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| 3GPP TR 38.850 V1.4.0 (2024-05) |
| Technical Report |
| 3rd Generation Partnership Project;Technical Specification Group Radio Access Network;Rel-18 High power UE (power class 2) for a single FR1 NR FDD band in UL of NR intra-band and inter-band CA/DC combinations with y bands downlink (y=1,2,3,4,5,6) and x bands uplink (x=1); (Release 18) |
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| ***3GPP***Postal address3GPP support office address650 Route des Lucioles - Sophia AntipolisValbonne - FRANCETel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16Internethttp://www.3gpp.org |
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Contents

Foreword 6

1 Scope 8

2 References 8

3 Definitions of terms, symbols and abbreviations 8

3.1 Terms 8

3.2 Symbols 8

3.3 Abbreviations 8

4 Background 9

4.1 TR Maintenance 9

5 High Power UE for Inter-band DL CA with PC2 on single FDD band 9

5.1 CA\_n1A-n78A 9

5.1.1 UE maximum output power 9

5.2 CA\_n3A-n78A 10

5.2.1 UE maximum output power 10

5.2.2 Reference sensitivity requirements 10

5.3 CA\_n25A-n77A 11

5.3.1 UE maximum output power 11

5.3.2 Reference sensitivity requirements 11

5.3.2.0 General 11

5.3.2.1 Reference sensitivity requirements with PC2 on n25 without TxD 11

5.3.2.2 Reference sensitivity requirements with PC2 on n25 with TxD 12

5.4 CA\_n25A-n71A 13

5.4.1 UE maximum output power 13

5.4.2 Reference sensitivity requirements 13

5.4.2.0 General 13

5.4.2.1 Reference sensitivity requirements with PC2 on n25 without TxD 13

5.4.2.2 Reference sensitivity requirements with PC2 on n25 with TxD 14

5.4.2.3 Reference sensitivity requirements with PC2 on n71 without TxD 15

5.4.2.4 Reference sensitivity requirements with PC2 on n71 with TxD 16

5.5 CA\_n41A-n71A 17

5.5.1 UE maximum output power 17

5.5.2 Reference sensitivity requirements 17

5.5.2.0 General 17

5.5.2.1 Reference sensitivity requirements with PC2 on n71 without TxD 17

5.5.2.2 Reference sensitivity requirements with PC2 on n71 with TxD 18

5.6 CA\_n66A-n77A 19

5.6.1 UE maximum output power 19

5.6.2 Reference sensitivity requirements 19

5.6.2.0 General 19

5.6.2.1 Reference sensitivity requirements with PC2 on n66 without TxD 19

5.6.2.2 Reference sensitivity requirements with PC2 on n66 with TxD 20

5.7 CA\_n71A-n77A 21

5.7.1 UE maximum output power 21

5.7.2 Reference sensitivity requirements 21

5.7.2.0 General 21

5.7.2.1 Reference sensitivity requirements with PC2 on n71 without TxD 21

5.7.2.2 Reference sensitivity requirements with PC2 on n71 with TxD 22

5.8 CA\_n41A-n66A 23

5.8.1 UE maximum output power 23

5.8.2 Reference sensitivity requirements 23

5.8.2.0 General 23

5.8.2.1 Reference sensitivity requirements with PC2 on n66 without TxD 23

5.8.2.2 Reference sensitivity requirements with PC2 on n66 with TxD 24

5.9 CA\_n71A-n85A 25

5.9.1 UE maximum output power 25

5.9.2 Reference sensitivity requirements 25

5.9.2.0 General 25

5.9.2.1 Reference sensitivity requirements with PC2 on n71 without TxD 25

5.9.2.2 Reference sensitivity requirements with PC2 on n71 with TxD 26

5.10.3 REFSENS requirements 28

5.11.2.1 Reference sensitivity requirements with PC2 on n8 without TxD 28

5.11.2.2 Reference sensitivity requirements with PC2 on n8 with TxD 29

5.11.3 ∆TIB and ∆RIB values 29

5.12.2.0 General 30

5.12.2.1 Reference sensitivity requirements with PC2 with TxD 30

5.12.2.2 Reference sensitivity requirements with PC2 without TxD 30

5.3.4 ∆TIB and ∆RIB values 32

5.3.4 ∆TIB and ∆RIB values 33

5.15.2.1 Reference sensitivity requirements with PC2 on n3 without TxD 34

5.15.2.2 Reference sensitivity requirements with PC2 on n3 with TxD 34

5.3.4 ∆TIB and ∆RIB values 34

5.16.2.0 General 34

5.16.2.1 Reference sensitivity requirements with PC2 with TxD 34

5.16.2.2 Reference sensitivity requirements with PC2 without TxD 35

5.17 CA\_n2A-n66A 35

5.17.1 UE maximum output power 35

5.17.2 Reference sensitivity requirements 35

5.17.2.1 Reference sensitivity requirements with PC2 on n2 without TxD 35

5.17.2.2 Reference sensitivity requirements with PC2 on n2 with TxD 36

5.17.3.1 Reference sensitivity requirements with PC2 on n66 without TxD 36

5.17.3.2 Reference sensitivity requirements with PC2 on n66 with TxD 36

5.18.2.0 General 37

5.18.2.1 Reference sensitivity requirements with PC2 with TxD 37

5.18.2.2 Reference sensitivity requirements with PC2 without TxD 37

5.19.2.1 Reference sensitivity requirements with PC2 on n3 and n7 without TxD 38

5.19.2.2 Reference sensitivity requirements with PC2 on n3 and n7 with TxD 38

5.3.4 ∆TIB and ∆RIB values 38

5.20.2.1 Reference sensitivity requirements with PC2 on n3 and n7 without TxD 40

5.20.2.2 Reference sensitivity requirements with PC2 on n3 and n7 with TxD 40

5.3.4 ∆TIB and ∆RIB values 40

5.21.2.0 General 41

5.21.2.1 Reference sensitivity requirements with PC2 on n3 without TxD 41

5.22.2.1 Reference sensitivity requirements with PC2 on n3 without TxD 42

5.22.2.2 Reference sensitivity requirements with PC2 on n3 with TxD 42

5.3.4 ∆TIB and ∆RIB values 42

5.23.2.0 General 43

5.23.2.1 Reference sensitivity requirements with PC2 on n3 without TxD 43

5.24.2.0 General 43

5.24.2.1 Reference sensitivity requirements with PC2 on n7 without TxD 43

5.25.2.0 General 44

5.25.2.1 Reference sensitivity requirements with PC2 on n7 without TxD 44

5.26 CA\_ n25A-n41A 44

5.26.2 Harmonic Mixing Reference sensitivity requirements 45

5.26.2.0 General 45

5.26.2.1 Reference sensitivity requirements with PC2 on n25 without TxD 45

5.26.2.2 Harmonic Mixing reference sensitivity requirements with PC2 on n25 with TxD 45

5.26.3 Cross-band isolation reference sensitivity requirements 46

5.26.3.0 General 46

5.26.3.1 Reference sensitivity requirements with PC2 on n25 without TxD 46

5.26.3.2 Cross-band isolation reference sensitivity requirements with PC2 on n25 with TxD 46

5.27 CA\_ n25A-n66A 46

5.27.2 Cross-band isolation reference sensitivity requirements 47

5.27.2.0 General 47

5.27.2.1 Reference sensitivity requirements with PC2 on n25 without TxD 47

5.27.2.2 Reference sensitivity requirements with PC2 on n25 with TxD 47

5.27.3.1 Reference sensitivity requirements with PC2 on n66 without TxD 48

5.27.3.2 Reference sensitivity requirements with PC2 on n66 with TxD 48

6 High Power UE for Intra-band DL CA with PC2 on single FDD band 49

6.1 CA\_n71(2A) 49

6.1.1 UE maximum output power 49

6.1.2 Reference sensitivity requirements 49

6.1.2.0 General 49

6.1.2.1 Reference sensitivity requirements with PC2 on n71 without TxD 49

6.1.2.2 Reference sensitivity requirements with PC2 on n71 with TxD 50

6.2 CA\_n25(2A) 51

6.2.1 UE maximum output power 51

6.2.2 Reference sensitivity requirements 51

6.2.2.0 General 51

6.2.2.1 Reference sensitivity requirements with PC2 on n25 without TxD 51

6.2.2.2 Reference sensitivity requirements with PC2 on n25 with TxD 52

6.3 CA\_n66(2A) 53

6.3.1 UE maximum output power 53

6.3.2 Reference sensitivity requirements 53

6.3.2.0 General 53

6.3.2.1 Reference sensitivity requirements with PC2 on n66 without TxD 53

6.3.2.2 Reference sensitivity requirements with PC2 on n66 with TxD 54

6.4 CA\_ n71B 55

6.4.1 UE maximum output power 55

6.4.2 Reference sensitivity requirements 55

6.4.2.0 General 55

6.4.2.1 Reference sensitivity requirements with PC2 on n71 without TxD 55

6.4.2.2 Reference sensitivity requirements with PC2 on n71 with TxD 56

Annex <A> (informative): Change history 57

# Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

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

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

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

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

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

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

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

**should** indicates a recommendation to do something

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

**may** indicates permission to do something

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

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

**can** indicates that something is possible

**cannot** indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

# 1 Scope

The present document is a technical report for Rel-18 High power UE (power class 2) for FR1 NR FDD band in UL of NR inter-band CA/DC combinations with y bands downlink (y=2,3,4,5,6) and x bands uplink (x=1) under Rel-18 time-frame. The purpose is to gather the relevant background information and studies in order to complete the band combination specific requirements for the newly requested band combinations.

# 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] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

…

[x] <doctype> <#>[ ([up to and including]{yyyy[-mm]|V<a[.b[.c]]>}[onwards])]: "<Title>".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

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

## 3.2 Symbols

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

<symbol> <Explanation>

## 3.3 Abbreviations

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

<ABBREVIATION> <Expansion>

DL Downlink

FDD Frequency Division Duplex

MPR Allowed maximum power reduction

MSD Maximum Sensitivity Degradation

REFSENS Reference Sensitivity power level

UE User Equipment

UL Uplink

# 4 Background

At 3GPP RAN4#97-e meeting, a basket Work Item on “Rel-18 High power UE (power class 2) for FR1 NR FDD band in UL of NR inter-band CA/DC combinations with y bands downlink (y=2,3,4,5,6) and x bands uplink (x=1)” was approved for Rel-18. The objectives of the core part are as follows:

The objectives of the core part are as follows:

1. Specify the band-combination specific RF requirements for cases in the table below, including
	1. Maximum output power and Tx power tolerance.
	2. Self-desensitization, applicable ∆TIB, c and ∆RIB, c and reference sensitivity exceptions including MSD test cases.
	3. Other additional impact on the requirements, if identified.

