|  |
| --- |
| 3GPP TR 38.717-04-01 V0.2.0 (2020-11) |
| Technical Report |
| 3rd Generation Partnership Project;Technical Specification Group Radio Access Network;NR inter-band Carrier Aggregation for 4 bands DL with 1 band UL (Release 17) |
|   |
| *5G-logo_175px* | 3GPP-logo_web |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |
| The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP.The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented.This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification.Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices. |

|  |
| --- |
|  |
| ***3GPP***Postal address3GPP support office address650 Route des Lucioles - Sophia AntipolisValbonne - FRANCETel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16Internethttp://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 members3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational PartnersLTE™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational PartnersGSM® and the GSM logo are registered and owned by the GSM Association |

Contents

Foreword 6

1 Scope 8

2 References 8

3 Definitions of terms, symbols and abbreviations 8

3.1 Terms 8

3.2 Symbols 8

3.3 Abbreviations 8

4 Background 8

4.1 TR maintenance 8

5 4 Band Carrier Aggregation with Single UL: Specific Band Combination Par 9

5.1 CA\_n3-n28-n41-n78 9

5.1.1 Operating bands for CA 9

5.1.2 Channel bandwidths per operating band for CA 9

5.1.3 ∆TIB,c and ∆RIB,c values 9

5.1.4 REFSENS requirements 10

5.2 CA\_n25-n41-n66-n71 10

5.2.1 Channel bandwidths per operating bands for CA 10

5.2.2 ∆TIB,c and ∆RIB,c values 10

5.2.3 REFSENS requirements 11

5.3 CA\_n3-n28-n41-n77 11

5.3.1 Operating bands for CA 11

5.3.2 Channel bandwidths per operating band for CA 11

5.3.3 ∆TIB and ∆RIB values 12

5.3.4 REFSENS requirements 12

5.4 CA\_n1-n77-n79-n257 12

5.4.1 Operating bands for CA 12

5.4.2 Channel bandwidths per operating band for CA 13

5.4.3 ∆TIB,c and ∆RIB,c values 15

5.4.4 REFSENS requirements 15

5.5 CA\_n1-n78-n79-n257 15

5.5.1 Operating bands for CA 15

5.5.2 Channel bandwidths per operating band for CA 16

5.5.3 ∆TIB,c and ∆RIB,c values 18

5.5.4 REFSENS requirements 18

5.6 CA\_n3-n5-n7-n78 18

5.6.1 Channel bandwidths per operating bands for CA 18

5.6.2 ∆TIB,c and ∆RIB,c values 19

5.6.3 REFSENS requirements 19

Annex A - Change history 20

# 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 on inter-band CA for 4 bands DL with 1 band UL under Rel-17 time frame. The purpose is to gather the relevant background information and studies in order to address 4 bands DL/1 band UL Inter-band Carrier Aggregation requirements for the Rel-17 band combinations in Table 1-1.

# 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-200665, “New WID: NR inter-band CA for 4 bands DL with 1 band UL”, RAN#88-e

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

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

## 3.2 Symbols

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

<symbol> <Explanation>

## 3.3 Abbreviations

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

<ABBREVIATION> <Expansion>

# 4 Background

The present document is a technical report for 4 bands DL/1 band UL Inter-band Carrier Aggregation under Rel-17 timeframe. The document covers each band combination specific issues (i.e. one sub-clause defined per band combination)

## 4.1 TR maintenance

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

# 5 4 Band Carrier Aggregation with Single UL: Specific Band Combination Par

<Editor’s note: The requirements for specific band combinations shall be described according to the same manner as specified in TS38.101-3.>

## 5.1 CA\_n3-n28-n41-n78

### 5.1.1 Operating bands for CA

Table 5.1.1-1: 4DL 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-n41-n78 | n3 | 1710 MHz | - | 1785 MHz | 1805 MHz | - | 1880 MHz | FDD |
| n28 | 703 MHz | - | 748 MHz | 758 MHz | - | 803 MHz | FDD |
| n41 | 2496 MHz | - | 2690 MHz | 2496 MHz | - | 2690 MHz | TDD |
| n78 | 3300 MHz | - | 3800 MHz | 3300 MHz | - | 3800 MHz | TDD |

### 5.1.2 Channel bandwidths per operating band for CA

Table 5.1.2-1: Supported channel bandwidths per CA configuration for 4DL 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-n28A-n41A-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  | Yes | Yes | Yes |  | 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 |

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.

