD2 and IMD3 generated by dual Tx n18 and n77 fall into the third band n41 Rx

IMD2, IMD3 and IMD5 generated by dual Tx n41 and n77 fall into the third band n18 Rx.

5.1.112.4 REFSENS requirements

Based on co-existence studies on 5.1.112.3, MSD values are defined below, IMD2 of dual Tx fall into n77 and IMD2 of dual Tx fall into n41 are reused from DC\_18A\_n41A-n77A and DC\_18A-41A\_n77A.

**Table 5.1.112.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n18-n41-n77 | n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |
| n41 | 2570 | 5 | 25 | 2570 | N/A | TDD | N/A |
| n77 | 3390 | 10 | 50 | 3390 | 30.1 | TDD | IMD22,4 |
| n18 | 820 | 5 | 25 | 865 | N/A | FDD | N/A |
| n77 | 3450 | 10 | 50 | 3450 | N/A | TDD | N/A |
| n41 | 2630 | 5 | 25 | 2630 | 28.5 | TDD | IMD24 |
| n41 | 2590 | 10 | 50 | 2590 | N/A | TDD | N/A |
| n77 | 3460 | 10 | 50 | 3460 | N/A | TDD | N/A |
| n18 | 825 | 5 | 25 | 870 | 29.3 | FDD | IMD21,4 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE2: This band is subject to IMD4 also which MSD is not specified.  NOTE 4: This band is subject to IMD3 also which MSD is not specified. | | | | | | | | |

5.1.113 CA\_n2-n5-n48

5.1.113.1 Operating bands for CA

**Table 5.1.113.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n5-n48 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |

5.1.113.2 Channel bandwidths per operating band for CA

**Table 5.1.113.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** |  |  | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n2A-n5A-n48A | CA\_n2A-n5A  CA\_n2A-n48A  CA\_n5A-n48A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |
| n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| A\_n2A-n5A-n48B | CA\_n2A-n5A  CA\_n2A-n48A  CA\_n5A-n48A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_n48B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_n48B Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 2 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| CA\_n2A-n5A-n48(2A) | CA\_n2A-n5A  CA\_n2A-n48A  CA\_n5A-n48A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | |  |
| CA\_n2A-n5A-n48(A-B) | CA\_n2A-n5A  CA\_n2A-n48A  CA\_n5A-n48A | n2 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  | 0 |
| n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_n48(A-B) Bandwidth Combination Set 0 in Table 5.5A.2-2 | | | | | | | | | | | | | | |
| n2 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  | 1 |
| n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  |
| n48 | See CA\_n48(A-B) Bandwidth Combination Set 1 in Table 5.5A.2-2 | | | | | | | | | | | | | | |

5.1.113.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD3 generated by dual Tx n2 and n5 falls into the third band n48 Rx

No IMD generated by dual Tx n2 and n48 falls into n5

IMD3 generated by dual Tx n5 and n48 fall into n2 Rx.

5.1.113.4 REFSENS requirements

Based on co-existence studies on 5.1.113.3, MSD values are defined below, reused from CA\_2A-5A-48A.

**Table 5.1.113.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n2-n5-n48 | n2 | 1882 | 5 | 25 | 1962 | 15.6 | FDD | IMD3 |
| n5 | 839 | 5 | 25 | 884 | N/A | FDD | N/A |
| n48 | 3640 | 5 | 25 | 3640 | N/A | TDD | N/A |
| n2 | 1905 | 5 | 25 | 1985 | N/A | FDD | N/A |
| n5 | 844 | 5 | 25 | 889 | N/A | FDD | N/A |
| n48 | 3593 | 5 | 25 | 3593 | 16.6 | TDD | IMD3 |

5.1.114 CA\_n2-n48-n66

5.1.114.1 Operating bands for CA

**Table 5.1.114.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n48-n66 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2100 MHz | – | 2200 MHz | FDD |

5.1.114.2 Channel bandwidths per operating band for CA

**Table 5.1.114.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** |  |  | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n2A-n48A-n66A | CA\_n2A-n48A  CA\_n2A-n66A  CA\_n48A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| CA\_n2A-n48(A-B)-n66A | CA\_n2A-n48A  CA\_n2A-n66A  CA\_n48A-n66A | n2 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  | 0 |
| n48 | See CA\_n48(A-B) Bandwidth Combination Set 0 in Table 5.5A.2-2 | | | | | | | | | | | | | | |  |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
| n2 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  | 1 |
| n48 | See CA\_n48(A-B) Bandwidth Combination Set 1 in Table 5.5A.2-2 | | | | | | | | | | | | | | |  |
|  | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
| CA\_n2A-n48B-n66A | CA\_n2A-n48A  CA\_n2A-n66A  CA\_n48A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | See CA\_n48B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n48 | See CA\_n48B Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 2 |
| n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| CA\_n2A-n48(2A)-n66A | CA\_n2A-n48A  CA\_n2A-n66A  CA\_n48A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |

5.1.114.3 UE co-existence studies

For CA combinations with 3 bands DL and 2 bands UL, only IMD issues due to dual Tx operation of two bands falling into the third band Rx need to be considered.

IMD4 generated by dual Tx n2 and n48 falls into the third band n66 Rx

IMD2 generated by dual Tx n2 and n66 falls into the third band n48 Rx

IMD2 and IMD5 generated by dual Tx n48 and n66 fall into n2 Rx.

5.1.x.4 REFSENS requirements

Based on co-existence studies on 5.1.114.3, MSD values are defined below, reused from CA\_2-48-66.

**Table 5.1.114.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n2-n48-n66 | n2 | 1855 | 5 | 25 | 1935 | N/A | FDD | N/A |
| n48 | 3625 | 5 | 25 | 3625 | 32.0 | TDD | IMD2 |
| n66 | 1770 | 5 | 25 | 2190 | N/A | FDD | N/A |
| n2 | 1905 | 5 | 25 | 1985 | N/A | FDD | N/A |
| n48 | 3560 | 5 | 25 | 3560 | N/A | TDD | N/A |
| n66 | 1755 | 5 | 25 | 2155 | 12.1 | FDD | IMD4 |
| n2 | 1880 | 5 | 25 | 1960 | 28.3 | FDD | IMD21 |
| n48 | 3695 | 5 | 25 | 3695 | N/A | TDD | N/A |
| n66 | 1735 | 5 | 25 | 2135 | N/A | FDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

5.1.115 CA\_n2-n48-n77

5.1.115.1 Operating bands for CA

**Table 5.1.115.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n48-n77 | 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 |

5.1.115.2 Channel bandwidths per operating band for CA

**Table 5.1.115.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** |  |  | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n2A-n48A-n77A | CA\_n2A-n48A  CA\_n2A-n77A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n2A-n48A-n77C | CA\_n2A-n48A  CA\_n2A-n77A  CA\_n77C | n2 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  | 0 |
|  |  | n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n2 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  | 1 |
|  |  | n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| CA\_n2A-n48B-n77A | CA\_n2A-n48A  CA\_n2A-n77A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | See CA\_n48B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n48 | See CA\_n48B Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 2 |
| n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n2A-n48(2A)-n77A | CA\_n2A-n48A  CA\_n2A-n77A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |

5.1.115.3 UE co-existence studies

CA\_n48-n77 is fully limited for downlink only, and there is no simultaneous Tx/Rx operation between NR n48 and n77 carriers. Thus there is no additional co-existence issue identified.

5.1.115.4 REFSENS requirements

Based on co-existence studies on 5.1.115.3, MSD exception are not needed.

5.1.116 CA\_n5-n48-n66

5.1.116.1 Operating bands for CA

**Table 5.1.116.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n48-n66 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

5.1.116.2 Channel bandwidths per operating band for CA

**Table 5.1.116.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** |  |  | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n5A-n48A-n66A | CA\_n5A-n48A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n5A-n66A | n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  | CA\_n48A-n66A | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
| CA\_n5A-n48(A-B)-n66A | CA\_n5A-n48A | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n5A-n66A | n48 | See CA\_n48(A-B) Bandwidth Combination Set 0 in Table 5.5A.2-2 | | | | | | | | | | | | | | |  |
|  | CA\_n48A-n66A | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
|  |  | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 1 |
|  |  | n48 | See CA\_n48(A-B) Bandwidth Combination Set 1 in Table 5.5A.2-2 | | | | | | | | | | | | | | |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
| CA\_n5A-n48B-n66A | CA\_n5A-n48A  CA\_n48A-n66A  CA\_n5A-n66A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | See CA\_n48B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n48 | See CA\_n48B Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 2 |
| n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| CA\_n5A-n48(2A)-n66A | CA\_n5A-n48A  CA\_n48A-n66A  CA\_n5A-n66A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |

5.1.116.3 UE co-existence studies

Based on co-existence studies, the Rx impact from IMD is shown in the followings,

* For CA\_n5-n66 UL, the 5th order IMD product is falling inside band n48 DL
* For CA\_n5-n48 UL, there is no IMD product falling inside band n66 DL
* For CA\_n48-n66 UL, there is no IMD product falling inside band n5 DL

Thus, additional MSD requirement should be considered for this band combination.

5.1.116.4 REFSENS requirements

Based on co-existence studies on 5.1.116.3, MSD values are defined below.

**Table 5.1.x.4-1 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n5-n48-n66 | n5 | 829 | 5 | 25 | 874 | N/A | FDD | N/A |
|  | n48 | 3622 | 10 | 50 | 3622 | 3.6 | TDD | IMD5 |
|  | n66 | 1760 | 5 | 216 | 2160 | N/A | FDD | N/A |

5.1.117 CA\_n5-n48-n77

5.1.117.1 Operating bands for CA

**Table 5.1.117.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n48-n77 | 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 |

5.1.117.2 Channel bandwidths per operating band for CA

**Table 5.1.117.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** |  |  | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n5A-n48A-n77A | CA\_n5A-n48A  CA\_n5A-n77A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n5A-n48A-n77C | CA\_n5A-n48A  CA\_n5A-n77A  CA\_n77C | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 1 |
|  |  | n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| CA\_n5A-n48(2A)-n77A | CA\_n5A-n48A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n5A-n77A | n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
|  |  | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n5A-n48(2A)-n77C | CA\_n5A-n48A | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n5A-n77A | n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 1 |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 2 |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 3 |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| CA\_n5A-n48B-n77A | CA\_n5A-n48A  CA\_n5A-n77A | n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| n48 | See CA\_n48B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 1 |
| n48 | See CA\_n48B Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
| n5 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 2 |
| n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n5A-n48B-n77C | CA\_n5A-n48A | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 0 |
|  | CA\_n5A-n77A | n48 | See CA\_n48B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 1 |
|  |  | n48 | See CA\_n48B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 2 |
|  |  | n48 | See CA\_n48B Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n5 | 5 | 10 | 15 | 20 | 251 |  |  |  |  |  |  |  |  |  |  | 3 |
|  |  | n48 | See CA\_n48B Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |

5.1.117.3 UE co-existence studies

CA\_n48-n77 is fully limited for downlink only, and there is no simultaneous Tx/Rx operation between NR n48 and n77 carriers. Thus there is no additional co-existence issue identified.

