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| 3GPP TR 36.717-04-01 V0.1.0 (2020-08) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Networks;  LTE inter-band Carrier Aggregation for  x bands DL (x=4, 5) with 1 band UL  (Release 17) | |
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# Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

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

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

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

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

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

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

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

**should** indicates a recommendation to do something

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

**may** indicates permission to do something

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

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

**can** indicates that something is possible

**cannot** indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

# 1 Scope

The present document is a technical report on inter-band CA for x bands DL (x=4, 5) with 1 band UL under Rel-17 timeframe. The purpose is to gather the relevant background information and studies in order to address 4 or 5 bands DL/1 band UL Inter-band Carrier Aggregation requirements for the Rel-17 band combinations in Table 1-1 and 1-2.

Table 1-1: Release 17 4 bands DL/1 band UL inter-band carrier aggregation combinations

|  |  |  |
| --- | --- | --- |
| **CA configuration** | **Uplink configuration** | **BCS** |
| CA\_1A-3C-7A-8A | CA\_3C | 0 |
| CA\_1A-3C-8A-20A | - | 0 |
| CA\_1A-3C-8A-20A | CA\_3C | 0 |
| CA\_1A-3C-8A-38A | - | 0 |
| CA\_1A-3C-8A-38A | CA\_3C | 0 |
| CA\_1A-3A-8A-40C | - | 0 |
| CA\_1A-3A-20A-38A | - | 0 |
| CA\_1A-3C-20A-38A | - | 0 |
| CA\_1A-3C-20A-38A | CA\_3C | 0 |
| CA\_1A-7A-8A-38A | - | 0 |
| CA\_1A-8A-20A-38A | - | 0 |
| CA\_2A-2A-5A-7A-66A | - | 0 |
| CA\_2A-5A-7A-66A | - | 0 |
| CA\_2A-5A-7C-66A | - | 0 |
| CA\_2A-7A-12A-66A-66A | - | 0 |
| CA\_2A-7A-28A-66A | - | 0 |
| CA\_2A-7C-28A-66A | - | 0 |
| CA\_3A-8A-20A-38A | - | 0 |

Table 1-2: Release 17 5 bands DL/1 band UL inter-band carrier aggregation combinations

|  |  |  |
| --- | --- | --- |
| **CA configuration** | **Uplink configuration** | **BCS** |
| CA\_1A-3A-7A-8A-38A | - | 0 |
| CA\_1A-3A-7A-8A-40A | - | 0 |
| CA\_1A-3A-7A-8A-40C | - | 0 |
| CA\_1A-3A-8A-20A-38A | - | 0 |

This TR contains a 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-201245, “LTE Advanced inter-band CA Rel-17 for x bands DL (x=4, 5) with 1 band UL”, RAN#80.

# 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 or 5 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 Part

## 5.1 CA\_2-5-7-66

### 5.1.1 Channel bandwidths per operating band for CA

Table 5.1.1-2: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-5A-7A-66A | - | 2 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-5A-7C-66A | - | 2 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 5 |  |  | Yes | Yes |  |  |
| 7 | See CA\_7C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | |
| 66 |  |  | Yes | Yes | Yes | Yes |

### 5.1.2 ∆TIB and ∆RIB values

Table 5.1.2-1: IB,c

|  |  |  |
| --- | --- | --- |
| CA\_2-5-7-66 | 2 | 0.5 |
| 5 | 0.3 |
| 7 | 0.5 |
| 66 | 0.5 |

Table 5.1.2-2: R IB,c

|  |  |  |
| --- | --- | --- |
| CA\_2-5-7-66 | 2 | 0.3 |
| 5 | 0 |
| 7 | 0.5 |
| 66 | 0.5 |

### 5.1.3 REFSENS requirements

There is no MSD requirements for CA\_2A-5A-7A-66A / CA\_2A-5A-7C-66A.

## 5.2 CA\_2-7-28-66

### 5.2.1 Channel bandwidths per operating band for CA

Table 5.2.1-2: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA configuration / Bandwidth combination set | | | | | | | | | | |
| E-UTRA CA Configuration | Uplink CA configurations | E-UTRA Bands | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Maximum aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_2A-7A-28A-66A | - | 2 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 28 |  |  | Yes | Yes | Yes | Yes |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_2A-7C-28A-66A | - | 2 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 7 | See CA\_7C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | |
| 28 |  |  | Yes | Yes | Yes | Yes |
| 66 |  |  | Yes | Yes | Yes | Yes |

### 5.2.2 ∆TIB and ∆RIB values

Table 5.2.2-1: IB,c

|  |  |  |
| --- | --- | --- |
| CA\_2-7-28-66 | 2 | 0.5 |
| 7 | 0.5 |
| 28 | 0.6 |
| 66 | 0.5 |

Table 5.2.2-2: R IB,c

|  |  |  |
| --- | --- | --- |
| CA\_2-7-28-66 | 2 | 0.3 |
| 7 | 0.5 |
| 28 | 0.2 |
| 66 | 0.5 |

### 5.2.3 REFSENS requirements

Table 5.2.3-1: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions due to harmonic issue)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth | | | | | | | | |
| EUTRA CA Configuration | EUTRA band | 1.4 MHz (dBm) | 3 MHz (dBm) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | Duplex mode |
| CA\_2A-7A-28A-66A5,6  CA\_2A-7C-28A-66A5,6 | 66 |  |  | -89,5 | -88,9 | -88,5 | -88,2 | FDD |
| NOTE 5: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of a high band.  NOTE 6: 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. | | | | | | | | |

Table 5.2.3-2: Uplink configuration for the low band (exceptions due to harmonic issue)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth of the high band / NRB / Duplex mode | | | | | | | | |
| EUTRA CA Configuration | UL band | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Duplex mode |
| CA\_2A-7A-28A-66A  CA\_2A-7C-28A-66A | 28 |  |  | 8 | 16 | 25 | 25 | FDD |