### 5.1.3 ∆TIB,c and ∆RIB,c values

For four DLs of Band n3, n28, n41and n78, the same ΔTIB,c and ΔRIB,c values specified for DC\_3-28-41\_n78 are used as below..

Table 5.1.3-1: ΔTIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n28-n41-n78 | n3 | 1 |
| n28 | 0.5 |
| n41 | 0.31/0.82 |
| n78 | 0.8 |
| NOTE 1: Applicable for the frequency range of 2515-2690 MHz. NOTE 2: Applicable for the frequency range of 2496-2515 MHz. |

Table 5.1.3-2: ΔRIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n28-n41-n78 | n3 | 0.5 |
| n28 | 0.2 |
| n41 | 01/0.52 |
| n78 | 0.5 |
| NOTE 1: Applicable for the frequency range of 2515-2690 MHz. NOTE 2: Applicable for the frequency range of 2496-2515 MHz |

### 5.1.4 REFSENS requirements

There are no additional MSD requirements for this band combination.

## 5.2 CA\_n25-n41-n66-n71

### 5.2.1 Channel bandwidths per operating bands for CA

Table 5.2.2-1: Supported channel bandwidths per CA configuration for 4DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n25A-n41A-n66A-n71A | - | 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 |  |  |  |  |  |  |
| n71 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CA\_n25A-n41(2A)-n66A-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| n41 | See CA\_n41(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 |
| 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\_n25A-n41C-n66A-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| n41 | See CA\_n41C Bandwidth Combination Set 0 in Table 5.5A.1-1 |
| 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 |  |  |  |  |  |  |  |  |  |  |  |  |  |

### 5.2.2 ∆TIB,c and ∆RIB,c values

For CA\_n25-n41-n66-n71 the ΔTIB,c and ΔRIB,c  values are shown in table 5.2.2-1 and table 5.2.2-2, respectively. Values are derived from DC\_2-7-66\_n71.

Table 5.2.2-1: ΔTIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n25-n41-n66-n71 | n25 | 0.5 |
| n41 | 0.5 |
| n66 | 0.5 |
| n71 | 0.3 |

Table 5.2.2-2: ΔRIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n25-n41-n66-n71 | n25 | 0.3 |
| n41 | 0.5 |
| n66 | 0.5 |

### 5.2.3 REFSENS requirements

MSD requirements are captured in lower order combinations.

## 5.3 CA\_n3-n28-n41-n77

### 5.3.1 Operating bands for CA

Table 5.3.1-1: 4DL 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-n41-n77 | n3 | 1710 MHz | - | 1785 MHz | 1805 MHz | - | 1880 MHz | FDD |
| n28 | 703 MHz | - | 748 MHz | 758 MHz | - | 803 MHz | FDD |
| n41 | 2496 MHz | - | 2690 MHz | 2496 MHz | - | 2690 MHz | TDD |
| n77 | 3300 MHz | - | 3800 MHz | 3300 MHz | - | 3800 MHz | TDD |

### 5.3.2 Channel bandwidths per operating band for CA

Table 5.3.2-1: Supported channel bandwidths per CA configuration for 4DL 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** | **70****MHz** | **80****MHz** | **90****MHz** | **100 MHz** | **Bandwidth combination set** |
| CA\_n3A-n28A-n41A-n77A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n28 | 15 | Yes | Yes | Yes | Yes |  | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

### 5.3.3 ∆TIB and ∆RIB values

For four DLs of Band n3, n28, n41and n77, the ΔTIB,c and ΔRIB,c values are given as below.

