|  |  |
| --- | --- |
| 3GPP TR 37.718-21-11 V0.4.0 (2023-03) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Networks;  Dual Connectivity of 2 bands LTE inter-band CA and 1 NR band (Release 18) | |
|  | |
|  |  |
|  | |
| The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP. The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented. This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification. Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices. | |

|  |
| --- |
|  |
| ***3GPP***  Postal address  3GPP support office address  650 Route des Lucioles - Sophia Antipolis  Valbonne - FRANCE  Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16  Internet  http://www.3gpp.org |
| ***Copyright Notification***  No part may be reproduced except as authorized by written permission. The copyright and the foregoing restriction extend to reproduction in all media.  © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).  All rights reserved.  UMTS™ is a Trade Mark of ETSI registered for the benefit of its members  3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners LTE™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners  GSM® and the GSM logo are registered and owned by the GSM Association |

Contents

Foreword 4

1 Scope 6

2 References 6

3 Definitions of terms, symbols and abbreviations 6

3.1 Terms 6

3.2 Symbols 6

3.3 Abbreviations 7

4 Background 7

4.1 TR Maintenance 7

5 DC of 2 bands LTE inter-band CA and 1 NR band within FR1: Specific Band Combination Part 7

5.x DC\_a-b\_nc 7

5.1 DC\_1-(n)7 8

5.2 DC\_3-(n)7 9

5.3 DC\_28-(n)7 10

5.4 DC\_1-26\_n78 11

5.5 DC\_3-26\_n78 12

5.6 DC\_7-26\_n78 14

5.7 DC\_1A-8A\_n7A 15

5.8 DC\_3-8\_n78, DC\_3-3-8\_n78 17

5.9 DC\_7-8\_n78, DC\_7-7-8\_n78 18

5.10 DC\_1-3\_n26 19

5.11 DC\_1-7\_n26 20

5.12 DC\_3-7\_n26 21

5.13 DC\_3-41\_n1 23

5.14 DC\_8-41\_n78 24

5.15 DC\_20-41\_n1 25

5.16 DC\_20-41\_n78 26

5.17 DC\_1-7\_n1 28

5.18 DC\_1-7\_n20 30

5.19 DC\_1-8\_n20 34

5.20 DC\_3-20\_n3 37

5.21 DC\_3-32\_n7 40

5.22 DC\_8-28\_n3 43

5.23 DC\_20-32\_n7 48

5.24 DC\_7-8\_n7 50

5.25 DC\_3-5\_n40 52

5.28 DC\_20-28\_n78 58

5.29 DC\_1-28\_n20 62

5.30 DC\_1-5\_n40 65

5.31 DC\_1-3\_n1 69

5.32 DC\_1-20\_n1 71

5.33 DC\_7-8\_n20 74

5.34 DC\_7-28\_n20 79

5.35 DC\_5-7\_n40 84

5.36 DC\_20-(n)3 86

5.37 DC\_3-8\_n7 87

# Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

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

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

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

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

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

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

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

**should** indicates a recommendation to do something

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

**may** indicates permission to do something

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

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

**can** indicates that something is possible

**cannot** indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

# 1 Scope

The present document is a technical report for Dual Connectivity of 2 bands LTE inter-band CA (2DL/1UL) and 1 NR band (1DL/1UL) under Rel-18 time frame. The purpose is to gather the relevant background information and studies in order to address Dual connectivity (DC) band combinations of 3 different bands DL with 2 different bands UL (2 different LTE bands and 1 NR band) for the Rel-18 band combinations. The actual requirements are added to the corresponding technical specification.

# 2 References

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

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

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

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

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

…

[x] <doctype> <#>[ ([up to and including]{yyyy[-mm]|V<a[.b[.c]]>}[onwards])]: "<Title>".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

Definition format (Normal)

**<defined term>:** <definition>.

**example:** text used to clarify abstract rules by applying them literally.

## 3.2 Symbols

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

Symbol format (EW)

<symbol> <Explanation>

## 3.3 Abbreviations

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

Abbreviation format (EW)

<ABBREVIATION> <Expansion>

# 4 Background

The present document is a technical report for Dual Connectivity (EN-DC) of 2 bands LTE inter-band CA and 1 NR band under Rel-18 timeframe. The document covers each band combination specific issues (i.e. one sub-clause defined per band combination)

## 4.1 TR Maintenance

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

# 5 DC of 2 bands LTE inter-band CA and 1 NR band within FR1: Specific Band Combination Part

## 5.x DC\_a-b\_nc

### 5.x.1 Configurations for DC

*<Editor’s note: it is required to use the same table format as in TS 38.101-3>*

Table 5.x.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration** |
| --- | --- |
|  |  |

### 5.x.2 Co-existence studies

*<Text will be added.>*

### 5.x.3 ∆TIB and ∆RIB values

*<Editor’s note: it is required to use the same table format as in TS 38.101-3>*

Table 5.X.3-1: ΔTIB,c

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_a-b\_nc |  |  |  |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.X.3-2: ΔRIB**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_a-b\_nc |  |  |  |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

### 5.x.4 Reference sensitivity exceptions

< Editor’s note: text will be added only for reference sensitivity exceptions for intermodulation interference due to dual uplink operation for DC in NR FR1 involving three bands >

## 5.1 DC\_1-(n)7

5.1.1 Operating bands for EN-DC

Table 5.1.1-1: EN-DC Band combinations (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| 1-(n)7 | CA\_1-7 | n7 | No |

### 5.1.2 Configuration for DC

Table 5.1.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_1A-(n)7AA | DC\_1A\_n7A | CA\_1A-7A | n7A |

5.1.3 ∆TIB and ∆RIB values

For DC\_1-(n)7, the ΔTIB,c and ΔRIB,c values are reused from DC\_1\_n7 and are given in the tables below.

**Table 5.1.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_1-(n)7 | 0.5 | 0.6 | 0.6 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.1.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_1-(n)7 | - | - | - |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.1.4 REFSENS requirements

There are no IMD impact from UL 1\_7 affecting DL band 1 or band n7.

## 5.2 DC\_3-(n)7

5.2.1 Operating bands for EN-DC

Table 5.2.1-1: EN-DC Band combinations (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| 3-(n)7 | CA\_3-7 | n7 | No |

### 5.2.2 Configuration for DC

Table 5.2.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_3A-(n)7AA | DC\_3A\_n7A | CA\_3A-7A | n7A |
| DC\_3C-(n)7AA | DC\_3A\_n7A | CA\_3C-7A | n7A |

5.2.3 ∆TIB and ∆RIB values

For DC\_3-(n)7, the ΔTIB,c and ΔRIB,c values are reused from DC\_3\_n7 and are given in the tables below.

**Table 5.2.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_3-(n)7 | 0.5 | 0.5 | 0.5 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.2.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_3-(n)7 | - | - | - |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.2.4 REFSENS requirements

There are possible IMD4 impact from UL 3\_n7 affecting band 7 MSD values based on Skyworks discussion paper R4-2215523: MSD for DC\_3A\_(n)7AA.

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-(n)7AA  DC\_3C-(n)7AA | 3 | 1730 | 5 | 25 | 1825 | N/A | N/A |
|  | 7 | N/A | 5 | N/A | 2647.5 | 6.9 | IMD4 |
|  | n7 | 2535 | 10 | 50 | 2655 | 10.2 | IMD4 |

## 5.3 DC\_28-(n)7

5.3.1 Operating bands for EN-DC

Table 5.3.1-1: EN-DC Band combinations (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| 28-(n)7 | CA\_28-7 | n7 | No |

### 5.3.2 Configuration for DC

Table 5.3.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_28A-(n)7AA | DC\_28A\_n7A | CA\_28A-7A | n7A |

5.3.3 ∆TIB and ∆RIB values

For DC\_28-(n)7, the ΔTIB,c and ΔRIB,c values are reused from DC\_28\_n7 and are given in the tables below.

**Table 5.3.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_28-(n)7 | 0.3 | 0.3 | 0.3 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.3.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_28-(n)7 | - | - | - |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.3.4 REFSENS requirements

There are no IMD impact from UL 28\_7 affecting DL band 28 or band n7.

## 5.4 DC\_1-26\_n78

5.4.1 Operating bands for EN-DC

Table 5.4.1-1: EN-DC Band combinations (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_1-26\_n78 | CA\_1-26 | n78 | No |

### 5.4.2 Configuration for DC

Table 5.4.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_1A-26A\_n78A | DC\_1A\_n78A  DC\_26A\_n78A | CA\_1A-26A | n78A |

5.4.3 ∆TIB and ∆RIB values

For DC\_1-26\_n78, the ΔTIB,c and ΔRIB,c values are reused from DC\_1-5\_n78 and are given in the tables below.

**Table 5.4.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_1-26\_n78 | 0.3 | 0.6 | 0.8 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.4.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_1-26\_n78 | 0.2 | 0.2 | 0.5 |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.4.4 REFSENS requirements

There are IMD3 impact from UL 26\_n78 affecting DL band 1.

There are IMD5 impact from UL 1\_n78 affecting DL band 26.

MSD values are reused from DC\_1A-5A\_n78A.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_1A-26A\_n78A | 1 | 1932 | 5 | 25 | 2122 | 18.1 | IMD3 |
|  | 26 | 829 | 5 | 25 | 874 | N/A | N/A |
|  | n78 | 3780 | 10 | 50 | 3780 | N/A | N/A |
|  | 1 | 1975 | 5 | 25 | 2165 | N/A | N/A |
|  | 26 | 840 | 5 | 25 | 885 | 3.1 | IMD5 |
|  | n78 | 3405 | 10 | 50 | 3405 | N/A | N/A |

## 5.5 DC\_3-26\_n78

5.5.1 Operating bands for EN-DC

Table 5.5.1-1: EN-DC Band combinations (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_3-26\_n78 | CA\_3-26 | n78 | No |

### 5.5.2 Configuration for DC

Table 5.5.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_3A-26A\_n78A  DC\_3C-26A\_n78A | DC\_3A\_n78A  DC\_26A\_n78A | CA\_3A-26A | n78A |

5.5.3 ∆TIB and ∆RIB values

For DC\_3-26\_n78, the ΔTIB,c and ΔRIB,c values are reused from DC\_3-5\_n78 and are given in the tables below.

**Table 5.5.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_3-26\_n78 | 0.6 | 0.6 | 0.8 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.5.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_3-26\_n78 | 0.2 | 0.2 | 0.5 |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.5.4 REFSENS requirements

There are IMD3 impact from UL 26\_n78 affecting DL band 3. MSD values are reused from DC\_5A\_n3A-n78A.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-26A\_n78A  DC\_3C-26A\_n78A | 3 | 1767 | 5 | 25 | 1862 | 15.7 | IMD3 |
|  | 26 | 839 | 5 | 25 | 884 | N/A | N/A |
|  | n78 | 3540 | 10 | 50 | 3540 | N/A | N/A |

## 5.6 DC\_7-26\_n78

5.6.1 Operating bands for EN-DC

Table 5.6.1-1: EN-DC Band combinations (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_7-26\_n78 | CA\_7-26 | n78 | No |

### 5.6.2 Configuration for DC

Table 5.6.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_7A-26A\_n78A  DC\_7C-26A\_n78A | DC\_7A\_n78A  DC\_26A\_n78A | CA\_7A-26A | n78A |

5.6.3 ∆TIB and ∆RIB values

For DC\_7-26\_n78, the ΔTIB,c and ΔRIB,c values are reused from DC\_5-7\_n78 and are given in the tables below.

**Table 5.6.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_7-26\_n78 | 0.6 | 0.6 | 0.8 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.6.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_7-26\_n78 | 0.2 | 0.2 | 0.5 |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.6.4 REFSENS requirements

There are IMD2 and IMD5 impact from UL 7\_n78 affecting DL band 26. MSD values are reused from DC\_5A-7A\_n78A.

There are IMD2 impact from UL 26\_n78 affecting DL band 7. MSD values are reused from DC\_5A-7A\_n78A.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_7A-26A\_n78A  DC\_7C-26A\_n78A | 7 | 2525 | 5 | 25 | 2645 | 30.1 | IMD2 |
|  | 26 | 844 | 5 | 25 | 889 | N/A | N/A |
|  | n78 | 3489 | 10 | 50 | 3489 | N/A | N/A |
|  | 7 | 2550 | 5 | 25 | 2670 | N/A | N/A |
|  | 26 | 834 | 5 | 25 | 879 | 30.2 | IMD2 |
|  | n78 | 3429 | 10 | 50 | 3429 | N/A | N/A |
|  | 7 | 2525 | 5 | 25 | 2645 | N/A | N/A |
|  | 26 | 830 | 5 | 25 | 875 | 3.3 | IMD5 |
|  | n78 | 3350 | 10 | 50 | 3350 | N/A | N/A |

## 5.7 DC\_1A-8A\_n7A

5.7.1 Configurations for DC

Table 5.7.1-1: Inter-band EN-DC configurations (three bands)

| EN-DC  configuration | Uplink EN-DC  configuration  (NOTE 1) |
| --- | --- |
| DC\_1A-8A\_n7A | DC\_8A\_n7A  DC\_1A\_n7A |

5.7.2 Co-existence studies

For 2UL/3DL(DC\_1A-8A\_n7A with UL DC\_1A\_n7A) UE coexistence study 2nd, 3rd, 4th and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.239.2-1.

