3GPP TR 38.716-03-01 V16.0.0 (2020-06)

Technical Report

3rd Generation Partnership Project;

Technical Specification Group Radio Access Network;

NR inter-band Carrier Aggregation (CA) for

3 Down Link (DL) / 1 Up Link (UL)

(Release 16)



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 Report 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.

© 2020, 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 8

1 Scope 10

2 References 10

3 Definitions, symbols and abbreviations 11

3.1 Definitions 11

3.2 Symbols 11

3.3 Abbreviations 11

4 Background 12

4.1 The present document maintenance 12

5 3 Band Carrier Aggregation with Single UL: General Part 12

6 3 Band Carrier Aggregation with Single UL: Specific Band Combination Part 12

6.1 CA\_n3A-n41A-n79A 12

6.1.1 Operating bands for CA 12

6.1.2 Channel bandwidths per operating band for CA 13

6.1.3 Co-existence studies 13

6.1.4 ∆TIB,c and ∆RIB,c values 14

6.1.5 REFSENS requirements 14

6.2 CA\_n8A-n41A-n79A 15

6.2.1 Operating bands for CA 15

6.2.2 Channel bandwidths per operating band for CA 15

6.2.3 Co-existence studies 16

6.2.4 ∆TIB,c and ∆RIB,c values 16

6.2.5 REFSENS requirements 17

6.3 CA\_n40A-n41A-n79A 17

6.3.1 Operating bands for CA 17

6.3.2 Channel bandwidths per operating band for CA 18

6.3.3 Co-existence studies 18

6.3.4 ∆TIB,c and ∆RIB,c values 19

6.3.5 REFSENS requirements 19

6.4 CA\_n1A-n3A-n78A 20

6.4.1 Operating bands for CA 20

6.4.2 Channel bandwidths per operating band for CA 20

6.4.3 Co-existence studies 20

6.4.4 ∆TIB,c and ∆RIB,c values 21

6.4.5 REFSENS requirements 21

6.5 CA\_n39A-n41A-n79A 21

6.5.1 Operating bands for CA 21

6.5.2 Channel bandwidths per operating band for CA 22

6.5.3 Co-existence studies 22

6.5.4 ∆TIB,c and ∆RIB,c values 23

6.5.5 REFSENS requirements 23

6.6 CA\_n8A-n39A-n41A 24

6.6.1 Operating bands for CA 24

6.6.2 Channel bandwidths per operating band for CA 24

6.6.3 Co-existence studies 24

6.6.4 ∆TIB,c and ∆RIB,c values 25

6.6.5 REFSENS requirements 26

6.7 CA\_n3A-n8A-n78A 26

6.7.1 Operating bands for CA 26

6.7.2 Channel bandwidths per operating band for CA 26

6.7.3 Co-existence studies 26

6.7.4 ∆TIB,c and ∆RIB,c values 27

6.7.5 REFSENS requirements 27

6.8 CA\_n66-n70-n71 28

6.8.1 Operating bands for CA 28

6.8.2 Channel bandwidths per operating band for CA 28

6.8.3 UE co-existence studies 28

6.8.4 ∆TIB and ∆RIB values 29

6.8.5 REFSENS requirements 29

6.9 CA\_n28-n78-n257 30

6.9.1 Operating bands for CA 30

6.9.2 Channel bandwidths per operating band for CA 31

6.9.3 Co-existence studies 32

6.9.4 ∆TIB,c and ∆RIB,c values 32

6.9.5 REFSENS requirements 32

6.10 CA\_n3-n77-n257 32

6.10.1 Operating bands for CA 32

6.10.2 Channel bandwidths per operating band for CA 33

6.10.3 Co-existence studies 35

6.10.4 ∆TIB,c and ∆RIB,c values 35

6.10.5 REFSENS requirements 35

6.11 CA\_n3-n78-n257 35

6.11.1 Operating bands for CA 35

6.11.2 Channel bandwidths per operating band for CA 36

6.11.3 Co-existence studies 38

6.11.4 ∆TIB,c and ∆RIB,c values 38

6.11.5 REFSENS requirements 38

6.12 CA\_n28-n77-n257 38

6.12.1 Operating bands for CA 38

6.12.2 Channel bandwidths per operating band for CA 39

6.12.3 Co-existence studies 40

6.12.4 ∆TIB,c and ∆RIB,c values 40

6.12.5 REFSENS requirements 40

6.13 CA\_n3-n28-n77 41

6.13.1 Operating band for CA 41

6.13.2 Channel bandwidths per operating band for CA 41

6.13.3 Co-existence studies 41

6.13.4 ∆TIB and ∆RIB values 42

6.13.5 REFSENS requirements 42

6.14 CA\_n3-n28-n257 42

6.14.1 Operating band for CA 42

6.14.2 Channel bandwidths per operating band for CA 43

6.14.3 Co-existence studies 45

6.14.4 ∆TIB and ∆RIB values 45

6.14.5 REFSENS requirements 46

6.15 CA\_n3A\_n40A-n41A 46

6.15.1 Operating bands for CA 46

6.15.2 Channel bandwidths per operating band for CA 46

6.15.3 Co-existence studies 46

6.15.4 ∆TIB and ∆RIB values 47

6.15.5 MSD 47

6.16 CA\_n77-n79-n257 48

6.16.1 Operating bands for CA 48

6.16.2 Channel bandwidths per operating band for CA 49

6.16.3 Co-existence studies 50

6.16.4 ∆TIB,c and ∆RIB,c values 50

6.16.5 REFSENS requirements 50

6.17 CA\_n78-n79-n257 50

6.17.1 Operating bands for CA 50

6.17.2 Channel bandwidths per operating band for CA 50

6.17.3 Co-existence studies 53

6.17.4 ∆TIB,c and ∆RIB,c values 53

6.17.5 REFSENS requirements 53

6.18 CA\_n1A-n3A-n8A 53

6.18.1 Operating bands for CA 53

6.18.2 Channel bandwidths per operating band for CA 54

6.18.3 Co-existence studies 54

6.18.4 ∆TIB,c and ∆RIB,c values 54

6.18.5 REFSENS requirements 55

6.19 CA\_n1A-n8A-n78A 55

6.19.1 Operating bands for CA 55

6.19.2 Channel bandwidths per operating band for CA 55

6.19.3 Co-existence studies 55

6.19.4 ∆TIB,c and ∆RIB,c values 56

6.19.5 REFSENS requirements 56

6.20 CA\_n1A-n3A-n28A 57

6.20.1 Operating bands for CA 57

6.20.2 Channel bandwidths per operating band for CA 57

6.20.3 Co-existence studies 57

6.20.4 ∆TIB,c and ∆RIB,c values 58

6.20.5 REFSENS requirements 58

6.21 CA\_n1A-n28A-n78A 58

6.21.1 Operating bands for CA 58

6.21.2 Channel bandwidths per operating band for CA 59

6.21.3 Co-existence studies 59

6.21.4 ∆TIB,c and ∆RIB,c values 59

6.21.5 REFSENS requirements 60

6.22 CA\_n3A-n28A-n78A 60

6.22.1 Operating bands for CA 60

6.22.2 Channel bandwidths per operating band for CA 60

6.22.3 Co-existence studies 61

6.22.4 ∆TIB,c and ∆RIB,c values 61

6.22.5 REFSENS requirements 61

6.23 CA\_n1A-n3A-n41A 62

6.23.1 Operating bands for CA 62

6.23.2 Channel bandwidths per operating band for CA 62

6.23.3 Co-existence studies 62

6.23.4 ∆TIB,c and ∆RIB,c values 63

6.23.5 REFSENS requirements 63

6.24 CA\_n29-n66-n70 63

6.24.1 Operating bands for CA 63

6.24.2 Channel bandwidths per operating band for CA 64

6.24.3 UE co-existence studies 64

6.24.4 ∆TIB and ∆RIB values 65

6.24.5 REFSENS requirements 65

6.25 CA\_n29-n66-n70 66

6.25.1 Operating bands for CA 66

6.25.2 Channel bandwidths per operating band for CA 67

6.25.3 UE co-existence studies 67

6.25.4 ∆TIB and ∆RIB values 68

6.25.5 REFSENS requirements 68

6.26 CA\_ n41-n66-n71 69

6.26.1 Operating bands for CA 69

6.26.2 Channel bandwidths per operating band for CA 70

6.26.3 UE co-existence studies 70

6.26.4 ∆TIB and ∆RIB values 71

6.26.5 REFSENS requirements 71

6.27 CA\_ n41-n66-n71 71

6.27.1 Operating bands for CA 71

6.27.2 Channel bandwidths per operating band for CA 72

6.27.3 UE co-existence studies 72

6.27.4 ∆TIB and ∆RIB values 73

6.27.5 REFSENS requirements 73

6.28 CA\_n25-n66-n78 73

6.28.1 Operating bands for CA 73

6.28.2 Channel bandwidths per operating band for CA 74

6.28.3 Co-existence studies 74

6.28.4 ∆TIB,c and ∆RIB,c values 74

6.28.5 REFSENS requirements 74

6.29 CA\_n7-n66-n78 75

6.29.1 Operating bands for CA 75

6.29.2 Channel bandwidths per operating band for CA 75

6.29.3 Co-existence studies 75

6.29.4 ∆TIB,c and ∆RIB,c values 75

6.29.5 REFSENS requirements 76

6.30 CA\_n5-n66-n78 76

6.30.1 Operating bands for CA 76

6.30.2 Channel bandwidths per operating band for CA 76

6.30.3 Co-existence studies 76

6.30.4 ∆TIB,c and ∆RIB,c values 76

6.30.5 REFSENS requirements 77

6.31 CA\_n7-n25-n66 77

6.31.1 Operating bands for CA 77

6.31.2 Channel bandwidths per operating band for CA 77

6.31.3 Co-existence studies 77

6.31.4 ∆TIB,c and ∆RIB,c values 77

6.31.5 REFSENS requirements 78

6.32 CA\_n20A-n28A-n78A 78

6.32.1 Operating bands for CA 78

6.32.2 Channel bandwidths per operating band for CA 79

6.32.3 Co-existence studies 79

6.32.4 ∆TIB,c and ∆RIB,c values 79

6.32.5 REFSENS requirements 80

6.33 CA\_n1A-n7A-n28A 80

6.33.1 Operating bands for CA 80

6.33.2 Channel bandwidths per operating band for CA 80

6.33.3 Co-existence studies 81

6.33.4 ∆TIB,c and ∆RIB,c values 81

6.33.5 REFSENS requirements 81

6.34 CA\_n1A-n7A-n78A 82

6.34.1 Operating bands for CA 82

6.34.2 Channel bandwidths per operating band for CA 82

6.34.3 Co-existence studies 82

6.34.4 ∆TIB,c and ∆RIB,c values 83

6.34.5 REFSENS requirements 83

6.35 CA\_n28A-n41A-n78A 83

6.36 CA\_n1A-n40A-n78A 85

6.37 CA\_n28A-n40A-n78A 86

6.38 CA\_n25-n66-n71 88

6.38.1 Operating bands for CA 88

6.38.2 Channel bandwidths per operating band for CA 88

6.38.3 UE co-existence studies 89

6.38.4 ∆TIB and ∆RIB values 89

6.38.5 REFSENS requirements 89

6.39 CA\_ n25-n41-n66 90

6.39.1 Operating bands for CA 90

6.39.2 Channel bandwidths per operating band for CA 90

6.39.3 UE co-existence studies 90

6.39.4 ∆TIB and ∆RIB values 91

6.39.5 REFSENS requirements 91

6.40 CA\_n1-n78-n257 92

6.40.1 Operating bands for CA 92

6.40.2 Channel bandwidths per operating band for CA 92

6.40.3 Co-existence studies 92

6.40.4 ∆TIB,c and ∆RIB,c values 92

6.40.5 REFSENS requirements 93

6.41 CA\_n1A-n3A-n7A 93

6.42 CA\_n3A-n7A-n28A 94

6.43 CA\_n3A-n7A-n78A 96

6.44 CA\_n3A-n28A-n78A 98

Annex A: Change history 100

# 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 NR 3DL/1UL Inter-band Carrier Aggregation. The purpose is to gather the relevant background information and studies in order to address 3DL/1UL Inter-band Carrier Aggregation requirements for the Rel-16 band combinations in Table 1-1. UL carrier shall be supported in each of the 3 bands being aggregated unless otherwise specified.

Table 1-1: Release 16 3DL/1UL inter-band carrier aggregation combinations

|  |  |  |  |
| --- | --- | --- | --- |
| CA combination | | REL independent from | |
| CA\_x1A-yA-zA | |  | |
|  | |  | |
|  | |  | |
|  | |  | |
|  | |  | |
|  | |  | |
|  | |  | |
|  | |  | |

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

# 2 References

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

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

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

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

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

[2] RP-190692: "New WID: Rel-16 NR inter-band CA for 3 bands DL with 1 band UL", RAN#83.

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

[4] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[5] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[6] 3GPP TR 37.865-01-01

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

