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| 3GPP TR 36.718-02-01 V0.0.7 (2024-04) | |
| 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:

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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..>

### 5.1.1 CA\_2C

#### 5.1.1.1 Channel bandwidths per operating band

Table 5.1.1.1-1: 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 | | |
| 2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |

Table 5.1.1.1-2: 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  (NOTE 3) | Component carriers in order of increasing carrier frequency | | | | | Maximum aggregated  bandwidth [MHz] | Bandwidth combination set |
| Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] |
| CA\_2C | CA\_2C | 5 | 20 |  |  |  | 40 | 0 |
| 10 | 15, 20 |  |  |  |
| 15 | 10, 15, 20 |  |  |  |
| 20 | 5, 10, 15, 20 |  |  |  |

#### 5.1.1.2 Maximum output power

Table 5.1.1.2: CA UE Power Class for intraband contiguous CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA CA Configuration | Class 1 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) | Class 4 (dBm) | Tolerance (dB) |
| CA\_2C |  |  |  |  | 23 | +2/-2 |  |  |

#### 5.1.1.3 Co-existence studies

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Configuration | Spurious emission | | | | | | |
| Protected band | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| CA\_2 | E-UTRA Band 4, 5, 12, 13, 14, 17, 24, 26, 27, 28, 29, 30, 41, 42, 50, 51, 53, 54, 66, 70, 71, 74, 85, 103, 106  NR Band n105 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 2, 25 | FDL\_low | - | FDL\_high | -50 | 1 | 15 |
| E-UTRA Band 43, 48  NR Band n77 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |

#### 5.1.1.4 REFSENS requirements

Table 5.1.1.4: Intra-band contiguous CA uplink configuration for reference sensitivity for Bandwidth Class C

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA configuration / CC combination / NRB\_agg / Duplex mode | | | | | | | | | | | | | |
| Uplink CA configuration | 100RB+25RB | | 100RB+50RB | | 75RB+75RB | | 75RB+50RB | | 100RB+75RB | | 100RB+100RB | | Duplex Mode |
| PCC | SCC | PCC | SCC | PCC | SCC | PCC | SCC | PCC | SCC | PCC | SCC |
| CA\_2C | 50 | 0 | 50 | 0 | 50 | 0 | 50 | 0 | 50 | 0 | 50 | 0 | FDD |

#### 5.1.1.5 AMPR CA\_2C

**Simulation assumptions and scenario**

- UL LTE channel for B2 at 1850-1910 MHz, SCS = 15 kHz

- I/Q image -28 dBc

- Carrier leakage -28 dBc

- CIM3 -60 dBc

- Power class PC3

- Only additional spectrum emission mask is considered; other gating factors (ACLR, spurious emission mask, EVM etc.) are excluded.

- The additional SEM is shown in Table 5.1.1.5-1. It is modified from the general LTE CA SEM by changing -10 dBm to -13 dBm in the ± 1-5 MHz segment. This modification is done following the additional SEM used for band 2 in the single-carrier case (NS\_03).

Table 5.1.1.5-1: Spectrum emission limits for CA\_2C

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Spectrum emission limit [dBm]/BWChannel\_CA | | | | | | | |
| ΔfOOB  (MHz) | 25RB +100RB  (24.95 MHz) | 50RB +75RB  (24.75 MHz) | 50RB +100RB  (29.9 MHz) | 75RB +75RB  (30 MHz) | 75RB +100RB  (34.85 MHz) | 100RB +100RB  (39.8 MHz) | Measurement bandwidth |
| ± 0-1 | -22 | -22 | -22.5 | -22.5 | -23.5 | -24 | 30 kHz |
| ± 1-5 | -13 | -13 | -13 | -13 | -13 | -13 | 1 MHz |
| ± 5-24.75 | -13 | -13 | -13 | -13 | -13 | -13 | 1 MHz |
| ± 24.75-24.95 | -13 | -25 | -13 | -13 | -13 | -13 | 1 MHz |
| ± 24.95-29.75 | -25 | -25 | -13 | -13 | -13 | -13 | 1 MHz |
| ± 29.75-29.9 | -25 |  | -13 | -13 | -13 | -13 | 1 MHz |
| ± 29.9-29.95 | -25 |  | -25 | -13 | -13 | -13 | 1 MHz |
| ± 29.95-30 |  |  | -25 | -13 | -13 | -13 | 1 MHz |
| ± 30-34.85 |  |  | -25 | -25 | -13 | -13 | 1 MHz |
| ± 34.85-34.9 |  |  | -25 | -25 | -25 | -13 | 1 MHz |
| ± 34.9-35 |  |  |  | -25 | -25 | -13 | 1 MHz |
| ± 35-39.8 |  |  |  |  | -25 | -13 | 1 MHz |
| ± 39.8-39.85 |  |  |  |  | -25 | -25 | 1 MHz |
| ± 39.85-44.8 |  |  |  |  |  | -25 | 1 MHz |

Table 5.1.1.5-2: E-UTRA CA configurations and bandwidth combination sets defined for intra-band contiguous CA\_2C

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | E-UTRA CA configuration / Bandwidth combination set | | | | | | |
| E-UTRA CA configuration | Uplink CA configurations  (NOTE 3) | Component carriers in order of increasing carrier frequency | | | | | Maximum aggregated  bandwidth [MHz] | Bandwidth combination set |
| Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] |
| CA\_2C |  | 5 | 20 |  |  |  | 40 | 0 |
| 10 | 15, 20 |  |  |  |
| 15 | 10, 15, 20 |  |  |  |
| 20 | 5, 10, 15, 20 |  |  |  |

**Simulation results**

In particular, the different value of the required backoff on top of the MPR defined in 36.101 are presented in triangle plots.

In Figures 5.1.1.3-1 and 5.1.1.3-2, we specifically present results for QPSK and 16 QAM modulations, respectively, which show allocations that may require A-MPR.

A graph with green and white lines

Description automatically generatedA graph with green and white lines

Description automatically generatedA graph with green and black text

Description automatically generatedA graph with green and grey bars

Description automatically generated

20MHz+10MHz

10MHz+20MHz

15MHz+10MHz

10MHz+15MHz

A graph with green and white lines

Description automatically generatedA graph with green and white lines

Description automatically generatedA graph with green and white lines

Description automatically generatedA graph with green and white lines

Description automatically generated

20MHz+20MHz

15MHz+15MHz

20MHz+15MHz

15MHz+20MHz

Figure 5.1.1.5-1: Examples of A-MPR needed for CA\_2C w.r.t. QPSK modulation

A graph with green and white lines

Description automatically generatedA graph with numbers and a green bar

Description automatically generated

20MHz+20MHz

15MHz+15MHz

Figure 5.1.1.5-2: Examples of A-MPR needed for CA\_2C w.r.t. 16QAM modulation

If simulation results are converted into a table format it could be as below.

Table5.1.1.5-3: Contiguous Allocation A-MPR for CA\_2C (power class 3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| CA Bandwidth Class C | RBStart | LCRB   [RBs] | RBStart +LCRB [RBs] | A-MPR for QPSK [dB] | A-MPR for 16 QAM |
| 50RB / 75 RB | 0 - 1 | 8 - 12 | N/A | ≤1dB | N/A |
| 112 -117 | N/A | >123 |
| 50RB / 100 RB | 0 | 10-12 | N/A | ≤0.5 dB | N/A |
| 138-140 | N/A | 150 |
| 75 RB / 75 RB | 0 - 2 | 8-16 | N/A | ≤1 dB | N/A |
| 132-142 | N/A | >147 |
| 0 | 9 | N/A | N/A | ≤0.5dB |
| 141 | N/A | 150 |
| 75 RB / 100 RB | 0 - 3 | 8-16 | N/A | ≤0.5 dB | N/A |
| 156-167 | N/A | >171 |
| 100 RB / 100 RB | 0 - 3 | 8-18 | N/A | ≤1 dB | N/A |
| 179-192 | N/A | >196 |
| 0 | 15 | N/A | N/A | ≤0.5dB |
| 185 | N/A | 200 |
| NOTE 1: RBstart indicates the lowest RB index of transmitted resource blocks  NOTE 2: LCRB is the length of a contiguous resource block allocation | | | | | |

### 5.1.2 CA\_28C

#### 5.1.2.1 Channel bandwidths per operating band

Table 5.1.2.1-1: 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 | | |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