Table 5.7.2-1: Harmonic and IMD analysis for DC\_1A\_n7A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| **UL frequency (MHz)** | **1920** | **1980** | **2500** | **2570** |
| **2nd harmonics frequency limits** | **2\*fx\_low** | **2\*fx\_high** | **2\* fy\_low** | **2\* fy\_high** |
| **2nd harmonics frequency limits (MHz)** | **3840** | **3960** | **5000** | **5140** |
| **3rd harmonics frequency limits** | **3\*fx\_low** | **3\*fx\_high** | **3\* fy\_low** | **3\* fy\_high** |
| **3rd harmonics frequency limits (MHz)** | **5760** | **5940** | **7500** | **7710** |
| **4th harmonics frequency limits** | **4\*fx\_low** | **4\*fx\_high** | **4\* fy\_low** | **4\* fy\_high** |
| **4th harmonics frequency limits (MHz)** | **7680** | **7920** | **10000** | **10280** |
| **5th harmonics frequency limits** | **5\*fx\_low** | **5\*fx\_high** | **5\* fy\_low** | **5\* fy\_high** |
| **5th harmonics frequency limits (MHz)** | **9600** | **9900** | **12500** | **12850** |
| **2nd order IMD products** | **|fy\_low – fx\_high|** | **|fy\_high – fx\_low|** | **|fy\_low + fx\_low|** | **|fy\_high + fx\_high|** |
| **IMD frequency limits (MHz)** | **520** | **650** | **4420** | **4550** |
| **Two-tone 3rd order IMD products** | **|2\*fx\_low – fy\_high|** | **|2\*fx\_high – fy\_low|** | **|2\*fy\_low – fx\_high|** | **|2\*fy\_high – fx\_low|** |
| **IMD frequency limits (MHz)** | **1270** | **1460** | **3020** | **3220** |
| **Two-tone 3rd order IMD products** | **|2\*fx\_low + fy\_low|** | **|2\*fx\_high + fy\_high|** | **|2\*fy\_low + fx\_low|** | **|2\*fy\_high + fx\_high|** |
| **IMD frequency limits (MHz)** | **6340** | **6530** | **6920** | **7120** |
| **Two-tone 4th order IMD products** | **|3\*fx\_low –1\* fy\_high|** | **|3\*fx\_high – 1\*fy\_low|** | **|3\*fy\_low – 1\*fx\_high|** | **|3\*fy\_high – 1\*fx\_low|** |
| **IMD frequency limits (MHz)** | **3190** | **3440** | **5520** | **5790** |
| **Two-tone 4th order IMD products** | **|3\*fx\_low +1\* fy\_low|** | **|3\*fx\_high + 1\*fy\_high|** | **|3\*fy\_low + 1\*fx\_low|** | **|3\*fy\_high + 1\*fx\_high|** |
| **IMD frequency limits (MHz)** | **8260** | **8510** | **9420** | **9690** |
| **Two-tone 4th order IMD products** | **|2\*fx\_low –2\* fy\_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 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** |

As we can see from the above table，for 3DL\_DC\_1A-8A\_n7A with 2UL\_1A\_n7A，Two-tone 5th order IMD products |2\*fy -3\*fx |may fall into DL reception frequency of Band 8.

5.7.3 ∆TIB and ∆RIB values

The requirements of ∆TIB values in Table 6.2.5-3: ΔTIB,c (three bands) “CA\_1-7-8 , CA\_1-7-7-8”from TS36.101 [2] can be applied for DC\_1-8\_n7.

The requirements of ∆RIB values in Table 7.3.1-1B: ΔRIB,c (three bands) “CA\_1-7-8 , CA\_1-7-7-8” from TS36.101 [2] can be applied for DC\_1-8\_n7.

Table 5.7.3-1:ΔTIB,c due to EN-DC (three bands)

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_1-8\_n7 | 0.5 | 0.6 | 0.6 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

Table 5.7.3-2:ΔRIB,c due to EN-DC (three bands)

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_1-8\_n7 | - | 0.2 | - |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.7.4 Reference sensitivity exceptions

Table 5.7.4-1 shows the required MSD levels for the DC configuration. The required MSD values are derived from DC\_1A-8A\_n7A.

Table 5.7.4-1: Reference sensitivity exceptions for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA and NR Band / Channel bandwidth / NRB / MSD | | | | | | | |
| EN-DC  Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_1A-8A\_n7A | 1 | 1977.5 | 5 | 25 | 2167.5 | N/A | N/A |
| n7 | 2502.5 | 5 | 25 | 2622.5 | N/A | N/A |
| 8 | 882.5 | 5 | 25 | 927.5 | 1.0 | IMD5 |

## 5.8 DC\_3-8\_n78, DC\_3-3-8\_n78

### 5.8.1 Configurations for DC

Table 5.8.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration** |
| --- | --- |
| DC\_3A-8B\_n78A5 | DC\_3A\_n78A  DC\_8A\_n78A |
| DC\_3A-3A-8B\_n78A5 | DC\_3A\_n78A  DC\_8A\_n78A |
| NOTE 5: Applicable for UE supporting inter-band EN-DC with mandatory simultaneous Rx/Tx capability | |

### 5.8.2 Co-existence studies

Co-existence was studied for DC\_3A-8A\_n78A in Rel-15 and the results are captured in TR 37.863-02-01. Based on the study for the impact on the third band, the 3rd order IMD generated by dual uplink of Band 8 + Band n78 may fall into own Rx of band 3.

### 5.8.3 ∆TIB and ∆RIB values

For DC\_3A-8B\_n78A, DC\_3A-3A-8B\_n78A, the ΔTIB,c and ΔRIB,c values are already covered by the DC\_3-8\_n78, DC\_3-3-8\_n78, as in the tables below.

Table 5.8.3-1: ΔTIB,c

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_3-8\_n78  DC\_3-3-8\_n78 | 0.6 | 0.6 | 0.8 |

**Table 5.8.3-2: ΔRIB**,c

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_3-8\_n78  DC\_3-3-8\_n78 | 0.2 | 0.2 | 0.5 |

### 5.8.4 Reference sensitivity exceptions

For the MSD requirements for IMD interference of DC\_3A-8B\_n78A and DC\_3A-3A-8B\_n78A, the requirements for DC\_3A-8A\_n78A and DC\_3A-3A-8A\_n78A can be referred as below.

**Table 5.8.4-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)**

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-8B\_n78A  DC\_3A-3A-8B\_n78A | 8 | 910 | 5 | 25 | 955 | N/A | N/A |
|  | n78 | 3640 | 10 | 50 | 3640 | N/A | N/A |
|  | 3 | 1725 | 5 | 25 | 1820 | 16.5 | IMD3 |

## 5.9 DC\_7-8\_n78, DC\_7-7-8\_n78

### 5.9.1 Configurations for DC

Table 5.9.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration** |
| --- | --- |
| DC\_7A-8B\_n78A5 | DC\_7A\_n78A  DC\_8A\_n78A |
| DC\_7A-7A-8B\_n78A5 | DC\_7A\_n78A  DC\_8A\_n78A |
| NOTE 5: Applicable for UE supporting inter-band EN-DC with mandatory simultaneous Rx/Tx capability | |

### 5.9.2 Co-existence studies

Co-existence was studied for DC\_7A-8A\_n78A in Rel-16 and the results are captured in TR 37.716-21-11. Based on the study for the impact on the third band,

- 2nd and 5th order IM generated by dual uplink of Band 7 and n78 may fall into Band 8

- 2nd order IM generated by dual uplink of Band 8 and n78 may fall into Band 7

### 5.9.3 ∆TIB and ∆RIB values

For DC\_7A-8B\_n78A, DC\_7A-7A-8B\_n78A, the ΔTIB,c and ΔRIB,c values are already covered by the DC\_7-8\_n78, as in the tables below.

Table 5.9.3-1: ΔTIB,c

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_7-8\_n78  DC\_7-7-8\_n78 | 0.5 | 0.6 | 0.8 |

**Table 5.9.3-2: ΔRIB**,c

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_7-8\_n78  DC\_7-7-8\_n78 | 0 | 0.2 | 0.5 |

### 5.9.4 Reference sensitivity exceptions

For the MSD requirements for IMD interference of DC\_7A-8B\_n78A and DC\_7A-7A-8B\_n78A, the requirements for DC\_7A-8A\_n78A can be referred as below.

**Table 5.9.4-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)**

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_7A-8B\_n78A  DC\_7A-7A-8B\_n78A | 7 | 2530 | 5 | 25 | 2650 | N/A | N/A |
|  | 8 | 895 | 5 | 25 | 940 | 30.5 | IMD2 |
|  | n78 | 3470 | 10 | 50 | 3470 | N/A | N/A |
|  | 7 | 2520 | 5 | 25 | 2640 | N/A | N/A |
|  | 8 | 895 | 5 | 25 | 940 | 3.1 | IMD5 |
|  | n78 | 3310 | 10 | 50 | 3310 | N/A | N/A |
|  | 7 | 2530 | 5 | 25 | 2650 | 28 | IMD2 |
|  | 8 | 895 | 5 | 25 | 940 | N/A | N/A |
|  | n78 | 3545 | 10 | 50 | 3545 | N/A | N/A |

## 5.10 DC\_1-3\_n26

5.10.1 Operating bands for EN-DC

Table 5.10.1-1: Band combinations EN-DC (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_1-3\_n26 | CA\_1-3 | n26 | No |

### 5.10.2 Configuration for DC

Table 5.10.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_1A-3A\_n26A | DC\_1A\_n26A  DC\_3A\_n26A | CA\_1A-3A | n26A |
| DC\_1A-3C\_n26A | DC\_1A\_n26A  DC\_3A\_n26A  DC\_3C\_n26A | CA\_1A-3A  CA\_1A-3C | n26A |

5.10.3 ∆TIB and ∆RIB values

For DC\_1-3\_n26, the ΔTIB,c and ΔRIB,c values are reused from DC\_1-3\_n5 and are given in the tables below.

**Table 5.10.3-1: ΔTIB,c**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_1-3\_n26 | 1 | 0.3 |
| 3 | 0.3 |
| n26 | 0.3 |

**Table 5.10.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_1-7\_n26 | 1 | 0 |
| 7 | 0 |
| n26 | 0 |

5.10.4 REFSENS requirements

Reusing the coexistence study results from DC\_1-3\_n5, there is no need to define MSD values for DC\_1-3\_n26.

## 5.11 DC\_1-7\_n26

5.11.1 Operating bands for EN-DC

Table 5.11.1-1: Band combinations EN-DC (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_1-7\_n26 | CA\_1-7 | n26 | No |

### 5.11.2 Configuration for DC

Table 5.11.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_1A-7A\_n26A | DC\_1A\_n26A  DC\_7A\_n26A | CA\_1A-7A | n26A |
| DC\_1A-7C\_n26A | DC\_1A\_n26A  DC\_7A\_n26A  DC\_7C\_n26A | CA\_1A-7A  CA\_1A-7C | n26A |

5.11.3 ∆TIB and ∆RIB values

For DC\_1-7\_n26, the ΔTIB,c and ΔRIB,c values are reused from DC\_1-7\_n5 and are given in the tables below.

**Table 5.11.3-1: ΔTIB,c**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_1-7\_n26 | 1 | 0.5 |
| 7 | 0.6 |
| n26 | 0.3 |

**Table 5.11.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_1-7\_n26 | 1 | 0 |
| 7 | 0 |
| n26 | 0 |

5.11.4 REFSENS requirements

Reusing the coexistence study results from DC\_1-7\_n5, there is no need to define MSD values for DC\_1-7\_n26.

## 5.12 DC\_3-7\_n26

5.12.1 Operating bands for EN-DC

Table 5.12.1-1: Band combinations EN-DC (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_3-7\_n26 | CA\_3-7 | n26 | Yes |

### 5.12.2 Configuration for DC

Table 5.12.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_3A-7A\_n26A | DC\_3A\_n26A  DC\_7A\_n26A | CA\_3A-7A | n26A |
| DC\_3A-7C\_n26A | DC\_3A\_n26A  DC\_7A\_n26A  DC\_7C\_n26A | CA\_3A-7A  CA\_3A-7C | n26A |
| DC\_3C-7A\_n26A | DC\_3A\_n26A  DC\_3C\_n26A  DC\_7A\_n26A | CA\_3A-7A  CA\_3C-7A | n26A |
| DC\_3C-7C\_n26A | DC\_3A\_n26A  DC\_3C\_n26A  DC\_7A\_n26A  DC\_7C\_n26A | CA\_3A-7A  CA\_3A-7C  CA\_3C-7A  CA\_3C-7C | n26A |

5.12.3 ∆TIB and ∆RIB values

For DC\_3-7\_n26, the ΔTIB,c and ΔRIB,c values are reused from DC\_3-7\_n5 and are given in the tables below.

**Table 5.12.3-1: ΔTIB,c**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_3-7\_n26 | 3 | 0.5 |
| 7 | 0.5 |
| n26 | 0.3 |

**Table 5.12.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_3-7\_n26 | 3 | 0 |
| 7 | 0 |
| n26 | 0 |

5.12.4 REFSENS requirements

Based on the discussions in R4-2219700 and reusing the coexistence study results from EN-DC combination DC\_3-7\_n5, MSD values should be defined as below:

Table 7.3B.2.3.5.2-1: Reference sensitivity exceptions for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| **EN-DC Configuration** | **EUTRA/NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** | **IMD order** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| DC\_3A-7A\_n26A  DC\_3A-7C\_n26A  DC\_3C-7C\_n26A  DC\_3C-7A\_n26A | 3 | 1780 | 10 | 50 | 1875 | N/A | FDD | N/A |
| 7 | 2505 | 10 | 50 | 2625 | 30.0 | IMD2 |
| n26 | 845 | 5 | 25 | 890 | N/A | N/A |
| DC\_3C-7A\_n26A  DC\_3C-7C\_n26A | 3 | 1755 | 20 | 1(RBSTART=20) | 1850 | N/A | FDD | N/A |
|  | 1774.8 | 20 | 1(RBSTART=79) | 1869.8 | N/A |  |  |
| 7 | N/A | 5 | N/A | 2682.5 | **19** | FDD | IMD3 |
| n26 | 846.5 | 5 | 25(RBSTART=0) | 891.5 | N/A | FDD | N/A |

## 5.13 DC\_3-41\_n1

### 5.13.1 Configuration for DC

Table 5.13.1-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_3A-41A\_n1A | DC\_3A\_n1A  DC\_41A\_n1A | CA\_3A-41A | n1A |
| DC\_3A-41C\_n1A | DC\_3A\_n1A  DC\_41A\_n1A  DC\_41C\_n1A | CA\_3A-41C | n1A |
| DC\_3A-3A-41A\_n1A | DC\_3A\_n1A  DC\_41A\_n1A | CA\_3A-3A-41A | n1A |
| DC\_3A-3A-41C\_n1A | DC\_3A\_n1A  DC\_41A\_n1A  DC\_41C\_n1A | CA\_3A-3A-41C | n1A |

### 5.13.2 Co-existence studies

When uplink is DC\_3A\_n1A there is IMD5 interfering band 41 downlink.

### 5.13.3 ∆TIB and ∆RIB values

For DC\_3-41\_n1, the ΔTIB,c and ΔRIB,c values are reused from DC\_1\_n3-n41 and are given in the tables below.

