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| 3GPP TR 38.898 V0.2.0 (2023-03) | |
| Technical Report | |
| High power UE (power class m with 1<m<3) for a single FR1 band in UL of Dual Connectivity (DC) combinations of x bands (x=1,2,3, 4 for y=1 or x=1, 2 for y=2) LTE inter-band CA (xDL/1UL) and y bands NR inter-band CA (yDL/1UL)  (Release 18) | |
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Contents

Foreword 5

1 Scope 7

2 References 7

3 Definitions of terms, symbols and abbreviations 7

3.1 Terms 7

3.2 Symbols 7

3.3 Abbreviations 7

4 Background 7

4.1 TR maintenance 8

5 EN-DC Power Class 2: Specific Band Combination Part 8

5.1 DC\_1\_n79 8

5.1.1 Configuration for DC 8

5.1.2 Maximum output power for DC 8

5.1.3 REFSENS requirements for DC 8

5.1.4 ∆TIB and ∆RIB values 8

5.2 DC\_3\_n79 8

5.2.1 Configuration for DC 8

5.2.2 Maximum output power for DC 9

5.2.3 REFSENS requirements for DC 9

5.2.4 ∆TIB and ∆RIB values 9

5.3 DC\_19\_n79 9

5.3.1 Configuration for DC 9

5.3.2 Maximum output power for DC 9

5.3.3 REFSENS requirements for DC 9

5.3.4 ∆TIB and ∆RIB values 10

5.4 DC\_21\_n79 10

5.4.1 Configuration for DC 10

5.4.2 Maximum output power for DC 10

5.4.3 REFSENS requirements for DC 10

5.4.4 ∆TIB and ∆RIB values 11

5.5 DC\_1\_n77-n79 12

5.5.1 Configuration for DC 12

5.5.2 Maximum output power for DC 12

5.5.3 REFSENS requirements for DC 12

5.5.4 ∆TIB and ∆RIB values 12

5.6 DC\_3\_n77-n79 12

5.6.1 Configuration for DC 12

5.6.2 Maximum output power for DC 13

5.6.3 REFSENS requirements for DC 13

5.6.4 ∆TIB and ∆RIB values 13

5.7 DC\_21\_n77-n79 13

5.7.1 Configuration for DC 13

5.7.2 Maximum output power for DC 13

5.7.3 REFSENS requirements for DC 13

5.7.4 ∆TIB and ∆RIB values 14

5.8 DC\_1\_n78-n79 14

5.8.1 Configuration for DC 14

5.8.2 Maximum output power for DC 14

5.8.3 REFSENS requirements for DC 14

5.8.4 ∆TIB and ∆RIB values 15

5.9 DC\_3\_n78-n79 15

5.9.1 Configuration for DC 15

5.9.2 Maximum output power for DC 15

5.9.3 REFSENS requirements for DC 15

5.9.4 ∆TIB and ∆RIB values 16

5.10 DC\_21\_n78-n79 16

5.10.1 Configuration for DC 16

5.10.2 Maximum output power for DC 16

5.10.3 REFSENS requirements for DC 16

5.10.4 ∆TIB and ∆RIB values 17

5.11 DC\_1-21\_n77 17

5.11.1 Configuration for DC 17

5.11.2 Maximum output power for DC 17

5.11.3 REFSENS requirements for DC 17

5.11.4 ∆TIB and ∆RIB values 18

5.12 DC\_1-42\_n77 18

5.12.1 Configuration for DC 18

5.12.2 Maximum output power for DC 18

5.12.3 REFSENS requirements for DC 19

5.12.4 ∆TIB and ∆RIB values 19

5.13 DC\_3-21\_n77 19

5.13.1 Configuration for DC 19

5.13.2 Maximum output power for DC 19

5.13.3 REFSENS requirements for DC 19

5.13.4 ∆TIB and ∆RIB values 20

5.14 DC\_3-42\_n77 20

5.14.1 Configuration for DC 20

5.14.2 Maximum output power for DC 20

5.14.3 REFSENS requirements for DC 20

5.14.4 ∆TIB and ∆RIB values 21

5.15 DC\_21-42\_n77 21

5.15.1 Configuration for DC 21

5.15.2 Maximum output power for DC 21

5.15.3 REFSENS requirements for DC 21

5.15.4 ∆TIB and ∆RIB values 21

5.16 DC\_1\_n77 22

5.16.1 Configuration for DC 22

5.16.2 Maximum output power for DC 22

5.16.3 REFSENS requirements for DC 22

5.16.4 ∆TIB and ∆RIB values 23

5.17 DC\_3\_n77 23

5.17.1 Configuration for DC 23

5.17.2 Maximum output power for DC 23

5.17.3 REFSENS requirements for DC 23

5.17.4 ∆TIB and ∆RIB values 24

5.18 DC\_21\_n77 24

5.18.1 Configuration for DC 24

5.18.2 Maximum output power for DC 24

5.18.3 REFSENS requirements for DC 24

5.18.4 ∆TIB and ∆RIB values 25

5.19 DC\_21\_n78 25

5.19.1 Configuration for DC 25

5.19.2 Maximum output power for DC 25

5.19.3 REFSENS requirements for DC 25

5.19.4 ∆TIB and ∆RIB values 25

5.20 DC\_1-3\_n77 26

5.20.1 Configuration for DC 26

5.20.2 Maximum output power for DC 26

5.20.3 REFSENS requirements for DC 26

5.20.4 ∆TIB and ∆RIB values 27

Annex A - Change history 28

# 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 High power UE (power class m with 1<m<3) for a single FR1 band in UL of Dual Connectivity (DC) combinations of x bands (x=1,2,3, 4 for y=1 or x=1, 2 for y=2) LTE inter-band CA (xDL/1UL) and y bands NR inter-band CA (yDL/1UL) in the Rel-18 time frame. The purpose is to gather the relevant background information and studies to address relevant requirements for the Rel-18 EN-DC HPUE band combinations requested by proponents and captured in the WID.

# 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] RP-222660, “New WID on High power UE for FR1 for DC\_R18\_xBLTE\_yBNR\_zDLnUL”, RAN#97-e

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

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

## 3.2 Symbols

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

<symbol> <Explanation>

## 3.3 Abbreviations

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

<ABBREVIATION> <Expansion>

# 4 Background

The present document is a technical report for EN-DC HPUE band combinations in the Rel-18 timeframe. The document covers each band combination specific issues (i.e. one sub-clause defined per band combination)

## 4.1 TR maintenance

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

# 5 EN-DC Power Class 2: Specific Band Combination Part

### 5.1 DC\_1\_n79

#### 5.1.1 Configuration for DC

When requested EN-DC configuration is 2DL2UL, it is not needed to update the inter-band EN-DC configuration table. By referring to the maximum output power table, it can be checked whether these configurations support PC2. This band combination for PC3 is already specified in TS 38.101-3, so this section is omitted.