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

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

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

## 3.2 Symbols

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

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

ΔTIB,c Allowed maximum configured output power relaxation due to support for inter-band CA operation, for serving cell *c*.

## 3.3 Abbreviations

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

BS Base Station

BCS Bandwidth Combination Set

CA Carrier Aggregation

CA\_X Intra-band contiguous CA of component carriers in one sub-block within Band X where X is the applicable NR operating band

CA\_X-X Intra-band non-contiguous CA of component carriers in two sub-blocks within Band X where X is the applicable NR operating band

CA\_X-Y Inter-band CA of component carrier(s) in one sub-block within Band X and component carrier(s) in one sub-block within Band Y where X and Y are the applicable NR operating band

CA\_X-X-Y CA of component carriers in two sub-blocks within Band X and component carrier(s) in one sub-block within Band Y where X and Y are the applicable NR operating bands

CC Component Carriers

DL Downlink

FDD Frequency Division Duplex

IMD Inter-modulation

MSD Maximum Sensitivity Degradation

SCS Subcarrier Spacing

TDD Time Division Duplex

PA Power Amplifier

PCC Primary Component Carrier

REFSENS Reference Sensitivity power level

SCC Secondary Component Carrier

TDD Time Division Duplex

UE User Equipment

UL Uplink

# 4 Background

The present document is a technical report for 3DL/1UL Inter-band Carrier Aggregation under Rel-16 time frame. It covers both the UE and BS side. The document is divided in two different parts:

- General part: this part covers BS and UE specific which is band combination independent.

- Specific band combination part: this part covers each band combination and its specific issues independently from each other (i.e. one subclause is defined per band combination).

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

## 4.1 The present document maintenance

A single company is responsible for introducing all approved TPs in the present document, i.e. editor of the present document. 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 3 Band Carrier Aggregation with Single UL: General Part

*<Text will be added.>*

# 6 3 Band Carrier Aggregation with Single UL: Specific Band Combination Part

## 6.1 CA\_n3A-n41A-n79A

### 6.1.1 Operating bands for CA

Table 6.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n41-n79 | n3 | 1710MHz | – | 1780MHz | 1805MHz | – | 1880MHz | FDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |

### 6.1.2 Channel bandwidths per operating band for CA

Table 6.1.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **100** | **Bandwidth combination set** |
| CA\_n3A-n41A-n79A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| CA\_n3A-n41A-n79A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 1 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |

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

### 6.1.3 Co-existence studies

Table 6.1.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 3rd order harmonic of Band n3 will fall into a small portion of Band n79.

Table 6.1.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 |  |  |

Table 6.1.3-2 gives harmonic mixing issue for CA with Band n3, n41 and n79. It is seen that a small part of Band n79 Tx frequency coincides with Band n41x3.

Table 6.1.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 |  |  |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.1.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n3, n41 and n79, the ΔTIB,c and ΔRIB,c values are shown in table 6.1.4-1 and table 6.1.4-2, respectively.

Table 6.1.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| **CA\_n3A-n41A-n79A** | **n3** | **0.3** |
| **n41** | **0.31** |
| **0.82** |
| **n79** | **0.8** |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2515-2690 MHz.  NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496-2515 MHz. | | |

Table 6.1.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| **CA\_n3A-n41A-n79A** | **n3** | **0** |
| **n41** | **0.5** |
| **n79** | **0.5** |

### 6.1.5 REFSENS requirements

For this combination, sensitivity degradation is allowed for Band n3 when uplink transmission occur in Band n41 due to cross band isolation issues. The reference sensitivity exceptions are specified in Table 6.1.5-1 with the uplink configuration specified in Table 6.1.5-2.

Table 6.1.5-1: MSD due to cross band isolation for CA CA\_n3A-n41A-n79A

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | NR UL band | NR DL band | Channel bandwidth | | | | | | | | | | | |
| 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | 25 MHz (dBm) | 30 MHz (dBm) | 40 MHz (dBm) | 50 MHz (dBm) | 60 MHz (dBm) | 80 MHz (dBm) | 90 MHz (dBm) | 100 MHz (dBm) |
| CA\_n3A-n41A-n79A | n3 | n41 |  | 0.7 | 0.7 | 0.7 |  |  | 0.7 | 0.7 | 0.7 | 0.7 |  | 0.7 |
| n41 | n3 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | - | - | - | - | - | - |

Table 6.1.5-2: Uplink configuration for reference sensitivity exceptions due to cross band isolation

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth of the affected DL band | | | | | | | | | | | | | | |
| NR UL band | NR DL band | SCS of UL band (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| n3 | n41 | 15kHz |  | 501 | 501 | 501 |  |  | 501 | 501 | 501 | 501 |  | 501 |
| n41 | n3 | 30 | 160 | 160 | 160 | 160 | 160 | 160 |  |  |  |  |  |  |
| NOTE: The UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth. | | | | | | | | | | | | | | |

## 6.2 CA\_n8A-n41A-n79A

### 6.2.1 Operating bands for CA

Table 6.2.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n8-n41-n79 | n8 | 880MHz | – | 915MHz | 925MHz | – | 960MHz | FDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |

### 6.2.2 Channel bandwidths per operating band for CA

Table 6.2.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **100** | **Bandwidth combination set** |
| CA\_n8A-n41A-n79A | - | n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| CA\_n3A-n41A-n79A | - | n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  | 1 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |

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

### 6.2.3 Co-existence studies

Table 6.2.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 3rd order harmonic of Band n8 will fall into Band n41 and the 5th order harmonic of Band 8 will fall into band n79.

Table 6.2.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th harmonic** | | **6th harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 | 4400 | 4575 | 5280 | 5490 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |  |  |  |  |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 |  |  |  |  |  |  |

Table 6.2.3-2 gives harmonic mixing issue for CA with Band n8, n41 and n79. It is seen that part of Band n79 Tx frequency coincides with Band 8x5.

Table 6.2.3-2: Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th harmonic** | | **6th harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 | 4625 | 4800 | 5550 | 5760 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |  |  |  |  |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 |  |  |  |  |  |  |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.2.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n8, n41 and n79, the ΔTIB,c and ΔRIB,c values are shown in table 6.2.4-1 and table 6.2.4-2, respectively.

Table 6.2.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n8-n41-n79 | n8 | 0.6 |
| n41 | 0.3 |
| n79 | 0.8 |

Table 6.2.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n8-n41-n79 | n8 | 0 |
| n41 | 0.5 |
| n79 | 0.5 |

### 6.2.5 REFSENS requirements

For this combination, sensitivity degradation is allowed for Band n41 and n79 when there is uplink transmission in Band n8. The reference sensitivity exceptions are specified in Table 6.2.5-1 with the uplink configuration specified in Table 6.2.5-2.

Table 6.2.5-1: MSD due to harmonic issue for CA\_n8-n41-n79

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | MSD due to harmonic exception for the DL band | | | | | | | | | | | |
| UL band | DL band | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **80 MHz** | **100 MHz** |
| dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB |
| n8 | n411,2 | N/A | 13 | 11.3 | 10.1 |  |  | 7.0 | 6.1 | 5.5 | 4.3 | 3.5 |
| n793,4 |  |  |  |  |  |  | [6.8] | 6.2 | [5.6] | 4.9 | 4.4 |
| NOTE 1: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.  NOTE 2 The requirements should be verified for UL EARFCN of a low band (superscript LB) such that in MHz and  with the carrier frequency of a high band in MHz and the channel bandwidth configured in the low band.  NOTE 3: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 5th transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.  NOTE 4: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that in MHz and  with carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the lower band. | | | | | | | | | | | | |

Table 6.2.5-2 Uplink configuration for the low band (exceptions)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 100 MHz |
| n8 | n41 | - | 16 | 25 | 25 | - | - | 25 | 25 | 25 | 25 | 25 |
| n79 | - | - | - | - | - | - | 25 | 25 | 25 | 25 | 25 |

## 6.3 CA\_n40A-n41A-n79A

### 6.3.1 Operating bands for CA

Table 6.3.1-1: 3DL Inter-band CA operating bands

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

### 6.3.2 Channel bandwidths per operating band for CA

Table 6.3.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **100** | **Bandwidth combination set** |
| CA\_n40A-n41A-n79A | - | n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| CA\_n3A-n41A-n79A | - | n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  | 1 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |

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

### 6.3.3 Co-existence studies

Table 6.3.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n40 and n41 will fall into Band n79. However, this harmonic issue has already addressed in CA\_n40-n79 and CA\_n41-n79.

