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| 3GPP TR 37.825 V16.0.0 (2019-12) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Networks;  High power User Equipment (UE) (power class 2) for E-UTRA (Evolved Universal Terrestrial Radio Access) - NR Dual Connectivity (EN-DC) (1 LTE TDD band + 1 NR TDD band) (Release 16) | |
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# Foreword

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

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

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.

# Scope

The present document is a technical report for high power UE (power class 2) for EN-DC (1 LTE TDD band + 1 NR TDD band). The purpose is to introduce high power UE (power class2) for EN-DC (1 LTE TDD band +1 NR TDD band).

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

# 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".

[3] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[4] 3GPP TS 36.101: "E-UTRAN; User Equipment (UE) radio transmission and reception".

[5] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

# Definitions, symbols and abbreviations

## Definitions

For the purposes of the present document, the terms and definitions 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].

## Symbols

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

ΔRIB,c Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell *c*.

ΔTIB,c Allowed maximum configured output power relaxation due to support for inter-band CA

FDL\_low The lowest frequency of the downlink operating band

FDL\_high The highest frequency of the downlink operating band

FUL\_low The lowest frequency of the uplink operating band

FUL\_high The highest frequency of the uplink operating band

## 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].

A-MPR Additional Maximum Power Reduction

DC Dual Connectivity

EN-DC E-UTRA/NR DC

FR Frequency Range

MPR Allowed maximum power reduction

MSD Maximum Sensitivity Degradation

NR New Radio

NS Network Signalling

NSA Non-Standalone, a mode of operation where operation of an other radio is assisted with an other radio

REFSENS Reference Sensitivity

RF Radio Frequency

Rx Receiver

TDM Time Division Multiplex

Tx Transmitter

UE User Equipment

# 4 Background

## 4.1 Justification

In order to reduce the big imbalance between 5G NR uplink and downlink coverage, RAN4 has completed PC2 HPUE feature to improve the uplink coverage for 5G SA deployments on NR bands n41, n77, n78 and n79 in Rel-15 NR WI, including PC2 UL MIMO (2Tx 23+23dBm) and PC2 1Tx (26dBm) UE. The following NR bands were approved to support PC2 HPUE for 5G NR SA in Rel-15：

* Band n41 (2496 – 2690 MHz)：

UL-MIMO (2Tx 23+23dBm) and 1Tx (26dBm) are supported for NR Band n41

* Band n77 (3.3 - 4.2 GHz)：

UL-MIMO (2Tx 23+23dBm) and 1Tx (26dBm) are supported for NR Band n77

* Band n78 (3.3 - 3.8 GHz)：

UL-MIMO (2Tx 23+23dBm) and 1Tx (26dBm) are supported for NR Band n78

* Band n79 (4.4 - 5 GHz)：

UL-MIMO (2Tx 23+23dBm) and 1Tx (26dBm) are supported for NR Band n79

For 5G NR NSA deployment, the imbalance between UL and DL coverage still exists, and the uplink coverage for EN-DC is also need to be improved. Considering the technical status of the industry chain, the Power Class 2 (+26dBm) EN-DC UE should be the most practical and suitable choice to improve the UL coverage for 5G NR NSA deployment.

It is proposed to specify Power Class 2 UE for EN-DC (1LTE band +1 NR band) supporting +26 dBm. PC2 EN-DC for TDD-TDD band combinations are proposed in this Work Item. This Work Item is to develop a new feature to enable Power Class 2 EN-DC UE with 26 dBm maximum output power.

## 4.2 Objective

The objective of the work item is to specify the RF requirements for Power Class 2 EN-DC (1 LTE band (PC3) +1 NR band (PC3) with 1Tx).

