

**3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
NR inter-band Carrier Aggregation (CA) for
3 Down Link (DL) / 1 Up Link (UL)
(Release 16)**



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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 for NR 3DL/1UL Inter-band Carrier Aggregation. The purpose is to gather the relevant background information and studies in order to address 3DL/1UL Inter-band Carrier Aggregation requirements for the Rel-16 band combinations in Table 1-1. UL carrier shall be supported in each of the 3 bands being aggregated unless otherwise specified.

Table 1-1: Release 16 3DL/1UL inter-band carrier aggregation combinations

| CA combination | REL independent from |
|----------------|----------------------|
| CA_x1A-yA-zA | |
| | |
| | |
| | |
| | |
| | |
| | |

The present document contains a general part and band specific combination part. The actual requirements are added to the corresponding technical specifications.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] RP-190692: "New WID: Rel-16 NR inter-band CA for 3 bands DL with 1 band UL", RAN#83.
- [3] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".
- [4] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".
- [5] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".
- [6] 3GPP TR 37.865-01-01

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 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 TR 21.905 [1].

Carrier aggregation: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

Inter-band carrier aggregation: Carrier aggregation of component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

3.2 Symbols

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

| | |
|-------------------|---|
| $\Delta R_{IB,c}$ | Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell c . |
| $\Delta T_{IB,c}$ | Allowed maximum configured output power relaxation due to support for inter-band CA operation, for serving cell c . |

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 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 TR 21.905 [1].

| | |
|----------|---|
| BS | Base Station |
| BCS | Bandwidth Combination Set |
| CA | Carrier Aggregation |
| CA_X | Intra-band contiguous CA of component carriers in one sub-block within Band X where X is the applicable NR operating band |
| CA_X-X | Intra-band non-contiguous CA of component carriers in two sub-blocks within Band X where X is the applicable NR operating band |
| CA_X-Y | Inter-band CA of component carrier(s) in one sub-block within Band X and component carrier(s) in one sub-block within Band Y where X and Y are the applicable NR operating band |
| CA_X-X-Y | CA of component carriers in two sub-blocks within Band X and component carrier(s) in one sub-block within Band Y where X and Y are the applicable NR operating bands |
| CC | Component Carriers |
| DL | Downlink |
| FDD | Frequency Division Duplex |
| IMD | Inter-modulation |
| MSD | Maximum Sensitivity Degradation |
| SCS | Subcarrier Spacing |
| TDD | Time Division Duplex |
| PA | Power Amplifier |
| PCC | Primary Component Carrier |
| REFSENS | Reference Sensitivity power level |
| SCC | Secondary Component Carrier |
| TDD | Time Division Duplex |
| UE | User Equipment |
| UL | Uplink |

4 Background

The present document is a technical report for 3DL/1UL Inter-band Carrier Aggregation under Rel-16 time frame. It covers both the UE and BS side. The document is divided in two different parts:

- General part: this part covers BS and UE specific which is band combination independent.
- Specific band combination part: this part covers each band combination and its specific issues independently from each other (i.e. one subclause is defined per band combination).

The specific band combination parts are independent and therefore, the working speed also differs.

4.1 The present document maintenance

A single company is responsible for introducing all approved TPs in the present document, i.e. editor of the present document. 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 3 Band Carrier Aggregation with Single UL: General Part

<Text will be added.>

6 3 Band Carrier Aggregation with Single UL: Specific Band Combination Part

6.1 CA_n3A-n41A-n79A

6.1.1 Operating bands for CA

Table 6.1.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|---------------|---------|------------------------------|---|------------------------------|---------|-------------|---------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | $F_{DL_low} - F_{DL_high}$ | | | | |
| CA_n3-n41-n79 | n3 | 1710MHz | – | 1780MHz | 1805MHz | – | 1880MHz | FDD |
| | n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| | n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |

6.1.2 Channel bandwidths per operating band for CA

Table 6.1.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 | Bandwidth combination set |
|----------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n3 A-n41A-n79A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| CA_n3 A-n41A-n79A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | 1 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | | | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | Yes | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 [3] and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.1.3 Co-existence studies

Table 6.1.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 3rd order harmonic of Band n3 will fall into a small portion of Band n79.

Table 6.1.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 | | |

Table 6.1.3-2 gives harmonic mixing issue for CA with Band n3, n41 and n79. It is seen that a small part of Band n79 Tx frequency coincides with Band n41x3.

Table 6.1.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 | | |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.1.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n3, n41 and n79, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.1.4-1 and table 6.1.4-2, respectively.

Table 6.1.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n3A-n41A-n79A | n3 | 0.3 |
| | n41 | 0.3 ¹ |
| | n79 | 0.8 ² |
| | | 0.8 |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2515-2690 MHz. | | |
| NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496-2515 MHz. | | |

Table 6.1.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3A-n41A-n79A | n3 | 0 |
| | n41 | 0.5 |
| | n79 | 0.5 |

6.1.5 REFSENS requirements

For this combination, sensitivity degradation is allowed for Band n3 when uplink transmission occur in Band n41 due to cross band isolation issues. The reference sensitivity exceptions are specified in Table 6.1.5-1 with the uplink configuration specified in Table 6.1.5-2.

Table 6.1.5-1: MSD due to cross band isolation for CA CA_n3A-n41A-n79A

| NR CA Configuration | NR UL band | NR DL band | Channel bandwidth | | | | | | | | | | | |
|---------------------|------------|------------|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|
| | | | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | 25 MHz (dBm) | 30 MHz (dBm) | 40 MHz (dBm) | 50 MHz (dBm) | 60 MHz (dBm) | 80 MHz (dBm) | 90 MHz (dBm) | 100 MHz (dBm) |
| CA_n3A-n41A-n79A | n3 | n41 | | 0.7 | 0.7 | 0.7 | | | 0.7 | 0.7 | 0.7 | 0.7 | | 0.7 |
| | n41 | n3 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | - | - | - | - | - | - |

Table 6.1.5-2: Uplink configuration for reference sensitivity exceptions due to cross band isolation

| Channel bandwidth of the affected DL band | | | | | | | | | | | | | | |
|---|------------|----------------------|-------|-----------------|-----------------|-----------------|--------|--------|-----------------|-----------------|-----------------|-----------------|--------|-----------------|
| NR UL band | NR DL band | SCS of UL band (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| n3 | n41 | 15kHz | | 50 ¹ | 50 ¹ | 50 ¹ | | | 50 ¹ | 50 ¹ | 50 ¹ | 50 ¹ | | 50 ¹ |
| n41 | n3 | 30 | 160 | 160 | 160 | 160 | 160 | 160 | | | | | | |
| NOTE: The UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth. | | | | | | | | | | | | | | |

6.2 CA_n8A-n41A-n79A

6.2.1 Operating bands for CA

Table 6.2.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|---------------|---------|--|--|--|--|---|---------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | | |
| | | F _{UL_low} – F _{UL_high} | F _{DL_low} – F _{DL_high} | F _{DL_low} – F _{DL_high} | F _{DL_low} – F _{DL_high} | | | | |
| CA_n8-n41-n79 | n8 | 880MHz | – | 915MHz | 925MHz | – | 960MHz | FDD | |
| | n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD | |
| | n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD | |

6.2.2 Channel bandwidths per operating band for CA

Table 6.2.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n8A-n41A-n79A | - | n8 | 15 | Yes | Yes | Yes | Yes | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | |
| | - | n41 | 15 | | Yes | Yes | | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| | - | n79 | 15 | | | | | | | Yes | Yes | | | | |
| | | | 30 | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| CA_n3A-n41A-n79A | - | n8 | 15 | Yes | Yes | Yes | Yes | | | | | | | | 1 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | | | | | | | | | | | |
| | - | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | | | |
| | - | n79 | 15 | | | | | | | Yes | Yes | | | | |
| | | | 30 | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 [3] and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.2.3 Co-existence studies

Table 6.2.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 3rd order harmonic of Band n8 will fall into Band n41 and the 5th order harmonic of Band 8 will fall into band n79.

Table 6.2.3-1: Harmonic Interference for 3DLs/1UL

| | | | | | 2 nd Harmonic | 3 rd Harmonic | 4 th Harmonic | 5 th harmonic | 6 th 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 |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 | | |

Table 6.2.3-2 gives harmonic mixing issue for CA with Band n8, n41 and n79. It is seen that part of Band n79 Tx frequency coincides with Band 8x5.

Table 6.2.3-2: Harmonic mixing for 3DLs/1UL

| | | | | | 2 nd Harmonic | 3 rd Harmonic | 4 th Harmonic | 5 th harmonic | 6 th 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 |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 | | |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.2.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n8, n41 and n79, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.2.4-1 and table 6.2.4-2, respectively.

Table 6.2.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n8-n41-n79 | n8 | 0.6 |
| | n41 | 0.3 |
| | n79 | 0.8 |

Table 6.2.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n8-n41-n79 | n8 | 0 |
| | n41 | 0.5 |
| | n79 | 0.5 |

6.2.5 REFSENS requirements

For this combination, sensitivity degradation is allowed for Band n41 and n79 when there is uplink transmission in Band n8. The reference sensitivity exceptions are specified in Table 6.2.5-1 with the uplink configuration specified in Table 6.2.5-2.

Table 6.2.5-1: MSD due to harmonic issue for CA_n8-n41-n79

| UL band | DL band | MSD due to harmonic exception for the DL band | | | | | | | | | | |
|------------|--------------------|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| | | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 100 MHz |
| | | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB |
| n8 | n41 ^{1,2} | N/A | 13 | 11.3 | 10.1 | | | 7.0 | 6.1 | 5.5 | 4.3 | 3.5 |
| | n79 ^{3,4} | | | | | | | [6.8] | 6.2 | [5.6] | 4.9 | 4.4 |

NOTE 1: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.

NOTE 2 The requirements should be verified for UL EARFCN of a low band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB} / 0.3 \rfloor 0.1$ in MHz and $F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL_high}^{LB} - BW_{Channel}^{LB} / 2$ with f_{DL}^{HB} the carrier frequency of a high band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the low band.

NOTE 3: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 5th transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.

NOTE 4: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB} / 0.5 \rfloor 0.1$ in MHz and $F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL_high}^{LB} - BW_{Channel}^{LB} / 2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.

Table 6.2.5-2 Uplink configuration for the low band (exceptions)

| UL band | DL band | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 100 MHz |
|------------|------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| n8 | n41 | - | 16 | 25 | 25 | - | - | 25 | 25 | 25 | 25 | 25 |
| | n79 | - | - | - | - | - | - | 25 | 25 | 25 | 25 | 25 |

6.3 CA_n40A-n41A-n79A

6.3.1 Operating bands for CA

Table 6.3.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|-------------------------------|---------|------------------------------|---|----------|------------------------------|---|----------|----------------|--|
| | | BS receive / UE transmit | | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | $F_{DL_low} - F_{DL_high}$ | | | | |
| CA_n40-n41-n79 ^{1,2} | n40 | 2300 MHz | - | 2400 MHz | 2300 MHz | - | 2400 MHz | TDD | |
| | n41 | 2496 MHz | - | 2690 MHz | 2496 MHz | - | 2690 MHz | TDD | |
| | n79 | 4400 MHz | - | 5000 MHz | 4400 MHz | - | 5000 MHz | TDD | |

NOTE 1: The frequency range below 2506 MHz for Band n41 is not used in this band combination.

NOTE 2: Applicable for frequency range above 4800 MHz for Band n79 in this band combination.

6.3.2 Channel bandwidths per operating band for CA

Table 6.3.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Configuration | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 | Bandwidth combination set |
|---------------------|------------------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n40A-n41A-n79A | - | n40 | 15 | Yes | | | | 0 |
| | | | 30 | | Yes | | |
| | | | 60 | | Yes | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| CA_n3A-n41A-n79A | - | n40 | 15 | Yes | | | | | 1 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | | | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | Yes | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 [3] and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.3.3 Co-existence studies

Table 6.3.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n40 and n41 will fall into Band n79. However, this harmonic issue has already addressed in CA_n40-n79 and CA_n41-n79.

Table 6.3.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 | | |

Table 6.3.3-2 gives harmonic mixing issue for CA with Band n40, n41 and n79. It is seen that there may be 2nd harmonic mixing issue for the band combination of n40, n49 and n79. However, this harmonic mixing issue has already addressed in CA_n40-n79 and CA_n41-n79.

Table 6.3.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|------------------------|--------------------------|------------------------|----------------------------|---------------------------|
| | | | | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 | |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.3.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band X, Y and Z, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.3.4-1 and table 6.3.4-2, respectively.

Table 6.3.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n40-n41-n79 | n40 | 0.5 ¹ |
| | n41 | 0.5 ¹ |
| | n79 | 0.8 |
| NOTE: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band 40 and 41. | | |

Table 6.3.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n40-n41-n79 | n40 | 0 ¹ |
| | n41 | 0.5 ¹ |
| | n79 | 0.5 |
| NOTE: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band 40 and 41. | | |

6.3.5 REFSENS requirements

Compared to its fall back modes, there are no additional MSD requirements for this band combination.

6.4 CA_n1A-n3A-n78A

6.4.1 Operating bands for CA

Table 6.4.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|--------------|---------|------------------------------|---|---------|--|------------------------------|---|---------|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | | $F_{DL_low} - F_{DL_high}$ | | | | | |
| CA_n1-n3-n78 | n1 | 1920MHz | – | 1980MHz | | 2110MHz | – | 2170MHz | | FDD | |
| | n3 | 1710MHz | – | 1785MHz | | 1805MHz | – | 1880MHz | | FDD | |
| | n78 | 3300MHz | – | 3800MHz | | 3300MHz | – | 3800MHz | | TDD | |

6.4.2 Channel bandwidths per operating band for CA

Table 6.4.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n1A-n3A-n78A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |

NOTE: This UE channel bandwidth is optional in this release of the specification.

6.4.3 Co-existence studies

Table 6.4.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n3 will fall into Band n78.

Table 6.4.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.4.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that Band n78 Tx frequency coincides with Band n3x2.

Table 6.4.3-2: Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | | |
|------|---------------------------|----------------------------|------------------------|----------------------------|------------------------|--------------------------|------------------------|----------------------------|---------------------------|-------|
| | | | | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.4.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n3 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.4.4-1 and table 6.4.4-2, respectively.

Table 6.4.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n3-n78 | n1 | 0.6 |
| | n3 | 0.6 |
| | n78 | 0.8 |

Table 6.4.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n3-n78 | n1 | 0.2 |
| | n3 | 0.2 |
| | n78 | 0.5 |

6.4.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

6.5 CA_n39A-n41A-n79A

6.5.1 Operating bands for CA

Table 6.5.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|----------------|---------|------------------------------|------------------------------|------------------------------|------------------------------|-------------|---------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{UL_low} - F_{UL_high}$ | | | |
| CA_n39-n41-n79 | n39 | 1880MHz | – | 1920MHz | 1880MHz | – | 1920MHz | TDD |
| | n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD |
| | n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |

6.5.2 Channel bandwidths per operating band for CA

Table 6.5.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 | Bandwidth combination set |
|-----------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n39 A-n41A-n79A | - | n39 | 15 | Yes | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| CA_n3A-n41A-n79A | - | n39 | 15 | Yes | | | | | 1 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | | | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | Yes | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 [3] and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.5.3 Co-existence studies

Table 6.5.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n41 will fall into a small portion of Band n79. However it is not a problem for this combination since the lower part of Band n41 will not be used in the region for this combination.