Table 5.3.3-1: ΔTIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n28-n41-n77 | n3 | 1 |
| n28 | 0.5 |
| n41 | 0.31/0.82 |
| n77 | 0.8 |
| NOTE 1: Applicable for the frequency range of 2515-2690 MHz. NOTE 2: Applicable for the frequency range of 2496-2515 MHz. |

Table 5.3.3-2: ΔRIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n28-n41-n77 | n3 | 0.5 |
| n28 | 0.2 |
| n41 | 01/0.52 |
| n77 | 0.5 |
| NOTE 1: Applicable for the frequency range of 2515-2690 MHz. NOTE 2: Applicable for the frequency range of 2496-2515 MHz. |

### 5.3.4 REFSENS requirements

There are no additional MSD requirements for this band combination

## 5.4 CA\_n1-n77-n79-n257

### 5.4.1 Operating bands for CA

Table 5.4.1-1: 4DL Inter-band CA operating bands

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | **Downlink (DL) operating band** | **Duplex Mode** |
| **BS receive / UE transmit** | **BS transmit / UE receive**  |
| **FUL\_low – FUL\_high** | **FDL\_low – FDL\_high** |
| CA\_n1-n77-n79-n257 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

### 5.4.2 Channel bandwidths per operating band for CA

Table 5.4.2-1: Supported channel bandwidths per CA configuration for 4DL inter-band CA

| **NR CA config** | **UL config** | **NR Band** | **SCS****(kHz)** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100**  | **200** | **400** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n1A-n77A-n79A-n257A | - | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes | Yes |
| CA\_n1A-n77A-n79A-n257G | CA\_n257G | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 |
| CA\_n1A-n77A-n79A-n257H | CA\_n257GCA\_n257H | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 |
| CA\_n1A-n77A-n79A-n257I | CA\_n257GCA\_n257HCA\_n257I | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| n77 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 |

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.

### 5.4.3 ∆TIB,c and ∆RIB,c values

For four simultaneous DLs and one UL of Band n1, n77, n79 and n257, the ΔTIB,c and ΔRIB,c values are shown in table 5.4.3-1 and table 5.4.3-2, respectively.

Table 5.4.3-1: ΔTIB,c for 4DL aggregation

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n1-n77-n79-n257 | n1 | 0.6 |
| n77 | 0.8 |
| n79 | 0.5 |
| n257 | 0 |

Table 5.4.3-2: ΔRIB,c for 4DL aggregation

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n1-n77-n79-n257 | n1 | 0.2 |
| n77 | 0.5 |
| n79 | 0 |
| n257 | 0 |

### 5.4.4 REFSENS requirements

MSD requirements are captured in lower order combinations.

## 5.5 CA\_n1-n78-n79-n257

### 5.5.1 Operating bands for CA

Table 5.5.1-1: 4DL 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-n79-n257 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| n257 | 26500 MHz | – | 29500 MHz | 26500 MHz | – | 29500 MHz | TDD |

### 5.5.2 Channel bandwidths per operating band for CA

Table 5.5.2-1: Supported channel bandwidths per CA configuration for 4DL inter-band CA

| **NR CA config** | **UL config** | **NR Band** | **SCS****(kHz)** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100**  | **200** | **400** | **Bandwidth combination set** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA\_n1A-n78A-n79A-n257A | - | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | 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 |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | 60 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes |  |
| 120 |  |  |  |  |  |  |  | Yes |  |  |  |  | Yes | Yes | Yes |
| CA\_n1A-n78A-n79A-n257G | CA\_n257G | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | 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 |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257G in Table 5.5A.1-1 in TS 38.101-2 |
| CA\_n1A-n78A-n79A-n257H | CA\_n257GCA\_n257H | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | 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 |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257H in Table 5.5A.1-1 in TS 38.101-2 |
| CA\_n1A-n78A-n79A-n257I | CA\_n257GCA\_n257HCA\_n257I | n1 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  | 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 |  |  |
| n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes |  | Yes |  | Yes |  |  |
| n257 | See CA\_n257I in Table 5.5A.1-1 in TS 38.101-2 |

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.