**Table 5.13.3-1: ΔTIB,c**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_3-41\_n1 | 0.5 | 0.33 / 0.84 | 0.5 |
| NOTE 3: The requirement is applied for UE transmitting on the frequency range of 2515 – 2690 MHz.  NOTE 4: The requirement is applied for UE transmitting on the frequency range of 2496 – 2515 MHz. | | | |

**Table 5.13.3-2: ΔRIB,c**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_3-41\_n1 | - | 03 / 0.54 | - |
| NOTE 3: The requirement is applied for UE transmitting on the frequency range of 2515 - 2690 MHz.  NOTE 4: The requirement is applied for UE transmitting on the frequency range of 2496 – 2515 MHz | | | |

5.13.4 REFSENS requirements

It is proposed to re-use the IMD5 MSD values from already specified configuration DC\_1\_n3-n41 which is similar to DC\_3-41\_n1.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-41A\_n1A  DC\_3A-41C\_n1A  DC\_3A-3A-41A\_n1A  DC\_3A-3A-41C\_n1A | n1 | 1977.5 | 5 | 25 | 2167.5 | N/A | N/A |
|  | 3 | 1712.5 | 5 | 25 | 1807.5 | N/A | N/A |
|  | 41 | 2507.5 | 5 | 25 | 2507.5 | 5.0 | IMD5 |

## 5.14 DC\_8-41\_n78

### 5.14.1 Configuration for DC

Table 5.14.1-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_8A-41A\_n78A | DC\_8A\_n78A  DC\_41A\_n78A | CA\_8A-41A | n78A |
| DC\_8A-41C\_n78A | DC\_8A\_n78A  DC\_41A\_n78A  DC\_41C\_n78A | CA\_8A-41C | n78A |

### 5.14.2 Co-existence studies

When uplink is DC\_8A\_n78A there is IMD2 interfering band 41 downlink.

When uplink is DC\_41A\_n78A there is IMD2 and IMD5 interfering band 8 downlink.

### 5.14.3 ∆TIB and ∆RIB values

For DC\_8-41\_n78, the ΔTIB,c and ΔRIB,c values are reused from DC\_8-41\_n77A and are given in the tables below.

**Table 5.14.3-1: ΔTIB,c**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_8-41\_n78 | 0.6 | 0.3 | 0.8 |

**Table 5.14.3-2: ΔRIB,c**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_8-41\_n78 | 0.2 | - | 0.5 |

5.14.4 REFSENS requirements

It is proposed to re-use the IMD2 MSD values from already specified configuration DC\_8-41\_n77 which is similar to DC\_8-41\_n78.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_8A-41A\_n78A  DC\_8A-41C\_n78A | 8 | 905 | 5 | 25 | 950 | 29.1 | IMD24 |
|  | 41 | 2630 | 5 | 25 | 2630 | N/A | N/A |
|  | n78 | 3580 | 10 | 50 | 3580 | N/A | N/A |
|  | 8 | 895 | 5 | 25 | 940 | N/A | N/A |
|  | 41 | 2650 | 5 | 25 | 2650 | 28.0 | IMD2 |
|  | n78 | 3545 | 10 | 50 | 3545 | N/A | N/A |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

## 5.15 DC\_20-41\_n1

### 5.15.1 Configuration for DC

Table 5.15.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_20A-41A\_n1A | DC\_20A\_n1A  DC\_41A\_n1A | CA\_20A-41A | n1A |
| DC\_20A-41C\_n1A | DC\_20A\_n1A  DC\_41A\_n1A  DC\_41C\_n1A | CA\_20A-41C | n1A |

### 5.15.2 Co-existence studies

There is no impact from UL 20\_n1 affecting DL band 41.

There are IMD5 impact from UL 41\_n1 affecting DL band 20.

5.15.3 ∆TIB and ∆RIB values

For DC\_20-41\_n1, the ΔTIB,c and ΔRIB,c values are reused from DC\_1-20\_n41 and are given in the tables below.

**Table 5.15.3-1: ΔTIB,c**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_20-41\_n1 | 20 | 0.3 |
| 41 | 0.51 |
| 1.22 |
| n1 | 0.5 |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545 - 2690 MHz.  NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496 - 2545 MHz. | | |

**Table 5.15.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_20-41\_n1 | 20 | 0 |
| 41 | 0 |
| n1 | 0 |

5.15.4 REFSENS requirements

MSD values are reused from DC\_1A-20A\_n7A.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_20A-41A\_n1A | 20 | 841 | 5 | 25 | 800 | 4.5 | IMD5 |
| DC\_20A-41C\_n1A | 41 | 2510 | 10 | 50 | 2510 | N/A | N/A |
|  | n1 | 1940 | 5 | 25 | 2130 | N/A | N/A |

## 5.16 DC\_20-41\_n78

### 5.16.1 Configuration for DC

Table 5.16.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_20A-41A\_n78A | DC\_20A\_n78A  DC\_41A\_n78A | CA\_20A-41A | n78A |
| DC\_20A-41C\_n78A | DC\_20A\_n78A  DC\_41A\_n78A  DC\_41C\_n78A | CA\_20A-41C | n78A |

### 5.16.2 Co-existence studies

There are IMD2 impact from UL 20\_n78 affecting DL band 41.

There are IMD2 and IMD5 impact from UL 41\_n78 affecting DL band 20.

5.16.3 ∆TIB and ∆RIB values

For DC\_20-41\_n78, the ΔTIB,c and ΔRIB,c values are reused from DC\_20\_n41-n78 and are given in the tables below.

**Table 5.16.3-1: ΔTIB,c**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_20-41\_n78 | 20 | 0.5 |
| 41 | 0.3 |
| n78 | 0.8 |

**Table 5.16.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_20-41\_n78 | 20 | 0 |
| 41 | 0 |
| n78 | 0.5 |

5.16.4 REFSENS requirements

MSD value band 41 is reused from DC\_20A\_n41A-n78A.

MSD value band 20 is reused from CA\_n28A-n41A-n78A.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_20A-41A\_n78A | 20 | 845 | 5 | 25 | 804 | N/A | N/A |
| DC\_20A-41C\_n78A | 41 | 2675 | 10 | 50 | 2675 | 29.8 | IMD2 |
|  | n78 | 3520 | 10 | 50 | 3520 | N/A | N/A |
|  | 20 | 839 | 5 | 25 | 798 | 30.8 | IMD24 |
|  | 41 | 2642 | 10 | 50 | 2642 | N/A | N/A |
|  | n78 | 3440 | 10 | 50 | 3440 | N/A | N/A |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified | | | | | | | |

## 5.17 DC\_1-7\_n1

### 5.17.1 Configurations for DC

Table 5.17.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-7A\_n1A | DC\_1A\_n1A  DC\_7A\_n1A |

### 5.17.2 Co-existence studies

Table 5.17.2-1 lists the Band 7A + Band n1A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.17.2-1: Band 7 and Band n1 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 2500 | 2570 | | 1920 | 1980 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 5000 – 5140 | | | 3840 – 3960 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 7500 – 7710 | | | 5760 – 5940 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 520 – 650 | | | 4420 – 4550 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 3020 – 3220 | | | 1270 – 1460 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 6920 – 7120 | | | 6340 – 6530 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 2450 – 2620 | | | 1900 – 2000 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 5520 – 5790 | | | 3190 – 3440 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 1040 – 1300 | | | 8840 – 9100 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 9420 – 9690 | | | 8260 – 8510 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5110 – 5420 | | | 8020 – 8360 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 620 – 940 | | | 3540 – 3870 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 10180 – 10490 | | | 11920 – 12260 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 10760 – 11080 | | | 11340 – 11670 | | |

Based on Table 5.17.2-1,

- 2nd order harmonics may fall into Rx frequencies of band 46 and 47.

- 3rd order harmonics may fall into Rx frequencies of band 77.

- 2nd order IMD may fall into Rx frequencies of bands 71 and 79.

- 3rd order IMD may fall into Rx frequencies of bands 32, 45, 50, 51, 75, 76, 91, 92, 93 and 94.

- 4th order IMD may fall into Rx frequencies of bands 42, 46, 52, 77 and 78.

- 5th order IMD may fall into Rx frequencies of bands 5, 6, 8, 12, 13, 14, 17, 18, 19, 20, 22, 26, 27, 28, 29, 42, 43, 44, 46, 48, 49, 67, 68, 71, 77, 78 and 85.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.17.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.17.2-2: 2UL Band 7 + Band n1 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd Harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD5 |
| 5470 | - | 5725 | Yes | IMD4 |
| 5150 | - | 5825 | Yes | Asia | 2nd Harmonic, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_7\_n1.

### 5.17.3 ∆TIB and ∆RIB values

Table 5.17.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_1-7\_n1 | 1 | 0.5 |
| 7 | 0.6 |
| n1 | 0.5 |

### 5.17.4 Reference sensitivity exceptions

No additional requirements compared to fallbacks.

## 5.18 DC\_1-7\_n20

### 5.18.1 Configurations for DC

Table 5.18.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-7A\_n20A | DC\_1A\_n20A  DC\_7A\_n20A |

### 5.18.2 Co-existence studies

Table 5.18.2-1 lists the Band 1A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.18.2-1: Band 1 and Band n20 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 1920 | 1980 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 3840 – 3960 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 5760 – 5940 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1058 – 1148 | | | 2752 – 2842 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 2978 – 3128 | | | 196 – 316 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 4672 – 4822 | | | 3584 – 3704 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 1900 – 2000 | | | 812 – 882 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4898 – 5108 | | | 516 – 666 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 2116 – 2296 | | | 5504 – 5684 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 6592 – 6802 | | | 4416 – 4566 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1348 – 1528 | | | 6818 – 7088 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1254 – 1464 | | | 4036 – 4276 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5248 – 5428 | | | 8512 – 8782 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6336 – 6546 | | | 7424 – 7664 | | |

Based on Table 5.18.2-1,

- 2nd order harmonics may fall into Rx frequencies of bands 46 and 47.

- 3rd order harmonics may fall into Rx frequencies of bands 38, 41, 69, 77 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 22, 42, 43, 48, 49, 77, 78 and 79.

- 4th order IMD may fall into Rx frequencies of bands 1, 4, 10, 23, 46, 65, 66, 71 and 79.

- 5th order IMD may fall into Rx frequencies of bands 11, 21, 24, 32, 45, 46, 50, 51, 74, 75, 76, 77, 91, 92, 93 and 94.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.18.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.18.2-2: 2UL Band 1 + Band n20 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD5 |
| 5470 | - | 5725 | Yes | IMD4 |
| 5150 | - | 5825 | Yes | Asia | 2nd harmonic, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_1\_n20.

Table 5.18.2-3 lists the Band 7A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.18.2-3: Band 7 and Band n20 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 2500 | 2570 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 5000 – 5140 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 7500 – 7710 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1638 – 1738 | | | 3332 – 3432 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 4138 – 4308 | | | 776 – 906 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 5832 – 6002 | | | 4164 – 4294 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 2480 – 2590 | | | 812 – 882 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 6638 – 6878 | | | 74 – 86 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 3276 – 3476 | | | 6664 – 6864 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 8332 – 8572 | | | 4996 – 5156 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 758 – 948 | | | 9138 – 9448 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 2414 – 2644 | | | 5776 – 6046 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5828 – 6018 | | | 10832 – 11142 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 7496 – 7726 | | | 9164 – 9434 | | |

Based on Table 5.18.2-3,

- 3rd order harmonics may fall into Rx frequencies of bands 38, 41, 69 and 90.

- 2nd order IMD may fall into Rx frequencies of bands 42, 52, 77 and 78.

- 3rd order IMD may fall into Rx frequencies of bands 5, 6, 18, 19, 20, 26, 27, 28, 44, 46, 47, 68 and 77.

- 4th order IMD may fall into Rx frequencies of bands 42, 46, 52, 77, 78 and 79.

- 5th order IMD may fall into Rx frequencies of bands 5, 6, 7, 8, 14, 18, 19, 20, 26, 27, 28, 38, 41, 44, 46, 47, 53, 68, 69 and 90.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.18.2-4 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.18.2-4: 2UL Band 7 + Band n20 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD5 |
| 2400 | - | 2494 | Yes | Asia | IMD5 |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | IMD3, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD4 |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | Yes | Asia | IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_7\_n20.

### 5.18.3 ∆TIB and ∆RIB values

Table 5.18.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_1-7\_n20 | 1 | 0.5 |
| 7 | 0.6 |
| n20 | 0.3 |

**Table 5.18.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_1-7\_n20 | 1 | 0.2 |
| 7 | 0.1 |

### 5.18.4 Reference sensitivity exceptions

No additional exceptions required compared to fallbacks.

## 5.19 DC\_1-8\_n20

### 5.19.1 Configurations for DC

Table 5.19.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-8A\_n20A | DC\_1A\_n20A  DC\_8A\_n20A |

### 5.19.2 Co-existence studies

Table 5.19.2-1 lists the Band 1A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.19.2-1: Band 1 and Band n20 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 1920 | 1980 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 3840 – 3960 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 5760 – 5940 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1058 – 1148 | | | 2752 – 2842 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 2978 – 3128 | | | 196 – 316 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 4672 – 4822 | | | 3584 – 3704 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 1900 – 2000 | | | 812 – 882 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4898 – 5108 | | | 516 – 666 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 2116 – 2296 | | | 5504 – 5684 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 6592 – 6802 | | | 4416 – 4566 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1348 – 1528 | | | 6818 – 7088 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1254 – 1464 | | | 4036 – 4276 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5248 – 5428 | | | 8512 – 8782 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6336 – 6546 | | | 7424 – 7664 | | |

Based on Table 5.19.2-1,

- 2nd order harmonics may fall into Rx frequencies of bands 46 and 47.

- 3rd order harmonics may fall into Rx frequencies of bands 38, 41, 69, 77 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 22, 42, 43, 48, 49, 77, 78 and 79.

- 4th order IMD may fall into Rx frequencies of bands 1, 4, 10, 23, 46, 65, 66, 71 and 79.

- 5th order IMD may fall into Rx frequencies of bands 11, 21, 24, 32, 45, 46, 50, 51, 74, 75, 76, 77, 91, 92, 93 and 94.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.19.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.19.2-2: 2UL Band 1 + Band n20 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD5 |
| 5470 | - | 5725 | Yes | IMD4 |
| 5150 | - | 5825 | Yes | Asia | 2nd harmonic, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_1\_n20.

Table 5.19.2-3 lists the Band 8A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.19.2-3: Band 8 and Band n20 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 880 | 915 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1760 – 1830 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2640 – 2745 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 18 – 83 | | | 1712 – 1777 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 898 – 998 | | | 749 – 844 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 2592 – 2692 | | | 2544 – 2639 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 860 – 935 | | | 822 – 872 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 1778 – 1913 | | | 1581 – 1706 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 36 – 166 | | | 3424 – 3554 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 3472 – 3607 | | | 3376 – 3501 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 2413 – 2568 | | | 2658 – 2828 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 666 – 826 | | | 916 – 1081 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 4208 – 4363 | | | 4352 – 4522 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 4256 – 4416 | | | 4304 – 4469 | | |

Based on Table 5.19.2-3,

- 2nd order harmonics may fall into Rx frequencies of bands 7, 41 and 90.

- 3rd order harmonics may fall into Rx frequencies of bands 3, 38, 41, 69 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 7, 8, 13, 14, 20, 28, 38, 38, 41, 44, 67, 68, 69 and 90.

