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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.>

### 5.3.1 CA\_1-41-41

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

Table 5.3.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_1A-41A-41A | CA\_1A-41A | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 41 | See CA\_41A-41A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

#### 5.3.1.2 Co-existence studies

Coexistence requirements for CA\_1-41 already exist in TS 36101.

#### 5.3.1.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_1-41 in TS 36101:

**Table 6.3.1.3-1:** **ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_1-41-41 | 1 | 0.5 |
| 41 | 0.5 |

**Table 6.3.1.3-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_1-41-41 | 1 | 0 |
| 41 | 0 |

#### 5.3.1.4 REFSENS requirements

No additional requirements necessary.

### 5.3.2 CA\_3-41-41

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

Table 5.3.2.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_3A-41A-41A | CA\_3A-41A | 3 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 41 | See CA\_41A-41A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

#### 5.3.2.2 Co-existence studies

Coexistence requirements for CA\_3-41 already exist in TS 36101.

#### 5.3.2.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_3-41 in TS 36101:

**Table 5.3.2.3-1: ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_3-41-41 | 3 | 0.5 |
| 41 | 0.310 |
| 0.811 |
| NOTE 10: The requirement is applied for UE transmitting on the frequency range of 2545-2690MHz.  NOTE 11: The requirement is applied for UE transmitting on the frequency range of 2496-2545MHz. | | |

**Table 5.3.2.3-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_3-41-41 | 3 | 0 |
| 41 | 010 |
| 0.511 |
| NOTE 10: The requirement is applied for UE transmitting on the frequency range of 2545-2690MHz.  NOTE 11: The requirement is applied for UE transmitting on the frequency range of 2496-2545MHz. | | |

#### 5.3.2.4 REFSENS requirements

Table 5.3.2.4-1: 2DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| EUTRA CA  Configuration | EUTRA band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_3A-41A-41A | 3 | 1740 | 5 | 25 | 1835 | 8.2 | FDD | IMD4 |
| 41 | 2657.5 | 5 | 25 | 2657.5 | N/A | TDD | N/A |

### 5.3.3 CA\_8-41-41

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

Table 5.3.3.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_8A-41A-41A | CA\_8A-41A | 8 |  |  | Yes | Yes |  |  | 50 | 0 |
| 41 | See CA\_41A-41A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

#### 5.3.3.2 Co-existence studies

Coexistence requirements for CA\_8-41 already exist in TS 36101.

#### 5.3.3.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_8-41 in TS 36101:

**Table 5.3.3.3-1: ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_8-41-41 | 8 | 0.3 |
| 41 | 0.3 |

**Table 5.3.3.3-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_8-41-41 | 8 | 0 |
| 41 | 0 |

#### 5.3.3.4 REFSENS requirements

No additional requirements necessary.

### 5.3.4 CA\_13-48

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

**Table 5.3.4.1-1: E-UTRA CA configurations and bandwidth combination sets**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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\_13A-48A | CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 30 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |
| CA\_13A-48C | CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 50 | 0 |
| 48 | See CA\_48C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |
| CA\_13A-48D | CA\_13A-48A | 13 |  |  | Yes | Yes |  |  | 70 | 0 |
| 48 | See CA\_48D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |

#### 5.3.4.2 Co-existence studies

For 2UL / 2DL own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.3.4.2-1.