* Specify the band combination specific RF requirements for all listed PC2 EN-DC configurations consisting of 2 different bands DL with 2 different bands UL (1 LTE band and 1 NR band) including at least
  + Applicable frequencies if necessary
  + Applicable bandwidths and bandwidth sets if necessary
  + UE requirements, including UE maximum output power, Tx power tolerance, MPR, A-MPR, IBE and ACLR for Power Class 2 EN-DC, taking into account the potential coexistence with Band 40 in China
* Analyse combinations that have self-desensitization due to following reasons:
  + TX Harmonic and/or intermodulation overlap of receive band
  + TX signal overlap of receiver harmonic frequency
  + TX frequency being in close proximity of one of the receive bands
  + Any other identified reasons
* For the combination where self-desensitization exists:
  + ∆TIB, c and ∆RIB, c
  + Reference sensitivity exceptions including MSD test cases
* UE Tx duty cycle requirements sufficient to prevent exceeding local regulatory limits such as SAR
* Regulatory issues related to the use of PC2 EN-DC capable devices when roaming and/or p-max absence shall be addressed.
* Simultaneous RxTx UE capability for PC2 EN-DC band combinations shall be decided
* Release independent issue is to be considered for PC2 EN-DC
* RAN4 needs to discuss whether existing RAN2 signalling can be reused to solve the issues in this WI. If there is RAN2 signalling impact then RAN4 will send LS to RAN2 to inform the solution. No RAN2 TUs are requested for this WI.

This WI is aimed to specify the category of PC2 EN-DC band combinations consisting of 2 different bands DL with 2 different bands UL (1 LTE band and 1 NR band). An overview table of these PC2 EN-DC configurations is provided here:

|  |  |  |
| --- | --- | --- |
| EN-DC configuration | | Uplink EN-DC configuration |
| DC\_39A-n41A | DC\_39A-n41A | |
| DC\_(n)41AA | DC\_(n)41AA | |
| DC\_41A-n41A | DC\_41A-n41A | |
| DC\_39A-n79A | DC\_39A-n79A | |
| DC\_41A-n79A | DC\_41A-n79A | |

# 5 High power UE (power class 2) for EN-DC (1 LTE TDD band + 1 NR TDD band): General Part

## 5.1 Output power and TX power tolerance

For EN-DC with 1 LTE TDD band and 1 NR TDD band, UE maximum output power shall be measured over all component carriers from different bands. If each band has separate antenna connectors, maximum output power is measured as the sum of maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms). The maximum output power is specified in Table 5.1-1.

Table 5.1-1 Maximum output power for EN-DC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DC configuration | Power class 2  (dBm) | Tolerance  (dB) | Power class 3  (dBm) | Tolerance  (dB) |
| DC\_39A-n41A | 26 | +2/-31 | 23 | +2/-31 |
| DC\_(n)41AA | 26 | +2/-21 | 23 | +2/-21 |
| DC\_41A-n41A | 26 | +2/-21 | 23 | +2/-21 |
| DC\_39A-n79A | 26 | +2/-3 | 23 | +2/-3 |
| DC\_41A-n79A | 26 | +2/-31 | 23 | +2/-31 |
| NOTE 1: refers to the transmission bandwidths confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high – 4 MHz and FUL\_high, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB  NOTE 2: PPowerClass\_EN-DC is the maximum UE power specified without taking into account the tolerance  NOTE 3: For inter-band EN-DC the maximum power requirement should apply to the total transmitted power over all component carriers (per UE). | | | | |

## 5.2 Maximum output power reduction for PC2 EN-DC

### 5.2.1 Intra-band EN-DC

The UE maximum output power reduction (MPR) specified in this clause is applicable for UEs configured with EN-DC when NS\_01 is indicated in the MCG and the SCG. The MPR applies subject to indication in the field modifiedMPRbehavior for the SCG [2].

#### 5.2.1.1 Intra-band contiguous EN-DC

##### 5.2.1.1.1 General

When the UE is configured for intra-band contiguous EN-DC, the UE determines the allowed maximum output power reduction as specified in this clause.