5.1.117.4 REFSENS requirements

Based on co-existence studies on 5.1.117.3, MSD exception are not needed.

5.1.118 CA\_n48-n66-n77

5.1.118.1 Operating bands for CA

**Table 5.1.118.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n48-n66-n77 | n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

5.1.118.2 Channel bandwidths per operating band for CA

**Table 5.1.118.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** |  |  | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **45** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n48A-n66A-n77A | CA\_n48A-n66A | n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
|  | CA\_n66A-n77A | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
|  |  | n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |  |
| CA\_n48A-n66A-n77C | CA\_n48A-n66A | n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
|  | CA\_n66A-n77A | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
|  | CA\_n77C | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| n48 | 5 | 10 | 15 | 20 |  | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 | 1 |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
| CA\_n48B-n66A-n77A | CA\_n48A-n66A  CA\_n66A-n77A | n48 | See CA\_n48B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| n48 | See CA\_n48B Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | | 1 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| n48 | See CA\_n48B Bandwidth Combination Set 2 in Table 5.5A.1-1 | | | | | | | | | | | | | | | 2 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n48(2A)-n66A-n77A | CA\_n48A-n66A  CA\_n66A-n77A | n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | | 1 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |
| n77 |  | 10 | 15 | 20 | 25 | 30 |  | 40 |  | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n48(2A)-n66A-n77C | CA\_n48A-n66A | n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | | 0 |
|  | CA\_n66A-n77A | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | | | 1 |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | | 2 |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |
|  |  | n48 | See CA\_n48(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | | | | 3 |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 |  |  |  |  |  |  |  |  |
|  |  | n77 | See CA\_n77C Bandwidth Combination Set 1 in Table 5.5A.1-1 | | | | | | | | | | | | | | |  |

5.1.118.3 UE co-existence studies

CA\_n48-n77 is fully limited for downlink only, and there is no simultaneous Tx/Rx operation between NR n48 and n77 carriers. Thus there is no additional co-existence issue identified.

5.1.118.4 REFSENS requirements

Based on co-existence studies on 5.1.118.3, MSD exception are not needed.

* 5.1.119 CA\_n12-n30-n66

5.1.119.1 Operating bands for CA

**Table 5.1.119.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n12A-n30A-n66A | n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

* 5.1.119.2 Channel bandwidths per operating band for CA

**Table 5.1.119.2-1: Supported channel bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n12A-n30A-n66A | CA\_n12A-n30A  CA\_n12A-n66A  CA\_n30A-n66A | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n12A-n30A-n66(2A) | CA\_n12A-n30A  CA\_n12A-n66A  CA\_n30A-n66A | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n12A-n30A-n66(3A) | CA\_n12A-n30A  CA\_n12A-n66A  CA\_n30A-n66A | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(3A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

* 5.1.119.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n12A-n30A, CA\_n12A-n66A and CA\_n30A-n66A have been captured in TR 38.717-02-01 where:

- There are no IMD products produced by Band n12 and n30 that might fall in Rx of band n66.

- There are no IMD products produced by Band n12 and n66 that might fall in Rx of band n30.

- IMD5 products are produced by Band n30 and n66 that might fall in Rx of band n12.

* 5.1.119.4 REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 5th IMD product falls inside band n12. There is no need for MSD test points to be defined since the overlap is only 1MHz (729MHz - 730MHz) and there is no possible test configuration available.

* 5.1.120 CA\_n2-n12-n30

5.1.120.1 Operating bands for CA

**Table 5.1.120.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2A-n12A-n30A | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |

* 5.1.120.2 Channel bandwidths per operating band for CA

**Table 5.1.120.2-1: Supported channel bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n2A-n12A-n30A | CA\_n2A-n12A CA\_n2A-n30A CA\_n12A-n30A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n2(2A)-n12A-n30A | CA\_n2A-n12A CA\_n2A-n30A CA\_n12A-n30A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |

* 5.1.120.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n2A-n12A, CA\_n2A-n30A and CA\_n12A-n30A have been captured in TR 38.717-02-01 where:

- IMD4 products are produced by Band n2 and n12 that might fall in Rx of band n30.

- There are no IMD products produced by Band n2 and n30 that might fall in Rx of band n12.

- There are no IMD products produced by Band n12 and n30 that might fall in Rx of band n2.

* 5.1.120.4 REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 4th IMD product falls inside band n30. The MSD value from DC\_12A-30A\_n2A is reused.

**Table 5.1.120.4-1: MSD for the CA configuration**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n2A-n12A-n30A | n2 | 1885 | 5 | 25 | 1965 | N/A | FDD | N/A |
| n12 | 708.5 | 5 | 25 | 738.5 | N/A | FDD | N/A |
| n30 | 2308 | 5 | 25 | 2353 | 12.0 | FDD | IMD4 |

* 5.1.121 CA\_n2-n12-n66

5.1.121.1 Operating bands for CA

**Table 5.1.121.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2A-n12A-n66A | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

* 5.1.121.2 Channel bandwidths per operating band for CA

**Table 5.1.121.2-1: Supported channel bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n2A-n12A-n66A | CA\_n2A-n12A  CA\_n12A-n66A  CA\_n2A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n2(2A)-n12A-n66A | CA\_n2A-n12A  CA\_n12A-n66A  CA\_n2A-n66A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n2A-n12A-n66(2A) | CA\_n2A-n12A  CA\_n12A-n66A  CA\_n2A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n2(2A)-n12A-n66(2A) | CA\_n2A-n12A CA\_n12A-n66A CA\_n2A-n66A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n2A-n12A-n66(3A) | CA\_n2A-n12A CA\_n12A-n66A CA\_n2A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n12 | 5 | 10 | 15 |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(3A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

* 5.1.121.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

Co-existence studies for dual uplink operation of two bands, i.e. CA\_n2A-n12A, CA\_n2A-n66A and CA\_n12A-n66A have been captured in TR 38.717-02-01 where:

- There are no IMD products produced by Band n2 and n12 that might fall in Rx of band n66.

- There are no IMD products produced by Band n2 and n66 that might fall in Rx of band n12.

- IMD4 products are produced by Band n12 and n66 that might fall in Rx of band n2.

* 5.1.121.4 REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 4th IMD product falls inside band n2. There is no need for MSD test points to be defined since the overlap is only 2MHz (1990MHz - 1988MHz) and there is no possible test configuration available.

* 5.1.122 CA\_n2-n29-n30

5.1.122.1 Operating bands for CA

**Table 5.1.122.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2A-n29A-n30A | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n29 | N/A | | | 717 MHz | – | 728 MHz | SDL |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |

* 5.1.122.2 Channel bandwidths per operating band for CA

**Table 5.1.122.2-1: Supported channel bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n2A-n29A-n30A | CA\_n2A-n30A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n2(2A)-n29A-n30A | CA\_n2A-n30A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |

* 5.1.122.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

The co-existence studies for dual uplink operation of two bands is therefore limited to 2UL in CA\_n2A-n30A from TR 38.717-02-01, since n29 is SDL.

* No IMD products produced by Band n2 and Band n30 impact the reference sensitivity of NR band n29.
* 5.1.122.4 REFSENS requirements

There is no impact on the REFSENS requirements.

* 5.1.123 CA\_n2-n29-n66

5.1.123.1 Operating bands for CA

**Table 5.1.123.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2A-n29A-n66A | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n29 | N/A | | | 717 MHz | – | 728 MHz | SDL |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

* 5.1.123.2 Channel bandwidths per operating band for CA

**Table 5.1.123.2-1: Supported channel bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n2A-n29A-n66A | CA\_n2A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n2(2A)-n29A-n66A | CA\_n2A-n66A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n2A-n29A-n66(2A) | CA\_n2A-n66A | n2 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |
| CA\_n2(2A)-n29A-n66(2A) | CA\_n2A-n66A | n2 | See CA\_n2(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 | | | | | | | | | | | | | 0 |
|  |  | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

* 5.1.123.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

The co-existence studies for dual uplink operation of two bands is therefore limited to 2UL in CA\_n2A-n66A from TR 38.717-02-01, since n29 is SDL.

* No IMD products produced by Band n2 and Band n66 impact the reference sensitivity of NR band n29.
* 5.1.123.4 REFSENS requirements

There is no impact on the REFSENS requirements.

* 5.1.124 CA\_n1-n3-n20
* 5.1.124.1 Operating bands for CA

**Table 5.1.124.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n20 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1805 MHz | – | 1880 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |

* 5.1.124.2 Channel bandwidths per operating band for CA

**Table 5.1.124.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n3A-n20A | CA\_n1A-n3A CA\_n1A-n20A CA\_n3A-n20A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n20 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |

* 5.1.124.3 UE co-existence studies

There are no IMD generated by UL n1-n3 that affect DL n20.

There are no IMD generated by UL n1-n20 that affect DL n3.

There are no IMD generated by UL n3-n20 that affect DL n1.

* 5.1.124.4 REFSENS requirements

As can be seen in the co-existence studies there are no need to define MSD.

* 5.1.125 CA\_n1-n3-n67
* 5.1.125.1 Operating bands for CA

**Table 5.1.125.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n67 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1805 MHz | – | 1880 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n67 | N/A | | | 738 MHz |  | 758 MHz | SDL |

* 5.1.125.2 Channel bandwidths per operating band for CA

**Table 5.1.125.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n3A-n67A | CA\_n1A-n3A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n67 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |

* 5.1.125.3 UE co-existence studies

There are no IMD generated by UL n1-n3 that affect DL n67.

* 5.1.125.4 REFSENS requirements

As can be seen in the co-existence studies there is no need to define MSD.