**Table 5.3.4.2-1: Harmonic and IMD analysis**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | | | **fx\_low** | | | **fx\_high** | | | **fy\_low** | | | **fy\_high** |
| UL frequency (MHz) | | 777 | | | 787 | | | 3550 | | | 3700 | |
| 2nd harmonics frequency limits | | | 2\*fx\_low | | | 2\*fx\_high | | | 2\* fy\_low | | | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1554 | | | 1574 | | | 7100 | | | 7400 | | |
| 3rd harmonics frequency limits | | | 3\*fx\_low | | | 3\*fx\_high | | | 3\* fy\_low | | | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | | | 2331 | | | 2361 | | | 10650 | | | 11100 |
| Two tone 2nd order IMD products | | | |fy\_high – fx\_low| | | | |fy\_low – fx\_high| | | | |fy\_low + fx\_low| | | | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | | | 2923 | | | 2763 | | | 4327 | | | 4487 |
| Two-tone 3rd order IMD products | | | |fy\_high – 2\*fx\_low| | | | |fy\_low – 2\*fx\_high| | | | |2\*fy\_low – fx\_high| | | | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | | | 2146 | | | 1976 | | | 6313 | | | 6623 |
| Two-tone 3rd order IMD products | | | |2\*fx\_low + fy\_low| | | | |2\*fx\_high + fy\_high| | | | |2\*fy\_low + fx\_low| | | | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | | | 5104 | | | 5274 | | | 7877 | | | 8187 |
| Two-tone 4th order IMD products | | | |2\*fx\_low –2\* fy\_high| | | | |2\*fx\_high – 2\*fy\_low| | | | |2\*fx\_low +2\* fy\_low| | | | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | | | 5846 | | | 5526 | | | 8654 | | | 8974 |
| Two-tone 4th order IMD products | | | |3\*fx\_low –1\* fy\_high| | | | |3\*fx\_high – 1\*fy\_low| | | | |3\*fy\_low – 1\*fx\_high| | | | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | | | 1369 | | | 1189 | | | 9863 | | | 10323 |
| Two-tone 4th order IMD products | | | |3\*fx\_low +1\* fy\_low| | | | |3\*fx\_high +1\* fy\_high| | | | |3\*fy\_low + 1\*fx\_low| | | | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | | | 5881 | | | 6061 | | | 11427 | | | 11887 |
| Two-tone 5th order IMD products | | | |fx\_low – 4\*fy\_high| | | | |fx\_high – 4\*fy\_low| | | | |fy\_low – 4\*fx\_high| | | | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | | | 14023 | | | 13413 | | | 402 | | | 592 |
| Two-tone 5th order IMD products | | | |fx\_low + 4\*fy\_low| | | | |fx\_high + 4\*fy\_high| | | | |fy\_low + 4\*fx\_low| | | | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | | | 14977 | | | 15587 | | | 6658 | | | 6848 |
| Two-tone 5th order IMD products | | | |2\*fx\_low – 3\*fy\_high| | | | |2\*fx\_high – 3\*fy\_low| | | | |2\*fy\_low – 3\*fx\_high| | | | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limits (MHz) | | | 9546 | | | 9076 | | | 4739 | | | 5069 |
| Two-tone 5th order IMD products | | | |2\*fx\_low + 3\*fy\_low| | | | |2\*fx\_high + 3\*fy\_high| | | | |2\*fy\_low + 3\*fx\_low| | | | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | | | 12204 | | | 12674 | | | 9431 | | | 9761 |

Based on analysis on above table, there is no IMD issue for this combination.

**Table 5.3.4.2-2: Requirements for uplink inter-band carrier aggregation (two bands)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA Configuration** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
| CA\_13-48 | E-UTRA Band 2, 4, 5, 12, 13, 17, 25, 26, 29, 41, 50, 51, 66, 70, 71, 74, 85, 103 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA band 24, 30 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| E-UTRA band 14 | FDL\_low | - | FDL\_high | -50 | 1 | 3 |
| NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd, 4th [or 5th] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2, 3, 4, [5] for the 2nd, 3rd, 4th [or 5th] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.  NOTE 3: These requirements also apply for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth. | | | | | | | |

#### 5.3.4.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

#### 5.3.4.4 REFSENS requirements

Based on analysis of 5.3.4.2, there are no additional MSD requirements for this combination.

### 5.3.5 CA\_48-66

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

**Table 5.3.5.1-1: E-UTRA CA configurations and bandwidth combination sets**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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\_48A-66A | CA\_48A-66A | 48 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_48A-48A-66A | CA\_48A-66A | 48 | See CA\_48A-48A Bandwidth combination set 0 in the Table 5.6A.1-3 | | | | | | 60 | 0 |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_48C-66A | CA\_48A-66A | 48 | See CA\_48C Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | | 60 | 0 |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_48D-66A | CA\_48A-66A | 48 | See CA\_48D Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | | 80 | 0 |
| 66 |  |  | Yes | Yes | Yes | Yes |
| CA\_48A-66A-66A | CA\_48A-66A | 48 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_48C-66A-66A | CA\_48A-66A | 48 | See CA\_48C Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | | 80 | 0 |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_48D-66A-66A | CA\_48A-66A | 48 | See CA\_48D Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | | 100 | 0 |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |
| CA\_48E-66A-66A | CA\_48A-66A | 48 | See CA\_48E Bandwidth combination set 0 in the Table 5.6A.1-1 | | | | | | 120 | 0 |
| 66 | See CA\_66A-66A Bandwidth Combination Set 0 in Table 5.6A.1-3 | | | | | |

#### 5.3.5.2 Co-existence studies

For 2UL / 2DL own receiver desensitization study 2nd and 3rd order harmonics and 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.3.5.2-1.