For UE supporting dynamic power sharing the following:

- for the MCG, MPR*c* in accordance with [4]

- for the SCG,

MPR'*c* = MPRNR = MAX( MPRsingle,NR, MPRENDC)

- for the total configured transmission power,

MPRtot = PPowerClass,EN-DC – min(PPowerClass,EN-DC ,10\*log10(10^((PPowerClass,E-UTRA - MPRE-UTRA)/10) + 10^((PPowerClass,NR - MPRNR)/10))

where

MPRE-UTRA = MAX(MPRsingle,E-UTRA, MPRENDC )

with

- MPRsingle, E-UTRA is the MPR defined for the E-UTRA transmission in [4]

- MPRsingle,NR is the MPR defined for the NR transmission in [2]

For UEs not supporting dynamic power sharing the following

- for the MCG,

MPR*c* = MAX(MPRsingle,E-UTRA, MPRENDC )

- for the SCG,

MPR'*c* = MAX( MPRsingle,NR, MPRENDC )

where

- MPRsingle,NR is the MPR defined for the NR transmission in [2]

- MPRsingle,E-UTRA is the MPR defined for the E-UTRA transmission in [4]

MPRENDC is defined in Subclause 5.2.1.1.2

5.2.1.1.2 MPR for EN-DC

MPR in this sub-clause is applicable for power class 3 and power class 2. The allowed maximum output power reduction applied to transmission on the MCG and the SCG is defined as follows:

MPRENDC = MA

Where MA is defined as follows

MA = [15] ; 0 ≤ B < 0.5

[10] ; 0.5 ≤ B < 1.0

[8] ; 1.0 ≤ B < 2.0

[5] ; 2.0 < B

Where:

For UEs supporting dynamic power sharing,

B = (LCRB\_alloc, E-UTRA \* 12\* SCSE-UTRA + LCRB\_alloc,NR \* 12 \* SCSNR)/1,000,000

For UEs not supporting dynamic power sharing,

For E-UTRA

B = (LCRB\_alloc, E-UTRA \* 12\* SCSE-UTRA + 12 \* SCSNR)/1,000,000

For NR

B = (12\* SCSE-UTRA + LCRB\_alloc,NR \* 12 \* SCSNR)/1,000,000

and MA is reduced by 1 dB for B < 2.

#### 5.2.1.2 Intra-band non-contiguous EN-DC

##### 5.2.1.2.1 General

When the UE is configured for intra-band non-contiguous EN-DC, the UE determines the allowed maximum output power reduction as specified in this clause.

For UE supporting dynamic power sharing the following:

- for the MCG, MPR*c* in accordance with [4]

- for the SCG,

MPR'*c* = MPRNR = MAX( MPRsingle,NR, MPRENDC)

- for the total configured transmission power,

MPRtot = PPowerClass,EN-DC – min(PPowerClass,EN-DC ,10\*log10(10^((PPowerClass,E-UTRA - MPRE-UTRA)/10) + 10^((PPowerClass,NR - MPRNR)/10))

where

MPRE-UTRA = MAX(MPRsingle,E-UTRA, MPRENDC )

with

- MPRsingle, E-UTRAis the MPR defined for the E-UTRA transmission in [4]

- MPRsingle,NR is the MPR defined for the NR transmission in [2]

For UEs not supporting dynamic power sharing the following

- for the MCG,

MPR*c* = MAX(MPRsingle,E-UTRA, MPRENDC )

- for the SCG,

MPR'*c* = MAX( MPRsingle,NR, MPRENDC )

where

- MPRsingle,NR is the MPR defined for the NR transmission in [2]

- MPRsingle,E-UTRA is the MPR defined for the E-UTRA transmission in [4]

MPRENDC is defined in Subclause 5.2.1.2.2

##### 5.2.1.2.2 MPR for EN-DC

MPR in this sub-clause is applicable for power class 3 and power class 2. The allowed maximum output power reduction for IM3 related emissions applied to transmission on the MCG and the SCG is defined as follows:

MPRENDC = MA

Where MA is defined as follows

MA = [18] ; 0 ≤ B < 1.0

[17] ; 1.0 ≤ B < 2.0

[16] ; 2.0 ≤ B < 5.0

[15] ; 5.0 < B

Where:

For UEs supporting dynamic power sharing,

B = (LCRB\_alloc, E-UTRA \* 12\* SCSE-UTRA + LCRB\_alloc,NR \* 12 \* SCSNR)/1,000.000

For UEs not supporting dynamic power sharing,

For E-UTRA

B= (LCRB\_alloc, E-UTRA \* 12\* SCSE-UTRA + 12 \* SCSNR)/1,000.000

For NR

B = (12 \* SCSE-UTRA + LCRB\_alloc,NR \* 12 \* SCSNR)/1,000.000

and MA is reduced by 1 dB for B < 2.