Note: For the combinations with UL harmonic impact, the text proposals for the Work Item can be reviewed in non-block-approval agenda.

## 4.1 TR Maintenance

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

# 5 High Power UE for Inter-band DL CA with PC2 on single FDD band

## 5.1 CA\_n1A-n78A

### 5.1.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n1A-n78A | n18n788CA\_n1A-n78A8 | n1 | 5, 10, 15, 20 | 0 |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |
|  |  | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 1 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |
|  |  | n1 | 5, 10, 15, 20, 25, 30, 40 | 2 |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |
|  |  | n1 | 5, 10, 15, 20 | 3 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |

NOTE 8: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combination.

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

## 5.2 CA\_n3A-n78A

### 5.2.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n3A-n78A | n38n788CA\_n3A-n78A8 | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40, | 1 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |

NOTE 8: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combination.

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.2.2 Reference sensitivity requirements

*<Editor’s note: This part will capture the Reference sensitivity degradation for specified band combination(s), please use the same table format as in 38101-1. >*

**Table 5.2.2-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| R4-2215895 (ZTE, CU) | n3 | n78 | 5 | 15 | 25 (RBstart=0) | 10 | 26.2 | NOTE 2 | UL2/DL1direct-hit |
| R4-2215660 (Apple) | n3 | n78 | 5 | 15 | 25 (RBstart=0) | 10 | 28.1 | NOTE 2 | UL2/DL1direct-hit |
| R4- 2302731 (Huawei, HiSilicon) | n3 | n78 | 5 | 15 | 25 (RBstart=0) | 10 | 26.9 | NOTE 2 | UL2/DL1direct-hit |
| R4-2215895 (ZTE, CU) | n3 | n78 | 10 | 15 | 50 (RBstart=0) | 100 | 16.6 | NOTE 2 | UL2/DL1direct-hit |
|  | NOTE 2: The requirements should be verified for UL NR-ARFCN of the aggressor (high) band (superscript HB) such that in MHz and  with carrier frequency in the victim (lower) band in MHz and  the channel bandwidth configured in the higher band. |

**Table 5.2.2-2: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| R4-2215660 (Apple) | n3 | n78 | 5 | 15 | 25 (RBstart=0) | 10 | 35.4 | NOTE 2 | UL2/DL1direct-hit |
| R4- 2302731 (Huawei, HiSilicon) | n3 | n78 | 5 | 15 | 25 (RBstart=0) | 10 | 29.2 | NOTE 2 | UL2/DL1direct-hit |
|  | NOTE 2: The requirements should be verified for UL NR-ARFCN of the aggressor (high) band (superscript HB) such that in MHz and  with carrier frequency in the victim (lower) band in MHz and  the channel bandwidth configured in the higher band. |

## 5.3 CA\_n25A-n77A

### 5.3.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n25A-n77A | n258n778,9CA\_n25A-n77A8,14 | n25 | 5, 10, 15, 20 | 0 |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.3.2 Reference sensitivity requirements

#### 5.3.2.0 General

For PC2, CA\_n25-n77 has harmonic MSD for UL n25. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 5.3.2.1 Reference sensitivity requirements with PC2 on n25 without TxD

For CA\_n25-n77, this is the configuration and MSD for UL n25 with PC3

Table 7.3A.4-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC3 aggressor NR UL band for NR DL CA FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n25 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 23.9 | NOTE 2 | UL2/DL1direct-hit |
| n25 | n77 | 10 | 15 | 50 (RBstart=0) | 100 | 13.8 | NOTE 2 | UL2/DL1direct-hit |
| n25 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 1.1 | NOTE 6 | UL2/DL1near-miss |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases 3 dB. For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 MSD:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n25 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 26.9 | NOTE 2 | UL2/DL1direct-hit |
| n25 | n77 | 10 | 15 | 50 (RBstart=0) | 100 | 16.8 | NOTE 2 | UL2/DL1direct-hit |
| n25 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 2.0 | NOTE 6 | UL2/DL1near-miss |

#### 5.3.2.2 Reference sensitivity requirements with PC2 on n25 with TxD

Using the approach of [R4-2407156 Guidelines for FDD PC2 Harmonic MSD Analysis, 3GPP TSG-RAN WG4 Meeting # 111, Fukuoka, Japan, Skyworks Solutions, Inc.] and assuming 9dB interference power imbalance, the following is proposed as a the dual-Tx PC2 MSD is proposed:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n25 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 31.9 | NOTE 2 | UL2/DL1direct-hit |
| n25 | n77 | 10 | 15 | 50 (RBstart=0) | 100 | 20.8 | NOTE 2 | UL2/DL1direct-hit |
| n25 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 3.1 | NOTE 6 | UL2/DL1near-miss |

## 5.4 CA\_n25A-n71A

### 5.4.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n25A-n71A | n258n718CA\_n25A-n71A | n25 | 5, 10, 15, 20 | 0 |
|  |  | n71 | 5, 10, 15, 20 |
|  |  | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n71 | 5, 10, 15, 20 |
|  |  | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.4.2 Reference sensitivity requirements

#### 5.4.2.0 General

For PC2, CA\_n25-n71 has harmonic mixing MSD for UL n25 and harmonic MSD for UL n71. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD on each band.

#### 5.4.2.1 Reference sensitivity requirements with PC2 on n25 without TxD

For CA\_n25-n71, this is the configuration and MSD for UL n25 with PC3

**Table 7.3A.4-4: Reference sensitivity exceptions and uplink/downlink configurations due to harmonic mixing from a PC3 aggressor NR UL band for DL NR CA FR1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| n25 | n713 | 5 | 15 | 25 (RBstart=0) | 5 | 26.5 | NOTE 4 | UL1/DL3 |
| n25 | n713 | 20 | 15 | 100 (RBstart=0) | 20 | 15.3 | NOTE 4 | UL1/DL3 |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases by 3 dB. For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 harmonic mixing MSD:

**Table 7.3A.4-4a: Reference sensitivity exceptions and uplink/downlink configurations due to harmonic mixing from a PC2 aggressor NR UL band for NR DL CA FR1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| n25 | n713 | 5 | 15 | 25 (RBstart=0) | 5 | 29.5 | NOTE 4 | UL1/DL3 |
| n25 | n713 | 20 | 15 | 100 (RBstart=0) | 20 | 18.2 | NOTE 4 | UL1/DL3 |

#### 5.4.2.2 Reference sensitivity requirements with PC2 on n25 with TxD

Using the approach of [R4-2407156 Guidelines for FDD PC2 Harmonic MSD Analysis, 3GPP TSG-RAN WG4 Meeting # 111, Fukuoka, Japan, Skyworks Solutions, Inc.] and assuming 9dB interference power imbalance, the following is proposed as a the dual-Tx PC2 MSD is proposed:

**Table 7.3A.4-4a: Reference sensitivity exceptions and uplink/downlink configurations due to harmonic mixing from a PC2 dual Tx aggressor NR UL band for NR DL CA FR1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| n25 | n713 | 5 | 15 | 25 (RBstart=0) | 5 | 34.5 | NOTE 4 | UL1/DL3 |
| n25 | n713 | 20 | 15 | 100 (RBstart=0) | 20 | 23.3 | NOTE 4 | UL1/DL3 |

#### 5.4.2.3 Reference sensitivity requirements with PC2 on n71 without TxD

For CA\_n25-n71, this is the configuration and MSD for UL n71 with PC3

Table 7.3A.4-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC3 aggressor NR UL band for NR DL CA FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n2510,11 | 5 | 15 | 8 (RBstart=0) | 5 | 10 | NOTE 3 | UL3/DL1direct-hit |
| n71 | n2510,11 | 5 | 15 | 8 (RBstart=0) | 40 | 2.1 | NOTE 3 | UL3/DL1direct-hit |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases by 3 dB. For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 MSD:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 single Tx aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n2510,11 | 5 | 15 | 8 (RBstart=0) | 5 | 12.8 | NOTE 3 | UL3/DL1direct-hit |
| n71 | n2510,11 | 5 | 15 | 8 (RBstart=0) | 40 | 3.5 | NOTE 3 | UL3/DL1direct-hit |
| NOTE 10: These requirements apply when the lower edge frequency of the 10 MHz, 15 MHz, or 20 MHz uplink channel in Band 71 is located at or below 668 MHz and the downlink channel in Band n25 is located with its upper edge at 1995 MHz.NOTE 11: These requirements apply when the lower edge frequency of the uplink channel in Band n71 is located at or below 668 MHz and the downlink channel in Band n25 is located with its upper edge at 1990 MHz. |

#### 5.4.2.4 Reference sensitivity requirements with PC2 on n71 with TxD

 Using the approach of [R4-2407156 Guidelines for FDD PC2 Harmonic MSD Analysis, 3GPP TSG-RAN WG4 Meeting # 111, Fukuoka, Japan, Skyworks Solutions, Inc.] and assuming 9dB interference power imbalance, the following is proposed as a the dual-Tx PC2 MSD is proposed:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n2510,11 | 5 | 15 | 8 (RBstart=0) | 5 | 17.0 | NOTE 3 | UL3/DL1direct-hit |
| n71 | n2510,11 | 5 | 15 | 8 (RBstart=0) | 40 | 4.1 | NOTE 3 | UL3/DL1direct-hit |
| NOTE 10: These requirements apply when the lower edge frequency of the 10 MHz, 15 MHz, or 20 MHz uplink channel in Band 71 is located at or below 668 MHz and the downlink channel in Band n25 is located with its upper edge at 1995 MHz.NOTE 11: These requirements apply when the lower edge frequency of the uplink channel in Band n71 is located at or below 668 MHz and the downlink channel in Band n25 is located with its upper edge at 1990 MHz. |

## 5.5 CA\_n41A-n71A

### 5.5.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n41A-n71A | n418,9n718CA\_n41A-n71A8, 13, 14 | n41 | 10, 15, 20, 40, 50, 60, 80, 90, 100 | 0 |
|  |  | n71 | 5, 10, 15, 20 |  |
|  |  | n41 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 | 1 |
|  |  | n71 | 5, 10, 15, 20 |  |
|  |  | n41 | n41 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.5.2 Reference sensitivity requirements

#### 5.5.2.0 General

For PC2, CA\_ n41A-n71A has harmonic MSD for UL n71. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 5.5.2.1 Reference sensitivity requirements with PC2 on n71 without TxD