#### 5.1.2 Maximum output power for DC

**Table 5.1.2-1:** **Maximum output power for inter-band EN-DC (two bands)**

| EN-DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| --- | --- | --- | --- | --- |
| DC\_1A\_n79A | 266,8 | +2/-3 | 23 | +2/-3 |
| NOTE 6: The UE supports PC3 within E-UTRA cell group, and supports either PC3 or PC2 within NR cell group. Power class support within each individual cell group is signaled separately by the UE.  NOTE 8: The UE that supports PC3 within a TDD or FDD band and supports PC2 within a second TDD band may signal a [HigherPowerLimitCADC] capability whereby the maximum output power indicated in the table may be exceeded in accordance with sub-clause 6.2B.4.1.3. | | | | |

#### 5.1.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. For PC3 DC\_1\_n79, the co-existence study is provided in TR 37.863-01-01 [1]. Based on above,

* the 2nd, 3rd, 4th, and 5th order harmonic do not fall into Rx frequencies of band 1.
* the 2nd, 3rd, 4th, and 5th order harmonic mixing do not fall into Rx frequencies of band 1.
* the 2nd, 3rd, 4th, and 5th order IMD do not fall into Rx frequencies of band 1 and n79.

Therefore, there is no MSD issue for this DC configuration.

#### 5.1.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.2 DC\_3\_n79

#### 5.2.1 Configuration for DC

When requested EN-DC configuration is 2DL2UL, it is not needed to update the inter-band EN-DC configuration table. By referring to the maximum output power table, it can be checked whether these configurations support PC2. This band combination for PC3 is already specified in TS 38.101-3, so this section is omitted.

#### 5.2.2 Maximum output power for DC

**Table 5.2.2-1:** **Maximum output power for inter-band EN-DC (two bands)**

| EN-DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| --- | --- | --- | --- | --- |
| DC\_3A\_n79A | 266,8 | +2/-3 | 23 | +2/-3 |
| NOTE 6: The UE supports PC3 within E-UTRA cell group, and supports either PC3 or PC2 within NR cell group. Power class support within each individual cell group is signaled separately by the UE.  NOTE 8: The UE that supports PC3 within a TDD or FDD band and supports PC2 within a second TDD band may signal a [HigherPowerLimitCADC] capability whereby the maximum output power indicated in the table may be exceeded in accordance with sub-clause 6.2B.4.1.3. | | | | |

#### 5.2.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. For PC3 DC\_3\_n79, the co-existence study is provided in TR 37.863-01-01 [1]. Based on above,

* the 2nd, 3rd, 4th, and 5th order harmonic do not fall into Rx frequencies of band 3.
* the 2nd, 3rd, 4th, and 5th order harmonic mixing do not fall into Rx frequencies of band 3.
* the 2nd, 3rd, 4th, and 5th order IMD do not fall into Rx frequencies of band 3 and n79.

Therefore, there is no MSD issue for this DC configuration.

#### 5.2.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.3 DC\_19\_n79

#### 5.3.1 Configuration for DC

When requested EN-DC configuration is 2DL2UL, it is not needed to update the inter-band EN-DC configuration table. By referring to the maximum output power table, it can be checked whether these configurations support PC2. This band combination for PC3 is already specified in TS 38.101-3, so this section is omitted.

#### 5.3.2 Maximum output power for DC

**Table 5.3.2-1:** **Maximum output power for inter-band EN-DC (two bands)**

| EN-DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| --- | --- | --- | --- | --- |
| DC\_19A\_n79A | 266,8 | +2/-3 | 23 | +2/-3 |
| NOTE 6: The UE supports PC3 within E-UTRA cell group, and supports either PC3 or PC2 within NR cell group. Power class support within each individual cell group is signaled separately by the UE.  NOTE 8: The UE that supports PC3 within a TDD or FDD band and supports PC2 within a second TDD band may signal a [HigherPowerLimitCADC] capability whereby the maximum output power indicated in the table may be exceeded in accordance with sub-clause 6.2B.4.1.3. | | | | |

#### 5.3.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. For PC3 DC\_19\_n79, the co-existence study is provided in TR 37.863-01-01. [1] Based on above,

* the 5th order harmonic mixing may fall into Rx frequencies of band 19.
* the 2nd, 3rd, 4th, and 5th order harmonic do not fall into Rx frequencies of band 19.
* the 2nd, 3rd, and 4th order harmonic mixing do not fall into Rx frequencies of band 19.
* the 2nd, 3rd, 4th, and 5th order IMD do not fall into Rx frequencies of band 19 and n79.

For MSD due to 5th harmonic mixing, MSD value of PC2 case will be 3dB higher than that of PC3 case. New MSD values are shown in Table 5.3.3-1 below. Uplink configuration is shown in Table 5.3.3-2 below.

**Table 5.3.3-1:** **Reference sensitivity exceptions (MSD) due to receiver harmonic mixing for PC2 EN-DC in NR FR1**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA or NR Band / Channel bandwidth of the affected DL band / MSD | | | | | | | | | | | | |
| UL band | DL band | 5  MHz  (dB) | 10 MHz  (dB) | 15 MHz  (dB) | 20 MHz  (dB) | 25 MHz  (dB) | 40 MHz  (dB) | 50 MHz  (dB) | 60 MHz  (dB) | 80 MHz  (dB) | 90 MHz  (dB) | 100 MHz  (dB) |
| n79 | 191 | 32.5 | 29.5 | 27.7 |  |  |  |  |  |  |  |  |
| NOTE 1: The requirements should be verified for DL EARFCN of the victim (lower) band (superscript LB) such that  with  the DL carrier frequency in the lower band and the UL carrier frequency in the higher band, both in MHz. | | | | | | | | | | | | |

**Table 5.3.3-2:** **Uplink configuration for reference sensitivity exceptions due to receiver harmonic mixing for EN-DC in NR FR1**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA or NR Band / SCS / Channel bandwidth of the affected DL band / UL RB allocation of the agressor band | | | | | | | | | | | | | |
| UL band | DL band | SCS of UL band  (kHz) | 5 MHz  (LCRB) | 10 MHz  (LCRB) | 15 MHz  (LCRB) | 20 MHz  (LCRB) | 25 MHz  (LCRB) | 40 MHz  (LCRB) | 50 MHz  (LCRB) | 60 MHz  (LCRB) | 80 MHz  (LCRB) | 90 MHz  (LCRB) | 100 MHz  (LCRB) |
| n79 | 19 | 15 | 25 | 50 | 75 |  |  |  |  |  |  |  |  |

#### 5.3.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.4 DC\_21\_n79

#### 5.4.1 Configuration for DC

When requested EN-DC configuration is 2DL2UL, it is not needed to update the inter-band EN-DC configuration table. By referring to the maximum output power table, it can be checked whether these configurations support PC2. This band combination for PC3 is already specified in TS 38.101-3, so this section is omitted.