* 5.1.126 CA\_n1-n20-n67
* 5.1.126.1 Operating bands for CA

**Table 5.1.126.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n20-n67 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| n67 | N/A | | | 738 MHz |  | 758 MHz | SDL |

* 5.1.126.2 Channel bandwidths per operating band for CA

**Table 5.1.126.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n1A-n20A-n67A | CA\_n1A-n20A | n1 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  | 0 |
|  |  | n20 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n67 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |

* 5.1.126.3 UE co-existence studies

There are no IMD generated by UL n1-n20 that affect DL n67.

* 5.1.126.4 REFSENS requirements

As can be seen in the co-existence studies there are no need to define MSD.

* 5.1.127 CA\_n3-n20-n67
* 5.1.127.1 Operating bands for CA

**Table 5.1.127.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n20-n67 | n3 | 1805 MHz | – | 1880 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| n67 | N/A | | | 738 MHz |  | 758 MHz | SDL |

* 5.1.127.2 Channel bandwidths per operating band for CA

**Table 5.1.127.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n3A-n20A-n67A | CA\_n3A-n20A | n3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
|  |  | n20 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |
|  |  | n67 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |

* 5.1.127.3 UE co-existence studies

There are IMD4 generated by UL n3-n20 that may affect DL n67.

* 5.1.127.4 REFSENS requirements

As can be seen in the co-existence studies there is a need to define MSD. MSD value is derived from DC\_3A-28A\_n5A.

**Table 5.1.127.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n3-n20-n67 | n3 | 1775 | 5 | 25 | 1870 | N/A | FDD | N/A |
| n20 | 840 | 5 | 25 | 799 | N/A | FDD | N/A |
| n67 | N/A | 5 | 25 | 745 | 9.4 | FDD | IMD4 |

5.1.128 CA\_n7-n46-n78

5.1.128.1 Operating bands for CA

**Table 5.1.128.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band Combination** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n46-n78 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

5.1.128.2 Channel bandwidths per operating band for CA

**Table 5.1.128.2-1: Supported channel bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA Config** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **35** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n7A-n46A-n78A | CA\_n7A-n46A CA\_n7A-n78A CA\_n46A-n78A | n7 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 | 50 |  |  |  |  |  | 0 |
| n46 |  |  |  | 20 |  |  |  | 40 |  | 60 |  | 80 |  |  |
| n78 |  | 10 | 15 | 20 | 25 | 30 |  | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n7A-n46C-n78A | CA\_n7A-n46A CA\_n7A-n78A CA\_n46A-n78A | n7 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 | 50 |  |  |  |  |  | 0 |
| n46 | See CA\_n46C Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | |
| n78 |  | 10 | 15 | 20 | 25 | 30 |  | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| CA\_n7A-n46D-n78A | CA\_n7A-n46A CA\_n7A-n78A CA\_n46A-n78A | n7 | 5 | 10 | 15 | 20 | 25 | 30 |  | 40 | 50 |  |  |  |  |  | 0 |
| n46 | See CA\_n46D Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | |
| n78 |  | 10 | 15 | 20 | 25 | 30 |  | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
|  | | | | | | | | | | | | | | | | | |

5.1.128.3 Co-existence studies

For UE coexistence study of Band n7 + Band n46 Band n7 + Band n78 and Band n46 + band n78 the 2nd 3rd 4th and 5th order harmonics are already analyzed in 3DL/1UL WI. The 2nd 3rd 4th and 5th order intermodulation products are calculated and presented in the following.

For CA\_n7-n46 the 5th IMD product is falling inside n78 as shown in the following analysis.

**Table 5.1.128.3-1: Band n7 and Band n46 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 5150 | 5925 |
| DL Frequency [MHz] | 2620 | 2690 | 5150 | 5925 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2580 | 3425 | 7650 | 8495 |
| 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) | 925 | 10 | 7730 | 9350 |
| 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) | 10150 | 11065 | 12800 | 14420 |
| 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) | 1575 | 2560 | 12880 | 15275 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 6850 | 5160 | 15300 | 16990 |
| 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) | 12650 | 13635 | 17950 | 20345 |
| 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) | 21200 | 18030 | 5130 | 4075 |
| 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) | 12775 | 10310 | 2590 | 4350 |
| 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) | 23100 | 26270 | 15150 | 16205 |
| 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) | 20450 | 22915 | 17800 | 19560 |

For CA\_n7-n78 the 5th IMD product is falling inside n46 as shown in the following analysis.

**Table 5.1.128.3-2: Band n7 and Band n78 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 3300 | 3800 |
| DL Frequency [MHz] | 2620 | 2690 | 3300 | 3800 |
| 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 |
| 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 |
| 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| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 2600 | 1460 | 11600 | 12740 |
| 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 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) | 12700 | 10630 | 6980 | 6200 |
| 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) | 6400 | 4760 | 1110 | 100 |
| 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 |

For CA\_n46-n78 the 2nd IMD product is on the lower 5 MHz of n7 as shown in the following analysis.

**Table 5.1.128.3-3: Band n46 and Band n78 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 5150 | 5925 | 3300 | 3800 |
| DL Frequency [MHz] | 5150 | 5925 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2625 | 1350 | 8450 | 9725 |
| 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) | 6500 | 8550 | 675 | 2450 |
| 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) | 13600 | 15650 | 11750 | 13525 |
| 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) | 11650 | 14475 | 3975 | 6250 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 2700 | 5250 | 16900 | 19450 |
| 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) | 18750 | 21575 | 15050 | 17325 |
| 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) | 10050 | 7275 | 20400 | 16800 |
| 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) | 1100 | 1950 | 11175 | 7850 |
| 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) | 18350 | 21125 | 23900 | 27500 |
| 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) | 20200 | 23250 | 22050 | 25375 |

Co-existence studies shows that

* The 2nd and 5th IMD generated by dual uplink of Band n7 + Band n46 may fall into own Rx of band n78.
* The 2nd and 5th IMD generated by dual uplink of Band n7 + Band n78 may fall into own Rx of band n46.
* The 2nd IMD generated by dual uplink of Band n46 + Band n78 may fall into own Rx of band n7. However, this is only the lower 5 MHz and given the possible channel placements for n46 it is not possible for the IMD to hit the Rx band of n7 in practice. Hence no MSD is defined for this case.

5.1.128.4 REFSENs requirements

MSD have been defined for the two 5th IMD issues. For the 2nd IMD issue no MSD is defined as it is only the lower 5 MHz of n7 which is impacted and given the possible channel placements for n46 it is not possible for the IMD to hit the Rx band of n7 in practice

**Table 5.1.128.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n7A-n46A-n78A  CA\_n7A-n46C-n78A  CA\_n7A-n46D-n78A | n7 | 2530 | 5 | 25 | 2650 | N/A | FDD | N/A |
| n46 | 5840 | 20 | 100 | 5840 | N/A | TDD | N/A |
| n78 | 3310 | 10 | 50 | 3310 | 29,7 | TDD | IMD21 |
| n7 | 2530 | 5 | 25 | 2650 | N/A | FDD | N/A |
| n46 | 5840 | 20 | 100 | 5840 | 25.2 | TDD | IMD21 |
| n78 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

* 5.1.129 CA\_n29-n30-n66

5.1.129.1 Operating bands for CA

**Table 5.1.129.1-1: Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n29A-n30A-n66A | n29 | N/A | | | 717 MHz | – | 728 MHz | SDL |
| n30 | 2305 MHz | – | 2315 MHz | 2350 MHz | – | 2360 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

* 5.1.129.2 Channel bandwidths per operating band for CA

**Table 5.1.129.2-1: Supported channel bandwidths per CA configuration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n29A-n30A-n66A | CA\_n30A-n66A | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
| CA\_n29A-n30A-n66(2A) | CA\_n30A-n66A | n29 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n30 | 5 | 10 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n66 | See CA\_n66(2A) Bandwidth Combination Set 1 in Table 5.5A.2-1 | | | | | | | | | | | | |  |

* 5.1.129.3 UE co-existence studies

For 3DL/2UL NR CA, only the IMD issues due to dual uplink operation of two bands falling into the DL of the third band shall be verified.

The co-existence studies for dual uplink operation of two bands is therefore limited to 2UL in CA\_n30A-n66A from TR 38.717-02-01, since n29 is SDL.

* IMD5 products are produced by Band n30 and Band n66 that might fall in Rx of band n29.
* 5.1.129.4 REFSENS requirements

The IMD issue specific to 3DL/2UL is that the 5th IMD product falls inside band n29. The same values are used as for DC\_29A-30A\_n66A.

**Table 5.1.129.4-1: MSD for the CA configuration**

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n29A-n30A-n66A | n29 | N/A | 5 | N/A | 719.5 | 4.5 | SDL | IMD5 |
| n30 | 2307.5 | 5 | 25 | 2352.5 | N/A | FDD | N/A |
| n66 | 1777.5 | 5 | 25 | 2177.5 | N/A | FDD | N/A |

* 5.1.130 CA\_n41-n70-n78
* 5.1.130.1 Operating bands for CA

**Table 5.1.130.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41-n70-n78 | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

* 5.1.130.2 Channel bandwidths per operating band for CA

**Table 5.1.130.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n41A-n70A-n78A | CA\_n41A-n70A CA\_n41A-n78A CA\_n70A-n78A | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
|  |  | n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlink. | | | | | | | | | | | | | | | | |

* 5.1.130.3 UE co-existence studies

IMD5 generated by UL n70-n78 might affect n41.

MD3 and IMD4 generated by UL n41-n78 might affect n70.

IMD3 generated by UL n41-n70 might affect DL n78.

* 5.1.130.4 REFSENS requirements

MSD value n41 are derived from CA\_n25-n41-n77.

MSD values n70 are derived from CA\_n3-n7-n78.

MSD value n78 are derived from CA\_n3-n7-n78.

Below are the updates needed in Table 7.3A.5-2 of TS 38.101-1.