Table 5.1.2.1-2: 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  (NOTE 3) | Component carriers in order of increasing carrier frequency | | | | | Maximum aggregated  bandwidth [MHz] | Bandwidth combination set |
| Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] |
| CA\_28C | CA\_28C | 5 | 20 |  |  |  | 30 | 0 |
| 10 | 15, 20 |  |  |  |
| 15 | 10, 15 |  |  |  |
| 20 | 5, 10 |  |  |  |

#### 5.1.2.2 Co-existence studies

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Configuration | Spurious emission | | | | | | |
| Protected band | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| CA\_28 | E-UTRA Band 1, 4, 22, 32, 42, 43, 50, 51, 65, 66, 73, 74, 75, 76  NR Band n77, n78, n100, n101 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| 28  E-UTRA Band 1 | FDL\_low | - | FDL\_high | -50 | 1 | 19, 25 |
| E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 20, 25, 26, 27, 31, 34, 38, 40, 41, 52, 72, 87, 88  NR Band n79 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA Band 11, 21 | FDL\_low | - | FDL\_high | -50 | 1 | 19, 24 |
| Frequency range | 470 | - | 694 | -42 | 8 | 15, 35 |
| Frequency range | 470 | - | 710 | -26.2 | 6 | 34 |
| Frequency range | 662 | - | 694 | -26.2 | 6 | 15 |
| Frequency range | 758 | - | 773 | -32 | 1 | 15 |
| Frequency range | 773 | - | 803 | -50 | 1 |  |
| Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 8, 19 |

#### 5.1.2.3 REFSENS requirements

Table 5.1.2.3: Intra-band contiguous CA uplink configuration for reference sensitivity for Bandwidth Class C

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA configuration / CC combination / NRB\_agg / Duplex mode | | | | | | | | | | | | | |
| Uplink CA configuration | 100RB+25RB | | 100RB+50RB | | 75RB+75RB | | 75RB+50RB | | 100RB+75RB | | 100RB+100RB | | Duplex Mode |
| PCC | SCC | PCC | SCC | PCC | SCC | PCC | SCC | PCC | SCC | PCC | SCC |
| CA\_28C | 25 | 0 | 25 | 0 | 25 | 0 | 25 | 0 | N/A | N/A | N/A | N/A | FDD |

#### 5.1.2.4 A-MPR CA\_28C

**General assumptions**

- UL LTE channel for B28 at 703-748 MHz, SCS = 15 kHz

- I/Q image -28 dBc

- Carrier leakage -28 dBc

- CIM3 -60 dBc

- Only additional spurious emission masks were considered. Other gating factors (such as ACLR, SEM, etc.) were excluded.

Table 5.1.2.4-1: E-UTRA CA configurations and bandwidth combination sets defined for intra-band contiguous CA\_28C

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | E-UTRA CA configuration / Bandwidth combination set | | | | | | |
| E-UTRA CA configuration | Uplink CA configurations | Component carriers in order of increasing carrier frequency | | | | | Maximum aggregated  bandwidth [MHz] | Bandwidth combination set |
| Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] | Channel bandwidths for carrier [MHz] |
| CA\_28C | - | 5 | 20 |  |  |  | 30 | 0 |
| 10 | 15, 20 |  |  |  |
| 15 | 10, 15 |  |  |  |
| 20 | 5, 10 |  |  |  |

##### 5.1.2.4.1 Additional spurious emission requirements for NS\_17

When “NS\_17” is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.10-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.10-1 [1]: Additional requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency band  (MHz) | Channel bandwidth / Spectrum emission limit (dBm) | Measurement bandwidth | NOTE |
| 3, 5, 10 MHz |
| 470 ≤ f ≤ 710 | -26.2 | 6 MHz | 1 |
| NOTE 1: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz. Applicable when the assigned E-UTRA carrier is confined within 715 MHz and 718 MHz and when the channel bandwidth used is 3 MHz. | | | |

##### 5.1.2.4.2 Additional spurious emission requirements for NS\_18

When “NS\_18” is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.11-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.11-1 [1]: Additional requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency band  (MHz) | Channel bandwidth / Spectrum emission limit (dBm) | Measurement bandwidth | NOTE |
| 5, 10, 15, 20 MHz |
| 692-698 | -26.2 | 6 MHz |  |

##### 5.1.2.4.3 Simulation results

A complete set of A-MPR results on LTE CA\_28C for different bandwidth combinations listed in Table 2 are provided in Appendix for both NS\_17 and NS\_18.

##### 5.1.2.4.4 A-MPR results with NS\_17

According to NOTE 1 in Table 6.6.3.3.10-1 [1], the additional spurious emission requirements for NS\_17 are applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz. Therefore, we present the A-MPR results at frequency positions such that the aggregated channel bandwidth is confined within 718 MHz and 748 MHz. In particular,

- For combinations 5MHz/20MHz, 10MHz/15MHz, i.e., 25MHz CA BW, the upper edge of the CA channel will be studied at maximum 5MHz frequency offset below 748Mhz.

- For combinations 10MHz+20MHz, 20MHz+10MHz, 15MHz+15MHz, i.e., 30MHz CA BW, i.e., the CA channel is placed exactly at 718-748 MHz.

In Figure 1, we show A-MPR triangle plots for 25MHz CA BW with QPSK modulation and with different frequency positions.

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Description automatically generated

20MHz+5MHz

5MHz+20MHz

A graph with green and white bars

Description automatically generatedA graph with green and grey bars

Description automatically generated

20MHz+5MHz

5MHz+20MHz

Figure 5.1.2.4-1: Examples of A-MPR needed for CA\_28C with NS\_17 w.r.t. QPSK modulation and different frequency position

As can be observed, A-MPR is needed for the allocations near the lower of the channel, and for large-size allocations that span across two carriers. In addition, within frequency between 718-748 MHz, required backoff values are almost same for all frequency positions. Similar observations are applicable for other modulations and for other bandwidth combinations (e.g., 10MHz/15MHz and 15MHz/15MHz), as can be seen from the attached results in Appendix.

**Observation: For CA\_28C with NS\_17, A-MPR is needed for the allocations near the lower of the channel, and for large-size allocations that span across two carriers.**

It can also be seen that the A-MPR areas are asymmetric for combinations with different per-carrier bandwidth sizes (e.g., 5MHz+20MHz and 20MHz+5MHz). This is due to the additional spectrum emission requirement signalled by NS\_17 is at one side of band 28.

**Observation: A-MPR areas are asymmetric for combinations with different per-carrier bandwidth sizes.**

Based on the A-MPR triangle plots, A-MPR table for CA\_28C with NS\_17

Table 5.1.2.4-2: Contiguous Allocation A-MPR for CA\_28C NS\_17 (power class 3)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA Bandwidth Class C | Upper edge frequency [MHz] | RBStart | LCRB [RBs] | RBstart + LCRB [RBs] | A-MPR per modulation [dB] | | | |
| QPSK | 16QAM | 64QAM | 256QAM |
| 25 RB / 100 RB | >=743 and < 748 | 0-25 | 100-125 |  | 4 | 3 | 3 | 1 |
| 0-17 | 25-99 |  | 4 | 3 | 3 | 1 |
| 0-26 | 1-8 | <=32 | 3.5 | 3 | 1 | N/A |
| 18-52 | 70-99 |  | 3 | 2 | 1 |
| 0-22 | 9-24 | <=41 | 2.5 | 1.5 | N/A |
| 748 | 0-25 | 100-125 |  | 2.5 | 2 | 2 | N/A |
| 0-10 | 51-99 |  | 2 | 2 | 2 |
| 0-26 | 1-8 | <=32 | 3.0 | 2.5 | 1.5 |
| 11-52 | 87-99 |  | 2 | 1 | 1 |
| 0-22 | 9-25 | <=41 | 2 | 1 | N/A |
| 50 RB / 75 RB | >=743 and < 748 | 0-25 | 100-125 |  | 4 | 3 | 3 | 1 |
| 0-15 | 39-99 |  | 4 | 3 | 3 | 1 |
| 16-26 | 38-99 |  | 3 | 2 | 2 | N/A |
| 0-26 | 1-12 | <=35 | 3 | 2 | 1 |
| 27-45 | 60-99 |  | 2 | 2 | 1 |
| 0-15 | 13-38 |  | 2 | 1 | 1 |
| 748 | 0-25 | 100-125 |  | 3 | 2 | 2 | N/A |
| 0-15 | 51-99 |  | 3 | 2 | 2 |
| 0-26 | 1-12 | <=35 | 3 | 2 | 1 |
| 16-26 | 72-99 |  | 2 | 1 | 1 |
| 0-8 | 13-50 |  | 1.5 | 1.5 | 0.5 |
| 50 RB / 100 RB | 748 | 0-26 | 125-150 |  | 4 | 3 | 3 | 1 |
| 0-17 | 34-124 |  | 4 | 3 | 3 |
| 18-28 | 34-124 |  | 3 | 2 | 2 |
| 0-35 | 1-12 | <=35 | 3 | 2 | 1 | N/A |
| 29-40 | 70-124 |  | 3 | 2 | 2 |
| 0-20 | 13-33 |  | 2 | 2 | 1 |
| 41-60 | 75-124 |  | 2 | 1 | 1 |
| 75 RB / 75 RB | 748 | 0-26 | 125-150 |  | 4.5 | 3 | 3 | 1 |
| 0-3 | 72-124 |  | 4.5 | 3 | 3 |
| 4-30 | 51-124 |  | 4 | 3 | 3 |
| 0-3 | 51-71 |  | 4 | 3 | 2 | N/A |
| 35-39 | 45-124 |  | 3 | 2 | 2 |
| 0-36 | 1-16 | <=48 | 3 | 2 | 1 |
| 43-51 | 45-124 |  | 2 | 1 | 1 |
| 0-25 | 40-50 |  | 2 | 2 | 1 |
| 0-28 | 18-36 |  | 1.5 | 1.5 | 0.5 |