Table 6.3.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 |  |  |

Table 6.3.3-2 gives harmonic mixing issue for CA with Band n40, n41 and n79. It is seen that there may be 2nd harmonic mixing issue for the band combination of n40, n49 and n79. However, this harmonic mixing issue has already addressed in CA\_n40-n79 and CA\_n41-n79.

Table 6.3.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 |  |  |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.3.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band X, Y and Z, the ΔTIB,c and ΔRIB,c values are shown in table 6.3.4-1 and table 6.3.4-2, respectively.

Table 6.3.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.3.4-2: ΔRIB,c for 3DL aggregation

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

### 6.3.5 REFSENS requirements

Compared to its fall back modes, there are no additional MSD requirements for this band combination.

## 6.4 CA\_n1A-n3A-n78A

### 6.4.1 Operating bands for CA

Table 6.4.1-1: 3DL Inter-band CA operating bands

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

### 6.4.2 Channel bandwidths per operating band for CA

Table 6.4.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

### 6.4.3 Co-existence studies

Table 6.4.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n3 will fall into Band n78.

Table 6.4.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.4.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that Band n78 Tx frequency coincides with Band n3x2.

Table 6.4.3-2: Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.4.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n3 and n78, the ΔTIB,c and ΔRIB,c values are shown in table 6.4.4-1 and table 6.4.4-2, respectively.

Table 6.4.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.4.4-2: ΔRIB,c for 3DL aggregation

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

### 6.4.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

## 6.5 CA\_n39A-n41A-n79A

### 6.5.1 Operating bands for CA

Table 6.5.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n39-n41-n79 | n39 | 1880MHz | – | 1920MHz | 1880MHz | – | 1920MHz | TDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |

### 6.5.2 Channel bandwidths per operating band for CA

Table 6.5.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **100** | **Bandwidth combination set** |
| CA\_n39A-n41A-n79A | - | n39 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| CA\_n3A-n41A-n79A | - | n39 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  | 1 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |

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

### 6.5.3 Co-existence studies

Table 6.5.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n41 will fall into a small portion of Band n79. However it is not a problem for this combination since the lower part of Band n41 will not be used in the region for this combination.

Table 6.5.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n39 | 1880 | 1920 | 1880 | 1920 | 3760 | 3840 | 5640 | 5760 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 |  |  |

Table 6.5.3-2 gives harmonic mixing issue for CA with Band n39, n41 and n79. It is seen that a small part of Band n79 Tx frequency coincides with Band n41x2.

Table 6.5.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n39 | 1880 | 1920 | 1880 | 1920 | 3760 | 3840 | 5640 | 5760 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 |  |  |

For single uplink, the UE coexistence requirement is already considered for these bands in TS 38.101-1 [3].

### 6.5.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n39, n41 and n79, the ΔTIB,c and ΔRIB,c values are shown in table 6.5.4-1 and table 6.5.4-2, respectively.

Table 6.5.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_39-41-79 | n39 | 0.3 |
| n41 | 0.3 |
| n79 | 0.8 |
| NOTE: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx between n39 and n41. | | |

Table 6.5.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_39-41-79 | n39 | 0.2 |
| n41 | 0.5 |
| n79 | 0.5 |
| NOTE: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx between n39 and n41. | | |

### 6.5.5 REFSENS requirements

Compared to its fall back modes, there are no additional MSD requirements for this band combination.

## 6.6 CA\_n8A-n39A-n41A

### 6.6.1 Operating bands for CA

Table 6.6.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n8-n39-n41 | n8 | 880MHz | – | 915MHz | 925MHz | – | 960MHz | FDD |
| n39 | 1880MHz | – | 1920MHz | 1880MHz | – | 1920MHz | TDD |
| n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |

### 6.6.2 Channel bandwidths per operating band for CA

Table 6.6.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **100** | **Bandwidth combination set** |
| CA\_n8-n39A-n41A | - | n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |
| n39 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| CA\_n3A-n41A-n79A | - | n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  | 1 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |
| n39 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes |  |  |

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

### 6.6.3 Co-existence studies

Table 6.6.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 3nd order harmonic of Band n8 will fall into a small portion of Band n41.

Table 6.6.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 |  |  |
| n39 | 1880 | 1920 | 1880 | 1920 | 3760 | 3840 | 5640 | 5760 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |

Table 6.6.3-2 gives harmonic mixing issue for CA with Band n8, n39 and n41. It is seen that Band n39 Tx frequency coincides with Band n8x3.

Table 6.6.3-2: Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 |  |  |
| n39 | 1880 | 1920 | 1880 | 1920 | 3760 | 3840 | 5640 | 5760 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |

For single uplink, the UE coexistence requirement is already considered for these bands in TS 38.101-1 [3].

### 6.6.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n8, n39, n41, the ΔTIB,c and ΔRIB,c values are shown in table 6.6.4-1 and table 6.6.4-2, respectively.

Table 6.6.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_8-39-41 | n8 | 0.6 |
| n39 | 0.5 |
| n41 | 0.5 |
| NOTE: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx between n39 and n41. | | |

Table 6.6.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_8-39-41 | n8 | **0** |
| n39 | 0.2 |
| n41 | 0.2 |
| NOTE: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx between n39 and n41. | | |

### 6.6.5 REFSENS requirements

Compared to its fall back modes, there are no additional MSD requirements for this band combination.

## 6.7 CA\_n3A-n8A-n78A

### 6.7.1 Operating bands for CA

Table 6.7.1-1: 3DL Inter-band CA operating bands

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

### 6.7.2 Channel bandwidths per operating band for CA

Table 6.7.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

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

### 6.7.3 Co-existence studies

Table 6.7.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n3 and n8 will fall into Band n78 and n3 respectively. 4th harmonic of band n8 will fall into Band n78, However, these harmonic issues have already been addressed in CA\_n3-n8, CA\_n3-n78 and CA\_n8-n78 respectively.

Table 6.7.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.7.3-2 gives harmonic mixing issue for CA with Band n3, n8 and n78. According to fall back mode, there are no harmonic mixing for these band combination.

Table 6.7.3-2: Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.7.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band X, Y and Z, the ΔTIB,c and ΔRIB,c values are shown in table 6.7.4-1 and table 6.7.4-2, respectively.

Table 6.7.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.7.4-2: ΔRIB,c for 3DL aggregation

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

### 6.7.5 REFSENS requirements

Compared to its fall back modes, there are no additional MSD requirements for this band combination

## 6.8 CA\_n66-n70-n71

### 6.8.1 Operating bands for CA

Table 6.8.1-1: 3DL Inter-band CA operating bands

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

### 6.8.2 Channel bandwidths per operating band for CA

Table 6.8.2-1: Supported channel bandwidths per CA combination for 3DL Inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA operating / channel bandwidth [MHz]** | | | | | | | | | | | | | | | | |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n66A-n70A-n71A | - | n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n66B-n70A-n71A | - | n66 | See CA\_n66B Bandwidth Combination Set 0 in Table 5.5A.1-1 in TS38.101-1 | | | | | | | | | | | | | 0 |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n66(2A)-n70A-n71A | - | n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS38.101-1 | | | | | | | | | | | | | 0 |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| NOTE: This UE channel bandwidth is applicable only to downlink. | | | | | | | | | | | | | | | | |

### 6.8.3 UE co-existence studies

Tables 6.8.3-1 and 2 summarize frequency ranges where harmonics and/or harmonics mixing occur for CA\_n66-n70-n71.

Table 6.8.3-1: Impact of UL/DL Harmonic

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **nth Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | **DL Low Band Edge** | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 |  |  |
| n70 | 1695 | 1710 | 1995 | 2020 | 3390 | 3420 | 5085 | 5130 |  |  |
| n71 | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 |  |  |

Based on the table above, there is 3rd harmonic relation between n71 UL and n70 DL. However, this relation is already specified in CA\_n70A-n71A so no additional requirements are needed for higher order CA.

Table 6.8.3-2: Impact of UL/DL Harmonic mixing

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **mth Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n66 | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 |  |  |
| n70 | 1695 | 1710 | 1995 | 2020 | 3990 | 4040 | 5985 | 6060 |  |  |
| n71 | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 |  |  |

Based on the table above, the is no harmonic mixing relation.

### 6.8.4 ∆TIB and ∆RIB values

For CA\_n66-n70-n71, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 6.8.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n66-n70-n71 | n66 | 0.5 |
| n70 | 0.5 |
| n71 | 0.6 |

Table 6.8.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n66-n70-n71 | n66 | 0 |
| n70 | 0 |
| n71 | 0 |

### 6.8.5 REFSENS requirements

Specific REFSENS requirement due to 3rd harmonic for CA\_n70-n71 has already been accounted in two band CA combination CA\_n70A-n71A.

## 6.9 CA\_n28-n78-n257

### 6.9.1 Operating bands for CA

Table 6.9.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n78-n257 | n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

### 6.9.2 Channel bandwidths per operating band for CA

Table 6.9.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

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

### 6.9.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

### 6.9.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n28, n78 and n257, the ΔTIB,c and ΔRIB,c values are shown in table 6.9.4-1 and table 6.9.4-2, respectively.

Table 6.9.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.9.4-2: ΔRIB,c for 3DL aggregation

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

### 6.9.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fallback modes in TR 38.716-02-00. There is no additional REFSENS requirement for this combination.

## 6.10 CA\_n3-n77-n257

### 6.10.1 Operating bands for CA

Table 6.10.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n77-n257 | n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

### 6.10.2 Channel bandwidths per operating band for CA

Table 6.10.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

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

### 6.10.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

### 6.10.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n3, n77 and n257, the ΔTIB,c and ΔRIB,c values are shown in table 6.10.4-1 and table 6.10.4-2, respectively.

Table 6.10.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.10.4-2: ΔRIB,c for 3DL aggregation

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

### 6.10.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fallback modes in TR 38.716-02-00. There is no additional REFSENS requirement for this combination.

## 6.11 CA\_n3-n78-n257

### 6.11.1 Operating bands for CA

Table 6.11.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n78-n257 | n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

### 6.11.2 Channel bandwidths per operating band for CA

Table 6.11.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

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

### 6.11.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

### 6.11.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n3, n78 and n257, the ΔTIB,c and ΔRIB,c values are shown in table 6.11.4-1 and table 6.11.4-2, respectively.

