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| 3GPP TR 38.717-01-01 V0.7.0 (2021-11) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Networks;  NR intra band Carrier Aggregation for xCC DL/yCC UL including contiguous and non-contiguous spectrum (x>=y).  (Release 17) | |
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| ***3GPP***  Postal address  3GPP support office address  650 Route des Lucioles - Sophia Antipolis  Valbonne - FRANCE  Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16  Internet  http://www.3gpp.org |
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# Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

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

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

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

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

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

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

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

**should** indicates a recommendation to do something

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

**may** indicates permission to do something

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

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

**can** indicates that something is possible

**cannot** indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

# 1 Scope

The present document is a technical report for NR Intra-band Carrier Aggregation Rel-17 for xDL/yUL including contiguous and non-contiguous spectrum under Rel-17 time frame. The purpose is to gather the relevant background information and studies in order to address NR Intra-band Carrier Aggregation requirements for the Rel-17 band combinations requested by proponents and captured in the WID..

# 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-200663, “New WID: NR intra band Carrier Aggregation for xCC DL/yCC UL including contiguous and non-contiguous spectrum (x>=y)”, RAN#88-e

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

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

## 3.2 Symbols

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

<symbol> <Explanation>

## 3.3 Abbreviations

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

<ABBREVIATION> <Expansion>

# 4 Background

The present document is a technical report for NR Intra-band Carrier Aggregation under Rel-17 timeframe. The document covers each band combination specific issues (i.e. one sub-clause defined per band combination)

## 4.1 TR maintenance

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

# 5 Intra-Band Contiguous Carrier Aggregation FR1: Specific Band Combination Part

## 5.1 CA\_n96 DL\_n96UL

### 5.1.1 Channel bandwidths per operating band for CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA configuration / Bandwidth combination set** | | | | | | | | |
| **NR CA configuration** | **Uplink NR CA  configurations** | **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]** | **Maximum aggregated  bandwidth** | **Bandwidth combination set** |
| CA\_n96B | CA\_n96B | 20, 40 | 20, 40, 60, 80 |  |  |  | 100 | 0 |
| CA\_n96C | CA\_n96C | 80 | 40, 60, 80 |  |  |  | 160 | 0 |
| CA\_n96D | - | 80 | 80 | 60, 80 |  |  | 240 | 0 |
| CA\_n96E | - | 80 | 80 | 80 | 80 |  | 320 | 0 |

### 5.1.2 UE co-existence studies

There are no co-existence issues for this combination.

### 5.1.3 REFSENS

Considering the receiver design for the higher operation frequency with for the band. And for CA\_n96E, there may be gain ripple due to larger aggregation bandwidth configuration than ever, we suggest to allow [0.5]dB REFSENS relaxation as below:

Table 5.1.3-1: ΔRIB,c due to CA

|  |  |  |
| --- | --- | --- |
| Inter-band CA combination | Operating Band | ΔRIB,c (dB) |
| CA\_n96E | n96 | 0.5 |

## 5.2 CA\_2DL\_n2B\_1UL\_n2A

### 5.2.1 Channel bandwidths per operating band for CA

Table 5.2A.1-1: Intra-band contiguous CA operating bands in FR1

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n2 | n2 |

Table 5.5A.1-1: NR CA configurations and bandwidth combination sets defined for intra-band contiguous CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration / Bandwidth combination set | | | | | | | | |
| NR CA configuration | Uplink CA configurations | 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) | Maximum aggregated  bandwidth (MHz) | Bandwidth combination set |
| CA\_n2B | - | 5 | 15 |  |  |  | 20 | 0 |
|  |  | 10 | 10 |  |  |  |  |  |

### 5.2.2 UE maximum output power for Intra-band contiguous CA

Not needed as uplink is single CC.

### 5.2.3 UE additional maximum output power reduction for CA

Not needed as uplink is single CC.

### 5.2.4 Spurious emissions for UE co-existence for intra-band contiguous CA

Not needed as uplink is single CC.

### 5.2.5 Reference sensitivity power level for Intra-band contiguous CA

Not needed as PCC REFSENS is same as single carrier REFSENS and DL SCC is further away from UL than DL PCC.