##### 5.1.2.5 A-MPR results with NS\_18

For CA\_28C with NS\_18, we present the A-MPR results at frequency positions within 703 -748 MHz. In particular, we plot the A-MPR triangle when the lower edge of aggregated channel is placed X [MHz] offset above the lower edge of band 28 (703 MHz), where

- X ranges from 0 to 20MHz in 5MHz grid for 25MHz CA BW

- X ranges from 0 to 15MHz in 5MHz grid for 30MHz CA BW

In Figure 5.1.2.4-2, we show A-MPR triangle plots for 5MHz+20MHz and 10MHz+15MHz (25MHz CA BW) with QPSK modulation and with different frequency positions, i.e., at offset 0, 5MHz and 10MHz from the the lower edge of band 28.

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10MHz+15MHz

5MHz+20MHz

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Description automatically generatedA graph with green and white lines

Description automatically generated

10MHz+15MHz

10MHz+15MHz

5MHz+20MHz

5MHz+20MHz

Figure 5.1.2.4-2: Examples of A-MPR needed for CA\_28C 5MHz/20MHz and 10MHz/15MHz with NS\_18 w.r.t. QPSK modulation and different frequency position

In general, same observations can be made, i.e., A-MPR is needed for the allocations near the lower edge of the channel, and for large-size allocations that span across two carriers. It can also be seen that when channel is placed near the operating band edge (0MHz offset), higher power backoff is required even for most of allocations that spans across two carriers. The required backoff decreases when the channel is moved far away from the lower edge of the operating band, and only allocations that start near the lower edge of the channel needs to apply A-MPR.

We also notice that combination 10MHz/15MHz may need larger A-MPR for the large-size allocation across two carrier compared to 5MHz/20MHz at the same frequency position. This could be understandable as the bandwidth gap between two carrier is larger in case 10MHz/15MHz, which results in emissions reaching further from the channel edge.

In Figure 5.1.2.4-3, we show A-MPR triangle plots for 30MHz CA BW, i.e., 10MHz+20MHz and 15MHz+15MHz with QPSK modulation and with different frequency positions, i.e., at offset 0 (closest), 5MHz, 10MHz and 15MHz from the lower edge of band 28. Compared with 25MHz CA BW, similar behavior of additionally required power backoff can be observed, and the frequency position of the 30MHz channel needs to be further from the lower edge of the operating band to transmit with lower or without power backoff.

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Description automatically generated

15MHz+15MHz

15MHz+15MHz

10MHz+20MHz

10MHz+20MHz

10MHz+20MHz

15MHz+15MHz

15MHz+15MHz

10MHz+20MHz

Figure 5.1.2.4-3: Examples of A-MPR needed for CA\_28C 10MHz+20MHz and 15MHz+15MHz with NS\_18 w.r.t. QPSK modulation and different frequency position

**Observation: For CA\_28C, with NS\_18, A-MPR is needed for the allocations near the lower edge of the channel, and for large-size allocations that span across two carriers. Higher A-MPR is need when channel is placed closer to the lower edge of the band and/or when guard band between two carrier is large.**

Based on the A-MPR triangle plots, A-MPR table for CA\_28C with NS\_18.

Table 3: Contiguous Allocation A-MPR for CA\_28C with NS\_18 (power class 3)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA Bandwidth Class C | Lower edge frequency [MHz] | RBStart | LCRB [RBs] | RBstart + LCRB [RBs] | A-MPR per modulation [dB] | | | |
| QPSK | 16QAM | 64QAM | 256QAM |
| 25 RB / 100 RB | >=703 and <713 | 0-25 | 100-125 |  | 5 | 3.5 | 3.5 | 1.5 |
| 0-1 | 26-99 |  | 5 | 3.5 | 3.5 | 1.5 |
| 5-14 | 45-99 |  | 4 | 3 | 3 | 1 |
| 15-25 | 81-99 |  | 4 | 3 | 3 | 1 |
| 2-4 | 65-99 |  | 4 | 3 | 3 | 1 |
| 2-4 | 40-64 |  | 4 | 3 | 3 | 1 |
| 20-29 | 1-8 | <=35 | 4 | 3 | 2 | N/A |
| 0-19 | 1-8 |  | 4 | 2 | 2 |
| 5-14 | 26-44 |  | 3 | 3 | 3 |
| 15-25 | 9-80 |  | 3 | 2 | 2 |
| 26-40 | 72-99 |  | 3 | 2 | 2 |
| 41-55 | 62-99 |  | 3 | 2 | 2 |
| 2-4 | 26-39 |  | 2 | 1 | N/A |
| 0-14 | 9-25 |  | 2.5 | 1.5 | 1.5 |
| >=713 | 0-17 | 100-125 |  | 2.5 | 2 | 1.5 | 1 |
| 0-13 | 1-8 |  | 2.5 | 2 | 1 | 1 |
| 0-1 | 65-99 |  | 2.5 | 1 | 1 | N/A |
| 0-25 | 9-25 | <=37 | 2 | 1 | N/A |
| 2-17 | 65-99 |  | 2 | 1.0 | N/A |
| 50 RB / 75 RB | >=703  and <713 | 0-5 | 45-125 |  | 6 | 4.5 | 4 | 2.5 |
| 6-20 | >=33 |  | 5 | 4 | 4 | 1 |
| 0-5 | 33-44 |  | 5 | 4 | 3 | 1 |
| 21-27 | 33-104 |  | 4 | 3 | 3 | 1 |
| 28-35 | >= 36 |  | 3 | 3 | 1 | N/A |
| 0-32 | 1-13 |  | 3 | 2 | 1 |
| 38-51 | 45-87 |  | 2 | 1 | 1 |
|  | 0-26 | 15-32 | <=54 | 2 | 1 | 1 |
| >713 | 0-5 | 33-125 |  | 2.5 | 2 | 2 |
| 0-13 | <13 | <=22 | 2.5 | 2 | 1 |
| 6-20 | >= 70 |  | 2 | 1 | 1 |
| 0-26 | 15-32 | <=54 | 1 | 1 | N/A |
| 21-27 | >= 70 |  | 1 | N/A | N/A |
| 50 RB / 100 RB | >=703  and <713 | 0-5 | 36-150 |  | 6 | 4.5 | 4.5 | 2.5 |
| 6-20 | 36-150 |  | 5 | 3 | 3 | 1 |
| 21-28 | 36-129 |  | 4 | 3 | 3 | 1 |
| 29-38 | 15-120 |  | 3 | 2 | 2 | N/A |
| 0-40 | 1-13 | <=49 | 3 | 2 | 2 |
| 39-68 | 60-112 |  | 3 | 2 | 2 |
| 0-28 | 15-35 |  | 3 | 1 | N/A |
| >=713 | 0-5 | 51-150 |  | 3 | 2 | 2 | N/A |
| 0-22 | 1-13 | <= 33 | 3 | 2 | 1 |
| 6-20 | 64-150 |  | 2 | 1 | 1 |
| 0-16 | 15-35 | <= 45 | 1 | 1 | N/A |
| 0-10 | 36-50 |  | 1 | N/A | N/A |
| 21-35 | 90-129 |  | 1 | N/A | N/A |
| 75 RB / 75 RB | >=703  and <713 | 0-3 | 72-150 |  | 6 | 4.5 | 4 | 2 |
| 4-15 | 72-150 |  | 5 | 4 | 4 | 2 |
| 16-30 | 72-150 |  | 5 | 4 | 3 | 1 |
| 0-16 | 37-71 |  | 5 | 4 | 3 | 1 |
| 31-39 | 42-120 |  | 4 | 3 | 2 | 1 |
| 40-51 | 48-120 |  | 3 | 2 | 2 | N/A |
| 0-41 | 1-17 | <=53 | 3 | 2 | 1 |
| 17-30 | 37-71 |  | 3 | 2 | 1 |
| 52-60 | 40-100 |  | 3 | 1 | N/A |
| 0-26 | 18-36 | <=62 | 2.5 | 1.5 |
| >=713 | 0-10 | 72-150 |  | 3 | 2 | 2 | N/A |
| 11-15 | 72-139 |  | 3 | 2 | 2 |
| 16-30 | 60-139 |  | 2 | 1 | 1 |
| 0-23 | 1-17 | <=35 | 3 | 2 | 1 |
| 0-18 | 18-36 | <=51 | 3 | 1 | N/A |
| 0-15 | 37-71 |  | 1 | N/A | N/A |
| 31-50 | 60-129 |  | 1 | N/A | N/A |
| NOTE 1: RBstart indicates the lowest RB index of transmitted resource blocks  NOTE 2: LCRB is the length of a contiguous resource block allocation | | | | | | | | |