**Table 5.1.130.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n41-n70-n78 | n41 | 2655 | 10 | 50 | 2655 | N/A | TDD | N/A |
| n70 | 1700 | 5 | 25 | 2000 | 17.6 | FDD | IMD3 |
| n78 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |
| n41 | 2565 | 10 | 50 | 2565 | N/A | TDD | N/A |
| n70 | 1700 | 5 | 25 | 2000 | 8.6 | FDD | IMD4 |
| n78 | 3565 | 10 | 50 | 3565 | N/A | TDD | N/A |
| n41 | 2480 | 10 | 50 | 2480 | 5.3 | TDD | IMD5 |
| n70 | 1700 | 5 | 25 | 2000 | N/A | FDD | N/A |
| n78 | 3790 | 10 | 50 | 3790 | N/A | TDD | N/A |
| n41 | 2545 | 10 | 50 | 2545 | N/A | FDD | N/A |
| n70 | 1700 | 5 | 25 | 2000 | N/A | FDD | N/A |
| n78 | 3390 | 10 | 50 | 3390 | 16.1 | TDD | IMD3 |

* 5.1.131 CA\_n66-n70-n78
* 5.1.131.1 Operating bands for CA

**Table 5.1.131.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n66-n70-n78 | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

* 5.1.131.2 Channel bandwidths per operating band for CA

**Table 5.1.131.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n66A-n70A-n78A | CA\_n66A-n78A CA\_n70A-n78A | n66 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  | 0 |
|  |  | n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |  |
|  |  | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlink. | | | | | | | | | | | | | | | | |

* 5.1.131.3 UE co-existence studies

IMD2, IMD4 and IMD5 generated by UL n66-n78 might affect DL n70.

IMD5 generated by UL n70-n78 might affect DL n66.

* 5.1.131.4 REFSENS requirements

Since DL n70 is close to DL n2, the MSD values for DL n70 can be derived from CA\_n2-n66-n77.

Since UL n70 is close to UL n66, the MSD value for DL n66 can be derived from CA\_n66-n78

**Table 5.1.131.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n66-n70-n78 | n66 | 1760 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n70 | 1700 | 5 | 25 | 2000 | 32.1 | FDD | IMD2 |
| n78 | 3760 | 10 | 50 | 3760 | N/A | TDD | N/A |
| n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |
| n70 | 1700 | 5 | 25 | 2000 | 9.1 | FDD | IMD4 |
| n78 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | N/A | FDD | N/A |
| n70 | 1700 | 5 | 25 | 2000 | 2.1 | FDD | IMD5 |
| n78 | 3640 | 10 | 50 | 3640 | N/A | TDD | N/A |
| n66 | 1760 | 5 | 25 | 2160 | 5.0 | FDD | IMD5 |
| n70 | 1700 | 5 | 25 | 2000 | N/A | FDD | N/A |
| n78 | 3630 | 10 | 50 | 3630 | N/A | TDD | N/A |

5.1.132 CA\_n28-n40-n41

5.1.132.1 Operating bands for CA

**Table 5.1.132.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28A-n40A-n41A | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

5.1.132.2 Channel bandwidths per operating band for CA

**Table 5.1.132.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n28A-n40A-n41A | CA\_n28A-n40A  CA\_n28A-n41A  CA\_n40A-n41A | n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  | 0 |
|  |  | n40 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |

5.1.132.3 Co-existence studies

The co-existence studies for the UL CA configurations of CA\_n28A-n40A, CA\_n28A-n41A, CA\_n40A-n41A have already captured in TR 38.716-02-00, where:

- 4th intermodulations (i.e. 192–780MHz) caused by 2UL CA\_n40A-n41A may fall into band n28 own DL Rx range.

- 5th intermodulations (i.e. 2356–2691MHz) caused by 2UL CA\_n28A-n40A may fall into band n41 own DL Rx range.

- No intermodulations caused by 2UL CA\_n28A-n41A may fall into band n40 own DL Rx range.

It should be noted for this band combination, CA\_n40A-n41A is applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx.

5.1.132.4 MSD

According to clause 5.1.132.3, IMD5 products produced by Band 28 and n40 that impact the reference sensitivity of NR band n41. However, considering the requirements for TDD-TDD NR CA combinations of CA\_n40-n41 are defined without simultaneous Rx/Tx capability in TS38.101-1, i.e. synchronous operation. Therefore it is no need to defined MSD requirements due to IMD5 issues.

For IMD4 intermodulations caused by 2UL CA\_n40A-n41A may fall into band n28 own DL Rx range, the MSD values caused by the intemodulation are defined as:

Table 5.1.132.4-1 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n28-n40-n41 | n28 | 710 | 5 | 25 | 765 | FFS | FDD | IMD4 |
|  | n40 | 2302.5 | 5 | 25 | 2302.5 | N/A | TDD | N/A |
|  | n41 | 2685 | 10 | 50 | 2685 | N/A | TDD | N/A |

* 5.1.133 CA\_n41-n66-n70
* 5.1.133.1 Operating bands for CA

**Table 5.1.133.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41-n66-n70 | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |

* 5.1.133.2 Channel bandwidths per operating band for CA

**Table 5.1.133.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |  |
| CA\_n41-n66-n70 | CA\_n41-n66  CA\_n41-n70 | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 0 |
|  |  | n66 |  | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |
|  |  | n70 | 5 | 10 | 15 | 201 | 251 |  |  |  |  |  |  |  |  |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlink. | | | | | | | | | | | | | | | | |

* 5.1.133.3 UE co-existence studies

UL n41-n66 does not affect DL n70.

UL n41-n70 does not affect DL n66.

* 5.1.133.4 REFSENS requirements

Based on the co-existence studies there are no need to defined MSD values.

## Inter-band within FR2

*< Editor's note: This section is reserved for future used>*

## Inter-band between FR1 and FR2

### CA\_n1-n77-n257

#### Operating bands for CA

Table 5.3.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n77-n257 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.3.1.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| **NR CA config** | **UL config** | **NR Band** | **SCS**  **(kHz)** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n1A-n77A-n257A | CA\_n1A-n77A  CA\_n1A-n257A  CA\_n77A-n257A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes | Yes |
| CA\_n1A-n77A-n257G | CA\_n1A-n77A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n77A-n257A  CA\_n77A-n257G | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n1A-n77A-n257H | CA\_n1A-n77A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n1A-n77A-n257I | CA\_n1A-n77A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n1A-n257I  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H  CA\_n77A-n257I | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |

#### UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n1-n77, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### REFSENS requirements

As mentioned in 5.3.1.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

### CA\_n1-n78-n257

#### Operating bands for CA

Table 5.3.2.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n78-n257 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.3.2.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| **NR CA config** | **UL config** | **NR Band** | **SCS**  **(kHz)** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n1A-n78A-n257A | CA\_n1A-n78A  CA\_n1A-n257A  CA\_n78A-n257A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes | Yes |
| CA\_n1A-n78A-n257G | CA\_n1A-n78A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n78A-n257A  CA\_n78A-n257G | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n1A-n78A-n257H | CA\_n1A-n78A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n78A-n257H | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n1A-n78A-n257I | CA\_n1A-n78A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n1A-n257I  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n78A-n257H  CA\_n78A-n257I | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |

#### UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n1-n78, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### REFSENS requirements

As mentioned in 5.3.2.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

### CA\_n1-n79-n257

#### Operating bands for CA

Table 5.3.3.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n79-n257 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4200 MHz | – | 5000 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.3.3.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| **NR CA config** | **UL config** | **NR Band** | **SCS**  **(kHz)** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n1A-n79A-n257A | CA\_n1A-n79A  CA\_n1A-n257A  CA\_n79A-n257A | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes | Yes |
| CA\_n1A-n79A-n257G | CA\_n1A-n79A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n79A-n257A  CA\_n79A-n257G | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n1A-n79A-n257H | CA\_n1A-n79A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n1A-n79A-n257I | CA\_n1A-n79A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n1A-n257I  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H  CA\_n79A-n257I | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |

#### UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n1-n79, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### REFSENS requirements

As mentioned in 5.3.3.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

### CA\_n77-n79-n257

#### Operating bands for CA

Table 5.3.4.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n77-n79-n257 | n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4200 MHz | – | 5000 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.3.4.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| **NR CA config** | **UL config** | **NR Band** | **SCS**  **(kHz)** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n77A-n79A-n257A | CA\_n77A-n79A  CA\_n77A-n257A  CA\_n79A-n257A | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes | Yes |
| CA\_n77A-n79A-n257G | CA\_n77A-n79A  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n79A-n257A  CA\_n79A-n257G | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n77A-n79A-n257H | CA\_n77A-n79A  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n77A-n79A-n257I | CA\_n77A-n79A  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H  CA\_n77A-n257I  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H  CA\_n79A-n257I | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |

#### UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n77-n79, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### REFSENS requirements

As mentioned in 5.3.4.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

### CA\_n78-n79-n257

#### Operating bands for CA

Table 5.3.5.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n78-n79-n257 | n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4200 MHz | – | 5000 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

#### Channel bandwidths per operating band for CA

Table 5.3.5.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| **NR CA config** | **UL config** | **NR Band** | **SCS**  **(kHz)** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n78A-n79A-n257A | CA\_n78A-n79A  CA\_n78A-n257A  CA\_n79A-n257A | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes | Yes |
| CA\_n78A-n79A-n257G | CA\_n78A-n79A  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n79A-n257A  CA\_n79A-n257G | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n78A-n79A-n257H | CA\_n78A-n79A  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n78A-n257H  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA\_n78A-n79A-n257I | CA\_n78A-n79A  CA\_n78A-n257A  CA\_n78A-n257G  CA\_n78A-n257H  CA\_n78A-n257I  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H  CA\_n79A-n257I | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |

#### UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n78-n79, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### REFSENS requirements

As mentioned in 5.3.5.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

### 5.3.6 CA\_n3-n79-n257

#### 5.3.6.1 Operating bands for CA

Table 5.3.6.1-1: CA band combination of band n3+n79+n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

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

Table 5.3.6.2-1: Supported bandwidths per CA band combination of band n3+n79+n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 1) | | | | | | | | | | | | | | | Bandwidth combination set | |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 200 | 400 | |  |
| CA\_n3A-n79A-n257A | CA\_n3A-n79A  CA\_n3A-n257A  CA\_n79A-n257A | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  | |  |
|  |  | n257 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 | |  |
| CA\_n3A-n79A-n257G | CA\_n257G  CA\_n3A-n79A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n79A-n257A  CA\_n79A-n257G | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  | |  |
|  |  | n257 | CA\_n257G | | | | | | | | | | | | | | | |  |
| CA\_n3A-n79A-n257H | CA\_n257G  CA\_n257H  CA\_n3A-n79A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  | |  |
|  |  | n257 | CA\_n257H | | | | | | | | | | | | | | | |  |
| CA\_n3A-n79A-n257I | CA\_n257G  CA\_n257H  CA\_n257I  CA\_n3A-n79A  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n3A-n257I  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H  CA\_n79A-n257I | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  | |  |
|  |  | n257 | CA\_n257I | | | | | | | | | | | | | | | |  |
| NOTE 1: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | | | |

#### 5.3.6.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n3-n79, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### 5.3.6.4 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.7 CA\_n28-n79-n257

