**3GPP TSG RAN Meeting #105 RP-24XXXX**

**Melbourne, Australia, Sep. 9-12, 2024**

**Source: Lenovo**

**Title: New WID on Multi-carrier enhancements for NR Phase 2**

**Document for: Approval**

**Agenda Item: 9.1.1**

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: Multi-carrier enhancements for NR Phase 2

## Acronym:

## 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 that this field above indicates the proposed Release at the time of submission of the WID to TSG approval. It can later be changed without a need to revise the WID. The updated target Release is indicated in the Work Plan. 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 work item is a …

|  |  |
| --- | --- |
| x | Feature |
|  | Building Block |
|  | *Work Task* |
|  | Study Item |

NOTE: Normally, Core/Perf./Testing parts in RAN WIDs are Building Blocks. Only if they are under an SA or CT umbrella, they are defined as work tasks. If you are in doubt, please contact MCC.

### 2.2 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 just 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 Items (if any) |
| Unique ID | Title | Nature of relationship |
| 940094 | Multi-carrier enhancements for NR | Rel-18 Work item on multi-carrier enhancements |

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

## 3 Justification

Multi-carrier operation is very important for 5G commercial networks by aggregating various spectrum resources for providing high data rate and low latency communication.

Due to quite limited TU for Rel-18 multi-carrier enhancements, some important use cases were excluded from Rel-18, e.g., different SCSs among co-scheduled cells, different carrier types among co-scheduled cells. Co-scheduled carriers with different SCSs have high commercial needs for operators, e.g., 3.5GHz TDD + Sub-3GHz FDD, FR1 + FR2, etc.

Furthermore, two new DCI formats were introduced in Rel-18, DCI format 0\_3 and 1\_3. Each DCI format 0\_3 or 1\_3 can schedule up to 4 cells with limitation of a single PUSCH or PDSCH per scheduled cell. In Rel-17, for FR2 with high SCS, multi-PDSCH/PUSCH scheduling was introduced, i.e., up to 8 PUSCHs or PDSCHs on a single serving cell can be scheduled by a single DCI format 0\_1 or 1\_1, in order to save UE power consumption and reduce PDCCH overhead. Hence, it is straightforward to combine multi-cell scheduling and multi-PDSCH/PUSCH scheduling in Rel-19 to fully exploit the gain of power saving and PDCCH overhead reduction so that one DCI format 0\_3 or 1\_3 can schedule multiple cells with one or multiple PUSCHs/PDSCHs per scheduled cell. This is especially useful when scheduling cell in FR1 with a lower SCS schedules multiple cells in FR2 with higher SCS.

## 4 Objective

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

1. Specify a solution for multi-cell PUSCH/PDSCH scheduling with a single DCI [RAN1]

* Different SCS/carrier type among co-scheduled cells by a single DCI is supported.
* One or multiple PUSCHs/PDSCHs per scheduled cell is supported by a single DCI.
	+ The maximum number of PUSCHs/PDSCHs per scheduled cell is [4 or 8].
	+ Note: Type-1 HARQ-ACK codebook is not enhanced for Rel-19 multi-cell scheduling.
	+ Note: The maximum number of sub-codebooks for Type-2 HARQ-ACK codebook is not increased for Rel-19 multi-cell scheduling.
	+ Note: UE does not expect to be configured with both single-cell multi-PUSCH/PDSCH scheduling and multi-cell multi-PUSCH/PDSCH scheduling on the same or different cells within a same PUCCH group.
* Note: No new DCI format is introduced.

### 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** *{One line per specification. Create/delete lines as needed}* |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Remarks |
|  |  |  |  |  |  |

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** *{One line per specification. Create/delete lines as needed}* |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| 38.212 | NR; Multiplexing and channel coding | RAN#108 | Core Part |
| 38.213 | NR; Physical layer procedures for control | RAN#108 | Core Part |
| 38.214 | NR; Physical layer procedures for data | RAN#108 | Core Part |
| 38.300 | NR; NR and NG-RAN Overall description; Stage-2 | RAN#109 | Core Part |
| 38.306 | NR; User Equipment (UE) radio access capabilities | RAN#109 | Core part |
| 38.331 | NR; Radio Resource Control (RRC); Protocol specification | 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)

## 7 Work item leadership

RAN1

## 8 Aspects that involve other WGs

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

## 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Lenovo |
| CMCC |
| China Telecom |
| China Unicom |
| NTT DOCOMO, INC. |
| Verizon |
| Huawei |
| HiSilicon |
| Nokia |
| Nokia Shanghai Bell |
| ZTE |
| Sanechips |
| CATT |
| Apple |
| OPPO |
| vivo |
| Spreadtrum |
| xiaomi |
| Motorola Mobility |
| NEC |
| HONOR |
| Cybercore |
| TCL |
| Transsion |
| New H3C |
| ASR |
| Baicells |
| Tencent |
| Telstra |
| Qualcomm |
| TELUS |
| MediaTek |