#### 5.4.2 Maximum output power for DC

**Table 5.4.2-1:** **Maximum output power for inter-band EN-DC (two bands)**

| EN-DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| --- | --- | --- | --- | --- |
| DC\_21A\_n79A | 266,8 | +2/-3 | 23 | +2/-3 |
| NOTE 6: The UE supports PC3 within E-UTRA cell group, and supports either PC3 or PC2 within NR cell group. Power class support within each individual cell group is signaled separately by the UE.  NOTE 8: The UE that supports PC3 within a TDD or FDD band and supports PC2 within a second TDD band may signal a [HigherPowerLimitCADC] capability whereby the maximum output power indicated in the table may be exceeded in accordance with sub-clause 6.2B.4.1.3. | | | | |

#### 5.4.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. For PC3 DC\_21\_n79, the co-existence study is provided in TR 37.863-01-01. [1] Based on above,

* the 3rd order harmonic mixing may fall into Rx frequencies of band 21.
* the 3rd order IMD may fall into Rx frequencies of band 21.
* the 2nd, 3rd, 4th, and 5th order harmonic do not fall into Rx frequencies of band 21.
* the 2nd, 4th, and 5th order harmonic mixing do not fall into Rx frequencies of band 21.
* the 2nd, 4th, and 5th order IMD do not fall into Rx frequencies of band 21 and n79.

For MSD due to 3rd harmonic mixing, MSD value of PC2 case will be 3dB higher than that of PC3 case. New MSD values are shown in Table 5.4.3-1 below. Uplink configuration is shown in Table 5.4.3-2 below.

For MSD due to 3rd IMD, the MSD value can be seen as dB related to 1st order proportional of n79 UL power + 2nd order proportional of B21 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. In addition, PSD will be 6dB higher when UL CBW of n79 is changed from 40MHz to 10MHz. Based on these, B21 UL power of PC2 case is 3dB higher than that of PC3 case, and n79 UL power of PC2 case is 9dB higher than that of PC3 case. Therefore, MSD value of PC2 case will be 15dB higher than that of PC3 case. New MSD values are shown in Table 5.4.3-3 below.

**Table 5.4.3-1:** **Reference sensitivity exceptions (MSD) due to receiver harmonic mixing for PC2 EN-DC in NR FR1**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA or NR Band / Channel bandwidth of the affected DL band / MSD | | | | | | | | | | | | |
| UL band | DL band | 5  MHz  (dB) | 10 MHz  (dB) | 15 MHz  (dB) | 20 MHz  (dB) | 25 MHz  (dB) | 40 MHz  (dB) | 50 MHz  (dB) | 60 MHz  (dB) | 80 MHz  (dB) | 90 MHz  (dB) | 100 MHz  (dB) |
| n79 | 213 | 42.3 | 39.3 | 37.5 |  |  |  |  |  |  |  |  |
| NOTE 3: The requirements should be verified for DL EARFCN or NR ARFCN of the victim (lower) band (superscript LB) such that  with   the DL carrier frequency in the lower band and the UL carrier frequency in the higher band, both in MHz. | | | | | | | | | | | | |

**Table 5.4.3-2:** **Uplink configuration for reference sensitivity exceptions due to receiver harmonic mixing for EN-DC in NR FR1**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA or NR Band / SCS / Channel bandwidth of the affected DL band / UL RB allocation of the agressor band | | | | | | | | | | | | | |
| UL band | DL band | SCS of UL band  (kHz) | 5 MHz  (LCRB) | 10 MHz  (LCRB) | 15 MHz  (LCRB) | 20 MHz  (LCRB) | 25 MHz  (LCRB) | 40 MHz  (LCRB) | 50 MHz  (LCRB) | 60 MHz  (LCRB) | 80 MHz  (LCRB) | 90 MHz  (LCRB) | 100 MHz  (LCRB) |
| n79 | 21 | 15 | 25 | 50 | 75 |  |  |  |  |  |  |  |  |

**Table 5.4.3-3:** **MSD test points for PCell due to dual uplink operation for PC2 EN-DC in NR FR1 (two bands)**

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC  Configuration | EUTRA or NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_21A\_n79A | 21 | 1457.5 | 5 | 25 | 1505.5 | 33.4 | IMD3 |
|  | n79 | 4420.5 | 10 | 50 | 4420.5 | N/A | N/A |

#### 5.4.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.5 DC\_1\_n77-n79

#### 5.5.1 Configuration for DC

Table 5.5.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A\_n77A-n79A14,X | DC\_1A\_n77A14  DC\_1A\_n79A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE X: The minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n77-n79 NR carriers. This restriction applies also for these carriers when applicable EN-DC configuration is part of a higher order configuration. | |

#### 5.5.2 Maximum output power for DC

Based on studies of PC2 DC\_1\_n77 and PC2 DC\_1\_n79, this section can be omitted.

#### 5.5.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_1\_n77 and DC\_1\_n79 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 3rd, 4th, and 5th order IMD generated by dual uplink of band 1 and band n77 may also fall into own Rx of band n79.
* the 5th order IMD generated by dual uplink of band 1 and band n79 may also fall into own Rx of band n77.

However, IMD will not be an issue because the minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n77-n79 NR carriers. Therefore, there is no MSD issue for this DC configuration.

#### 5.5.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.6 DC\_3\_n77-n79

#### 5.6.1 Configuration for DC

Table 5.6.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_3A\_n77A-n79A14,X | DC\_3A\_n77A14  DC\_3A\_n79A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE X: The minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n77-n79 NR carriers. This restriction applies also for these carriers when applicable EN-DC configuration is part of a higher order configuration. | |

#### 5.6.2 Maximum output power for DC

Based on studies of PC2 DC\_3\_n77 and PC2 DC\_3\_n79, this section can be omitted.

#### 5.6.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_3\_n77 and DC\_3\_n79 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 3rd and 4th order IMD generated by dual uplink of band 3 and band n77 may also fall into own Rx of band n79.
* the 5th order IMD generated by dual uplink of band 3 and band n79 may also fall into own Rx of band n77.

However, IMD will not be an issue because the minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n77-n79 NR carriers. Therefore, there is no MSD issue for this DC configuration.

#### 5.6.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.7 DC\_21\_n77-n79

#### 5.7.1 Configuration for DC

Table 5.7.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_21A\_n77A-n79A14,X | DC\_21A\_n77A14  DC\_21A\_n79A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE X: The minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n77-n79 NR carriers. This restriction applies also for these carriers when applicable EN-DC configuration is part of a higher order configuration. | |

#### 5.7.2 Maximum output power for DC

Based on studies of PC2 DC\_21\_n77 and PC2 DC\_21\_n79, this section can be omitted.