Table 6.5.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n39 | 1880 | 1920 | 1880 | 1920 | 3760 | 3840 | 5640 | 5760 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 | | |

Table 6.5.3-2 gives harmonic mixing issue for CA with Band n39, n41 and n79. It is seen that a small part of Band n79 Tx frequency coincides with Band n41x2.

Table 6.5.3-2 Harmonic mixing for 3DLs/1UL

| Band | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | 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 |
| n39 | 1880 | 1920 | 1880 | 1920 | 3760 | 3840 | 5640 | 5760 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |
| n79 | 4400 | 5000 | 4400 | 5000 | 8800 | 10000 | 1320 | 15000 | | |

For single uplink, the UE coexistence requirement is already considered for these bands in TS 38.101-1 [3].

6.5.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n39, n41 and n79, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.5.4-1 and table 6.5.4-2, respectively.

Table 6.5.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_39-41-79 | n39 | 0.3 |
| | n41 | 0.3 |
| | n79 | 0.8 |
| NOTE: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx between n39 and n41. | | |

Table 6.5.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_39-41-79 | n39 | 0.2 |
| | n41 | 0.5 |
| | n79 | 0.5 |
| NOTE: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx between n39 and n41. | | |

6.5.5 REFSENS requirements

Compared to its fall back modes, there are no additional MSD requirements for this band combination.

6.6 CA_n8A-n39A-n41A

6.6.1 Operating bands for CA

Table 6.6.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|---------------|---------|------------------------------|---|---------|------------------------------|---|---------|-------------|--|
| | | BS receive / UE transmit | | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | $F_{DL_low} - F_{DL_high}$ | | | | |
| CA_n8-n39-n41 | n8 | 880MHz | — | 915MHz | 925MHz | — | 960MHz | FDD | |
| | n39 | 1880MHz | — | 1920MHz | 1880MHz | — | 1920MHz | TDD | |
| | n41 | 2496MHz | — | 2690MHz | 2496MHz | — | 2690MHz | TDD | |

6.6.2 Channel bandwidths per operating band for CA

Table 6.6.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n8-n39A-n41A | - | n8 | 15 | Yes | Yes | Yes | Yes | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | | | | | | | | | | | |
| | | n39 | 15 | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | |
| CA_n3A-n41A-n79A | - | n8 | 15 | Yes | Yes | Yes | Yes | | | | | | | | 1 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | | | | | | | | | | | |
| | | n39 | 15 | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 [3] and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.6.3 Co-existence studies

Table 6.6.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 3rd order harmonic of Band n8 will fall into a small portion of Band n41.

Table 6.6.3-1: Harmonic Interference for 3DLs/1UL

| Band | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | 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 |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | | |
| n39 | 1880 | 1920 | 1880 | 1920 | 3760 | 3840 | 5640 | 5760 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |

Table 6.6.3-2 gives harmonic mixing issue for CA with Band n8, n39 and n41. It is seen that Band n39 Tx frequency coincides with Band n8x3.

Table 6.6.3-2: Harmonic mixing for 3DLs/1UL

| Band | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | 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 |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | | |
| n39 | 1880 | 1920 | 1880 | 1920 | 3760 | 3840 | 5640 | 5760 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |

For single uplink, the UE coexistence requirement is already considered for these bands in TS 38.101-1 [3].

6.6.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n8, n39, n41, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.6.4-1 and table 6.6.4-2, respectively.

Table 6.6.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|---|
| CA_8-39-41 | n8 | 0.6 |
| | n39 | 0.5 |
| | n41 | 0.5 |
| NOTE: | | Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx between n39 and n41. |

Table 6.6.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|---|
| CA_8-39-41 | n8 | 0 |
| | n39 | 0.2 |
| | n41 | 0.2 |
| NOTE: | | Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx between n39 and n41. |

6.6.5 REFSENS requirements

Compared to its fall back modes, there are no additional MSD requirements for this band combination.

6.7 CA_n3A-n8A-n78A

6.7.1 Operating bands for CA

Table 6.7.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|-----------------|---------|------------------------------|---|----------|--|------------------------------|---|----------|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | | $F_{DL_low} - F_{DL_high}$ | | | | | |
| CA_n3A-n8A-n78A | n3 | 1710 MHz | – | 1785 MHz | | 1805 MHz | – | 1880 MHz | | FDD | |
| | n8 | 880 MHz | – | 915 MHz | | 925 MHz | – | 960 MHz | | FDD | |
| | n78 | 3300 MHz | – | 3800 MHz | | 3300 MHz | – | 3800 MHz | | TDD | |

6.7.2 Channel bandwidths per operating band for CA

Table 6.7.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Configuration | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|------------------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|---------------------------|
| CA_n3A-n8A-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | - | n8 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | - | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | | Yes | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 [3] and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.7.3 Co-existence studies

Table 6.7.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n3 and n8 will fall into Band n78 and n3 respectively. 4th harmonic of band n8 will fall into Band n78. However, these harmonic issues have already been addressed in CA_n3A-n8A, CA_n3A-n78A and CA_n8A-n78A respectively.

Table 6.7.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.7.3-2 gives harmonic mixing issue for CA with Band n3, n8 and n78. According to fall back mode, there are no harmonic mixing for these band combination.

Table 6.7.3-2: Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.7.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band X, Y and Z, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.7.4-1 and table 6.7.4-2, respectively.

Table 6.7.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n8-n78 | n3 | 0.6 |
| | n8 | 0.6 |
| | n78 | 0.8 |

Table 6.7.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n8-n78 | n3 | 0.2 |
| | n8 | 0.2 |
| | n78 | 0.5 |

6.7.5 REFSENS requirements

Compared to its fall back modes, there are no additional MSD requirements for this band combination

6.8 CA_n66-n70-n71

6.8.1 Operating bands for CA

Table 6.8.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|----------------|---------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | | |
| | | F_{UL_low} – F_{UL_high} | F_{DL_low} – F_{DL_high} | | |
| CA_n66-n70-n71 | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD | |
| | n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD | |
| | n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | TDD | |

6.8.2 Channel bandwidths per operating band for CA

Table 6.8.2-1: Supported channel bandwidths per CA combination for 3DL Inter-band CA

| CA operating / channel bandwidth [MHz] | | | | | | | | | | | | | | | Bandwidth combination set | |
|--|-----------|---------|--|-----|-----|-----|------------------|------------------|----|-----|----|----|----|----|---------------------------|---|
| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | |
| CA_n66A-n70A-n71A | - | n66 | 15 | Yes | Yes | Yes | Yes | | | Yes | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | | | | |
| | | n70 | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | n71 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| CA_n66B-n70A-n71A | - | n66 | See CA_n66B Bandwidth Combination Set 0 in Table 5.5A.1-1 in TS38.101-1 | | | | | | | | | | | | 0 | |
| | | n70 | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | n71 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| CA_n66(2A)-n70A-n71A | - | n66 | See CA_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS38.101-1 | | | | | | | | | | | | 0 | |
| | | n70 | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | n71 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |

NOTE: This UE channel bandwidth is applicable only to downlink.

6.8.3 UE co-existence studies

Tables 6.8.3-1 and 2 summarize frequency ranges where harmonics and/or harmonics mixing occur for CA_n66-n70-n71.

Table 6.8.3-1: 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 |
| n66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | | |
| n70 | 1695 | 1710 | 1995 | 2020 | 3390 | 3420 | 5085 | 5130 | | |
| n71 | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | | |

Based on the table above, there is 3rd harmonic relation between n71 UL and n70 DL. However, this relation is already specified in CA_n70A-n71A so no additional requirements are needed for higher order CA.

Table 6.8.3-2: 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 |
| n66 | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | | |
| n70 | 1695 | 1710 | 1995 | 2020 | 3990 | 4040 | 5985 | 6060 | | |
| n71 | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | | |

Based on the table above, there is no harmonic mixing relation.

6.8.4 ΔT_{IB} and ΔR_{IB} values

For CA_n66-n70-n71, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are given in the tables below.

Table 6.8.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n66-n70-n71 | n66 | 0.5 |
| | n70 | 0.5 |
| | n71 | 0.6 |

Table 6.8.4-2: $\Delta R_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n66-n70-n71 | n66 | 0 |
| | n70 | 0 |
| | n71 | 0 |

6.8.5 REFSENS requirements

Specific REFSENS requirement due to 3rd harmonic for CA_n70-n71 has already been accounted in two band CA combination CA_n70A-n71A.

6.9 CA_n28-n78-n257

6.9.1 Operating bands for CA

Table 6.9.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|-----------------|---------|----------------------------|---|------------------------------|----------|-------------|----------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | FUL_low – FUL_high | | FDL_low – FDL_high | | | | |
| CA_n28-n78-n257 | n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| | n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| | n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

6.9.2 Channel bandwidths per operating band for CA

Table 6.9.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| CA config | UL config | NR Band | SCS (kHz) | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | 200 | 400 | BW combination set | |
|--------------------|-----------|---------|-----------|---|-----|-----|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|--------------------|--|
| CA_n28A-n78A-n257A | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | | |
| | | n257 | 60 | | | | | | | Yes | | | | | Yes | Yes | | | |
| | | | 120 | | | | | | | Yes | | | | | Yes | Yes | Yes | | |
| | | | | | | | | | | | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | |
| | | n257 | | See CA_n257D in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA_n28A-n78A-n257G | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | |
| | | n257 | | See CA_n257G in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | n78 | 60 | | | | | | | | | | | | | | | | |
| | | | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | n257 | 60 | | Yes | Yes | Yes | | | Yes | | | |
| | | | | See CA_n257H in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| CA_n28A-n78A-n257I | - | n28 | 30 | | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | n78 | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | |
| | | | | See CA_n257I in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | |
| | | n257 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | | | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.9.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

6.9.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n28, n78 and n257, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.9.4-1 and table 6.9.4-2, respectively.

Table 6.9.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n28-n78-n257 | n28 | 0.5 |
| | n78 | 0.8 |
| | n257 | 0 |

Table 6.9.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n28-n78-n257 | n28 | 0.2 |
| | n78 | 0.5 |
| | n257 | 0 |

6.9.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fallback modes in TR 38.716-02-00. There is no additional REFSENS requirement for this combination.

6.10 CA_n3-n77-n257

6.10.1 Operating bands for CA

Table 6.10.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|----------------|---------|----------------------------|---|------------------------------|----------|-------------|----------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | FUL_low – FUL_high | | FDL_low – FDL_high | | | | |
| CA_n3-n77-n257 | n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| | n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| | n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

6.10.2 Channel bandwidths per operating band for CA

Table 6.10.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA config | UL config | NR Band | SCS (kHz) | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | 200 | 400 | Bandwidth combination set |
|-------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n3A-n77A-n257A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n257 | 60 | | | | | | | Yes | | | | Yes | Yes | | | |
| | | | 120 | | | | | | | Yes | | | | Yes | Yes | Yes | Yes | |
| | | | | | | | | | | | | | | | | | | |
| CA_n3A-n77A-n257D | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n257 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| CA_n3A-n77A-n257G | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n257 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| CA_n3A-n77A-n257H | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n257 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| CA_n3A-n77A-n257I | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

| NR CA config | UL config | NR Band | SCS (kHz) | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | 200 | 400 | Bandwidth combination set | |
|----------------------|-----------|---------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|--|
| CA_n3A-n77(2A)-n257A | - | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | | |
| | | n257 | See CA_n257I in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | |
| | | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | - | n77 | See CA_n77(2A) Bandwidth Combination Set 0 (TBD) | | | | | | | | | | | | | | | | |
| | | n257 | 60 | | | | | | | | Yes | | | | | Yes | Yes | | |
| | | | 120 | | | | | | | | Yes | | | | | Yes | Yes | Yes | |
| CA_n3A-n77(2A)-n257D | - | n3 | 15 | Yes | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n77 | See CA_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | | | |
| | | n257 | See CA_n257D in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | |
| CA_n3A-n77(2A)-n257G | - | n3 | 15 | Yes | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n77 | See CA_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | | | |
| | | n257 | See CA_n257G in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | |
| CA_n3A-n77(2A)-n257H | - | n3 | 15 | Yes | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n77 | See CA_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | | | |
| | | n257 | See CA_n257H in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | |
| CA_n3A-n77(2A)-n257I | - | n3 | 15 | Yes | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n77 | See CA_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | | | |
| | | n257 | See CA_n257I in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.10.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

6.10.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n3, n77 and n257, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.10.4-1 and table 6.10.4-2, respectively.

Table 6.10.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n77-n257 | n3 | 0.6 |
| | n77 | 0.8 |
| | n257 | 0 |

Table 6.10.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n77-n257 | n3 | 0.2 |
| | n77 | 0.5 |
| | n257 | 0 |

6.10.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fallback modes in TR 38.716-02-00. There is no additional REFSENS requirement for this combination.

6.11 CA_n3-n78-n257

6.11.1 Operating bands for CA

Table 6.11.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | | | | |
|----------------|---------|----------------------------|---|--------------------------|------------------------------|---|----------|-------------|--|--|--|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | | | | | |
| | | FUL_low – FUL_high | | FDL_low – FDL_high | | | | | | | | |
| CA_n3-n78-n257 | n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD | | | | |
| | n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD | | | | |
| | n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD | | | | |

6.11.2 Channel bandwidths per operating band for CA

Table 6.11.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA config | UL config | NR Band | SCS (kHz) | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | 200 | 400 | Band width combination set |
|-------------------|-----------|---------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------------------|
| CA_n3A-n78A-n257A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n257 | 60 | | | | | | | | Yes | | | | | Yes | Yes | |
| | | | 120 | | | | | | | | Yes | | | | | Yes | Yes | |
| | | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | |
| | | n257 | See CA_n257D in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA_n3A-n78A-n257G | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | |
| | | n257 | See CA_n257G in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA_n3A-n78A-n257H | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | |
| | | n257 | See CA_n257H in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA_n3A-n78A-n257I | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | |
| | | n257 | See CA_n257I in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.11.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

6.11.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n3, n78 and n257, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.11.4-1 and table 6.11.4-2, respectively.

Table 6.11.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n78-n257 | n3 | 0.6 |
| | n78 | 0.8 |
| | n257 | 0 |

Table 6.11.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n78-n257 | n3 | 0.2 |
| | n78 | 0.5 |
| | n257 | 0 |

6.11.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fallback modes in TR 38.716-02-00. There is no additional REFSENS requirement for this combination.