#### 5.3.7.1 Operating bands for CA

Table 5.3.7.1-1: CA band combination of band n28+n79+n257

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

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

Table 5.3.7.2-1: Supported bandwidths per CA band combination of band n28+n79+n257

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) (NOTE 1) | | | | | | | | | | | | | | | Bandwidth combination set | |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 200 | 400 | |  |
| CA\_n28A-n79A-n257A | CA\_n28A-n79A  CA\_n28A-n257A  CA\_n79A-n257A | n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  | |  |
|  |  | n257 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 | |  |
| CA\_n28A-n79A-n257G | CA\_n257G  CA\_n28A-n79A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n79A-n257A  CA\_n79A-n257G | n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  | |  |
|  |  | n257 | CA\_n257G | | | | | | | | | | | | | | | |  |
| CA\_n28A-n79A-n257H | CA\_n257G  CA\_n257H  CA\_n28A-n79A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H | n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  | |  |
|  |  | n257 | CA\_n257H | | | | | | | | | | | | | | | |  |
| CA\_n28A-n79A-n257I | CA\_n257G  CA\_n257H  CA\_n257I  CA\_n28A-n79A  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n28A-n257I  CA\_n79A-n257A  CA\_n79A-n257G  CA\_n79A-n257H  CA\_n79A-n257I | n28 | 5 | 10 | 15 | 20 |  | 30 |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  | |  |
|  |  | n257 | CA\_n257I | | | | | | | | | | | | | | | |  |
| NOTE 1: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | | | |

#### 5.3.7.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n28-n79, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### 5.3.7.4 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.8 CA\_n41-n79-n258

5.3.8.1 Operating bands for CA

**Table 5.3.8.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41A-n79A-n258A | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| n258 | 24250 MHz | – | 27500 MHz | 24250 MHz | – | 27500 MHz | TDD |

5.3.8.2 Channel bandwidths per operating band for CA

Table 5.3.8.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) | | | | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 200 | 400 |  |
| CA\_n41A-n79A-n258A | CA\_n41A-n79A  CA\_n41A-n258A  CA\_n79A-n258A | n41 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | 0 |
|  |  | n79 |  |  |  |  |  |  | 40 | 50 | 60 |  | 80 |  | 100 |  |  |  |
|  |  | n258 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 |  |

5.3.8.3 Co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n41-n79 in TR 38.716-02-00, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

5.3.8.4 MSD

As mentioned in 5.3.8.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

### 5.3.9 CA\_n7-n78-n258

#### 5.3.9.1 Operating bands for CA

Table 5.3.9.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n78-n258 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n258 | 24250 MHz | – | 27500 MHz | 24250 MHz | – | 27500 MHz | TDD |

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

Table 5.3.9.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA configuration | Uplink configuration | NR Band |  | Channel bandwidth (MHz) (NOTE 1) | | | | | | | | | | | | | | Bandwidth combination set |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 200 | 400 |  |
| CA\_n7A-n78A-n258A | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n78A-n258A | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |
| n258 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 |
| CA\_n7A-n78A-n258B | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258B  CA\_n78A-n258A  CA\_n78A-n258B | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258B | | | | | | | | | | | | | | |  |
| CA\_n7A-n78A-n258C | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258B  CA\_n7A-n258C  CA\_n78A-n258A  CA\_n78A-n258B  CA\_n78A-n258C | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258C | | | | | | | | | | | | | | |  |
| CA\_n7A-n78A-n258D | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258D  CA\_n78A-n258A  CA\_n78A-n258D | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |
| n258 | CA\_n258D | | | | | | | | | | | | | | |
| CA\_n7A-n78A-n258E | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258D  CA\_n7A-n258E  CA\_n78A-n258A  CA\_n78A-n258D  CA\_n78A-n258E | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258E | | | | | | | | | | | | | | |  |
| CA\_n7A-n78A-n258F | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258D  CA\_n7A-n258E  CA\_n7A-n258F  CA\_n78A-n258A  CA\_n78A-n258D  CA\_n78A-n258E  CA\_n78A-n258F | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |
| n258 | CA\_n258F | | | | | | | | | | | | | | |
| CA\_n7A-n78A-n258G | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258G  CA\_n78A-n258A  CA\_n78A-n258G | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258G | | | | | | | | | | | | | | |  |
| CA\_n7A-n78A-n258H | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258G  CA\_n7A-n258H  CA\_n78A-n258G  CA\_n78A-n258H | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |
| n258 | CA\_n258H | | | | | | | | | | | | | | |
| CA\_n7A-n78A-n258I | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258G  CA\_n7A-n258H  CA\_n7A-n258I  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258I | | | | | | | | | | | | | | |  |
| CA\_n7A-n78A-n258J | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258G  CA\_n7A-n258H  CA\_n7A-n258I  CA\_n7A-n258J  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I  CA\_n78A-n258J | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
|  | n258 | CA\_n258J | | | | | | | | | | | | | | |  |
| CA\_n7A-n78A-n258K | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258G  CA\_n7A-n258H  CA\_n7A-n258I  CA\_n7A-n258J  CA\_n7A-n258K  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I  CA\_n78A-n258J  CA\_n78A-n258K | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |
| n258 | CA\_n258K | | | | | | | | | | | | | | |
| CA\_n7A-n78A-n258L | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258G  CA\_n7A-n258H  CA\_n7A-n258I  CA\_n7A-n258J  CA\_n7A-n258K  CA\_n7A-n258L  CA\_n7A-n78A  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I  CA\_n78A-n258J  CA\_n78A-n258K  CA\_n78A-n258L | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258L | | | | | | | | | | | | | | |  |
| CA\_n7A-n78A-n258M | CA\_n7A-n78A  CA\_n7A-n258A  CA\_n7A-n258G  CA\_n7A-n258H  CA\_n7A-n258I  CA\_n7A-n258J  CA\_n7A-n258K  CA\_n7A-n258L  CA\_n7A-n258M  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I  CA\_n78A-n258J  CA\_n78A-n258K  CA\_n78A-n258L  CA\_n78A-n258M | n7 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |  |  |  |  |  |  |  | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258M | | | | | | | | | | | | | | |  |
|  |  | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| CA\_n7B-n78A-n258A | CA\_n7B-n78A  CA\_n7B-n258A  CA\_n78A-n258A | n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258A | | | | | | | | | | | | | | |  |
| CA\_n7B-n78A-n258B | CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258B  CA\_n78A-n258A  CA\_n78A-n258B | n7 | CA\_n7B | | | | | | | | | | | | | | | n7 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258B | | | | | | | | | | | | | | | n258 |
| CA\_n7B-n78A-n258C | CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258B  CA\_n7B-n258C  CA\_n78A-n258A  CA\_n78A-n258B  CA\_n78A-n258C | n7 | CA\_n7B | | | | | | | | | | | | | | | n7 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258C | | | | | | | | | | | | | | | n258 |
| CA\_n7B-n78A-n258D | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258D  CA\_n78A-n258A  CA\_n78A-n258D | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258D | | | | | | | | | | | | | | |  |
| CA\_n7B-n78A-n258E | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258D  CA\_n7B-n258E  CA\_n78A-n258A  CA\_n78A-n258D  CA\_n78A-n258E | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258E | | | | | | | | | | | | | | |  |
| CA\_n7B-n78A-n258F | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258D  CA\_n7B-n258E  CA\_n7B-n258F  CA\_n78A-n258A  CA\_n78A-n258D  CA\_n78A-n258E  CA\_n78A-n258F | n7 | CA\_n7B | | | | | | | | | | | | | | | n7 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258F | | | | | | | | | | | | | | | n258 |
| CA\_n7B-n78A-n258G | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258G  CA\_n78A-n258A  CA\_n78A-n258G | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258G | | | | | | | | | | | | | | |  |
| CA\_n7B-n78A-n258H | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258G  CA\_n7B-n258H  CA\_n78A-n258G  CA\_n78A-n258H | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258H | | | | | | | | | | | | | | |  |
| CA\_n7B-n78A-n258I | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258G  CA\_n7B-n258H  CA\_n7B-n258I  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258 | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258I | | | | | | | | | | | | | | |  |
| CA\_n7B-n78A-n258J | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258G  CA\_n7B-n258H  CA\_n7B-n258I  CA\_n7B-n258J  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I  CA\_n78A-n258J | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258J | | | | | | | | | | | | | | |  |
| CA\_n7B-n78A-n258K | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258G  CA\_n7B-n258H  CA\_n7B-n258I  CA\_n7B-n258J  CA\_n7B-n258K  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I  CA\_n78A-n258J  CA\_n78A-n258K | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258K | | | | | | | | | | | | | | |  |
|  |
| CA\_n7B-n78A-n258L | CA\_n7B  CA\_n7B-n258A  CA\_n7B-n258G  CA\_n7B-n258H  CA\_n7B-n258I  CA\_n7B-n258J  CA\_n7B-n258K  CA\_n7B-n258L  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I  CA\_n78A-n258J  CA\_n78A-n258K  CA\_n78A-n258L | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258L | | | | | | | | | | | | | | |  |
| CA\_n7B-n78A-n258M | CA\_n7B  CA\_n7B-n78A  CA\_n7B-n258A  CA\_n7B-n258G  CA\_n7B-n258H  CA\_n7B-n258I  CA\_n7B-n258J  CA\_n7B-n258K  CA\_n7B-n258L  CA\_n7B-n258M  CA\_n78A-n258A  CA\_n78A-n258G  CA\_n78A-n258H  CA\_n78A-n258I  CA\_n78A-n258J  CA\_n78A-n258K  CA\_n78A-n258L  CA\_n78A-n258M | n7 | CA\_n7B | | | | | | | | | | | | | | | 0 |
| n78 |  | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  |  |
| n258 | CA\_n258M | | | | | | | | | | | | | | |  |
| NOTE 1: The SCS of each channel bandwidth for NR FR1 and NR FR2 band refers to Table 5.3.5-1 of TS 38.101-1 and TS 38.101-2 respectively. | | | | | | | | | | | | | | | | | | |

#### 5.3.9.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n7-n78, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### 5.3.9.4 REFSENS requirements

As mentioned in 5.3.1.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

5.3.10 CA\_n41-n79-n258

5.3.10.1 Operating bands for CA

**Table 5.3.10.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n40A-n41A-n258A | n40 | 2300 MHz | – | 2400MHz | 2300 MHz | – | 2400 MHz | TDD |
| n41 | 2496 MHz | – | 2690MHz | 2496 MHz | – | 2690 MHz | TDD |
| n258 | 24250 MHz | – | 27500 MHz | 24250 MHz | – | 27500 MHz | TDD |

5.3.10.2 Channel bandwidths per operating band for CA

Table 5.3.10.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration | NR Band | Channel bandwidth (MHz) | | | | | | | | | | | | | | | Bandwidth combination set |
|  |  |  | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 200 | 400 |  |
| CA\_n40A-n41A-n258A | CA\_n40A-n41A  CA\_n40A-n258A  CA\_n41A-n258A | n40 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 |  | 80 |  |  |  |  | 0 |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  |  |
|  |  | n258 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 |  |

5.3.10.3 Co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n40-n41 in TR 38.716-02-00, where band n40 and n41 are synchronization operation in these configuration, which means simultaneous Rx/Tx is not supported between band n40 and band n41. Moreover, harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

5.3.10.4 MSD

As mentioned in 5.3.10.3, MSD analysis can be omitted and there is no need to specify additional MSD requirement for the CA combination.