Table 6.11.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.11.4-2: ΔRIB,c for 3DL aggregation

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

### 6.11.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fallback modes in TR 38.716-02-00. There is no additional REFSENS requirement for this combination.

## 6.12 CA\_n28-n77-n257

### 6.12.1 Operating bands for CA

Table 6.12.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n77-n257 | n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

### 6.12.2 Channel bandwidths per operating band for CA

Table 6.12.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

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

### 6.12.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

### 6.12.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n28, n77 and n257, the ΔTIB,c and ΔRIB,c values are shown in table 6.12.4-1 and table 6.12.4-2, respectively.

Table 6.12.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.12.4-2: ΔRIB,c for 3DL aggregation

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

### 6.12.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fallback modes in TR 38.716-02-00. There is no additional REFSENS requirement for this combination.

## 6.13 CA\_n3-n28-n77

### 6.13.1 Operating band for CA

Table 6.13.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n28-n77 | n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |

### 6.13.2 Channel bandwidths per operating band for CA

Table 6.13.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **100** | **Maximum aggregated bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n28A-n77A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 210 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n41 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |
| n79 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes |

### 6.13.3 Co-existence studies

Table 6.13.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that there is 5th harmonic issue but it has already captured in the fallback CA in TR 38.716-02-00.

Table 6.13.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 | 8550 | 8925 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 | 3515 | 3740 |
| n77 | 3300 | 4200 | 3300 | 4200 | 6600 | 8400 | 9900 | 12600 | 13200 | 16800 | 16500 | 21000 |

Table 6.13.3-2 gives harmonic mixing issue for CA with Band n3, n28 and n77. It can be seen that there is 2th harmonic mixing issue but it is considered in the fallback CA.

Table 6.13.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n77 | 3300 | 4200 | 3300 | 4200 | 6600 | 8400 | 9900 | 12600 | 13200 | 16800 |

### 6.13.4 ∆TIB and ∆RIB values

For CA\_n3-n28-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 6.13.4-1: ΔTIB,c

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

Table 6.13.4: ΔRIB

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

### 6.13.5 REFSENS requirements

Based on 6.13.3, there are no additional MSD requirements for this band combination.

## 6.14 CA\_n3-n28-n257

### 6.14.1 Operating band for CA

Table 6.14.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n28-n257 | n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

### 6.14.2 Channel bandwidths per operating band for CA

Table 6.14.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| **NR CA configuration / Bandwidth combination set** | | | | | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25 MHz** | **30 MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **Maximum Aggregated bandwidth**  **[MHz]** | **Bandwidth combination set** |
| CA\_n3A-n28A-n257A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 450 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n3A-n28A-n257D | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 450 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| n257 | See CA\_n257D BCS0 in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n28A-n257G | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 250 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| n257 | See CA\_n257G BCS0 in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n28A-n257H | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 350 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| n257 | See CA\_n257H BCS0 in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n3A-n28A-n257I | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 450 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| n257 | See CA\_n257I BCS0 in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

### 6.14.3 Co-existence studies

Table 6.14.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that there is no harmonic issues.

Table 6.14.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n257 | 26500 | 29500 | 26500 | 29500 | 53000 | 59000 | 79500 | 88500 | 106000 | 118000 |

Table 6.14.3-2 gives harmonic mixing issue for CA with Band n3, n28 and n257. It can be seen that there is no harmonic mixing issue.

Table 6.14.3-2: Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th harmonic** | | **6th harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 | 9025 | 9400 | 10830 | 11280 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 | 3790 | 4015 | 4548 | 4818 |
| n257 | 26500 | 29500 | 26500 | 29500 | 53000 | 59000 | 79500 | 88500 | 106000 | 118000 | 132500 | 147500 | 159000 | 177000 |

### 6.14.4 ∆TIB and ∆RIB values

For CA\_n3-n28-n257, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 6.14.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3-n28-n257 | n3 | 0.3 |
| n28 | 0.3 |
| n257 | 0 |

Table 6.14.4-2: ΔRIB

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_n3-n28-n257 | n3 | 0 |
| n28 | 0 |
| n257 | 0 |

### 6.14.5 REFSENS requirements

Based on 6.14.3, there are no additional MSD requirements for this band combination.

## 6.15 CA\_n3A\_n40A-n41A

### 6.15.1 Operating bands for CA

**Table 6.15.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3A\_n40A-n41A | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

### 6.15.2 Channel bandwidths per operating band for CA

Table 6.15.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

### 6.15.3 Co-existence studies

Table 6.15.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL.

**Table 6.15.3-1: Harmonic Interference for 3DLs/1UL**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 |  |  |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |

Table 6.15.3-2 gives harmonic mixing issue for CA with Band n3, n40 and n41.

**Table 6.15.3-2 Harmonic mixing for 3DLs/1UL**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 |  |  |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |

It can been that there are no hormonic interference and harmonic mixing problem for CA\_n3A\_n40A-n41A

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.15.4 ∆TIB and ∆RIB values

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

Table 6.15.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n3A\_n40A-n41A | n3 | 0.5 |
| n40 | 0.5 |
| n41 | 0.51 |
| 0.82 |
| NOTE 1: Applicable for the frequency range of 2515-2690 MHz.  NOTE 2: Applicable for the frequency range of 2496-2515 MHz.  NOTE 3: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band 40 and 41. | | |

**Table 6.15.4-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB [dB] |
| --- | --- | --- |
| CA\_n3A\_n40A-n41A | n3 | 0 |
| n40 | 0 |
| n41 | 01 |
| 0.52 |
| NOTE 1: Applicable for the frequency range of 2515-2690 MHz.  NOTE 2: Applicable for the frequency range of 2496-2515 MHz.  NOTE 3: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band 40 and 41. | | |

### 6.15.5 MSD

According the co-existing studies, there is no need to specify additional MSD requirement for this UL CA configuration.

## 6.16 CA\_n77-n79-n257

### 6.16.1 Operating bands for CA

Table 6.16.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n77-n79-n257 | n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

### 6.16.2 Channel bandwidths per operating band for CA

Table 6.16.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA configuration** | **Uplink CA config** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25 MHz** | **30 MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **Bandwidth combination set** |
| CA\_n77-n79A-n257A | - | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n77-n79A-n257G | CA\_n257G | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n77-n79A-n257H | CA\_n257G  CA\_n257H | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G and n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n77-n79A-n257I | CA\_n257G  CA\_n257H  CA\_n257I | n77 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G, n257H, and n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

### 6.16.3 Co-existence studies

Co-existence studies can be omitted because harmonic interference from n77 to n79 and from n79 to n77 have been already studied for NR CA n77-n79 as described in [6], and interference between FR1 bands and FR2 band are negligible.

### 6.16.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n77, n79 and n257, the ΔTIB,c and ΔRIB,c values are shown in table 6.16.4-1 and table 6.16.4-2, respectively. The ΔTIB,c and ΔRIB,c values are derived from [6].

Table 6.16.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.16.4-2: ΔRIB,c for 3DL aggregation

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

### 6.16.5 REFSENS requirements

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

## 6.17 CA\_n78-n79-n257

### 6.17.1 Operating bands for CA

Table 6.17.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n78-n79-n257 | n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

### 6.17.2 Channel bandwidths per operating band for CA

Table 6.17.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| **NR CA configuration** | **NR Uplink CA configuration** | **NR Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25 MHz** | **30 MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100 MHz** | **200 MHz** | **400 MHz** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n78-n79A-n257A | - | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |
| CA\_n78-n79A-n257G | CA\_n257G | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n78-n79A-n257H | CA\_n257G  CA\_n257H | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G and n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |
| CA\_n78-n79A-n257I | CA\_n257G  CA\_n257H  CA\_n257I | n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |  |  |
| n257 | See CA\_n257G, n257H, and n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | |

### 6.17.3 Co-existence studies

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

### 6.17.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n78, n79 and n257, the ΔTIB,c and ΔRIB,c values are shown in table 6.17.4-1 and table 6.17.4-2, respectively. The ΔTIB,c and ΔRIB,c values are derived from TR 37.865-01-01.

Table 6.17.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.17.4-2: ΔRIB,c for 3DL aggregation

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

### 6.17.5 REFSENS requirements

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

## 6.18 CA\_n1A-n3A-n8A

### 6.18.1 Operating bands for CA

Table 6.18.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n8 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |

### 6.18.2 Channel bandwidths per operating band for CA

Table 6.18.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n3A-n8A | - | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

### 6.18.3 Co-existence studies

Table 6.18.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n8 will fall into Band n3.

Table 6.18.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 |

Table 6.18.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that Band n1 Tx frequency coincides with Band n8x2.

Table 6.18.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.18.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n3 and n8, the ΔTIB,c and ΔRIB,c values are shown in table 6.18.4-1 and table 6.18.4-2, respectively. Values are derived from LTE CA\_1-3-8.

Table 6.18.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n8 | n1 | 0.3 |
| n3 | 0.3 |
| n8 | 0.3 |

Table 6.18.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n8 | n1 | **0** |
| n3 | **0** |
| n8 | **0** |

### 6.18.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

## 6.19 CA\_n1A-n8A-n78A

### 6.19.1 Operating bands for CA

Table 6.19.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n8-n78 | n1 | 1920MHz | – | 1980MHz | 2110MHz | – | 2170MHz | FDD |
| n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

### 6.19.2 Channel bandwidths per operating band for CA

Table 6.19.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n8A-n78A | - | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| NOTE: This UE channel bandwidth is optional in this release of the specification. | | | | | | | | | | | | | | | | |

### 6.19.3 Co-existence studies

Table 6.19.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.19.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.18.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that Band n1 Tx frequency coincides with Band n8x2 and that Band n78 Tx frequency coincides with Band n8x4.

Table 6.19.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.19.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n8 and n78, the ΔTIB,c and ΔRIB,c values are shown in table 6.19.4-1 and table 6.19.4-2, respectively. Values are derived from DC\_1-8\_n78.

Table 6.19.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n8-n78 | n1 | 0.3 |
| n8 | 0.6 |
| n78 | 0.8 |

Table 6.19.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n8-n78 | n1 | 0 |
| n8 | 0.2 |
| n78 | 0.5 |

### 6.19.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

## 6.20 CA\_n1A-n3A-n28A

### 6.20.1 Operating bands for CA

Table 6.20.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n28 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

### 6.20.2 Channel bandwidths per operating band for CA

Table 6.20.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n3A-n28A | - | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes1 |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| NOTE: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz. | | | | | | | | | | | | | | | | |

### 6.20.3 Co-existence studies

Table 6.20.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 3rd order harmonic of Band n28 will fall into Band n1.