**Table 5.3.5.2-1: Harmonic and IMD analysis**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UE UL carriers** | | **fx\_low** | | **fx\_high** | | **fy\_low** | | **fy\_high** |
| UL frequency (MHz) | | 1710 | | 1780 | | 3550 | | 3700 |
| 2nd harmonics frequency limits | | 2\*fx\_low | | 2\*fx\_high | | 2\* fy\_low | | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | | 3560 | | 7100 | | 7400 | |
| 3rd harmonics frequency limits | | 3\*fx\_low | | 3\*fx\_high | | 3\* fy\_low | | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | | 5130 | | 5340 | | 10650 | | 11100 |
| Two tone 2nd order IMD products | | |fy\_high – fx\_low| | | |fy\_low – fx\_high| | | |fy\_low + fx\_low| | | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | | 1990 | | 1770 | | 5260 | | 5480 |
| Two-tone 3rd order IMD products | | |fy\_high – 2\*fx\_low| | | |fy\_low – 2\*fx\_high| | | |2\*fy\_low – fx\_high| | | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | | 280 | | 10 | | 5320 | | 5690 |
| Two-tone 3rd order IMD products | | |2\*fx\_low + fy\_low| | | |2\*fx\_high + fy\_high| | | |2\*fy\_low + fx\_low| | | |2\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | | 6970 | | 7260 | | 8810 | | 9180 |
| Two-tone 4th order IMD products | | |2\*fx\_low –2\* fy\_high| | | |2\*fx\_high – 2\*fy\_low| | | |2\*fx\_low +2\* fy\_low| | | |2\*fx\_high +2\* fy\_high| |
| IMD frequency limits (MHz) | | 3980 | | 3540 | | 10520 | | 10960 |
| Two-tone 4th order IMD products | | |3\*fx\_low –1\* fy\_high| | | |3\*fx\_high – 1\*fy\_low| | | |3\*fy\_low – 1\*fx\_high| | | |3\*fy\_high – 1\*fx\_low| |
| IMD frequency limits (MHz) | | 1430 | | 1790 | | 8870 | | 9390 |
| Two-tone 4th order IMD products | | |3\*fx\_low +1\* fy\_low| | | |3\*fx\_high +1\* fy\_high| | | |3\*fy\_low + 1\*fx\_low| | | |3\*fy\_high + 1\*fx\_high| |
| IMD frequency limits (MHz) | | 8680 | | 9040 | | 12360 | | 12880 |
| Two-tone 5th order IMD products | | |fx\_low – 4\*fy\_high| | | |fx\_high – 4\*fy\_low| | | |fy\_low – 4\*fx\_high| | | |fy\_high – 4\*fx\_low| |
| IMD frequency limits (MHz) | | 13090 | | 12420 | | 3570 | | 3140 |
| Two-tone 5th order IMD products | | |fx\_low + 4\*fy\_low| | | |fx\_high + 4\*fy\_high| | | |fy\_low + 4\*fx\_low| | | |fy\_high + 4\*fx\_high| |
| IMD frequency limits (MHz) | | 15910 | | 16580 | | 10390 | | 10820 |
| Two-tone 5th order IMD products | | |2\*fx\_low – 3\*fy\_high| | | |2\*fx\_high – 3\*fy\_low| | | |2\*fy\_low – 3\*fx\_high| | | |2\*fy\_high – 3\*fx\_low| |
| IMD frequency limits (MHz) | | 7680 | | 7090 | | 1760 | | 2270 |
| Two-tone 5th order IMD products | | |2\*fx\_low + 3\*fy\_low| | | |2\*fx\_high + 3\*fy\_high| | | |2\*fy\_low + 3\*fx\_low| | | |2\*fy\_high + 3\*fx\_high| |
| IMD frequency limits (MHz) | | 14070 | | 14660 | | 12230 | | 12740 |

**Table 5.3.5.2-2: Requirements for uplink inter-band carrier aggregation (two bands)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA CA Configuration** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
| CA\_48-66 | E-UTRA Band 2, 4, 5, 12, 13, 14, 17, 24, 25, 26, 29, 30, 41, 50, 51, 66, 70, 71, 74, 85, 103 | FDL\_low | - | FDL\_high | -50 | 1 |  |

#### 5.3.5.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

#### 5.3.5.4 REFSENS requirements

Based on co-existence analysis in 5.3.5.2 there are IMD5 into band 66 and 2nd harmonic into band 48.