#### 5.7.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_21\_n77 and DC\_21\_n79 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 2nd and 4th order IMD generated by dual uplink of band 21 and band n77 may also fall into own Rx of band n79.
* the 2nd order IMD generated by dual uplink of band 21 and band n79 may also fall into own Rx of band n77.

However, IMD will not be an issue because the minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n77-n79 NR carriers. Therefore, there is no MSD issue for this DC configuration.

#### 5.7.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.8 DC\_1\_n78-n79

#### 5.8.1 Configuration for DC

Table 5.8.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A\_n78A-n79A14,X | DC\_1A\_n78A14  DC\_1A\_n79A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE X: For UEs supporting band n77, the minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n78-n79 NR carriers. This restriction applies also for these carriers when applicable EN-DC configuration is part of a higher order configuration. | |

#### 5.8.2 Maximum output power for DC

Based on studies of PC2 DC\_1\_n78 and PC2 DC\_1\_n79, this section can be omitted.

#### 5.8.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_1\_n78 and DC\_1\_n79 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 3rd and 5th order IMD generated by dual uplink of band 1 and band n78 may also fall into own Rx of band n79.
* the 5th order IMD generated by dual uplink of band 1 and band n79 may also fall into own Rx of band n78.

For MSD due to 3rd order IMD generated by dual uplink of band 1 and band n78, the MSD value can be seen as dB related to 1st order proportional of band 1 UL power + 2nd order proportional of band n78 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 9dB higher than that of PC3 case. New MSD value is shown in Table 5.8.3-1 below.

Also, For MSD due to 5th order IMD generated by dual uplink of band 1 and band n79, the MSD value can be seen as dB related to 4th order proportional of band 1 UL power + 1st order proportional of band n79 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. In addition, PSD will be 6dB higher when UL CBW of n79 is changed from 40MHz to 10MHz. Therefore, MSD value of PC2 case will be 18dB higher than that of PC3 case. New MSD value is shown in Table 5.8.3-1 below.

Table 5.8.3-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_1A\_n78A-n79A | 1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
|  | n78 | 3410 | 10 | 50 | 3410 | N/A | N/A |
|  | n79 | 4870 | 10 | 50 | 4870 | 24.9 | IMD31 |
|  | 1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
|  | n78 | 3490 | 10 | 50 | 3490 | 22.6 | IMD5 |
|  | n79 | 4670 | 10 | 50 | 4670 | N/A | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

#### 5.8.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.9 DC\_3\_n78-n79

#### 5.9.1 Configuration for DC

Table 5.9.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_3A\_n78A-n79A14,X | DC\_3A\_n78A14  DC\_3A\_n79A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE X: For UEs supporting band n77, the minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n78-n79 NR carriers. This restriction applies also for these carriers when applicable EN-DC configuration is part of a higher order configuration. | |

#### 5.9.2 Maximum output power for DC

Based on studies of PC2 DC\_3\_n78 and PC2 DC\_3\_n79, this section can be omitted.

#### 5.9.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_3\_n78 and DC\_3\_n79 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 3rd order IMD generated by dual uplink of band 3 and band n78 may also fall into own Rx of band n79.
* the 5th order IMD generated by dual uplink of band 3 and band n79 may also fall into own Rx of band n78.

For MSD due to 3rd order IMD generated by dual uplink of band 3 and band n78, the MSD value can be seen as dB related to 1st order proportional of band 3 UL power + 2nd order proportional of band n78 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 9dB higher than that of PC3 case. New MSD value is shown in Table 5.9.3-1 below.

Also, For MSD due to 5th order IMD generated by dual uplink of band 1 and band n79, the MSD value can be seen as dB related to 3rd order proportional of band 1 UL power + 2nd order proportional of band n79 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. In addition, PSD will be 6dB higher when UL CBW of n79 is changed from 40MHz to 10MHz. Therefore, MSD value of PC2 case will be 21dB higher than that of PC3 case. New MSD value is shown in Table 5.9.3-1 below.

Table 5.9.3-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A\_n78A-n79A | 3 | 1770 | 5 | 25 | 1865 | N/A | N/A |
|  | n78 | 3340 | 10 | 50 | 3340 | N/A | N/A |
|  | n79 | 4910 | 10 | 50 | 4910 | 25.3 | IMD3 |
|  | 3 | 1770 | 5 | 25 | 1865 | N/A | N/A |
|  | n78 | 3710 | 10 | 50 | 3710 | 25.2 | IMD5 |
|  | n79 | 4510 | 10 | 50 | 4510 | N/A | N/A |

#### 5.9.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.10 DC\_21\_n78-n79

#### 5.10.1 Configuration for DC

Table 5.10.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_21A\_n78A-n79A14,X | DC\_21A\_n78A14  DC\_21A\_n79A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE X: For UEs supporting band n77, the minimum requirements apply only when there is non-simultaneous Rx/Tx operation between n78-n79 NR carriers. This restriction applies also for these carriers when applicable EN-DC configuration is part of a higher order configuration. | |

#### 5.10.2 Maximum output power for DC

Based on studies of PC2 DC\_21\_n78 and PC2 DC\_21\_n79, this section can be omitted.

#### 5.10.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_21\_n78 and DC\_21\_n79 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 2nd and 4th order IMD generated by dual uplink of band 21 and band n78 may also fall into own Rx of band n79.
* the 2nd order IMD generated by dual uplink of band 21 and band n79 may also fall into own Rx of band n78.

For MSD due to 2nd order IMD generated by dual uplink of band 21 and band n78, the MSD value can be seen as dB related to 1st order proportional of band 21 UL power + 1st order proportional of band n78 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 6dB higher than that of PC3 case. New MSD value is shown in Table 5.10.3-1 below.

Also, For MSD due to 2nd order IMD generated by dual uplink of band 21 and band n79, the MSD value can be seen as dB related to 1st order proportional of band 21 UL power + 1st order proportional of band n79 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. In addition, PSD will be 6dB higher when UL CBW of n79 is changed from 40MHz to 10MHz. Therefore, MSD value of PC2 case will be 9dB higher than that of PC3 case. New MSD value is shown in Table 5.10.3-1 below.

Table 5.10.3-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_21A\_n78A-n79A | 21 | 1453 | 5 | 25 | 1501 | N/A | N/A |
|  | n78 | 3420 | 10 | 50 | 3420 | N/A | N/A |
|  | n79 | 4873 | 10 | 50 | 4873 | 36.1 | IMD25 |
|  | 21 | 1453 | 5 | 25 | 1501 | N/A | N/A |
|  | n78 | 3487 | 10 | 50 | 3487 | 38.8 | IMD2 |
|  | n79 | 4940 | 10 | 50 | 4940 | N/A | N/A |
| NOTE 5: This band is subject to IMD4 also which MSD is not specified. | | | | | | | |

#### 5.10.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.11 DC\_1-21\_n77

#### 5.11.1 Configuration for DC

Table 5.11.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-21A\_n77A5,14 | DC\_1A\_n77A14  DC\_21A\_n77A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 5: Applicable for UE supporting inter-band EN-DC with mandatory simultaneous Rx/Tx capability  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations. | |

#### 5.11.2 Maximum output power for DC

Based on studies of PC2 DC\_1\_n77 and PC2 DC\_21\_n77, this section can be omitted.