- 4th order IMD may fall into Rx frequencies of bands 3, 9, 22, 33, 35, 37, 39, 42, 43, 48, 49, 52, 77 and 78.

- 5th order IMD may fall into Rx frequencies of bands 7, 8, 12, 13, 14, 17, 20, 28, 29, 41, 44, 53, 67, 68, 79, 85 and 90.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.19.2-4 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.19.2-4: 2UL Band 8 + Band n20 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD4 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD4 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD4 |
| GPS | 1563 | - | 1587 | Yes |  | IMD4 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD5 |
| 2400 | - | 2494 | Yes | Asia | IMD5 |
| ISM band  (5GHz) | 5150 | - | 5925 | No | US |  |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | No | Asia |  |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_8\_n20.

### 5.19.3 ∆TIB and ∆RIB values

Table 5.19.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_1-8\_n20 | 1 | 0.3 |
| 8 | 0.4 |
| n20 | 0.4 |

### 5.19.4 Reference sensitivity exceptions

No additional exceptions required compared to fallbacks.

## 5.20 DC\_3-20\_n3

### 5.20.1 Configurations for DC

Table 5.20.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_3A-20A\_n3A | DC\_3A\_n3A2  DC\_20A\_n3A |
| NOTE 2: Only single switched UL is supported | |

### 5.20.2 Co-existence studies

Table 5.20.2-1 lists the Band 20A + Band n3A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.20.2-1: Band 20 and Band n3 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 832 | 862 | | 1710 | 1785 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1664 – 1724 | | | 3420 – 3570 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2496 – 2586 | | | 5130 – 5355 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 848 – 953 | | | 2542 – 2647 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 14 – 121 | | | 2558 – 2738 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 3374 – 3509 | | | 4252 – 4432 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 802 – 892 | | | 1690 – 1805 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 711 – 876 | | | 4268 – 4523 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 1696 – 1906 | | | 5084 – 5294 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 4206 – 4371 | | | 5962 – 6217 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5978 – 6308 | | | 1543 – 1738 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 3406 – 3691 | | | 834 – 1074 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 7672 – 8002 | | | 5038 – 5233 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6794 – 7079 | | | 5916 – 6156 | | |

Based on Table 5.20.2-1,

- 2nd order harmonics may fall into Rx frequencies of band 46.

- 3rd order harmonics may fall into Rx frequencies of bands 22, 38, 41, 42, 48, 49, 69, 77, 78 and 90.

- 2nd order IMD may fall into Rx frequencies of bands 5, 6, 7, 8, 18, 19, 26, 27, 38, 41, 69 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 7, 38, 41, 42, 52, 69, 77, 78, 79 and 90.

- 4th order IMD may fall into Rx frequencies of bands 3, 5, 6, 9, 12, 13, 14, 17, 18, 19, 20, 26, 27, 28, 29, 33, 35, 39, 44, 46, 67, 68, 79 and 85.

- 5th order IMD may fall into Rx frequencies of bands 5, 6, 8, 18, 19, 22, 24, 26, 27, 42, 43, 46, 47, 48, 49, 77 and 78.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.20.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.20.2-2: 2UL Band 20 + Band n3 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD5 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD5 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD5 |
| GPS | 1563 | - | 1587 | Yes |  | IMD5 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd Harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | 2nd Harmonic, IMD4, IMD5 |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | Yes | Asia | 2nd Harmonic, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_20\_n3.

### 5.20.3 ∆TIB and ∆RIB values

Table 5.20.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_3-20\_n3 | 3 | 0.3 |
| 20 | 0.3 |
| n3 | 0.3 |

### 5.20.4 Reference sensitivity exceptions

Table 5.204-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-20A\_n3A | 3 | 1775 | 5 | 25 | 1870 | 4 | IMD4 |
| 20 | 835 | 5 | 25 | 794 | N/A | N/A |
| n3 | 1765 | 5 | 25 | 1860 | N/A | N/A |

## 5.21 DC\_3-32\_n7

### 5.21.1 Configurations for DC

Table 5.21.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_3A-32A\_n7A | DC\_3A\_n7A |

### 5.21.2 Co-existence studies

Table 5.21.2-1 lists the Band 3A + Band n7A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.21.2-1: Band 3 and Band n7 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 1710 | 1785 | | 2500 | 2570 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 3420 – 3570 | | | 5000 – 5140 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 5130 – 5355 | | | 7500 – 7710 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 715 – 860 | | | 4210 – 4355 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 850 – 1070 | | | 3215 – 3430 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 5920 – 6140 | | | 6710 – 6925 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 1660 – 1835 | | | 2480 – 2590 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 2560 – 2855 | | | 5715 – 6000 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 1430 – 1720 | | | 8420 – 8710 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 7630 – 7925 | | | 9210 – 9495 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 8215 – 8570 | | | 4270 – 4640 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 3930 – 4290 | | | 10 – 355 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 11710 – 12065 | | | 9340 – 9710 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 10920 – 11280 | | | 10130 – 10495 | | |

Based on Table 5.21.2-1,

- 2nd order harmonics may fall into Rx frequencies of band 46.

- 3rd order harmonics may fall into Rx frequencies of bands 22, 42, 48, 49, 77 and 78.

- 2nd order IMD may fall into Rx frequencies of bands 12, 13, 14, 17, 20, 26, 27, 28, 29, 44, 67, 68 and 85.

- 3rd order IMD may fall into Rx frequencies of bands 5, 6, 8, 18, 19, 26, 27, 42, 46, 47, 52, 77 and 78.

- 4th order IMD may fall into Rx frequencies of bands 7, 11, 21, 24, 32, 38, 41, 45, 46, 47, 50, 51, 69, 74, 75, 76, 90, 91, 92, 93 and 94.

- 5th order IMD may fall into Rx frequencies of bands 77 and 79.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.21.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.21.2-2: 2UL Band 3 + Band n7 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD4 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD4 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD4 |
| GPS | 1563 | - | 1587 | Yes |  | IMD4 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd harmonic, IMD3, IMD4 |
| 5150 | - | 5350 | Yes | Europe | 2nd harmonic |
| 5470 | - | 5725 | Yes | IMD4 |
| 5150 | - | 5825 | Yes | Asia | 2nd harmonic, IMD4 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_3\_n7.

### 5.21.3 ∆TIB and ∆RIB values

Table 5.21.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_3-32\_n7 | 3 | 0.7 |
| n7 | 0.7 |

### 5.21.4 Reference sensitivity exceptions

Table 5.21.4-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-32A\_n7A | 3 | 1775 | 5 | 25 | 1870 | N/A | N/A |
| 32 | N/A | N/A | N/A | 1470 | 10.5 | IMD4 |
| n7 | 2510 | 10 | 50 | 2630 | N/A | N/A |

## 5.22 DC\_8-28\_n3

### 5.22.1 Configurations for DC

Table 5.22.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_8A-28A\_n3A | DC\_8A\_n3A  DC\_28A\_n3A |

### 5.22.2 Co-existence studies

Table 5.22.2-1 lists the Band 8A + Band n3A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.22.2-1: Band 8 and Band n3 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 880 | 915 | | 1710 | 1785 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1760 – 1830 | | | 3420 – 3570 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2640 – 2745 | | | 5130 – 5355 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 795 – 905 | | | 2590 – 2700 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 25 – 120 | | | 2505 – 2690 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 3470 – 3615 | | | 4300 – 4485 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 850 – 945 | | | 1700 – 1795 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 855 – 1035 | | | 4215 – 4475 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 1590 – 1810 | | | 5180 – 5400 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 4350 – 4530 | | | 6010 – 6270 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5925 – 6260 | | | 1735 – 1950 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 3300 – 3595 | | | 675 – 930 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 7720 – 8055 | | | 5230 – 5445 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6890 – 7185 | | | 6060 – 6315 | | |

Based on Table 5.22.2-1,

- 2nd order harmonics may fall into Rx frequencies of bands 3 and 46.

- 3rd order harmonics may fall into Rx frequencies of bands 7, 22, 41, 42, 48, 49, 77, 78 and 90.

- 2nd order IMD may fall into Rx frequencies of bands 5, 6, 7, 18, 19, 20, 26, 27, 28, 38, 41, 44, 69 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 7, 22, 38, 41, 42, 43, 48, 49, 69, 77, 78, 79 and 90.

- 4th order IMD may fall into Rx frequencies of bands 3, 5, 6, 8, 18, 19, 26, 27, 46 and 79.

- 5th order IMD may fall into Rx frequencies of bands 2, 3, 5, 6, 8, 9, 12, 13, 14, 17, 18, 19, 20, 22, 25, 26, 27, 28, 29, 33, 35, 36, 37, 39, 42, 44, 46, 48, 49, 52, 67, 68, 77, 78 and 85.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.22.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.22.2-2: 2UL Band 8 + Band n3 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD4 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD4 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD4 |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | 2nd harmonic, IMD4, IMD5 |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | Yes | Asia | 2nd harmonic, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_8\_n3.

Table 5.22.2-3 lists the Band 28A + Band n3A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.22.2-3: Band 28 and Band n3 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 703 | 748 | | 1710 | 1785 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1406 – 1496 | | | 3420 – 3570 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2109 – 2244 | | | 5130 – 5355 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 962 – 1082 | | | 2413 – 2533 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 214 – 379 | | | 2672 – 2867 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 3116 – 3281 | | | 4123 – 4318 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 673 – 778 | | | 1690 – 1805 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 324 – 534 | | | 4382 – 4652 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 1924 – 2164 | | | 4826 – 5066 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 3819 – 4029 | | | 5833 – 6103 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6092 – 6437 | | | 1027 – 1282 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 3634 – 3949 | | | 1176 – 1461 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 7543 – 7888 | | | 4522 – 4777 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6536 – 6851 | | | 5529 – 5814 | | |

Based on Table 5.22.2-3,

- 2nd order harmonics may fall into Rx frequencies of bands 11, 21, 32, 45, 46, 50, 51, 74, 75, 76, 91, 92, 93 and 94.

- 3rd order harmonics may fall into Rx frequencies of bands 1, 4, 10, 22, 23, 42, 48, 49, 65, 66, 77 and 78.

- 2nd order IMD may fall into Rx frequencies of bands 41, 53 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 7, 41, 77 and 90.

- 4th order IMD may fall into Rx frequencies of bands 1, 2, 4, 10, 25, 31, 34, 36, 37, 46, 47, 65, 66, 70, 72, 73, 77, 79, 87 and 88.

- 5th order IMD may fall into Rx frequencies of bands 32, 43, 45, 46, 48, 49, 50, 51, 75, 76, 77, 78, 79, 91, 92, 93 and 94.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.22.2-4 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.22.2-4: 2UL Band 28 + Band n3 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD2 |
| 2400 | - | 2494 | Yes | Asia | IMD2 |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | 2nd harmonic |
| 5470 | - | 5725 | Yes | IMD5 |
| 5150 | - | 5825 | Yes | Asia | 2nd harmonic, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_28\_n3.

### 5.22.3 ∆TIB and ∆RIB values

Table 5.22.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_8-28\_n3 | 8 | 0.6 |
| 28 | 0.5 |
| n3 | 0.3 |

**Table 5.22.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_8-28\_n3 | 8 | 0.2 |
| 28 | 0.1 |

### 5.22.4 Reference sensitivity exceptions

Table 5.22.4-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_8A-28A\_n3A | 8 | 912.5 | 5 | 25 | 957.5 | N/A | N/A |
| 28 | 745 | 5 | 25 | 800 | 30.4 | IMD24 |
| n3 | 1712.5 | 5 | 25 | 1807.5 | N/A | N/A |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

## 5.23 DC\_20-32\_n7

### 5.23.1 Configurations for DC

Table 5.23.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_20A-32A\_n7A | DC\_20A\_n7A |

### 5.23.2 Co-existence studies

Table 5.23.2-1 lists the Band 20A + Band n7A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.23.2-1: Band 20 and Band n7 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 832 | 862 | | 2500 | 2570 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1664 – 1724 | | | 5000 – 5140 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2496 – 2586 | | | 7500 – 7710 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1638 – 1738 | | | 3332 – 3432 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 776 – 906 | | | 4138 – 4308 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 4164 – 4294 | | | 5832 – 6002 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 782 – 912 | | | 2480 – 2590 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 74 – 86 | | | 6638 – 6878 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 3276 – 3476 | | | 6664 – 6864 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 4996 – 5156 | | | 8332 – 8572 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 9138 – 9448 | | | 758 – 948 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 5776 – 6046 | | | 2414 – 2644 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 10832 – 11142 | | | 5828 – 6018 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 9164 – 9434 | | | 7496 – 7726 | | |

Based on Table 5.23.2-1,

- 3rd order harmonics may fall into Rx frequencies of bands 38, 41, 69 and 90.

- 2nd order IMD may fall into Rx frequencies of bands 42, 52, 77 and 78.

- 3rd order IMD may fall into Rx frequencies of bands 5, 6, 18, 19, 20, 26, 27, 28, 44, 46, 47, 68 and 77.

- 4th order IMD may fall into Rx frequencies of bands 42, 46, 52, 77, 78 and 79.

- 5th order IMD may fall into Rx frequencies of bands 5, 6, 7, 8, 14, 18, 19, 20, 26, 27, 28, 38, 41, 44, 46, 47, 53, 68, 69 and 90.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.23.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.23.2-2: 2UL Band 20 + Band n7 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD5 |
| 2400 | - | 2494 | Yes | Asia | IMD5 |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | IMD3, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD4, IMD5 |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | Yes | Asia | IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_20\_n7.

### 5.23.3 ∆TIB and ∆RIB values

Table 5.23.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_20-32\_n7 | 20 | 0.3 |
| n7 | 0.7 |

### 5.23.4 Reference sensitivity exceptions

No addition exceptions required compared to fallbacks.

## 5.24 DC\_7-8\_n7

### 5.24.1 Configurations for DC

Table 5.24.1-1: Inter-band DC configurations (three bands)

| DC  Configuration | Uplink configuration |
| --- | --- |
| DC\_7A-8A\_n7A | DC\_7A\_n7A  DC\_8A\_n7A |

### 5.24.2 Co-existence studies

For UL configuration of DC\_7A\_n7A, only single UL is required. Thus no IMD issue needs to be evaluated. Besides, there is no harmonic issue from DC\_7A\_n7A to Band 8 DL reception.

For UE coexistence study of Band 8 + Band n7, the 2nd, 3rd and 4th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.24.2-1.