Table 6.20.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |

Table 6.20.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues can be seen.

Table 6.20.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.20.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n3 and n28, the ΔTIB,c and ΔRIB,c values are shown in table 6.20.4-1 and table 6.20.4-2, respectively. Values are derived from LTE CA\_1-3-28.

Table 6.20.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n28 | n1 | 0.3 |
| n3 | 0.3 |
| n28 | 0.6 |

Table 6.20.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n28 | n1 | 0 |
| n3 | 0 |
| n28 | 0.2 |

### 6.20.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

## 6.21 CA\_n1A-n28A-n78A

### 6.21.1 Operating bands for CA

Table 6.21.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n28-n78 | n1 | 1920MHz | – | 1980MHz | 2110MHz | – | 2170MHz | FDD |
| n28 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

### 6.21.2 Channel bandwidths per operating band for CA

Table 6.21.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1A-n28A-n78A | - | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes2 |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes2 |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| NOTE 1: This UE channel bandwidth is optional in this release of the specification.  NOTE 2: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz. | | | | | | | | | | | | | | | | |

### 6.21.3 Co-existence studies

Table 6.21.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.21.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.21.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.21.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.21.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n28 and n78, the ΔTIB,c and ΔRIB,c values are shown in table 6.21.4-1 and table 6.21.4-2, respectively. Values are derived from DC\_1-28\_n78.

Table 6.21.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n28-n78 | n1 | 0.3 |
| n28 | 0.6 |
| n78 | 0.8 |

Table 6.21.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n28-n78 | n1 | 0 |
| n28 | 0.2 |
| n78 | 0.5 |

### 6.21.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

## 6.22 CA\_n3A-n28A-n78A

### 6.22.1 Operating bands for CA

Table 6.22.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n28-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

### 6.22.2 Channel bandwidths per operating band for CA

Table 6.22.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n3A-n28A-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes2 |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes2 |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes1 | Yes |
| NOTE 1: This UE channel bandwidth is optional in this release of the specification.  NOTE 2: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz. | | | | | | | | | | | | | | | | |

### 6.22.3 Co-existence studies

Table 6.22.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n3 will fall into Band n78.

Table 6.22.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.22.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that Band n78 Tx frequency coincides with Band n3x2.

Table 6.22.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.22.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n3, n28 and n78, the ΔTIB,c and ΔRIB,c values are shown in table 6.22.4-1 and table 6.22.4-2, respectively. Values are derived from DC\_3-28\_n78.

Table 6.22.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.22.4-2: ΔRIB,c for 3DL aggregation

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

### 6.22.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

## 6.23 CA\_n1A-n3A-n41A

### 6.23.1 Operating bands for CA

Table 6.23.1-1: 3DL Inter-band CA operating bands

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

### 6.23.2 Channel bandwidths per operating band for CA

Table 6.23.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

### 6.23.3 Co-existence studies

Table 6.23.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL.

Table 6.23.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 |  |  |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |

Table 6.23.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL.

Table 6.23.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 |  |  |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 |  |  |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 |  |  |

For this band combination, there is no harmonic and harmonic mixing issue.

### 6.23.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n3 and n41, the ΔTIB,c and ΔRIB,c values are shown in table 6.23.4-1 and table 6.23.4-2, respectively.

Table 6.23.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.23.4-2: ΔRIB,c for 3DL aggregation

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

### 6.23.5 REFSENS requirements

There is no additional MSD requirements for CA\_n1-n3-n41.

## 6.24 CA\_n29-n66-n70

### 6.24.1 Operating bands for CA

Table 6.24.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Band | NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| CA\_n29-n66-n70 | n29 | N/A | | | 717 | – | 728 | SDL |
| n66 | 1710 | – | 1780 | 2110 | – | 2200 | FDD |
| n70 | 1695 | – | 1710 | 1995 | – | 2020 | FDD |

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

Table 6.24.2-1: Supported channel bandwidths per CA combination for 3DL Inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA operating / channel bandwidth [MHz]** | | | | | | | | | | | | | | | | |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n29A-n66A-n70A | - | n29 | 15 | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| CA\_n29A-n66B-n70A | - | n29 | 15 | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | See CA\_n66B Bandwidth Combination Set 0 in Table 5.5A.1-1 in TS38.101-1 | | | | | | | | | | | | |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| CA\_n29A-n66(2A)-n70A | - | n29 | 15 | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS38.101-1 | | | | | | | | | | | | |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| NOTE: This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | |

#### 6.24.3 UE co-existence studies

Table 6.24.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n29-n66-n70.

Table 6.24.3-1: Impact of UL/DL Harmonic

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **nth Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | **DL Low Band Edge** | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n29 | N/A | N/A | 717 | 728 | N/A | N/A | N/A | N/A | N/A | N/A |
| n66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 |  |  |
| n70 | 1695 | 1710 | 1995 | 2020 | 3390 | 3420 | 5085 | 5130 |  |  |

Based on the table above, there is no harmonic relation

Table 6.24.3-2: Impact of UL/DL Harmonic mixing

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **mth Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n29 | N/A | N/A | 717 | 728 | 1434 | 1456 | 2151 | 2184 | N/A | N/A |
| 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 1710 |  |  |
| n70 | 1695 | 1710 | 1995 | 2020 | 3990 | 4040 | 5985 | 6060 |  |  |

Based on the table above, the is no harmonic mixing relation.

#### 6.24.4 ∆TIB and ∆RIB values

For CA\_n29-n66-n70, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 6.24.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n29-n66-n70 | n29 | 0 |
| n66 | 0.5 |
| n70 | 0.5 |

Table 6.24.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n29-n66-n70 | n29 | 0 |
| n66 | 0 |
| n70 | 0 |

#### 6.24.5 REFSENS requirements

REFSENS is defined in TS38.101-1 Table 7.3A.2.4-1, because n29A is an SDL band.

Table 6.24.5-1: Reference sensitivity for SDL bands

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band/Channel bandwidth | | | | | | | | | | | | | | |
| NR CA Configuration | NR band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB |
| CA\_n29A-n66A-n70A | n29 | 15 | -97.0 | -93.8 |  |  |  |  |  |  |  |  |  |  |
| 30 |  | -94.1 |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |  | -90.1 |  |  |  |  |  |
| 30 |  | -96.6 | -94.6 | -93.5 |  |  | -90.2 |  |  |  |  |  |
| 60 |  | -97.0 | -94.9 | -93.7 |  |  | -90.4 |  |  |  |  |  |
| n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 |  |  |  |  |  |  |  |
| 30 |  | -97.1 | -95.1 | -94.0 | -92.8 |  |  |  |  |  |  |  |
| 60 |  | -97.5 | -95.4 | -94.2 | -93.0 |  |  |  |  |  |  |  |
| CA\_n29A-n66B-n70A | n29 | 15 | -97.0 | -93.8 |  |  |  |  |  |  |  |  |  |  |
| 30 |  | -94.1 |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |  | -90.1 |  |  |  |  |  |
| 30 |  | -96.6 | -94.6 | -93.5 |  |  | -90.2 |  |  |  |  |  |
| 60 |  | -97.0 | -94.9 | -93.7 |  |  | -90.4 |  |  |  |  |  |
| n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 |  |  |  |  |  |  |  |
| 30 |  | -97.1 | -95.1 | -94.0 | -92.8 |  |  |  |  |  |  |  |
| 60 |  | -97.5 | -95.4 | -94.2 | -93.0 |  |  |  |  |  |  |  |
| CA\_n29A-n66(2A)-n70A | n29 | 15 | -97.0 | -93.8 |  |  |  |  |  |  |  |  |  |  |
| 30 |  | -94.1 |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |  | -90.1 |  |  |  |  |  |
| 30 |  | -96.6 | -94.6 | -93.5 |  |  | -90.2 |  |  |  |  |  |
| 60 |  | -97.0 | -94.9 | -93.7 |  |  | -90.4 |  |  |  |  |  |
| n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 |  |  |  |  |  |  |  |
| 30 |  | -97.1 | -95.1 | -94.0 | -92.8 |  |  |  |  |  |  |  |
| 60 |  | -97.5 | -95.4 | -94.2 | -93.0 |  |  |  |  |  |  |  |
| NOTE 1: The transmitter shall be set to PUMAX, as defined in subclause 6.2.4.  NOTE 2: Four Rx antenna ports shall be the baseline for this operating band, except for two Rx vehicular UE. | | | | | | | | | | | | | | |

## 6.25 CA\_n29-n66-n70

#### 6.25.1 Operating bands for CA

Table 6.25.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Band | NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| CA\_n29-n66-n70 | n29 | N/A | | | 717 | – | 728 | SDL |
| n66 | 1710 | – | 1780 | 2110 | – | 2200 | FDD |
| n70 | 1695 | – | 1710 | 1995 | – | 2020 | FDD |

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

Table 6.25.2-1: Supported channel bandwidths per CA combination for 3DL Inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA operating / channel bandwidth [MHz]** | | | | | | | | | | | | | | | | |
| **NR CA Configuration** | **UL Configuration** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n29A-n66A-n70A | - | n29 | 15 | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| CA\_n29A-n66B-n70A | - | n29 | 15 | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | See CA\_n66B Bandwidth Combination Set 0 in Table 5.5A.1-1 in TS38.101-1 | | | | | | | | | | | | |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| CA\_n29A-n66(2A)-n70A | - | n29 | 15 | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | See CA\_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS38.101-1 | | | | | | | | | | | | |
| n70 | 15 | Yes | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes1 | Yes1 |  |  |  |  |  |  |  |
| NOTE: This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | |

#### 6.25.3 UE co-existence studies

Table 6.25.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n29-n66-n70.

Table 6.25.3-1: Impact of UL/DL Harmonic

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **nth Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | **DL Low Band Edge** | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n29 | N/A | N/A | 717 | 728 | N/A | N/A | N/A | N/A | N/A | N/A |
| n66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 |  |  |
| n70 | 1695 | 1710 | 1995 | 2020 | 3390 | 3420 | 5085 | 5130 |  |  |

Based on the table above, there is no harmonic relation

Table 6.25.3-2: Impact of UL/DL Harmonic mixing

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **mth Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n29 | N/A | N/A | 717 | 728 | 1434 | 1456 | 2151 | 2184 | N/A | N/A |
| 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 1710 |  |  |
| n70 | 1695 | 1710 | 1995 | 2020 | 3990 | 4040 | 5985 | 6060 |  |  |

Based on the table above, the is no harmonic mixing relation.