## 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 |

### 5.2.1 CA\_7-32

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

Table 5.2.1.1-1: 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 | | |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD2 |
| NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell. | | | | | | | |

Table 5.2.1.1-2: 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\_7C-32A | CA\_7C | 7 | See CA\_7C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | | 60 | 0 |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.2.1.2 Co-existence studies

Table 5.2.1.2-1: 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 |
| 7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| 32 | N/A | N/A | 1452 | 1496 | TBD | TBD | TBD | TBD | TBD | TBD |

Table 5.2.1.2-2: 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 |
| 7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| 32 | N/A | N/A | 1452 | 1496 | 2904 | 2992 | 4356 | 4488 | 5808 | 5984 |

#### 5.3.1.3 ∆TIB and ∆RIB values

Relaxation values for CA\_7-32 already specified.

#### 5.3.1.4 REFSENS Requirements

The following REFSENS requirement for CA with an SDL band has already been specified for CA\_7A-32A and can be reused for CA\_7C-32A:

Table 5.3.1.4-1: Reference sensitivity QPSK PREFSENS (CA with a SDL band)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_7C-32A | 7 |  |  |  | -95 | -93.2 | -92 | FDD |
| 32 |  |  | -100 | -97 | -95.2 | -94 |

### 5.2.2 CA\_7-20

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

Table 5.2.2.1-1: 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 | | |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |

Table 5.2.2.1-2: 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\_7C-20A | CA\_7C  CA\_7A-20A | 7 | See CA\_7C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | | 60 | 0 |
| 20 |  |  | Yes | Yes | Yes | Yes |

#### 5.2.2.2 Co-existence studies

Coexistence for CA\_7-20 has already been specified in TS 36101.

#### 5.2.2.3 ∆TIB and ∆RIB values

Relaxation values for CA\_7-20 already specified.

#### 5.2.2.4 REFSENS Requirements

No additional REFSENS requirements needed when compared to CA\_7A-20A.

### 5.2.3 CA\_3-67

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

Table 5.2.3.1-1: 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 | | |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 67 |  | N/A |  | 738 MHz | – | 758 MHz | FDD2 |
| NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell. | | | | | | | |

Table 5.2.3.1-2: 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\_3A-67A | - | 3 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| 67 |  |  | Yes | Yes | Yes | Yes |
| CA\_3C-67A | CA\_3C | 3 | See CA\_3C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 60 | 0 |
| 67 |  |  | Yes | Yes | Yes | Yes |

#### 5.2.3.2 Co-existence studies

Table 5.2.3.2-1: 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 |
| 3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| 67 | N/A | N/A | 738 | 758 | N/A | N/A | N/A | N/A | N/A | N/A |

Table 5.2.3.2-2: 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 |
| 3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| 67 | N/A | N/A | 738 | 758 | 1476 | 1516 | 2214 | 2274 | 2952 | 3032 |

As can be seen in Table 5.2.3.2-1 and Table 5.2.3.2-2 there are no harmonic or harmonic mixing issues identified.

#### 5.2.3.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_3-28 in TS 36101:

Table 5.2.3.3-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_3-67 | 3 | 0.3 |
| 67 | N/A |

Table 5.2.3.3-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_3-67 | 3 | 0 |
| 67 | 0 |

#### 5.2.3.4 REFSENS Requirements

The following REFSENS requirement for CA with an SDL band has been specified for CA\_20A-67A and can be reused for band 67 together with the original band 3 sensitivity:

Table 5.2.3.4-1: Reference sensitivity QPSK PREFSENS (CA with a SDL band)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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\_3A-67A | 3 |  |  | -97 | -94 | -92.2 | -91 | FDD |
| 67 |  |  | -100 | -97 | -95.2 | -94 |
| CA\_3C-67A | 3 |  |  | -97 | -94 | -92.2 | -91 | FDD |
| 67 |  |  | -100 | -97 | -95.2 | -94 |

5.2.5 CA\_12-71

5.2.5.1 Channel bandwidths per operating band for CA

**Table 5.2.5.1-1: 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** | | |
| 12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| 71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

Table 5.2.5.1-2: 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\_12A-71A | - | 12 |  |  | Yes | Yes |  |  | 20 | 0 |
|  |  | 71 |  |  | Yes | Yes |  |  |  |  |

5.2.5.2 Co-existence studies

Table 5.2.5.2-1 and Table 5.2.5.2-2 summarize frequency ranges where harmonics and/or harmonics mixing occur for CA\_12-71.

**Table 5.2.5.2-1: Impact of UL/DL Harmonic**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| 12 | 699 | 716 | 729 | 746 | 1398 | 1432 | 2097 | 2148 | 2796 | 2864 | 3495 | 3580 |
| 71 | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | 2652 | 2792 | 3315 | 3490 |

**Table 5.2.5.2-2: Impact of UL/DL Harmonic mixing**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **2nd Harmonic** | | **3rd Harmonic** | | **4th Harmonic** | | **5th Harmonic** | |
| **Band** | **UL Low Band Edge** | **UL High Band Edge** | **DL Low Band Edge** | **DL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** | **UL Low Band Edge** | **UL High Band Edge** |
| 12 | 699 | 716 | 729 | 746 | 1458 | 1492 | 2187 | 2238 | 2916 | 2984 | 3645 | 3730 |
| 71 | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | 2468 | 2608 | 3085 | 3260 |

As can be seen in Table 5.2.5.2-1 and Table 5.2.5.2-2 there are no harmonic or harmonic mixing issues identified.

However, there are cross band isolation interferences from UL 71 to DL 12.

5.2.5.3 ∆TIB and ∆RIB values

For CA\_12-71, the ΔTIB,c and ΔRIB,c values are reused from NR CA\_n12-n71 and are given in the tables below.

**Table 5.2.5.3-1: ΔTIB,c**

|  |  |  |
| --- | --- | --- |
| CA\_12-71 | 12 | 1 |
| 71 | 1 |

**Table 5.2.5.3-2: ΔRIB,c**

|  |  |  |
| --- | --- | --- |
| CA\_12-71 | 12 | 0.8 |
| 71 | 0.8 |

5.2.5.4 REFSENS Requirements

Based on the co-existence studies there is a need to define additional REFSENS requirements. MSD value and test points are shown as below.