**Table 5.24.2-1: Harmonic and IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 880 | 915 | 2500 | 2570 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1760 | 1830 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2640 | 2745 | 7500 | 7710 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3520 | 3660 | 10000 | 10280 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1585 | 1690 | 3380 | 3485 |
| Two-tone 3rd order IMD products | |2\*fx\_high – fy\_low| | |2\*fx\_low – fy\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 670 | 810 | 4085 | 4260 |
| 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) | 4260 | 4400 | 5880 | 6055 |
| 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) | 70 | 245 | 6585 | 6830 |
| 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) | 5140 | 5315 | 8380 | 8625 |
| Two-tone 4th order IMD products | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low - 2\* fy\_high| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3170 | 3310 | 6760 | 6970 |
| Two-tone 5th order IMD products | |fx\_high – 4\*fy\_low| | |fx\_low – 4\*fy\_high| | |fy\_high – 4\*fx\_low| | |fy\_low – 4\*fx\_high| |
| IMD frequency limits (MHz) | 9085 | 9400 | 950 | 1160 |
| Two-tone 5th order IMD products | |2\*fx\_high - 3\*fy\_low| | |2\*fx\_low - 3\*fy\_high| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 5670 | 5950 | 2255 | 2500 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 10880 | 11195 | 6020 | 6230 |
| 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) | 9260 | 9540 | 7640 | 7885 |

As we can see from the above table, there could be MSD due to IMD:

- The 5th order IMD generated by Band 8 and Band n7 may fall into DL reception frequency of Band 8.

But when we consider the implementation of Band 8 duplexer, we can find that such 5th order IMD will not impact the DL reception of Band 8.

The 3rd order harmonic generated by Band 8 will fall into DL reception frequency of Band n7.

### 5.24.3 ∆TIB and ∆RIB values

For DC\_7-8\_n7, the ΔTIB,c and ΔRIB,c values are given in the following tables.

Table 5.24.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_7-8\_n7 | 7 | 0.3 |
| 8 | 0.6 |

**Table 5.24.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_7-8\_n7 | 8 | 0.2 |

### 5.24.4 Reference sensitivity exceptions

Compared to its fallback modes, no additional MSD requirements for this band combination are needed.

## 5.25 DC\_3-5\_n40

5.25.1 Configurations for DC

Table 5.25.1-1: Inter-band DC configurations (three bands)

| DC  Configuration | Uplink DC  configuration |
| --- | --- |
| DC\_3A-5A\_n40A | DC\_3A\_n40A DC\_5A\_n40A |

### 5.25.2 Co-existence studies

For UE coexistence study of Band 3 + Band n40, the 2nd, 3rd, 4th, and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.25.2-1

**Table 5.25.2-1: Harmonic and IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Fx low | Fx high | Fy low | Fy high |
| UL Frequency [MHz] | 1710 | 1785 | 2300 | 2400 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3570 | 4600 | 4800 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 | 6900 | 7200 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 6840 | 7140 | 9200 | 9600 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 8550 | 8925 | 11500 | 12000 |
| 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) | 515 | 690 | 4010 | 4185 |
| 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) | 102 | 1270 | 2815 | 3090 |
| 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) | 5720 | 5970 | 6310 | 6585 |
| 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) | 2730 | 3055 | 5115 | 5490 |
| 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) | 1380 | 1030 | 8020 | 8370 |
| 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) | 7430 | 7755 | 8610 | 8985 |
| 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) | 7890 | 7415 | 4840 | 4440 |
| 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) | 3780 | 3330 | 755 | 330 |
| 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) | 10910 | 11385 | 9140 | 9540 |
| 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) | 10320 | 10770 | 9730 | 10155 |

For UE coexistence study of Band 5 + Band n40, the 2nd, 3rd, 4th, and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.25.2-2

**Table 5.25.2-2: Harmonic and IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Fx low | Fx high | Fy low | Fy high |
| UL Frequency [MHz] | 824 | 849 | 2300 | 2400 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 4600 | 4800 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 6900 | 7200 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 9200 | 9600 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 11500 | 12000 |
| 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) | 1451 | 1576 | 3124 | 3249 |
| 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) | 752 | 602 | 3751 | 3976 |
| 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) | 3948 | 4098 | 5424 | 5649 |
| 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) | 72 | 247 | 6051 | 6376 |
| 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) | 3152 | 2902 | 6248 | 6498 |
| 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) | 4772 | 4947 | 7724 | 8049 |
| 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) | 8776 | 8351 | 1096 | 896 |
| 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) | 5552 | 5202 | 2053 | 2328 |
| 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) | 10024 | 10449 | 5596 | 5796 |
| 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) | 8548 | 8898 | 7072 | 7347 |

The Rx impacts can be identified as below.

* No IMD products generated by DC\_3\_n40 uplink fall into own Rx of band 5.
* No IMD products generated by DC\_5\_n40 uplink fall into own Rx of band 3.

5.25.3 ∆TIB and ∆RIB values

For DC\_3-5\_n40, the ΔTIB,c and ΔRIB,c values are reused from DC\_3-8\_n40 which is similar

Table 5.25.3-1: ΔTIB,c

| Inter-band DC configuration | E-UTRA or NR Band | ΔTIB,c (dB) |
| --- | --- | --- |
| DC\_3-5\_n40 | 3 | 0.5 |
| 5 | 0.3 |
| n40 | 0.5 |

Table 5.25.3-2: ΔRIB

| Inter-band DC configuration | E-UTRA or NR Band | ΔRIB,c (dB) |
| --- | --- | --- |
| DC\_3-5\_n40 | 3 | 0 |
| 5 | 0 |
| n40 | 0 |

5.25.4 Reference sensitivity exceptions

No additional MSD requirements need to be defined.

5.26 DC\_1-28\_n38

### 5.26.1 Configuration for DC

Table 5.26.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_1A-28A\_n38A | DC\_1A\_n38A  DC\_28A\_n38A | CA\_1A-28A | n38A |

### 5.26.2 Co-existence studies

There are IMD5 impact from UL 1\_n38 affecting DL band 28.

There are no IMD impact from UL 28\_n38 affecting DL band 1.

5.26.3 ∆TIB and ∆RIB values

For DC\_1-28\_n38, the ΔTIB,c and ΔRIB,c values are reused from DC\_1-28\_n7 and are given in the tables below.

**Table 5.1.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_1-28\_n38 | 0.5 | 0.6 | 0.6 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.1.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_1-28\_n38 | - | 0.2 | - |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.26.4 REFSENS requirements

MSD values are reused from DC\_1A-28A\_n7A.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_1A-28A\_n38A | 1 | 1975 | 5 | 25 | 2165 | N/A | N/A |
|  | 28 | 710 | 5 | 25 | 765 | 4.5 | IMD5 |
|  | n38 | 2580 | 5 | 25 | 2580 | N/A | N/A |

5.27 DC\_3-28\_n38

### 5.27.1 Configuration for DC

Table 5.27.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_3A-28A\_n38A | DC\_3A\_n38A  DC\_28A\_n38A | CA\_3A-28A | n38A |

### 5.27.2 Co-existence studies

There are IMD2 and IMD3 impact from UL 3\_n38 affecting DL band 28.

There are IMD2 impact from UL 28\_n38 affecting DL band 3.

5.27.3 ∆TIB and ∆RIB values

For DC\_3-28\_n38, the ΔTIB,c and ΔRIB,c values are reused from DC\_3-28\_n7 and are given in the tables below.

**Table 5.1.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_3-28\_n38 | 0.5 | 0.3 | 0.5 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.1.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_3-28\_n38 | - | - | - |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.27.4 REFSENS requirements

MSD values are reused from DC\_3A-28A\_n7A.

Table 7.3B.2.3.5.2-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-28A\_n38A | 3 | 1775 | 5 | 25 | 1870 | 26.0 | IMD2 |
|  | 28 | 710 | 5 | 25 | 765 | N/A | N/A |
|  | n38 | 2580 | 5 | 25 | 2580 | N/A | N/A |
|  | 3 | 1780 | 5 | 25 | 1875 | N/A | N/A |
|  | 28 | 745 | 5 | 25 | 800 | 20.0 | IMD21 |
|  | n38 | 2580 | 5 | 25 | 2580 | N/A | N/A |
| NOTE 1: This band is subject to IMD3 also which MSD is not specified. | | | | | | | |

## 5.28 DC\_20-28\_n78

### 5.28.1 Configurations for DC

Table 5.28.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_20A-28A\_n78A | DC\_20A\_n78A  DC\_28A\_n78A |

### 5.28.2 Co-existence studies

Table 5.28.2-1 lists the Band 20A + Band n78A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.28.2-1: Band 20 and Band n78 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 832 | 862 | | 3300 | 3800 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1664 – 1724 | | | 6600 – 7600 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2496 – 2586 | | | 9900 – 11400 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 2438 – 2968 | | | 4132 – 4662 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 1576 – 2136 | | | 5738 – 6768 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 4964 – 5524 | | | 7432 – 8462 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 732 – 962 | | | 3280 – 3820 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 714 – 1304 | | | 9038 – 10568 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 4876 – 5936 | | | 8264 – 9324 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 5796 – 6386 | | | 10732 – 12262 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 12338 – 14368 | | | 148 – 472 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 8176 – 9736 | | | 4014 – 5104 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 14032 – 16062 | | | 6628 – 7248 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 11564 – 13124 | | | 9096 – 10186 | | |

Based on Table 5.28.2-1,

- 2nd order harmonics may fall into Rx frequencies of bands 38, 41, 69 and 90.

- 2nd order IMD may fall into Rx frequencies of bands 7, 38, 41, 53, 69, 77, 79 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 1, 2, 3, 4, 9, 10, 25, 33, 34, 35, 36, 37, 39, 46, 47, 65, 66, 70 and 79.

- 4th order IMD may fall into Rx frequencies of bands 5, 6, 8, 12, 13, 14, 17, 18, 19, 20, 26, 27, 28, 29, 44, 46, 47, 67, 68, 79 and 85.

- 5th order IMD may fall into Rx frequencies of bands 31, 72, 73, 77, 79, 87 and 88.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.28.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.28.2-2: 2UL Band 20 + Band n78 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD3 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD3 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD3 |
| GPS | 1563 | - | 1587 | Yes |  | IMD3 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD2 |
| 2400 | - | 2494 | Yes | Asia | IMD2 |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | IMD3, IMD4 |
| 5150 | - | 5350 | Yes | Europe | IMD3, IMD4 |
| 5470 | - | 5725 | Yes | IMD3, IMD4 |
| 5150 | - | 5825 | Yes | Asia | IMD3, IMD4 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_20\_n78.

Table 5.28.2-3 lists the Band 28A + Band n78A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.28.2-3: Band 28 and Band n78 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 703 | 748 | | 3300 | 3800 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1406 – 1496 | | | 6600 – 7600 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2109 – 2244 | | | 9900 – 11400 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 2552 – 3097 | | | 4003 – 4548 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 1804 – 2394 | | | 5852 – 6897 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 4706 – 5296 | | | 7303 – 8348 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 603 – 848 | | | 3280 – 3820 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 1056 – 1691 | | | 9152 – 10697 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 5104 – 6194 | | | 8006 – 9096 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 5409 – 6044 | | | 10603 – 12148 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 12452 – 14497 | | | 308 – 988 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 8404 – 9994 | | | 4356 – 5491 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 13903 – 15948 | | | 6112 – 6792 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 11306 – 12896 | | | 8709 – 9844 | | |

Based on Table 5.28.2-3,

- 2nd order harmonics may fall into Rx frequencies of bands 1, 4, 10, 23, 65 and 66.

- 3rd order harmonics may fall into Rx frequencies of bands 11, 21, 32, 45, 50, 51, 74, 75, 76, 91, 92, 93 and 94.

- 2nd order IMD may fall into Rx frequencies of bands 7, 38, 41, 69, 77, 79 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 1, 2, 3, 4, 9, 10, 23, 25, 30, 33, 34, 35, 36, 37, 39, 40, 46, 47, 65, 66, 70 and 79.

- 4th order IMD may fall into Rx frequencies of bands 11, 21, 24, 32, 45, 46, 46, 47, 47, 50, 51, 74, 75, 76, 91, 92, 93 and 94.

- 5th order IMD may fall into Rx frequencies of bands 5, 6, 8, 12, 13, 14, 17, 18, 19, 20, 26, 27, 28, 29, 31, 44, 46, 67, 68, 71, 72, 73, 79, 85, 87 and 88.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.28.2-4 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.28.2-4: 2UL Band 28 + Band n78 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD4 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD4 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD4 |
| GPS | 1563 | - | 1587 | Yes |  | IMD4 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | IMD3, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD3, IMD4, IMD5 |
| 5470 | - | 5725 | Yes | IMD4, IMD5 |
| 5150 | - | 5825 | Yes | Asia | IMD3, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_28\_n78.

### 5.28.3 ∆TIB and ∆RIB values

Table 5.28.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_20-28\_n78 | 20 | 0.6 |
| 28 | 0.5 |
| n78 | 0.8 |

**Table 5.28.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_20-28\_n78 | 28 | 0.2 |
| n78 | 0.5 |

### 5.28.4 Reference sensitivity exceptions

Table 5.284-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_20A-28A\_n78A | 20 | 837 | 5 | 25 | 796 | N/A | N/A |
| 28 | 744 | 5 | 25 | 799 | 9.4 | IMD4 |
| n78 | 3310 | 10 | 50 | 3310 | N/A | N/A |
| 20 | 849 | 5 | 25 | 808 | 3.8 | IMD5 |
| 28 | 705.5 | 5 | 25 | 760.5 | N/A | N/A |
| n78 | 3630 | 10 | 50 | 3630 | N/A | N/A |

## 5.29 DC\_1-28\_n20

### 5.29.1 Configurations for DC

Table 5.29.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-28A\_n20A22 | DC\_1A\_n20A  DC\_28A\_n20A22 |
| NOTE 22: The frequency range in band 28 is restricted for this band combination to 703 - 733 MHz for the UL and 758 - 788 MHz for the DL. | |

### 5.29.2 Co-existence studies

Table 5.29.2-1 lists the Band 1A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.29.2-1: Band 1 and Band n20 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 1920 | 1980 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 3840 – 3960 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 5760 – 5940 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1058 – 1148 | | | 2752 – 2842 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 2978 – 3128 | | | 196 – 316 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 4672 – 4822 | | | 3584 – 3704 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 1900 – 2000 | | | 812 – 882 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 4898 – 5108 | | | 516 – 666 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 2116 – 2296 | | | 5504 – 5684 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 6592 – 6802 | | | 4416 – 4566 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 1348 – 1528 | | | 6818 – 7088 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1254 – 1464 | | | 4036 – 4276 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5248 – 5428 | | | 8512 – 8782 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 6336 – 6546 | | | 7424 – 7664 | | |

Based on Table 5.29.2-1,

- 2nd order harmonics may fall into Rx frequencies of bands 46 and 47.

- 3rd order harmonics may fall into Rx frequencies of bands 38, 41, 69, 77 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 22, 42, 43, 48, 49, 77, 78 and 79.