#### 5.11.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_1\_n77 and DC\_21\_n77 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 2nd and 5th order IMD generated by dual uplink of band 1 and band n77 may also fall into own Rx of band 21.
* the 2nd and 5th order IMD generated by dual uplink of band 21 and band n77 may also fall into own Rx of band 1.

Considering that Band 21 is currently operated only by a certain operator in Japan, the frequency range can be limited as Band 1 UL/DL = 1940-1960/2130-2150 MHz and Band n77 UL/DL = 3600-4200/3600-4200 MHz. Then own Rx impact can be simplified as below.

* the 5th order IMD generated by dual uplink of band 1 and band n77 may also fall into own Rx of band 21.
* the 2nd and 5th order IMD generated by dual uplink of band 21 and band n77 may also fall into own Rx of band 1.

For MSD due to 5th order IMD generated by dual uplink of band 1 and band n77, the MSD value can be seen as dB related to 3rd order proportional of band 1 UL power + 2nd order proportional of band n77 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 15dB higher than that of PC3 case. New MSD value is shown in Table 5.11.3-1 below.

Also, For MSD due to 2nd order IMD generated by dual uplink of band 21 and band n77, the MSD value can be seen as dB related to 1st order proportional of band 21 UL power + 1st order proportional of band n77 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 6dB higher than that of PC3 case. New MSD value is shown in Table 5.11.3-1 below.

Table 5.11.3-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_1A-21A\_n77A | 1 | N/A | N/A | N/A | N/A | N/A | N/A |
|  | 21 | N/A | N/A | N/A | N/A | N/A | IMD2 |
|  | n77 | N/A | N/A | N/A | N/A | N/A | N/A |
|  | 1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
|  | 21 | 1452 | 5 | 25 | 1500 | 17.9 | IMD5 |
|  | n77 | 3605 | 10 | 50 | 3605 | N/A | N/A |
|  | 1 | 1964.6 | 5 | 25 | 2154.6 | 36.6 | IMD21 |
|  | 21 | 1450.4 | 5 | 25 | 1498.4 | N/A | N/A |
|  | n77 | 3605 | 10 | 50 | 3605 | N/A | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

#### 5.11.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.12 DC\_1-42\_n77

#### 5.12.1 Configuration for DC

Table 5.12.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-42A\_n77A14,15,16  DC\_1A-42C\_n77A14,15,16  DC\_1A-42D\_n77A14,15,16  DC\_1A-42E\_n77A14,15,16 | DC\_1A\_n77A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE 15: For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, the minimum requirements for intra-band non-contiguous EN-DC apply for the Band 42/48 and Band n77/n78 combination and for the Band 2 and Band n25 combinations. For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, when UE capability *interBandContiguousMRDC* is indicated, the minimum requirements for intra-band-contiguous EN-DC also should be met in addtion to intra-band non-contiguous EN-DC*.*  NOTE 16: For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, the minimum requirements for inter-band EN-DC apply when the maximum power spectral density imbalance between downlink carriers contained in overlapping or partially overlapping DL bands is within 6 dB. | |

#### 5.12.2 Maximum output power for DC

Based on studies of PC2 DC\_1\_n77, this section can be omitted.

#### 5.12.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_1\_n77 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 4th and 5th order IMD generated by dual uplink of band 1 and band n77 may also fall into own Rx of band 42.

However, IMD will not be an issue because there is non-simultaneous Rx/Tx operation between band 42 and band n77. Therefore, there is no MSD issue for this DC configuration.

#### 5.12.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.13 DC\_3-21\_n77

#### 5.13.1 Configuration for DC

Table 5.13.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_3A-21A\_n77A5,14 | DC\_3A\_n77A14  DC\_21A\_n77A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 5: Applicable for UE supporting inter-band EN-DC with mandatory simultaneous Rx/Tx capability  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations. | |

#### 5.13.2 Maximum output power for DC

Based on studies of PC2 DC\_3\_n77 and PC2 DC\_21\_n77, this section can be omitted.

#### 5.13.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_3\_n77 and DC\_21\_n77 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 4th and 5th order IMD generated by dual uplink of band 3 and band n77 may also fall into own Rx of band 21.
* the 2nd and 5th order IMD generated by dual uplink of band 21 and band n77 may also fall into own Rx of band 3.

Considering that Band 21 is currently operated only by a certain operator in Japan, the frequency range can be limited as Band n77 UL/DL = 3600-4200/3600-4200 MHz. Therefore, own Rx impact can be simplified as below.

* the 4th order IMD generated by dual uplink of band 3 and band n77 may also fall into own Rx of band 21.
* the 5th order IMD generated by dual uplink of band 21 and band n77 may also fall into own Rx of band 3.

For MSD due to 4th order IMD generated by dual uplink of band 3 and band n77, the MSD value can be seen as dB related to 3rd order proportional of band 3 UL power + 1st order proportional of band n77 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 12dB higher than that of PC3 case. New MSD value is shown in Table 5.13.3-1 below.

Also, For MSD due to 5th order IMD generated by dual uplink of band 21 and band n77, the MSD value can be seen as dB related to 4th order proportional of band 21 UL power + 1st order proportional of band n77 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 15dB higher than that of PC3 case. New MSD value is shown in Table 5.13.3-1 below.

Table 5.13.3-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A-21A\_n77A | 3 | 1767.5 | 5 | 25 | 1862.5 | N/A | N/A |
|  | 21 | 1459.5 | 5 | 25 | 1507.5 | 20.8 | IMD4 |
|  | n77 | 3795 | 10 | 50 | 3795 | N/A | N/A |
|  | 3 | N/A | N/A | N/A | N/A | N/A | IMD2 |
|  | 21 | N/A | N/A | N/A | N/A | N/A | N/A |
|  | n77 | N/A | N/A | N/A | N/A | N/A | N/A |
|  | 3 | 1771.6 | 5 | 25 | 1866.6 | 18.4 | IMD5 |
|  | 21 | 1450.4 | 5 | 25 | 1498.4 | N/A | N/A |
|  | n77 | 3935 | 10 | 50 | 3935 | N/A | N/A |

#### 5.13.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.14 DC\_3-42\_n77

#### 5.14.1 Configuration for DC

Table 5.14.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_3A-42A\_n77A14,15,16  DC\_3A-42C\_n77A14,15,16  DC\_3A-42D\_n77A14,15,16  DC\_3A-42E\_n77A14,15,16 | DC\_3A\_n77A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE 15: For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, the minimum requirements for intra-band non-contiguous EN-DC apply for the Band 42/48 and Band n77/n78 combination and for the Band 2 and Band n25 combinations. For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, when UE capability *interBandContiguousMRDC* is indicated, the minimum requirements for intra-band-contiguous EN-DC also should be met in addtion to intra-band non-contiguous EN-DC*.*  NOTE 16: For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, the minimum requirements for inter-band EN-DC apply when the maximum power spectral density imbalance between downlink carriers contained in overlapping or partially overlapping DL bands is within 6 dB. | |

#### 5.14.2 Maximum output power for DC

Based on studies of PC2 DC\_3\_n77, this section can be omitted.