**Table 5.2.5.4-1: 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\_12A-71A | 12 |  |  | -93.2 | -90.2 |  |  | FDD |
| CA\_12A-71A | 71 |  |  | -96.4 | -93.4 |  |  | FDD |

**Table 5.2.5.4-2: Uplink configuration for the uplink band**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **E-UTRA Band / Channel bandwidth of the affected DL 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\_12A-71A | 71 |  |  | 20 | 20 |  |  | FDD |
| CA\_12A-71A | 12 |  |  | 20 | 20 |  |  | FDD |

## 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 |

### 5.3.7 CA\_7-40, CA\_7-40-40

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

Table 5.3.7.1-1: 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** | | |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |

Table 5.3.7.1-2: 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\_7A-40A | CA\_7A-40A | 7 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
|  |  | 40 |  |  | Yes | Yes | Yes | Yes |  |  |
| CA\_7A-40C | CA\_7A-40A | 7 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
|  |  | 40 | See CA\_40C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | |  |  |
| CA\_7A-40D | CA\_7A-40A | 7 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 40 | See CA\_40D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |  |  |
| CA\_7A-40A-40A | CA\_7A-40A | 7 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
|  |  | 40 | See CA\_40A-40A Bandwidth Combination Set 1 in Table 5.6A.1-3 | | | | | |  |  |

#### 5.3.7.2 Co-existence studies

Since 2DL / 1UL fallbacks have been specified, there is no need to study harmonic and cross band isolation issues again. For 2DL / 2UL own receiver desensitization study 2nd, 3rd, 4th and 5th order intermodulation products were calculated and presented in Table 5.3.7.2-1.

Table 5.3.7.2-1: IMD analysis UL\_CA\_7A-40A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequencies (MHz) | 2500 | 2570 | 2300 | 2400 |
| 2nd order IMD products | |fx\_low – fy\_high| | |fx\_high – fy\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 100 | 270 | 4800 | 4970 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2600 | 2840 | 2030 | 2300 |
| 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) | 7300 | 7540 | 7100 | 7370 |
| 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) | 5100 | 5410 | 4330 | 4700 |
| 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) | 9800 | 10110 | 9400 | 9770 |
| 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) | 200 | 540 | 9600 | 9940 |
| 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) | 6630 | 7100 | 7600 | 7980 |
| 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) | 11700 | 12170 | 12300 | 12680 |
| 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) | 1760 | 2200 | 2700 | 3110 |
| 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) | 11900 | 12340 | 12100 | 12510 |

Based on Table 5.3.7.2-1, IMD3 issue caused by 7+40 falls into band 7 Rx.

Table 5.3.7.2-2: 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\_7-40 | Frequency range | 1884.5 | - | 1915.7 | -41 | 0.3 | 8 |
|  | Frequency range | 2570 | - | 2575 | +1.6 | 5 | 15, 21, 26 |
|  | Frequency range | 2575 | - | 2595 | -15.5 | 5 | 15, 21, 26 |
|  | Frequency range | 2595 | - | 2620 | -40 | 1 | 15, 21 |
| NOTE 8:Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.  NOTE 15: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 channel bandwidth.  NOTE21:This requirement is applicable for any channel bandwidths within the range 2500 - 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.  NOTE 26: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band. | | | | | | | |

#### 5.3.7.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

#### 5.3.7.4 REFSENS Requirements

Based on the co-existence studies there is a need to define additional REFSENS requirements. MSD value and test points are taken from NR CA\_n7-n40.

Table 5.3.7.4-1: 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\_7A-40A  CA\_7A-40C  CA\_7A-40D  CA\_7A-40A-40A | 7 | 2510 | 5 | 25 | 2630 | 23 | FDD | IMD3 |
|  | 40 | 2390 | 5 | 25 | 2390 | N/A | TDD | N/A |

### 5.3.8 CA\_2-28

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

Table 5.3.8.1-1: 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** | | |
| 2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

Table 5.3.8.1-2: 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-28A | CA\_2A-28A | 2 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| 28 |  |  | Yes | Yes | Yes | Yes |

#### 5.3.8.2 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 5.3.8-1.

Table 5.3.8.2-1: Harmonic and IMD analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fn\_low** | **fn\_high** |
| UL frequency (MHz) | 1850 | 1910 | 703 | 748 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fn\_low | 2\* fn\_high |
| 2nd harmonics frequency limits (MHz) | 3700-3820 | | 1406 – 1496 | |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fn\_low | 3\* fn\_high |
| 3rd harmonics frequency limits (MHz) | 5550-5730 | | 2109 – 2244 | |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1207 | | 1102 | |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2952 | | 3117 | |
| 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) | 4403 | | 4568 | |
| Two-tone 3rd 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) | 4802 | | 5027 | |
| 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) | 2204 | | 2414 | |
| 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) | 6253 | | 6478 | |
| Two-tone 4th 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) | 1142 | | 902 | |
| 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) | 1456 | | 1711 | |
| 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) | 4662 | | 4902 | |
| 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) | 5809 | | 6064 | |
| Two-tone 5th order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1207 | | 1102 | |

Based on Table 5.3.8-1, there are no IMD issues.

Table 5.3.8.2-2: 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\_2-28 | E-UTRA Band 5, 26, 27, 41 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| E-UTRA band 4, 10, 42, 43, 50, 51, 66, 74 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| E-UTRA band 2, 25 | FDL\_low | - | FDL\_high | -50 | 1 | 3 |
|  | Frequency range | 758 | - | 773 | -32 | 1 | 3 |
|  | Frequency range | 773 | - | 803 | -50 | 1 |  |
| 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. | | | | | | | |

5.3.8.3 ∆TIB and ∆RIB values

Relaxation values for CA\_2-28 are already specified.

#### 5.3.8.4 REFSENS Requirements

No additional REFSENS requirements needed when compared to CA\_2A-28A.

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

### 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. | | | | | | | | | | |

### 5.4.5 CA\_3-7-32

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

Table 5.4.5.1-1: 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 | | |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.5.1-2: 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\_3A-7C-32A | CA\_7C  CA\_3A-7A | 3 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 7 | See CA\_7C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.5.2 Co-existence studies

Coexistence for CA\_3-7 and CA\_7 has already been specified in TS 36101.

#### 5.4.5.3 ∆TIB and ∆RIB values

Relaxation values for CA\_3-7-32 have already been specified in TS 36101.

#### 5.4.5.4 REFSENS Requirements

Table 5.4.5.4-1: 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-7C-32A | CA\_7C  CA\_3A-7A | 3 | 1775 | 5 | 25 | 1870 | 5 | N/A | FDD | N/A |
| 7 | 2510 | 10 | 50 | 2630 | 10 | N/A | N/A |
| 32 | - | - | - | 1470 | 5 | 10.5 | IMD4 |

### 5.4.6 CA\_7-20-32

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

Table 5.4.6.1-1: 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 | | |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.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\_7C-20A-32A | CA\_7C  CA\_7A-20A | 7 | See CA\_7C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | | 80 | 0 |
| 20 |  |  | Yes | Yes | Yes | Yes |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.6.2 Co-existence studies

Coexistence for CA\_7-20 and CA\_7 has already been specified in TS 36101.

#### 5.4.6.3 ∆TIB and ∆RIB values

Relaxation values for CA\_7-20-32 have already been specified in TS 36101.

#### 5.4.6.4 REFSENS Requirements

No additional REFSENS relaxation required compared to CA\_7A-20A-32A.

### 5.4.7 CA\_1-28-32

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

Table 5.4.7.1-1: 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 | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.7.1-2: 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\_1A-28A-32A | CA\_1A-28A | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 28 |  |  | Yes | Yes | Yes | Yes |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.7.2 Co-existence studies

Coexistence for CA\_1-28 has already been specified in TS 36101.

#### 5.4.7.3 ∆TIB and ∆RIB values

Relaxation values already specified for CA\_1-28-32.

#### 5.4.7.4 REFSENS Requirements

No addition relaxation required compared to fallbacks.

### 5.4.8 CA\_1-7-32

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

Table 5.4.8.1-1: 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 | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.8.1-2: 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\_1A-7C-32A | CA\_7C  CA\_1A-7A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 7 | See CA\_7C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.8.2 Co-existence studies

Coexistence for CA\_1-7 has already been specified in TS 36101.

#### 5.4.8.3 ∆TIB and ∆RIB values

Relaxation values already specified for CA\_1-7-32.