- 4th order IMD may fall into Rx frequencies of bands 1, 4, 10, 23, 46, 65, 66, 71 and 79.

- 5th order IMD may fall into Rx frequencies of bands 11, 21, 24, 32, 45, 46, 50, 51, 74, 75, 76, 77, 91, 92, 93 and 94.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.29.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.29.2-2: 2UL Band 1 + Band n20 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD5 |
| 5470 | - | 5725 | Yes | IMD4 |
| 5150 | - | 5825 | Yes | Asia | 2nd harmonic, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_1\_n20.

Table 5.29.2-3 lists the Band 28A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

Table 5.29.2-3: Band 28 and Band n20 UL harmonics and IMD products

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 703 | 733 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1406 – 1466 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2109 – 2199 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 99 – 159 | | | 1535 – 1595 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 544 – 634 | | | 931 – 1021 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 2238 – 2328 | | | 2367 – 2457 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 683 – 753 | | | 812 – 882 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 1247 – 1367 | | | 1763 – 1883 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 198 – 318 | | | 3070 – 3190 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2941 – 3061 | | | 3199 – 3319 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 2595 – 2745 | | | 1950 – 2100 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1030 – 1180 | | | 385 – 535 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 4031 – 4181 | | | 3644 – 3794 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 3902 – 4052 | | | 3773 – 3923 | | |

Based on Table 5.29.2-3,

- 2nd order harmonics may fall into Rx frequencies of bands 32, 38, 41, 45, 50, 51, 69, 75, 76, 90, 91, 92, 93 and 94.

- 3rd order harmonics may fall into Rx frequencies of bands 1, 4, 10, 23, 65 and 66.

- 2nd order IMD may fall into Rx frequencies of band 24.

- 3rd order IMD may fall into Rx frequencies of bands 8, 40 and 71.

- 4th order IMD may fall into Rx frequencies of bands 3, 9, 35, 39, 52, 77 and 78.

- 5th order IMD may fall into Rx frequencies of bands 2, 7, 25, 31, 34, 36, 38, 41, 43, 48, 49, 69, 70, 72, 73, 77, 78, 87, 88 and 90.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.29.2-4 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

Table 5.29.2-4: 2UL Band 28 + Band n20 harmonic and IMD for ISM and GNSS bands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD2 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD2 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD2 |
| GPS | 1563 | - | 1587 | Yes |  | IMD2 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD3 |
| 2400 | - | 2494 | Yes | Asia | IMD3 |
| ISM band  (5GHz) | 5150 | - | 5925 | No | US |  |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | No | Asia |  |

The requirements for spurious emission band UE coexistence that exist in 38.101-3 for DC\_20\_n28 can be reused.

### 5.29.3 ∆TIB and ∆RIB values

Table 5.29.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_1-28\_n20 | 1 | 0.3 |
| 28 | 0.6 |
| n20 | 0.6 |

**Table 5.29.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_1-28\_n20 | 28 | 0.2 |
| n20 | 0.2 |

5.29.4 Reference sensitivity exceptionsNo additional sensitivity exceptions required compared to fallbacks.

## 5.30 DC\_1-5\_n40

5.30.1 Configurations for DC

**Table 5.30.1-1: Inter-band DC configurations (three bands)**

| **DC**  **Configuration** | **Uplink DC**  **configuration** |
| --- | --- |
| DC\_1A-5A\_n40A | DC\_1A\_n40A DC\_5A\_n40A |

5.30.2 Co-existence studies

For UE coexistence study of Band 1 + Band n40, the 2nd, 3rd, 4th, and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.30.2-1

**Table 5.30.2-1: Harmonic and IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Fx low | Fx high | Fy low | Fy high |
| UL Frequency [MHz] | 1920 | 1980 | 2300 | 2400 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | 4600 | 4800 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 6900 | 7200 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 7680 | 7920 | 9200 | 9600 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 9600 | 9900 | 11500 | 12000 |
| 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) | 320 | 480 | 4220 | 4380 |
| Two tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 1440 | 1660 | 2620 | 2880 |
| Two tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 6140 | 6360 | 6520 | 6780 |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 3360 | 3640 | 4920 | 5280 |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |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 UE coexistence study of Band 5 + Band n40, the 2nd, 3rd, 4th, and 5th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.30.2-2

**Table 5.216.2-2: Harmonic and IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Fx low | Fx high | Fy low | Fy high |
| UL Frequency [MHz] | 824 | 849 | 2300 | 2400 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 4600 | 4800 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 6900 | 7200 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 9200 | 9600 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 11500 | 12000 |
| 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) | 1451 | 1576 | 3124 | 3249 |
| 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) | 752 | 602 | 3751 | 3976 |
| 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) | 3948 | 4098 | 5424 | 5649 |
| 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) | 72 | 247 | 6051 | 6376 |
| 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) | 3152 | 2902 | 6248 | 6498 |
| 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) | 4772 | 4947 | 7724 | 8049 |
| 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) | 8776 | 8351 | 1096 | 896 |
| 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) | 5552 | 5202 | 2053 | 2328 |
| 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) | 10024 | 10449 | 5596 | 5796 |
| 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) | 8548 | 8898 | 7072 | 7347 |

The Rx impacts can be identified as below.

* Co-existence analysis for DC\_1\_n40 UL shows that 4th IMD may fall in DL band 5.
* Co-existence analysis for DC\_5\_n40 UL shows that 5th IMD may fall in DL band 1.

5.30.3 ∆TIB and ∆RIB values

For DC\_1-5\_n40, the ΔTIB,c and ΔRIB,c values are reused from DC\_1-28\_n40 which is very similar

**Table 5.30.3-1: ΔTIB,c**

| **Inter-band DC configuration** | **E-UTRA or NR Band** | **ΔTIB,c (dB)** |
| --- | --- | --- |
| DC\_1-5\_n40 | 1 | 0.6 |
| 5 | 0.3 |
| n40 | 0.5 |

**Table 5.30.3-2: ΔRIB**

| **Inter-band DC configuration** | **E-UTRA or NR Band** | **ΔRIB,c (dB)** |
| --- | --- | --- |
| DC\_1-5\_n40 | 1 | 0 |
| 5 | 0.2 |
| n40 | 0 |

5.30.4 Reference sensitivity exceptions

The MSD requirement due to 5th order IMD for DC\_5-66\_n30 can be reused for DC\_1-5\_n40.

The MSD requirement due to 4th order IMD for DC\_1-8\_n40 can be reused for DC\_1-5\_n40.

**Table 6.x.5-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC**  **Configuration** | **EUTRA or NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| DC\_1A-5A\_n40A | 1 | 1954 | 5 | 25 | 2144 | 4.0 | IMD5 |
| 5 | 832 | 5 | 25 | 877 | N/A | N/A |
| n40 | 2320 | 5 | 25 | 2320 | N/A | N/A |
| 1 | 1945 | 5 | 25 | 2135 | N/A | N/A |
| 5 | 835 | 5 | 25 | 880 | 8.0 | IMD4 |
| n40 | 2385 | 5 | 25 | 2385 | N/A | N/A |

## 5.31 DC\_1-3\_n1

5.31.1 Configurations for DC

**Table 5.31.1-1: Inter-band DC configurations (three bands)**

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-3A\_n1A | DC\_1A\_n1A2  DC\_3A\_n1A |
| NOTE 2: Only single switched UL is supported. | |

5.31.2 Co-existence studies

Table 5.31.2-1 lists the Band 3A + Band n1A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 5.31.2-1: Band 3 and Band n1 UL harmonics and IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 1710 | 1785 | | 1920 | 1980 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 3420 – 3570 | | | 3840 – 3960 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 5130 – 5355 | | | 5760 – 5940 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 135 – 270 | | | 3630 – 3765 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 1440 – 1650 | | | 2055 – 2250 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 5340 – 5550 | | | 5550 – 5745 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 1660 – 1835 | | | 1900 – 2000 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 3150 – 3435 | | | 3975 – 4230 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 270 – 540 | | | 7260 – 7530 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 7050 – 7335 | | | 7470 – 7725 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 5895 – 6210 | | | 4860 – 5220 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 2190 – 2520 | | | 1170 – 1515 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 9390 – 9705 | | | 8760 – 9120 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 9180 – 9510 | | | 8970 – 9315 | | |

Based on Table 5.31.2-1,

- 2nd order harmonics may fall into Rx frequencies of band 22, 42, 46, 47, 48, 49, 77 and 78.

- 3rd order harmonics may fall into Rx frequencies of band 46 and 77

- 2nd order IMD may fall into Rx frequencies of bands 43, 48, 49, 77 and 78.

- 3rd order IMD may fall into Rx frequencies of bands 1, 4, 10, 11, 21, 23, 24, 32, 45, 46, 50, 65, 66, 74, 75, 92 and 94.

- 4th order IMD may fall into Rx frequencies of bands 31, 42, 52, 72, 73, 77, 78, 87 and 88

- 5th order IMD may fall into Rx frequencies of bands 11, 21, 23, 30, 32, 40, 41, 45, 46, 47, 50, 51, 53, 65, 66, 74, 75, 76, 79, 90, 91, 92, 93 and 94.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.31.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

**Table 5.31.2-2: 2UL Band 3 + Band n1 harmonic and IMD for ISM and GNSS bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD3 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD3 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD3 |
| GPS | 1563 | - | 1587 | Yes |  | IMD3 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD5 |
| 2400 | - | 2494 | Yes | Asia | IMD5 |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd harmonic, 3rd harmonic, IMD3, IMD5 |
| 5150 | - | 5350 | Yes | Europe | 3rd harmonic, IMD3, IMD5 |
| 5470 | - | 5725 | Yes | IMD3 |
| 5150 | - | 5825 | Yes | Asia | 2nd harmonic, 3rd harmonic, IMD3, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_3\_n1.

5.31.3 ∆TIB and ∆RIB values

**Table 5.31.3-1: ΔTIB,c**

| **Inter-band DC Configuration** | **E-UTRA and NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| DC\_1-3\_n1 | 1 | 0.3 |
| 3 | 0.3 |
| n1 | 0.3 |

5.31.4 Reference sensitivity exceptions

**Table 5.31.4-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)**

| **NR or E-UTRA Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **EUTRA / NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| DC\_1A-3A\_n1A | n1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
| 3 | 1750 | 5 | 25 | 1845 | N/A | N/A |
| 1 | N/A | 5 | N/A | 2150 | 23 | IMD3 |

## 5.32 DC\_1-20\_n1

5.32.1 Configurations for DC

**Table 5.32.1-1: Inter-band DC configurations (three bands)**

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-20A\_n1A | DC\_1A\_n1A2  DC\_20A\_n1A |
| NOTE 2: Only single switched UL is supported. | |

5.32.2 Co-existence studies

Table 5.32.2-1 lists the Band 20A + Band n1A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 5.32.2-1: Band 20 and Band n1 UL harmonics and IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 832 | 862 | | 1920 | 1980 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1664 – 1724 | | | 3840 – 3960 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2496 – 2586 | | | 5760 – 5940 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1058 – 1148 | | | 2752 – 2842 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 196 – 316 | | | 2978 – 3128 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 3584 – 3704 | | | 4672 – 4822 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 782 – 912 | | | 1900 – 2000 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 516 – 666 | | | 4898 – 5108 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 2116 – 2296 | | | 5504 – 5684 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 4416 – 4566 | | | 6592 – 6802 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 6818 – 7088 | | | 1348 – 1528 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 4036 – 4276 | | | 1254 – 1464 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 8512 – 8782 | | | 5248 – 5428 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 7424 – 7664 | | | 6336 – 6546 | | |

Based on Table 5.32.2-1,

- 2nd order harmonics may fall into Rx frequencies of band 46 and 47.

- 3rd order harmonics may fall into Rx frequencies of bands 38, 41, 69, 77 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 22, 42, 43, 48, 49, 77, 78 and 79.

- 4th order IMD may fall into Rx frequencies of bands 1, 4, 10, 23, 46, 65, 66, 71 and 79.

- 5th order IMD may fall into Rx frequencies of bands 11, 21, 24, 32, 45, 46, 50, 51, 74, 75, 76, 77, 91, 92, 93 and 94.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.32.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

**Table 5.32.2-2: 2UL Band 20 + Band n1 harmonic and IMD for ISM and GNSS bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | 2nd Harmonic, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD5 |
| 5470 | - | 5725 | Yes | IMD4 |
| 5150 | - | 5825 | Yes | Asia | 2nd Harmonic, IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_20\_n1.

5.32.3 ∆TIB and ∆RIB values

**Table 5.32.3-1: ΔTIB,c**

| **Inter-band DC Configuration** | **E-UTRA and NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| DC\_1-20\_n1 | 1 | 0.3 |
| 20 | 0.3 |
| n1 | 0.3 |

5.32.4 Reference sensitivity exceptions

**Table 5.32.4-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)**

| **NR or E-UTRA Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **EUTRA / NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| DC\_1A-20A\_n1A | n1 | 1930 | 5 | 25 | 2120 | N/A | N/A |
| 20 | 850 | 5 | 25 | 809 | N/A | N/A |
| 1 | N/A | 5 | N/A | 2160 | 6 | IMD4 |

## 5.33 DC\_7-8\_n20

5.33.1 Configurations for DC

**Table 5.33.1-1: Inter-band DC configurations (three bands)**

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_7A-8A\_n20A | DC\_7A\_n20A  DC\_8A\_n20A |

5.33.2 Co-existence studies

Table 5.33.2-1 lists the Band 7A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 5.33.2-1: Band 7 and Band n20 UL harmonics and IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 2500 | 2570 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 5000 – 5140 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 7500 – 7710 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1638 – 1738 | | | 3332 – 3432 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 4138 – 4308 | | | 776 – 906 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 5832 – 6002 | | | 4164 – 4294 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 2480 – 2590 | | | 812 – 882 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 6638 – 6878 | | | 74 – 86 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 3276 – 3476 | | | 6664 – 6864 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 8332 – 8572 | | | 4996 – 5156 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 758 – 948 | | | 9138 – 9448 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 2414 – 2644 | | | 5776 – 6046 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5828 – 6018 | | | 10832 – 11142 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 7496 – 7726 | | | 9164 – 9434 | | |

Based on Table 5.33.2-1,

- 3rd order harmonics may fall into Rx frequencies of bands 38, 41, 69 and 90.

- 2nd order IMD may fall into Rx frequencies of bands 42, 52, 77 and 78.

- 3rd order IMD may fall into Rx frequencies of bands 5, 6, 18, 19, 20, 26, 27, 28, 44, 46, 47, 68 and 77.

- 4th order IMD may fall into Rx frequencies of bands 42, 46, 52, 77, 78 and 79.