6.12 CA_n28-n77-n257

6.12.1 Operating bands for CA

Table 6.12.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|-----------------|---------|----------------------------|---|------------------------------|----------|-------------|----------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | FUL_low – FUL_high | | FDL_low – FDL_high | | | | |
| CA_n28-n77-n257 | n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | FDD |
| | n77 | 3300MHz | – | 4200MHz | 3300MHz | – | 4200MHz | TDD |
| | n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

6.12.2 Channel bandwidths per operating band for CA

Table 6.12.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA config | UL config | NR Band | SCS (kHz) | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | 200 | 400 | Bandwidth combination set | |
|---|-----------|---|-----------|-----|-----|-----|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|--|
| CA_n28 A-n77A-n257A | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | - | n257 | 60 | | Yes | Yes | Yes | | | Yes | | | | | | | | 0 | |
| | | | 120 | | | | | | | Yes | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | n257 | 60 | | Yes | Yes | Yes | | | Yes | | | |
| See CA_n257D in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | | | | |
| CA_n28 A-n77A-n257G | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | n257 | 60 | | Yes | Yes | Yes | | | Yes | | | |
| | | See CA_n257G in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | | |
| | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | n257 | 60 | | Yes | Yes | Yes | | | Yes | | | |
| See CA_n257H in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | | | | |
| CA_n28 A-n77A-n257I | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | n257 | 60 | | Yes | Yes | Yes | | | Yes | | | |
| | | See CA_n257I in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | | |
| | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | |
| | | n257 | 60 | | Yes | Yes | Yes | | | Yes | | | |
| See CA_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | | | | | | |
| CA_n28 A-n77(2A)-n257A | - | n28 | 60 | | | | | | | Yes | | | | | | | | 0 | |
| | | | 120 | | | | | | | Yes | | | | | | | | | |
| | | n257 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | - | n28 | 30 | | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | | 90 | | | | | | | | | | | | | | | | |
| | | n257 | 120 | | | | | | | | | | | | | | | | |
| CA_n28 A-n77(2A)-n257D | - | See CA_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | | | | |
| | | See CA_n257D in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | | |
| | | See CA_n257G in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | | |
| | | See CA_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | | | | |
| | | See CA_n257H in Table 5.5A.1-2 in TS 38.101-2 | | | | | | | | | | | | | | | | | |
| CA_n28 A-n77(2A)-n257G | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n257 | 90 | | | | | | | | | | | | | | | | |
| CA_n28 A-n77(2A)-n257H | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | | | |
| | | n257 | 120 | | | | | | | | | | | | | | | | |
| CA_n28 A-n77(2A) | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | |
| | | n28 | 60 | | | | | | | | | | | | | | | | |

| | | | | |
|--------|--|------|---|--|
| -n257I | | n77 | See CA_n77(2A) in Table 5.5A.2-1 in TS 38.101-1 | |
| | | n257 | See CA_n257I in Table 5.5A.1-2 in TS 38.101-2 | |

NOTE: For the UE that signals support of any bandwidth combination set for carrier aggregation, the UE shall support all single carrier bandwidths for the constituent bands as defined in Table 5.3.5-1 of TS 38.101-1 and in Table 5.3.5-1 of TS 38.101-2 when operating in single carrier mode.

6.12.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

6.12.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n28, n77 and n257, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.12.4-1 and table 6.12.4-2, respectively.

Table 6.12.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n28-n77-n257 | n28 | 0.5 |
| | n77 | 0.8 |
| | n257 | 0 |

Table 6.12.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n28-n77-n257 | n28 | 0.2 |
| | n77 | 0.5 |
| | n257 | 0 |

6.12.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fallback modes in TR 38.716-02-00. There is no additional REFSENS requirement for this combination.

6.13 CA_n3-n28-n77

6.13.1 Operating band for CA

Table 6.13.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|---------------|---------|----------------------------|---|---------|--|------------------------------|---|---------|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | FUL_low – FUL_high | | | | FDL_low – FDL_high | | | | | |
| CA_n3-n28-n77 | n3 | 1710MHz | – | 1785MHz | | 1805MHz | – | 1880MHz | | FDD | |
| | n28 | 703MHz | – | 748MHz | | 758MHz | – | 803MHz | | FDD | |
| | n77 | 3300MHz | – | 4200MHz | | 3300MHz | – | 4200MHz | | TDD | |

6.13.2 Channel bandwidths per operating band for CA

Table 6.13.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 | Maximum aggregated bandwidth (MHz) | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------------------------------|---------------------------|
| CA_n3-A-n28A-n77A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | 210 | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | n41 | 15 | Yes | Yes | Yes | | | | | | | | | | |
| | | | 30 | | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | | | | | | | | | | |
| | | n79 | 15 | | Yes | Yes | | | | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | | |

6.13.3 Co-existence studies

Table 6.13.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that there is 5th harmonic issue but it has already captured in the fallback CA in TR 38.716-02-00.

Table 6.13.3-1: Harmonic Interference for 3DLs/1UL

| Band | | | | | 2nd Harmonic | | | 3rd Harmonic | | | 4th Harmonic | | | 5th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|--|
| | 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 | UL Low Band Edge | UL High Band Edge | |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 | 8550 | 8925 | | | |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 | 3515 | 3740 | | | |
| n77 | 3300 | 4200 | 3300 | 4200 | 6600 | 8400 | 9900 | 12600 | 13200 | 16800 | 16500 | 21000 | | | |

Table 6.13.3-2 gives harmonic mixing issue for CA with Band n3, n28 and n77. It can be seen that there is 2th harmonic mixing issue but it is considered in the fallback CA.

Table 6.13.3-2 Harmonic mixing for 3DLs/1UL

| 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 |
|------|---------------------------|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|
| | 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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n77 | 3300 | 4200 | 3300 | 4200 | 6600 | 8400 | 9900 | 12600 | 13200 | 16800 |

6.13.4 ΔT_{IB} and ΔR_{IB} values

For CA_n3-n28-n77, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are given in the tables below.

Table 6.13.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n28-n77 | n3 | 0.6 |
| | n28 | 0.5 |
| | n77 | 0.8 |

Table 6.13.4: ΔR_{IB}

| Inter-band CA Configuration | NR Band | ΔR_{IB} [dB] |
|-----------------------------|---------|----------------------|
| CA_n3-n28-n77 | n3 | 0.2 |
| | n28 | 0.2 |
| | n77 | 0.5 |

6.13.5 REFSENS requirements

Based on 6.13.3, there are no additional MSD requirements for this band combination.

6.14 CA_n3-n28-n257

6.14.1 Operating band for CA

Table 6.14.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|----------------|---------|----------------------------|---|------------------------------|----------|-------------|----------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | FUL_low – FUL_high | | FDL_low – FDL_high | | | | |
| CA_n3-n28-n257 | n3 | 1710MHz | – | 1785MHz | 1805MHz | FDD | | |
| | n28 | 703MHz | – | 748MHz | 758MHz | – | 803MHz | TDD |
| | n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | |

6.14.2 Channel bandwidths per operating band for CA

Table 6.14.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| | | NR CA configuration / Bandwidth combination set | | | | | | | | | | | | | | | | Maximum Aggregated bandwidth [MHz] | Bandwidth combination set | | |
|---------------------|----------------------------|--|--|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|------------------------------------|---------------------------|--|--|
| NR CA configuration | NR Uplink CA configuration | NR Band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz | 200 MHz | 400 MHz | | | | |
| CA_n3A-n28A-n257A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 450 | 0 | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | n257 | 60 | | | | | | | Yes | | | | | Yes | Yes | | | | | |
| | | | 120 | | | | | | | Yes | | | | | Yes | Yes | Yes | | | | |
| CA_n3A-n28A-n257D | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 450 | 0 | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | n257 | See CA_n257D BCS0 in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | | | | |
| CA_n3A-n28A-n257G | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | 250 | 0 | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | n257 | See CA_n257G BCS0 in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | | | | |
| | | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | |
| CA_n3A-n28A-n257H | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 350 | 0 | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | n257 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | | | | | |
| | | See CA_n257H BCS0 in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | | | | | |
| CA_n3A-n28A-n257I | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | 450 | 0 | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | | | | |

| NR CA configuration / Bandwidth combination set | | | | | | | | | | | | | | | | | | | |
|---|----------------------------|--|-----------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|------------------------------------|---------------------------|
| NR CA configuration | NR Uplink CA configuration | NR Band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz | 200 MHz | 400 MHz | Maximum Aggregated bandwidth [MHz] | Bandwidth combination set |
| | | | 30 | Yes | Yes | Yes | | | | | | | | | | | | | |
| | | | 60 | Yes | Yes | Yes | | | | | | | | | | | | | |
| n257 | | See CA_n257I BCS0 in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | | | |

6.14.3 Co-existence studies

Table 6.14.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that there is no harmonic issues.

Table 6.14.3-1: Harmonic Interference for 3DLs/1UL

| | | | | | 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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n257 | 26500 | 29500 | 26500 | 29500 | 53000 | 59000 | 79500 | 88500 | 106000 | 118000 |

Table 6.14.3-2 gives harmonic mixing issue for CA with Band n3, n28 and n257. It can be seen that there is no harmonic mixing issue.

Table 6.14.3-2: Harmonic mixing for 3DLs/1UL

| | | | | | 2nd Harmonic | | 3rd Harmonic | | 4th Harmonic | | 5th harmonic | | 6th 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 | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 | 9025 | 9400 | 10830 | 11280 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 | 3790 | 4015 | 4548 | 4818 |
| n257 | 26500 | 29500 | 26500 | 29500 | 53000 | 59000 | 79500 | 88500 | 106000 | 118000 | 132500 | 147500 | 159000 | 177000 |

6.14.4 ΔT_{IB} and ΔR_{IB} values

For CA_n3-n28-n257, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are given in the tables below.

Table 6.14.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n28-n257 | n3 | 0.3 |
| | n28 | 0.3 |
| | n257 | 0 |

Table 6.14.4-2: ΔR_{IB}

| Inter-band CA Configuration | NR Band | ΔR_{IB} [dB] |
|-----------------------------|---------|----------------------|
| CA_n3-n28-n257 | n3 | 0 |
| | n28 | 0 |
| | n257 | 0 |

6.14.5 REFSENS requirements

Based on 6.14.3, there are no additional MSD requirements for this band combination.

6.15 CA_n3A_n40A-n41A

6.15.1 Operating bands for CA

Table 6.15.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) band | | | | Downlink (DL) band | | | | Duplex mode | |
|------------------|---------|------------------------------|--|---------------------|--|------------------------------|--|--|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | | $F_{DL_low} - F_{DL_high}$ | | | | | |
| CA_n3A_n40A-n41A | n3 | 1710 MHz – 1785 MHz | | 1805 MHz – 1880 MHz | | FDD | | | | | |
| | n40 | 2300 MHz – 2400 MHz | | 2300 MHz – 2400 MHz | | TDD | | | | | |
| | n41 | 2496 MHz – 2690 MHz | | 2496 MHz – 2690 MHz | | TDD | | | | | |

6.15.2 Channel bandwidths per operating band for CA

Table 6.15.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | Uplink config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Maximum aggregated bandwidth [MHz] |
|---------------------|---------------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------------------------------|
| CA_n3A_n40A-n41A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | | | | | | | | 210 |
| | | | 30 | | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | | | | | | | | |
| | | n40 | 15 | Yes | | | | | |
| | | | 30 | | Yes | | | |
| | | | 60 | | Yes | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |

6.15.3 Co-existence studies

Table 6.15.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL.

Table 6.15.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | | |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |

Table 6.15.3-2 gives harmonic mixing issue for CA with Band n3, n40 and n41.

Table 6.15.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | | |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |

It can be seen that there are no harmonic interference and harmonic mixing problem for CA_n3A_n40A-n41A

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.15.4 ΔT_{IB} and ΔR_{IB} values

For CA_n3A_n40A-n41A, the $\Delta T_{IB,c}$ and ΔR_{IB} values are given in the tables below.

Table 6.15.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3A_n40A-n41A | n3 | 0.5 |
| | n40 | 0.5 |
| | n41 | 0.5 ¹ |
| | | 0.8 ² |

NOTE 1: Applicable for the frequency range of 2515-2690 MHz.
 NOTE 2: Applicable for the frequency range of 2496-2515 MHz.
 NOTE 3: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band 40 and 41.

Table 6.15.4-2: $\Delta R_{IB,c}$

| Inter-band CA Configuration | NR Band | ΔR_{IB} [dB] |
|-----------------------------|---------|----------------------|
| CA_n3A_n40A-n41A | n3 | 0 |
| | n40 | 0 |
| | n41 | 0 ¹ |
| | | 0.5 ² |

NOTE 1: Applicable for the frequency range of 2515-2690 MHz.
 NOTE 2: Applicable for the frequency range of 2496-2515 MHz.
 NOTE 3: Only applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among band 40 and 41.

6.15.5 MSD

According to the co-existing studies, there is no need to specify additional MSD requirement for this UL CA configuration.

6.16 CA_n77-n79-n257

6.16.1 Operating bands for CA

Table 6.16.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | |
|-----------------|---------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | F_{UL_low} – F_{UL_high} | F_{DL_low} – F_{DL_high} | F_{DL_low} – F_{DL_high} | F_{DL_low} – F_{DL_high} | | |
| CA_n77-n79-n257 | n77 | 3300MHz | – | 4200MHz | 3300MHz | TDD | |
| | n79 | 4400MHz | – | 5000MHz | 4400MHz | TDD | |
| | n257 | 26500MHz | – | 29500MHz | 26500MHz | TDD | |

6.16.2 Channel bandwidths per operating band for CA

Table 6.16.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| CA configuration | Uplink CA config | NR Band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz | 200 MHz | 400 MHz | Bandwidth combination set |
|-------------------|-------------------------------------|---------|---|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------------------------|
| CA_n77-n79A-n257A | - | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | | | Yes | | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | | | Yes | | |
| | | n257 | 60 | | | | | | | | Yes | | | | Yes | Yes | | |
| | | | 120 | | | | | | | | Yes | | | | Yes | Yes | Yes | |
| CA_n77-n79A-n257G | CA_n25 7G | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | | | Yes | | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | | | Yes | | |
| | | n257 | See CA_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA_n77-n79A-n257H | CA_n25 7G CA_n25 7H | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | | | Yes | | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | | | Yes | | |
| | | n257 | See CA_n257G and n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA_n77-n79A-n257I | CA_n25 7G CA_n25 7H CA_n25 7I | n77 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n79 | 15 | | | | | | | Yes | Yes | | | | | | | |
| | | | 30 | | | | | | | Yes | Yes | Yes | Yes | | | Yes | | |
| | | | 60 | | | | | | | Yes | Yes | Yes | Yes | | | Yes | | |
| | | n257 | See CA_n257G, n257H, and n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |

6.16.3 Co-existence studies

Co-existence studies can be omitted because harmonic interference from n77 to n79 and from n79 to n77 have been already studied for NR CA n77-n79 as described in [6], and interference between FR1 bands and FR2 band are negligible.

6.16.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n77, n79 and n257, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.16.4-1 and table 6.16.4-2, respectively. The $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are derived from [6].

Table 6.16.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n77-n79-n257 | n77 | 0 |
| | n79 | 0 |
| | n257 | 0 |

Table 6.16.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n78-n79-n257 | n77 | 0 |
| | n79 | 0 |
| | n257 | 0 |

6.16.5 REFSENS requirements

MSD studies can be omitted because harmonic interference from n77 to n79 and from n79 to n77 have been already studied for NR CA n77-n79 as described in TR 37.865-01-01, and interference between FR1 bands and FR2 band are negligible.