### 5.3.11 CA\_n1-n3-n257

#### 5.3.11.1 Operating bands for CA

**Table 5.3.11.1-1: CA band combination of band n1+n3+n257**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

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

**Table 5.3.11.2-1: Supported bandwidths per CA band combination of band n1+n3+n257**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | | | | | | | | | | | | | | | **Bandwidth combination set** | |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | |  |
| CA\_n1A-n3A-n257A | CA\_n1A-n3A  CA\_n1A-n257A  CA\_n3A-n257A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  |  |  | |  |
|  |  | n257 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 | |  |
| CA\_n1A-n3A-n257G | CA\_n1A-n3A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n3A-n257A  CA\_n3A-n257G | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  |  |  | |  |
|  |  | n257 | CA\_n257G | | | | | | | | | | | | | | | |  |
| CA\_n1A-n3A-n257H | CA\_n1A-n3A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  |  |  | |  |
|  |  | n257 | CA\_n257H | | | | | | | | | | | | | | | |  |
| CA\_n1A-n3A-n257I | CA\_n1A-n3A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n1A-n257I  CA\_n3A-n257A  CA\_n3A-n257G  CA\_n3A-n257H  CA\_n3A-n257I | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n3 | 5 | 10 | 15 | 20 | 25 | 30 |  |  |  |  |  |  |  |  |  | |  |
|  |  | n257 | CA\_n257I | | | | | | | | | | | | | | | |  |
| NOTE 1: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | | | |

#### 5.3.11.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n1-n3, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### 5.3.11.4 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.12 CA\_n1-n28-n257

#### 5.3.12.1 Operating bands for CA

**Table 5.3.12.1-1: CA band combination of band n1+n28+n257**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

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

**Table 5.3.12.2-1: Supported bandwidths per CA band combination of band n1+n28+n257**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | | | | | | | | | | | | | | | **Bandwidth combination set** |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** |  |
| CA\_n1A-n28A-n257A | CA\_n1A-n28A  CA\_n1A-n257A  CA\_n28A-n257A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n257 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 |  |
| CA\_n1A-n28A-n257G | CA\_n1A-n28A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n28A-n257A  CA\_n28A-n257G | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n257 | CA\_n257G | | | | | | | | | | | | | | |  |
| CA\_n1A-n28A-n257H | CA\_n1A-n28A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n257 | CA\_n257H | | | | | | | | | | | | | | |  |
| CA\_n1A-n28A-n257I | CA\_n1A-n28A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n1A-n257I  CA\_n28A-n257A  CA\_n28A-n257G  CA\_n28A-n257H  CA\_n28A-n257I | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | 0 |
|  |  | n28 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | n257 | CA\_n257I | | | | | | | | | | | | | | |  |
| NOTE 1: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | | |

#### 5.3.12.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n1-n28, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### 5.3.12.4 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.13 CA\_n1-n41-n257

#### 5.3.13.1 Operating bands for CA

**Table 5.3.13.1-1: CA band combination of band n1+n41+n257**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

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

**Table 5.3.13.2-1: Supported bandwidths per CA band combination of band n1+n41+n257**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | | | | | | | | | | | | | | | **Bandwidth combination set** | |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | |  |
| CA\_n1A-n41A-n257A | CA\_n1A-n41A  CA\_n1A-n257A  CA\_n41A-n257A | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | |  |
|  |  | n257 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 | |  |
| CA\_n1A-n41A-n257G | CA\_n1A-n41A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n41A-n257A  CA\_n41A-n257G | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | |  |
|  |  | n257 | CA\_n257G | | | | | | | | | | | | | | | |  |
| CA\_n1A-n41A-n257H | CA\_n1A-n41A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n41A-n257A  CA\_n41A-n257G  CA\_n41A-n257H | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | |  |
|  |  | n257 | CA\_n257H | | | | | | | | | | | | | | | |  |
| CA\_n1A-n41A-n257I | CA\_n1A-n41A  CA\_n1A-n257A  CA\_n1A-n257G  CA\_n1A-n257H  CA\_n1A-n257I  CA\_n41A-n257A  CA\_n41A-n257G  CA\_n41A-n257H  CA\_n41A-n257I | n1 | 5 | 10 | 15 | 20 |  |  |  |  |  |  |  |  |  |  |  | | 0 |
|  |  | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | |  |
|  |  | n257 | CA\_n257I | | | | | | | | | | | | | | | |  |
| NOTE 1: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | | | |

#### 5.3.13.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n1-n41, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### 5.3.13.4 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.14 CA\_n41-n77-n257

#### 5.3.14.1 Operating bands for CA

**Table 5.3.14.1-1: CA band combination of band n41+n77+n257**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

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

**Table 5.3.14.2-1: Supported bandwidths per CA band combination of band n41+n77+n257**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | | | | | | | | | | | | | | | **Bandwidth combination set** | |
|  |  |  | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | |  |
| CA\_n41A-n77A-n257A | CA\_n41A-n77A  CA\_n41A-n257A  CA\_n77A-n257A | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | | 0 |
|  |  | n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | |  |
|  |  | n257 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 | |  |
| CA\_n41A-n77A-n257G | CA\_n41A-n77A  CA\_n41A-n257A  CA\_n41A-n257G  CA\_n77A-n257A  CA\_n77A-n257G | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | | 0 |
|  |  | n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | |  |
|  |  | n257 | CA\_n257G | | | | | | | | | | | | | | | |  |
| CA\_n41A-n77A-n257H | CA\_n41A-n77A  CA\_n41A-n257A  CA\_n41A-n257G  CA\_n41A-n257H  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | | 0 |
|  |  | n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | |  |
|  |  | n257 | CA\_n257H | | | | | | | | | | | | | | | |  |
| CA\_n41A-n77A-n257I | CA\_n41A-n77A  CA\_n41A-n257A  CA\_n41A-n257G  CA\_n41A-n257H  CA\_n41A-n257I  CA\_n77A-n257A  CA\_n77A-n257G  CA\_n77A-n257H  CA\_n77A-n257I | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | | 0 |
|  |  | n77 |  | 10 | 15 | 20 |  |  | 40 | 50 | 60 |  | 80 | 90 | 100 |  |  | |  |
|  |  | n257 | CA\_n257I | | | | | | | | | | | | | | | |  |
| NOTE 1: The SCS of each channel bandwidth for NR band refer to Table 5.3.5-1. | | | | | | | | | | | | | | | | | | | |

#### 5.3.14.3 UE co-existence studies

Co-existence studies can be omitted because harmonic and intermodulation impact between FR1 bands have been already studied for CA\_n41-n77, and harmonic and intermodulation impact between FR1 bands and FR2 band are negligible.

#### 5.3.14.4 REFSENS requirements

There is no additional REFSENS requirement for this combination.

### 5.3.15 CA\_n41-n66-n260

#### 5.3.15.1 Operating bands for CA

**Table 5.3.15.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n41-n66-n260 | n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n260 | 37000 MHz | – | 40000 MHz | 37000 MHz | – | 40000 MHz | TDD |

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

**Table 5.3.15.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Conf** | **NR Band** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **200** | **400** | **BCS** |
| CA\_n41A-n66A-n260A | CA\_n41A-n260A  CA\_n66A-n260A | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |  |
| n260 |  |  |  |  |  |  |  | 50 |  |  |  |  | 100 | 200 | 400 |
| CA\_n41A-n66A-n260(2A) | CA\_n41A-n260A  CA\_n66A-n260A | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |  |
| n260 | CA\_n260(2A) | | | | | | | | | | | | | | |
| CA\_n41A-n66A-n260G | CA\_n41A-n260A  CA\_n41A-n260G  CA\_n66A-n260A  CA\_n66A-n260G | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |  |
| n260 | CA\_n260G | | | | | | | | | | | | | | |
| CA\_n41A-n66A-n260H | CA\_n41A-n260A  CA\_n41A-n260G  CA\_n41A-n260H  CA\_n66A-n260A  CA\_n66A-n260G  CA\_n66A-n260H | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |  |
| n260 | CA\_n260H | | | | | | | | | | | | | | |
| CA\_n41A-n66A-n260I | CA\_n41A-n260A  CA\_n41A-n260G  CA\_n41A-n260H  CA\_n41A-n260I  CA\_n66A-n260A  CA\_n66A-n260G  CA\_n66A-n260H  CA\_n66A-n260I | n41 |  | 10 | 15 | 20 |  | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |  |  | 0 |
| n66 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |  |  |  |  |  |  |  |  |
| n260 | CA\_n260I | | | | | | | | | | | | | | |

#### 5.3.15.3 UE co-existence studies

UL n41-n260 does not affect DL n66.

UL n66-n260 does not affect DL n41.