- 5th order IMD may fall into Rx frequencies of bands 5, 6, 7, 8, 14, 18, 19, 20, 26, 27, 28, 38, 41, 44, 46, 47, 53, 68, 69 and 90.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.33.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

**Table 5.33.2-2: 2UL Band 7 + Band n20 harmonic and IMD for ISM and GNSS bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD5 |
| 2400 | - | 2494 | Yes | Asia | IMD5 |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | IMD3, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD4 |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | Yes | Asia | IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_7\_n20.

Table 5.33.2-3 lists the Band 8A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 5.33.2-3: Band 8 and Band n20 UL harmonics and IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 880 | 915 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1760 – 1830 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2640 – 2745 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 18 – 83 | | | 1712 – 1777 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 898 – 998 | | | 749 – 844 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 2592 – 2692 | | | 2544 – 2639 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 860 – 935 | | | 822 – 872 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 1778 – 1913 | | | 1581 – 1706 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 36 – 166 | | | 3424 – 3554 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 3472 – 3607 | | | 3376 – 3501 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 2413 – 2568 | | | 2658 – 2828 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 666 – 826 | | | 916 – 1081 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 4208 – 4363 | | | 4352 – 4522 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 4256 – 4416 | | | 4304 – 4469 | | |

Based on Table 5.33.2-3,

- 2nd order harmonics may fall into Rx frequencies of bands 7, 41 and 90.

- 3rd order harmonics may fall into Rx frequencies of bands 3, 38, 41, 69 and 90.

- 3rd order IMD may fall into Rx frequencies of bands 7, 8, 13, 14, 20, 28, 38, 38, 41, 44, 67, 68, 69 and 90.

- 4th order IMD may fall into Rx frequencies of bands 3, 9, 22, 33, 35, 37, 39, 42, 43, 48, 49, 52, 77 and 78.

- 5th order IMD may fall into Rx frequencies of bands 7, 8, 12, 13, 14, 17, 20, 28, 29, 41, 44, 53, 67, 68, 79, 85 and 90.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.33.2-4 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

**Table 5.33.2-4: 2UL Band 8 + Band n20 harmonic and IMD for ISM and GNSS bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD4 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD4 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD4 |
| GPS | 1563 | - | 1587 | Yes |  | IMD4 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD5 |
| 2400 | - | 2494 | Yes | Asia | IMD5 |
| ISM band  (5GHz) | 5150 | - | 5925 | No | US |  |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | No | Asia |  |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_8\_n20.

5.33.3 ∆TIB and ∆RIB values

**Table 5.33.3-1: ΔTIB,c**

| **Inter-band DC Configuration** | **E-UTRA and NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| DC\_7-8\_n20 | 7 | 0.3 |
| 8 | 0.6 |
| n20 | 0.6 |

**Table 5.33.3-2: ΔRIB**

| **Inter-band DC Configuration** | **E-UTRA and NR Band** | **ΔRIB [dB]** |
| --- | --- | --- |
| DC\_7-8\_n20 | 8 | 0.2 |
| n20 | 0.2 |

5.33.4 Reference sensitivity exceptions

**Table 5.33.4-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)**

| **NR or E-UTRA Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **EUTRA / NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| DC\_7A-8A\_n20A | 7 | 2520 | 5 | 25 | 2640 | 21.1 | IMD34,15 |
| 8 | 900 | 5 | 25 | 945 | N/A | N/A |
| n20 | 840 | 5 | 25 | 799 | N/A | N/A |
| 7 | 2503 | 5 | 25 | 2623 | N/A | N/A |
| n20 | 859 | 5 | 25 | 818 | N/A | N/A |
| 8 | N/A | 5 | N/A | 933 | 4.4 | IMD5 |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified.  NOTE 15: This band is subject to additional IMD3 for which MSD is not specified. | | | | | | | |

## 5.34 DC\_7-28\_n20

5.34.1 Configurations for DC

**Table 5.34.1-1: Inter-band DC configurations (three bands)**

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_7A-28A\_n20A | DC\_7A\_n20A  DC\_28A\_n20A |

5.34.2 Co-existence studies

Table 5.34.2-1 lists the Band 7A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 5.34.2-1: Band 7 and Band n20 UL harmonics and IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 2500 | 2570 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 5000 – 5140 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 7500 – 7710 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 1638 – 1738 | | | 3332 – 3432 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 4138 – 4308 | | | 776 – 906 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 5832 – 6002 | | | 4164 – 4294 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 2480 – 2590 | | | 812 – 882 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 6638 – 6878 | | | 74 – 86 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 3276 – 3476 | | | 6664 – 6864 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 8332 – 8572 | | | 4996 – 5156 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 758 – 948 | | | 9138 – 9448 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 2414 – 2644 | | | 5776 – 6046 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 5828 – 6018 | | | 10832 – 11142 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 7496 – 7726 | | | 9164 – 9434 | | |

Based on Table 5.34.2-1,

- 3rd order harmonics may fall into Rx frequencies of bands 38, 41, 69 and 90.

- 2nd order IMD may fall into Rx frequencies of bands 42, 52, 77 and 78.

- 3rd order IMD may fall into Rx frequencies of bands 5, 6, 18, 19, 20, 26, 27, 28, 44, 46, 47, 68 and 77.

- 4th order IMD may fall into Rx frequencies of bands 42, 46, 52, 77, 78 and 79.

- 5th order IMD may fall into Rx frequencies of bands 5, 6, 7, 8, 14, 18, 19, 20, 26, 27, 28, 38, 41, 44, 46, 47, 53, 68, 69 and 90.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.34.2-2 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

**Table 5.34.2-2: 2UL Band 7 + Band n20 harmonic and IMD for ISM and GNSS bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD5 |
| 2400 | - | 2494 | Yes | Asia | IMD5 |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | IMD3, IMD4, IMD5 |
| 5150 | - | 5350 | Yes | Europe | IMD4 |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | Yes | Asia | IMD4, IMD5 |

The requirements for spurious emission band UE coexistence already exist in 38.101-3 for DC\_7\_n20.

Table 5.34.2-3 lists the Band 28A + Band n20A 2UL DC 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order IMD for the UE-to-UE coexistence analysis.

**Table 5.34.2-3: Band 28 and Band n20 UL harmonics and IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | | **fn\_low** | **fn\_high** | |
| UL frequency (MHz) | 703 | 748 | | 832 | 862 | |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | | 2\* fn\_low | 2\* fn\_high | |
| 2nd harmonics frequency limits (MHz) | 1406 – 1496 | | | 1664 – 1724 | | |
| 3rd harmonics frequency limits | 3\*fx\_low | | 3\*fx\_high | 3\* fn\_low | | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 2109 – 2244 | | | 2496 – 2586 | | |
| 2nd order IMD products | |fn\_low – fx\_high| | |fn\_high – fx\_low| | | |fn\_low + fx\_low| | |fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 84 – 159 | | | 1535 – 1610 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fn\_high| | |2\*fx\_high – fn\_low| | | |2\*fn\_low – fx\_high| | |2\*fn\_high – fx\_low| | |
| IMD frequency limits (MHz) | 544 – 664 | | | 916 – 1021 | | |
| Two-tone 3rd order IMD products | |2\*fx\_low + fn\_low| | |2\*fx\_high + fn\_high| | | |2\*fn\_low + fx\_low| | |2\*fn\_high + fx\_high| | |
| IMD frequency limits (MHz) | 2238 – 2358 | | | 2367 – 2472 | | |
| Two-tone 3rd order IMD products | (fx\_low – max BW fn) | | (fx\_high + max BW fn) | (fn\_low – max BW fx) | | (fn\_high + max BW fx) |
| IMD frequency limits (MHz) | 683 – 768 | | | 812 – 882 | | |
| Two-tone 4th order IMD products | |3\*fx\_low –1\* fn\_high| | | |3\*fx\_high – 1\*fn\_low| | |3\*fn\_low – 1\*fx\_high| | | |3\*fn\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | 1247 – 1412 | | | 1748 – 1883 | | |
| Two-tone 4th order IMD products | |2\*fx\_low –2\* fn\_high| | | |2\*fx\_high –2\* fn\_low| | |2\*fx\_low +2\* fn\_low| | | |2\*fx\_high +2\* fn\_high| |
| IMD frequency limits (MHz) | 168 – 318 | | | 3070 – 3220 | | |
| Two-tone 4th order IMD products | |3\*fx\_low +1\* fn\_low| | | |3\*fx\_high + 1\*fn\_high| | |3\*fn\_low + 1\*fx\_low| | | |3\*fn\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | 2941 – 3106 | | | 3199 – 3334 | | |
| Two-tone 5th order IMD products | |fx\_low – 4\*fn\_high| | | |fx\_high – 4\*fn\_low| | |fn\_low – 4\*fx\_high| | | |fn\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | 2580 – 2745 | | | 1950 – 2160 | | |
| Two-tone 5th order IMD products | |2\*fx\_low - 3\*fn\_high| | | |2\*fx\_high - 3\*fn\_low| | |2\*fn\_low - 3\*fx\_high| | | |2\*fn\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 1000 – 1180 | | | 385 – 580 | | |
| Two-tone 5th order IMD products | |fx\_low + 4\*fn\_low| | | |fx\_high + 4\*fn\_high| | |fn\_low + 4\*fx\_low| | | |fn\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 4031 – 4196 | | | 3644 – 3854 | | |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fn\_low| | | |2\*fx\_high + 3\*fn\_high| | |2\*fn\_low + 3\*fx\_low| | | |2\*fn\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 3902 – 4082 | | | 3773 – 3968 | | |

Based on Table 5.34.2-3,

- 2nd order harmonics may fall into Rx frequencies of bands 11, 21, 32, 38, 41, 45, 50, 51, 69, 74, 75, 76, 90, 91, 92, 93 and 94.

- 3rd order harmonics may fall into Rx frequencies of bands 1, 4, 10, 23, 65 and 66.

- 2nd order IMD may fall into Rx frequencies of band 24.

- 3rd order IMD may fall into Rx frequencies of bands 8, 30, 40 and 71.

- 4th order IMD may fall into Rx frequencies of bands 3, 9, 35, 39, 52, 77 and 78.

- 5th order IMD may fall into Rx frequencies of bands 1, 2, 4, 7, 10, 25, 31, 34, 36, 38, 41, 43, 48, 49, 65, 66, 69, 70, 72, 73, 77, 78, 87, 88 and 90.

When a 2UL inter-band DC UE is operating with other systems such as Wi-Fi, Bluetooth and GNSS, the harmonics and intermodulation products can have an impact on these systems. Table 5.34.2-4 lists if up to 3rd order harmonics and IMD up to 5th order falls into one of these receiving bands.

**Table 5.34.2-4: 2UL Band 28 + Band n20 harmonic and IMD for ISM and GNSS bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | Yes |  | IMD2 |
| Galileo | 1559 | - | 1591 | Yes |  | IMD2 |
| GLONASS | 1591 | - | 1610 | Yes |  | IMD2 |
| GPS | 1563 | - | 1587 | Yes |  | IMD2 |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | Yes | US/Europe | IMD3 |
| 2400 | - | 2494 | Yes | Asia | IMD3 |
| ISM band  (5GHz) | 5150 | - | 5925 | No | US |  |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | No | Asia |  |

The requirements for spurious emission band UE coexistence that exist in 38.101-3 for DC\_20\_n28 can be reused.

5.34.3 ∆TIB and ∆RIB values

**Table 5.34.3-1: ΔTIB,c**

| **Inter-band DC Configuration** | **E-UTRA and NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| DC\_7-28\_n20 | 7 | 0.3 |
| 28 | 0.6 |
| n20 | 0.6 |

**Table 5.34.3-2: ΔRIB**

| **Inter-band DC Configuration** | **E-UTRA and NR Band** | **ΔRIB [dB]** |
| --- | --- | --- |
| DC\_7-28\_n20 | 28 | 0.2 |
| n20 | 0.2 |

5.34.4 Reference sensitivity exceptions**Table 5.344-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)**

| **NR or E-UTRA Band / Channel bandwidth / NRB / MSD** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **EUTRA / NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL**  **LCRB** | **DL Fc (MHz)** | **MSD  (dB)** | **IMD order** |
| DC\_7A-28A\_n20A | 7 | 2520 | 5 | 25 | 2640 | 5.9 | IMD5 |
| 28 | 728 | 5 | 25 | 783 | N/A | N/A |
| n20 | 842 | 5 | 25 | 801 | N/A | N/A |
| 7 | 2505 | 5 | 25 | 2625 | N/A | N/A |
| n20 | 859 | 5 | 25 | 818 | N/A | N/A |
| 28 | N/A | 5 | N/A | 787 | 17.4 | IMD3 |

## 5.35 DC\_5-7\_n40

### 5.35.1 Configurations for DC

Table 5.35.1-1: Inter-band DC configurations (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration** |
| --- | --- |
| DC\_5A-7A\_n40A | DC\_5A\_n40A  DC\_7A\_n40A |

### 5.35.2 Co-existence studies

For UE coexistence study of Band 5 + Band n40, the 2nd, 3rd, 4th, and 5th order harmonics and the 2nd, 3rd, 4th, and 5th order inter-modulation products are calculated and presented in Table 5.35.2-1.

Based on this calculation, we find that there is no impact of harmonics and inter-modulation products from UL DC\_5\_n40 affecting DL Band 7.

Table 5.35.2-1: Harmonics and IMD analysis of Band 5 + Band n40

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 2300 | 2400 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\*fy\_low | 2\*fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 4600 | 4800 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\*fy\_low | 3\*fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 6900 | 7200 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\*fy\_low | 4\*fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 9200 | 9600 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\*fy\_low | 5\*fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 11500 | 12000 |
| 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) | 1451 | 1576 | 3124 | 3249 |
| 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) | 752 | 602 | 3751 | 3976 |
| 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) | 3948 | 4098 | 5424 | 5649 |
| 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) | 72 | 247 | 6051 | 6376 |
| 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) | 3152 | 2902 | 6248 | 6498 |
| 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) | 4772 | 4947 | 7724 | 8049 |
| 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) | 8776 | 8351 | 1096 | 896 |
| 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) | 5552 | 5202 | 2053 | 2328 |
| 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) | 10024 | 10449 | 5596 | 5796 |
| 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) | 8548 | 8898 | 7072 | 7347 |

For UE coexistence study of Band 7 + Band n40, the 2nd, 3rd, 4th, and 5th order harmonics and the 2nd, 3rd, 4th, and 5th order inter-modulation products are calculated and presented in Table 5.35.2-2.

Based on this calculation, we find that there is no impact of harmonics and inter-modulation products from UL DC\_7\_n40 affecting DL Band 5.