MSD due to IMD5 to be added in Table 7.3.1A-0f in TS 36.101 as in Table 5.3.5.4-1 below:

Table 5.3.5.4-1: 2DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| EUTRA CA  Configuration | EUTRA band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_48-66 | 48 | 3660 | 5 | 25 | 3660 | N/A | TDD  FDD | N/A |
| 66 | 1730 | 5 | 25 | 2130 | 5.0 | IMD5 |

Exceptions due to harmonics for CA\_48-66 is already defined in TS 36.101.

Harmonic mixing due to 5th order DL 66 into 3rd order UL 48 can occur but is not specified.

### 5.3.6 CA\_8-48

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

Table 5.3.6.1-1: 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 | | |
| 8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| 48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |

**Table 5.3.6-1: E-UTRA CA configurations and bandwidth combination sets**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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\_8A-48A | - | 8 | Yes | Yes | Yes | Yes |  |  | 30 | 0 |
| 48 |  |  | Yes | Yes | Yes | Yes |

#### 5.3.6.2 Co-existence studies

Table 5.3.6-1 summarizes frequency ranges where harmonics occur for CA\_8-48.

**Table 5.3.6.2-1: 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 |
| 8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 |
| 48 | 3550 | 3700 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14200 | 14800 |

Table 5.3.6-2 summarizes frequency ranges where harmonics mixing occur for CA\_8-48.

**Table 5.3.6.2-2: 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 |
| 8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 |
| 48 | 3550 | 3700 | 3550 | 3700 | 7100 | 7400 | 10650 | 11100 | 14200 | 14800 |

#### 5.3.6.3 ∆TIB and ∆RIB values

Values are same as for CA\_8-42.

Table 5.3.6.3-1: IB,c

|  |  |  |
| --- | --- | --- |
| CA\_8-48 | 8 | 0.6 |
| 48 | 0.8 |

Table 5.3.6.3-2: R IB,c

|  |  |  |
| --- | --- | --- |
| CA\_8-48 | 8 | 0.2 |
| 48 | 0.5 |

#### 5.3.6.4 REFSENS requirements

Based on analysis of 5.3.6.2, there are MSD requirements for band 8 UL 4th harmonics into DL of band 48. MSD values same as for CA\_8A-42A and to be added in Table 7.3.1A-0a and Table 7.3.1A-0b of TS 36.101.

Table 5.3.6.4-1: 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\_8A-48A12,13 | 4833 |  |  | -84.8 | -84.7 | -84.6 | -84.5 | TDD |
| NOTE 12: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 4th transmitter harmonic is within the downlink transmission bandwidth of a high band.  NOTE 13: 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 33: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured. | | | | | | | | |

Table 5.3.6.4-2: 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\_8A-48A | 8 | 2 | 5 | 8 | 16 | 25 | 25 | FDD |

## 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**

### 5.4.1 CA\_1-3-41-41

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

Table 5.4.1.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_1A-3A-41A-41A | CA\_1A-3A  CA\_1A-41A  CA\_3A-41A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 41 | See CA\_41A-41A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

#### 5.4.1.2 Co-existence studies

Coexistence requirements for CA\_1-3, CA\_1-41 and CA\_3-41 already exist in TS 36101.

#### 5.4.1.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_1-3-41 in TS 36101:

**Table 5.4.1.3-1: ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_1-3-41-41 | 1 | 0.5 |
| 3 | 0.5 |
| 41 | 0.35/0.86 |
| NOTE 5**:** The requirement is specified for the frequency range of 2545-2690MHz.  NOTE 6**:** The requirement is specified for the frequency range of 2496-2545MHz. | | |

**Table 5.4.1.3-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_1-3-41-41 | 1 | 0 |
| 3 | 0 |
| 41 | 05/0.56 |
| NOTE 5: The requirement is specified for the frequency range of 2545-2690MHz.  NOTE 6: The requirement is specified for the frequency range of 2496-2545MHz. | | |