6.17 CA_n78-n79-n257

6.17.1 Operating bands for CA

Table 6.17.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|-----------------|---------|------------------------------|------------------------------|------------------------------|------------------------------|-------------|----------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{DL_low} - F_{DL_high}$ | | | |
| CA_n78-n79-n257 | n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| | n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |
| | n257 | 26500MHz | – | 29500MHz | 26500MHz | – | 29500MHz | TDD |

6.17.2 Channel bandwidths per operating band for CA

Table 6.17.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA configuration | NR Uplink CA configuration | NR Band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz | 200 MHz | 400 MHz | Bandwidth combination set |
|---------------------|----------------------------|---------|---|-------|---------|---------|---------|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|
| CA_n78-n79A-n257A | - | n78 | 15 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | | | | | | | 0 |
| | | | 30 | | Ye s | Ye s | Ye s | | | Ye s | |
| | | | 60 | | Ye s | Ye s | Ye s | | | Ye s | |
| | | n79 | 15 | | | | | | | Ye s | Ye s | | | | | | | |
| | | | 30 | | | | | | | Ye s | Ye s | Ye s | Ye s | | | Ye s | | |
| | | | 60 | | | | | | | Ye s | Ye s | Ye s | Ye s | | | Ye s | | |
| | | n257 | 60 | | | | | | | Ye s | | | | | | Ye s | Ye s | |
| | | | 120 | | | | | | | Ye s | | | | | | Ye s | Ye s | |
| CA_n78-n79A-n257G | CA_n257G | n78 | 15 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | | | | | | | 0 |
| | | | 30 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | | | |
| | | | 60 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | | | |
| | | n79 | 15 | | | | | | | Ye s | Ye s | | | | | | | |
| | | | 30 | | | | | | | Ye s | Ye s | Ye s | Ye s | | | Ye s | | |
| | | | 60 | | | | | | | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | | | |
| | | n257 | See CA_n257G in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA_n78-n79A-n257H | CA_n257G CA_n257H | n78 | 15 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | | | | | | | 0 |
| | | | 30 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | | | |
| | | | 60 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | | | |
| | | n79 | 15 | | | | | | | Ye s | Ye s | | | | | | | |
| | | | 30 | | | | | | | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | | | |

| NR CA configuration | NR Uplink CA configuration | NR Band | SCS (kHz) | 5 M Hz | 10 M Hz | 15 M Hz | 20 M Hz | 25 M Hz | 30 M Hz | 40 M Hz | 50 M Hz | 60 M Hz | 80 M Hz | 90 M Hz | 100 M Hz | 200 M Hz | 400 M Hz | Bandwidth combination set |
|---------------------|----------------------------------|----------|---|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|---------------------------|
| | | | | | | | | | | s | s | s | s | | s | | | |
| | | | 60 | | | | | | | Ye s | Ye s | Ye s | Ye s | | Ye s | | | |
| | | n25 7 | See CA_n257G and n257H in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |
| CA_n78-n79A-n257I | CA_n257G CA_n257H CA_n257I | n78 | 15 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | | | | | | | 0 |
| | | | 30 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | | |
| | | | 60 | | Ye s | Ye s | Ye s | | | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | Ye s | | |
| | | n79 | 15 | | | | | | | Ye s | Ye s | | | | | | | |
| | | | 30 | | | | | | | Ye s | Ye s | Ye s | Ye s | | Ye s | | | |
| | | | 60 | | | | | | | Ye s | Ye s | Ye s | Ye s | | Ye s | | | |
| | | n25 7 | See CA_n257G, n257H, and n257I in Table 5.5A.1-1 in TS 38.101-2 | | | | | | | | | | | | | | | |

6.17.3 Co-existence studies

Co-existence studies can be omitted because harmonic interference from n78 to n79 and from n79 to n78 have been already studied for NR CA n78-n79 as described in TR 37.865-01-01, and interference between FR1 bands and FR2 band are negligible.

6.17.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n78, n79 and n257, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.17.4-1 and table 6.17.4-2, respectively. The $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are derived from TR 37.865-01-01.

Table 6.17.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n78-n79-n257 | n78 | 0.5 |
| | n79 | 0.5 |
| | n257 | 0 |

Table 6.17.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n78-n79-n257 | n78 | 0 |
| | n79 | 0 |
| | n257 | 0 |

6.17.5 REFSENS requirements

MSD studies can be omitted because harmonic interference from n78 to n79 and from n79 to n78 have been already studied for NR CA n78-n79 as described in TR 37.865-01-01, and interference between FR1 bands and FR2 band are negligible.

6.18 CA_n1A-n3A-n8A

6.18.1 Operating bands for CA

Table 6.18.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|-------------|---------|----------------------------|----------------|------------------------------|----------------|-------------|----------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | F_{UL_low} | F_{UL_high} | F_{DL_low} | F_{DL_high} | | | |
| CA_n1-n3-n8 | n1 | 1920 MHz | — | 1980 MHz | 2110 MHz | — | 2170 MHz | FDD |
| | n3 | 1710 MHz | — | 1785 MHz | 1805 MHz | — | 1880 MHz | FDD |
| | n8 | 880 MHz | — | 915 MHz | 925 MHz | — | 960 MHz | FDD |

6.18.2 Channel bandwidths per operating band for CA

Table 6.18.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|-----|---------------------------|
| CA_n1A-n3A-n8A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | n8 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |

6.18.3 Co-existence studies

Table 6.18.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n8 will fall into Band n3.

Table 6.18.3-1: Harmonic Interference for 3DLs/1UL

| Band | | | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | 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 |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 | | |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 | | |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 | | |

Table 6.18.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that Band n1 Tx frequency coincides with Band n8x2.

Table 6.18.3-2 Harmonic mixing for 3DLs/1UL

| Band | | | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | 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 | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 | | |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 | | |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 | | |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.18.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of Band n1, n3 and n8, the $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values are shown in table 6.18.4-1 and table 6.18.4-2, respectively. Values are derived from LTE CA_1-3-8.

Table 6.18.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n3-n8 | n1 | 0.3 |
| | n3 | 0.3 |
| | n8 | 0.3 |

Table 6.18.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n3-n8 | n1 | 0 |
| | n3 | 0 |
| | n8 | 0 |

6.18.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

6.19 CA_n1A-n8A-n78A

6.19.1 Operating bands for CA

Table 6.19.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | | |
|--------------|---------|------------------------------|------------------------------|------------------------------|------------------------------|-------------|---------|-----|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{DL_low} - F_{DL_high}$ | | | |
| CA_n1-n8-n78 | n1 | 1920MHz | – | 1980MHz | 2110MHz | FDD | | |
| | n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| | n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

6.19.2 Channel bandwidths per operating band for CA

Table 6.19.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|----|----|----|-----|-----|-----|-----|------------------|---------------------------|
| CA_n1A-n8A-n78A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n8 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | | Yes | Yes | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | Yes | Yes | Yes | Yes | Yes ¹ | |
| | | | 60 | | Yes | Yes | Yes | | | | Yes | Yes | Yes | Yes | Yes ¹ | |

NOTE: This UE channel bandwidth is optional in this release of the specification.

6.19.3 Co-existence studies

Table 6.19.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.19.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n8 | 880 | 915 | 925 | 960 | 1760 | 1830 | 2640 | 2745 | 3520 | 3660 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.18.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that Band n1 Tx frequency coincides with Band n8x2 and that Band n78 Tx frequency coincides with Band n8x4.

Table 6.19.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n8 | 880 | 915 | 925 | 960 | 1850 | 1920 | 2775 | 2880 | 3700 | 3840 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.19.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n8 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.19.4-1 and table 6.19.4-2, respectively. Values are derived from DC_1-8_n78.

Table 6.19.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n8-n78 | n1 | 0.3 |
| | n8 | 0.6 |
| | n78 | 0.8 |

Table 6.19.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n8-n78 | n1 | 0 |
| | n8 | 0.2 |
| | n78 | 0.5 |

6.19.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

6.20 CA_n1A-n3A-n28A

6.20.1 Operating bands for CA

Table 6.20.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|--------------|---------|------------------------------|---|----------|------------------------------|---|----------|-------------|--|
| | | BS receive / UE transmit | | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | $F_{DL_low} - F_{DL_high}$ | | | | |
| CA_n1-n3-n28 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD | |
| | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD | |
| | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD | |

6.20.2 Channel bandwidths per operating band for CA

Table 6.20.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|------------------|-----|----|----|----|----|----|-----|---------------------------|
| CA_n1A-n3A-n28A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes ¹ | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |

NOTE: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz.

6.20.3 Co-existence studies

Table 6.20.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 3rd order harmonic of Band n28 will fall into Band n1.

Table 6.20.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |

Table 6.20.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues can be seen.

Table 6.20.3-2 Harmonic mixing for 3DLs/1UL

| 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 |
|------|---------------------------|----------------------------|------------------------|----------------------------|------------------------|-------------------------|------------------------|----------------------------|------------------------|----------------------------|
| | n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.20.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n3 and n28, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.20.4-1 and table 6.20.4-2, respectively. Values are derived from LTE CA_1-3-28.

Table 6.20.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n3-n28 | n1 | 0.3 |
| | n3 | 0.3 |
| | n28 | 0.6 |

Table 6.20.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n3-n28 | n1 | 0 |
| | n3 | 0 |
| | n28 | 0.2 |

6.20.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

6.21 CA_n1A-n28A-n78A

6.21.1 Operating bands for CA

Table 6.21.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | |
|---------------|---------|------------------------------|------------------------------|------------------------------|------------------------------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | $F_{UL_low} - F_{UL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{UL_low} - F_{UL_high}$ | | |
| CA_n1-n28-n78 | n1 | 1920MHz – 1980MHz | 2110MHz – 2170MHz | 2110MHz – 2170MHz | 1920MHz – 1980MHz | FDD | |
| | n28 | 880 MHz – 915 MHz | 925 MHz – 960 MHz | 925 MHz – 960 MHz | 880 MHz – 915 MHz | FDD | |
| | n78 | 3300MHz – 3800MHz | 3300MHz – 3800MHz | 3300MHz – 3800MHz | 3300MHz – 3800MHz | TDD | |

6.21.2 Channel bandwidths per operating band for CA

Table 6.21.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|------------------|----|----|-----|-----|-----|-----|-----|------------------|---------------------------|
| CA_n1A-n28A-n78A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes ² | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ² | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes ¹ | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes ¹ | |

NOTE 1: This UE channel bandwidth is optional in this release of the specification.

NOTE 2: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz.

6.21.3 Co-existence studies

Table 6.21.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.21.3-1: Harmonic Interference for 3DLs/1UL

| Band | | | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | 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 |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 | | |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 | | |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 | | |

Table 6.21.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.21.3-2 Harmonic mixing for 3DLs/1UL

| Band | | | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | 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 | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 | | |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 | | |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 | | |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.21.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n28 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.21.4-1 and table 6.21.4-2, respectively. Values are derived from DC_1-28_n78.

Table 6.21.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n28-n78 | n1 | 0.3 |
| | n28 | 0.6 |
| | n78 | 0.8 |

Table 6.21.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n28-n78 | n1 | 0 |
| | n28 | 0.2 |
| | n78 | 0.5 |

6.21.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

6.22 CA_n3A-n28A-n78A

6.22.1 Operating bands for CA

Table 6.22.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | |
|---------------|---------|------------------------------|------------------------------|------------------------------|------------------------------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | $F_{UL_low} - F_{UL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{DL_low} - F_{DL_high}$ | $F_{UL_low} - F_{UL_high}$ | | |
| CA_n3-n28-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | FDD | |
| | n28 | 703 MHz | – | 748 MHz | 758 MHz | FDD | |
| | n78 | 3300MHz | – | 3800MHz | 3300MHz | TDD | |

6.22.2 Channel bandwidths per operating band for CA

Table 6.22.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|------------------|----|----|-----|-----|-----|-----|-----|------------------|---------------------------|
| CA_n3A-n28A-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes ² | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ² | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes ¹ | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes ¹ | |

NOTE 1: This UE channel bandwidth is optional in this release of the specification.

NOTE 2: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz.

6.22.3 Co-existence studies

Table 6.22.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n3 will fall into Band n78.

Table 6.22.3-1: Harmonic Interference for 3DLs/1UL

| Band | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | 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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.22.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that Band n78 Tx frequency coincides with Band n3x2.

Table 6.22.3-2 Harmonic mixing for 3DLs/1UL

| Band | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | 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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.22.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n3, n28 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.22.4-1 and table 6.22.4-2, respectively. Values are derived from DC_3-28_n78.

Table 6.22.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n28-n78 | n3 | 0.5 |
| | n28 | 0.3 |
| | n78 | 0.8 |

Table 6.22.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n28-n78 | n3 | 0 |
| | n28 | 0.2 |
| | n78 | 0.5 |

6.22.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

6.23 CA_n1A-n3A-n41A

6.23.1 Operating bands for CA

Table 6.23.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|--------------|---------|------------------------------|---|---------|------------------------------|---|---------|-------------|--|
| | | BS receive / UE transmit | | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | $F_{DL_low} - F_{DL_high}$ | | | | |
| CA_n1-n3-n41 | n1 | 1920MHz | – | 1980MHz | 2110MHz | – | 2170MHz | FDD | |
| | n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD | |
| | n41 | 2496MHz | – | 2690MHz | 2496MHz | – | 2690MHz | TDD | |

6.23.2 Channel bandwidths per operating band for CA

Table 6.23.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n1A-n3A-n41A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | Yes | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | Yes | |
| | | | 60 | | Yes | Yes | Yes | | Yes | |

6.23.3 Co-existence studies

Table 6.23.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL.

Table 6.23.3-1: Harmonic Interference for 3DLs/1UL

| | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th 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 |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | | |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |

Table 6.23.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL.

Table 6.23.3-2 Harmonic mixing for 3DLs/1UL

| | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th 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 |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | | |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | | |

For this band combination, there is no harmonic and harmonic mixing issue.

6.23.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n3 and n41, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.23.4-1 and table 6.23.4-2, respectively.

Table 6.23.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n1-n3-n41 | n1 | 0.5 |
| | n3 | 0.5 |
| | n41 | 0.3 ¹ |
| | | 0.8 ² |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545 - 2690 MHz. | | |
| NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496 - 2545 MHz. | | |

Table 6.23.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n1-n3-n41 | n1 | 0 |
| | n3 | 0 |
| | n41 | 0 ¹ |
| | | 0.5 ² |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545 – 2690 MHz. | | |
| NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496 – 2545 MHz. | | |

6.23.5 REFSENS requirements

There is no additional MSD requirements for CA_n1-n3-n41.