### 5.2.2 Inter-band EN-DC

For inter-band EN-DC supporting PC2, UE maximum output power reduction for PC3 as specified in TS 36.101[4] and TS 38.101-1[2] apply for E-UTRA and NR respectively.

## 5.3 Additional maximum output power reduction for PC2 EN-DC

### 5.3.1 Intra-band EN-DC

The details of A-MPR for PC2 DC\_(n)41AA and DC\_41A-n41A configuration with NS\_04 signal have been specified in 38.101-3[3] 6.2B.3.1 and 6.2B.3.2 respectively.

### 5.3.2 Inter-band EN-DC

For inter-band EN-DC supporting PC2, UE A-MPR for PC3 as specified in TS 36.101[4] and TS 38.101-1[2] apply for E-UTRA and NR respectively.

## 5.4 Configured output power for PC2 EN-DC

The configured output power for intra-band and inter-band EN-DC as specified in TS 38.101-3[3] apply for PC2 UE.

## 5.5 Adjacent channel leakage ratio

### 5.5.1 Intra-band EN-DC

For EN-DC operation with an E-UTRA sub-block immediately adjacent to an NR sub-block, the ACLR is defined as the ratio of the filtered mean power centred on the aggregated sub-block bandwidth ENBW to the filtered mean power centred on an adjacent bandwidth of the same size ENBW at nominal channel spacing. The UE shall meet the ACLR minimum requirement EN-DCACLR specified in Table 5.5.1-1 with ENBW the sum of the sub-block bandwidths.

The assigned channel power and adjacent channel power are measured with rectangular filters with measurement bandwidths specified in 6.5B.2.1.3-1 in [3].

Table 5.5.1-1 ACLR for intra-band EN-DC (contiguous sub-blocks) power class 2

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| EN-DCACLR | dBc | 31 |
| Measurement bandwidth of EN-DC channel |  | 1.00\*ENBW |
| Measurement bandwidth of adjacent channel |  | 0.95\*ENBW |
| Frequency offset of adjacent channel |  | ENBW  /  -ENBW |
| NOTE 1: ENBW is the aggregated bandwidth in MHz as defined in 38.101-3 sub-clause 5.3B.  NOTE 2: The frequency offset is that in between the centre frequencies of the measurement filters | | |

For intra-band non-contiguous EN-DC, the EN-DC Adjacent Channel Leakage power Ratio (EN-DCACLR) is the ratio of the sum of the filtered mean powers centered on the assigned E-UTRA and NR sub-block frequencies to the filtered mean power centered on an adjacent channel frequency at nominal channel spacing. In case the sub-block gap bandwidth Wgap is smaller than a E-UTRA or NR sub-block bandwidth, no EN-DCACLR requirement is set for the corresponding sub-block for the gap. The assigned EN-DC sub-block power and adjacent channel power are measured with rectangular filters with measurement bandwidths specified in [4] for the E-UTRA sub-block, and [2], [3] for the NR sub-block. If the measured adjacent channel power is greater than –50dBm then the EN-DCACLR shall be higher than the value specified in for E-UTRAACLR and NRACLR

### 5.5.2 Inter-band EN-DC

The ACLR requirements specified in sub-clause 6.6.2.3 of TS 36.101[4] and sub- clause 6.5.2.4 of TS 38.101-1[2] apply for each component carrier of inter-band EN-DC.

