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| 3GPP TR 36.718-02-01 V0.0.1 (2022-08) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Networks;  LTE-A intra-band/inter-band Carrier Aggregation for x (x<=6) bands DL with y bands (y=1, 2) UL (Release 18) | |
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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 intra-band CA and inter-band CA for x bands DL (2≤x≤6) with y bands UL (y=1,2) under Rel-18 timeframe.

The purpose is to gather the relevant background information and studies, in order to address Rel-18 band combinations that are related to x bands (1≤x≤6) DL with y bands UL (y=1,2) bands UL CA requirements. The band combinations are requested in the Excel file of the WID [2] or its revisions.

# 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-221831, “New WID Rel-18 LTE Advanced CA for x (x<=6) bands DL with y bands (y=1, 2) UL”, RAN#96.

# 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 intra-band Carrier Aggregation and inter-band CA for x bands DL (2≤x≤6) with y bands UL (y=1,2) under Rel-18 timeframe. The document covers each band combination specific issues (i.e. one sub-clause defined per band combination)

## 4.1 TR maintenance

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

# 5 Specific Band Combination Part

Intra-band Carrier Aggregation, as well as, Inter-band Carrier Aggregation combination with x (2≤x≤6) and a single UL band within Rel-18 timeframe.

## 5.1 LTE-A intra-band CA

### 5.1.x CA\_a

#### 5.1.x.1 Channel bandwidths per operating band

< Editor's note: Text will be added, the examples is given as follows>

Table 5.1.x.1-1: Intra-band CA operating band

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating band BS receive UE transmit | | | Downlink (DL) operating band BS transmit  UE receive | | | Duplex Mode |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| xx | xx MHz | – | xxxx MHz | xx MHz | – | xx MHz | FDD/TDD |

Table 5.1.x.1-2: E-UTRA CA configurations and bandwidth combination sets defined for intra-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\_xxA | CA\_xxA | xx |  |  | Yes | Yes | Yes | Yes | 20 | 0 |
| CA\_xxC | CA\_xxC | xx |  |  | Yes | Yes | Yes | Yes | 40 | 0 |

< Editor's note: If the UL CA is proposed for the CA configuration, the Uplink CA configurations column should be added in the table.>

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

< Editor’s note: Text will be added, the examples is given as follows. The harmonics and harmonics mixing issues should be analysed based on this table. >

Table 5.1.2-1 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA \_ xx.

**Table 5.1.x.2-1: 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 |
| xx | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |

< Editor’s note: Harmonic relation should be captured as far as there is harmonic interference, e.g. n = floor(xx\_DL High Band Edge/xx\_UL Low Band Edge). >

#### 5.1.x.3 REFSENS requirements

< Editor's note: Text will be added if harmonics and/or harmonic mixing, etc. issues are identified, and only REFSENS numbers for bands have these issues need to be provided in the table.>

Table 5.1.x.3-1: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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\_xxA  CA\_xxC | xx | TBD | TBD | TBD | TBD | TBD | TBD | TBD |

#### 5.1.x.3 AMPR UL CA bandwidth class X

< Editor's note: Text will be added if AMPR studies and simulations are required..>

## 5.2 LTE-A inter-band CA for x (x>1) bands DL with 1 band UL

### 5.2.x CA\_a-b

#### 5.2.x.1 Channel bandwidths per operating band for CA

< Editor's note: Text will be added, the examples are given as follows for the case of x=2 >

Table 5.2.x.1-1: Inter-band CA operating bands

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating band BS receive UE transmit | | | Downlink (DL) operating band BS transmit  UE receive | | | Duplex Mode |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| xx | xx MHz | – | 1910 MHz | xx MHz | – | xx MHz | FDD |
| yy | yy MHz | – | 5925 MHz | yy MHz | – | yy MHz | TDD |

Table 5.2.x.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\_xxA-yyA | - | xx |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| yy |  |  | Yes | Yes | Yes | Yes |
| CA\_xxA-yyC | - | xx |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| yy | See the CA\_yyC Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |
| CA\_xxC-yyA | - | xx | See the CA\_xxC Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | | 60 | 0 |
| yy |  |  | Yes | Yes | Yes | Yes |
| CA\_xxA-yyC | CA\_yCC | xx |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| yy | See the CA\_yyC Bandwidth combination set 0 in Table 5.6A.1-1 | | | | | |

< Editor's note: If the UL CA is proposed for the CA configuration, the Uplink CA configurations column should be added in the table.>

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

< Editor’s note: Co-existence studies are needed till x=2 since these issue shall be treated on fallback combinations. Text will be added, the examples is given as follows. The harmonics and harmonics mixing issues shouldbe analysed based on this table. >

Table 5.2.2-1 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA \_ xx-yy.

**Table 5.2.x.2-1: 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 |
| xx | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| yy | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |

< Editor’s note: Harmonic relation should be captured as far as there is harmonic interference, e.g. n = floor(yy or xx\_DL High Band Edge/xx or yy\_UL Low Band Edge). >

**Table 5.2.x.2-2: 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 |
| xx | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| yy | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |

< Editor’s note: Harmonic mixing relation should be captured as far as there is harmonic mixing interference, e.g. m= floor(yy or xx\_UL High Band Edge/xx or yy\_DL Low Band Edge)>

#### 5.2.x.3 ∆TIB and ∆RIB values

< Editor's note: Text will be added, the examples is given as follows. IB,c and R IB,c can be added based on band>

Table 5.2.x.3-1: IB,c

|  |  |  |
| --- | --- | --- |
| CA\_xx-yy | xx | TBD |
| yy | TBD |

Table 5.2.x.3-2: R IB,c

|  |  |  |
| --- | --- | --- |
| CA\_xx-yy | xx | TBD |
| yy | TBD |

#### 5.2.x.4 REFSENS requirements

< Editor's note: Text will be added if harmonics and/or harmonic mixing, etc. issues are identified, and only REFSENS numbers for bands have these issues need to be provided in the table.>

Table 5.2.x.4-1: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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\_xxA-yyA  CA\_xxA-yyC  CA\_xxC-yyA | yy | TBD | TBD | TBD | TBD | TBD | TBD | TBD |

## 5.3 LTE-A inter-band CA for 2 bands DL with 2 bands UL

### 5.3.x CA\_a-b

#### 5.3.x.1 Channel bandwidths per operating band for CA

<Text will be added.>

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

<Text will be added. Spurious emission band UE co-existence for CA, i.e. the tables similar to Table 6.6.3.2A-0 in TS 36.101 should be reflected here. Noted that the protected bands are common set of the UL CA bands.>

#### 5.3.x.3 ∆TIB and ∆RIB values

<Text will be added.>

#### 5.3.x.4 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.>

## 5.4 LTE-A inter-band CA for x (x>2)  bands DL with 2 bands UL

### 5.4.x LTE-A inter-band CA: up to 6 bands DL(Band U and Band V and Band W and Band X and Band Y and Band Z) with 2 bands UL

**[Editor Note] It will be updated in future**

# Annex A: Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2022-08 | 3GPP RAN4#104e |  |  |  |  | Initial TR skeleton | 0.0.1 |
|  |  |  |  |  |  |  |  |