### 5.2.6 In-band blocking

Table 7.6A.2.1-2a: In-band blocking for intra-band contiguous CA with FDL\_low < 2700 MHz and FUL\_low < 2700 MHz

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Case 1 | Case 2 |  |
|  | Pinterferer | dBm | -56 | -44 |  |
| n2 | Finterferer (offset) | MHz | -BWchannel CA/2 –FIoffset, case 1  and  BWchannel CA/2 +FIoffset, case 1 | ≤ -BWchannel CA/2 –FIoffset, case 2  and  ≥ BWchannel CA/2 +FIoffset, case 2 |  |
|  | Finterferer | MHz | NOTE 2 | FDL\_low – 15  to  FDL\_high + 15 |  |
|  | Finterferer | MHz | NOTE 2 | FDL\_low – 12  to  FDL\_high + 15 |  |
| NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with 15 kHz SCS.  NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -BWchannel CA/2 – FIoffset, case 1; b: BWchannel CA/2 + FIoffset, case 1  NOTE 3: BWchannel CA denotes the aggregated channel bandwidth of the wanted signal  NOTE 4: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1A. | | | | | |

### 5.2.7 Out-of-band blocking

Table 7.6A.3-2: Out of-band blocking for intra-band contiguous CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Range1 | Range 2 | Range 3 |
|  | Pinterferer | dBm | -45 | -30 | -15 |
| n2 | Finterferer (CW) | MHz | -60 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -85 < f – FDL\_low ≤ -60  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 85  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| NOTE 1: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 6000 MHz.  NOTE 2: BWChannel\_CA denotes the aggregated channel bandwidth of the wanted signal  NOTE 3: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm, for FInterferer > 2700 MHz and FInterferer < 4800 MHz. For BWChannel\_CA > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3\*BWChannel\_CA from the band edge. For BWChannel\_CA larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3\*BWChannel\_CA from the band edge.  NOTE 4: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm, for FInterferer > 3650 MHz and FInterferer < 5750 MHz. For BWChannel\_CA≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3\*BWChannel\_CA from the band edge.  NOTE 5: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 2700 MHz and FInterferer < 4800 MHz | | | | | |

### 5.2.8 Narrow band blocking

Table 7.6A.4.1-1: Narrow-band blocking for intra-band contiguous CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | NR CA bandwidth class | |
|  |  |  | B | C |
| n2 | Pw in Transmission Bandwidth Configuration, per CC | dBm | REFSENS + NR CA Bandwidth Class specific value below | |
|  |  |  | 16 | 16 |
|  | Puw (CW) | dBm | -55 | -55 |
|  | Fuw (offset for*Df* = 15 kHz, 30 kHz) | MHz | - Foffset – 0.2  /  + Foffset + 0.2 | - Foffset – 0.2  /  + Foffset + 0.2 |
|  |  |  |  |  |
| NOTE 1: The transmitter shall be set a 4 dB below PCMAX\_L,f,c at the minimum UL configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c defined in clause 6.2.4.  NOTE 2: Reference measurement channel is specified in Annexes A.3.2 and A3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.  NOTE 3: The PREFSENS power level is specified in Table 7.3.2-1 and Table 7.3.2-2 for two and four antenna ports, respectively.  NOTE 4: The Fuw (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to MHz to be offset from the sub-carrier raster. | | | | |

## 5.3 CA\_2DL\_n25B\_1UL\_n25A

### 5.3.1 Channel bandwidths per operating band for CA

Table 5.2A.1-1: Intra-band contiguous CA operating bands in FR1

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n25 | n25 |

Table 5.5A.1-1: NR CA configurations and bandwidth combination sets defined for intra-band contiguous CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration / Bandwidth combination set | | | | | | | | |
| NR CA configuration | Uplink CA configurations | 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) | Maximum aggregated  bandwidth (MHz) | Bandwidth combination set |
| CA\_n25B | - | 5 | 15 |  |  |  | 20 | 0 |
|  |  | 10 | 10 |  |  |  |  |  |

### 5.3.2 UE maximum output power for Intra-band contiguous CA

Not needed as uplink is single CC.

### 5.3.3 UE additional maximum output power reduction for CA

Not needed as uplink is single CC.

### 5.3.4 Spurious emissions for UE co-existence for intra-band contiguous CA

Not needed as uplink is single CC.

### 5.3.5 Reference sensitivity power level for Intra-band contiguous CA

Not needed as PCC REFSENS is same as single carrier REFSENS and DL SCC is further away from UL than DL PCC.