6.24 CA_n29-n66-n70

6.24.1 Operating bands for CA

Table 6.24.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) band | Downlink (DL) band | Duplex mode |
|----------------|---------|------------------------------|------------------------------|-------------|
| | | BS receive / UE transmit | BS transmit / UE receive | |
| | | $F_{UL_low} - F_{UL_high}$ | $F_{DL_low} - F_{DL_high}$ | |
| CA_n29-n66-n70 | n29 | N/A | 717 – 728 | SDL |
| | n66 | 1710 – 1780 | 2110 – 2200 | FDD |
| | n70 | 1695 – 1710 | 1995 – 2020 | FDD |

6.24.2 Channel bandwidths per operating band for CA

Table 6.24.2-1: Supported channel bandwidths per CA combination for 3DL Inter-band CA

| NR CA Configuration | UL Configuration | NR Band | SCS [kHz] | CA operating / channel bandwidth [MHz] | | | | | | | | | | | | Bandwidth combination set |
|----------------------|------------------|---------|--|--|-----|-----|------------------|------------------|------------------|----|-----|----|----|----|-----|---------------------------|
| | | | | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | |
| CA_n29A-n66A-n70A | - | n29 | 15 | Yes | Yes | | | | | | | | | | | 0 |
| | | | 30 | | Yes | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | | | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | Yes | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | Yes | | | | | |
| | | n70 | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| CA_n29A-n66B-n70A | - | n29 | 15 | Yes | Yes | | | | | | | | | | | 0 |
| | | | 30 | | Yes | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n66 | See CA_n66B Bandwidth Combination Set 0 in Table 5.5A.1-1 in TS38.101-1 | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| CA_n29A-n66(2A)-n70A | - | n29 | 15 | Yes | Yes | | | | | | | | | | | 0 |
| | | | 30 | | Yes | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n66 | See CA_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS38.101-1 | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | n70 | 15 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | |
| | | | 60 | | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | |

NOTE: This UE channel bandwidth is applicable only to downlink

6.24.3 UE co-existence studies

Table 6.24.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA_n29-n66-n70.

Table 6.24.3-1: Impact of UL/DL Harmonic

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2nd Harmonic | | 3rd Harmonic | | nth Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n29 | N/A | N/A | 717 | 728 | N/A | N/A | N/A | N/A | N/A | N/A |
| n66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | | |
| n70 | 1695 | 1710 | 1995 | 2020 | 3390 | 3420 | 5085 | 5130 | | |

Based on the table above, there is no harmonic relation

Table 6.24.3-2: Impact of UL/DL Harmonic mixing

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2nd Harmonic | | 3rd Harmonic | | mth Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|------------------------|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|
| | 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 | DL Low Band Edge | DL High Band Edge |
| n29 | N/A | N/A | 717 | 728 | 1434 | 1456 | 2151 | 2184 | N/A | N/A |
| 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 1710 | | |
| n70 | 1695 | 1710 | 1995 | 2020 | 3990 | 4040 | 5985 | 6060 | | |

Based on the table above, there is no harmonic mixing relation.

6.24.4 ΔT_{IB} and ΔR_{IB} values

For CA_n29-n66-n70, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are given in the tables below.

Table 6.24.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n29-n66-n70 | n29 | 0 |
| | n66 | 0.5 |
| | n70 | 0.5 |

Table 6.24.4-2: $\Delta R_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n29-n66-n70 | n29 | 0 |
| | n66 | 0 |
| | n70 | 0 |

6.24.5 REFSENS requirements

REFSENS is defined in TS38.101-1 Table 7.3A.2.4-1, because n29A is an SDL band.

Table 6.24.5-1: Reference sensitivity for SDL bands

| NR Band/Channel bandwidth | | | | | | | | | | | | | | |
|---------------------------|---------|-----------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| NR CA Configuration | NR band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | |
| | | | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | |
| CA_n29A-n66A-n70A | n29 | 15 | -97.0 | -93.8 | | | | | | | | | | |
| | | 30 | | -94.1 | | | | | | | | | | |
| | | 60 | | | | | | | | | | | | |
| | n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 | | | | -90.1 | | | | |
| | | 30 | | -96.6 | -94.6 | -93.5 | | | | -90.2 | | | | |
| | | 60 | | -97.0 | -94.9 | -93.7 | | | | -90.4 | | | | |
| | n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 | | | | | | | |
| | | 30 | | -97.1 | -95.1 | -94.0 | -92.8 | | | | | | | |
| | | 60 | | -97.5 | -95.4 | -94.2 | -93.0 | | | | | | | |
| CA_n29A-n66B-n70A | n29 | 15 | -97.0 | -93.8 | | | | | | | | | | |
| | | 30 | | -94.1 | | | | | | | | | | |
| | | 60 | | | | | | | | | | | | |
| | n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 | | | | -90.1 | | | | |
| | | 30 | | -96.6 | -94.6 | -93.5 | | | | -90.2 | | | | |
| | | 60 | | -97.0 | -94.9 | -93.7 | | | | -90.4 | | | | |
| | n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 | | | | | | | |
| | | 30 | | -97.1 | -95.1 | -94.0 | -92.8 | | | | | | | |
| | | 60 | | -97.5 | -95.4 | -94.2 | -93.0 | | | | | | | |
| CA_n29A-n66(2A)-n70A | n29 | 15 | -97.0 | -93.8 | | | | | | | | | | |
| | | 30 | | -94.1 | | | | | | | | | | |
| | | 60 | | | | | | | | | | | | |
| | n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 | | | | -90.1 | | | | |
| | | 30 | | -96.6 | -94.6 | -93.5 | | | | -90.2 | | | | |
| | | 60 | | -97.0 | -94.9 | -93.7 | | | | -90.4 | | | | |
| | n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 | | | | | | | |
| | | 30 | | -97.1 | -95.1 | -94.0 | -92.8 | | | | | | | |
| | | 60 | | -97.5 | -95.4 | -94.2 | -93.0 | | | | | | | |

NOTE 1: The transmitter shall be set to P_{UMAX} , as defined in subclause 6.2.4.

NOTE 2: Four Rx antenna ports shall be the baseline for this operating band, except for two Rx vehicular UE.

6.25 CA_n29-n66-n70

6.25.1 Operating bands for CA

Table 6.25.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) band | | Downlink (DL) band | | Duplex mode | |
|----------------|---------|------------------------------|--|------------------------------|--|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | $F_{DL_low} - F_{DL_high}$ | | | |
| CA_n29-n66-n70 | n29 | N/A | | 717 – 728 | | SDL | |
| | n66 | 1710 – 1780 | | 2110 – 2200 | | FDD | |
| | n70 | 1695 – 1710 | | 1995 – 2020 | | FDD | |

6.25.2 Channel bandwidths per operating band for CA

Table 6.25.2-1: Supported channel bandwidths per CA combination for 3DL Inter-band CA

| NR CA Configuration | UL Configuration | NR Band | SCS [kHz] | CA operating / channel bandwidth [MHz] | | | | | | | | | | | | Bandwidth combination set |
|--|------------------|---------|--|--|-----|-----|------------------|------------------|------------------|----|-----|----|----|----|-----|---------------------------|
| | | | | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | |
| CA_n29A-n66A-n70A | - | n29 | 15 | Yes | Yes | | | | | | | | | | | 0 |
| | | | 30 | | Yes | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | | | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | Yes | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | Yes | | | | | |
| | | n70 | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| CA_n29A-n66B-n70A | - | n29 | 15 | Yes | Yes | | | | | | | | | | | 0 |
| | | | 30 | | Yes | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n66 | See CA_n66B Bandwidth Combination Set 0 in Table 5.5A.1-1 in TS38.101-1 | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| CA_n29A-n66(2A)-n70A | - | n29 | 15 | Yes | Yes | | | | | | | | | | | 0 |
| | | | 30 | | Yes | | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n66 | See CA_n66(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS38.101-1 | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | n70 | 15 | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | | |
| | | | 30 | | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | |
| | | | 60 | | | Yes | Yes | Yes ¹ | Yes ¹ | | | | | | | |
| NOTE: This UE channel bandwidth is applicable only to downlink | | | | | | | | | | | | | | | | |

6.25.3 UE co-existence studies

Table 6.25.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA_n29-n66-n70.

Table 6.25.3-1: Impact of UL/DL Harmonic

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2nd Harmonic | | 3rd Harmonic | | nth Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n29 | N/A | N/A | 717 | 728 | N/A | N/A | N/A | N/A | N/A | N/A |
| n66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | | |
| n70 | 1695 | 1710 | 1995 | 2020 | 3390 | 3420 | 5085 | 5130 | | |

Based on the table above, there is no harmonic relation

Table 6.25.3-2: Impact of UL/DL Harmonic mixing

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2nd Harmonic | | 3rd Harmonic | | mth Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|------------------------|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|
| | 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 | DL Low Band Edge | DL High Band Edge |
| n29 | N/A | N/A | 717 | 728 | 1434 | 1456 | 2151 | 2184 | N/A | N/A |
| 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 1710 | | |
| n70 | 1695 | 1710 | 1995 | 2020 | 3990 | 4040 | 5985 | 6060 | | |

Based on the table above, there is no harmonic mixing relation.

6.25.4 ΔT_{IB} and ΔR_{IB} values

For CA_n29-n66-n70, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are given in the tables below.

Table 6.25.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n29-n66-n70 | n66 | 0.5 |
| | n70 | 0.5 |

Table 6.25.4-2: $\Delta R_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n29-n66-n70 | n66 | 0 |
| | n70 | 0 |

6.25.5 REFSENS requirements

REFSENS is defined in TS38.101-1 Table 7.3A.2.4-1, because n29A is an SDL band.

Table 6.25.5-1: Reference sensitivity for SDL bands

| NR Band/Channel bandwidth | | | | | | | | | | | | | | |
|---------------------------|---------|-----------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| NR CA Configuration | NR band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | |
| | | | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | dB | |
| CA_n29A-n66A-n70A | n29 | 15 | -97.0 | -93.8 | | | | | | | | | | |
| | | 30 | | -94.1 | | | | | | | | | | |
| | | 60 | | | | | | | | | | | | |
| | n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 | | | | -90.1 | | | | |
| | | 30 | | -96.6 | -94.6 | -93.5 | | | | -90.2 | | | | |
| | | 60 | | -97.0 | -94.9 | -93.7 | | | | -90.4 | | | | |
| | n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 | | | | | | | |
| | | 30 | | -97.1 | -95.1 | -94.0 | -92.8 | | | | | | | |
| | | 60 | | -97.5 | -95.4 | -94.2 | -93.0 | | | | | | | |
| CA_n29A-n66B-n70A | n29 | 15 | -97.0 | -93.8 | | | | | | | | | | |
| | | 30 | | -94.1 | | | | | | | | | | |
| | | 60 | | | | | | | | | | | | |
| | n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 | | | | -90.1 | | | | |
| | | 30 | | -96.6 | -94.6 | -93.5 | | | | -90.2 | | | | |
| | | 60 | | -97.0 | -94.9 | -93.7 | | | | -90.4 | | | | |
| | n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 | | | | | | | |
| | | 30 | | -97.1 | -95.1 | -94.0 | -92.8 | | | | | | | |
| | | 60 | | -97.5 | -95.4 | -94.2 | -93.0 | | | | | | | |
| CA_n29A-n66(2A)-n70A | n29 | 15 | -97.0 | -93.8 | | | | | | | | | | |
| | | 30 | | -94.1 | | | | | | | | | | |
| | | 60 | | | | | | | | | | | | |
| | n66 | 15 | -99.5 | -96.3 | -94.5 | -93.3 | | | | -90.1 | | | | |
| | | 30 | | -96.6 | -94.6 | -93.5 | | | | -90.2 | | | | |
| | | 60 | | -97.0 | -94.9 | -93.7 | | | | -90.4 | | | | |
| | n70 | 15 | -100 | -96.8 | -95.0 | -93.8 | -92.7 | | | | | | | |
| | | 30 | | -97.1 | -95.1 | -94.0 | -92.8 | | | | | | | |
| | | 60 | | -97.5 | -95.4 | -94.2 | -93.0 | | | | | | | |

NOTE 1: The transmitter shall be set to P_{UMAX}, as defined in subclause 6.2.4.

6.26 CA_n41-n66-n71

6.26.1 Operating bands for CA

Table 6.26.1-1: 3DL Inter-band CA operating bands

| NR Band | Uplink (UL) band | | Downlink (DL) band | | Duplex mode | | |
|---------|------------------------------|---|------------------------------|----------|-------------|----------|-----|
| | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | $F_{UL_low} - F_{UL_high}$ | | $F_{DL_low} - F_{DL_high}$ | | | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n41 | 2469 MHz | – | 2690 MHz | 2469 MHz | – | 2690 MHz | TDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

6.26.2 Channel bandwidths per operating band for CA

Table 6.26.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA configuration | NR Uplink CA configuration | NR Band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz | Maximum Aggregated bandwidth [MHz] | Bandwidth combination set |
|----------------------|----------------------------|---------|---|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------------------------------------|---------------------------|
| CA_n25A-n41A-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 140 | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | Yes | Yes | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | Yes | | |
| | | | 60 | | Yes | Yes | Yes | | Yes | | |
| | | n71 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | |
| CA_n25A-n41(2A)-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 230 | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | |
| | | n41 | See CA_n41(2A) Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.2-1 | | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | |
| CA_n25A-n41C-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 220 | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | |
| | | n41 | See CA_n41C Bandwidth Combination Set 0 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | | n71 | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | |

6.26.3 UE co-existence studies

Table 6.26.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA_n25-n41-n71.

Table 6.26.3-1: Impact of UL/DL Harmonic

| | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th 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 |
| n25 | 1850 | 1915 | 1930 | 1995 | 3700 | 3830 | 5550 | 5985 | 7400 | 7660 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| n71 | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | 2652 | 2792 |

Band n71 uplink 4th harmonic hits band n41 downlink.

Table 6.26.3-2: Impact of UL/DL Harmonic mixing

| | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th 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 |
| n25 | 1850 | 1915 | 1930 | 1995 | 3860 | 3990 | 5790 | 5985 | 7720 | 7980 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| n71 | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | 2468 | 2608 |

Band n41 is at 4th receiver harmonic of band n71 no MSD is necessary.

6.26.4 ΔT_{IB} and ΔR_{IB} values

For CA_n25-n41-n71, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are derived from fallback CAs using max operation as given in the tables below.

Table 6.26.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n25-n41-n71 | n25 | 0.5 |
| | n41 | 0.5 |
| | n71 | 0.6 |

Table 6.26.4-2: $\Delta R_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n25-n41-n71 | n25 | 0 |
| | n41 | 0 |
| | n71 | 0.2 |

6.26.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

6.27 CA_ n41-n66-n71

6.27.1 Operating bands for CA

Table 6.27.1-1: 3DL Inter-band CA operating bands

| NR Band | Uplink (UL) band | | Downlink (DL) band | | Duplex mode | | |
|---------|------------------------------|---|------------------------------|----------|-------------|----------|-----|
| | BS receive / UE transmit | | BS transmit / UE receive | | | | |
| | $F_{UL_low} - F_{UL_high}$ | | $F_{DL_low} - F_{DL_high}$ | | | | |
| n41 | 2469 MHz | – | 2690 MHz | 2469 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

6.27.2 Channel bandwidths per operating band for CA

Table 6.27.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| A dition | NR Uplink CA configuration | NR Band | SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz | Maximum Aggregated bandwidth [MHz] | Bar com |
|--------------|----------------------------------|------------|---|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|---|------------|
| 1A- 71A | - | n41 | 15 | | Yes | Yes | Yes | | Yes | Yes | Yes | | | | | 160 | |
| | | | 30 | | Yes | Yes | Yes | | Yes | | |
| | | | 60 | | Yes | Yes | Yes | | Yes | | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | n71 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | |
| (2A)- 71A | - | n41 | See CA_n41(2A) Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.2-1 | | | | | | | | | | | | | 250 | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | Yes | | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | n71 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | |
| 1C- 71A | - | n41 | See CA_n41C Bandwidth Combination Set 0 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | | 240 | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | Yes | | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | n71 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | |

6.27.3 UE co-existence studies

Table 6.27.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA_41X-71Y.