#### 5.4.8.4 REFSENS Requirements

Table 5.4.8.4-1: 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-7A-32A  CA\_1A-7C-32A | CA\_1A-7A | 1 | 1977.5 | 5 | 25 | 2167.5 | 5 | N/A | FDD | N/A |
| 7 | 2502.5 | 5 | 25 | 2622.5 | 5 | N/A | N/A |
| 32 | N/A | N/A | N/A | 1454.5 | 5 | 15.2 | IMD34 |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | | | |

### 5.4.9 CA\_1-3-32

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

Table 5.4.9.1-1: 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 | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.9.1-2: 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\_1A-3A-32A | CA\_1A-3A | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.9.2 Co-existence studies

Coexistence for CA\_1-3 has already been specified in TS 36101.

#### 5.4.9.3 ∆TIB and ∆RIB values

Relaxation values already specified for CA\_1-3-32.

#### 5.4.9.4 REFSENS Requirements

Table 5.4.9.4-1: 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-3A-32A | CA\_1A-3A | 1 | 1960 | 5 | 25 | 2510 | 5 | N/A | FDD | N/A |
| 3 | 1720 | 5 | 25 | 1815 | 5 | N/A | N/A |
| 32 | N/A | N/A | 25 | 1480 | 5 | 15.2 | IMD34 |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | | | |

### 5.4.10 CA\_1-3-7-32

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

Table 5.4.10.1-1: 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 | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.10.1-2: 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\_1A-3A-7A-32A | CA\_1A-3A  CA\_1A-7A  CA\_3A-7A | 1 |  |  | Yes | | Yes | | Yes | | Yes | | 80 | 0 |
| 3 |  |  | Yes | | Yes | | Yes | | Yes | |
| 7 |  |  | |  | | Yes | | Yes | | Yes |
| 32 |  |  | Yes | | Yes | | Yes | | Yes | |
| CA\_1A-3A-7C-32A | CA\_7C  CA\_1A-3A  CA\_1A-7A  CA\_3A-7A | 1 |  |  | Yes | | Yes | | Yes | | Yes | | 100 | 0 |
| 3 |  |  | Yes | | Yes | | Yes | | Yes | |
| 7 | See CA\_7C in Table 5.6A.1-1 of 36.101 Bandwidth combination set 1 | | | | | | | | | |
| 32 |  |  | Yes | | Yes | | Yes | | Yes | |

#### 5.4.10.2 Co-existence studies

Coexistence for CA\_7, CA\_1-3, CA\_1-7 and CA\_3-7 has already been specified in TS 36101.

#### 5.4.10.3 ∆TIB and ∆RIB values

Relaxation values already specified for CA\_1-3-7-32.

#### 5.4.10.4 REFSENS Requirements

No additional relaxation required compared to fallbacks.

### 5.4.11 CA\_1-3-28-32

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

Table 5.4.11.1-1: 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 | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.11.1-2: 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\_1A-3A-28A-32A | CA\_1A-3A  CA\_1A-28A  CA\_3A-28A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 28 |  |  | Yes | Yes | Yes | Yes |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.11.2 Co-existence studies

Coexistence for CA\_1-3, CA\_1-28 and CA\_3-28 has already been specified in TS 36101.

#### 5.4.11.3 ∆TIB and ∆RIB values

Relaxation values already specified for CA\_1-3-28-32.

#### 5.4.11.4 REFSENS Requirements

No additional relaxation required compared to fallbacks.

### 5.4.12 CA\_1-7-28-32

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

Table 5.4.12.1-1: 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 | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.12.1-2: 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\_1A-7A-28A-32A | CA\_1A-7A  CA\_1A-28A  CA\_7A-28A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 28 |  | Yes | Yes | Yes | Yes | Yes |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.12.2 Co-existence studies

Coexistence for CA\_1-7, CA\_1-28 and CA\_7-28 has already been specified in TS 36101.

#### 5.4.12.3 ∆TIB and ∆RIB values

Relaxation values already specified for CA\_1-7-28-32.

#### 5.4.12.4 REFSENS Requirements

No additional relaxation required compared to fallbacks.

### 5.4.13 CA\_3-7-28-32

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

Table 5.4.13.1-1: 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 | | |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.13.1-2: 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\_3A-7A-28A-32A | CA\_3A-7A  CA\_3A-28A  CA\_7A-28A | 3 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
| 7 |  |  | Yes | Yes | Yes | Yes |
| 28 |  | Yes | Yes | Yes | Yes | Yes |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.13.2 Co-existence studies

Coexistence for CA\_3-7, CA\_3-28 and CA\_7-28 has already been specified in TS 36101.

#### 5.4.13.3 ∆TIB and ∆RIB values

Table 5.3.13.3-1: ΔTIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_3-7-28-32 | 3 | 0.7 |
| 7 | 0.7 |
| 28 | 0.3 |

Table 5.3.13.3-2: ΔRIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **E-UTRA Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_3-7-28-32 | 1 | 0 |
| 3 | 0 |
| 28 | 0 |
| 32 | 0 |

#### 5.4.13.4 REFSENS Requirements

No additional relaxation required compared to fallbacks.

### 5.4.14 CA\_1-3-7-28-32

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

Table 5.4.14.1-1: 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 | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| 32 |  | N/A |  | 1452 MHz | – | 1496 MHz | FDD |

Table 5.4.14.1-2: 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\_1A-3A-7A-28A-32A | CA\_1A-3A  CA\_1A-7A  CA\_1A-28A  CA\_3A-7A  CA\_3A-28A  CA\_7A-28A | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
| 3 |  |  | Yes | Yes | Yes | Yes |
| 7 |  |  |  | Yes | Yes | Yes |
| 28 |  | Yes | Yes | Yes | Yes | Yes |
| 32 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.14.2 Co-existence studies

Coexistence for CA\_1-3, CA\_1-7, CA\_1-28, CA\_3-7, CA\_3-28 and CA\_7-28 has already been specified in TS 36101.

#### 5.4.14.3 ∆TIB and ∆RIB values

Table 5.3.14.3-1: ΔTIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **E-UTRA Band** | **ΔTIB,c [dB]** |
| --- | --- | --- |
| CA\_1-3-7-28-32 | 1 | 0.6 |
| 3 | 0.6 |
| 7 | 0.6 |
| 28 | 0.6 |

Table 5.3.14.3-2: ΔRIB,c for 4DL aggregation

| **Inter-band CA Configuration** | **E-UTRA Band** | **ΔRIB,c [dB]** |
| --- | --- | --- |
| CA\_1-3-7-28-32 | 1 | 0 |
| 3 | 0 |
| 7 | 0 |
| 28 | 0.2 |
| 32 | 0 |

#### 5.4.14.4 REFSENS Requirements

No additional relaxation required compared to fallbacks.

### 5.4.15 CA\_3-20-67

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

Table 5.4.15.1-1: 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 | | |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| 67 |  | N/A |  | 738 MHz | – | 758 MHz | FDD2 |
| NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell. | | | | | | | |

Table 5.4.15.1-2: 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\_3A-20A-67A | CA\_3A-20A | 3 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 20 |  |  | Yes | Yes | Yes | Yes |
| 67 |  |  | Yes | Yes | Yes | Yes |
| CA\_3C-20A-67A | CA\_3C  CA\_3A-20A | 3 | See CA\_3C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | | 80 | 0 |
| 20 |  |  | Yes | Yes | Yes | Yes |
| 67 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.15.2 Co-existence studies

Co-existence studies show that UL CA\_3-20 give IMD4 into DL 67

#### 5.4.15.3 ∆TIB and ∆RIB values

The following ∆TIB and ∆RIB values are drawn from CA\_3-20-28 in TS 36101:

Table 5.4.15.3-1: ΔTIB,c

| Inter-band CA Configuration | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_3-20-67 | 3 | 0.3 |
| 20 | 0.5 |
| 67 | N/A |

Table 5.4.15.3-2: ΔRIB,c

| Inter-band CA Configuration | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_3-20-67 | 3 | 0 |
| 20 | 0.1 |
| 67 | 0.1 |

#### 5.4.15.4 REFSENS Requirements

Based on the co-existence studies there is a need to define additional REFSENS requirements. MSD value and test points are reused from CA\_n3-n20-n67.