#### 5.14.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_3\_n77 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 4th and 5th order IMD generated by dual uplink of band 3 and band n77 may also fall into own Rx of band 42.

However, IMD will not be an issue because there is non-simultaneous Rx/Tx operation between band 42 and band n77. Therefore, there is no MSD issue for this DC configuration.

#### 5.14.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.15 DC\_21-42\_n77

#### 5.15.1 Configuration for DC

Table 5.15.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_21A-42A\_n77A14,15,16  DC\_21A-42C\_n77A14,15,16 | DC\_21A\_n77A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations.  NOTE 15: For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, the minimum requirements for intra-band non-contiguous EN-DC apply for the Band 42/48 and Band n77/n78 combination and for the Band 2 and Band n25 combinations. For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, when UE capability *interBandContiguousMRDC* is indicated, the minimum requirements for intra-band-contiguous EN-DC also should be met in addtion to intra-band non-contiguous EN-DC*.*  NOTE 16: For UEs not indicating *interBandMRDC-WithOverlapDL-Bands-r16*, the minimum requirements for inter-band EN-DC apply when the maximum power spectral density imbalance between downlink carriers contained in overlapping or partially overlapping DL bands is within 6 dB. | |

#### 5.15.2 Maximum output power for DC

Based on studies of PC2 DC\_21\_n77, this section can be omitted.

#### 5.15.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_21\_n77 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 5th order IMD generated by dual uplink of band 21 and band n77 may also fall into own Rx of band 42.

However, IMD will not be an issue because there is non-simultaneous Rx/Tx operation between band 42 and band n77. Therefore, there is no MSD issue for this DC configuration.

#### 5.15.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.16 DC\_1\_n77

#### 5.16.1 Configuration for DC

When requested EN-DC configuration is 2DL2UL, it is not needed to update the inter-band EN-DC configuration table. By referring to the maximum output power table, it can be checked whether these configurations support PC2. This band combination for PC3 is already specified in TS 38.101-3 [2], so this section is omitted.

#### 5.16.2 Maximum output power for DC

**Table 5.16.2-1:** **Maximum output power for inter-band EN-DC (two bands)**

| EN-DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| --- | --- | --- | --- | --- |
| DC\_1A\_n77A | 266,8 | +2/-3 | 23 | +2/-3 |
| NOTE 6: The UE supports PC3 within E-UTRA cell group, and supports either PC3 or PC2 within NR cell group. Power class support within each individual cell group is signaled separately by the UE.  NOTE 8: The UE that supports PC3 within a TDD or FDD band and supports PC2 within a second TDD band may signal a [HigherPowerLimitCADC] capability whereby the maximum output power indicated in the table may be exceeded in accordance with sub-clause 6.2B.4.1.3. | | | | |

#### 5.16.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. For PC3 DC\_1\_n77, the co-existence study is provided in TR 37.863-01-01 [3]. Based on above,

* the 2nd, 4th, and 5th order IMD may impact the Rx frequencies of band 1.
* the 4th and 5th order IMD may impact the Rx frequencies of band n77.
* the 2nd, 3rd, 4th, and 5th order harmonic from PC2 UL band n77 do not fall into Rx frequencies of band 1.
* the 2nd, 3rd, 4th, and 5th order harmonic mixing from PC2 UL band n77 do not impact the Rx frequencies of band 1.
* the 3rd order IMD do not impact the Rx frequencies of band 1.
* the 2nd and 3rd order IMD do not impact the Rx frequencies of band n77.

It should be noted that IMD will not be an issue for band n77 (no self-interference for the TDD band) even through the IMD products may impact the concerning band.

For MSD due to 2nd order IMD, the MSD value can be seen as dB related to 1st order proportional of band 1 UL power + 1st order proportional of band n77 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 6dB higher than that of PC3 case.

For MSD due to 4th order IMD, MSD value for PC2 DC\_1A\_n77A can reuse the value for PC2 DC\_1A\_n78A already specified in TS 38.101-3.

New MSD values are shown in Table 5.16.3-1 below.

**Table 5.16.3-1: MSD test points for PCell due to dual uplink operation for PC2 EN-DC in NR FR1 (two bands)**

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC  Configuration | EUTRA or NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_1A\_n77A | 1 | 1950 | 5 | 25 | 2140 | 35.8 | IMD21 |
|  | n77 | 4090 | 10 | 50 | 4090 | N/A | N/A |
|  | 1 | 1950 | 5 | 25 | 2140 | 17.8 | IMD41 |
|  | n77 | 3710 | 10 | 50 | 3710 | N/A | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

#### 5.16.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.17 DC\_3\_n77

#### 5.17.1 Configuration for DC

When requested EN-DC configuration is 2DL2UL, it is not needed to update the inter-band EN-DC configuration table. By referring to the maximum output power table, it can be checked whether these configurations support PC2. This band combination for PC3 is already specified in TS 38.101-3 [2], so this section is omitted.

#### 5.17.2 Maximum output power for DC

**Table 5.17.2-1:** **Maximum output power for inter-band EN-DC (two bands)**

| EN-DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| --- | --- | --- | --- | --- |
| DC\_3A\_n77A | 266,8 | +2/-3 | 23 | +2/-3 |
| NOTE 6: The UE supports PC3 within E-UTRA cell group, and supports either PC3 or PC2 within NR cell group. Power class support within each individual cell group is signaled separately by the UE.  NOTE 8: The UE that supports PC3 within a TDD or FDD band and supports PC2 within a second TDD band may signal a [HigherPowerLimitCADC] capability whereby the maximum output power indicated in the table may be exceeded in accordance with sub-clause 6.2B.4.1.3. | | | | |

#### 5.17.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. For PC3 DC\_3\_n77, the co-existence study is provided in TR 37.863-01-01 [3]. Based on above,

* the 2nd order harmonic mixing from PC2 UL band n77 may impact the Rx frequencies of band 3.
* the 2nd, 4th and 5th order IMD may impact the Rx frequencies of band 3.
* the 4th and 5th order IMD may impact the Rx frequencies of band n77.
* the 2nd, 3rd, 4th, and 5th order harmonic from PC2 UL band n77 do not fall into Rx frequencies of band 3.
* the 3rd, 4th, and 5th order harmonic mixing from PC2 UL band n77 do not impact the Rx frequencies of band 3.
* the 3rd order IMD do not impact the Rx frequencies of band 3.
* the 2nd and 3rd order IMD do not impact the Rx frequencies of band n77.