## 5.6 SAR

### 5.6.1 Intra-band EN-DC

If UE supports a different power class than the default UE power class for intra-band EN-DC band combination and the supported power class enables the higher maximum output power than that of the default power class:

- if the LTE UL/DL configuration is 0 or 6; or

- if the LTE UL/DL configuration is 1 and special subframe configuration is 0 or 5; or

- if the IE *p-maxUE-FR1* as defined in TS 38.331 [5] is provided and set to the maximum output power of the default power class or lower;

- apply all requirements for the default power class and set the configured transmitted power as specified in sub-clause 5.4;

- else

- apply all requirements for the supported power class and set the configured transmitted power class as specified in sub-clause 5.4;

### 5.6.2 Inter-band EN-DC

If UE supports a different power class than the default UE power class for EN-DC band combination, and the supported power class enables higher maximum output power than that of the default power class:

- if the field of UE capability *maxUplinkDutyCycle-EN-DC* is absent and the percentage of NR uplink symbols transmitted in a certain evaluation period is larger than 30% (The exact evaluation period is no less than one radio frame); or

- if the field of UE capability *maxUplinkDutyCycle-EN-DC* is not absent and the percentage of NR uplink symbols transmitted in a certain evaluation period is larger than *maxUplinkDutyCycle-EN-DC* as defined in TS 38.331 (The exact evaluation period is no less than one radio frame); or

- if the *IE p-maxUE-FR1* as defined in TS 38.331 is provided and set to the maximum output power of the default power class or lower:

- shall apply all requirements for the default power class to the supported power class and set the configured transmitted power as specified in sub-clause 6.2B.4;

- else if the *IE p-maxUE-FR1* as defined in TS 38.331 is not provided or set to the higher value than the maximum output power of the default power class and the percentage of uplink symbols transmitted in a certain evaluation period is less than or equal to *maxUplinkDutyCycle-EN-DC* as defined in TS 38.331; or

- if the *IE p-maxUE-FR1* as defined in TS 38.331 is not provided or set to the higher value than the maximum output power of the default power class and the percentage of NR uplink symbols transmitted in a certain evaluation period is less than or equal to 30% when *maxUplinkDutyCycle-EN-DC* is absent. (The exact evaluation period is no less than one radio frame):

- shall apply all requirements for the supported power class and set the configured transmitted power class as specified in sub-clause 6.2B.4.

## 5.7 n41-B40 co-existence requirement

For synchronous operation, EUTRA B40 is removed from non-contiguous DC\_41\_n41 and contiguous DC (n)41 coexistence protected bands.

# 6 High power UE (power class 2) for EN-DC (1 LTE TDD band + 1 NR TDD band): Specific Band Combination Part

## 6.1 Inter-band PC2 EN-DC

### 6.1.1 PC2 EN-DC\_41A-79A

#### 6.1.1.1 Operating bands for PC2 EN\_DC

Table 6.1.1.1-1: DC band combination of LTE 1DL/1UL + one NR band

| EN-DC band | E-UTRA Band | NR Band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_41A-n79A1 | 41 | n79 | No |
| NOTE 1: Applicable for UE supporting inter-band carrier aggregation with mandatory simultaneous Rx/Tx capability. | | | |

#### 6.1.1.2 Channel bandwidths per operating band for PC2 EN\_DC

Table 6.1.1.2-1: Supported bandwidths per DC band combination of LTE 1DL/1UL + one NR band

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| DC operating / channel bandwidth | | | | | | | | | | | | |
| E-UTRA and NR DC Configuration | E-UTRA and NR Band | Subcarrier spacing  [kHz] | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 40  MHz] | 50  MHz | [60  MHz] | 80  MHz | 100 MHz | Maximum aggregated bandwidth  [MHz] |
| DC\_41A-n79A | 41 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  | 120 |
| n79 | 15 |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  | Yes | Yes | Yes | Yes | Yes |

#### 6.1.1.3 Co-existence studies for PC2 EN\_DC

The co-existence studies for PC2 EN\_DC\_41A-n79A are reused from PC3 EN\_DC\_41A-n79A.

#### 6.1.1.4 ∆TIB and ∆RIB values for PC2 EN\_DC

For PC2 EN\_DC\_41A-n79A, the TIB,c and RIB values are reused from PC3 EN\_DC\_41A-n79A.