Table 5.4.15.4-1: 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-20A-67A CA\_3C-20A-67A | CA\_3A-20A | 3 | 1775 | 5 | 25 | 1870 | 5 | N/A | FDD | N/A |
| 20 | 840 | 5 | 25 | 799 | 5 | N/A | N/A |
| 67 | N/A | 5 | 25 | 745 | 5 | 9.4 | IMD4 |

### 5.4.16 CA\_2-4-28

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

**Table 5.4.16.1-1: 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** | | |
| 2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| 4 | 1710 MHz | – | 1755 MHz | 2110 MHz | – | 2155 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

Table 5.4.16.1-2: 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-4A-28A | CA\_2A-4A  CA\_2A-28A  CA\_4A-28A | 2 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
| 4 |  |  | Yes | Yes | Yes | Yes |
| 28 |  |  | Yes | Yes | Yes | Yes |

#### 5.4.16.2 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 5.4.16.2-1, in Table 5.4.16.2-2 and in Table 5.4.16.2-3

Table 5.4.16.2-1: Harmonic and IMD analysis UL\_CA\_2A-4A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL Frequency [MHz] | 1850 | 1910 | 1710 | 1755 |
| DL Frequency [MHz] | 1930 | 1990 | 2110 | 2155 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 200 | 95 | 3560 | 3665 |
| 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 1945 | 2110 | 1510 | 1660 |
| 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) | 5410 | 5575 | 5270 | 5420 |
| 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) | 3795 | 4020 | 3220 | 3415 |
| 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) | 190 | 400 | 7120 | 7330 |
| 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) | 7260 | 7485 | 6980 | 7175 |
| 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) | 5170 | 4930 | 5930 | 5645 |
| 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) | 1565 | 1310 | 2310 | 2040 |
| 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) | 8690 | 8930 | 9110 | 9395 |
| 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) | 8830 | 9085 | 8970 | 9240 |

Based on Table 5.4.16.2-1, there are no IMD issues falling inside the third RX band 28.

Table 5.4.16.2-2: Harmonic and IMD analysis UL\_CA\_2A-28A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1850 | 1910 | 703 | 748 |
| DL Frequency [MHz] | 1930 | 1990 | 758 | 803 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1207 | 1102 | 2553 | 2658 |
| 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2952 | 3117 | 504 | 354 |
| 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) | 4403 | 4568 | 3256 | 3406 |
| 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) | 4802 | 5027 | 199 | 394 |
| 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) | 2204 | 2414 | 5106 | 5316 |
| 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) | 6253 | 6478 | 3959 | 4154 |
| 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) | 1142 | 902 | 6937 | 6652 |
| 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) | 1456 | 1711 | 4324 | 4054 |
| 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) | 4662 | 4902 | 8103 | 8388 |
| 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) | 5809 | 6064 | 6956 | 7226 |

Based on Table 5.4.16.2-2, there are no IMD issues falling inside the third RX band 4.

Table 5.4.16.2-3: Harmonic and IMD analysis UL\_CA\_4A-28A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1755 | 703 | 748 |
| DL Frequency [MHz] | 2110 | 2155 | 758 | 803 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1052 | 962 | 2413 | 2503 |
| 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2672 | 2807 | 349 | 214 |
| 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) | 4123 | 4258 | 3116 | 3251 |
| 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) | 4382 | 4562 | 354 | 534 |
| 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) | 1924 | 2104 | 4826 | 5006 |
| 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) | 5833 | 6013 | 3819 | 3999 |
| 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) | 1282 | 1057 | 6317 | 6092 |
| 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) | 1176 | 1401 | 3859 | 3634 |
| 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) | 4522 | 4747 | 7543 | 7768 |
| 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) | 5529 | 5754 | 6536 | 6761 |

Based on Table 5.4.16.2-3, there are 4th order IMD issues falling inside the third RX band 2.

#### 5.4.16.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

#### 5.4.16.4 REFSENS Requirements

Based on the co-existence studies there is a need to define additional REFSENS requirements. MSD value and test points are taken from DC\_2A-4A\_n28A, which also has two mid-band + one low band configuration.

Table 5.4.16.4-1: 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\_2A-4A-28A | CA\_4A-28A | 2 | 1880 | 5 | 25 | 1960 | 11.0 | IMD4 | FDD | IMD4 |
| 4 | 1720 | 5 | 25 | 2120 | N/A | N/A | N/A |
| 28 | 740 | 5 | 25 | 795 | N/A | N/A | N/A |

5.4.17 CA\_1-7-40, CA\_1-7-40-40

5.4.17.1 Channel bandwidths per operating band for CA

**Table 5.4.17.1-1: 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** | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |

**Table 5.4.17.1-2: 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\_1A-7A-40A | CA\_1A-7A  CA\_1A-40A  CA\_7A-40A | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
|  |  | 7 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 |  |  | Yes | Yes | Yes | Yes |  |  |
| CA\_1A-7A-40A-40A | CA\_1A-7A  CA\_1A-40A  CA\_7A-40A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 7 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40A-40A Bandwidth Combination Set 1 in Table 5.6A.1-3 | | | | | |  |  |
| CA\_1A-7A-40C | CA\_1A-7A  CA\_1A-40A  CA\_7A-40A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 7 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | |  |  |
| CA\_1A-7A-40D | CA\_1A-7A  CA\_1A-40A  CA\_7A-40A | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
|  |  | 7 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |  |  |

5.4.17.2 Co-existence studies

Based on the co-existence studies, it can be observed:

No IMD issue caused by 1+7 falls into band 40 Rx;

IMD3 issue caused by 1+40 falls into band 7 Rx;

IMD3/5 issue caused by 7+40 falls into band 1 Rx;

5.4.17.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

5.4.17.4 REFSENS Requirements

Based on the co-existence studies there is a need to define additional REFSENS requirements. MSD value and test points are taken from NR CA\_n1-n7-n40.

**Table 5.4.17.4-1: 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-7A-40A CA\_1A-7A-40C  CA\_1A-7A-40D CA\_1A-7A-40A-40A | 1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | 7 | N/A | 5 | N/A | 2630 | 23 | FDD | IMD3 |
|  | 40 | 2390 | 5 | 25 | 2390 | N/A | TDD | N/A |
|  | 1 | N/A | 5 | N/A | 2120 | 16.4 | FDD | IMD3X |
|  | 7 | 2530 | 5 | 25 | 2650 | N/A | FDD | N/A |
|  | 40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
| NOTE X: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

5.4.18 CA\_1-28-40, CA\_1-28-40-40

5.4.18.1 Channel bandwidths per operating band for CA

**Table 5.4.18.1-1: 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** | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| 40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |

**Table 5.4.18.1-2: 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\_1A-28A-40A | CA\_1A-28A  CA\_1A-40A  CA\_28A-40A | 1 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
|  |  | 28 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 |  |  | Yes | Yes | Yes | Yes |  |  |
| CA\_1A-28A-40A-40A | CA\_1A-28A  CA\_1A-40A  CA\_28A-40A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 28 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40A-40A Bandwidth Combination Set 1 in Table 5.6A.1-3 | | | | | |  |  |
| CA\_1A-28A-40C | CA\_1A-28A  CA\_1A-40A  CA\_28A-40A | 1 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 28 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |  |  |
| CA\_1A-28A-40D | CA\_1A-28A  CA\_1A-40A  CA\_28A-40A | 1 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
|  |  | 28 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |  |  |

5.4.18.2 Co-existence studies

Based on the co-existence studies, it can be observed:

IMD4 issue caused by 1+28 falls into band 40 Rx;

IMD4 issue caused by 1+40 falls into band 28 Rx;

No IMD issue caused by 28+40 falls into band 1 Rx;

5.4.18.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

5.4.18.4 REFSENS Requirements

Based on the co-existence studies there is a need to define additional REFSENS requirements. MSD value and test points are taken from DC\_1A\_n28A-n40A.