### 5.3.6 In-band blocking

Table 7.6A.2.1-2a: In-band blocking for intra-band contiguous CA with FDL\_low < 2700 MHz and FUL\_low < 2700 MHz

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Case 1 | Case 2 |  |
|  | Pinterferer | dBm | -56 | -44 |  |
| n25 | Finterferer (offset) | MHz | -BWchannel CA/2 –FIoffset, case 1  and  BWchannel CA/2 +FIoffset, case 1 | ≤ -BWchannel CA/2 –FIoffset, case 2  and  ≥ BWchannel CA/2 +FIoffset, case 2 |  |
|  | Finterferer | MHz | NOTE 2 | FDL\_low – 15  to  FDL\_high + 15 |  |
|  | Finterferer | MHz | NOTE 2 | FDL\_low – 12  to  FDL\_high + 15 |  |
| NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with 15 kHz SCS.  NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -BWchannel CA/2 – FIoffset, case 1; b: BWchannel CA/2 + FIoffset, case 1  NOTE 3: BWchannel CA denotes the aggregated channel bandwidth of the wanted signal  NOTE 4: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1A. | | | | | |

### 5.3.7 Out-of-band blocking

Table 7.6A.3-2: Out of-band blocking for intra-band contiguous CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | Range1 | Range 2 | Range 3 |
|  | Pinterferer | dBm | -45 | -30 | -15 |
| n25 | Finterferer (CW) | MHz | -60 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -85 < f – FDL\_low ≤ -60  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 85  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| NOTE 1: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 6000 MHz.  NOTE 2: BWChannel\_CA denotes the aggregated channel bandwidth of the wanted signal  NOTE 3: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm, for FInterferer > 2700 MHz and FInterferer < 4800 MHz. For BWChannel\_CA > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3\*BWChannel\_CA from the band edge. For BWChannel\_CA larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3\*BWChannel\_CA from the band edge.  NOTE 4: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm, for FInterferer > 3650 MHz and FInterferer < 5750 MHz. For BWChannel\_CA≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3\*BWChannel\_CA from the band edge.  NOTE 5: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 2700 MHz and FInterferer < 4800 MHz | | | | | |

### 5.3.8 Narrow band blocking

Table 7.6A.4.1-1: Narrow-band blocking for intra-band contiguous CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR band | Parameter | Unit | NR CA bandwidth class | |
|  |  |  | B | C |
| n25 | Pw in Transmission Bandwidth Configuration, per CC | dBm | REFSENS + NR CA Bandwidth Class specific value below | |
|  |  |  | 16 | 16 |
|  | Puw (CW) | dBm | -55 | -55 |
|  | Fuw (offset for*Df* = 15 kHz, 30 kHz) | MHz | - Foffset – 0.2  /  + Foffset + 0.2 | - Foffset – 0.2  /  + Foffset + 0.2 |
|  |  |  |  |  |
| NOTE 1: The transmitter shall be set a 4 dB below PCMAX\_L,f,c at the minimum UL configuration specified in Table 7.3.2-3 with PCMAX\_L,f,c defined in clause 6.2.4.  NOTE 2: Reference measurement channel is specified in Annexes A.3.2 and A3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.  NOTE 3: The PREFSENS power level is specified in Table 7.3.2-1 and Table 7.3.2-2 for two and four antenna ports, respectively.  NOTE 4: The Fuw (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to MHz to be offset from the sub-carrier raster. | | | | |

## 5.4 CA\_2DL\_n77B\_1UL\_n77A

### 5.4.1 Channel bandwidths per operating band for CA

Table 5.2A.1-1: Intra-band contiguous CA operating bands in FR1

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n77 | n77 |

Table 5.5A.1-1: NR CA configurations and bandwidth combination sets defined for intra-band contiguous CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration / Bandwidth combination set | | | | | | | | |
| NR CA configuration | Uplink CA configurations | 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) | Maximum aggregated  bandwidth (MHz) | Bandwidth combination set |
| CA\_n77B | - | 20 | 25, 30, 40 |  |  |  | 60 | 0 |
|  |  | 25 | 30 |  |  |  |  |  |

### 5.4.2 UE maximum output power for Intra-band contiguous CA

Not needed as uplink is single CC.

### 5.4.3 UE additional maximum output power reduction for CA

Not needed as uplink is single CC.

### 5.4.4 Spurious emissions for UE co-existence for intra-band contiguous CA

Not needed as uplink is single CC.