## 5.3 CA\_1-3-20-38

### 5.3.1 Channel bandwidths per operating band for CA

Table 5.3.1-1: Supported channel bandwidths per CA configuration for 4DL inter-band CA

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA Configuration** | **UL CA configurations** | **E-UTRA Bands** | **1.4** | **3** | **5** | **10** | **15** | **20** | **Maximum aggregated bandwidth** | **Bandwidth combination set** |
| **MHz** | **MHz** | **MHz** | **MHz** | **MHz** | **MHz** | **[MHz]** |
| CA\_1A-3A-20A-38A | - | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 | Yes | Yes | Yes | Yes | Yes | Yes |
| 20 |  |  | Yes | Yes | Yes | Yes |
| 38 |  |  | Yes | Yes | Yes | Yes |

### 5.3.2 ∆TIB and ∆RIB values

For CA\_1A-3A-20A-38A, the ΔTIB,c and ΔRIB,c values are shown in table 5.3.2-1 and table 5.3.2-2, respectively.

Table 5.3.2-1: ΔTIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| **CA\_1A-3A-20A-38A** | **1** | **0.3** |
| **3** | **0.3** |
| **20** | **0.3** |
| **38** | **0.3** |
|  | | |

Table 5.3.2-2: ΔRIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **E-UTRA Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| **CA\_1A-3A-20A-38A** | **1** | **0** |
| **3** | **0** |
| **20** | **0** |
| **38** | **0** |
|  | | |

### 5.3.3 REFSENS requirements

REFSENS requirements are defined in table 5.3.3-1 for inclusion in TS36.101 table 7.3.1A-0a.

Table 5.3.3-1: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions due to harmonic issue)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth | | | | | | | | |
| EUTRA CA Configuration | EUTRA band | 1.4 MHz (dBm) | 3 MHz (dBm) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | Duplex mode |
| CA\_1A-3A-20A-38A8 | 20 |  |  | N/A | N/A | N/A | N/A | FDD |
| NOTE 8: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply). | | | | | | | | |

REFSENS requirements are defined in table 5.3.3-2 for inclusion in TS36.101 table 7.3.1A-0bD1.

Table 5.3.3-2: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions for four bands due to close proximity of UL to DL channel)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel bandwidth | | | | | | | | |
| EUTRA CA Configuration | EUTRA band | 1.4 MHz (dBm) | 3 MHz (dBm) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | Duplex mode |
| CA\_1A-3A-20A-38A | 34,9 |  |  | -93.8 | -91.3 | -89.8 | -88.8 | FDD |
| 35 |  |  | -96.8 | -93.8 | -92 | -90.8 |
| NOTE 4: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in the bands other than Band 1, the requirement applies regardless of channel bandwidth in Band 1.  NOTE 5: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in the bands other than Band 1, the requirement applies regardless of channel bandwidth in Band 1.  NOTE 9: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured. | | | | | | | | |

REFSENS requirements are defined in table 5.3.3-3 for inclusion in TS36.101 table 7.3.1A-0bE.

Table 5.3.3-3: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions due to cross band isolation issues of TDD and FDD bands)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EUTRA CA Configuration | EUTRA band | Channel bandwidth | | | | | | Duplex mode | Applicable active UL band |
| 1.4 MHz (dBm) | 3 MHz (dBm) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) |
| CA\_1A-3A-20A-38A13,20 | 3 |  |  | -97 | -94 | -92.2 | -91 | FDD | 1 |
| 3819 |  |  | -93.3 | -90.7 | -89.2 | -88.1 | TDD |
| 3819 |  |  | -93.3 | -90.7 | -89.2 | -88.1 | TDD | 3 |
| CA\_1A-3A-20A-38A12,20 | 319 |  |  | -94 | -91.5 | -90 | -89 | FDD | 1 |
| 3819 |  |  | -93.3 | -90.7 | -89.2 | -88.1 | TDD |
| 3819 |  |  | -93.3 | -90.7 | -89.2 | -88.1 | TDD | 3 |
| NOTE 12: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in Band 3 and Band 41, the requirement applies regardless of channel bandwidth in Band 1.  NOTE 13: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in Band 3 and Band 41, the requirement applies regardless of channel bandwidth in Band 1.  NOTE 19: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured.  NOTE 20: The B38 requirements also apply to the supported CA\_1A-38A. | | | | | | | | | |

# 6 5 Band Carrier Aggregation with Single UL: Specific Band Combination Part

## 6.1 CA\_a-b-c-d-e

### 6.1.1 Channel bandwidths per operating band for CA

<Text will be added.>

### 6.1.2 ∆TIB and ∆RIB values

<Text will be added.>

### 6.1.3 REFSENS requirements

<Text will be added if it’s necessary, only REFSENS numbers for bands with exception due to harmonics and/or harmonic mixing need to be provided in the table.>

# Annex A: Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-08 | 3GPP RAN4#96e |  |  |  |  | Initial TR skeleton | 0.0.1 |
| 2020-08 | 3GPP RAN4#96e |  |  |  |  | The following agreed text proposals have been included:  R4-2011405; Updated scope of TR: LTE inter-band CA for 4/5 bands DL with 1 band UL; Nokia, Nokia Shanghai Bell  R4-2011582 TP for TR 36.717-04-01: CA\_1-3-20-38; Vodafone  R4-2010875 TP for TR 36.717-04-01: CA\_2A-7A-28A-66A / CA\_2A-7C-28A-66A; Huawei  R4-2010876 TP for TR 36.717-04-01: CA\_2A-5A-7A-66A / CA\_2A-5A-7C-66A; Huawei | 0.1.0 |