#### 5.3.15.4 REFSENS requirements

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

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

## 6.X 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 contribution only to add pure NR DC texts is not allowned.>*

### 6.x.1 Configurations for DC\_nX-nY-nZ

Table 6.x.2-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_nXA-nYA-nZA | DC\_nXA-nYA  DC\_nXA-nZA  ... |

## **6.1 DC\_n28-n46-n78**

### 6.1.1 Configurations for DC\_n28-n46-n78

**Table 6.x.1-1: Inter-band NR DC configurations (three bands)**

| **NR DC**  **configuration** | **Uplink NR DC**  **configuration** |
| --- | --- |
| DC\_n28A-n46A-n78A  DC\_n28A-n46C-n78A  DC\_n28A-n46D-n78A | DC\_n28A-n46A  DC\_n28A-n78A  DC\_n46A-n78A |

## **6.2 DC\_n7-n46-n78**

### 6.2.1 Configurations for DC\_n7-n46-n78

**Table 6.2.1-1: Inter-band NR DC configurations (three bands)**

| **NR DC**  **configuration** | **Uplink NR DC**  **configuration** |
| --- | --- |
| DC\_n7A-n46A-n78A  DC\_n7A-n46C-n78A  DC\_n7A-n46D-n78A | DC\_n7A-n46A  DC\_n7A-n78A  DC\_n7A-n78A |

## 

## **6.3 DC\_n41-n66-n260**

### 6.3.1 Configurations for DC\_n41-n66-n260

**Table 6.3.1-1: Inter-band NR DC configurations (three bands)**

| **NR DC**  **configuration** | **Uplink NR DC**  **Configuration** |
| --- | --- |
| DC\_n41A-n66A-n260A | DC\_n41A-n260A  DC\_n66A-n260A |
| DC\_n41A-n66A-n260(2A) | DC\_n41A-n260A  DC\_n66A-n260A |
| DC\_n41A-n66A-n260G | DC\_n41A-n260A  DC\_n41A-n260G  DC\_n66A-n260A  DC\_n66A-n260G |
| DC\_n41A-n66A-n260H | DC\_n41A-n260A  DC\_n41A-n260G  DC\_n41A-n260H  DC\_n66A-n260A  DC\_n66A-n260G  DC\_n66A-n260H |
| DC\_n41A-n66A-n260I | DC\_n41A-n260A  DC\_n41A-n260G  DC\_n41A-n260H  DC\_n41A-n260I  DC\_n66A-n260A  DC\_n66A-n260G  DC\_n66A-n260H  DC\_n66A-n260I |