#### 5.4.1.4 REFSENS requirements

Table 5.4.1.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| EUTRA CA  Configuration | EUTRA band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_1A-3A-41A-41A | 3 | 1740 | 5 | 25 | 1835 | 8.2 | FDD | IMD4 |
| 41 | 2657.5 | 5 | 25 | 2657.5 | N/A | TDD | N/A |

### 5.4.2 CA\_1-8-41-41

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

Table 5.4.2.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_1A-8A-41A-41A | CA\_1A-8A  CA\_1A-41A  CA\_8A-41A | 1 |  |  | Yes | Yes | Yes | Yes | 70 | 0 |
| 8 |  |  | Yes | Yes |  |  |
| 41 | See CA\_41A-41A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

#### 5.4.2.2 Co-existence studies

Coexistence requirements for CA\_1-8, CA\_1-41 and CA\_8-41 already exist in TS 36101.

#### 5.4.2.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_1-8-41 in TS 36101:

**Table 5.4.2.3-1: ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_1-8-41-41 | 1 | 0.5 |
| 8 | 0.3 |
| 41 | 0.5 |

**Table 5.4.2.3-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_1-8-41-41 | 1 | 0 |
| 8 | 0 |
| 41 | 0 |

#### 5.4.2.4 REFSENS requirements

For IMD5 hit in B8 DL from CA\_1A-41A UL, it is proposed the following MSD is re-used from DC\_8-41\_n1 in 38101-3:

Table 5.4.2.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | Source of IMD |
| EUTRA CA | EUTRA CA | EUTRA band | UL Fc | UL BW | UL | DL Fc | DL BW | MSD | Duplex mode |
| DL Configuration | UL Configuration | (MHz) | (MHz) | CLRB | (MHz) | (MHz) | (dB) |
| CA\_1A-8A-41A-41A | CA\_1A-41A | 1 | 1977 | 5 | 25 | 2167 | 5 | N/A | FDD | N/A |
| 8 | 886 | 5 | 25 | 931 | 5 | 4.5 | FDD | IMD5 |
| 41 | 2500 | 5 | 25 | 2500 | 5 | N/A | TDD | N/A |

### 5.4.3 CA\_3-8-41-41

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

Table 5.4.3.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_3A-8A-41A-41A | CA\_3A-8A  CA\_3A-41A  CA\_8A-41A | 3 |  | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 8 | Yes | Yes | Yes | Yes |  |  |
| 41 | See CA\_41A-41A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

#### 5.4.3.2 Co-existence studies

Coexistence requirements for CA\_3-8, CA\_3-41 and CA\_8-41 already exist in TS 36101.

#### 5.4.3.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_3-8-41 in TS 36101:

**Table 5.4.3.3-1: ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_3-8-41-41 | 3 | 0.5 |
| 8 | 0.3 |
| 41 | 0.35 |
| 0.86 |
| NOTE 5**:** The requirement is specified for the frequency range of 2545-2690MHz.  NOTE 6**:** The requirement is specified for the frequency range of 2496-2545MHz. | | |

**Table 5.4.3.3-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_3-8-41-41 | 3 | 0 |
| 8 | 0 |
| 41 | 05 |
| 0.56 |
| NOTE 5: The requirement is specified for the frequency range of 2545-2690MHz.  NOTE 6: The requirement is specified for the frequency range of 2496-2545MHz. | | |

#### 5.4.3.4 REFSENS requirements

For IMD2 component in B41 DL from CA\_3A-8A UL and IMD2 component in B8 DL from CA\_3A-41A, it is proposed the following MSD is re-used from DC\_8-41\_n3 in 38101-3:

Table 5.4.3.4-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | Source of IMD |
| EUTRA CA | EUTRA CA | EUTRA band | UL Fc | UL BW | UL | DL Fc | DL BW | MSD | Duplex mode |
| DL Configuration | UL Configuration | (MHz) | (MHz) | CLRB | (MHz) | (MHz) | (dB) |
| CA\_3A-8A-41A-41A | CA\_3A-8A | 3 | 1780 | 5 | 25 | 1875 | 5 | N/A | FDD | N/A |
| 8 | 885 | 5 | 25 | 930 | 5 | N/A | FDD | N/A |
| 41 | 2665 | 5 | 25 | 2665 | 5 | 27.4 | TDD | IMD21 |
| CA\_3A-8A-41A-41A | CA\_3A-41A | 3 | 1715 | 5 | 25 | 1810 | 5 | N/A | FDD | N/A |
| 8 | 905 | 5 | 25 | 950 | 5 | 28.9 | FDD | IMD21 |
| 41 | 2665 | 5 | 25 | 2665 | 5 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD3 also which MSD is not specified. | | | | | | | | | | |