#### 6.25.4 ∆TIB and ∆RIB values

For CA\_n29-n66-n70, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 6.25.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n29-n66-n70 | n66 | 0.5 |
| n70 | 0.5 |

Table 6.25.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n29-n66-n70 | n66 | 0 |
| n70 | 0 |

#### 6.25.5 REFSENS requirements

REFSENS is defined in TS38.101-1 Table 7.3A.2.4-1, because n29A is an SDL band.

Table 6.25.5-1: Reference sensitivity for SDL bands

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band/Channel bandwidth | | | | | | | | | | | | | | |
| NR CA Configuration | NR band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB |
| CA\_n29A-n66A-n70A | n29 | 15 | -97.0 | -93.8 |  |  |  |  |  |  |  |  |  |  |
| 30 |  | -94.1 |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |  | -90.1 |  |  |  |  |  |
| 30 |  | -96.6 | -94.6 | -93.5 |  |  | -90.2 |  |  |  |  |  |
| 60 |  | -97.0 | -94.9 | -93.7 |  |  | -90.4 |  |  |  |  |  |
| n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 |  |  |  |  |  |  |  |
| 30 |  | -97.1 | -95.1 | -94.0 | -92.8 |  |  |  |  |  |  |  |
| 60 |  | -97.5 | -95.4 | -94.2 | -93.0 |  |  |  |  |  |  |  |
| CA\_n29A-n66B-n70A | n29 | 15 | -97.0 | -93.8 |  |  |  |  |  |  |  |  |  |  |
| 30 |  | -94.1 |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |  | -90.1 |  |  |  |  |  |
| 30 |  | -96.6 | -94.6 | -93.5 |  |  | -90.2 |  |  |  |  |  |
| 60 |  | -97.0 | -94.9 | -93.7 |  |  | -90.4 |  |  |  |  |  |
| n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 |  |  |  |  |  |  |  |
| 30 |  | -97.1 | -95.1 | -94.0 | -92.8 |  |  |  |  |  |  |  |
| 60 |  | -97.5 | -95.4 | -94.2 | -93.0 |  |  |  |  |  |  |  |
| CA\_n29A-n66(2A)-n70A | n29 | 15 | -97.0 | -93.8 |  |  |  |  |  |  |  |  |  |  |
| 30 |  | -94.1 |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |  | -90.1 |  |  |  |  |  |
| 30 |  | -96.6 | -94.6 | -93.5 |  |  | -90.2 |  |  |  |  |  |
| 60 |  | -97.0 | -94.9 | -93.7 |  |  | -90.4 |  |  |  |  |  |
| n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 |  |  |  |  |  |  |  |
| 30 |  | -97.1 | -95.1 | -94.0 | -92.8 |  |  |  |  |  |  |  |
| 60 |  | -97.5 | -95.4 | -94.2 | -93.0 |  |  |  |  |  |  |  |
| NOTE 1: The transmitter shall be set to PUMAX, as defined in subclause 6.2.4. | | | | | | | | | | | | | | |

## 6.26 CA\_ n41-n66-n71

#### 6.26.1 Operating bands for CA

Table 6.26.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n41 | 2469 MHz | – | 2690 MHz | 2469 MHz | – | 2690 MHz | TDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 6.26.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA configuration | NR Uplink CA configuration | NR  Band | SCS  (kHz) | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25  MHz | 30  MHz | 40  MHz | 50  MHz | 60  MHz | 80  MHz | 90  MHz | 100  MHz | ****Maximum Aggregated bandwidth****  ****[MHz]**** | ****Bandwidth combination set**** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n25A-n41A-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 140 | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n25A-n41(2A)-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 230 | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n41 | See CA\_n41(2A) Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.2-1 | | | | | | | | | | | | |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n25A-n41C-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 220 | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n41 | See CA\_n41C Bandwidth Combination Set 0 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

#### 6.26.3 UE co-existence studies

Table 6.26.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n25-n41-n71.

**Table 6.26.3-1: Impact of UL/DL Harmonic**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| **n25** | 1850 | 1915 | 1930 | 1995 | 3700 | 3830 | 5550 | 5985 | 7400 | 7660 |
| **n41** | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| **n71** | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | 2652 | 2792 |

Band n71 uplink 4th harmonic hits band n41 downlink.

**Table 6.26.3-2: Impact of UL/DL Harmonic mixing**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** |
| **n25** | 1850 | 1915 | 1930 | 1995 | 3860 | 3990 | 5790 | 5985 | 7720 | 7980 |
| **n41** | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| **n71** | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | 2468 | 2608 |

Band n41 is at 4th receiver harmonic of band n71 no MSD is necessary.

#### 6.26.4 ∆TIB and ∆RIB values

For CA\_n25-n41-n71, the ΔTIB,c and ΔRIB,c values are derived from fallback CAs using max operation as given in the tables below.

Table 6.26.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n41-n71 | n25 | 0.5 |
| n41 | 0.5 |
| n71 | 0.6 |

Table 6.26.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n41-n71 | n25 | 0 |
| n41 | 0 |
| n71 | 0.2 |

#### 6.26.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

## 6.27 CA\_ n41-n66-n71

#### 6.27.1 Operating bands for CA

Table 6.27.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n41 | 2469 MHz | – | 2690 MHz | 2469 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 6.27.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| **NR CA configuration** | **NR Uplink CA configuration** | **NR**  **Band** | **SCS**  **(kHz)** | **5**  **MHz** | **10**  **MHz** | **15**  **MHz** | **20**  **MHz** | **25**  **MHz** | **30**  **MHz** | **40**  **MHz** | **50**  **MHz** | **60**  **MHz** | **80**  **MHz** | **90**  **MHz** | **100**  **MHz** | **Maximum Aggregated bandwidth**  **[MHz]** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n41A-n66A-n71A | - | n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  | 160 | 0 |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n41(2A)-n66A-n71A | - | n41 | See CA\_n41(2A) Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.2-1 | | | | | | | | | | | | | 250 | 0 |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n41C-n66A-n71A | - | n41 | See CA\_n41C Bandwidth Combination Set 0 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | | 240 | 0 |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

#### 6.27.3 UE co-existence studies

Table 6.27.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_41X-71Y.

**Table 6.27.3-1: Impact of UL/DL Harmonic**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| **n41** | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| **n66** | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | 6840 | 7120 |
| **n71** | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | 2652 | 2792 |

Band n71 uplink 4th harmonic hits band n41 downlink.

**Table 6.27.3-2: Impact of UL/DL Harmonic mixing**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** |
| **n41** | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| **n66** | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 8440 | 8800 |
| **n71** | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | 2468 | 2608 |

Band n41 is at 4th receiver harmonic of band n71 no MSD is necessary.

#### 6.27.4 ∆TIB and ∆RIB values

For CA\_n41-n66-n71, the ΔTIB,c and ΔRIB,c values are derived from fallback CAs using max operation given in the tables below.

Table 6.27.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n41-n66-n71 | n41 | 0.81 |
| 1.32 |
| n66 | 0.5 |
| n71 | 0.3 |
| 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 6.27.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n41-n66-n71 | n41 | 0.51 |
| 12 |
| n66 | 0.5 |
| n71 | 0 |
| 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. | | |

#### 6.27.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

## 6.28 CA\_n25-n66-n78

### 6.28.1 Operating bands for CA

Table 6.28.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n25-n66-n78 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

### 6.28.2 Channel bandwidths per operating band for CA

Table 6.28.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

### 6.28.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fall-back modes.

### 6.28.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n25, n66 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.28.4-1 and table 6.28.4-2, respectively.

Table 6.28.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.28.4-2: ΔRIB,c for 3DL aggregation

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n66-n78 | n25 | 0.3 |
| n66 | 0.3 |
| n78 | 0.5 |

### 6.28.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fall-back modes. There is no additional REFSENS requirement for this combination.

## 6.29 CA\_n7-n66-n78

### 6.29.1 Operating bands for CA

Table 6.29.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n66-n78 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

### 6.29.2 Channel bandwidths per operating band for CA

Table 6.29.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| n7A-n66A-n78A | - | n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes |  | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

### 6.29.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fall-back modes.

### 6.29.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n7, n66 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.29.4-1 and table 6.29.4-2, respectively.

Table 6.29.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.29.4-2: ΔRIB,c for 3DL aggregation

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

### 6.29.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fall-back modes. There is no additional REFSENS requirement for this combination.

## 6.30 CA\_n5-n66-n78

### 6.30.1 Operating bands for CA

Table 6.30.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n66-n78 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 896 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

### 6.30.2 Channel bandwidths per operating band for CA

Table 6.30.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| n5A-n66A-n78A | - | n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes |  | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

### 6.30.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fall-back modes.

### 6.30.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n7, n66 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.30.4-1 and table 6.30.4-2, respectively.

Table 6.30.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.30.4-2: ΔRIB,c for 3DL aggregation

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

### 6.30.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fall-back modes. There is no additional REFSENS requirement for this combination.

## 6.31 CA\_n7-n25-n66

### 6.31.1 Operating bands for CA

Table 6.31.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n25-n66 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD |

### 6.31.2 Channel bandwidths per operating band for CA

Table 6.x.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

### 6.31.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fall-back modes.

### 6.31.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n28, n78 and n257, the ΔTIB,c and ΔRIB,c  values are shown in table 6.31.4-1 and table 6.31.4-2, respectively.

Table 6.31.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.31.4-2: ΔRIB,c for 3DL aggregation

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

### 6.31.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fall-back modes. There is no additional REFSENS requirement for this combination.

## 6.32 CA\_n20A-n28A-n78A

### 6.32.1 Operating bands for CA

Table 6.32.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n20-n28-n78y | n20 | 832MHz | – | 862MHz | 791MHz | – | 821MHz | FDD |
| n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| NOTE y: The frequency range in band n28 is restricted for this band combination to 703-733 MHz for the UL and 758-788 MHz for the DL. | | | | | | | | |

### 6.32.2 Channel bandwidths per operating band for CA

Table 6.32.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n20A-n28A-n78A | - | n20 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

### 6.32.3 Co-existence studies

Table 6.32.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL.

Table 6.32.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| n20 | 832 | 862 | 791 | 821 | 1664 | 1724 | 2496 | 2586 | 3328 | 3448 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 |  |  |

Table 6.32.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL.

Table 6.32.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** |
| n20 | 832 | 862 | 791 | 821 | 1582 | 1642 | 2373 | 2463 | 3164 | 3284 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 |  |  |

There is a 4th harmonic interference for band n78 Rx with band n20 Tx.

For this band combination, there is no harmonic mixing issue.

### 6.32.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n20, n28 and n78, the TIB,c and RIB,c values are shown in table 6.32.4-1 and table 6.32.4-2, respectively.