It should be noted that IMD will not be an issue for band n77 (no self-interference for the TDD band) even through the IMD products may impact the concerning band.

For MSD due to 2nd order harmonic mixing, MSD value of PC2 case will be 3dB higher than that of PC3 case. However, the MSD value is updated to match re-analysed value in R4-2301133 [4] when the channel bandwidth of UL n77 is 5MHz. New MSD values are shown in Table 5.17.3-1 below. Uplink configuration is shown in Table 5.17.3-2 below.

For MSD due to 2nd order IMD and 4th order IMD, MSD values for PC2 DC\_3A\_n77A can reuse the values for PC2 DC\_3A\_n78A already specified in TS 38.101-3. MSD value is shown in Table 5.17.3-3 below.

Table 5.17.3-1: Reference sensitivity exceptions (MSD) due to receiver harmonic mixing for PC2 EN-DC in NR FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA or NR Band / Channel bandwidth of the affected DL band / MSD | | | | | | | | | | | | |
| UL band | DL band | 5  MHz  (dB) | 10 MHz  (dB) | 15 MHz  (dB) | 20 MHz  (dB) | 25 MHz  (dB) | 40 MHz  (dB) | 50 MHz  (dB) | 60 MHz  (dB) | 80 MHz  (dB) | 90 MHz  (dB) | 100 MHz  (dB) |
| n77 | 3 | 8.1 | 7.0 | 6.0 | 5.7 |  |  |  |  |  |  |  |

Table 5.17.3-2: Uplink configuration for reference sensitivity exceptions due to receiver harmonic mixing for EN-DC in NR FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA or NR Band / SCS / Channel bandwidth of the affected DL band / UL RB allocation of the agressor band | | | | | | | | | | | | | |
| UL band | DL band | SCS of UL band  (kHz) | 5 MHz  (LCRB) | 10 MHz  (LCRB) | 15 MHz  (LCRB) | 20 MHz  (LCRB) | 25 MHz  (LCRB) | 40 MHz  (LCRB) | 50 MHz  (LCRB) | 60 MHz  (LCRB) | 80 MHz  (LCRB) | 90 MHz  (LCRB) | 100 MHz  (LCRB) |
| n77 | 3 | 15 | 25 | 50 | 75 | 100 |  |  |  |  |  |  |  |

**Table 5.17.3-3: MSD test points for PCell due to dual uplink operation for PC2 EN-DC in NR FR1 (two bands)**

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC  Configuration | EUTRA or NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_3A\_n77A | 3 | 1740 | 5 | 25 | 1835 | 31.9 | IMD21 |
|  | n77 | 3575 | 10 | 50 | 3575 | N/A | N/A |
|  | 3 | 1765 | 5 | 25 | 1860 | 18.5 | IMD41 |
|  | n77 | 3435 | 10 | 50 | 3435 | N/A | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

#### 5.17.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.18 DC\_21\_n77

#### 5.18.1 Configuration for DC

When requested EN-DC configuration is 2DL2UL, it is not needed to update the inter-band EN-DC configuration table. By referring to the maximum output power table, it can be checked whether these configurations support PC2. This band combination for PC3 is already specified in TS 38.101-3 [2], so this section is omitted.

#### 5.18.2 Maximum output power for DC

**Table 5.18.2-1:** **Maximum output power for inter-band EN-DC (two bands)**

| EN-DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| --- | --- | --- | --- | --- |
| DC\_21A\_n77A | 266,8 | +2/-3 | 23 | +2/-3 |
| NOTE 6: The UE supports PC3 within E-UTRA cell group, and supports either PC3 or PC2 within NR cell group. Power class support within each individual cell group is signaled separately by the UE.  NOTE 8: The UE that supports PC3 within a TDD or FDD band and supports PC2 within a second TDD band may signal a [HigherPowerLimitCADC] capability whereby the maximum output power indicated in the table may be exceeded in accordance with sub-clause 6.2B.4.1.3. | | | | |

#### 5.18.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. For PC3 DC\_21\_n77, the co-existence study is provided in TR 37.863-01-01 [3]. Based on above,

* the 4th and 5th order IMD may impact the Rx frequencies of band n77.
* the 2nd, 3rd, 4th, and 5th order harmonic from PC2 UL band n77 do not fall into Rx frequencies of band 21.
* the 2nd, 3rd, 4th, and 5th order harmonic mixing from PC2 UL band n77 do not impact the Rx frequencies of band 21.
* the 2nd, 3rd, 4th, and 5th order IMD do not impact the Rx frequencies of band 21.
* the 2nd and 3rd order IMD do not impact the Rx frequencies of band n77.

It should be noted that IMD will not be an issue for band n77 (no self-interference for the TDD band) even through the IMD products may impact the concerning band. Therefore, there is no MSD issue for this DC configuration.

#### 5.18.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.19 DC\_21\_n78

#### 5.19.1 Configuration for DC

When requested EN-DC configuration is 2DL2UL, it is not needed to update the inter-band EN-DC configuration table. By referring to the maximum output power table, it can be checked whether these configurations support PC2. This band combination for PC3 is already specified in TS 38.101-3 [2], so this section is omitted.

#### 5.19.2 Maximum output power for DC

**Table 5.19.2-1:** **Maximum output power for inter-band EN-DC (two bands)**

| EN-DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| --- | --- | --- | --- | --- |
| DC\_21A\_n78A | 266,8 | +2/-3 | 23 | +2/-3 |
| NOTE 6: The UE supports PC3 within E-UTRA cell group, and supports either PC3 or PC2 within NR cell group. Power class support within each individual cell group is signaled separately by the UE.  NOTE 8: The UE that supports PC3 within a TDD or FDD band and supports PC2 within a second TDD band may signal a [HigherPowerLimitCADC] capability whereby the maximum output power indicated in the table may be exceeded in accordance with sub-clause 6.2B.4.1.3. | | | | |

#### 5.19.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. For PC3 DC\_21\_n78, the co-existence study is provided in TR 37.863-01-01 [3]. Based on above,

* the 4th order IMD may impact the Rx frequencies of band n78.
* the 2nd, 3rd, 4th, and 5th order harmonic from PC2 UL band n78 do not fall into Rx frequencies of band 21.
* the 2nd, 3rd, 4th, and 5th order harmonic mixing from PC2 UL band n78 do not impact the Rx frequencies of band 21.
* the 2nd, 3rd, 4th, and 5th order IMD do not impact the Rx frequencies of band 21.
* the 2nd, 3rd, and 5th order IMD do not impact the Rx frequencies of band n78.