## Annex A: Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-08 | RAN4#96-e | R4-2010791 |  |  |  | TR skeleton | 0.0.1 |
| 2020-08 | RAN4#96-e | R4-2010793 |  |  |  | The following approved TPs in RAN4 96-e meeting are included:   1. R4-2011677 TP to TR 38.717-03-02: CA\_n5-n25-n66, Nokia, Bell Mobility 2. R4-2010531 TP to TR 38.717-03-02: CA\_n5-n25-n78, Nokia, Bell Mobility 3. R4-2010644 TP for TR38.717-03-02\_CA\_n39A-n40A-n79A, ZTE Corporation 4. R4-2010645 TP for TR38.717-03-02\_CA\_n39A-n40A-n41A, ZTE Corporation 5. R4-2009690 TP for CA\_n1-n77-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. 6. R4-2009691 TP for CA\_n1-n78-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. 7. R4-2009692 TP for CA\_n1-n79-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. 8. R4-2009693 TP for CA\_n77-n79-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. 9. R4-2009694 TP for CA\_n78-n79-n257 3UL/2DL for TR38.717-03-02, NTT DOCOMO, INC. | 0.1.0 |
| 2020-11 | RAN4#97-e | R4-2015185 |  |  |  | The following completed band combinations of inter-band CA for 3 bands DL with 2 bands UL are added from RAN4 #97-e:   1. R4-2016755 TP for TR 38.717-03-02 CA\_n3-n28-n41 2. R4-2016756 TP for TR 38.717-03-02 CA\_n3-n28-n78 3. R4-2016757 TP for CA 3DL2UL n1-n77-n79 for TR 38.717-03-02 4. R4-2016758 TP for CA 3DL2UL n1-n78-n79 for TR 38.717-03-02 5. R4-2015052 TP for TR38.717-03-02\_ CA\_n8A-n40A-n41A 6. R4-2015080 TP to TR 38.717-03-02: CA\_n5-n66-n77 7. R4-2015081 TP to TR 38.717-03-02: CA\_n2-n66-n77 8. R4-2016759 TP to add CA\_n25A-n41A-n77A, CA\_n25A-n41(2A)-n77A, CA\_n25A-n41C-n77A 9. R4-2016760 TP to add CA\_n25A-n66A-n77A 10. R4-2016761 TP to add CA\_n25A-n71A-n77A 11. R4-2016762 TP to add CA\_n41A-n66A-n77A, CA\_n41(2A)-n66A-n77A, CA\_n41C-n66A-n77A 12. R4-2016763 TP to add CA\_n41A-n71A-n77A, CA\_n41(2A)-n71A-n77A, CA\_n41C-n71A-n77A 13. R4-2016764 TP to add CA\_n66A-n71A-n77A | 0.2.0 |
| 2021-02 | RAN4#98-e | R4-2102305 |  |  |  | The following completed band combinations of inter-band CA for 3 bands DL with 2 bands UL are added from RAN4 #98-e:   1. R4-2103084 TP to TR 38.717-03-02: CA\_n25-n41-n71 Nokia, T-Mobile USA 2. R4-2100698 Draft CR for TS 38.101-1: Support of DC\_ n3-n28-n77 SoftBank Corp. 3. R4-2100700 Draft CR for TS 38.101-3: Support of n77(2A) in DC\_ n28-n77-n257 SoftBank Corp. 4. R4-2103085 TP to TR 38.717-03-02 CA\_n5-n25-n77 Nokia, Nokia Shanghai Bell 5. R4-2103100 TP to TR 38.717-03-02 CA\_n25-n66-n77 Nokia, Nokia Shanghai Bell 6. R4-2103101 TP for TR 38.717-03-02: CA\_n3-n28-n78 Samsung, KDDI 7. R4-2103086 TP for TR 38.717-03-02: DC\_n3-n41-n257 Samsung, KDDI 8. R4-2103087 TP for TR 38.717-03-02: CA\_n3-n18-n41 Samsung, KDDI 9. R4-2103088 TP for TR 38.717-03-02: CA\_n3-n41-n77 Samsung, KDDI 10. R4-2103089 TP for TR 38.717-03-02: CA\_n3-n41-n78 Samsung, KDDI 11. R4-2103090 TP for TR 38.717-03-02: CA\_n28-n41-n77 Samsung, KDDI 12. R4-2103091 TP for TR 38.717-03-02: CA\_n28-n41-n78 Samsung, KDDI 13. R4-2103092 TP for TR 38.717-03-02: CA\_n25-n29-n66 Samsung, TELUS, Bell mobility 14. R4-2103093 TP for TR 38.717-03-02: CA\_n13-n25-n66 Samsung, TELUS, Bell mobility 15. R4-2101198 draft CR to TS 38.101-1 Modification of MSD values for n1-n77-n79 and n1-n78-n79 NTT DOCOMO INC. 16. R4-2101513 TP for TR 38.717-03-02: CA\_n66-n71-n78 Huawei, HiSilicon, Bell Mobility, Telus 17. R4-2103094 TP for TR 38.717-03-02: CA\_n38A-n66A-n78A Huawei, HiSilicon, Bell Mobility, Telus 18. R4-2101515 TP for TR 38.717-03-02: CA\_n25A-n38A-n78A Huawei, HiSilicon, Bell Mobility, Telus 19. R4-2103095 TP for 38.717-03-02 to include n25-n66-n71 Ericsson, T-Mobile US 20. R4-2101903 TP for 38.717-03-02 to include n41-n66-n71 Ericsson, T-Mobile US 21. R4-2103099 TP for 38.717-03-02 to include n25-n41-n66 Ericsson, Bell Mobility | 0.3.0 |
| 2021-04 | RAN4#98bis-e | R4-2104914 |  |  |  | The following completed band combinations of inter-band CA for 3 bands DL with 2 bands UL are added from RAN4 #98bis-e:   1. R4-2106837 TP for TR38.717-03-02\_Removal of the sub-clauses under clause 5.2，ZTE Corporation 2. R4-2104709 TP to TR 38.717-03-02 CA\_n7-n66-n77， Nokia, Nokia Shanghai Bell 3. R4-2106383 TP for TR38.717-03-02\_ CA\_n8A-n39A-n41A，ZTE Corporation 4. R4-2106496 TP for TR 38.717-03-02: CA\_n25-n71-n78， Huawei, HiSilicon, Bell Mobility, Telus 5. R4-2106719 TP for 38.717-03-02 to include n2-n5-n66，Ericsson, AT&T 6. R4-2106721 TP for 38.717-03-02 to include CA\_n2-n5-n30，Ericsson, AT&T 7. R4-2106730 TP for 38.717-03-02 to include n13-n25-n77，Ericsson, Bell Mobility 8. R4-2106732 TP for 38.717-03-02 to include n13-n66-n77， Ericsson, Bell Mobility 9. R4-2105281 TP to TR 38.717-03-02 Addition of CA\_n2A-n5A-n66A，Nokia, Verizon | V0.4.0 |
| 2021-05 | RAN4#99-e | R4-2111000 |  |  |  | The following completed band combinations of inter-band CA for 3 bands DL with 2 bands UL are added from RAN4 #99-e:   1. R4-2108933 TP to TR 38.717-03-02: CA\_n2-n30-n66 Nokia, AT&T 2. R4-2107713 TP to TR 38.717-03-02: CA\_n5-n30-n66 Nokia, AT&T 3. R4-2107714 TP to TR 38.717-03-02 Addition of CA\_n2A-n5A-n77A AT&T, Nokia 4. R4-2107715 TP to TR 38.717-03-02 Addition of CA\_n2A-n12A-n77A AT&T, Nokia 5. R4-2107716 TP to TR 38.717-03-02 Addition of CA\_n2A-n14A-n77A AT&T, Nokia 6. R4-2107717 TP to TR 38.717-03-02 Addition of CA\_n2A-n30A-n77A AT&T, Nokia 7. R4-2107718 TP to TR 38.717-03-02 Addition of CA\_n5A-n12A-n77A AT&T, Nokia 8. R4-2107719 TP to TR 38.717-03-02 Addition of CA\_n5A-n14A-n77A AT&T, Nokia 9. R4-2107720 TP to TR 38.717-03-02 Addition of CA\_n5A-n30A-n77A AT&T, Nokia 10. R4-2107721 TP to TR 38.717-03-02 Addition of CA\_n12A-n30A-n77A AT&T, Nokia 11. R4-2107722 TP to TR 38.717-03-02 Addition of CA\_n12A-n66A-n77A AT&T, Nokia 12. R4-2107723 TP to TR 38.717-03-02 Addition of CA\_n14A-n30A-n77A AT&T, Nokia 13. R4-2107724 TP to TR 38.717-03-02 Addition of CA\_n14A-n66A-n77A AT&T, Nokia 14. R4-2107725 TP to TR 38.717-03-02 Addition of CA\_n30A-n66A-n77A AT&T, Nokia 15. R4-2109469 TP for TR 38.717-03-02: CA\_n3-n28-n79 SoftBank Corp. 16. R4-2107726 TP for TR 38.717-03-02: CA\_n28-n77-n79 SoftBank Corp. 17. R4-2107728 TP to TR 38.717-03-02 Addition of CA\_n25-n48-n66 Nokia, T-Mobile USA 18. R4-2107730 TP for TR 38.717-03-02 to include CA\_n7-n25-n78 Ericsson, Bell Mobility 19. R4-2109471 TP for TR 38.717-03-02: CA\_n3-n79-n257 SoftBank Corp. 20. R4-2109473 TP for TR 38.717-03-01: CA\_n28-n79-n257 SoftBank Corp. 21. R4-2107727 TP for TR38.717-03-02\_CA\_n41A-n79A-n258A ZTE Corporation 22. R4-2107731 TP for TR 38.717-03-02 to include CA\_n7-n78-n258 Ericsson,Telstra | V0.5.0 |
| 2021-08 | RAN4#100-e | R4-2114090 |  |  |  | The following completed band combinations of inter-band CA for 3 bands DL with 2 bands UL are added from RAN4 #100-e:   1. R4-2111777 TP to TR 38.717-03-02: Addition of CA\_n2-n14-n30， Nokia, AT&T 2. R4-2111778 TP to TR 38.717-03-02: Addition of CA\_n2-n14-n66， Nokia, AT&T 3. R4-2111779 TP to TR 38.717-03-02: Addition of CA\_n14-n30-n66， Nokia, AT&T 4. R4-2114831 TP to TR 38.717-03-02: Addition of CA\_n1-n3-n7， Nokia, BT plc 5. R4-2114832 TP to TR 38.717-03-02: Addition of CA\_n1-n3-n28，Nokia, BT plc 6. R4-2114833 TP to TR 38.717-03-02: Addition of CA\_n3-n7-n28，Nokia, BT plc 7. R4-2112060 TP for TR 38.717-03-02: CA\_n3-n77-n79，SoftBank Corp. 8. R4-2112749 TP for TR 38.717-03-02 to include CA\_n1A-n5A-n78A，Ericsson, Telstra 9. R4-2112751 TP for TR 38.717-03-02 to include CA\_n1-n3-n5，Ericsson, Telstra 10. R4-2112753 TP for TR 38.717-03-02 to include CA\_n1-n5-n7，Ericsson, Telstra 11. R4-2112859 TP for TR38.717-03-02\_CA\_n28A-n41A-n79A， CMCC, ZTE Corporation 12. R4-2113057 TP for TR 38.717-03-02: CA\_n25-n38-n66，Huawei, HiSilicon, Bell Mobility, Telus 13. R4-2113579 TP for TR 38.717-03-02 to include UL for CA\_n3-n5-n7，Ericsson, Telstra 14. R4-2113581 TP for TR 38.717-03-02 to include CA\_n3-n5-n78，Ericsson, Telstra 15. R4-2114852 TP for TR 38.717-03-02 to include UL for CA\_n3-n7-n78， Ericsson, Telstra 16. R4-2113585 TP for TR 38.717-03-02 to include UL for CA\_n5-n7-n78， Ericsson, Telstra 17. R4-2113586 TP for TR 38.717-03-02 to include CA\_n7-n28-n78，Ericsson, Telstra 18. R4-2114857 TP for TR 38.717-03-02 to include UL and a new configuration for CA\_n1-n28-n78，Ericsson, BT plc 19. R4-2113602 TP for TR 38.717-03-02 to include CA\_n25-n41-n78， Ericsson, Bell Mobility 20. R4-2113603 TP for TR 38.717-03-02 to include CA\_n41-n71-n78，Ericsson, Bell Mobility 21. R4-2113605 TP for TR 38.717-03-02 to include CA\_n41-n66-n78，Ericsson, Bell Mobility 22. R4-2113728 TP to TR 38.717-03-02 Addition of CA\_n26\_n66\_n70， Nokia, DISH Network 23. R4-2114864 TP to TR 38.717-03-02 Addition of CA\_n48\_n66\_n70，Nokia, DISH Network 24. R4-2114865 TP to TR 38.717-03-02 Addition of CA\_n48\_n66\_n71，Nokia, DISH Network 25. R4-2114866 TP to TR 38.717-03-02 Addition of CA\_n48\_n70\_n71，Nokia, DISH Network 26. R4-2114867 TP to TR 38.717-03-02 Addition of CA\_n66\_n70\_n71， Nokia, DISH Network 27. R4-2112939 TP for TR38.717-03-02\_CA\_n40A-n41A-n258A，ZTE Corporation | V0.6.0 |
| 2021-11 | RAN4#101-e | R4-2118598 |  |  |  | The following completed band combinations of inter-band CA for 3 bands DL with 2 bands UL are added from RAN4 #101-e:   1. R4-2119760 TP for TR 38.717-03-01: CA\_n24-n41-n77 combinations 2. R4-2119761 TP for TR 38.717-03-02: CA\_n24-n41-n48 combinations 3. R4-2119762 TP update for TR 38.717-03-02: CA\_n3-n77-n79 4. R4-2117904 TP for TR 38.717-03-02: CA\_n30A-n66A-n77(2A) 5. R4-2117924 TP for TR 38.717-03-02 CA\_n1A-n3A-n77A 6. R4-2119765 TP for TR38.717-03-02\_CA\_n28A-n40A-n79A 7. R4-2118543 TP to TR 38.717-03-02 for CA\_n28-n46-n78 and DC\_n28-n46-n78 8. R4-2119752 TP to TR 38.717-03-02 Addition of CA\_n1A-n40-n78A 9. R4-2119753 TP to TR 38.717-03-02 Addition of CA\_n28A-n40-n78A 10. R4-2119757 TP to TR 38.717-03-02 Addition of CA\_n7-n25-n77 11. R4-2118669 TP to TR 38.717-03-01 Addition of CA\_n29-n66-n77 12. R4-2118670 TP to TR 38.717-03-02 Addition of CA\_n2-n29-n77 13. R4-2118671 TP to TR 38.717-03-02 Addition of CA\_n5-n29-n77 14. R4-2118672 TP to TR 38.717-03-02 Addition of CA\_n29-n30-n77 15. R4-2118673 TP to TR 38.717-03-02 Addition of CA\_n29-n66-n77 | V0.7.0 |
| 2022-01 | RAN4#101-bis-e | R4-2205219 |  |  |  | 1. R4-2200202 TP for TR 38.717-03-02: CA\_n1-n3-n79 2. R4-2200203 TP for TR 38.717-03-02: CA\_n1-n3-n257 3. R4-2200204 TP for TR 38.717-03-02: CA\_n1-n28-n41 4. R4-2200205 TP for TR 38.717-03-02: CA\_n1-n28-n77 5. R4-2200206 TP for TR 38.717-03-02: CA\_n1-n28-n79 6. R4-2200207 TP for TR 38.717-03-02: CA\_n1-n28-n257 7. R4-2200208 TP for TR 38.717-03-02: CA\_n1-n41-n77 8. R4-2200209 TP for TR 38.717-03-02: CA\_n1-n41-n257 9. R4-2200210 TP for TR 38.717-03-02: CA\_n41-n77-n257 10. R4-2200355 TP for CA\_n28-n78-n79 for TR 38.717-03-02 11. R4-2201036 TP for TR 38.717-03-02 CA\_n1A-n3A-n18A 12. R4-2201037 TP for TR 38.717-03-02 CA\_n1A-n18A-n28A 13. R4-2201038 TP for TR 38.717-03-02 CA\_n1A-n18A-n41A 14. R4-2201039 TP for TR 38.717-03-02 CA\_n1A-n18A-n77A 15. R4-2201043 TP for TR 38.717-03-02 CA\_n3A-n18A-n28A 16. R4-2201044 TP for TR 38.717-03-02 CA\_n3A-n18A-n77A 17. R4-2201045 TP for TR 38.717-03-02 CA\_n18A-n28A-n41A 18. R4-2201046 TP for TR 38.717-03-02 CA\_n18A-n28A-n77A 19. R4-2201047 TP for TR 38.717-03-02 CA\_n18A-n41A-n77A 20. R4-2201053 TP for TR 38.717-03-02 CA\_n2-n5-n48 21. R4-2201054 TP for TR 38.717-03-02 CA\_n2-n48-n66 22. R4-2201055 TP for TR 38.717-03-02 CA\_n2-n48-n77 23. R4-2201056 TP for TR 38.717-03-02 CA\_n5-n48-n66 24. R4-2201057 TP for TR 38.717-03-02 CA\_n5-n48-n77 25. R4-2201058 TP for TR 38.717-03-02 CA\_n48-n66-n77 26. R4-2201114 TP to TR 38.717-03-02 Addition of CA\_n12-n30-n66 27. R4-2201116 TP to TR 38.717-03-02 Addition of CA\_n2-n12-n30 28. R4-2201117 TP to TR 38.717-03-02 Addition of CA\_n2-n12-n66 29. R4-2201118 TP to TR 38.717-03-02 Addition of CA\_n2-n29-n30 30. R4-2201119 TP to TR 38.717-03-02 Addition of CA\_n2-n29-n66 31. R4-2201560 TP for TR 38.717-03-02 to include CA\_n1-n3-n20 32. R4-2201563 TP for TR 38.717-03-02 to include CA\_n1-n3-n67 33. R4-2201567 TP for TR 38.717-03-02 to include CA\_n1-n20-n67 34. R4-2201569 TP for TR 38.717-03-02 to include CA\_n3-n20-n67 35. R4-2202187 TP to TR 38.717-03-02 Addition of CADC\_n7A-n46-n78A 36. R4-2202189 TP for TR 38.717-03-02 to include CA\_n41-n66-n260 37. R4-2202190 TP for TR 38.717-03-02 to include CA\_n41-n70-n78 | V0.8.0 |
| 2022-03 | RAN4#102-e | R4-2205219 |  |  |  | 1. R4-2206250 TP for TR38.717-03-02: CA\_n28A-n40A-n41A 2. R4-2206251 TP for TR 38.717-03-02 to include CA\_n41-n66-n70 3. R4-2205694 TP for TR 38.717-03-02 to include CA\_n66-n70-n78 | V0.8.0 |