### 5.4.5 Reference sensitivity power level for Intra-band contiguous CA

Not needed as PCC REFSENS is same as single carrier REFSENS and DL SCC is further away from UL than DL PCC.

### 5.4.6 In-band blocking

Already specified for n77.

### 5.4.7 Out-of-band blocking

Already specified for n77.

### 5.4.8 Narrow band blocking

Not needed for n77.

# 6 Intra-Band Non-Contiguous Carrier Aggregation FR1: Specific Band Combination Part

## 6.1 CA\_2DL\_n71(2A)\_1UL\_n71A

### 6.1.1 Channel bandwidths per operating band for CA

Table 6.1.1-1: Supported bandwidth combinations for CA\_n71(2A)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink Configurations | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Maximum  Aggregated bandwidth  (MHz) | Bandwidth combination set |
| CA\_n71(2A) | - | 5,10,15,20 | 5,10,15, 20 |  |  | 30 | 0 |

### 6.1.2 UE co-existence studies

There are no co-existence issues for this combination.

### 6.1.3 REFSENS

REFSENS for CA\_n71(2A) need to be added in below table of TS 38.101-1. MSD values proposed are tentative values for the RAN4 #96 meeting, and these will be crosschecked and to be concluded at the following RAN4 meeting.

Table 7.3A.2.2-1: Intra-band non-contiguous CA with one uplink configuration for reference sensitivity

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS  (kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation | ΔRIBNC (dB) | Duplex mode |
| CA\_n71(2A) | 15 | 25RB+25RB | Wgap = 25.0 | 5 | 4.0 | FDD |
| Wgap = 5.0 | 20 | 0.0 |
| 50RB+25RB | Wgap = 20.0 | 51 | 4.6 |
| Wgap = 5.0 | 201 | 2.3 |
| 75RB+50RB | Wgap = 10.0 | 52 | 22.2 |
| Wgap = 5.0 | 203 | 5.2 |
| Note 1: Uplink resource block starts at RB postion [9] for SCS=15KHz.  Note 2: Uplink resource block starts at RB postion [2] for SCS=15KHz.  Note 3: Uplink resource block starts at RB postion [19] for SCS=15KHz. | | | | | | |

## 6.2 CA\_2DL\_n2(2A)\_1UL\_n2A

### 6.2.1 Channel bandwidths per operating band for CA

Table 6.2.1-1: Supported bandwidth combinations for CA\_2DL\_n2(2A)\_1UL \_n2A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | E-UTRA CA configuration / Bandwidth combination set | | | | | | |
| NR 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\_n2(2A) | - | 5, 10, 15, 20 | 5, 10, 15, 20 |  |  |  | 40 | 0 |

### 6.2.2 Co-existence studies

There are no co-existence issues for this combination.

### 6.2.3 REFSENS

REFSENS can be impacted by the PCC UL being closer to do the SCC DL than the nominal spacing. REFSENS values are same as for CA\_n2(2A).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CA configuration** | **SCS**  **kHz** | **Aggregated channel bandwidth (PCC+SCC)** | **Wgap / [MHz]** | **UL PCC allocation** | **ΔRIBNC (dB)** | **Duplex mode** |
| CA\_n2(2A) | 15 | 25RB+25RB | Wgap = 55.0 | 101 | 5.0 | FDD |
| Wgap = 30.0 | 25 | 0.0 |
| NOTE 1: 1 refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission.  NOTE 2: Wgap is the sub-block gap between the two sub-blocks.  NOTE 3: The carrier centre frequency of SCC in the DL operating band is configured closer to the UL operating band. | | | | | | |

## 6.3 CA\_2DL\_n5(2A)\_1UL\_n5A

### 6.3.1 Channel bandwidths per operating band for CA

Table 6.3.1-1: Supported bandwidth combinations for CA\_n5(2A)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink Configurations | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Maximum  Aggregated bandwidth  (MHz) | Bandwidth combination set |
| CA\_n5(2A) | - | 5,10,15,20 | 5,10,15, 20 |  |  | 25 | 0 |

### 6.3.2 UE co-existence studies

There are no co-existence issues for this combination.

### 6.3.3 REFSENS

Below analysis assumptions are used in the REFSENS analysis.

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Unit** |
| CIM5 | -70 | dBc |
| n5 filter T/R isolation | 53 | dB |
| Front-end loss | 4 | dB |
| Thermal noise at n5 RX ANT port | -165 | dBm/Hz |
| Transceiver effective phase noise | -140 | dBc/Hz |
| SNR requirement for QPSK | -1 | dB |

REFSENS for CA\_n5(2A) need to be added in below table of TS 38.101-1.