Table 5.35.2-2: Harmonics and IMD analysis of Band 7 + Band n40

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2500 | 2570 | 2300 | 2400 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\*fy\_low | 2\*fy\_high |
| 2nd harmonics frequency limits (MHz) | 5000 | 5140 | 4600 | 4800 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\*fy\_low | 3\*fy\_high |
| 3rd harmonics frequency limits (MHz) | 7500 | 7710 | 6900 | 7200 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\*fy\_low | 4\*fy\_high |
| 4th harmonics frequency limits (MHz) | 10000 | 10280 | 9200 | 9600 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\*fy\_low | 5\*fy\_high |
| 5th harmonics frequency limits (MHz) | 12500 | 12850 | 11500 | 12000 |
| 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) | 270 | 100 | 4800 | 4970 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2600 | 2840 | 2030 | 2300 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 7300 | 7540 | 7100 | 7370 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 5100 | 5410 | 4330 | 4700 |
| Two-tone 4th order IMD products | |2\*fx\_low – 2\*fy\_high| | |2\*fx\_high – 2\*fy\_low| | |2\*fx\_low + 2\*fy\_low| | |2\*fx\_high + 2\*fy\_high| |
| IMD frequency limits (MHz) | 200 | 540 | 9600 | 9940 |
| 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) | 9800 | 10110 | 9400 | 9770 |
| 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) | 7100 | 6630 | 7980 | 7600 |
| 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) | 2200 | 1760 | 3110 | 2700 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 11700 | 12170 | 12300 | 12680 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 11900 | 12340 | 12100 | 12510 |

### 5.35.3 ∆TIB and ∆RIB values

For DC\_5-7\_n40, ΔTIB,c and ΔRIB,c values are given as follows.

Table 5.35.3-1: ΔTIB,c

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_5-7\_n40 | 0.3 | 0.5 | 0.6 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.35.3-2: ΔRIB,c**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_5-7\_n40 | 0.2 | 0.3 | 0.7 |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

### 5.35.4 Reference sensitivity exceptions

Based on the coexistence study results, there is no need to define additional MSD requirements for this band combination.

## 5.36 DC\_20-(n)3

5.36.1 Operating bands for EN-DC

Table 5.36.1-1: EN-DC Band combinations (three bands)

| EN-DC band | E-UTRA CA band | NR band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_20-(n)3 | CA\_3-20 | n3 | DC\_(n)3 |

### 5.36.2 Configuration for DC

Table 5.36.2-1: Inter-band EN-DC configurations (three bands)

| EN-DC  Configuration | Uplink EN-DC  configuration  (NOTE 1) | E-UTRA CA configuration | NR band |
| --- | --- | --- | --- |
| DC\_20A-(n)3AA | DC\_(n)3AA2  DC\_20A\_n3A | CA\_3A-20A | n3A |
| NOTE 2: Only single switched UL is supported | | | |

5.36.3 ∆TIB and ∆RIB values

For DC\_20-(n)3, the ΔTIB,c and ΔRIB,c values are reused from DC\_20\_n3 and are given in the tables below.

**Table 5.36.3-1:ΔTIB,c due to EN-DC (three bands)**

| Inter-band EN-DC configuration | ΔTIB,c for E-UTRA band / NR band (dB)6 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration7 | | |
| DC\_20-(n)3 | 0.3 | 0.3 | 0.3 |
| NOTE 6: “-” denotes ΔTIB,c = 0.  NOTE 7: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_66\_(n)12 the band order from left to right is 12, 66 and n12. | | | |

**Table 5.36.3-2:ΔRIB,c due to EN-DC (three bands)**

| **Inter-band EN-DC configuration** | ΔRIB,c for E-UTRA band / NR band (dB)7 | | |
| --- | --- | --- | --- |
| Component band in order of bands in configuration8 | | |
| DC\_20-(n)3 | - | - | - |
| NOTE 7: “-” denotes ΔRIB,c = 0.  NOTE 8: The component band order in the configuration should be listed by the order of E-UTRA band and NR band respectively, such as for DC\_5\_(n)12 the band order from left to right is 5, 12 and n12. | | | |

5.36.4 REFSENS requirements

There are IMD4 impact from UL 20\_n3 affecting DL band 3.

MSD value band n3 is derived from DC\_3\_n20.

A similar approach to the effect on SCell as DC\_3\_(n)7 (see R4-2216086) has been used for MSD value band 3.

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_20A-(n)3AA | 3 | N/A | 5 | N/A | 1865 | 3 | IMD4 |
|  | n3 | 1775 | 5 | 25 | 1870 | 4 | IMD4 |
|  | 20 | 840 | 5 | 25 | 799 | N/A | N/A |

## 5.37 DC\_3-8\_n7

### 5.37.1 Configurations for DC

Table 5.37.1-1: Inter-band DC configurations (three bands)

| DC  Configuration | Uplink configuration |
| --- | --- |
| DC\_3A-8A\_n7A | DC\_3A\_n7A  DC\_8A\_n7A |

### 5.37.2 Co-existence studies

For UE coexistence study of Band 3 + Band n7, the 2nd, 3rd and 4th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.37.2-1.

**Table 5.37.2-1: Harmonic and IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1710 | 1785 | 2500 | 2570 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3570 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 | 7500 | 7710 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 6840 | 7140 | 10000 | 10280 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 715 | 860 | 4210 | 4355 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 850 | 1070 | 3215 | 3430 |
| Two-tone 3rd order IMD products | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 5920 | 6140 | 6710 | 6925 |
| Two-tone 4th order IMD products | |3\*fx\_low - fy\_high| | |3\*fx\_high - fy\_low| | |3\*fy\_low - fx\_high| | |3\*fy\_high - fx\_low| |
| IMD frequency limits (MHz) | 2560 | 2855 | 5715 | 6000 |
| 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) | 7630 | 7925 | 9210 | 9495 |
| Two-tone 4th order IMD products | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low - 2\* fy\_high| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 1430 | 1570 | 8420 | 8710 |
| Two-tone 5th order IMD products | |fx\_high – 4\*fy\_low| | |fx\_low – 4\*fy\_high| | |fy\_high – 4\*fx\_low| | |fy\_low – 4\*fx\_high| |
| IMD frequency limits (MHz) | 8215 | 8570 | 4270 | 4640 |
| Two-tone 5th order IMD products | |2\*fx\_high - 3\*fy\_low| | |2\*fx\_low - 3\*fy\_high| | |2\*fy\_high -3\*fx\_low| | |2\*fy\_low - 3\*fx\_high| |
| IMD frequency limits (MHz) | 3930 | 4290 | 10 | 355 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 11710 | 12065 | 9340 | 9710 |
| Two-tone 5th order IMD products | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | 10920 | 11280 | 10130 | 10495 |

As we can see from the above table, there could be MSD due to IMD:

1. The 3rd order IMD generated by Band 3 and Band n7 may fall into DL reception frequency of Band 8.
2. The 4th order IMD generated by Band 3 and Band n7 may fall into DL reception frequency of Band n7.

The MSD value for the 3rd order IMD can reuse what have been specified in TS 36.101 Table 7.3.1A-0g for CA\_3A-7A-8A.

For the 4th order IMD, it has already been studied with its fallback mode.

For UE coexistence study of Band 8 + Band n7, the 2nd, 3rd and 4th order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.37.2-2.

**Table 5.37.2-2: Harmonic and IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 880 | 915 | 2500 | 2570 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1760 | 1830 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2640 | 2745 | 7500 | 7710 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3520 | 3660 | 10000 | 10280 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1585 | 1690 | 3380 | 3485 |
| Two-tone 3rd order IMD products | |2\*fx\_high – fy\_low| | |2\*fx\_low – fy\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 670 | 810 | 4085 | 4260 |
| 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) | 4260 | 4400 | 5880 | 6055 |
| 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) | 70 | 245 | 6585 | 6830 |
| 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) | 5140 | 5315 | 8380 | 8625 |
| Two-tone 4th order IMD products | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low - 2\* fy\_high| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | 3170 | 3310 | 6760 | 6970 |
| Two-tone 5th order IMD products | |fx\_high – 4\*fy\_low| | |fx\_low – 4\*fy\_high| | |fy\_high – 4\*fx\_low| | |fy\_low – 4\*fx\_high| |
| IMD frequency limits (MHz) | 9085 | 9400 | 950 | 1160 |
| Two-tone 5th order IMD products | |2\*fx\_high - 3\*fy\_low| | |2\*fx\_low - 3\*fy\_high| | |2\*fy\_low - 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| IMD frequency limits (MHz) | 5670 | 5950 | 2255 | 2500 |
| Two-tone 5th order IMD products | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | 10880 | 11195 | 6020 | 6230 |
| 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) | 9260 | 9540 | 7640 | 7885 |

As we can see from the above table, there could be MSD due to IMD:

1. The 5th order IMD generated by Band 8 and Band n7 may fall into DL reception frequency of Band 8.

Besides, harmonic could be a cause for MSD:

1. The 2nd order harmonic generated by Band 8 may fall into DL reception frequency of Band 3.
2. The 3rd order harmonic generated by Band 8 may fall into DL reception frequency of Band n7.

The above IMD issue has been studied for DC\_7-8\_n7. Specifically, when we consider the implementation of Band 8 duplexer, we can find that such 5th order IMD will not impact the DL reception of Band 8.

The MSD values due to the above two harmonic issues have been specified as in TS 38.101-3 table 7.3B.2.3.1-1.

### 5.37.3 ∆TIB and ∆RIB values

For DC\_3-8\_n7, the ΔTIB,c and ΔRIB,c values are given in the following tables. (Both are reusing the specified values for DC\_3-7\_n8 as in TS 38.101-3)

Table 5.37.3-1: ΔTIB,c

| Inter-band DC Configuration | E-UTRA and NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| DC\_3-8\_n7 | 3 | 0.5 |
| 8 | 0.6 |
| n7 | 0.5 |

**Table 5.37.3-2: ΔRIB**

| Inter-band DC Configuration | E-UTRA and NR Band | ΔRIB [dB] |
| --- | --- | --- |
| DC\_3-8\_n7 | 8 | 0.2 |

### 5.37.4 Reference sensitivity exceptions

The required MSD values are derived from CA\_3A-7A-8A.

Table 5.37.4-1: Reference sensitivity exceptions for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA and NR Band / Channel bandwidth / NRB / MSD | | | | | | | |
| EN-DC  Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-8A\_n7A | 3 | 1735 | 5 | 25 | 1830 | N/A | N/A |
| n7 | 2530 | 10 | 50 | 2650 | N/A | N/A |
| 8 | 895 | 5 | 25 | 940 | 18.0 | IMD3 |

Annex A (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2022-8 | RAN4#104-e | R4-2212499 |  |  |  | TR skeleton | 0.0.1 |
| 2022-8 | RAN4#104-e | R4-2212500 |  |  |  | The following approved TPs were implemented:  R4-2215008 TP for TR 37 718-21-11 to include DC\_1-(n)7  R4-2215009 TP for TR 37 718-21-11 to include DC\_3-(n)7  R4-2215010 TP for TR 37 718-21-11 to include DC\_28-(n)7  R4-2215011 TP for TR 37 718-21-11 to include DC\_1-26\_n78  R4-2215012 TP for TR 37 718-21-11 to include DC\_3-26\_n78  R4-2215013 TP for TR 37 718-21-11 to include DC\_7-26\_n78  R4-2215031 TP for TR 37.718-21-11 DC\_1A-8A\_n7A | 0.1.0 |
| 2022-10 | RAN4#104-bis-e | R4-2216246 |  |  |  | The following approved TPs were implemented:  R4-2215771 TP for TR 37.718-21-11: support of DC\_3A-8B\_n78A, DC\_3A-3A-8B\_n78A  R4-2215772 TP for TR 37.718-21-11: support of DC\_7A-8B\_n78A, DC\_7A-7A-8B\_n78A  R4-2215849 TP for TR 37.718-21-11 to include DC\_1\_3-n26  R4-2215850 TP for TR 37.718-21-11 to include DC\_1\_7-n26  R4-2217104 TP for TR 37.718-21-11 to include DC\_3\_7-n26  R4-2215901 TP for TR 37.718-21-11: Including band combinations DC\_3-41\_n1  R4-2215902 TP for TR 37.718-21-11: Including band combinations DC\_8-41\_n78  R4-2216092 TP for TR 37 718-21-11 to include DC\_20-41\_n1  R4-2216093 TP for TR 37 718-21-11 to include DC\_20-41\_n78  R4-2216161 TP for TR 37.718-21-11: DC\_1-7\_n1  R4-2217067 TP for TR 37.718-21-11: DC\_1-7\_n20  R4-2217068 TP for TR 37.718-21-11: DC\_1-8\_n20  R4-2217071 TP for TR 37.718-21-11: DC\_3-20\_n3  R4-2217072 TP for TR 37.718-21-11: DC\_3-32\_n7  R4-2217075 TP for TR 37.718-21-11: DC\_8-28\_n3  R4-2217077 TP for TR 37.718-21-11: DC\_20-32\_n7  R4-2216249 TP for TR 37.718-21-11: update the format of tables for ?TIB and ?RIB values  R4-2216591 TP for TR 37.718-21-11 DC\_7A-8A\_n7A  R4-2216625 TP for TR 37.718-21-11 on table templates and error corrections | 0.2.0 |
| 2022-11 | RAN4#105 | R4-2219165 |  |  |  | The following approved TPs were implemented:  R4-2218525 TP for TR 37.718-21-11 DC\_3A-5A\_n40A  R4-2218958 TP for 37.718-21-11 to include DC\_1-28\_n38  R4-2218959 TP for 37.718-21-11 to include DC\_3-28\_n38  R4-2219282 TP for TR 37.718-21-11: DC\_20-28\_n78  R4-2219338 TP for TR 37.718-21-11: DC\_1-28\_n20  R4-2220607 TP for TR 37.718-21-11 DC\_1A-5A\_n40A  R4-2220773 TP for TR 37.718-21-11: DC\_1-3\_n1  R4-2220774 TP for TR 37.718-21-11: DC\_1-20\_n1  R4-2220775 TP for TR 37.718-21-11: DC\_7-8\_n20  R4-2220776 TP for TR 37.718-21-11: DC\_7-28\_n20 | 0.3.0 |
| 2023-03 | RAN4#106 | R4-2301454 |  |  |  | The following approved TPs were implemented:  R4-2220568 TP for TR 37.718-21-11: DC\_3-7\_n26  R4-2216086 TP for TR 37 718-21-11 to update DC\_3-(n)7  R4-2300180 TP for TR 37.718-21-11 to include DC\_5-7\_n40  R4-2303610 TP for 37.718-21-11 to include DC\_20-(n)3  R4-2301769 TP for TR 37.718-21-11 DC\_3A-8A\_n7A | 0.4.0 |