#### 6.1.1.5 MSD for PC2 EN-DC

No specific REFSENS requirements need to be specified

### 6.1.2 PC2 EN-DC\_39A-79A

#### 6.1.2.1 Operating bands for PC2 EN\_DC

Table 6.1.2.1-1: DC band combination of LTE 1DL/1UL + one NR band

| EN-DC band | E-UTRA Band | NR Band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_39A\_n79A 1 | 39 | n79 | No |
| NOTE 1: Applicable for UE supporting inter-band carrier aggregation with mandatory simultaneous Rx/Tx capability. | | | |

#### 6.1.2.2 Channel bandwidths per operating band for PC2 EN\_DC

Table 6.1.2.2-1: Supported bandwidths per DC band combination of LTE 1DL/1UL + one NR band

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| DC operating / channel bandwidth | | | | | | | | | | | | |
| E-UTRA and NR DC Configuration | E-UTRA and NR Band | Subcarrier spacing  [kHz] | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 40  MHz] | 50  MHz | [60  MHz] | 80  MHz | 100 MHz | Maximum aggregated bandwidth  [MHz] |
| DC\_39A-n79A | 39 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  | 120 |
| n79 | 15 |  |  |  |  | Yes | Yes |  |  |  |
| 30 |  |  |  |  | Yes | Yes | Yes | Yes | Yes |
| 60 |  |  |  |  | Yes | Yes | Yes | Yes | Yes |

#### 6.1.2.3 Co-existence studies for PC2 EN\_DC

The co-existence studies for PC2 EN\_DC\_39A-n79A are reused from PC3 EN\_DC\_39A-n79A.

#### 6.1.2.4 ∆TIB and ∆RIB values for PC2 EN\_DC

For PC2 EN\_DC\_39A-n79A, the TIB,c and RIB values are reused from PC3 EN\_DC\_39A-n79A.

#### 6.1.2.5 MSD for PC2 EN-DC

No specific REFSENS requirements need to be specified

### 6.1.3 PC2 EN-DC\_39A-41A

#### 6.1.3.1 Operating bands for PC2 EN\_DC

Table 6.1.3.1-1: DC band combination of LTE 1DL/1UL + one NR band

| EN-DC band | E-UTRA Band | NR Band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_39\_n411 | 39 | n41 | No |
| NOTE 1: Applicable for UE supporting inter-band EN-DC without simultaneous Rx/Tx. | | | |

#### 6.1.3.2 Channel bandwidths per operating band for PC2 EN\_DC

Table 6.1.3.2-1: Supported bandwidths per DC band combination of LTE 1DL/1UL + one NR band

| EN-DC  configuration | Uplink EN-DC  configuration | E-UTRA configuration | NR configuration |
| --- | --- | --- | --- |
| DC\_39A\_n41A | DC\_39A\_n41A | 39A | n41A |

#### 6.1.3.3 Co-existence studies for PC2 EN\_DC

The co-existence studies for PC2 EN\_DC\_39A-n41A are reused from PC3 EN\_DC\_39A-n41A.

#### 6.1.3.4 ∆TIB and ∆RIB values for PC2 EN\_DC

For PC2 EN\_DC\_39A-n41A, the TIB,c and RIB values are reused from PC3 EN\_DC\_39A-n41A.

#### 6.1.3.5 MSD for PC2 EN-DC

No specific REFSENS requirements need to be specified

## 6.2 Intra-band PC2 EN-DC

### 6.2.1 PC2 EN-DC\_(n)41AA

#### 6.2.1.1 Operating bands for PC2 EN\_DC

Table 6.2.1.1-1: DC band combination of LTE 1DL/1UL + one NR band

| EN-DC band | E-UTRA Band | NR Band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_(n)41AA 1 | 41 | n41 | Yes |
| NOTE 1: Applicable for UE supporting intra-band EN-DC without simultaneous Rx/Tx. | | | |

#### 6.2.1.2 Channel bandwidths per operating band for PC2 EN\_DC

Table 6.2.1.2-1: Supported bandwidths per DC band combination of LTE 1DL/1UL + one NR band

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| DC operating / channel bandwidth | | | | | | | | | | | | | | |
| E-UTRA and NR DC Configuration | E-UTRA and NR Band | Subcarrier spacing  [kHz] | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25 MHz | 40  MHz | 50  MHz | 60  MHz | 80  MHz | 100 MHz |  | Maximum aggregated bandwidth  [MHz] |
| DC\_(n)41AA | 41 | 15 |  |  |  | Yes |  |  |  |  |  |  |  | 120 |
| n41 | 15 |  |  |  |  |  | Yes | Yes |  |  |  |  |
| 30 |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |  |
| 60 |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |  |

#### 6.2.1.3 Co-existence studies for PC2 EN\_DC

The co-existence studies for PC2 EN\_DC\_(n)41AA can reuse the band combination specific RF requirements of PC2 EN\_DC\_(n)41AA in TS 38.101-3.