Table 7.3A.2.2-1: Intra-band non-contiguous CA with one uplink configuration for reference sensitivity

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS  (kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation | ΔRIBNC (dB) | Duplex mode |
| CA\_n5(2A) | 15 | 75RB + 25RB | Wgap = 5.0 | 55 | 6.3 | FDD |
| NOTE 5: Refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission. | | | | | | |

## 6.4 CA\_3DL\_n77(3A)\_1UL\_n77A

### 6.4.1 Channel bandwidths per operating band for CA

Table 6.4.1-1: Supported bandwidth combinations for CA\_3DL\_n77(3A)\_1UL \_n77A

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink Configurations | Channel bandwidths for carrier  [MHz] | Channel bandwidths for carrier  [MHz] | Channel bandwidths for carrier  [MHz] | Aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_n77(3A) | - | 20, 40, 80, 100 | 20, 40, 80, 100 | 20, 40, 80, 100 | 300 | 0 |
| 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 300 | 1 |

### 6.4.2 Co-existence studies

There are no additional co-existence issues for this combination.

### 6.4.3 REFSENS

There are no REFSENS exceptions for this combination.

## 6.5 CA\_2DL\_n96(2A)\_1UL\_n96A

### 6.5.1 Channel bandwidths per operating band for CA

Table 6.5.1-1: Supported bandwidth combinations for CA\_n96(2A)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink Configurations | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Maximum  Aggregated bandwidth  (MHz) | Bandwidth combination set |
| CA\_n96(2A) | - | 20, 40, 60, 80 | 20, 40, 60, 80 |  |  | 160 | 0 |

### 6.5.2 UE co-existence studies

There are no co-existence issues for this combination.

### 6.5.3 REFSENS

There are no REFSENS exceptions for this combination.

## 6.6 CA\_2DL\_n96(3A)\_1UL\_n96A

### 6.6.1 Channel bandwidths per operating band for CA

Table 6.6.1-1: Supported bandwidth combinations for CA\_n96(3A)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink Configurations | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Maximum  Aggregated bandwidth  (MHz) | Bandwidth combination set |
| CA\_n96(3A) | - | 20, 40, 60, 80 | 20, 40, 60, 80 | 20, 40, 60, 80 |  | 240 | 0 |

### 6.6.2 UE co-existence studies

There are no co-existence issues for this combination.

### 6.6.3 REFSENS

There are no REFSENS exceptions for this combination.

## 6.7 CA\_2DL\_n96(4A)\_1UL\_n96A

### 6.7.1 Channel bandwidths per operating band for CA

Table 6.7.1-1: Supported bandwidth combinations for CA\_n96(4A)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink Configurations | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Channel bandwidths for carrier  (MHz) | Maximum  Aggregated bandwidth  (MHz) | Bandwidth combination set |
| CA\_n96(4A) | - | 20, 40, 60, 80 | 20, 40, 60, 80 | 20, 40, 60, 80 | 20, 40, 60, 80 | 320 | 0 |

### 6.7.2 UE co-existence studies

There are no co-existence issues for this combination.

### 6.7.3 REFSENS

The DL NCCA with four carriers CA\_n96(4A) was first required in RAN4. Considering design complexity of four non-contiguous carriers, REFSENS relaxation may be needed. One possible implantation is split receiver architecture to cover non-contiguous carriers within the whole pass band. Here we propose ΔRIBNC as below:

Table 6.7.3-1: Intra-band non-contiguous CA reference sensitivity for shared spectrum

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA configuration | SCS  (PCC/SCC)  (kHz) | Aggregated channel bandwidth (PCC+SCC) | ΔRIBNC (dB) | Duplex mode |
| CA\_n96(4A) | 15/30/60 | 320MHz | 0.5 | TDD |

## 6.8 CA\_2DL\_n12(2A)\_1UL\_n12A

### 6.8.1 Channel bandwidths per operating band for CA

Table 5.2A.1-1: Intra-band contiguous CA operating bands in FR1

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n12(\*) | n12 |

Table 5.5A.1-1: NR CA configurations and bandwidth combination sets defined for intra-band contiguous CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA configuration / Bandwidth combination set | | | | | | | | |
| NR CA configuration | Uplink CA configurations | 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) | Maximum aggregated  bandwidth (MHz) | Bandwidth combination set |
| CA\_n12(2A) | - | 5 | 5 |  |  |  | 10 | 0 |

### 6.8.2 UE maximum output power for Intra-band contiguous CA

Not needed as uplink is single CC.