For CA\_n25-n71, this is the configuration and MSD for UL n71 with PC3

Table 7.3A.4-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC3 aggressor NR UL band for NR DL CA FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n41 | 5 | 15 | 16 (RBstart=0) | 10 | 10.8 | NOTE 4 | UL4/DL1direct-hit |
| n71 | n41 | 5 | 15 | 25 (RBstart=0) | 100 | 1.4 | NOTE 4 | UL4/DL1direct-hit |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases by 3 dB . For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 MSD:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n41 | 5 | 15 | 16 (RBstart=0) | 10 | 13.6 | NOTE 4 | UL4/DL1direct-hit |
| n71 | n41 | 5 | 15 | 25 (RBstart=0) | 100 | 2.5 | NOTE 4 | UL4/DL1direct-hit |

#### 5.5.2.2 Reference sensitivity requirements with PC2 on n71 with TxD

Using the approach of [R4-2407156 Guidelines for FDD PC2 Harmonic MSD Analysis, 3GPP TSG-RAN WG4 Meeting # 111, Fukuoka, Japan, Skyworks Solutions, Inc.] and assuming 9dB interference power imbalance, the following is proposed as a the dual-Tx PC2 MSD is proposed:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n41 | 5 | 15 | 16 (RBstart=0) | 10 | 17.8 | NOTE 4 | UL4/DL1direct-hit |
| n71 | n41 | 5 | 15 | 25 (RBstart=0) | 100 | 3.4 | NOTE 4 | UL4/DL1direct-hit |

##  5.6 CA\_n66A-n77A

### 5.6.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n66A-n77A | n668n778,9CA\_n66A-n77A8 | n66 | 5, 10, 15, 20, 40 | 0 |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n66 | n66 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.6.2 Reference sensitivity requirements

#### 5.6.2.0 General

For PC2, CA\_ n66A-n77A has harmonic MSD for UL n66. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 5.6.2.1 Reference sensitivity requirements with PC2 on n66 without TxD

For CA\_n66-n77, this is the configuration and MSD for UL n66 with PC3

Table 7.3A.4-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC3 aggressor NR UL band for NR DL CA FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n66 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 23.9 | NOTE 2 | UL2/DL1direct-hit |
| n66 | n77 | 20 | 15 | 100 (RBstart=0) | 100 | 13.8 | NOTE 2 | UL2/DL1direct-hit |
| n66 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 1.1 | NOTE 6 | UL2/DL1near-miss |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases by 3 dB. For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 MSD:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 single Tx aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n66 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 26.9 | NOTE 2 | UL2/DL1direct-hit |
| n66 | n77 | 20 | 15 | 100 (RBstart=0) | 100 | 16.7 | NOTE 2 | UL2/DL1direct-hit |
| n66 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 2.0 | NOTE 6 | UL2/DL1near-miss |

#### 5.6.2.2 Reference sensitivity requirements with PC2 on n66 with TxD

Using the approach of [R4-2407156 Guidelines for FDD PC2 Harmonic MSD Analysis, 3GPP TSG-RAN WG4 Meeting # 111, Fukuoka, Japan, Skyworks Solutions, Inc.] and assuming 9dB interference power imbalance, the following is proposed as a the dual-Tx PC2 MSD is proposed:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n66 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 31.9 | NOTE 2 | UL2/DL1direct-hit |
| n66 | n77 | 20 | 15 | 100 (RBstart=0) | 100 | 20.8 | NOTE 2 | UL2/DL1direct-hit |
| n66 | n77 | 5 | 15 | 25 (RBstart=0) | 10 | 3.1 | NOTE 6 | UL2/DL1near-miss |

## 5.7 CA\_n71A-n77A

### 5.7.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n71A-n77A | n778, 9CA\_n71A-n77A8 | n71 | 5, 10, 15, 20 | 0 |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.7.2 Reference sensitivity requirements

#### 5.7.2.0 General

For PC2, CA\_ n71A-n77A has harmonic MSD for UL n71. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 5.7.2.1 Reference sensitivity requirements with PC2 on n71 without TxD

The MSD for CA\_n71-n77 is missing. CA\_n71-n77 should reuse the MSD for CA\_n71-n78 for UL n71 with PC3.

Table 7.3A.4-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC3 aggressor NR UL band for NR DL CA FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n77 | 5 | 15 | 10 (RBstart=0) | 10 | 10.4 | NOTE 5 | UL5/DL1direct-hit |
| n71 | n78 | 5 | 15 | 10 (RBstart=0) | 10 | 10.4 | NOTE 5 | UL5/DL1direct-hit |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases by 3 dB. For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 MSD:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 single Tx aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n77 | 5 | 15 | 10 (RBstart=0) | 10 | 13.2 | NOTE 5 | UL5/DL1direct-hit |

#### 5.7.2.2 Reference sensitivity requirements with PC2 on n71 with TxD

Using the approach of [R4-2407156 Guidelines for FDD PC2 Harmonic MSD Analysis, 3GPP TSG-RAN WG4 Meeting # 111, Fukuoka, Japan, Skyworks Solutions, Inc.] and assuming 9dB interference power imbalance, the following is proposed as a the dual-Tx PC2 MSD is proposed:

Table 7.3A.4-2a: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE supporting Tx Diversity

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n71 | n77 | 5 | 15 | 10 (RBstart=0) | 10 | 17.4 | NOTE 5 | UL5/DL1direct-hit |

## 5.8 CA\_n41A-n66A

### 5.8.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n41A-n66A13,14 | n418,9n668CA\_n41A-n66A8, 13,14 | n41 | 10, 15, 20, 40, 50, 60, 80, 90, 100 | 0 |
|  |  | n66 | 5, 10, 15, 20, 40 |  |
|  |  | n41 | 10, 15, 20, 30, 40, 50, 60, 80, 90, 100 | 1 |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n41 | n41 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.8.2 Reference sensitivity requirements

#### 5.8.2.0 General

For PC3, CA\_ n41A-n66A has no cross band isolation MSD for UL n66. This section proposes MSD for PC2 FDD.

#### 5.8.2.1 Reference sensitivity requirements with PC2 on n66 without TxD

For CA\_ n41A-n66A, this would be the configuration and MSD for UL n66 with PC3. It has been proposed to use 0.4 dB MSD for PC3.

Table 7.3A.6-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC3 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n66 | n41 | 1760 | 40 | 15 | 216 (RBstart=0) | 2501 | 10 | 0.4 | >ACLR2 |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases by 3 dB. For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 MSD:

Table 7.3A.6-1a: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 single Tx aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n66 | n41 | 1760 | 40 | 15 | 216 (RBstart=0) | 2501 | 10 | 0.8 | >ACLR2 |
| NOTE 1: Applicable only when harmonic mixing MSD for this combination is not applied.NOTE 2: VoidNOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.NOTE 4: VoidNOTE 5: The MSD exceptions are applicable to the case that interference of UL band 3rd order IMD product falls into the affected DL channels. |

#### 5.8.2.2 Reference sensitivity requirements with PC2 on n66 with TxD

Based on discussions at RAN4#111, the following is proposed as a the PC2 2Tx MSD:

Table 7.3A.6-1a: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a 2Tx PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n66 | n41 | 1760 | 40 | 15 | 216 (RBstart=0) | 2501 | 10 | 1.0 | >ACLR2 |
| NOTE 1: Applicable only when harmonic mixing MSD for this combination is not applied.NOTE 2: VoidNOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.NOTE 4: VoidNOTE 5: The MSD exceptions are applicable to the case that interference of UL band 3rd order IMD product falls into the affected DL channels. |

## 5.9 CA\_n71A-n85A

### 5.9.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n71A-n85A | n718 | n71 | See n71 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n85 | See n85 channel bandwidths in Table 5.3.5-1 |  |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.9.2 Reference sensitivity requirements

#### 5.9.2.0 General

For PC3, CA\_ n71A-n85A has cross band isolation MSD for UL n71. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 5.9.2.1 Reference sensitivity requirements with PC2 on n71 without TxD

For CA\_ n71A-n85A, this is the configuration and MSD for UL n71 with PC3

Table 7.3A.6-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC3 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n71 | n85 | 688 | 20 | 15 | 20 (RBstart=86) | 730.5 | 5 | 8.26 | ACLR2 |
| n71 | n85 | 680.5 | 35 | 15 | 20 (Rbstart=168) | 730.5 | 5 | 237 | ACLR1 |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases by 3 dB. For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 MSD:

Table 7.3A.6-1a: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n71 | n85 | 688 | 20 | 15 | 20 (RBstart=86) | 730.5 | 5 | 10.9x | ACLR2 |
| n71 | n85 | 680.5 | 35 | 15 | 20 (Rbstart=168) | 730.5 | 5 | 26y | ACLR1 |
| NOTE 1: Applicable only when harmonic mixing MSD for this combination is not applied.NOTE 2: VoidNOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.NOTE x: Applicable to UE not supporting n71 optional maximum symmetrical UL/DL channel bandwidthNOTE y: Applicable to UE supporting n71 optional maximum symmetrical UL/DL channel bandwidth |

#### 5.9.2.2 Reference sensitivity requirements with PC2 on n71 with TxD

 R4-2407156 documented the guidelines for FDD PC2 MSD but the results did not apply to cross-band isolation MSD. So based on a proposal in R4-2407580, the following is proposed for n71 PC2 MSD with 2Tx:

Table 7.3A.6-1a: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1 with transmit diversity

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n71 | n85 | 688 | 20 | 15 | 20 (RBstart=86) | 730.5 | 5 | 15.9x | ACLR2 |
| n71 | n85 | 680.5 | 35 | 15 | 20 (Rbstart=168) | 730.5 | 5 | 32.3y | ACLR1 |
| NOTE 1: Applicable only when harmonic mixing MSD for this combination is not applied.NOTE 2: VoidNOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.NOTE x: Applicable to UE not supporting n71 optional maximum symmetrical UL/DL channel bandwidthNOTE y: Applicable to UE supporting n71 optional maximum symmetrical UL/DL channel bandwidth |

5.10 CA\_n8A-n79A

5.10.1 UE maximum output power

**Table 5.10.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or****single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n8A-n79A | n88n798,9CA\_n8A-n79A8 | n8 | 5, 10, 15, 20 | 0 |
|  |  | n79 | 10, 20, 40, 50, 60, 80, 100 |  |
|  |  | n8 | See n8 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |
| NOTE 8: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combinationNOTE 9: Power Class 1.5 is allowed for this single uplink carrier in this downlink/uplink combination |

5.10.2 Reference sensitivity requirements

For PC3 CA\_n8-n79, there are harmonic MSD for this band combination:

5th harmonic of band n8 UL may fall into band n79 DL.

For PC2, CA\_n8-n79 has harmonic MSD for UL n8.

5.10.2.1 Reference sensitivity requirements with PC2 on n8 without TxD

For CA\_n8-n79, this is the configuration and MSD for UL n8 with PC3 in TS 38.101-1.