Table 6.32.4-1: ΔTIB,c for 3DL aggregation

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n20-n28-n78 | n20 | 0.6 |
| n28 | 0.5 |
| n78 | 0.8 |

Table 6.32.4-2: ΔRIB,c for 3DL aggregation

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n20-n28-n78 | n20 | 0 |
| n28 | 0.2 |
| n78 | 0.5 |

### 6.32.5 REFSENS requirements

The MSD requirements due to UL harmonic interference for band n78 Rx with band n20 Tx has been specified in TS 38.101-1.

## 6.33 CA\_n1A-n7A-n28A

### 6.33.1 Operating bands for CA

Table 6.33.1-1: 3DL Inter-band CA operating bands

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

### 6.33.2 Channel bandwidths per operating band for CA

Table 6.33.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

### 6.33.3 Co-existence studies

Table 6.33.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.33.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |

Table 6.33.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It is noted that 3rd harmonics from n28 UL affects band n1 DL.

Table 6.33.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.33.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n7 and n28, the ΔTIB,c and ΔRIB,c  values are shown in table 6.33.4-1 and table 6.33.4-2, respectively. Values are derived from DC\_1-7\_n28.

Table 6.33.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.33.4-2: ΔRIB,c for 3DL aggregation

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

### 6.33.5 REFSENS requirements

Additional REFSENS requirements for band n28 UL affecting band n1 DL are already defined in Table 7.3A.4-2 of TS 38.101-1. No additional requirements are needed.

## 6.34 CA\_n1A-n7A-n78A

### 6.34.1 Operating bands for CA

Table 6.34.1-1: 3DL Inter-band CA operating bands

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

### 6.34.2 Channel bandwidths per operating band for CA

Table 6.34.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

### 6.34.3 Co-existence studies

Table 6.34.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.34.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.34.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.34.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

### 6.34.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n7 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.34.4-1 and table 6.34.4-2, respectively. Values are derived from DC\_1-7\_n78.

Table 6.34.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.34.4-2: ΔRIB,c for 3DL aggregation

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

### 6.34.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

## 6.35 CA\_n28A-n41A-n78A

6.35.1 Operating bands for CA

Table 6.35.1-1: 3DL Inter-band CA operating bands

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

6.35.2 Channel bandwidths per operating band for CA

Table 6.35.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

6.35.3 Co-existence studies

Table 6.35.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL.

Table 6.35.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.35.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL.

Table 6.35.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For this band combination, the harmonic and harmonic mixing issue have been solved by fallback combos.

6.35.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of CA\_n28-n41-n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.35.4-1 and table 6.35.4-2, respectively.

Table 6.35.4-1: ΔTIB,c for 3DL aggregation

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

Table 6.35.4-2: ΔRIB,c for 3DL aggregation

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

6.35.5 REFSENS requirements

There is no additional MSD requirements for CA\_n28-n41-n78.

## 6.36 CA\_n1A-n40A-n78A

6.36.1 Operating bands for CA

Table 6.36.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n40-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

6.36.2 Channel bandwidths per operating band for CA

Table 6.36.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n1-n40-n78 | - | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |

6.36.3 Co-existence studies

Table 6.36.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.36.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | 9200 | 9600 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.36.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.36.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | 9200 | 9600 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.36.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n40 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.36.4-1 and table 6.36.4-2, respectively. Values are same as for DC\_1\_n40-n78.

Table 6.36.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n40-n78 | n1 | 0.3 |
| n40 | 0.5 |
| n78 | 0.8 |

Table 6.36.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n40-n78 | n1 | 0 |
| n40 | 0 |
| n78 | 0.5 |

6.36.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

## 6.37 CA\_n28A-n40A-n78A

6.37.1 Operating bands for CA

Table 6.37.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n40-n78 | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

6.37.2 Channel bandwidths per operating band for CA

Table 6.37.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n28-n40-n78 | - | n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |

6.37.3 Co-existence studies

Table 6.37.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.37.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | 9200 | 9600 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.37.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. 3rd harmonic DL mixing from band n28 UL will affect band n40 DL.

Table 6.37.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n28 | 703 | 748 | 2110 | 2170 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | 9200 | 9600 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.37.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n28, n40 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.37.4-1 and table 6.37.4-2, respectively. Values are derived from DC\_28-41\_n78.

Table 6.37.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n40-n78 | n28 | 0.5 |
| n40 | 0.3 |
| n78 | 0.8 |

Table 6.37.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n28-n40-n78 | n28 | 0 |
| n40 | 0 |
| n78 | 0.5 |

6.37.5 REFSENS requirements

Harmonic mixing is already defined for CA\_n28-n40. No additional REFSENS requirements are needed to be defined.

## 6.38 CA\_n25-n66-n71

#### 6.38.1 Operating bands for CA

Table 6.38.1-1: 3DL Inter-band CA operating bands

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

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

Table 6.38.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
| CA\_n25A-n66A-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

#### 6.38.3 UE co-existence studies

Table 6.38.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n25-n41-n71.

Table 6.38.3-1: Impact of UL/DL Harmonic

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | 2nd Harmonic | | 3rd Harmonic | | 4th Harmonic | |
| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| 25 | 1850 | 1915 | 1930 | 1995 | 3700 | 3830 | 5550 | 5745 | 7400 | 7660 |
| 66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | 6840 | 7120 |
| 71 | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | 2652 | 2792 |

3rd harmonic of n71 UL will interfere n25 DL.

Table 6.38.3-2: Impact of UL/DL Harmonic mixing

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | 2nd Harmonic | | 3rd Harmonic | | 4th Harmonic | |
| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| 25 | 1850 | 1915 | 1930 | 1995 | 3860 | 3990 | 5790 | 5985 | 7720 | 7980 |
| 66 | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 8440 | 8800 |
| 71 | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | 2468 | 2608 |

3rd DL harmonic of n71 will co-inside n25 UL.

#### 6.38.4 ∆TIB and ∆RIB values

For CA\_n25-n66-n71, the ΔTIB,c and ΔRIB,c values are derived from fallback CAs using max operation as given in the tables below.

Table 6.38.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n66-n71 | n25 | 0.5 |
| n66 | 0.5 |
| n71 | 0.6 |

Table 6.38.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n66-n71 | n25 | 0.3 |
| n66 | 0.3 |
| n71 | 0.3 |

#### 6.38.5 REFSENS requirements

MSDs due to harmonic interference and harmonic mixing for band pair of n25 and n71 are already captured into specification.

## 6.39 CA\_ n25-n41-n66

#### 6.39.1 Operating bands for CA

Table 6.39.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n41 | 2469 MHz | – | 2690 MHz | 2469 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 6.39.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n25A-n41A-n66A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n25A-n41C-n66A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n41 | See CA\_n41C Bandwidth Combination Set 0 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n25A-n41(2A)-n66A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| n41 | See CA\_n41(2A) Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.2-1 | | | | | | | | | | | | |
| n66 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |

#### 6.39.3 UE co-existence studies

Table 6.39.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA\_n25-n41-n71.

**Table 6.39.3-1: Impact of UL/DL Harmonic**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | 2nd Harmonic | | 3rd Harmonic | | 4th Harmonic | |
| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| 25 | 1850 | 1915 | 1930 | 1995 | 3700 | 3830 | 5550 | 5745 | 7400 | 7660 |
| 41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| 66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | 6840 | 7120 |

No harmonic interference.

**Table 6.39.3-2: Impact of UL/DL Harmonic mixing**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | 2nd Harmonic | | 3rd Harmonic | | 4th Harmonic | |
| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| 25 | 1850 | 1915 | 1930 | 1995 | 3860 | 3990 | 5790 | 5985 | 7720 | 7980 |
| 41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| 66 | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 8440 | 8800 |

No harmonic mixing.

#### 6.39.4 ∆TIB and ∆RIB values

For CA\_n25-n41-n66, the ΔTIB,c and ΔRIB,c values are derived from fallback CAs using max operation as given in the tables below.

Table 6.39.4-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n41-n66 | n25 | 0.5 |
| n41 | 0.86 |
| 1.37 |
| n66 | 0.5 |
| NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2545-2690 MHz.  NOTE 7: The requirement is applied for UE transmitting on the frequency range of 2496-2545 MHz. | | |

Table 6.39.4-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n25-n41-n66 | n25 | 0.3 |
| n41 | 0.56 |
| 17 |
| n66 | 0.3 |
| NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2545-2690 MHz.  NOTE 7: The requirement is applied for UE transmitting on the frequency range of 2496-2545 MHz | | |

#### 6.39.5 REFSENS requirements

MSD is not required.

## 6.40 CA\_n1-n78-n257

### 6.40.1 Operating bands for CA

Table 6.40.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n78-n257 | n1 | 1920MHz | – | 1980MHz | 2110MHz | – | 2170MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

### 6.40.2 Channel bandwidths per operating band for CA

Table 6.40.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **200** | **400** | **Bandwidth combination set** |
| CA\_n1A-n78A-n257A | - | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes |  |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes |  |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  | Yes | Yes | Yes |

### 6.40.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

### 6.40.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n78 and n257, the ΔTIB,c and ΔRIB,c values are shown in tables below

Table 6.40.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n78-n257 | n1 | 0.3 |
| n78 | 0.8 |
| n257 | 0 |

Table 6.40.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n78-n257 | n1 | 0 |
| n78 | 0.5 |
| n257 | 0 |

### 6.40.5 REFSENS requirements

No additional MSD requirement is needed.

## 6.41 CA\_n1A-n3A-n7A

6.41.1 Operating bands for CA

Table 6.41.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n7 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |

6.41.2 Channel bandwidths per operating band for CA

Table 6.41.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

6.41.3 Co-existence studies

Table 6.41.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.41.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |

Table 6.41.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.41.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.41.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n1, n3 and n7, the ΔTIB,c and ΔRIB,c  values are shown in table 6.41.4-1 and table 6.41.4-2, respectively. Values are same as for DC\_1-3\_n7.

Table 6.41.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n7 | n1 | 0.6 |
| n3 | 0.6 |
| n7 | 0.6 |

Table 6.41.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n1-n3-n7 | n1 | 0 |
| n3 | 0 |
| n7 | 0 |

6.41.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

## 6.42 CA\_n3A-n7A-n28A

6.42.1 Operating bands for CA

Table 6.42.1-1: 3DL Inter-band CA operating bands

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

6.42.2 Channel bandwidths per operating band for CA

Table 6.42.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

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

6.42.3 Co-existence studies

Table 6.42.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.42.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |

Table 6.42.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.42.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.42.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n3, n7 and n28, the ΔTIB,c and ΔRIB,c  values are shown in table 6.42.4-1 and table 6.42.4-2, respectively. Values are same as for DC\_3-7\_n28.

