**3GPP TSG RAN Meeting #98-e RP-22nnnn**

**Electronic Meeting, December 12-16, 2022** was RP-222332

**Source: MediaTek Inc.**

**Title: Revised WID on Further NR mobility enhancements**

**Document for: Approval**

**Agenda Item: 9.3.2.1**

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: Further NR Mobility Enhancements

## Acronym: NR\_Mob\_enh2

## 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** | **X** |

 or:

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

Potential target Release: Rel-18

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 |  |  |  |  |
| **Don't know** |  |  |  | X |  |

## 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 |
|  |  | *{optional free text}*  |

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

## 3 Justification

When the UE moves from the coverage area of one cell to another cell, at some point a serving cell change needs to be performed. Currently serving cell change is triggered by L3 measurements and is done by RRC signalling triggered Reconfiguration with Synchronisation for change of PCell and PSCell, as well as release add for SCells when applicable. All cases involve complete L2 (and L1) resets, leading to longer latency, larger overhead and longer interruption time than beam switch mobility. The goal of L1/L2 mobility enhancements is to enable a serving cell change via L1/L2 signalling, in order to reduce the latency, overhead and interruption time.

In Rel-17 Conditional PSCell change (CPC)/Conditional PSCell addition (CPA), a CPC/CPA-configured UE has to release the CPC/CPA configurations when completing random access towards the target PSCell. Hence the UE doesn’t have a chance to perform subsequent CPC/CPA without prior CPC/CPA reconfiguration and re-initialization from the network. This will increase the delay for the cell change and increase the signaling overhead, especially in the case of frequent SCG changes when operating FR2. Therefore, MR-DC with selective activation of cell groups aims at enabling subsequent CPC/CPA after SCG change, without reconfiguration and re-initialization on the CPC/CPA preparation from the network. This results in a reduction of the signalling overhead and interrupting time for SCG change.

Currently, CHO and MR-DC cannot be configured simultaneously. This limits the usefulness of these two features when MR-DC is configured. If it is not completed in Rel-17, Rel-18 should specify mechanisms for CHO and MR-DC to be configured simultaneously. However, this alone may not be sufficient to optimise MR-DC mobility, as the radio link quality of the conditionally-configured PSCell may not be good enough or may not be the best candidate PSCell when the UE accesses the target PCell, and this may impact the UE throughput. To mitigate this throughput impact, Rel-18 CHO+MRDC can consider CHO including target MCG and multiple candidate SCGs for CPC/CPA.

## 4 Objective

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

The detailed objective of this work item are:

1. To specify mechanism and procedures of L1/L2 based inter-cell mobility for mobility latency reduction:
* Configuration and maintenance for multiple candidate cells to allow fast application of configurations for candidate cells [RAN2, RAN3]
* Dynamic switch mechanism among candidate serving cells (including SpCell and SCell) for the potential applicable scenarios based on L1/L2 signalling [RAN2, RAN1]
* L1 enhancements for inter-cell beam management, including L1 measurement and reporting, and beam indication [RAN1, RAN2]
	+ *Note 1: Early RAN2 involvement is necessary, including the possibility of further clarifying the interaction between this bullet with the previous bullet*
* Timing Advance management [RAN1, RAN2]
* CU-DU interface signaling to support L1/L2 mobility, if needed [RAN3]

*Note 2: FR2 specific enhancements are not precluded, if any.*

*Note 3: The procedure of L1/L2 based inter-cell mobility are applicable to the following scenarios:*

* + - *Standalone, CA and NR-DC case with serving cell change within one CG*
		- *Intra-DU case and intra-CU inter-DU case (applicable for Standalone and CA: no new RAN interfaces are expected)*
		- *Both intra-frequency and inter-frequency*
		- *Both FR1 and FR2*
		- *Source and target cells may be synchronized or non-synchronized*
1. To specify mechanism and procedures of NR-DC with selective activation of the cell groups (at least for SCG) via L3 enhancements:
* To allow subsequent cell group change after changing CG without reconfiguration and re-initiation of CPC/CPA [RAN2, RAN3, RAN4]

*Note 4: A harmonized* RRC modelling approach for objectives 1 and 2 could be considered to minimize the workload in RAN2.