**Table 5.10.2.1-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC3 aggressor NR UL band for DL NR CA FR1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n8 | n79 | 5 | 15 | 16 (RBstart=0) | 10 | 12.0 | NOTE 5 | UL5/DL1direct-hit |
| n8 | n79 | 5 | 15 | 25 (RBstart=0) | 100 | 4.4 | NOTE 5 | UL5/DL1direct-hit |
| NOTE 5: The requirements should be verified for UL NR-ARFCN of the aggressor (lower) band (superscript LB) such that in MHz and  with carrier frequency in the victim (higher) band in MHz and  the channel bandwidth configured in the lower band. |

PC2 MSD for PC2 UL n8 without TxD is specified as below.

**Table 5.10.2.1-2: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n8 | n79 | 5 | 15 | 16 (RBstart=0) | 10 | 14.9 | NOTE X | UL5/DL1direct-hit |
| n8 | n79 | 5 | 15 | 25 (RBstart=0) | 100 | 6.2 | NOTE X | UL5/DL1direct-hit |
| NOTE X: The requirements should be verified for UL NR-ARFCN of the aggressor (lower) band (superscript LB) such that in MHz and  with carrier frequency in the victim (higher) band in MHz and  the channel bandwidth configured in the lower band. |

5.10.2.2 Reference sensitivity requirements with PC2 on n8 with TxD

PC2 MSD for PC2 UL n8 without TxD is specified as below.

**Table 5.10.2.2-2: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| n8 | n79 | 5 | 15 | 16 (RBstart=0) | 10 | [16.7] | NOTE X | UL5/DL1direct-hit |
| n8 | n79 | 5 | 15 | 25 (RBstart=0) | 100 | [8.2] | NOTE X | UL5/DL1direct-hit |
| NOTE X: The requirements should be verified for UL NR-ARFCN of the aggressor (lower) band (superscript LB) such that in MHz and  with carrier frequency in the victim (higher) band in MHz and  the channel bandwidth configured in the lower band. |

### 5.10.3 REFSENS requirements

Void

5.11 CA\_ n8A-n41A

5.11.1 UE maximum output power

**Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or****single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n8A-n41A | n88CA\_n8A-n41A | n8 | 5, 10, 15, 20 | 0 |
|  |  | n41 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n8 | 5, 10, 15, 20 | 1 |
|  |  | n41 | 10, 15, 20, 40, 50, 60 |  |
|  |  | n8 | See n8 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | See n41 channel bandwidths in Table 5.3.5-1 |  |
| NOTE 8: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combinationNOTE 9: Power Class 1.5 is allowed for this single uplink carrier in this downlink/uplink combination |

5.11.2 Reference sensitivity requirements

For PC3 CA\_n8A-n41A, there are harmonic MSD for this band combination:

3rd harmonic of band n8 UL fall into band n41 DL.

#### 5.11.2.1 Reference sensitivity requirements with PC2 on n8 without TxD

For CA\_n8-n41, this is the configuration and MSD for UL n8 with PC3 in TS 38.101-1.

**Table 5.11.2.1-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC3 aggressor NR UL band for NR DL CA FR1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n8 | n41 | 5 | 15 | 16 (RBstart=0) | 10 | 13 | NOTE 3 | UL3/DL1direct-hit |
| n8 | n41 | 5 | 15 | 25 (RBstart=0) | 100 | 3.5 | NOTE 3 | UL3/DL1direct-hit |
| NOTE 3: The requirements should be verified for UL NR ARFCN of the aggressor (lower) band (superscript LB) such that  in MHz and  with the carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the low band. |

PC2 MSD for PC2 UL n8 without TxD is specified as below.

**Table 5.11.2.1-2: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n8 | n41 | 5 | 15 | 16 (RBstart=0) | 10 | 15.9 | NOTE X | UL3/DL1direct-hit |
| n8 | n41 | 5 | 15 | 25 (RBstart=0) | 100 | 6.2 | NOTE X | UL3/DL1direct-hit |
| NOTE X: The requirements should be verified for UL NR ARFCN of the aggressor (lower) band (superscript LB) such that  in MHz and  with the carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the low band. |

#### 5.11.2.2 Reference sensitivity requirements with PC2 on n8 with TxD

PC2 MSD for PC2 UL n8 with TxD is specified as below.

**Table 5.11.2.2-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC2 aggressor NR UL band for NR DL CA FR1 for UE supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n8 | n41 | 5 | 15 | 16 (RBstart=0) | 10 | 19.3 | NOTE X | UL3/DL1direct-hit |
| n8 | n41 | 5 | 15 | 25 (RBstart=0) | 100 | 8.3 | NOTE X | UL3/DL1direct-hit |
| NOTE X: The requirements should be verified for UL NR ARFCN of the aggressor (lower) band (superscript LB) such that  in MHz and  with the carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the low band. |

### 5.11.3 ∆TIB and ∆RIB values

Void

5.12 CA\_n1A-n3A

5.12.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier10** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n3A | n38CA\_n1A-n3A | n1 | 5, 10, 15, 20 | 0 |
| n3 | 5, 10, 15, 20, 25, 30 |
| n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 1 |
| n3 | 5, 10, 15, 20, 25, 30, 40 |
|  |  | n1 | 5, 10, 15, 20 | 2 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 35, 40 |  |
|  |  | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n3 | n3 channel bandwidths in Table 5.3.5-1 |  |
| NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combinationNOTE 10: Only single uplink carriers with power class other than PC3 are listed. |

5.12.2 REFSENS requirements

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power uplink.

#### 5.12.2.0 General

For PC3, CA\_ n1A-n3A has no cross-band isolation MSD for UL n3.

For PC3, CA\_ n1A-n3A has no uplink harmonic or harmonic mixing MSD for UL n3.

#### 5.12.2.1 Reference sensitivity requirements with PC2 with TxD

Based on vendor input the following MSD have been defined.**Table 5.12.2.1-1: Reference sensitivity exceptions and uplink/downlink configurations due to cross band isolation from NR UL band for NR DL CA FR1 for UE supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n3 | n1 | 1760 | 50 | 15 | 50 (RBstart=220) | 2112.5 | 5 | 1.1 | >ALCR2 |

#### 5.12.2.2 Reference sensitivity requirements with PC2 without TxD

Based on vendor input the following MSD have been defined.

**Table 5.12.2.1-2: Reference sensitivity exceptions and uplink/downlink configurations due to cross band isolation from NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n3 | n1 | 1760 | 50 | 15 | 50 (RBstart=220) | 2112.5 | 5 | 0.8 | >ALCR2 |

5.13 CA\_n1-n3-n7

5.13.1 UE maximum output power

**Table 5.13.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (three bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or****single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n3A-n7A | n37n77CA\_n1A-n3ACA\_n1A-n7ACA\_n3A-n7A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30 |  |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 1 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n1 | 5, 10, 15, 20 | 2 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  | n37n77 | n1 | n1 channel bandwidths in Table 5.3.5-1  | 4 and 5 |
|  |  | n3 | n3 channel bandwidths in Table 5.3.5-1  |  |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1  |  |
| NOTE 7: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combination |

5.13.2 Reference sensitivity requirements

For single UL PC2 n3 in CA\_n1A-n3A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n1.

- Cross band isolation interference of PC2 n3 does not fall into n1.

For single UL PC2 n7 in CA\_n1A-n7A:

- The harmonic uplink and mixing interference of n7 does not fall into Rx frequencies of n1

- Cross band isolation interference of PC2 n7 does not fall into n1.

For single UL PC2 n3 in CA\_n3A-n7A:

- The harmonic uplink and mixing interference of n7 does not fall into Rx frequencies of n3.

- Cross band isolation interference of PC2 n7 does not fall into n3.

For single UL PC2 n7 in CA\_n3A-n7A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n7.

- Cross band isolation interference of PC2 n3 does not fall into n7.

### 5.3.4 ∆TIB and ∆RIB values

Not applicable

5.14 CA\_n1-n3-n28

5.14.1 UE maximum output power

**Table 5.14.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (three bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or****single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n3A-n28A | n37 | n1 | 5, 10, 15, 20 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30 |  |
|  |  | n28 | 5, 10, 15, 202 |  |
|  | n37CA\_n1A-n3ACA\_n1A-n28ACA\_n3A-n28A | n1 | 5, 10, 15, 20 | 1 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 2 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n28 | 5, 10, 15, 201, 301 |  |
| NOTE 1: This UE channel bandwidth is applicable only to downlinkNOTE 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.NOTE 7: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combination |

5.14.2 Reference sensitivity requirements

For single UL PC2 n3 in CA\_n1A-n3A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n1.

- Cross band isolation interference of PC2 n3 does not fall into n1.

For single UL PC2 n3 in CA\_n3A-n28A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n28.

- Cross band isolation interference of PC2 n3 does not fall into n28.

### 5.3.4 ∆TIB and ∆RIB values

Not applicable

5.15 CA\_n1-n3-n78

5.15.1 UE maximum output power

**Table 5.15.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (three bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or****single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n3A-n78A | n37CA\_n1A-n3ACA\_n1A-n78A7CA\_n3A-n78A7 | n1 | 5, 10, 15, 20 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30 |  |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 1 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n1 | 5, 10, 15, 20 | 2 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n1 | n1 channel bandwidths in Table 5.3.5-1  | 4 and 5 |
|  |  | n3 | n3 channel bandwidths in Table 5.3.5-1  |  |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1  |  |
| CA\_n1A-n3A-n78(2A) | n37CA\_n78(2A)CA\_n1A-n3ACA\_n1A-n78ACA\_n3A-n78A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
| NOTE 7: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combination |

5.15.2 Reference sensitivity requirements

For single UL PC2 n3 in CA\_n1A-n3A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n1.

- Cross band isolation interference of PC2 n3 does not fall into n1.

For single UL PC2 n3 in CA\_n3A-n78A:

- The harmonic uplink interference of n3 falls into Rx frequencies of n78

- Cross band isolation interference of PC2 n3 does not fall into n78.

#### 5.15.2.1 Reference sensitivity requirements with PC2 on n3 without TxD

For CA\_n3A-n78A, reference sensitivity exception due to harmonic UL interference are captured in the related PC2 fallback.

#### 5.15.2.2 Reference sensitivity requirements with PC2 on n3 with TxD

For CA\_n3A-n78A, reference sensitivity exception due to harmonic UL interference are captured in the related PC2 fallback.

### 5.3.4 ∆TIB and ∆RIB values

Not applicable

5.16 CA\_n1A-n7A

5.16.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier10** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n7A | n78CA\_n1A-n7A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 1 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n1 | n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
| NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combinationNOTE 10: Only single uplink carriers with power class other than PC3 are listed. |

5.16.2 REFSENS requirements

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power uplink.

#### 5.16.2.0 General

For PC3, CA\_ n1A-n7A has no cross-band isolation MSD for UL n7.