#### 6.2.1.4 ∆TIB and ∆RIB values for PC2 EN\_DC

For PC2 EN\_DC\_(n)41AA, the TIB,c and RIB values can reuse the band combination specific RF requirements of PC2 EN\_DC\_(n)41AA in TS 38.101-3..

#### 6.2.1.5 MSD for PC2 EN-DC

No specific REFSENS requirements need to be specified

#### 6.2.1.6 SEM/A-SEM for PC2 EN-DC

SEM/A-SEM can reuse the band combination specific RF requirements of PC2 EN-DC\_(n)41AA in TS 38.101-3.

#### 6.2.1.7 MPR/A-MPR for PC2 EN-DC

MPR/A-MPR can reuse the band combination specific RF requirements of PC2 EN-DC\_(n)41AA in TS 38.101-3.

### 6.2.2 PC2 EN-DC\_41A-n41A

#### 6.2.2.1 Operating bands for PC2 EN\_DC

Table 6.2.2.1-1: DC band combination of LTE 1DL/1UL + one NR band

| EN-DC band | E-UTRA Band | NR Band | Single UL allowed |
| --- | --- | --- | --- |
| DC\_41A-n41A 1 | 41 | n41 | Yes |
| NOTE 1: Applicable for UE supporting intra-band EN-DC without simultaneous Rx/Tx. | | | |

#### 6.2.2.2 Channel bandwidths per operating band for PC2 EN\_DC

Table 6.2.2.2-1: Supported bandwidths per DC band combination of LTE 1DL/1UL + one NR band

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| DC operating / channel bandwidth | | | | | | | | | | | | | | |
| E-UTRA and NR DC Configuration | E-UTRA and NR Band | Subcarrier spacing  [kHz] | 5  MHz | 10  MHz | 15  MHz | 20  MHz | 25 MHz | 40  MHz | 50  MHz | 60  MHz | 80  MHz | 100 MHz |  | Maximum aggregated bandwidth  [MHz] |
| DC\_41A-n41A | 41 | 15 |  |  |  | Yes |  |  |  |  |  |  |  | 120 |
| n41 | 15 |  |  |  |  |  | Yes | Yes |  |  |  |  |
| 30 |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |  |
| 60 |  |  |  |  |  | Yes | Yes | Yes | Yes | Yes |  |

#### 6.2.2.3 Co-existence studies for PC2 EN\_DC

The co-existence studies for PC2 EN\_DC\_41A-n41A can reuse the band combination specific RF requirements of PC2 EN-DC\_41A-n41A in TS 38.101-3.

#### 6.2.2.4 ∆TIB and ∆RIB values for PC2 EN\_DC

For PC2 EN\_DC\_41A-n41A, the TIB,c and RIB values can reuse the band combination specific RF requirements of PC2 EN-DC\_41A-n41A in TS 38.101-3.

#### 6.2.2.5 MSD for PC2 EN-DC

No specific REFSENS requirements need to be specified

#### 6.2.2.6 SEM/A-SEM for PC2 EN-DC

SEM/A-SEM can reuse the band combination specific RF requirements of PC2 EN-DC\_41A-n41A in TS 38.101-3.

#### 6.2.2.7 MPR/A-MPR for PC2 EN-DC

MPR/A-MPR can reuse the band combination specific RF requirements of PC2 EN-DC\_41A-n41A in TS 38.101-3.

# 7 Specification impacts

## 7.1 Impacts on RAN4 specifications

### 7.1.1 Intraband EN-DC

Requirements for a Rel-15 UE for additional EN-DC intraband configurations within FR1 compared to TS 38.101-3 of Rel-15 are introduced via this clause.