1. For CHO including target MCG and target SCG in NR-DC [RAN3]:
	* to specify data forwarding optimizations; and
	* to specify, if needed, a solution to avoid unnecessary signaling exchange between source MN and target SN.
2. To specify CHO including target MCG and candidate SCGs for CPC/CPA in NR-DC [RAN3, RAN2]
* CHO including target MCG and target SCG is used as the baseline
1. To specify RRM core requirements for the following, as necessary [RAN4]:
* L1/L2-based inter-cell mobility
* Enhanced CHO configurations addressed by this WI
1. To specify RF requirements to cover inter-frequency L1/L2-based mobility, as necessary [RAN4].
2. To study and specify how to reuse the IDLE/INACTIVE mode measurement results which are to be reported during and/or after RRC connection setup/resume in order to improve SCell/SCG setup delay [RAN4, RAN2], including:
	* Availability and validation of the IDLE/INACTIVE mode measurement results to be reported [RAN4]; and
	* Definition of corresponding RRM requirements [RAN4]; and
	* If necessary based on RAN4 outcome, definition of corresponding signalling support [RAN2].

*Note 5: RAN4 will coordinate in due course with RAN2 to start the work*.

Note 6: R4-2220415 serves as baseline for future work in RAN4

*Note 7: With exception of the above scenarios, enhancements on IDLE/INACTIVE mode measurements and on UE behavior in IDLE/INACTIVE mode are not in scope.*

### 4.2 Objective of Performance part WI

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

1. Specify RRM performance requirements for L1/L2-based inter-cell mobility scenarios [RAN4]
2. Specify RRM performance requirements for the enhanced CHO configurations [RAN4]

### 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 |
| 38.401 | NG-RAN; Architecture Description | RAN#102 | Core Part |
| 38.331 | NR RRC signalling changes to support mobility enhancements | RAN#102 | Core part |
| 38.306 | Necessary UE capabilities to support mobility enhancements | RAN#102 | Core part |
| 38.300 | Possible changes to NR Stage-2 specification | RAN#102 | Core part |
| 37.340 | Possible changes to MR-DC Stage-2 specification | RAN#102 | Core part |
| 38.321 | Possible changes to NR MAC specification | RAN#102 | Core part |
| 38.413 | Possible changes to NR Stage 3 NG-AP to support mobility enhancements | RAN#102 | Core part |
| 38.420 | Possible changes to NR Stage 2 Xn-AP to support mobility enhancements | RAN#102 | Core part |
| 38.423 | Possible changes to NR Stage 3 Xn-AP to support mobility enhancements | RAN#102 | Core part |
| 38.470 | Possible changes to NR Stage 2 F1-AP to support mobility enhancements | RAN#102 | Core part |
| 38.473 | Possible changes to NR Stage 3 F1-AP to support mobility enhancements | RAN#102 | Core part |
| 38.212 | Possible changes to introduce L1/L2 mobility enhancements | RAN#101 | Core part |
| 38.213 | Possible changes to introduce L1/L2 mobility enhancements | RAN#101 | Core part |
| 38.214 | Possible changes to introduce L1/L2 mobility enhancements | RAN#101 | Core part |
| 38.101 | Possible changes to UE RF requirements | RAN#102 | Core Part |
| 38.133 | Requirements to support mobility enhancements | RAN#102 | Core part |
| 38.133 | Requirements to support mobility enhancements | RAN#104 | Performance part |
| 37.483 | Possible changes to NR E1-AP to support mobility enhancements | RAN#102 | 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)

*Primary: Tseng, Li-Chuan, MediaTek Inc.,* *li-chuan.tseng@mediatek.com* *(RAN2)*

*Secondary: He, Hong, Apple,* *hhe5@apple.com* *(RAN1)*

## 7 Work item leadership

Primary WG: RAN2

Secondary WGs: RAN1, RAN3, RAN4

## 8 Aspects that involve other WGs

None identified yet.

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

## 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Apple |
| AT&T |
| CAICT |
| CATT |
| Charter Communications |
| China Telecom |
| China Unicom |
| CMCC |
| Continental Automotive |
| Denso Corporation |
| Ericsson |
| Fujitsu |
| Futurewei |
| HONOR |
| Huawei |
| HiSilicon |
| Intel Corporation |
| KDDI |
| Lenovo |
| MediaTek Inc. |
| Motorola Mobility |
| NEC |
| Nokia |
| Nokia Shanghai Bell |
| NTT DOCOMO, Inc. |
| OPPO |
| Qualcomm Incorporated |
| Samsung |
| Sharp |
| SoftBank |
| Telia Company |
| Transsion |
| Turkcell |
| vivo |
| Xiaomi |
| ZTE |