**Table 5.4.18.4-1: 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-28A-40A CA\_1A-28A-40C  CA\_1A-28A-40D CA\_1A-28A-40A-40A | 1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | 28 | 743 | 5 | 25 | 798 | N/A | FDD | N/A |
|  | 40 | N/A | 5 | N/A | 2374 | 10.1 | TDD | IMD4 |
|  | 1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | 28 | N/A | 5 | N/A | 768 | 8.6 | FDD | IMD4 |
|  | 40 | 2314 | 5 | 25 | 2314 | N/A | TDD | N/A |

5.4.19 CA\_3-7-40, CA\_3-7-40-40

5.4.19.1 Channel bandwidths per operating band for CA

**Table 5.4.19.1-1: 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** | | |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |

**Table 5.4.19.1-2: 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\_3A-7A-40A | CA\_3A-7A  CA\_3A-40A  CA\_7A-40A | 3 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
|  |  | 7 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 |  |  | Yes | Yes | Yes | Yes |  |  |
| CA\_3A-7A-40A-40A | CA\_3A-7A  CA\_3A-40A  CA\_7A-40A | 3 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 7 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40A-40A Bandwidth Combination Set 1 in Table 5.6A.1-3 | | | | | |  |  |
| CA\_3A-7A-40C | CA\_3A-7A  CA\_3A-40A  CA\_7A-40A | 3 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 7 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40C Bandwidth Combination Set 1 in Table 5.6A.1-1 | | | | | |  |  |
| CA\_3A-7A-40D | CA\_3A-7A  CA\_3A-40A  CA\_7A-40A | 3 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
|  |  | 7 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |  |  |

5.4.19.2 Co-existence studies

Based on the co-existence studies, it can be observed:

No IMD issue caused by 3+7 falls into band 40 Rx;

No IMD issue caused by 3+40 falls into band 7 Rx;

IMD5 issue caused by 7+40 falls into band 3 Rx;

5.4.19.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

5.4.19.4 REFSENS Requirements

Based on the co-existence studies there is a need to define additional REFSENS requirements. MSD value and test points are taken from DC\_3A-7A\_n40A.

**Table 5.4.19.4-1: 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\_3A-7A-40A CA\_3A-7A-40C  CA\_3A-7A-40D CA\_3A-7A-40A-40A | 3 | N/A | 5 | N/A | 1866.6 | 3.4 | FDD | IMD5 |
|  | 7 | 2530 | 5 | 25 | 2650 | N/A | FDD | N/A |
|  | 40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |

5.4.20 CA\_7-28-40, CA\_7-28-40-40

5.4.20.1 Channel bandwidths per operating band for CA

**Table 5.4.20.1-1: 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** | | |
| 7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| 28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| 40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |

**Table 5.4.20.1-2: 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\_7A-28A-40A | CA\_7A-28A  CA\_7A-40A  CA\_28A-40A | 7 |  |  | Yes | Yes | Yes | Yes | 60 | 0 |
|  |  | 28 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 |  |  | Yes | Yes | Yes | Yes |  |  |
| CA\_7A-28A-40A-40A | CA\_7A-28A  CA\_7A-40A  CA\_28A-40A | 7 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 28 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40A-40A Bandwidth Combination Set 1 in Table 5.6A.1-3 | | | | | |  |  |
| CA\_7A-28A-40C | CA\_7A-28A  CA\_7A-40A  CA\_28A-40A | 7 |  |  | Yes | Yes | Yes | Yes | 80 | 0 |
|  |  | 28 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40C Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |  |  |
| CA\_7A-28A-40D | CA\_7A-28A  CA\_7A-40A  CA\_28A-40A | 7 |  |  | Yes | Yes | Yes | Yes | 100 | 0 |
|  |  | 28 |  |  | Yes | Yes | Yes | Yes |  |  |
|  |  | 40 | See CA\_40D Bandwidth Combination Set 0 in Table 5.6A.1-1 | | | | | |  |  |

5.4.20.2 Co-existence studies

Based on the co-existence studies, it can be observed:

No IMD issue caused by 7+28 falls into band 40 Rx;

No IMD issue caused by 7+40 falls into band 28 Rx;

IMD5 issue caused by 28+40 falls into band 7 Rx;

5.4.20.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

5.4.20.4 REFSENS Requirements

Based on the co-existence studies there is a need to define additional REFSENS requirements. MSD value and test points are taken from DC\_7A-28A\_n40A.

**Table 5.4.20.4-1: 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\_7A-28A-40A CA\_7A-28A-40C  CA\_7A-28A-40D CA\_7A-28A-40A-40A | 7 | N/A | 5 | N/A | 2630 | 5.9 | FDD | IMD5 |
|  | 28 | 743 | 5 | 25 | 798 | N/A | FDD | N/A |
|  | 40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |

5.4.21 CA\_1-8-11

5.4.21.1 Channel bandwidths per operating band for CA

**Table 5.4.21.1-1: 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** | | |
| 1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| 11 | 1427.9 MHz | – | 1447.9 MHz | 1475.9 MHz | – | 1495.9 MHz | FDD |

Table 5.4.21.1-2: 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\_1A-8A-11A | CA\_1A-8A  CA\_1A-11A | 1 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| 8 | Yes | Yes | Yes | Yes |  |  |
| 11 |  |  | Yes | Yes |  |  |

#### 5.4.21.2 Co-existence studies

Coexistence for CA\_1-8 and CA\_1-11 has already been specified in TS 36.101.

#### 5.4.21.3 ∆TIB and ∆RIB values

Already included in TS 36.101.

#### 5.4.21.4 REFSENS Requirements

No additional requirements necessary.

5.4.22 CA\_3-8-11

5.4.22.1 Channel bandwidths per operating band for CA

**Table 5.4.22.1-1: 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** | | |
| 3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| 8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| 11 | 1427.9 MHz | – | 1447.9 MHz | 1475.9 MHz | – | 1495.9 MHz | FDD |

**Table 5.4.22.1-2: 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\_3A-8A-11A | CA\_3A-8A  CA\_3A-11A | 3 |  |  | Yes | Yes | Yes | Yes | 40 | 0 |
| 8 |  |  | Yes | Yes |  |  |
| 11 |  |  | Yes | Yes |  |  |

5.4.22.2 Co-existence studies

Coexistences for CA\_3-8 and CA\_3-11 were referred the DC\_8-11\_n3 with UL DC\_8\_n3 and UL DC\_11\_n3 which are already analysed in TR37.716-21-11[3]. The analysis result is that there is no additional intermodulation impact for the additional band receiver.

So this section can be omitted.

5.4.22.3 ∆TIB and ∆RIB values

Relaxation values for CA\_3-8-11 have already been specified in TS 36.101.

5.4.22.4 REFSENS Requirements

No additional REFSENS relaxation required compared to fallbacks.

# 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 | 0.0.1 |
| 2022-10 | 3GPP RAN4#104e-bis | R4-2215561  R4-2215971  R4-2215973  R4-2215975  R4-2216098  R4-2216100  R4-2216101  R4-2216102  R4-2216138  R4-2216139  R4-2217799  R4-2217800  R4-2216140 |  |  |  | TR 36.718-02-01 :  The following band combinations are added  R4-2215561: CA\_7-32  R4-2215971: CA\_7-20  R4-2215973: CA\_3-7-32  R4-2215975: CA\_7-20-32  R4-2216098: CA\_1-28-32  R4-2217799: CA\_1-7-32  R4-2217800: CA\_1-3-32  R4-2216100: CA\_1-3-7-32 (CA\_1A-3A-7C-32A)  R4-2216101: CA\_1-3-7-32 (CA\_1A-3A-7A-32A)  R4-2216102: CA\_1-3-28-32  R4-2216138: CA\_1-7-28-32  R4-2216139: CA\_3-7-28-32  R4-2216140: CA\_1-3-7-28-32 | 0.0.2 |
| 2023-02 | 3GPP RAN4#106 | R4-2303647  R4-2303648 |  |  |  | R4-2303647: CA\_3-67  R4-2303648: CA\_3-20-67  Some section numbering edits for CA\_7-20 | 0.0.3 |
| 2023-04 | 3GPP RAN4#106bis-e | R4-2304964  R4-2306532 |  |  |  | R4-2304964: CA\_2A-28A  R4-2306532: CA\_2A-4A-28A  Some section numbering edits for CA\_3-20-67 | 0.0.4 |
| 2024-03 | 3GPP RAN4#110 | R4-2402623 |  |  |  | R4-2403792: CA\_7-40, CA\_7-40-40 | 0.0.5 |
| 2024-04 | 3GPP RAN4#110bis | R4-2404276 |  |  |  | R4-2404466: CA\_1-7-40, CA\_1-7-40-40  R4-2404467: CA\_1-28-40, CA\_1-28-40-40  R4-2404468: CA\_3-7-40, CA\_3-7-40-40  R4-2404469: CA\_7-28-40, CA\_7-28-40-40  R4-2405405: CA\_2C  R4-2406667: CA\_12-71  R4-2406669: CA\_1-8-11  R4-2406670: CA\_28C  Moving CA\_2-28 from 5.2.4 to 5.3.8 | 0.0.6 |
| 2024-05 | 3GPP RAN4#111 | R4-2409158 |  |  |  | R4-2410593: CA\_3-8-11 | 0.0.7 |