For PC3, CA\_ n1A-n7A has no uplink harmonic or harmonic mixing MSD for UL n7.

#### 5.16.2.1 Reference sensitivity requirements with PC2 with TxD

Based on vendor input the following MSD have been defined.**Table 5.16.2.1-1: Reference sensitivity exceptions and uplink/downlink configurations due to cross band isolation from NR UL band for NR DL CA FR1 for UE supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n7 | n1 | 2525 | 50 | 15 | 45 (RBstart=0) | 2167.5 | 5 | 1.1 | >ALCR2 |

#### 5.16.2.2 Reference sensitivity requirements with PC2 without TxD

Based on vendor input the following MSD have been defined.

**Table 5.16.2.1-2: Reference sensitivity exceptions and uplink/downlink configurations due to cross band isolation from NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n7 | n1 | 2525 | 50 | 15 | 45 (RBstart=0) | 2167.5 | 5 | 0.8 | >ALCR2 |

## 5.17 CA\_n2A-n66A

### 5.17.1 UE maximum output power

Table 5.17.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n2A-n66A | n28n668 | n2 | 5, 10, 15, 20 | 0 |
|  |  | n66 | 5, 10, 15, 20, 40 |
|  | n28n668CA\_n2A-n66A | n2 | 5, 10, 15, 20 | 1 |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.17.2 Reference sensitivity requirements

For n2 PC2 with 20 MHz UL channel BW and n66 PC2 with 40 MHz UL channel BW, cross-band isolation MSD is considered based on simulation and measurement data. This section will propose MSD for PC2 FDD.

#### 5.17.2.1 Reference sensitivity requirements with PC2 on n2 without TxD

For single Tx PC2 n2, the following MSD is proposed.

Table 5.17.2.1-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n2 | n66 | 1900 | 20 | 15 | 50 (RBstart=56) | 2112.5 | 5 | 0.7XX | >ACLR2 |
| NOTE XX: Applicable to single Tx |

#### 5.17.2.2 Reference sensitivity requirements with PC2 on n2 with TxD

For dual Tx PC2 n2, the following MSD is proposed.

Table 5.17.2.2-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n2 | n66 | 1900 | 20 | 15 | 50 (RBstart=56) | 2112.5 | 5 | 0.9 YY | >ACLR2 |
| NOTE YY: Applicable to dual Tx |

#### 5.17.3.1 Reference sensitivity requirements with PC2 on n66 without TxD

For single Tx PC2 n66, the following MSD is proposed.

Table 5.17.3.1-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n66 | n2 | 1760 | 40 | 15 | 216 (RBstart=0) | 1932.5 | 5 | 1.9 XX | >ACLR2 |
| NOTE XX: Applicable to single Tx |

#### 5.17.3.2 Reference sensitivity requirements with PC2 on n66 with TxD

For dual Tx PC2 n66, the following MSD is proposed.

Table 5.17.3.2-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n66 | n2 | 1760 | 40 | 15 | 216 (RBstart=0) | 1932.5 | 5 | 3.3 YY | >ACLR2 |
| NOTE YY: Applicable to dual Tx |

5.18 CA\_n3A-n7A

5.18.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier10** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n7A | n38n78CA\_n3A-n7A | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n3 | n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 |  |
| NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combinationNOTE 10: Only single uplink carriers with power class other than PC3 are listed. |

5.18.2 REFSENS requirements

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power uplink.

#### 5.18.2.0 General

For PC3, CA\_ n3A-n7A has no cross-band isolation MSD for UL n3 and UL n7.

For PC3, CA\_ n3A-n7A has no uplink harmonic or harmonic mixing MSD for UL n3 and UL n7.

#### 5.18.2.1 Reference sensitivity requirements with PC2 with TxD

Based on vendor input the following MSD have been defined.**Table 5.18.2.1-1: Reference sensitivity exceptions and uplink/downlink configurations due to cross band isolation from NR UL band for NR DL CA FR1 for UE supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n7 | n3 | 2525 | 50 | 15 | 45 (RBstart=0) | 1877.5 | 5 | 0.5 | >ALCR2 |
| n3 | n7 | 1760 | 50 | 15 | 50 (RBstart=220) | 2622.5 | 5 | 0.7 | >ALCR2 |

#### 5.18.2.2 Reference sensitivity requirements with PC2 without TxD

Based on vendor input the following MSD have been defined.

**Table 5.18.2.1-2: Reference sensitivity exceptions and uplink/downlink configurations due to cross band isolation from NR UL band for NR DL CA FR1 for UE not supporting Tx Diversity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL Fc | UL BW | SCS of UL band | UL RB Allocation | DL Fc | DL BW | MSD | Cross-bandInterferencesource |
| (MHz) | (MHz) | (kHz) | LCRB | (MHz) | (MHz) | (dB) |
| n7 | n3 | 2525 | 50 | 15 | 45 (RBstart=0) | 1877.5 | 5 | 0.4 | >ALCR2 |
| n3 | n7 | 1760 | 50 | 15 | 50 (RBstart=220) | 2622.5 | 5 | 0.5 | >ALCR2 |

5.19 CA\_n3-n7-n28

5.19.1 UE maximum output power

**Table 5.19.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (three bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or****single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n7A-n28A | n37n77 | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n28 | 5, 10, 15, 20 |  |
|  | n37n77CA\_n3A-n7ACA\_n3A-n28ACA\_n7A-n28A | n3 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 2 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n28 | 5, 10, 15, 20 |  |
| NOTE 7: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combination |

5.19.2 Reference sensitivity requirements

For single UL PC2 n3 in CA\_n3A-n7A:

- The harmonic uplink and mixing interference of n7 does not fall into Rx frequencies of n3.

- Cross band isolation interference of PC2 n7 does not fall into n3.

For single UL PC2 n7 in CA\_n3A-n7A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n7.

- Cross band isolation interference of PC2 n3 does not fall into n7.

For single UL PC2 n3 in CA\_n3A-n28A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n28.

- Cross band isolation interference of PC2 n3 does not fall into n28.

For single UL PC2 n7 in CA\_n7A-n28A:

- The harmonic uplink and mixing interference of n7 does not fall into Rx frequencies of n28.

- Cross band isolation interference of PC2 n7 does not fall into n28.

#### 5.19.2.1 Reference sensitivity requirements with PC2 on n3 and n7 without TxD

Void

#### 5.19.2.2 Reference sensitivity requirements with PC2 on n3 and n7 with TxD

Void

### 5.3.4 ∆TIB and ∆RIB values

Not applicable

5.20 CA\_n3A-n7A-n78A and CA\_n3A-n7A-n78(2A)

5.20.1 UE maximum output power

**Table 5.20.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (three bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or****single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n7A-n78A | n37n77CA\_n3A-n7ACA\_n3A-n78ACA\_n7A-n78A | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 80, 90, 100 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 704, 80, 90, 100 |  |
|  |  | n3 | n3 channel bandwidths in Table 5.3.5-1  | 4 and 5 |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1  |  |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1  |  |
| CA\_n3A-n7A-n78(2A) | n37n77CA\_n78(2A)CA\_n3A-n7ACA\_n3A-n78ACA\_n7A-n78A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
| NOTE 4: The minimum requirements only apply for non-simultaneous Tx/Rx between all carriers for TDD combinations.NOTE 7: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combination |

5.20.2 Reference sensitivity requirements

For single UL PC2 n7 in CA\_n3A-n7A:

- The harmonic uplink and mixing interference of n7 does not fall into Rx frequencies of n3.

- Cross band isolation interference of PC2 n7 does not fall into n3.

For single UL PC2 n3 in CA\_n3A-n7A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n7.

- Cross band isolation interference of PC2 n3 does not fall into n7.

For single UL PC2 n3 in CA\_n3A-n78A:

- The harmonic uplink interference of n3 falls into Rx frequencies of n78.

- Cross band isolation interference of PC2 n3 does not fall into n78.

For single UL PC2 n7 in CA\_n7A-n78A:

- The harmonic mixing interference of n7 falls into Rx frequencies of n78

- Cross band isolation interference of PC2 n7 does not fall into n78.

#### 5.20.2.1 Reference sensitivity requirements with PC2 on n3 and n7 without TxD

For CA\_n3A-n78A, reference sensitivity exception due to harmonic UL interference are captured in the related PC2 fallback.

For CA\_n7A-n78A, reference sensitivity exception due to harmonic mixing is not recorded in PC3, so some arguments must exist why UL3/DL2 was not included. Similar there’s no harm mixing for CA\_n7A-n77A either, so there must be an argument that UL3/DL2 have been omitted, while the UL2/DL3 of n77 is defined. An earlier harmonic mixing rule must have been considered:

Rule a thumb for harmonic mixing:

nxDL=mxUL

n=1,3,5 but n=2 should be considered for DL freq>2GHz

Therefore, no MSD in PC2 is declared either.

#### 5.20.2.2 Reference sensitivity requirements with PC2 on n3 and n7 with TxD

For CA\_n3A-n78A, reference sensitivity exception due to harmonic UL interference are captured in the related PC2 fallback.

For CA\_n7A-n78A, there is same concern as in the above discussion for the requirement without TxD.

### 5.3.4 ∆TIB and ∆RIB values

Not applicable

5.21 CA\_n3-n28

5.21.1 UE maximum output power

**Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier10** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n28A | n38CA\_n3A-n28A | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 2 |
|  |  | n28 | 5, 10, 15, 20, 30 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 35, 40 | 3 |
|  |  | n28 | 5, 10, 15, 20, 25, 30 |  |
|  |  | n3 | n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n28 | n28 channel bandwidths in Table 5.3.5-1 |  |
| NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combinationNOTE 10: Only single uplink carriers with power class other than PC3 are listed. |

5.21.2 REFSENS requirements

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power uplink.

#### 5.21.2.0 General

For PC3, CA\_ n3A-n28A has no cross-band isolation MSD for UL n3.

For PC3, CA\_ n3A-n28A has no uplink harmonic or harmonic mixing MSD for UL n3.

#### 5.21.2.1 Reference sensitivity requirements with PC2 on n3 without TxD

For CA\_ n3A-n28A, this would follow already specified reference sensitivity requirements.