Table 6.27.3-1: Impact of UL/DL Harmonic

| | | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th 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 | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 | |
| n66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | 6840 | 7120 | |
| n71 | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | 2652 | 2792 | |

Band n71 uplink 4th harmonic hits band n41 downlink.

Table 6.27.3-2: Impact of UL/DL Harmonic mixing

| | | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th 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 | |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 | |
| n66 | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 8440 | 8800 | |
| n71 | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | 2468 | 2608 | |

Band n41 is at 4th receiver harmonic of band n71 no MSD is necessary.

6.27.4 ΔT_{IB} and ΔR_{IB} values

For CA_n41-n66-n71, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are derived from fallback CAs using max operation given in the tables below.

Table 6.27.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n41-n66-n71 | n41 | 0.8 ¹ |
| | | 1.3 ² |
| | n66 | 0.5 |
| | n71 | 0.3 |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545-2690 MHz. | | |
| NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496-2545 MHz. | | |

Table 6.27.4-2: $\Delta R_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n41-n66-n71 | n41 | 0.5 ¹ |
| | | 1 ² |
| | n66 | 0.5 |
| | n71 | 0 |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545-2690 MHz. | | |
| NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496-2545 MHz. | | |

6.27.5 REFSENS requirements

MSD requirements are captured in lower order combinations.

6.28 CA_n25-n66-n78

6.28.1 Operating bands for CA

Table 6.28.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | |
|----------------|---------|----------------------------|---|------------------------------|----------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | FUL_low – FUL_high | | FDL_low – FDL_high | | | |
| CA_n25-n66-n78 | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | FDD | |
| | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | TDD | |
| | n78 | 3300MHz | – | 3800MHz | 3300MHz | TDD | |

6.28.2 Channel bandwidths per operating band for CA

Table 6.28.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n25A-n66A-n78A | - | n25 | 15 | Yes | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| | | n78 | 15 | | Yes | | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | | 30 | | Yes | | Yes | |
| | | | 60 | | Yes | | Yes | |

6.28.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fall-back modes.

6.28.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of Band n25, n66 and n78, the $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values are shown in table 6.28.4-1 and table 6.28.4-2, respectively.

Table 6.28.4-1: $\Delta T_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n25-n66-n78 | n25 | 0.6 |
| | n66 | 0.6 |
| | n78 | 0.8 |

Table 6.28.4-2: $\Delta R_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n25-n66-n78 | n25 | 0.3 |
| | n66 | 0.3 |
| | n78 | 0.5 |

6.28.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fall-back modes. There is no additional REFSENS requirement for this combination.

6.29 CA_n7-n66-n78

6.29.1 Operating bands for CA

Table 6.29.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode |
|---------------|---------|----------------------------|---|--------------------|------------------------------|---|--------------------|-------------|
| | | BS receive / UE transmit | | FUL_low – FUL_high | BS transmit / UE receive | | FDL_low – FDL_high | |
| | | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | |
| CA_n7-n66-n78 | n7 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD |
| | n66 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| | n78 | | | | | | | |

6.29.2 Channel bandwidths per operating band for CA

Table 6.29.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| n7A-n66A-n78A | - | n7 | 15 | Yes | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| | | | 30 | | Yes | Yes | | | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | | | Yes | Yes | | | | | | |
| | | n78 | 15 | | Yes | | | | | |
| | | | 30 | | Yes | |
| | | | 60 | | Yes | |

6.29.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fall-back modes.

6.29.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of Band n7, n66 and n78, the $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values are shown in table 6.29.4-1 and table 6.29.4-2, respectively.

Table 6.29.4-1: $\Delta T_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n7-n66-n78 | n7 | 0.5 |
| | n66 | 0.6 |
| | n78 | 0.8 |

Table 6.29.4-2: $\Delta R_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n7-n66-n78 | n7 | 0.5 |
| | n66 | 0.5 |
| | n78 | 0.5 |

6.29.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fall-back modes. There is no additional REFSENS requirement for this combination.

6.30 CA_n5-n66-n78

6.30.1 Operating bands for CA

Table 6.30.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|---------------|---------|----------------------------|---|--------------------------|----------|------------------------------|----------|---|----------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | | | | | |
| | | FUL_low – FUL_high | | | | FDL_low – FDL_high | | | | | |
| CA_n5-n66-n78 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 896 MHz | – | 896 MHz | FDD | |
| | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | – | 2200 MHz | TDD | |
| | n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | – | 3800MHz | TDD | |

6.30.2 Channel bandwidths per operating band for CA

Table 6.30.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| n5A-n66A-n78A | - | n5 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| | | | 60 | Yes | Yes | Yes | | | Yes | Yes | | | | | | |
| | | n78 | 15 | | Yes | | | | | |
| | | | 30 | | Yes | |
| | | | 60 | | Yes | |

6.30.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fall-back modes.

6.30.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of Band n7, n66 and n78, the $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values are shown in table 6.30.4-1 and table 6.30.4-2, respectively.

Table 6.30.4-1: $\Delta T_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n5-n66-n78 | n5 | 0.6 |
| | n66 | 0.6 |
| | n78 | 0.8 |

Table 6.30.4-2: $\Delta R_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n5-n66-n78 | n5 | 0.5 |
| | n66 | 0.2 |
| | n78 | 0.5 |

6.30.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fall-back modes. There is no additional REFSENS requirement for this combination.

6.31 CA_n7-n25-n66

6.31.1 Operating bands for CA

Table 6.31.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|---------------|---------|----------------------------|---|----------|------------------------------|---|----------|-------------|--|
| | | BS receive / UE transmit | | | BS transmit / UE receive | | | | |
| | | FUL_low – FUL_high | | | FDL_low – FDL_high | | | | |
| CA_n7-n25-n66 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD | |
| | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD | |
| | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD | |

6.31.2 Channel bandwidths per operating band for CA

Table 6.x.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|-----|---------------------------|
| CA_n7A-n25A-n66A | - | n7 | 15 | Yes | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | n25 | 15 | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | Yes | Yes | | | | | | |

6.31.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fall-back modes.

6.31.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of Band n28, n78 and n257, the $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values are shown in table 6.31.4-1 and table 6.31.4-2, respectively.

Table 6.31.4-1: $\Delta T_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n7-n25-n66 | n7 | 0.5 |
| | n25 | 0.5 |
| | n66 | 0.5 |

Table 6.31.4-2: $\Delta R_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n7-n25-n66 | n7 | 0.5 |
| | n25 | 0.3 |
| | n66 | 0.5 |

6.31.5 REFSENS requirements

Sensitivity degradation is covered by the constituent fall-back modes. There is no additional REFSENS requirement for this combination.

6.32 CA_n20A-n28A-n78A

6.32.1 Operating bands for CA

Table 6.32.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | |
|-----------------------------|---------|------------------------------|------------------------------|------------------------------|------------------------------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | $F_{UL,low}$ – $F_{UL,high}$ | $F_{DL,low}$ – $F_{DL,high}$ | $F_{DL,low}$ – $F_{DL,high}$ | $F_{DL,low}$ – $F_{DL,high}$ | | |
| CA_n20-n28-n78 ^y | n20 | 832MHz – 862MHz | 791MHz – 821MHz | 791MHz – 821MHz | 791MHz – 821MHz | FDD | |
| | n28 | 703MHz – 748MHz | 758MHz – 803MHz | 758MHz – 803MHz | 758MHz – 803MHz | FDD | |
| | n78 | 3300MHz – 3800MHz | 3300MHz – 3800MHz | 3300MHz – 3800MHz | 3300MHz – 3800MHz | TDD | |

NOTE y: The frequency range in band n28 is restricted for this band combination to 703-733 MHz for the UL and 758-788 MHz for the DL.

6.32.2 Channel bandwidths per operating band for CA

Table 6.32.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n20A-n28A-n78A | - | n20 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | Yes | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | Yes | |
| | | | 60 | | Yes | Yes | Yes | | Yes | |

6.32.3 Co-existence studies

Table 6.32.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL.

Table 6.32.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2nd Harmonic | | 3rd Harmonic | | 4th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n20 | 832 | 862 | 791 | 821 | 1664 | 1724 | 2496 | 2586 | 3328 | 3448 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | | |

Table 6.32.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL.

Table 6.32.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2nd Harmonic | | 3rd Harmonic | | 4th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n20 | 832 | 862 | 791 | 821 | 1582 | 1642 | 2373 | 2463 | 3164 | 3284 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | | |

There is a 4th harmonic interference for band n78 Rx with band n20 Tx.

For this band combination, there is no harmonic mixing issue.

6.32.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of Band n20, n28 and n78, the $T_{IB,C}$ and $R_{IB,C}$ values are shown in table 6.32.4-1 and table 6.32.4-2, respectively.

Table 6.32.4-1: $\Delta TIB,c$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta TIB,c$ [dB] |
|-----------------------------|---------|---------------------|
| CA_n20-n28-n78 | n20 | 0.6 |
| | n28 | 0.5 |
| | n78 | 0.8 |

Table 6.32.4-2: $\Delta RIB,c$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta RIB,c$ [dB] |
|-----------------------------|---------|---------------------|
| CA_n20-n28-n78 | n20 | 0 |
| | n28 | 0.2 |
| | n78 | 0.5 |

6.32.5 REFSENS requirements

The MSD requirements due to UL harmonic interference for band n78 Rx with band n20 Tx has been specified in TS 38.101-1.

6.33 CA_n1A-n7A-n28A

6.33.1 Operating bands for CA

Table 6.33.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|--------------|---------|--------------------------------|--------------------------------|----------|------------------------------|---|----------|-------------|--|
| | | BS receive / UE transmit | | | BS transmit / UE receive | | | | |
| | | F_{UL_low} – F_{UL_high} | F_{DL_low} – F_{DL_high} | | | | | | |
| CA_n1-n7-n28 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD | |
| | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD | |
| | n28 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD | |

6.33.2 Channel bandwidths per operating band for CA

Table 6.33.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|------------------|-----|-----|-----|-----|----|----|----|-----|---------------------------|
| CA_n1A-n7A-n28A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes ² | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes ² | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

NOTE 1: This UE channel bandwidth is optional in this release of the specification.

NOTE 2: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz

6.33.3 Co-existence studies

Table 6.33.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.33.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|--------------------------|-------------------------|--------------------------|-------------------------|---------------------------|-------------------------|
| | 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 | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |

Table 6.33.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It is noted that 3rd harmonics from n28 UL affects band n1 DL.

Table 6.33.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | 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 |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.33.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n7 and n28, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.33.4-1 and table 6.33.4-2, respectively. Values are derived from DC_1-7_n28.

Table 6.33.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n7-n28 | n1 | 0.5 |
| | n7 | 0.6 |
| | n28 | 0.6 |

Table 6.33.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n7-n28 | n1 | 0 |
| | n7 | 0 |
| | n28 | 0.2 |

6.33.5 REFSENS requirements

Additional REFSENS requirements for band n28 UL affecting band n1 DL are already defined in Table 7.3A.4-2 of TS 38.101-1. No additional requirements are needed.

6.34 CA_n1A-n7A-n78A

6.34.1 Operating bands for CA

Table 6.34.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|--------------|---------|------------------------------|---|----------|--|------------------------------|---|----------|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | | $F_{DL_low} - F_{DL_high}$ | | | | | |
| CA_n1-n7-n78 | n1 | 1920 MHz | – | 1980 MHz | | 2110 MHz | – | 2170 MHz | | FDD | |
| | n7 | 2500 MHz | – | 2570 MHz | | 2620 MHz | – | 2690 MHz | | FDD | |
| | n78 | 3300 MHz | – | 3800 MHz | | 3300 MHz | – | 3800 MHz | | TDD | |

6.34.2 Channel bandwidths per operating band for CA

Table 6.34.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set | |
|---------------------|-----------|---|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|--|
| CA_n1A-n7A-n78A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 | |
| | | | 30 | Yes | Yes | Yes | | | | | | | | | | | |
| | | | 60 | Yes | Yes | Yes | | | | | | | | | | | |
| | | n7 | 15 | Yes | | | | | | |
| | | | 30 | Yes | | | | | | |
| | | | 60 | Yes | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | |
| | | See CA_n78(2A) Bandwidth Combination Set 0 in Table 5.5A.2-1 in TS 38.101-1 | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

NOTE 1: This UE channel bandwidth is optional in this release of the specification.

NOTE 2: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz

6.34.3 Co-existence studies

Table 6.34.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.34.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.34.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.34.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1 [3].

6.34.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n7 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.34.4-1 and table 6.34.4-2, respectively. Values are derived from DC_1-7_n78.

Table 6.34.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n7-n78 | n1 | 0.6 |
| | n7 | 0.6 |
| | n78 | 0.8 |

Table 6.34.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n7-n78 | n1 | 0.2 |
| | n7 | 0.2 |
| | n78 | 0.5 |

6.34.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

6.35 CA_n28A-n41A-n78A

6.35.1 Operating bands for CA

Table 6.35.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | |
|----------------|---------|--|--|--|--|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | F _{UL_low} – F _{UL_high} | F _{DL_low} – F _{DL_high} | F _{DL_low} – F _{DL_high} | F _{UL_low} – F _{UL_high} | | |
| CA_n28-n41-n78 | n28 | 703MHz – 748MHz | 758MHz – 803MHz | 758MHz – 803MHz | 703MHz – 748MHz | FDD | |
| | n41 | 2496MHz – 2690MHz | 2496MHz – 2690MHz | 2496MHz – 2690MHz | 2496MHz – 2690MHz | TDD | |
| | n78 | 3300MHz – 3800MHz | 3300MHz – 3800MHz | 3300MHz – 3800MHz | 3300MHz – 3800MHz | TDD | |

6.35.2 Channel bandwidths per operating band for CA

Table 6.35.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|---------------------------|
| CA_n28A-n41A-n78A | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | Yes | Yes | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | Yes | Yes | Yes | Yes | | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | Yes | Yes | Yes | Yes | | Yes | Yes | Yes | |
| | | n78 | 15 | | Yes | | | | | |
| | | | 30 | | Yes | | Yes | Yes | Yes | |
| | | | 60 | | Yes | | Yes | Yes | Yes | |

6.35.3 Co-existence studies

Table 6.35.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL.

Table 6.35.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | | |
|------|------------------|-------------------|------------------|--------------------------|------------------|--------------------------|------------------|--------------------------|------------------|-------|
| | | | | DL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.35.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL.

Table 6.35.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | 2 nd Harmonic | | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|--------------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | 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 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For this band combination, the harmonic and harmonic mixing issue have been solved by fallback combos.