### 5.4.4 CA\_1-3-8-41-41

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

Table 5.4.4.1-1: CA configurations under study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_1A-3A-8A-41A-41A | CA\_1A-3A  CA\_1A-8A  CA\_1A-41A  CA\_3A-8A  CA\_3A-41A  CA\_8A-41A | 1 |  |  | Yes | Yes | Yes | Yes | 90 | 0 |
| 3 | Yes | Yes | Yes | Yes | Yes | Yes |
| 8 | Yes | Yes | Yes | Yes |  |  |
| 41 | See CA\_41A-41A Bandwidth combination set 0 in Table 5.6A.1-3 | | | | | |

#### 5.4.4.2 Co-existence studies

Coexistence requirements for CA\_1-3, CA\_1-8, CA\_1-41, CA\_3-8, CA\_3-41 and CA\_8-41 already exist in TS 36101.

#### 5.4.4.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_1-3-8-41 in TS 36101:

**Table 5.4.4.3-1: ΔTIB,c**

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_1-3-8-41-41 | 1 | 0.5 |
| 3 | 0.5 |
| 8 | 0.3 |
| 41 | 0.35 |
| 0.86 |
| NOTE 5**:** The requirement is specified for the frequency range of 2545-2690MHz.  NOTE 6**:** The requirement is specified for the frequency range of 2496-2545MHz. | | |

**Table 5.4.4.3-2: ΔRIB,c**

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_1-3-8-41-41 | 1 | 0 |
| 3 | 0 |
| 8 | 0 |
| 41 | 05 |
| 0.56 |
| NOTE 5: The requirement is specified for the frequency range of 2545-2690MHz.  NOTE 6: The requirement is specified for the frequency range of 2496-2545MHz. | | |

#### 5.4.4.4 REFSENS requirements

Table 5.4.4.4-1: 4DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | | | Source of IMD |
| EUTRA CA | EUTRA CA | EUTRA band | UL Fc | UL BW | UL | DL Fc | DL BW | MSD | Duplex mode |
| DL Configuration | UL Configuration | (MHz) | (MHz) | CLRB | (MHz) | (MHz) | (dB) |
| CA\_1A-3A-8A-41A-41A | CA\_3A-8A | 3 | 1780 | 5 | 25 | 1875 | 5 | N/A | FDD | N/A |
| 8 | 885 | 5 | 25 | 930 | 5 | N/A | FDD | N/A |
| 41 | 2665 | 5 | 25 | 2665 | 5 | 27.4 | TDD | IMD21 |
| CA\_3A-41A | 3 | 1715 | 5 | 25 | 1810 | 5 | N/A | FDD | N/A |
| 8 | 905 | 5 | 25 | 950 | 5 | 28.9 | FDD | IMD21 |
| 41 | 2665 | 5 | 25 | 2665 | 5 | N/A | TDD | N/A |
| CA\_1A-41A | 1 | 1977 | 5 | 25 | 2167 | 5 | N/A | FDD | N/A |
| 8 | 886 | 5 | 25 | 931 | 5 | 4.5 | FDD | IMD5 |
| 41 | 2500 | 5 | 25 | 2500 | 5 | N/A | TDD | N/A |
| CA\_3A-41A | 3 | 1740 | 5 | 25 | 1835 | 5 | 8.2 | FDD | IMD4 |
| 41 | 2657.5 | 5 | 25 | 2657.5 | 5 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD3 also which MSD is not specified. | | | | | | | | | | |

# 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 |
| 2022-08 | 3GPP RAN4#104e | R4-2214917  R4-2214918  R4-2211999  R4-2214919  R4-2214920  R4-2214921  R4-2214922  R4-2215005  R4-2215006  R4-2215007 |  |  |  | TR 36.718-02-01 :  The following band combinations are added  R4-2214917: CA\_1-41-41  R4-2214918: CA\_3-41-41  R4-2211999: CA\_8-41-41  R4-2214919: CA\_1-3-41-41  R4-2214920: CA\_1-8-41-41  R4-2214921: CA\_3-8-41-41  R4-2214922: CA\_1-3-8-41-41  R4-2215005: CA\_13-48  R4-2215006: CA\_48-66  R4-2215007: CA\_8-48 | V0.0.1 |