**3GPP TSG RAN Meeting #104 RP-24xxxx**

**Shanghai, China, June 17-20, 2024**

**Source: Moderator (RAN4 Vice Chair, China Telecom)**

**Title: New WID: Rel-19 High power UE (power class 1.5 or 2) for NR intra-band Carrier Aggregation (CA) or NR inter-band CA/Dual connectivity (DC) band combinations with/without NR SUL (supplementary uplink)**

**Document for: Approval**

**Agenda Item: 9.1.5**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

# Title: New WID: Rel-19 High power UE (power class 1.5 or 2) for NR intra-band Carrier Aggregation (CA) or NR inter-band CA/Dual connectivity (DC) band combinations with/without NR SUL (supplementary uplink)

Acronym: HPUE\_NR\_CADC\_SUL\_R19

Unique identifier:

NOTE: For new WIs/SIs leave the Unique identifier empty and make a proposal for an Acronym.

 For a revised WI/SI: Take Unique identifier and acronym as shown in 3GPP workplan.

 If this is a RAN WID including Core and Perf. part, then Title, Acronym and Unique identifier refer to the feature WI.

 Please tick (X) the applicable box(es) in the table below:

 Either:

|  |  |
| --- | --- |
| **This WID includes a Core part** | **X** |
| **This WID includes a Performance part** |  |

 or:

|  |  |
| --- | --- |
| **This WID includes a Testing part** |  |
| **and it addresses the following 3GPP work area:** | **Radio Access** |  |
| **Core Network** |  |
| **Services** |  |

Potential target Release: *Rel-19*

NOTE: In case of contradiction with the target dates of clause 5, clause 5 determines the target release.

# 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Affects:** | UICC apps | ME | AN | CN | Others (specify) |
| **Yes** |  | X | X |  |  |
| **No** | X |  |  | X |  |
| **Don't know** |  |  |  |  |  |

# 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

This description is either a …

|  |  |
| --- | --- |
|  | Study Item |

or a

|  |
| --- |
| Normative Work Item:*tick applicable boxes below* |
|  | Stage 1 |
|  | Stage 2 |
|  | Stage 3 |
|  | Other (e.g. testing) |

### 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
|  |  |  |  |

NOTE: RAN agreed some time ago, that it describes the feature WI + Core/Perf. part WI or Testing part WI in one WID. Therefore, the table above should include the feature WI data (In case the feature covers Core and Perf. part, please list under Working Group the leading WG of the Core part).

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work/Study Items (if any) |
| **Acronym** | Unique ID | Title | Nature of relationship |
| HPUE\_FR1\_TDD\_NR\_CADC\_SUL\_R18 | 970089 | Rel-18 High power UE (power class 1,5 and 2) for a single FR1 NR TDD band in UL of NR inter-band CA/DC combinations with/without NR SUL (supplementary uplink) with y bands downlink (y=2,3,4,5,6) and x bands uplink (x=1,2) | *The 970089 WI is the Rel-18 basket WI focused on the requirements of UL TDD PC2 and PC1.5/DL CA for requested band combinations from operators. The current Rel-19 basket WI focuses on uncompleted requests from Rel-18, and new requests made in Rel-19.* |
| HPUE\_FR1\_FDD\_NR\_CADC\_R18 | 970090 | Rel-18 High power UE (power class 2) for a single FR1 NR FDD band in UL of NR intra-band and inter-band CA/DC combinations with y bands downlink (y=1,2,3,4,5,6) and x bands uplink (x=1) | *The 970090 WI is the Rel-18 basket WI focused on the requirements of UL FDD PC2/DL CA for requested band combinations from operators. The current Rel-19 basket WI focuses on uncompleted requests from Rel-18, and new requests made in Rel-19.* |
| NR\_RF\_FR1\_enh | 890062 | RF requirements enhancement for NR frequency range 1 (FR1)  | *generic requirements for high power UEs for intra-band CA combinations considered in this WI are specified in WI NR\_RF\_FR1\_enh* |
| NR\_intra\_HPUE\_R17 | 900163 | High power UE for NR TDD intra-band carrier aggregation in frequency range FR1 | *Core part in this WI is completed in NR\_intra\_HPUE\_R17 and Perf part in this WI is a continuation of NR\_intra\_HPUE\_R17.*  |
| HPUE\_NR\_FR1\_TDD\_intra\_CA\_R18 | 970087 | High power UE (power class 1.5 or 2) for intra-band Carrier Aggregation combinations of a single NR FR1 TDD band | *A continuation of HPUE\_NR\_FR1\_TDD\_intra\_CA\_R18.* |
| NR\_ENDC\_RF\_Ph4 | 1030077 | UE RF enhancements for NR FR1/FR2 and EN-DC, Phase 4 | *Core part for PC1.5 for UL intra-band CA configuration will be handled in NR\_ENDC\_RF\_Ph4* |

NOTE: Also related or dependent WIs/SIs in other TSGs shall be indicated here.