### 5.5.3 ∆TIB,c and ∆RIB,c values

For four simultaneous DLs and one UL of Band n1, n78, n79 and n257, the ΔTIB,c and ΔRIB,c values are shown in table 5.5.3-1 and table 5.5.3-2, respectively.

Table 5.5.3-1: ΔTIB,c for 4DL aggregation

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n1-n78-n79-n257 | n1 | 0.3 |
| n78 | 0.8 |
| 1.58 |
| n79 | 0 |
| 1.58 |
| n257 | 0 |
| NOTE 8: The requirements only apply for UE supporting inter-band carrier aggregation with simultaneous Rx/Tx capability, and NR UL carrier frequencies are confined to 3700 MHz-3800MHz for n78 and 4400 MHz-4500MHz for n79. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation. |

Table 5.5.3-2: ΔRIB,c for 4DL aggregation

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n1-n78-n79-n257 | n1 | 0 |
| n78 | 0.5 |
| n79 | 0 |
| n257 | 0 |

### 5.5.4 REFSENS requirements

MSD requirements are captured in lower order combinations.

## 5.6 CA\_n3-n5-n7-n78

### 5.6.1 Channel bandwidths per operating bands for CA

Table 5.6.2-1: Supported channel bandwidths per CA configuration for 4DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Configuration** | **UL Config** | **NR Band** | **SCS [kHz]** | **5** | **10** | **15** | **20** | **25** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **BCS** |
| CA\_n3A-n5A-n7A-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 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 | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| CA\_n3A-n5A-n7B-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |  |
| n5 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 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 | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

### 5.6.2 ∆TIB,c and ∆RIB,c values

For CA\_n3-n5-n7-n78 the ΔTIB,c and ΔRIB,c  values are shown in table 5.6.2-1 and table 5.6.2-2, respectively. Values are derived from DC\_3-5-7\_n78.

Table 5.6.2-1: ΔTIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n5-n7-n78 | n3 | 0.6 |
| n5 | 0.6 |
| n7 | 0.6 |
| n78 | 0.8 |

Table 5.6.2-2: ΔRIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **NR Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_n3-n5-n7-n78 | n3 | 0.2 |
| n5 | 0.2 |
| n7 | 0.2 |
| n78 | 0.5 |

### 5.6.3 REFSENS requirements

MSD requirements are captured in lower order combinations.

# Annex A - Change history

|  |
| --- |
| **Change history** |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-08 | 3GPP RAN4#96-e | R4-2010682 |  |  |  | TR skeleton | 0.0.1 |
| 2020-08 | 3GPP RAN4#96-e | R4-2011887 |  |  |  | Implemented TP’s from RAN4 #96-e:R4-2010254, “TP for TR 38.717-04-01 CA\_n3A-n28A-n41A-n78A”, Samsung, KDDIR4-2011676, “TP to add CA\_n25A-n41A-n66A-n71A, CA\_n25A-n41(2A)-n66A-n71A, CA\_n25A-n41C-n66A-n71A”, Ericsson, T-Mobile US | 0.1.0 |
| 2020-11 | 3GPP RAN4#97-e | R4-2015926 |  |  |  | Implemented TP’s from RAN4 #96-e:R4-2014118, “TP for TR 38.717-04-01 CA\_n3-n28-n41-n77”, Samsung, KDDIR4-2014816, “TP for CA\_n1-n77-n79-n257 4DL/1UL for TR38.717-04-01”, NTT DOCOMO, INC.R4-2014817, “TP for CA\_n1-n78-n79-n257 4DL/1UL for TR38.717-04-01”, NTT DOCOMO, INC.R4-2016307, “TP to add CA\_n3A-n5A-n7A-n78A, CA\_n3A-n5A-n7B-n78A”, Ericsson, Telstra | 0.2.0 |