Table 7.1.1-1: EN-DC intraband UE power class

|  |  |  |  |
| --- | --- | --- | --- |
| Feature | Duplex-mode | Release  independent from | Requirements to be fulfilled  (see TS 38.307 of the release in which the band was introduced) |
| Intraband contiguous EN-DC power class 2 | TDD | Rel-15 |  |
| Intraband non-contiguous EN-DC power class 2 | TDD | Rel-15 |  |

Table 7.1.1-2: PC2 EN-DC intraband configuration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EN-DC configuration | REL-indep.  From | contact  name, company | contact  email | other supporting companies  (min. 3) |
| DC\_(n)41AA | Rel-15 | Shao Zhe,  CMCC | shaozhe@chinamobile.com | CATT, ZTE, Huawei |
| DC\_41A-n41A | Rel-15 | Shao Zhe,  CMCC | shaozhe@chinamobile.com | CATT, ZTE, Huawei |

### 7.1.2 Interband EN-DC

Requirements for a Rel-15 UE for additional EN-DC interband configurations within FR1 compared to TS 38.101-3 of Rel-15 are introduced via this clause.

Table 7.1.2-1: EN-DC interband UE power class

|  |  |  |  |
| --- | --- | --- | --- |
| Feature | Duplex-mode | Release  independent from | Requirements to be fulfilled  (see TS 38.307 of the release in which the band was introduced) |
| Interband EN-DC Power Class 2 | TDD | Rel-15 |  |

Table 7.1.1-2: PC2 EN-DC interband configuration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EN-DC configuration | REL-indep.  From | contact  name, company | contact  email | other supporting companies  (min. 3) |
| DC\_39A-n41A | Rel-15 | Shao Zhe,  CMCC | shaozhe@chinamobile.com | CATT, ZTE, Huawei |
| DC\_39A-n79A | Rel-15 | Shao Zhe,  CMCC | shaozhe@chinamobile.com | CATT, ZTE, Huawei |
| DC\_41A-n79A | Rel-15 | Shao Zhe,  CMCC | shaozhe@chinamobile.com | CATT, ZTE, Huawei |

## 7.2 Impacts on specifications for the other WGs (if applicable)

No changes identified

# Annex A: Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| 04/2019 | RAN4#90bis | R4-1903017 |  |  | TR skeleton | N/A | 0.0.1 |
| 05/2019 | RAN4#91 | R4-1905403 |  |  | R4-1903018 General part TP for TR37.825 PC2 EN-DC (1 LTE TDD band + 1 NR TDD band).  R4-1903019 TP for TR37.825 for PC2 EN-DC\_41A-79A  R4-1903020 TP for TR37.825 for PC2 EN-DC\_39A-79A  R4-1903021 TP for TR37.825 for PC2 EN-DC\_39A-41A.  R4-1903022 TP for TR37.825 for PC2 EN-DC\_(n)41AA  R4-1903023 TP for TR37.825 for PC2 EN-DC\_41A-n41A | 0.0.1 | 0.1.0 |
| 08/2019 | RAN4#92 | R4-1908765 |  |  | R4-1907452 TP for TR37.825 for SAR requirement | 0.1.0 | 0.2.0 |
| 10/2019 | RAN4#92-bis | R4-1910768 |  |  | Update Definitions, symbols and abbreviations | 0.2.0 | 0.3.0 |
| 11/2019 | RAN4#93 | R4-1913208 |  |  | [R4-1910770](file:///D:\RAN4\TSGRAN4_92bis\Docs\R4-1910770.zip) TP for TR37.825 for release independent issue | 0.3.0 | 0.4.0 |
| 12/2019 | RAN#86 | RP-192583 |  |  | [R4-1913208](file:///D:\RAN4\TSGRAN4_93\Docs\R4-1913208.zip) TR 37.825 v0.4.0 Finalization | 0.4.0 | 1.0.0 |
| 12/2019 | RAN#86 | RP-192583 |  |  | v16.0.0 created based on approved RP-192583 | 1.0.0 | 16.0.0 |