It should be noted that IMD will not be an issue for band n78 (no self-interference for the TDD band) even through the IMD products may impact the concerning band. Therefore, there is no MSD issue for this DC configuration.

#### 5.19.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

### 5.20 DC\_1-3\_n77

#### 5.20.1 Configuration for DC

Table 5.20.1-1: Inter-band EN-DC configurations within FR1 (three bands)

| **EN-DC**  **configuration** | **Uplink EN-DC**  **configuration**  **(NOTE 1)** |
| --- | --- |
| DC\_1A-3A\_n77A5,14 | DC\_1A\_n77A14  DC\_3A\_n77A14 |
| NOTE 1: Uplink EN-DC configurations are the configurations supported by the present release of specifications.  NOTE 5: Applicable for UE supporting inter-band EN-DC with mandatory simultaneous Rx/Tx capability  NOTE 14: PC3 or PC2 Uplink EN-DC configuration is applicable to EN-DC configurations. | |

#### 5.20.2 Maximum output power for DC

Based on studies of PC2 DC\_1\_n77 and PC2 DC\_3\_n77, this section can be omitted.

#### 5.20.3 REFSENS requirements for DC

Analysis of REFSENS exceptions or MSD requirements is needed due to higher power UL DC. Based on co-existence studies of DC\_1\_n77 and DC\_3\_n77 captured in TR 37.863-01-01 [2], own Rx impact of the 3rd band is the followings.

* the 2nd, 4th, and 5th order IMD generated by dual uplink of band 1 and band n77 may also impact the own Rx of band 3.
* the 2nd and 5th order IMD generated by dual uplink of band 3 and band n77 may also impact the own Rx of band 1.

For MSD due to 2nd order IMD generated by dual uplink of band 1 and band n77, the MSD value can be seen as dB related to 1st order proportional of band 1 UL power + 1st order proportional of band n77 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 6dB higher than that of PC3 case. New MSD value is shown in Table 5.20.3-1 below.

For MSD due to 4th order IMD generated by dual uplink of band 1 and band n77, the MSD value can be seen as dB related to 3rd order proportional of band 1 UL power + 1st order proportional of band n77 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 12dB higher than that of PC3 case. New MSD value is shown in Table 5.20.3-1 below.

For MSD due to 2nd order IMD generated by dual uplink of band 3 and band n77, the MSD value can be seen as dB related to 1st order proportional of band 3 UL power + 1st order proportional of band n77 UL power. PC3 DC is assumed to be 20dBm+20dBm and PC2 DC is assumed to be 23dBm+23dBm. Therefore, MSD value of PC2 case will be 6dB higher than that of PC3 case. New MSD value is shown in Table 5.20.3-1 below.

Table 5.20.3-1: MSD test points for Scell due to dual uplink operation for EN-DC in NR FR1 (three bands)

| NR or E-UTRA Band / Channel bandwidth / NRB / MSD | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| EN-DC Configuration | EUTRA / NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| DC\_1A-3A\_n77A | 1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
|  | 3 | 1712.5 | 5 | 25 | 1807.5 | 37.5 | IMD21 |
|  | n77 | 3757.5 | 10 | 50 | 3757.5 | N/A | N/A |
|  | 1 | 1950 | 5 | 25 | 2140 | N/A | N/A |
|  | 3 | 1775 | 5 | 25 | 1870 | 20.5 | IMD41 |
|  | n77 | 3980 | 10 | 50 | 3980 | N/A | N/A |
|  | 1 | 1950 | 5 | 25 | 2140 | 37.0 | IMD21 |
|  | 3 | 1775 | 5 | 25 | 1870 | N/A | N/A |
|  | n77 | 3915 | 10 | 50 | 3915 | N/A | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

#### 5.20.4 ∆TIB and ∆RIB values

There is no change by comparing to the values for PC3 DC, so this section is omitted.

# Annex A - Change history

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **Meeting** | **TDoc** | **Subject/Comment** | **New version** |
| 2022-11 | 3GPP RAN4#105 | R4-2218950 | Initial version  Implemented TP’s from RAN4 #105:  R4-2220466, TP for PC2 DC\_1\_n79 for TR 38.898, DoCoMo  R4-2220467, TP for PC2 DC\_3\_n79 for TR 38.898, DoCoMo  R4-2220468, TP for PC2 DC\_19\_n79 for TR 38.898, DoCoMo  R4-2220469, TP for PC2 DC\_21\_n79 for TR 38.898, DoCoMo | 0.1.0 |
| 2023-03 | 3GPP RAN4#106 | R4-2301062 | Implemented TP’s from RAN4 #106:  R4-2301302, TP for PC2 DC\_1\_n77-n79 for TR 38.898, NTT DOCOMO, INC.  R4-2301303, TP for PC2 DC\_3\_n77-n79 for TR 38.898, NTT DOCOMO, INC.  R4-2301304, TP for PC2 DC\_21\_n77-n79 for TR 38.898, NTT DOCOMO, INC.  R4-2301305, TP for PC2 DC\_1\_n78-n79 for TR 38.898, NTT DOCOMO, INC.  R4-2301306, TP for PC2 DC\_3\_n78-n79 for TR 38.898, NTT DOCOMO, INC.  R4-2301307, TP for PC2 DC\_21\_n78-n79 for TR 38.898, NTT DOCOMO, INC.  R4-2301309, TP for PC2 DC\_1-21\_n77 for TR 38.898, NTT DOCOMO, INC.  R4-2301310, TP for PC2 DC\_1-42\_n77 for TR 38.898, NTT DOCOMO, INC.  R4-2301311, TP for PC2 DC\_3-21\_n77 for TR 38.898, NTT DOCOMO, INC.  R4-2301312, TP for PC2 DC\_3-42\_n77 for TR 38.898, NTT DOCOMO, INC.  R4-2301313, TP for PC2 DC\_21-42\_n77 for TR 38.898, NTT DOCOMO, INC.  R4-2303446, TP for PC2 DC\_1\_n77 for TR 38.898, NTT DOCOMO, INC.  R4-2303447, TP for PC2 DC\_3\_n77 for TR 38.898, NTT DOCOMO, INC.  R4-2303448, TP for PC2 DC\_21\_n77 for TR 38.898, NTT DOCOMO, INC.  R4-2303449, TP for PC2 DC\_21\_n78 for TR 38.898, NTT DOCOMO, INC.  R4-2303450, TP for PC2 DC\_1-3\_n77 for TR 38.898, NTT DOCOMO, INC. | 0.2.0 |