### 6.8.3 UE additional maximum output power reduction for CA

Not needed as uplink is single CC.

### 6.8.4 Spurious emissions for UE co-existence for intra-band contiguous CA

Not needed as uplink is single CC.

### 6.8.5 Reference sensitivity power level for Intra-band contiguous CA

MDS is re-used from CA\_12A-12A.

Table 7.3A.2.2-1: Intra-band non-contiguous CA with one uplink configuration for reference sensitivity in FDD bands.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CA configuration** | **SCS**  **kHz** | **Aggregated channel bandwidth (PCC+SCC)** | **Wgap / [MHz]** | **UL PCC allocation** | **ΔRIBNC (dB)** | **Duplex mode** |
| CA\_n12(2A) | 15/15 | 5MHz + 5MHz | 0.0 < Wgap ≤ 7.0 | 5(RBstart=12) | 3 | FDD |
| NOTE 1: 1 refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission.  NOTE 2: Wgap is the sub-block gap between the two sub-blocks.  NOTE 3: The carrier centre frequency of SCC in the DL operating band is configured closer to the UL operating band. | | | | | | |

### 6.8.6 In-band blocking

Not needed requirement refers back to single carrier requirement.

### 6.8.7 Out-of-band blocking

Not needed requirement refers back to single carrier requirement.

### 6.8.8 Narrow band blocking

Not needed requirement refers back to single carrier requirement.

## 6.9 CA\_2DL\_n25(2A)\_1UL\_n25A CA\_3DL\_n25(3A)\_1UL\_n25A

### 6.9.1 Channel bandwidths per operating band for CA

Table 6.9.1-1: Supported bandwidth combinations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | E-UTRA CA configuration / Bandwidth combination set | | | | | | |
| NR 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\_n25(2A) | - | 5, 10, 15, 20, 25, 30, 40 | 5, 10, 15, 20, 25, 30, 40 |  |  |  | 60 | 1 |
| CA\_n25(3A) | - | 5, 10, 15, 20, 25, 30, 40 | 5, 10, 15, 20, 25, 30, 40 | 5, 10, 15, 20, 25, 30, 40 |  |  | 55 | 0 |

### 6.9.2 REFSENS

Table 6.9.2-1: MSD values

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CA configuration** | SCS  (PCC/SCC)  (kHz) | **Aggregated channel bandwidth (PCC+SCC)** | **Wgap / [MHz]** | **UL PCC allocation** | **ΔRIBNC (dB)** | **Duplex mode** |
| CA\_n25(2A) CA\_n25(3A) | 15/15 | 40MHz + 5MHz | Wgap = 20.0 | 40 (RBstart = 176) | [24.6]11 | FDD |
| NOTE 11: For operation with three or more non-contiguous component carriers, ΔRIBNC applies to all secondary component carriers | | | | | | |

## 6.10 CA\_2DL\_n41(2A)\_1UL\_n41A CA\_2DL\_n41(A-C)\_1UL\_n41A CA\_3DL\_n41(3A)\_1UL\_n41A

### 6.10.1 Channel bandwidths per operating band for CA

Table 6.10.1-1: Supported bandwidth combinations for CA\_2DL\_n41(xA)\_1UL \_n41A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | E-UTRA CA configuration / Bandwidth combination set | | | | | | |
| NR 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\_n41(2A) | - | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 |  |  |  | 190 | 3 |
| CA\_n41(3A) | - | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 |  |  | 190 | 0 |
| CA\_n41(A-C) |  | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 | See CA\_n41C Bandwidth Combination Set 2 in Table 5.5A.1-1 |  |  |  | 190 | 0 |

### 6.10.2 REFSENS

Since n41 is TDD there is no need to define additional REFSENS requirements.

## 6.11 CA\_2DL\_n1(2A)\_1UL\_n1A

### 6.11.1 Channel bandwidths per operating band for CA

Table 6.11.1-1: Supported bandwidth combinations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink Configurations | Channel bandwidths for carrier  [MHz] | Channel bandwidths for carrier  [MHz] | Channel bandwidths for carrier  [MHz] | Aggregated bandwidth  [MHz] | Bandwidth combination set |
| CA\_n1(2A) | - | 5, 10, 15, 20 | 5, 10, 15, 20 |  | 40 | 0 |

### 6.11.2 Co-existence studies

There are no additional co-existence issues for this combination since it is single UL.