Table 6.42.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n7-n28 | n3 | 0.5 |
| n7 | 0.5 |
| n28 | 0.3 |

Table 6.42.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n7-n28 | n3 | 0 |
| n7 | 0 |
| n28 | 0 |

6.42.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

## 6.43 CA\_n3A-n7A-n78A

6.43.1 Operating bands for CA

Table 6.43.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n7-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

6.43.2 Channel bandwidths per operating band for CA

Table 6.43.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n3A-n7A-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n3A-n7B-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n7 | See CA\_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

6.43.3 Co-existence studies

Table 6.43.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n3 will fall into a portion of Band n78.

Table 6.43.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.43.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic mixing of Band n78 Tx coincides with Band n3x2.

Table 6.43.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.43.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n3, n7 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.43.4-1 and table 6.43.4-2, respectively. Values are same as for DC\_3-7\_n78.

Table 6.43.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n7-n78 | n3 | 0.6 |
| n7 | 0.6 |
| n78 | 0.8 |

Table 6.43.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n7-n78 | n3 | 0.2 |
| n7 | 0.2 |
| n78 | 0.5 |

6.43.5 REFSENS requirements

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

## 6.44 CA\_n3A-n28A-n78A

6.44.1 Operating bands for CA

Table 6.44.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n28-n78 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

6.44.2 Channel bandwidths per operating band for CA

Table 6.44.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **80** | **90** | **100** | **Bandwidth combination set** |
| CA\_n7A-n28A-n78A | - | n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n7B-n28A-n78A | - | n7 | See CA\_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | 0 |
| n28 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

6.44.3 Co-existence studies

Table 6.44.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that there are no issues.

Table 6.44.3-1: Harmonic Interference for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.44.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that there are no issues.

Table 6.44.3-2 Harmonic mixing for 3DLs/1UL

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | |
| **Band** | **UL Low Band Edge** | UL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.44.4 ∆TIB,c and ∆RIB,c values

For three simultaneous DLs and one UL of Band n3, n7 and n78, the ΔTIB,c and ΔRIB,c  values are shown in table 6.x.4-1 and table 6.x.4-2, respectively. Values are same as for DC\_7-28\_n78.

Table 6.44.4-1: ΔTIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n7-n28-n78 | n7 | 0.3 |
| n28 | 0.3 |
| n78 | 0.8 |

Table 6.44.4-2: ΔRIB,c for 3DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n7-n28-n78 | n7 | 0 |
| n28 | 0 |
| n78 | 0.5 |

6.44.5 REFSENS requirements

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

Annex A:  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Date** | **Meeting** | **TDoc.** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2019-04 | 3GPP RAN4#90bis | R4-1903260 |  |  |  | Initial TR skeleton | 0.0.1 |
| 2019-05 | 3GPP RAN4#91 | R4-1905398 |  |  |  | TR 38.716-03-01 v0.1.0, the update is based on the following contributions,  R4-1903261, TP for TR 38.xxx: interference analysis for CA\_n3A-n41A-n79A with 1 uplink, CATT  R4-1903262, TP for TR 38.xxx: interference analysis for CA\_n8A-n41A-n79A with 1 uplink, CATT | 0.1.0 |
| 2019-08 | 3GPP RAN4#92 | R4-1908373 |  |  |  | TR 38.716-03-01 v0.2.0, the update is based on the following contributions,  R4-1905400 TP for 38.716-03-01: UE requirements for CA\_n3A-n41A-n79A, CATT  R4-1907456 TP for 38.716-03-01: UE requirements for CA\_n3A-n41A-n79A, CATT  R4-1905401 TP for 38.716-03-01: UE requirements for CA\_n8A-n41A-n79A, CATT  R4-1905623 TP for TR38.716-03-01:1 band UL for CA\_40A-n41A-n79A, ZTE  R4-1906106 TP for TR 38.716-03-01: CA\_n1A-n3A-n78A with 1UL, China Telecom | 0.2.0 |
| 2019-10 | 3GPP RAN4#92bis | R4-1911202 |  |  |  | TR 38.716-03-01 v0.3.0, the update is based on the following contributions,  R4-1908256, TP for TR 38.716-03-01: CA\_n28-n78-n257, KDDI  R4-1908257, TP for TR 38.716-03-01: CA\_n3-n77-n257, KDDI  R4-1908258, TP for TR 38.716-03-01: CA\_n3-n78-n257, KDDI  R4-1908259, TP for TR 38.716-03-01: CA\_n28-n77-n257, KDDI  R4-1908414, TP for 38.716-03-01: interference analysis for CA\_n39A-n41A-n79A, CATT  R4-1908415, TP for 38.716-03-01: UE requirements for CA\_n8A-n39A-n41A, CATT  R4-1908560, TP for TR38.716-03-01 1 band UL for CA\_n3-n8-n78, Nubia Technology  R4-1908695, TP for TR38.716-03-01: Requirements for CA\_n66A-n70A-n71A, CA\_n66B-n70A-n71A, and CA\_n66(2A)-n70A-n71A, DISH | 0.3.0 |
| 2019-11 | 3GPP RAN4#93 | R4-1913757 |  |  |  | TR 38.716-03-01 v0.4.0, the update is based on the following contributions,  [R4-1911159](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911159.zip), TP for TR 38.716-03-01: NR CA\_n3-n28-n77, SoftBank Corp  [R4-1911160](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911160.zip) TP for TR 38.716-03-01: NR CA\_n3-n28-n257, SoftBank Corp  [R4-1911203](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911203.zip), TP for 38.716-03-01: interference analysis for CA\_n39A-n41A-n79A, CATT  [R4-1911204](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911204.zip), TP for 38.716-03-01: UE requirements for CA\_n8A-n39A-n41A, CATT  [R4-1911247](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911247.zip) TP for TR38.716-03-01\_ CA\_n3A\_n40A-n41A, ZTE  [R4-1911709](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911709.zip) TP for CA\_n77-n79-n257 for TR 38.716-03-01, NTT DoCoMo  [R4-1911711](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1911711.zip) TP for CA\_n78-n79-n257 for TR 38.716-03-01, NTT DoCoMo  [R4-1912254](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1912254.zip) TP for TR 38.716-03-01 to include CA\_n1-n3-n8, Ericsson, Swisscom  [R4-1912255](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1912255.zip) TP for TR 38.716-03-01 to conclude CA\_n1-n3-n78, Ericsson, Swisscom  [R4-1912256](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1912256.zip) TP for TR 38.716-03-01 to include CA\_n1-n8-n78, Ericsson, Swisscom  [R4-1912257](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1912257.zip) TP for TR 38.716-03-01 to include CA\_n1-n3-n28, Ericsson, Swisscom  [R4-1912258](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1912258.zip) TP for TR 38.716-03-01 to include CA\_n1-n28-n78, Ericsson, Swisscom  [R4-1912259](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1912259.zip) TP for TR 38.716-03-01 to include CA\_n3-n28-n78, Ericsson, Swisscom |  |
| 2020-02 | 3GPP RAN4#94-e | R4-2000624 |  |  |  | TR 38.716-03-01 v0.5.0, the update is based on the following contributions,  R4-1914298, TP for TR 38.716-03-01: CA\_n1A-n3A-n41A\_BCS0, Huawei, HiSilicon |  |
| 2020-04 | 3GPP RAN4#94-ebis | R4-2003317 |  |  |  | TR 38.716-03-01 v0.6.0, the update is based on the following contributions,  R4-2000144 TP for TR38.716-03-01: Requirements for CA\_n29A-n66A-n70A, CA\_n29A-n66B-n70A, and CA\_n29A-n66(2A)-n70A, Dish Network  R4-2002666 TP for TR38.716-03-01: Requirements for CA\_n29A-n66A-n70A, CA\_n29A-n66B-n70A, and CA\_n29A-n66(2A)-n70A, Dish Network  R4-2000185 TP to TR 38.716-03-01: CA\_n25-n41-n71, Nokia, Nokia Shanghai Bell, T-Mobile USA  R4-2000186 TP to TR 38.716-03-01: CA\_n41-n66-n71, Nokia, Nokia Shanghai Bell, T-Mobile USA  R4-2000847 TP for TR 38.716-03-01:CA\_n25-n66-n78, Huawei, HiSilicon  R4-2000848 TP for TR 38.716-03-01: CA\_n7-n66-n78, Huawei, HiSilicon  R4-2000849 TP for TR 38.716-03-01: CA\_n5-n66-n78, Huawei, HiSilicon  R4-2000850 TP for TR 38.716-03-01: CA\_n7-n25-n66, Huawei, HiSilicon  R4-2002667 TP for TR 38.716-03-01: CA\_n20A-n28A-n78A\_BCS0, Huawei, HiSilicon  R4-2001520 TP for TR 38.716-03-01 to include CA\_n1-n7-n28, Ericsson  R4-2001521 TP for TR 38.716-03-01 to include CA\_n1-n7-n78, Ericsson |  |
| 2020-04 | 3GPP RAN4#94-ebis | R4-2005742 |  |  |  | TR 38.716-03-01 v0.7.0, the update is based on the following contributions,  R4-2003946, TP for TR 38.716-03-01: CA\_n28A-n41A-n78A, Huawei, HiSilicon  R4-2004625, TP for TR 38.716-03-01 to include CA\_n1A-n40A-n78A, Ericsson  R4-2004626, TP for TR 38.716-03-01 to include CA\_n28A-n40A-n78A, Ericsson  R4-2005018, TP to TR 38.716-03-01: CA\_n25-n66-n71, Nokia, TMO US  R4-2005019, TP to TR 38.716-03-01: CA\_n25-n41-n66, Nokia, TMO US |  |
| 2020-05 | 3GPP RAN4#95-e | R4-2006283 |  |  |  | TR 38.716-03-01 v0.8.0, the update is based on the following contributions,  R4-2006839, TP for TR 38.716-03-01: UE requirements for CA\_n1A-n78A-n257A, CHTTL  R4-2007627, TP for TR 38.716-03-01 to include CA\_n1-n3-n7, Ericsson, Telstra  R4-2007628 TP for TR 38.716-03-01 to include CA\_n3-n7-n28, Ericsson, Telstra  R4-2007629 TP for TR 38.716-03-01 to include CA\_n3-n7-n78, Ericsson, Telstra  R4-2007630 TP for TR 38.716-03-01 to include CA\_n7-n28-n78, Ericsson, Telstra |  |

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