5.22 CA\_n3A-n28A-n78A and CA\_n3A-n28A-n78(2A)

5.22.1 UE maximum output power

**Table 5.22.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (three bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or****single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n28A-n78A | n37CA\_n3A-n28ACA\_n3A-n78ACA\_n28A-n78A | n3 | 5, 10, 15, 20 | 0 |
|  |  | n28 | 5, 10, 15, 202 |  |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n28 | 5, 10, 15, 202 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 | 2 |
|  |  | n28 | 5, 10 |  |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
| CA\_n3A-n28A-n78(2A) | n37CA\_n3A-n28ACA\_n3A-n78ACA\_n28A-n78A | n3 | 5, 10, 15, 20 | 0 |
|  |  | n28 | 5, 10, 15, 202 |  |
|  |  | n78 | CA\_n78(2A)\_BCS0 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n28 | 5, 10 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  | n37CA\_n78(2A)CA\_n3A-n28ACA\_n3A-n78ACA\_n28A-n78A | n3 | 5, 10, 15, 20, 25, 30, 40 | 2 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
| 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.NOTE 7: Power Class 2 is allowed for this uplink combination or single uplink carrier in this downlink/uplink combination |

5.22.2 Reference sensitivity requirements

For single UL PC2 n3 in CA\_n3A-n28A:

- The harmonic uplink and mixing interference of n3 does not fall into Rx frequencies of n28.

- Cross band isolation interference of PC2 n3 does not fall into n28.

For single UL PC2 n3 in CA\_n3A-n78A:

- The harmonic uplink interference of n3 falls into Rx frequencies of n78

- Cross band isolation interference of PC2 n3 does not fall into n78.

#### 5.22.2.1 Reference sensitivity requirements with PC2 on n3 without TxD

For CA\_n3A-n78A, reference sensitivity exception due to harmonic UL interference are captured in the related PC2 fallback.

#### 5.22.2.2 Reference sensitivity requirements with PC2 on n3 with TxD

For CA\_n3A-n78A, reference sensitivity exception due to harmonic UL interference are captured in the related PC2 fallback.

### 5.3.4 ∆TIB and ∆RIB values

Not applicable

5.23 CA\_n3A-n78(2A)

5.23.1 UE maximum output power

**Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier10** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n78(2A) | n38CA\_n3A-n78ACA\_n78(2A) | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS0 |  |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n78 | CA\_n78(2A)\_BCS4 and 5 |  |
| NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combinationNOTE 10: Only single uplink carriers with power class other than PC3 are listed. |

5.23.2 REFSENS requirements

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power uplink.

#### 5.23.2.0 General

For PC3, CA\_n3A-n78(2A) has no cross-band isolation MSD for UL n3.

For PC3, CA\_n3A-n78(2A) the harmonic uplink interference of n3 falls into Rx frequencies of n78, and requirements are captured in CA\_n3A-n78A PC2 fallback.

#### 5.23.2.1 Reference sensitivity requirements with PC2 on n3 without TxD

For CA\_n3A-n78(2A), this would follow already specified reference sensitivity requirements.

5.24 CA\_n7A-n28A

5.24.1 UE maximum output power

**Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier10** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n7A-n28A | n78CA\_n7A-n28A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20 |  |
| NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combinationNOTE 10: Only single uplink carriers with power class other than PC3 are listed. |

5.24.2 REFSENS requirements

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power uplink.

#### 5.24.2.0 General

For PC3, CA\_ n7A-n28A has no cross-band isolation MSD for UL n7.

For PC3, CA\_ n7A-n28A has no uplink harmonic or harmonic mixing MSD for UL n7.

#### 5.24.2.1 Reference sensitivity requirements with PC2 on n7 without TxD

For CA\_ n7A-n28A, this would follow already specified reference sensitivity requirements.

5.25 CA\_n7A-n78A and CA\_n7A-n78(2A)

5.25.1 UE maximum output power

**Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier10** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n7A-n78A | n78n788,9CA\_n7A-n78A8 | n7 | 5, 10, 15, 20 | 0 |
|  |  | n78 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 1 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n7 | n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n78 | n78 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n7A-n78(2A) | n78n788,9CA\_n7A-n78A8CA\_n78(2A)8 | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS0 |  |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 1 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n7 | See n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n78 | CA\_n78(2A)\_BCS4 and 5 |  |
| NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combinationNOTE 10: Only single uplink carriers with power class other than PC3 are listed. |

5.25.2 REFSENS requirements

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power uplink.

#### 5.25.2.0 General

For PC3, CA\_n7A-n78A and CA\_n7A-n78(2A) has no cross-band isolation MSD for UL n7.

For PC3, CA\_n7A-n78A and CA\_n7A-n78(2A) but harmonic mixing of UL3/DL2 is present for UL n7.

#### 5.25.2.1 Reference sensitivity requirements with PC2 on n7 without TxD

The harmonic mixing interference of n7 falls into Rx frequencies of n78, but this is not recorded in PC3, so some arguments must exist why UL3/DL2 was not included. Similar there’s no harm mixing for CA\_n7A-n77A either, so there must be an argument that UL3/DL2 have been omitted, while the UL2/DL3 of n77 is defined. An earlier harmonic mixing rule must have been considered:

Rule a thumb for harmonic mixing:

nxDL=mxUL

n=1,3,5 but n=2 should be considered for DL freq>2GHz

Therefore, no MSD in PC2 is declared either.

## 5.26 CA\_ n25A-n41A

5.26.1 UE maximum output power

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n25A-n41A | n418,9n25A8CA\_n25A-n41A8, 13,14 | n25 | 5, 10, 15, 20 | 0 |
|  |  | n41 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n41 | 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n25 | See n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | See n41 channel bandwidths in Table 5.3.5-1 |  |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.26.2 Harmonic Mixing Reference sensitivity requirements

#### 5.26.2.0 General

For PC3, CA\_ n25A-n41A has no harmonic MSD for UL n25. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 5.26.2.1 Reference sensitivity requirements with PC2 on n25 without TxD

MSD for 1Tx PC2 in n25 was discussed at RAN4#111 and the following was agreed to:

**Table 7.3A.4-4a: Reference sensitivity exceptions and uplink/downlink configurations due to harmonic mixing from a PC2 aggressor NR UL band for NR DL CA FR1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| n25 | n41 | 5 | 15 | 25 (RBstart=0) | 10 | 2.2 | NOTE 11 | UL4/DL3 |

#### 5.26.2.2 Harmonic Mixing reference sensitivity requirements with PC2 on n25 with TxD

MSD for 2Tx PC2 in n25 was discussed at RAN4#111 and the following was agreed to:

**Table 7.3A.4-4a: Reference sensitivity exceptions and uplink/downlink configurations due to harmonic mixing from a PC2 aggressor NR UL band for NR DL CA FR1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL BW** | **MSD** | **UL/DL fc condition** | **UL/DL harmonic order** |
| **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(dB)** |
| n25 | n41 | 5 | 15 | 25 (RBstart=0) | 10 | 3.2 | NOTE 11 | UL4/DL3 |

### 5.26.3 Cross-band isolation reference sensitivity requirements

#### 5.26.3.0 General

For PC3, CA\_ n25A-n41A has no cross band isolation MSD for UL n25. This section proposes MSD for PC2 FDD.

#### 5.26.3.1 Reference sensitivity requirements with PC2 on n25 without TxD

MSD for PC2 in n25 was discussed at RAN4#111 and the following was agreed to for single Tx:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n25 | n41 | 1760 | 40 | 15 | 40 (RBstart=176) | 2501 | 10 | 0.8 | >ACLR2 |
| NOTE 1: Applicable only when harmonic mixing MSD for this combination is not applied.NOTE 2: VoidNOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.NOTE 4: VoidNOTE 5: The MSD exceptions are applicable to the case that interference of UL band 3rd order IMD product falls into the affected DL channels. |

#### 5.26.3.2 Cross-band isolation reference sensitivity requirements with PC2 on n25 with TxD

MSD for PC2 in n25 was discussed at RAN4#111 and the following was agreed to for 2Tx:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n25 | n41 | 1760 | 40 | 15 | 40 (RBstart=176) | 2501 | 10 | 1.0 | >ACLR2 |
| NOTE 1: Applicable only when harmonic mixing MSD for this combination is not applied.NOTE 2: VoidNOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.NOTE 4: VoidNOTE 5: The MSD exceptions are applicable to the case that interference of UL band 3rd order IMD product falls into the affected DL channels. |

## 5.27 CA\_ n25A-n66A

5.27.1 UE maximum output power

The addition of the PC2 notes for n25 and n66 have already been added to 38.101-1 as follows:

Table 5.5A.3.1-1: NR CA configurations and bandwidth combinations sets defined for inter-band CA (two bands)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier10 | NR Band | Channel bandwidth (MHz) (NOTE 3) | Bandwidth combination set |
| CA\_n25A-n66A | n25A8n66A8CA\_n25A-n66A | n25 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n66 | 5, 10, 15, 20, 30, 40 |  |
|  |  | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |

NOTE 8: Minimum requirements for Power Class 2 are applicable for this uplink combination with 1Tx antenna connector in each band or single uplink carrier with up to 2Tx antenna connectors in this downlink/uplink combination

NOTE 10: Only single uplink carriers with power class other than PC3 are listed.

### 5.27.2 Cross-band isolation reference sensitivity requirements

#### 5.27.2.0 General

For PC3, CA\_ n25A-n66A has no MSD for UL n25 or UL n66 currently. This may be updated based on wider channel bandwidths.

#### 5.27.2.1 Reference sensitivity requirements with PC2 on n25 without TxD

For n25 PC2 with 40 MHz UL channel BW, cross-band isolation MSD is considered based on simulation and measurement data. For single Tx PC2 n25 the following MSD is proposed:

Table 5.27.2.1-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n25 | n66 | 1895 | 40 | 15 | 40 (RBstart=176) | 2112.5 | 5 | 0.74 | >ACLR2 |

#### 5.27.2.2 Reference sensitivity requirements with PC2 on n25 with TxD

For dual Tx PC2 n25 the following MSD is proposed:

Table 5.27.2.2-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n25 | n66 | 1895 | 40 | 15 | 40 (RBstart=176) | 2112.5 | 5 | 0.95 | >ACLR2 |

#### 5.27.3.1 Reference sensitivity requirements with PC2 on n66 without TxD

For CA\_n25-n66, there is no cross-band isolation MSD for UL n66 with PC3 based on channel bandwidths up to 20 MHz. Re-examining the MSD based on up to 45 MHz UL channel BW on n66 with PC3 resulted in around 0.3 dB MSD and was decided it was not worth adding.