6.35.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of CA_n28-n41-n78, the $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values are shown in table 6.35.4-1 and table 6.35.4-2, respectively.

Table 6.35.4-1: $\Delta T_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n28-n41-n78 | n28 | 0.5 |
| | n41 | 0.3 |

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| | n78 | 0.8 |
| | | |

Table 6.35.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n28-n41-n78 | n28 | 0.2 |
| | n41 | 0 |
| | n78 | 0.5 |
| | | |

6.35.5 REFSENS requirements

There is no additional MSD requirements for CA_n28-n41-n78.

6.36 CA_n1A-n40A-n78A

6.36.1 Operating bands for CA

Table 6.36.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | |
|---------------|---------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | F_{UL_low} – F_{UL_high} | F_{DL_low} – F_{DL_high} | F_{DL_low} – F_{DL_high} | F_{DL_low} – F_{DL_high} | | |
| CA_n1-n40-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | FDD | |
| | n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | TDD | |
| | n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | TDD | |

6.36.2 Channel bandwidths per operating band for CA

Table 6.36.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n1-n40-n78 | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n40 | 15 | Yes | | | | | |
| | | | 30 | | Yes | | | | | |
| | | | 60 | | Yes | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |

6.36.3 Co-existence studies

Table 6.36.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.36.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | 9200 | 9600 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.36.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.36.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | 9200 | 9600 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.36.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n40 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.36.4-1 and table 6.36.4-2, respectively. Values are same as for DC_1_n40-n78.

Table 6.36.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n40-n78 | n1 | 0.3 |
| | n40 | 0.5 |
| | n78 | 0.8 |

Table 6.36.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n40-n78 | n1 | 0 |
| | n40 | 0 |
| | n78 | 0.5 |

6.36.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

6.37 CA_n28A-n40A-n78A

6.37.1 Operating bands for CA

Table 6.37.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|----------------|---------|------------------------------|---|----------|--|------------------------------|---|----------|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | | $F_{DL_low} - F_{DL_high}$ | | | | | |
| CA_n28-n40-n78 | n28 | 703 MHz | — | 748 MHz | | 758 MHz | — | 803 MHz | | FDD | |
| | n40 | 2300 MHz | — | 2400 MHz | | 2300 MHz | — | 2400 MHz | | TDD | |
| | n78 | 3300 MHz | — | 3800 MHz | | 3300 MHz | — | 3800 MHz | | TDD | |

6.37.2 Channel bandwidths per operating band for CA

Table 6.37.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n28-n40-n78 | - | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n40 | 15 | Yes | | | | | |
| | | | 30 | | Yes | | | | | |
| | | | 60 | | Yes | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | |

6.37.3 Co-existence studies

Table 6.37.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.37.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | 9200 | 9600 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.37.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. 3rd harmonic DL mixing from band n28 UL will affect band n40 DL.

Table 6.37.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n28 | 703 | 748 | 2110 | 2170 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |
| n40 | 2300 | 2400 | 2300 | 2400 | 4600 | 4800 | 6900 | 7200 | 9200 | 9600 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.37.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n28, n40 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.37.4-1 and table 6.37.4-2, respectively. Values are derived from DC_28-41_n78.

Table 6.37.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n28-n40-n78 | n28 | 0.5 |
| | n40 | 0.3 |
| | n78 | 0.8 |

Table 6.37.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n28-n40-n78 | n28 | 0 |
| | n40 | 0 |
| | n78 | 0.5 |

6.37.5 REFSENS requirements

Harmonic mixing is already defined for CA_n28-n40. No additional REFSENS requirements are needed to be defined.

6.38 CA_n25-n66-n71

6.38.1 Operating bands for CA

Table 6.38.1-1: 3DL Inter-band CA operating bands

| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex mode | |
|---------|------------------------------|---|----------|------------------------------|---|----------|-------------|--|
| | BS receive / UE transmit | | | BS transmit / UE receive | | | | |
| | $F_{UL_low} - F_{UL_high}$ | | | $F_{DL_low} - F_{DL_high}$ | | | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD | |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | TDD | |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD | |

6.38.2 Channel bandwidths per operating band for CA

Table 6.38.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|----|----|-----|----|----|----|----|-----|---------------------------|
| CA_n25A-n66A-n71A | - | n25 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | | | | |
| | | n71 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |

6.38.3 UE co-existence studies

Table 6.38.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA_n25-n41-n71.

Table 6.38.3-1: Impact of UL/DL Harmonic

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| 25 | 1850 | 1915 | 1930 | 1995 | 3700 | 3830 | 5550 | 5745 | 7400 | 7660 |
| 66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | 6840 | 7120 |
| 71 | 663 | 698 | 617 | 652 | 1326 | 1396 | 1989 | 2094 | 2652 | 2792 |

3rd harmonic of n71 UL will interfere n25 DL.

Table 6.38.3-2: Impact of UL/DL Harmonic mixing

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| 25 | 1850 | 1915 | 1930 | 1995 | 3860 | 3990 | 5790 | 5985 | 7720 | 7980 |
| 66 | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 8440 | 8800 |
| 71 | 663 | 698 | 617 | 652 | 1234 | 1304 | 1851 | 1956 | 2468 | 2608 |

3rd DL harmonic of n71 will co-inside n25 UL.

6.38.4 ΔT_{IB} and ΔR_{IB} values

For CA_n25-n66-n71, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are derived from fallback CAs using max operation as given in the tables below.

Table 6.38.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n25-n66-n71 | n25 | 0.5 |
| | n66 | 0.5 |
| | n71 | 0.6 |

Table 6.38.4-2: $\Delta R_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n25-n66-n71 | n25 | 0.3 |
| | n66 | 0.3 |
| | n71 | 0.3 |

6.38.5 REFSENS requirements

MSDs due to harmonic interference and harmonic mixing for band pair of n25 and n71 are already captured into specification.

6.39 CA_n25-n41-n66

6.39.1 Operating bands for CA

Table 6.39.1-1: 3DL Inter-band CA operating bands

| NR Band | Uplink (UL) band | | | | Downlink (DL) band | | | | Duplex mode | | | | | |
|---------|------------------------------|---|------------------------------|---|--------------------|---|----------|---|-------------|--|--|--|--|--|
| | BS receive / UE transmit | | BS transmit / UE receive | | | | | | | | | | | |
| | $F_{UL_low} - F_{UL_high}$ | | $F_{DL_low} - F_{DL_high}$ | | | | | | | | | | | |
| n25 | 1850 MHz | – | 1915 MHz | – | 1930 MHz | – | 1995 MHz | – | FDD | | | | | |
| n41 | 2469 MHz | – | 2690 MHz | – | 2469 MHz | – | 2690 MHz | – | TDD | | | | | |
| n66 | 1710 MHz | – | 1780 MHz | – | 2110 MHz | – | 2200 MHz | – | FDD | | | | | |

6.39.2 Channel bandwidths per operating band for CA

Table 6.39.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n25A-n41A-n66A | - | n25 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n41 | 15 | | Yes | Yes | Yes | | Yes | Yes | Yes | | | | | |
| | | | 30 | | Yes | Yes | Yes | | Yes | |
| | | | 60 | | Yes | Yes | Yes | | Yes | |
| | | n66 | 15 | Yes | Yes | Yes | Yes | | | Yes | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | | | | | | |

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set | |
|---------------------|-----------|---------|--|-----|-----|-----|-----|----|----|-----|----|----|----|----|-----|---------------------------|--|
| CA_n25A-n41C-n66A | - | n25 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | |
| | | n41 | See CA_n41C Bandwidth Combination Set 0 in 38.101-1 Table 5.5A.1-1 | | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | 60 | | Yes | Yes | Yes | Yes | | | Yes | | | | | | | |

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set | |
|----------------------|-----------|---------|---|-----|-----|-----|-----|----|----|-----|----|----|----|----|-----|---------------------------|--|
| CA_n25A-n41(2A)-n66A | - | n25 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | | |
| | | n41 | See CA_n41(2A) Bandwidth Combination Set 1 in 38.101-1 Table 5.5A.2-1 | | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | | | | | | |
| | | 60 | | Yes | Yes | Yes | Yes | | | Yes | | | | | | | |

6.39.3 UE co-existence studies

Table 6.39.3-1/2 summarizes frequency ranges where harmonics and/or harmonics mixing occur for CA_n25-n41-n71.

Table 6.39.3-1: Impact of UL/DL Harmonic

| | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th 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 |
| 25 | 1850 | 1915 | 1930 | 1995 | 3700 | 3830 | 5550 | 5745 | 7400 | 7660 |
| 41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| 66 | 1710 | 1780 | 2110 | 2200 | 3420 | 3560 | 5130 | 5340 | 6840 | 7120 |

No harmonic interference.

Table 6.39.3-2: Impact of UL/DL Harmonic mixing

| | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th 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 |
| 25 | 1850 | 1915 | 1930 | 1995 | 3860 | 3990 | 5790 | 5985 | 7720 | 7980 |
| 41 | 2496 | 2690 | 2496 | 2690 | 4992 | 5380 | 7488 | 8070 | 9984 | 10760 |
| 66 | 1710 | 1780 | 2110 | 2200 | 4220 | 4400 | 6330 | 6600 | 8440 | 8800 |

No harmonic mixing.

6.39.4 ΔT_{IB} and ΔR_{IB} values

For CA_n25-n41-n66, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are derived from fallback CAs using max operation as given in the tables below.

Table 6.39.4-1: $\Delta T_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n25-n41-n66 | n25 | 0.5 |
| | n41 | 0.8 ⁶ |
| | n66 | 1.3 ⁷ |
| | | 0.5 |
| NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2545-2690 MHz. | | |
| NOTE 7: The requirement is applied for UE transmitting on the frequency range of 2496-2545 MHz. | | |

Table 6.39.4-2: $\Delta R_{IB,c}$

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|---|---------|------------------------|
| CA_n25-n41-n66 | n25 | 0.3 |
| | n41 | 0.5 ⁶ |
| | n66 | 1 ⁷ |
| | | 0.3 |
| NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2545-2690 MHz. | | |
| NOTE 7: The requirement is applied for UE transmitting on the frequency range of 2496-2545 MHz. | | |

6.39.5 REFSENS requirements

MSD is not required.

6.40 CA_n1-n78-n257

6.40.1 Operating bands for CA

Table 6.40.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|----------------|---------|------------------------------|---|----------|--|------------------------------|---|----------|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | | $F_{DL_low} - F_{DL_high}$ | | | | | |
| CA_n1-n78-n257 | n1 | 1920MHz | – | 1980MHz | | 2110MHz | – | 2170MHz | | FDD | |
| | n78 | 3300MHz | – | 3800MHz | | 3300MHz | – | 3800MHz | | TDD | |
| | n257 | 26500MHz | – | 29500MHz | | 26500MHz | – | 29500MHz | | TDD | |

6.40.2 Channel bandwidths per operating band for CA

Table 6.40.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | 200 | 400 | Bandwidth combination set |
|---------------------|-----------|---------|-----------|-----|-----|-----|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n1A-n78A-n257A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | | | 0 |
| | | | 30 | Yes | Yes | Yes | | | | | | | | | | | | |
| | | | 60 | Yes | Yes | Yes | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | Yes | Yes | | | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | Yes | | |
| | | | 60 | | Yes | Yes | Yes | | | Yes | Yes | Yes | Yes | Yes | Yes | | | |
| | | n257 | 60 | | | | | | | | Yes | | | | | Yes | Yes | |
| | | | 120 | | | | | | | | Yes | | | | | Yes | Yes | |

6.40.3 Co-existence studies

The coexistence studies of harmonic interference have been captured in the constituent fallback modes in TR 38.716-02-00.

6.40.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of Band n1, n78 and n257, the $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values are shown in tables below

Table 6.40.4-1: $\Delta T_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n78-n257 | n1 | 0.3 |
| | n78 | 0.8 |
| | n257 | 0 |

Table 6.40.4-2: $\Delta R_{IB,C}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,C}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n78-n257 | n1 | 0 |
| | n78 | 0.5 |
| | n257 | 0 |

6.40.5 REFSENS requirements

No additional MSD requirement is needed.

6.41 CA_n1A-n3A-n7A

6.41.1 Operating bands for CA

Table 6.41.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|-------------|---------|------------------------------|---|----------|--|------------------------------|---|----------|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | | $F_{DL_low} - F_{DL_high}$ | | | | | |
| CA_n1-n3-n7 | n1 | 1920 MHz | – | 1980 MHz | | 2110 MHz | – | 2170 MHz | | FDD | |
| | n3 | 1710 MHz | – | 1785 MHz | | 1805 MHz | – | 1880 MHz | | FDD | |
| | n7 | 2500 MHz | – | 2570 MHz | | 2620 MHz | – | 2690 MHz | | FDD | |

6.41.2 Channel bandwidths per operating band for CA

Table 6.41.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|----------------|-----------|--|-----|-----|-----|-----|-----|-----|-----|-----|----|----|-----|---------------------------|
| CA_n1A-n3A-n7A | - | n1 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | | | | | | | | | |
| | | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | n7 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | | |
| | | | 30 | | Yes | | | | |
| | | | 60 | | Yes | | | | |
| | | CA_n1A-n3A-n7B | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 30 | | Yes | Yes | | | | | | | | | | |
| | | | 60 | | Yes | Yes | | | | | | | | | | |
| | | | n7 | See CA_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | |

6.41.3 Co-existence studies

Table 6.41.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.41.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 3840 | 3960 | 5760 | 5940 | 7680 | 7920 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |

Table 6.41.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.41.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n1 | 1920 | 1980 | 2110 | 2170 | 4220 | 4340 | 6330 | 6510 | 8440 | 8680 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.41.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n1, n3 and n7, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.41.4-1 and table 6.41.4-2, respectively. Values are same as for DC_1-3_n7.

Table 6.41.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n3-n7 | n1 | 0.6 |
| | n3 | 0.6 |
| | n7 | 0.6 |

Table 6.41.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n1-n3-n7 | n1 | 0 |
| | n3 | 0 |
| | n7 | 0 |

6.41.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

6.42 CA_n3A-n7A-n28A

6.42.1 Operating bands for CA

Table 6.42.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | Downlink (DL) operating band | | Duplex Mode | |
|--------------|---------|------------------------------|---|------------------------------|----------|-------------|--|
| | | BS receive / UE transmit | | BS transmit / UE receive | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | $F_{DL_low} - F_{DL_high}$ | | | |
| CA_n3-n7-n28 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | FDD | |
| | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | FDD | |
| | n28 | 703 MHz | – | 748 MHz | 758 MHz | FDD | |

6.42.2 Channel bandwidths per operating band for CA

Table 6.42.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|-----|---------------------------|
| CA_n3A-n7A-n28A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | n7 | 15 | Yes | | | | |
| | | | 30 | | Yes | | | | |
| | | | 60 | | Yes | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| CA_n3A-n7B-n28A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | |
| | | n7 | See CA_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | |
| | | | 15 | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |

6.42.3 Co-existence studies

Table 6.42.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. No issues are found.

Table 6.42.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |

Table 6.42.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. No issues are found.