### 6.11.3 REFSENS

This combination requires MSD.

Table 7.3A.2.2-1: Intra-band non-contiguous CA with one uplink configuration for reference sensitivity in FDD bands.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS  (PCC/SCC)  (kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation  (LCRB) | ΔRIBNC (dB) | Duplex mode |
| CA\_n1(2A) | 15/15 | 5MHz + 5MHz | 0.0 < Wgap ≤ 50.0 | 25 | 0.5 | FDD |

# 7 Intra-Band Contiguous Carrier Aggregation FR2: Specific Band Combination Part

## 7.1 CA\_xDL\_a\_yUL\_b

### 7.1.1 Channel bandwidths per operating band for CA

<Text will be added.>

### 7.1.2 UE co-existence studies

<Text will be added.>

# 8 Intra-Band Non-Contiguous Carrier Aggregation FR2: Specific Band Combination Part

## 8.1 CA\_xDL\_a-a\_yUL\_b-b

### 8.1.1 Channel bandwidths per operating band for CA

<Text will be added.>

### 8.1.2 UE co-existence studies

<Text will be added.>

# Annex A - Change history

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **Meeting** | **TDoc** | **Subject/Comment** | **New version** |
| 2020-08 | 3GPP RAN4#96-e | R4-2010680 | TR skeleton | 0.0.1 |
| 2020-08 | 3GPP RAN4#96-e | R4-2011888 | Implemented TP’s from RAN4 #96-e:  R4-2011619, “TP to TR 38.717-01-01 to include CA\_n71(2A)”, Ericsson, T-Mobile US | 0.1.0 |
| 2020-11 | 3GPP RAN4#97-e | R4-2015924 | Implemented TP’s from RAN4 #97-e:  R4-2016329. “TP to TR 38.717-01-01 to include CA\_n2(2A)”, Ericsson, Verizon  R4-2016679, “TP to TR 38.717-01-01 to include CA\_n5(2A)”, Ericsson, Verizon, MediaTek  R4-2016339, “TP to TR 38.717-01-01 to update MSD values CA\_n71(2A)”, Ericsson, T-Mobile US | 0.2.0 |
| 2021-02 | 3GPP RAN4#98-e | R4-2101891 | Implemented TP from RAN4 #98-e:  R4-2100708, “TP for TR 38.717-01-01: CA\_3DL\_n77(3A)\_1UL\_n77A”, SoftBank Corp. | 0.3.0 |
| 2021-04 | 3GPP RAN4#98-bis-e | R4-2106704 | Implemented TP from RAN4 #98-bis-e:  R4-2106648, “Updated TP for TR 38.717-01-01: CA\_n77(3A)\_BCS1”, Huawei, HiSilicon | 0.4.0 |
| 2021-05 | 3GPP RAN4#99-e | R4-2111079 | No new TP’s to implement from RAN4 #99-e | 0.5.0 |
| 2021-08 | 3GPP RAN4#100-e | R4-2113562 | No new TP’s to implement from RAN4 #100-e | 0.6.0 |
| 2020-11 | 3GPP RAN4#101-e | R4-2118494 | Implemented TP’s from RAN4 #101-e:  R4-2119799, TP to TR 38.717.01-01 for NR intra band CA\_n96, Charter Communications, Inc  R4-2119804 TP to TR 38.717-01-01: CA\_n2B, Nokia, US Cellular  R4-2119805, TP to TR 38.717-01-01: CA\_n25B, Nokia, US Cellular  R4-2117583, TP to TR 38.717-01-01: CA\_n77B, Nokia, US Cellular  R4-2117584, TP to TR 38.717-01-01: CA\_n12(2A), Nokia, US Cellular  R4-2119820, TP for 38.717-01-01 to add CA\_n25(2A) and CA\_n25(3A), Ericsson, T-Mobile US  R4-2119821, TP for 38.717-01-01 to add CA\_n41(2A), CA\_n41(3A) and CA\_n41(A-C), Ericsson, T-Mobile US  R4-2119824, TP to TR 38.717-01-01 Addition of CA\_n1(2A), Nokia | 0.7.0 |