For n66 PC2 with 45 MHz UL channel BW, cross-band isolation MSD is considered based on simulation and measurement data. For single Tx PC2 n66 the following MSD is proposed:

Table 5.27.3.1-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n66 | n25 | 1757.5 | 45 | 15 | 240 (RBstart=2) | 1932.5 | 5 | 2.24 | >ACLR2 |

#### 5.27.3.2 Reference sensitivity requirements with PC2 on n66 with TxD

For dual Tx PC2 n66 the following MSD is proposed:

Table 5.27.3.2-1: Reference sensitivity exceptions (MSD) and uplink/downlink configurations due to cross band isolation from a PC2 aggressor NR UL band for NR CA FR1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **DL band** | **UL Fc** | **UL BW** | **SCS of UL band** | **UL RB Allocation** | **DL Fc** | **DL BW** | **MSD** | **Cross-band****Interference****source** |
| **(MHz)** | **(MHz)** | **(kHz)** | **LCRB** | **(MHz)** | **(MHz)** | **(dB)** |
| n66 | n25 | 1757.5 | 45 | 15 | 240 (RBstart=2) | 1932.5 | 5 | 3.85 | >ACLR2 |

# 6 High Power UE for Intra-band DL CA with PC2 on single FDD band

## 6.1 CA\_n71(2A)

### 6.1.1 UE maximum output power

Table 5.5A.2-1: NR CA configurations and bandwidth combination sets defined for intra-band non-contiguous CA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink CA Configurations or single uplink carrier5 | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | MaximumAggregated bandwidth(MHz) | Bandwidth combination set |
| CA\_n71(2A) | n713 | 5, 10, 15, 20 | 5,10,15, 20 |  |  | 30 | 0 |
|  |  | See n71 channel bandwidths in Table 5.3.5-1 for each carrier up to 25 MHz per carrier |  |  | 30 | 4 and 5 |
| NOTE 3: Minimum requirements for Power Class 2 are applicable for this uplink combination or single uplink carrier in this downlink/uplink combination |

### 6.1.2 Reference sensitivity requirements

#### 6.1.2.0 General

For PC2, CA\_n71(2A) has self-interference for UL n71. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 6.1.2.1 Reference sensitivity requirements with PC2 on n71 without TxD

For CA\_n71(2A), this is the configuration and MSD for UL n71 with PC3 based on the proposal in R4-2407158

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS(PCC/SCC)(kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation(LCRB) | ΔRIBNC (dB) | Duplex mode |
| CA\_n71(2A) | 15/15 |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  | 15MHz + 10MHz | Wgap = 10.0 | 5 (RBstart = 2) | 22.2 |  |
|  |  | 25MHz + 5MHzx | Wgap = 5.0 | 20 (RBstart = 19) | 25.1 |  |
| NOTE x: Applicable only to Bandwidth Combination Set 4 and 5 and for UEs supporting the symmetrical UL/DL channel bandwidths. |

The following is proposed as a the PC2 single Tx MSD which would require a new table in 38.101-1 based on the linear average of values proposed by Skyworks, Qualcomm and Murata:

**Table 7.3A.2.2-1a: Power class 2 intra-band non-contiguous CA reference sensitivity with one uplink carrier.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA configuration** | **SCS****(kHz)** | **Aggregated channel bandwidth (PCC+SCC)** | **Wgap / [MHz]** | **UL PCC allocation** | **SCC****ΔRIBNC1 (dB)** | **SCC****ΔRIBNC2 (dB)** | **Duplex mode** |
| CA\_n71(2A) | 15/15 | 15MHz + 10MHz | Wgap = 10.0 | 5 (RBstart = 2) | 24.8 |  | FDD |
|  |  | 25MHz + 5MHz1 | Wgap = 5.0 | 20 (RBstart = 8) | 27.23 |  |  |
| NOTE 1: Applicable to UE supporting PC2 with single Tx. NOTE 2: Applicable to UE supporting PC2 with dual Tx.NOTE 3: Applicable only to BCS 4 and 5 and for UEs supporting the optional symmetrical UL/DL channel bandwidths. |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

#### 6.1.2.2 Reference sensitivity requirements with PC2 on n71 with TxD

 tThe following is proposed as a the PC2 dual Tx MSD which would require a new table in 38.101-1 based on the linear average of values proposed by Skyworks, Qualcomm and Murata:

**Table 7.3A.2.2-1a: Power class 2 intra-band non-contiguous CA reference sensitivity with one uplink carrier.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA configuration** | **SCS****(kHz)** | **Aggregated channel bandwidth (PCC+SCC)** | **Wgap / [MHz]** | **UL PCC allocation** | **SCC****ΔRIBNC1 (dB)** | **SCC****ΔRIBNC2 (dB)** | **Duplex mode** |
| CA\_n71(2A) | 15/15 | 15MHz + 10MHz | Wgap = 10.0 | 5 (RBstart = 2) |  | 29.3 | FDD |
|  |  | 25MHz + 5MHz1 | Wgap = 5.0 | 20 (RBstart = 8) |  | 31.83 |  |
| NOTE 1: Applicable to UE supporting PC2 with single Tx. NOTE 2: Applicable to UE supporting PC2 with dual Tx.NOTE 3: Applicable only to BCS 4 and 5 and for UEs supporting the optional symmetrical UL/DL channel bandwidths. |

## 6.2 CA\_n25(2A)

### 6.2.1 UE maximum output power

Table 5.5A.2-1: NR CA configurations and bandwidth combination sets defined for intra-band non-contiguous CA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink CA Configurations or single uplink carrier5 | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | MaximumAggregated bandwidth(MHz) | Bandwidth combination set |
| CA\_n25(2A) | n253 | 5, 10, 15, 20 | 5, 10, 15, 20 |  |  | 40 | 0 |
|  |  | 5, 10, 15, 20, 25, 30, 40 | 5, 10, 15, 20, 25, 30, 40 |  |  | 60 | 1 |
|  |  | See n25 channel bandwidths in Table 5.3.5-1 for each carrier |  |  | 60 | 4 and 5 |
| NOTE 3: Minimum requirements for Power Class 2 are applicable for this uplink combination or single uplink carrier in this downlink/uplink combination |

### 6.2.2 Reference sensitivity requirements

#### 6.2.2.0 General

For PC2, CA\_n25(2a) has self-interference for UL n25. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 6.2.2.1 Reference sensitivity requirements with PC2 on n25 without TxD

For CA\_n25(2A), this is the configuration and MSD for UL n25 with PC3

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS(PCC/SCC)(kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation(LCRB) | ΔRIBNC (dB) | Duplex mode |
| CA\_n25(2A) 9 | 15/15 | 5MHz + 5MHz | Wgap = 55.0 | 105 | 5.0 | FDD |
|  |  |  | Wgap = 30.0 | 25 | 0.0 |  |
| CA\_n25(2A) 10CA\_n25(3A) | 15/15 | 40MHz + 5MHz | Wgap = 20.0 | 40 (RBstart = 176) | [24.6] 8 | FDD |

For PC3 MSD we have N+IPC3. For PC2 MSD we have N+IPC2. So, for PC2 compared to PC3, I increases by 3 dB. For our other PC2 and PC1.5 MSD analysis we have been using the following approach:

MSD due to interference power *I* is given by:

where *N* is the noise spectral density and BW is the bandwidth of the carrier. If the initial MSD is known,

then we have:

 

If *I* is increased by *X* dB, then *MSD(X)* is given by







Using that approach, the following is proposed as a the PC2 MSD which would require a new table in 38.101-1:

Table 7.3A.2.2-1a: Intra-band non-contiguous CA with one PC2 uplink configuration for reference sensitivity in FDD bands without Transmit Diversity.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS(PCC/SCC)(kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation(LCRB) | ΔRIBNC (dB) | Duplex mode |
| CA\_n25(2A) 9 | 15/15 | 5MHz + 5MHz | Wgap = 55.0 | 105 | 7.3 | FDD |
|  |  |  | Wgap = 30.0 | 25 | 0.0 |  |
| CA\_n25(2A) 10CA\_n25(3A) | 15/15 | 40MHz + 5MHz | Wgap = 20.0 | 40 (RBstart = 176) | [27.6] 8 | FDD |

#### 6.2.2.2 Reference sensitivity requirements with PC2 on n25 with TxD

R4-2407156 documented the guidelines for FDD PC2 MSD analysis. Based on that. The following is proposed for n71 PC2 MSD with 2Tx:

Table 7.3A.2.2-1a: Intra-band non-contiguous CA with one PC2 uplink configuration for reference sensitivity in FDD bands with Transmit Diversity.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS(PCC/SCC)(kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation(LCRB) | ΔRIBNC (dB) | Duplex mode |
| CA\_n25(2A) 9 | 15/15 | 5MHz + 5MHz | Wgap = 55.0 | 105 | 10.0 | FDD |
|  |  |  | Wgap = 30.0 | 25 | 0.0 |  |
| CA\_n25(2A) 10CA\_n25(3A) | 15/15 | 40MHz + 5MHz | Wgap = 20.0 | 40 (RBstart = 176) | 32.68 | FDD |

## 6.3 CA\_n66(2A)

### 6.3.1 UE maximum output power

Table 5.5A.2-1: NR CA configurations and bandwidth combination sets defined for intra-band non-contiguous CA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Uplink CA Configurations or single uplink carrier5 | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | Channel bandwidths for carrier(MHz) | MaximumAggregated bandwidth(MHz) | Bandwidth combination set |
| CA\_n66(2A) | n663 | 5, 10, 15, 20 | 5, 10, 15, 20, 40 |  |  | 60 | 0 |
|  |  | 5, 10, 15, 20, 25, 30, 40 | 5, 10, 15, 20, 25, 30, 40 |  |  | 80 | 1 |
|  |  | 5, 10, 15, 20, 40 | 5, 10, 15, 20, 40 |  |  | 80 |
|  |  | See n66 channel bandwidths in Table 5.3.5-1 for each carrier |  |  | 85 | 4 and 5 |
| NOTE 3: Minimum requirements for Power Class 2 are applicable for this uplink combination or single uplink carrier in this downlink/uplink combination |

### 6.3.2 Reference sensitivity requirements

#### 6.3.2.0 General

For PC2, CA\_n66(2A) has self-interference for UL n66. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 6.3.2.1 Reference sensitivity requirements with PC2 on n66 without TxD

For CA\_n66(2A), this is the configuration and MSD for UL n66 with PC3

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS(PCC/SCC)(kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation(LCRB) | ΔRIBNC (dB) | Duplex mode |
| CA\_n66(2A)CA\_n66(3A) | N/A | NOTE 1 | NOTE 2 | NOTE 3, NOTE 4 | 0.0 | FDD |

Due to the wide duplex gap, the following is proposed as a the PC2 MSD which would require a new table in 38.101-1:

Table 7.3A.2.2-1a: Intra-band non-contiguous CA with one PC2 uplink configuration for reference sensitivity in FDD bands without Transmit Diversity.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS(PCC/SCC)(kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation(LCRB) | ΔRIBNC (dB) | Duplex mode |
| CA\_n66(2A)CA\_n66(3A) | N/A | NOTE 1 | NOTE 2 | NOTE 3, NOTE 4 | 0.0 | FDD |
| NOTE 1: All combinations of channel bandwidths defined in Table 5.5A.2-1.NOTE 2: All applicable sub-block gap sizes.NOTE 3: The PCC allocation is same as Transmission bandwidth configuration NRB as defined in Table 5.3.2-1. NOTE 4: The carrier center frequency of PCC in the DL operating band is configured closer to the UL operating band.NOTE 5: Refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission.NOTE 6: Wgap is the sub-block gap between the two sub-blocks.NOTE 7: The carrier centre frequency of SCC in the DL operating band is configured closer to the UL operating band.NOTE 8: For operation with three or more non-contiguous component carriers, ΔRIBNC applies to all secondary component carriers.NOTE 9: Bandwidth Combination Set 0.NOTE 10: Bandwidth Combination Set 1 |

#### 6.3.2.2 Reference sensitivity requirements with PC2 on n66 with TxD

Due to the wide Duplex gap, it is proposed that there is no MSD for CA\_66(2A) PC2 with Transmit Diversity

Table 7.3A.2.2-1b: Intra-band non-contiguous CA with one PC2 uplink configuration for reference sensitivity in FDD bands with Transmit Diversity.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS(PCC/SCC)(kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation(LCRB) | ΔRIBNC (dB) | Duplex mode |
| CA\_n66(2A)CA\_n66(3A) | N/A | NOTE 1 | NOTE 2 | NOTE 3, NOTE 4 | 0.0 | FDD |
| NOTE 1: All combinations of channel bandwidths defined in Table 5.5A.2-1.NOTE 2: All applicable sub-block gap sizes.NOTE 3: The PCC allocation is same as Transmission bandwidth configuration NRB as defined in Table 5.3.2-1. NOTE 4: The carrier center frequency of PCC in the DL operating band is configured closer to the UL operating band.NOTE 5: Refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission.NOTE 6: Wgap is the sub-block gap between the two sub-blocks.NOTE 7: The carrier centre frequency of SCC in the DL operating band is configured closer to the UL operating band.NOTE 8: For operation with three or more non-contiguous component carriers, ΔRIBNC applies to all secondary component carriers.NOTE 9: Bandwidth Combination Set 0.NOTE 10: Bandwidth Combination Set 1 |

## 6.4 CA\_ n71B

### 6.4.1 UE maximum output power

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

|  |
| --- |
| **NR CA configuration / Bandwidth combination set** |
| **NR CA configuration** | **Uplink CA configurations or single uplink carrier5** | **Channel bandwidths for carrier (MHz)** | **Channel bandwidths for carrier (MHz)** | **Channel bandwidths for carrier (MHz)** | **Channel bandwidths for carrier (MHz)** | **Channel bandwidths for carrier (MHz)** | **Maximum aggregated bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n71B | n713 | 5 | 20 |  |  |  | 25 | 0 |
|  |  | 10 | 15 |  |  |  |  |  |
|  |  | 10 | 20 |  |  |  | 35 | 1 |
|  |  | 15 | 15, 20 |  |  |  |  |  |
|  |  | 5, 10, 15 | 15, 20 |  |  |  | 35 | 2 |
|  |  | See n71 channel bandwidths in Table 5.3.5-1 for each carrier2 |  |  |  | 35 | 4 and 5 |

### 6.4.2 Reference sensitivity requirements

#### 6.4.2.0 General

For PC3, CA\_n71B does not have self-interference for UL n71. This section will examine the existing PC3 MSD and propose MSD for PC2 FDD.

#### 6.4.2.1 Reference sensitivity requirements with PC2 on n71 without TxD

For PC3 CA\_n71B, there is currently no MSD defined. However, there is a proposal for MSD for MSD for PCC channel bandwidths >20 MHz. This is the proposed configuration and MSD for UL n71 with PC3.

**Table 7.3A.2.1-2: Power class 3 intra-band contiguous CA reference sensitivity with one uplink carrier.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CA configuration** | **SCS****(PCC/SCC)****(kHz)** | **Aggregated channel bandwidth (PCC+SCC)** | **UL PCC allocation****(LCRB)** | **SCC****ΔRIBC (dB)** | **Duplex mode** |
| CA\_n71B1 | 15/15 | 30MHz + 5MHz | 20 (RBSTART = 0)  | 3.8 | FDD |
| NOTE 1: Applicable only to BCS 4 and 5 and for UEs supporting the optional symmetrical UL/DL channel bandwidths. |

Based on simulation and measurements, the following is proposed as a the PC2 single Tx MSD which would require a new table in 38.101-1. It is based on the linear average of values proposed by Skyworks Solutions, Qualcomm and Murata.

**Table 7.3A.2.1-3: Power class 2 intra-band contiguous CA reference sensitivity with one uplink carrier.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CA configuration** | **SCS****(kHz)** | **Aggregated channel bandwidth (PCC+SCC)** | **UL PCC allocation** | **SCC****ΔRIBNC1 (dB)** | **SCC****ΔRIBNC2 (dB)** | **Duplex mode** |
| CA\_n71B | 15/15 | 30 MHz + 5 MHz | 20 (RBstart = 0) | 5.63 |  | FDD |
| NOTE 1: Applicable to UE supporting PC2 with single Tx. NOTE 2: Applicable to UE supporting PC2 with dual Tx.NOTE 3: Applicable only to BCS 4 and 5 and for UEs supporting the optional symmetrical UL/DL channel bandwidths. |

#### 6.4.2.2 Reference sensitivity requirements with PC2 on n71 with TxD

Based on simulation and measurements, the following is proposed as a the PC2 dual Tx MSD which would require a new table in 38.101-1. It is based on the linear average of values proposed by Skyworks Solutions, Qualcomm and Murata.

**Table 7.3A.2.1-3: Power class 2 intra-band contiguous CA reference sensitivity with one uplink carrier.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CA configuration** | **SCS****(kHz)** | **Aggregated channel bandwidth (PCC+SCC)** | **UL PCC allocation** | **SCC****ΔRIBNC1 (dB)** | **SCC****ΔRIBNC2 (dB)** | **Duplex mode** |
| CA\_n71B | 15/15 | 30 MHz + 5 MHz | 20 (RBstart = 0) |  | 7.7 **3** | FDD |
| NOTE 1: Applicable to UE supporting PC2 with single Tx. NOTE 2: Applicable to UE supporting PC2 with dual Tx.NOTE 3: Applicable only to BCS 4 and 5 and for UEs supporting the optional symmetrical UL/DL channel bandwidths. |

# Annex <A> (informative): Change history

|  |
| --- |
| **Change history** |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2023-02 | RAN4 #106 | R4-2300172 |  |  |  | TR skeleton | 0.0.1 |
| 2023-03 | RAN4 #106 | R4-2300954 |  |  |  | Included TPs/pCRs:R4-2303457 PC2 for CA\_n1A\_n78AR4-2303457 PC2 for CA\_n3A\_n78A | 0.1.0 |
| 2023-04 | RAN4#106bis-e | R4-2304471 |  |  |  | Included TPs/pCRs:R4-2304470 | 0.2.0 |
| 2023-09 | RAN#101 | RP-232227 |  |  |  | Provided for information to RAN | 1.0.0 |
| 2024-03 | RAN4#110 | R4-2400351 |  |  |  | Included TPs/pCRs:R4-2403626 TP for TR 38.850: DL CA\_n25A-n77A UL n25 PC2R4-2402466 TP for TR 38.850: DL CA\_n71(2A) UL n71 PC2R4-2402464 TP for TR 38.850: DL CA\_n25(2A) UL n25 PC2R4-2402465 TP for TR 38.850: DL CA\_n66(2A) UL n77 PC2R4-2403670 TP for TR 38.850: DL CA\_n25A-n71A UL n25 PC2 and n71 PC2R4-2403671 TP for TR 38.850: DL CA\_n41A-n71A UL n71 PC2R4-2403672 TP for TR 38.850: DL CA\_n66A-n77A UL n66 PC2R4-2403673 TP for TR 38.850: DL CA\_n71A-n77A UL n71 PC2 | 1.2.0 |
| 2024-04 | RAN4#110bis | R4-2404779 |  |  |  | Included TPs/pCRs:R4-2404381 TP for TR 38.850 Corrections for typosR4-2404383 TP for TR 38.850 DL CA\_n41A-n66A UL n66 PC2R4-2406569 TP for TR 38.850 DL CA\_n71A-n85A UL n71 PC2R4-2406571 (HPUE\_FR1\_FDD\_NR\_CADC\_R18) TP for TR 38.850 to introduce PC2 CA\_n8A-n79A with UL n8R4-2406572 (HPUE\_FR1\_FDD\_NR\_CADC\_R18) TP for TR 38.850 to introduce PC2 CA\_n8A-n41A with UL n8 | 1.3.0 |
| 2024-05 | RAN4#111 | R4-2407670 |  |  |  | Included TPs/pCRs:R4-2410545 (HPUE\_FR1\_FDD\_NR\_CADC\_R18) TP for TR 38.850 to introduce PC2 CA\_n8A-n41A on n8 with TxDR4-2407947 (HPUE\_FR1\_FDD\_NR\_CADC\_R18)TP for TR 38.850 to introduce PC2 CA\_n8A-n79A on UL n8 with TxDR4-2410546 TP for TR 38.850 Replacing TBD MSD for TxDR4-2410547 TP to TR 38.850 to add HP-NRCA n1-n3R4-2409197 TP to TR 38.850 to add HP-NRCA n1-n3-n7R4-2409198 TP to TR 38.850 to add HP-NRCA n1-n3-n28R4-2409199 TP to TR 38.850 to add HP-NRCA n1-n3-n78R4-2410548 TP to TR 38.850 to add HP-NRCA n1-n7R4-2407215 TP for TR 38.850 Addition of Single UL PC2 FDD for CA\_n2-n66R4-2410549 TP to TR 38.850 to add HP-NRCA n3-n7R4-2409202 TP to TR 38.850 to add HP-NRCA n3-n7-n28R4-2410550 TP to TR 38.850 to add HP-NRCA n3-n7-n78R4-2409204 TP to TR 38.850 to add HP-NRCA n3-n28R4-2410551 TP to TR 38.850 to add HP-NRCA n3-n28-n78R4-2410552 TP to TR 38.850 to add HP-NRCA n3-n78R4-2410553 TP to TR 38.850 to add HP-NRCA n7-n28R4-2410554 TP to TR 38.850 to add HP-NRCA n7-n78 R4-2410555 TP for TR 38.850 DL CA\_n25A-n41A UL n25A PC2R4-2407711 TP for TR 38.850 DL CA\_n25A-n66A UL n25A PC2 n66A PC2R4-2410556 TP for TR 38.850 DL CA\_n71(2A) UL PC2 n71AR4-2410557 TP for TR 38.850 DL CA\_n71B UL PC2 n71A | 1.4.0 |