# 3 Justification

Increasing the transmit power of UE has significant benefits on extending uplink coverage area and improving the experience of cell edge users.

In Release 18, several basket WIs for HPUE, including power class 2 for NR FDD band and power class 2/1.5 for NR TDD band, were created to capture the requests and work on the band-combination specific RF requirements for NR inter-band CA/DC. For NR intra-band CA, Rel-18 HPUE\_NR\_FR1\_TDD\_intra\_CA\_R18 WI introduces PC1.5 for single uplink carrier rather than UL intra-band CA configuration.

In release 19, there are new requests from operators for power class 2 and power class 1.5 inter-band CA/DC with/without SUL or intra-band CA combinations with both single uplink carrier and intra-band CA configuration, so to set up the new corresponding basket WI is also necessary to accommodate these requests and to handle these band-combination requirements in a same way.

Hence, this WID is proposed to set up a basket WI to work on the band-combination specific requirements for power class 2 and power class 1.5 UE for NR intra-band CA and inter-band CA/DC with/without SUL band combinations.

The rules and procedures for this basket WI include:

A) Request for additions of band combinations to this WI shall be provided using an agreed template and sent to the 3GPP\_TSG\_RAN\_WG4\_NR\_BANDS email reflector before a RAN4 Tdoc submission deadline and no new band combinations are allowed to be requested after the deadline except to correct the missing fallback and add more supporting companies for the proposed band combinations.

B) The preconditions shall ensure that the constituent of PC3 NR CA/DC configurations shall be completed and specified before or at the same meeting as High power UE configurations.

C) A band combination configuration can only be considered as completed when the fallback configuration is completed and specified before or at the same meeting. It is the responsibility of the proponent to ensure the status of the fallback mode configuration. Rapporteurs and other companies are encouraged to check the status of the fallback configuration once the higher power band combination is declared as completed.

# 4 Objective

### 4.1 Objective of SI or Core part WI or Testing part WI

The objectives of the core part are as follows:

Specify the band-combination specific RF requirements for all listed band combinations as defined in attached excel file of this WI. The band combinations list contains following cases.

|  |
| --- |
| **Rel-19 High power UE (power class 1,5 and 2) for NR CA/DC combinations with/without NR SUL** |
| **Obj.** | **Band combination list** | **Power class cases for uplink** |
| 1 | High power UE (power class 1.5 or 2) for NR Intra-band Carrier Aggregation (CA) with high power on FDD or TDD band | 1UL(FDD): PC2 on FDD band1UL(TDD): PC1.5 or PC2 on TDD bandNote: single UL carrier for FDD, Single UL carrier or intra-band UL CA for TDD |
| 2 | High power UE (power class 1.5 or 2) for NR Inter-band Carrier Aggregation (CA)/Dual connectivity (DC) with/without SUL (supplementary uplink) with high power on TDD band(s)Note: Including PC3 FDD/TDD+ PC3 TDD case | PC2 inter-band CA/DC:1UL(TDD): PC2 on TDD band2UL (TDD+TDD): PC3 or PC2 on TDD band2UL (FDD+TDD): PC3 on FDD band, PC3 or PC2 on TDD band |
| PC1.5 inter-band CA/DC:1UL(TDD): PC 1.5 on TDD band2UL (TDD+TDD): PC3, PC2 or PC1.5 on TDD band2UL (FDD+TDD): PC3 on FDD band, PC1.5 on TDD band |
| PC2 SUL band combinations with or without CA:SUL: PC3 or PC2 on SUL bandNUL(TDD): PC2 on TDD bandPC1.5 SUL band combinations with or without CA:SUL: PC3 or PC2 on SUL bandNUL(TDD): PC1.5 on TDD bandNUL = Normal Uplink in contrast to SUL. |
| 3 | High power UE (power class 2) for NR Inter-band Carrier Aggregation (CA)/Dual connectivity (DC) with high power on FDD band(s)Note: Including PC3 FDD+ PC3 FDD | 1UL(FDD): PC2 on FDD band2UL (FDD+FDD): PC3 on FDD band |
| 4 | High power UE (power class 1.5) for NR Inter-band Carrier Aggregation (CA)/Dual connectivity (DC) with high power on both FDD and TDD bands | 2UL (FDD+TDD): PC2 on FDD band, PC2 or PC1.5 on TDD band |