Table 6.42.3-2 Harmonic mixing for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge | DL Low Band Edge | DL High Band Edge |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.42.4 $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values

For three simultaneous DLs and one UL of Band n3, n7 and n28, the $\Delta T_{IB,C}$ and $\Delta R_{IB,C}$ values are shown in table 6.42.4-1 and table 6.42.4-2, respectively. Values are same as for DC_3-7_n28.

Table 6.42.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n7-n28 | n3 | 0.5 |
| | n7 | 0.5 |
| | n28 | 0.3 |

Table 6.42.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n7-n28 | n3 | 0 |
| | n7 | 0 |
| | n28 | 0 |

6.42.5 REFSENS requirements

Additional REFSENS requirements are not needed to be defined.

6.43 CA_n3A-n7A-n78A

6.43.1 Operating bands for CA

Table 6.43.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | Downlink (DL) operating band | | | Duplex Mode | |
|--------------|---------|------------------------------|---|----------|------------------------------|---|----------|-------------|--|
| | | BS receive / UE transmit | | | BS transmit / UE receive | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | $F_{DL_low} - F_{DL_high}$ | | | | |
| CA_n3-n7-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD | |
| | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD | |
| | n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD | |

6.43.2 Channel bandwidths per operating band for CA

Table 6.43.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set | |
|---------------------|-----------|---------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|--|
| CA_n3A-n7A-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | n7 | 15 | Yes | | | | | | |
| | | | 30 | | Yes | | | | | | |
| | | | 60 | | Yes | | | | | | |
| | | n78 | 15 | | Yes | | | | | | |
| | | | 30 | | Yes | | |
| | | | 60 | | Yes | | |
| CA_n3A-n7B-n78A | - | n3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | | | | | | | 0 | |
| | | | 30 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | | 60 | | Yes | Yes | Yes | Yes | Yes | | | | | | | | |
| | | n7 | See CA_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| | | | 15 | | Yes | | | | | | |
| | | n78 | 30 | | Yes | | |
| | | n78 | 60 | | Yes | | |

6.43.3 Co-existence studies

Table 6.43.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic of Band n3 will fall into a portion of Band n78.

Table 6.43.3-1: Harmonic Interference for 3DLs/1UL

| Band | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | 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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3420 | 3570 | 5130 | 5355 | 6840 | 7140 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.43.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that the 2nd order harmonic mixing of Band n78 Tx coincides with Band n3x2.

Table 6.43.3-2 Harmonic mixing for 3DLs/1UL

| Band | | | | | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | 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 |
| n3 | 1710 | 1785 | 1805 | 1880 | 3610 | 3760 | 5415 | 5640 | 7220 | 7520 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.43.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n3, n7 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.43.4-1 and table 6.43.4-2, respectively. Values are same as for DC_3-7_n78.

Table 6.43.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n7-n78 | n3 | 0.6 |
| | n7 | 0.6 |
| | n78 | 0.8 |

Table 6.43.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n3-n7-n78 | n3 | 0.2 |
| | n7 | 0.2 |
| | n78 | 0.5 |

6.43.5 REFSENS requirements

Compared to its fallback modes, there are no additional MSD requirements for this band combination.

6.44 CA_n3A-n28A-n78A

6.44.1 Operating bands for CA

Table 6.44.1-1: 3DL Inter-band CA operating bands

| NR CA Band | NR Band | Uplink (UL) operating band | | | | Downlink (DL) operating band | | | | Duplex Mode | |
|------------------|---------|------------------------------|---|----------|--|------------------------------|---|----------|--|-------------|--|
| | | BS receive / UE transmit | | | | BS transmit / UE receive | | | | | |
| | | $F_{UL_low} - F_{UL_high}$ | | | | $F_{DL_low} - F_{DL_high}$ | | | | | |
| CA_n3A-n28A-n78A | n7 | 2500 MHz | – | 2570 MHz | | 2620 MHz | – | 2690 MHz | | FDD | |
| | n28 | 703 MHz | – | 748 MHz | | 758 MHz | – | 803 MHz | | FDD | |
| | n78 | 3300 MHz | – | 3800 MHz | | 3300 MHz | – | 3800 MHz | | TDD | |

6.44.2 Channel bandwidths per operating band for CA

Table 6.44.2-1: Supported channel bandwidths per CA configuration for 3DL inter-band CA

| NR CA Configuration | UL Config | NR Band | SCS [kHz] | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 90 | 100 | Bandwidth combination set |
|---------------------|-----------|---|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|
| CA_n7A-n28A-n78A | - | n7 | 15 | Yes | | | | | 0 |
| | | | 30 | | Yes | | | | | |
| | | | 60 | | Yes | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | | | | | |
| | | | 30 | | Yes | |
| | | | 60 | | Yes | |
| | | n7 See CA_n7B Bandwidth Combination Set 0 in Table 5.5A.1-1 | | | | | | | | | | | | | | |
| | | n28 | 15 | Yes | Yes | Yes | Yes | | | | | | | | | 0 |
| | | | 30 | | Yes | Yes | Yes | | | | | | | | | |
| | | | 60 | | | | | | | | | | | | | |
| | | n78 | 15 | | Yes | | | | | |
| | | | 30 | | Yes | |
| | | | 60 | | Yes | |

6.44.3 Co-existence studies

Table 6.44.3-1 summarizes frequency ranges where harmonics occur due to 3DL bands CA with 1 UL. It can be seen that there are no issues.

Table 6.44.3-1: Harmonic Interference for 3DLs/1UL

| Band | UL Low Band Edge | UL High Band Edge | DL Low Band Edge | DL High Band Edge | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|------------------|-------------------|------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
| | | | | | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge | UL Low Band Edge | UL High Band Edge |
| n7 | 2500 | 2570 | 2620 | 2690 | 5000 | 5140 | 7500 | 7710 | 10000 | 10280 |
| n28 | 703 | 748 | 758 | 803 | 1406 | 1496 | 2109 | 2244 | 2812 | 2992 |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 |

Table 6.44.3-2 gives harmonic mixing issue for the 3DL bands CA with 1 UL. It can be seen that there are no issues.

Table 6.44.3-2 Harmonic mixing for 3DLs/1UL

| 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 | 2 nd Harmonic | | 3 rd Harmonic | | 4 th Harmonic | |
|------|---------------------------|----------------------------|------------------------|----------------------------|------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| | DL Low Band Edge | DL High Band Edge | | DL Low 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 |
| n7 | 2500 | 2570 | 2620 | 2690 | 5240 | 5380 | 7860 | 8070 | 10480 | 10760 | | |
| n28 | 703 | 748 | 758 | 803 | 1516 | 1606 | 2274 | 2409 | 3032 | 3212 | | |
| n78 | 3300 | 3800 | 3300 | 3800 | 6600 | 7600 | 9900 | 11400 | 13200 | 15200 | | |

For single uplink, the UE coexistence is already considered for these bands in TS 38.101-1.

6.44.4 $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values

For three simultaneous DLs and one UL of Band n3, n7 and n78, the $\Delta T_{IB,c}$ and $\Delta R_{IB,c}$ values are shown in table 6.x.4-1 and table 6.x.4-2, respectively. Values are same as for DC_7-28_n78.

Table 6.44.4-1: $\Delta T_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta T_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n7-n28-n78 | n7 | 0.3 |
| | n28 | 0.3 |
| | n78 | 0.8 |

Table 6.44.4-2: $\Delta R_{IB,c}$ for 3DL aggregation

| Inter-band CA Configuration | NR Band | $\Delta R_{IB,c}$ [dB] |
|-----------------------------|---------|------------------------|
| CA_n7-n28-n78 | n7 | 0 |
| | n28 | 0 |
| | n78 | 0.5 |

6.44.5 REFSENS requirements

Compared to its fallback modes, there are no additional MSD requirements for this band combination.

Annex A:

Change history

| Date | Meeting | TDoc. | CR | Rev | Cat | Subject/Comment | New version |
|---------|------------------|------------|----|-----|-----|---|-------------|
| 2019-04 | 3GPP RAN4#90 bis | R4-1903260 | | | | Initial TR skeleton | 0.0.1 |
| 2019-05 | 3GPP RAN4#91 | R4-1905398 | | | | TR 38.716-03-01 v0.1.0, the update is based on the following contributions, R4-1903261, TP for TR 38.xxx: interference analysis for CA_n3A-n41A-n79A with 1 uplink, CATT R4-1903262, TP for TR 38.xxx: interference analysis for CA_n8A-n41A-n79A with 1 uplink, CATT | 0.1.0 |
| 2019-08 | 3GPP RAN4#92 | R4-1908373 | | | | TR 38.716-03-01 v0.2.0, the update is based on the following contributions, R4-1905400 TP for 38.716-03-01: UE requirements for CA_n3A-n41A-n79A, CATT R4-1907456 TP for 38.716-03-01: UE requirements for CA_n3A-n41A-n79A, CATT R4-1905401 TP for 38.716-03-01: UE requirements for CA_n8A-n41A-n79A, CATT R4-1905623 TP for TR38.716-03-01:1 band UL for CA_40A-n41A-n79A, ZTE R4-1906106 TP for TR 38.716-03-01: CA_n1A-n3A-n78A with 1UL, China Telecom | 0.2.0 |
| 2019-10 | 3GPP RAN4#92 bis | R4-1911202 | | | | TR 38.716-03-01 v0.3.0, the update is based on the following contributions, R4-1908256, TP for TR 38.716-03-01: CA_n28-n78-n257, KDDI R4-1908257, TP for TR 38.716-03-01: CA_n3-n77-n257, KDDI R4-1908258, TP for TR 38.716-03-01: CA_n3-n78-n257, KDDI R4-1908259, TP for TR 38.716-03-01: CA_n28-n77-n257, KDDI R4-1908414, TP for 38.716-03-01: interference analysis for CA_n39A-n41A-n79A, CATT R4-1908415, TP for 38.716-03-01: UE requirements for CA_n8A-n39A-n41A, CATT R4-1908560, TP for TR38.716-03-01 1 band UL for CA_n3-n8-n78, Nubia Technology R4-1908695, TP for TR38.716-03-01: Requirements for CA_n66A-n70A-n71A, CA_n66B-n70A-n71A, and CA_n66(2A)-n70A-n71A, DISH | 0.3.0 |
| 2019-11 | 3GPP RAN4#93 | R4-1913757 | | | | TR 38.716-03-01 v0.4.0, the update is based on the following contributions, R4-1911159, TP for TR 38.716-03-01: NR CA_n3-n28-n77, SoftBank Corp R4-1911160 TP for TR 38.716-03-01: NR CA_n3-n28-n257, SoftBank Corp R4-1911203, TP for 38.716-03-01: interference analysis for CA_n39A-n41A-n79A, CATT R4-1911204, TP for 38.716-03-01: UE requirements for CA_n8A-n39A-n41A, CATT R4-1911247 TP for TR38.716-03-01_ CA_n3A_n40A-n41A, ZTE R4-1911709 TP for CA_n77-n79-n257 for TR 38.716-03-01, NTT DoCoMo R4-1911711 TP for CA_n78-n79-n257 for TR 38.716-03-01, NTT DoCoMo R4-1912254 TP for TR 38.716-03-01 to include CA_n1-n3-n8, Ericsson, Swisscom R4-1912255 TP for TR 38.716-03-01 to conclude CA_n1-n3-n78, Ericsson, Swisscom R4-1912256 TP for TR 38.716-03-01 to include CA_n1-n8- | |

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| | | | | | n78, Ericsson, Swisscom R4-1912257 TP for TR 38.716-03-01 to include CA_n1-n3-n28, Ericsson, Swisscom R4-1912258 TP for TR 38.716-03-01 to include CA_n1-n28-n78, Ericsson, Swisscom R4-1912259 TP for TR 38.716-03-01 to include CA_n3-n28-n78, Ericsson, Swisscom | |
| 2020-02 | 3GPP RAN4#94-e | R4-2000624 | | | TR 38.716-03-01 v0.5.0, the update is based on the following contributions, R4-1914298, TP for TR 38.716-03-01: CA_n1A-n3A-n41A_BCS0, Huawei, HiSilicon | |
| 2020-04 | 3GPP RAN4#94-ebis | R4-2003317 | | | TR 38.716-03-01 v0.6.0, the update is based on the following contributions, R4-2000144 TP for TR38.716-03-01: Requirements for CA_n29A-n66A-n70A, CA_n29A-n66B-n70A, and CA_n29A-n66(2A)-n70A, Dish Network R4-2002666 TP for TR38.716-03-01: Requirements for CA_n29A-n66A-n70A, CA_n29A-n66B-n70A, and CA_n29A-n66(2A)-n70A, Dish Network R4-2000185 TP to TR 38.716-03-01: CA_n25-n41-n71, Nokia, Nokia Shanghai Bell, T-Mobile USA R4-2000186 TP to TR 38.716-03-01: CA_n41-n66-n71, Nokia, Nokia Shanghai Bell, T-Mobile USA R4-2000847 TP for TR 38.716-03-01:CA_n25-n66-n78, Huawei, HiSilicon R4-2000848 TP for TR 38.716-03-01: CA_n7-n66-n78, Huawei, HiSilicon R4-2000849 TP for TR 38.716-03-01: CA_n5-n66-n78, Huawei, HiSilicon R4-2000850 TP for TR 38.716-03-01: CA_n7-n25-n66, Huawei, HiSilicon R4-2002667 TP for TR 38.716-03-01: CA_n20A-n28A-n78A_BCS0, Huawei, HiSilicon R4-2001520 TP for TR 38.716-03-01 to include CA_n1-n7-n28, Ericsson R4-2001521 TP for TR 38.716-03-01 to include CA_n1-n7-n78, Ericsson | |
| 2020-04 | 3GPP RAN4#94-ebis | R4-2005742 | | | TR 38.716-03-01 v0.7.0, the update is based on the following contributions, R4-2003946, TP for TR 38.716-03-01: CA_n28A-n41A-n78A, Huawei, HiSilicon R4-2004625, TP for TR 38.716-03-01 to include CA_n1A-n40A-n78A, Ericsson R4-2004626, TP for TR 38.716-03-01 to include CA_n28A-n40A-n78A, Ericsson R4-2005018, TP to TR 38.716-03-01: CA_n25-n66-n71, Nokia, TMO US R4-2005019, TP to TR 38.716-03-01: CA_n25-n41-n66, Nokia, TMO US | |
| 2020-05 | 3GPP RAN4#95-e | R4-2006283 | | | TR 38.716-03-01 v0.8.0, the update is based on the following contributions, R4-2006839, TP for TR 38.716-03-01: UE requirements for CA_n1A-n78A-n257A, CHTTL R4-2007627, TP for TR 38.716-03-01 to include CA_n1-n3-n7, Ericsson, Telstra R4-2007628 TP for TR 38.716-03-01 to include CA_n3-n7-n28, Ericsson, Telstra R4-2007629 TP for TR 38.716-03-01 to include CA_n3-n7-n78, Ericsson, Telstra R4-2007630 TP for TR 38.716-03-01 to include CA_n7-n28-n78, Ericsson, Telstra | |

| Change history | | | | | | |
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| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment |
| 2020-06 | RAN#88 | | | | | Approved by plenary – Rel-16 spec under change control |