The requirements corresponding to the above Band combination list include:

* + For Objective 1:
* For NR intra-band downlink CA with PC2 or 1.5 TDD band or PC2 FDD band, introduce band combinations to the CA configuration tables and specify maximum output power.
* For NR intra-band uplink CA with PC2 or 1.5 FR1 TDD band, introduce band combinations to the CA configuration tables and specify requirements for intra-band UL CA.
	+ For Objective 2, 3 and 4:
* Introduce band combinations to the CA configuration tables and specify maximum output power, Tx power tolerance and A-MPR requirements if needed
* Analyze combinations that have self-desensitization and specify applicable ∆TIB, c and ∆RIB, c and reference sensitivity exceptions including MSD test cases
* For 3Tx band combinations
	+ Introduce band combinations to the CA configuration tables, and inter-band CA MOP tables
	+ Specify corresponding MSD requirements
	+ Other additional impact to the requirements due to the high power on UL, if necessary
	+ Specify the release independency if necessary
* Unless otherwise stated, CA combinations of this WI are introduced in a REL-independent way starting from REL-15.

Note 1: For 3Tx, both high power classes and PC3 for band combinations are included in this WID.

Note 2: The common requirements should be done first before working on the band specific requirements.

4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

### 4.3 RAN time budget request (not applicable to RAN5 WIs/SIs)

NOTE: For all new RAN related WIs/SIs which are not led by RAN WG5 the WI/SI rapporteur has to fill out the attached Excel table to request time budgets for corresponding RAN WG meetings.
The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI.
One time unit (TU) corresponds to ~ 2 hours in the meeting.
If no TU is needed, then leave the field empty otherwise enter a number >0 in the field.

 For revisions of already approved WI/SI descriptions: Please remove the Excel table from the WID/SID's zip file. The time budgets are already recorded. If you want to modify them, then this has to be done via the status report and not via a revised WID/SID.

 If this WID is covering Core and Performance part, then please fill out one line for each part in the attached Excel table.

**additional comments to the time budget request in the attached Excel table:**

# 5 Expected Output and Time scale

|  |
| --- |
| **New specifications**  |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Remarks |
| TR | 38.8xx | High power UE (power class 1.5 or 2) for NR Intra-band Carrier Aggregation (CA) with high power on FDD or TDD band | RAN#108 | RAN#109 | Core |
| TR | 38.8xx | High power UE (power class 1.5 or 2) for NR Inter-band Carrier Aggregation (CA)/Dual Connectivity (DC) with/without SUL (Supplementary Uplink) with high power on TDD band(s) | RAN#108 | RAN#109 | Core |
| TR | 38.8xx | High power UE (power class 2) for NR Inter-band Carrier Aggregation (CA)/Dual Connectivity (DC) with high power on FDD band(s) | RAN#108 | RAN#109 | Core |
| TR | 38.8xx | High power UE (power class 1.5) for NR Inter-band Carrier Aggregation (CA)/Dual connectivity (DC) with high power on both FDD and TDD bands | RAN#108 | RAN#109 | Core |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
By default a new specs can only be new for one of both parts.

|  |
| --- |
| **Impacted existing TS/TR**  |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| 38.101-1  | NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone | RAN#109 | Core part |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
If an existing spec is affected by both (Core part and Perf. part), then it has to be listed twice with appropriate approval dates.

# 6 Work item Rapporteur(s)

NOTE: The first listed Rapporteur has the overall responsibility for this WI (incl all secondary tasks).

# 7 Work item leadership

RAN WG4

# 8 Aspects that involve other WGs

NOTE: For RAN WIs: Section 8 applies only toWGs outside of TSG RAN because all RAN WG aspects have to be covered in section 4.

# 9 Supporting Individual Members

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| --- |
| Supporting IM name |
| China Telecom |
| T-Mobile USA |
| Huawei |
| HiSilicon |
| AT&T |
| Verizon |
| NTT DOCOMO INC. |
| Ericsson |
| KDDI |
| Samsung |
| SoftBank |
| Telstra |
| OPPO |
| Nokia |
| China Unicom |
| LG Uplus |
| ZTE |
| Sanechips |
| TELUS |
| vivo |
| CHTTL |
| CATT |
| DISH Network |
| BT |
| DISH |
| MediaTek |
| SK Telecom |
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