**3GPP TSG RAN Meeting #95e RP-22xxxx**

**Electronic Meeting, Mar. 17 - 23, 2022** (revision of RP-21xxxx)

**Source: Moderator (Huawei, HiSilicon)**

**Title: New WID on Further RF requirements enhancement for NR frequency range 1 (FR1)**

**Document for: Approval**

**Agenda Item: 9.1.4.1**

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 RF requirements enhancement for NR frequency range 1 (FR1)

## Acronym: NR\_RF\_FR1\_Fenh

## Unique identifier: *{A number to be provided by MCC at the plenary}*

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 *{ For Normative work, identify the anticipated impacts. For a Study, identify the scope of the study.}*

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

## 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

This work item is a … *{Tick one box. "***Feature** */* **Building Block** */ Work Task" form a hierarchical structure. E.g. no Building Block can be proposed without a corresponding parent Feature. The full structure of all existing Work Items is shown in the 3GPP Work Plan in* *ftp://ftp.3gpp.org/Information/WORK\_PLAN* *}*

|  |  |
| --- | --- |
| 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 Item refers to the related, earlier Stage, Work Item, e.g. the related Stage 1 Work Item shall be indicated here when a Stage 2 Work Item is presented or e.g. the related Study Item shall be indicated here when a normative-work Work Items is started. List here all parent Work Items of which requirements are either fully or partially covered by the proposed Item. List previous Work Items of earlier releases if relevant.}*

*{This section is mandatory to be filled out by the rapporteur.}*

*{Not applicable for a* **Study Item***}*

*{For a* **Building Block***: list here the parent* **Feature** *}*

*{For a* Work Task*: list here the parent* **Building Block** *}*

|  |
| --- |
| 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

*{List here other Work Items which relate to the proposed one, such as preceding SI or a preceding WI (e.g. if further enhancing a feature).}*

|  |
| --- |
| 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.

**Dependency on non-3GPP (draft) specification**:

*{This section is to be typically used to identify the IETF dependencies. Delete the header "Dependency on non-3GPP (draft) specification:" if no such dependency.}*

## 3 Justification

This work item includes the objectives of UE FR1 requirement focus on evolution for potential RAN4 enhancements for NR frequency range 1. The following working areas are based on the summary of email discussion in [[RAN95e-RAN4-R18Prep-01]](https://nwm-trial.etsi.org/#/documents/7458) (RP-220019).

* Enable 4Tx on a single carrier for CPE/FWA/vehicle/industrial devices
* Enable 8Rx and for CPE/FWA/vehicle/industrial device
* Investigate the feasibility of lower MSD for inter-band CA/EN-DC/DC combinations

## 4 Objective

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

The objectives of core part for Rel-18 RF FR1 requirement focus evolution include:

**Enable 4Tx on a single carrier for CPE/FWA/vehicle/industrial devices (RAN4)**

* Investigate framework and architecture Example bands:
	+ TDD bands: n41, n77/n78
	+ FDD bands: n1
		- Note 1: the total number of example bands should be limited to 3. n77/n78 are considered as one band during the study.
		- Note 2: other bands to be introduced in the release independent way later on from Rel-18
		- Note 3: specifying requirements for TDD bands has first priority
* Specify the UE RF requirements to support 4Tx
	+ First priority: 4x4 UL MIMO
	+ Second priority: investigate and if necessary specify TxD requirement to support the same power class in UL MIMO and single antenna port
	+ PA configuration assumption:
		- First priority: 4x23dBm
		- Second priority: 2x23dBm + 2x26dBm, 4x26dBm
	+ UE power class
		- First priority: PC 1.5
		- Second priority: PC2/PC3, and/or new power class if needed
		- Note 1: PC1.5 is only applicable for TDD bands
	+ Note: detailed combinations for 2nd priority PA/UE power class assumptions are to be revisited in RAN#97
* NOTE1: Requirements are specified with phase approach. Objectives with 1st priority are considered first.
* NOTE2: It is assumed the devices are equipped with 4Rx antennas for band n1 requirement definition.

**Enable 8Rx for CPE/FWA/vehicle/industrial devices (RAN4)**

* Example bands:
	+ TDD bands: n41, n77/ n78
	+ FDD bands: n7
		- Note 1: the total number of example band should be limited to 3. n77/n78 are considered as one band during the study.
		- Note 2: other bands to be introduced in the release independent way later on from Rel-18
		- Note 3: specifying requirements for TDD bands has first priority
* Specify the UE RF requirements to support 8Rx
* Study and specify the requirements to support SRS antenna switching for t1r8, t2r8, t4r8
	+ Discussion on t4r8 shall start after at least one PC for 4Tx is completed
* NOTE: Requirements are specified with phase approach. Objectives with 1st priority are considered first.

**Investigate the feasibility of lower MSD for inter-band CA/EN-DC/DC combinations (RAN4)**

* Select a limited set of band combinations (2-4 combinations) to cover all types of MSD (harmonic, harmonic mixing, IMD and cross band isolation)
* Study how the MSD performance can be improved for the example band combinations
* Study of MSD improvement with different MSD sources (harmonics, IMD2/3/4/5, cross band isolation and harmonic mixing)
* Study the feasibility of and options for allowing a UE to signal improved lower MSD performance capability for combinations where MSD is allowed
* Aim to conclude the study phase by RAN#99, and further discuss in RAN#99 how to handle the objective based on the study progress.

### 4.2 Objective of Performance part WI

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

The objectives of performance part for Rel-18 RF FR1 requirement focus evolution include:

* Enable 4Tx on a single carrier for CPE/FWA/vehicle/industrial devices
	+ Specify the BS demodulation performance requirements to support UL 4-layer MIMO UE operation
* Enable 8Rx for CPE/FWA/vehicle/industrial devices
	+ Specify RLM test cases to support 8Rx
		- Investigate if the existing 4Rx RLM test can be reused or the new test will be specified
	+ Specify UE demodulation performance and CSI requirements with up to 8 layers to support 8Rx
		- Investigate and, if necessary, specify the requirements with up to 8 DL MIMO layers
	+ Specify the SDR requirements with 8 MIMO layers
* Specify release independence requirements in TS 38.307 if needed.

### 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 |
| Internal TR | 38.8xx | Study of lower MSD for inter-band CA/EN-DC/DC combinations | #99 | #100 | LIU, Ye, Huawei, leo.liuye@huawei.com |

*{Note 1: Only TSs may contain normative provisions. Study Items shall create or impact only TRs.
"Internal TR" is intended for 3GPP internal use only whereas "External TR" may be transposed by OPs.}*

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 |
| *{E.g. "22.281"}* | *{Possible values:* *- either free text (e.g. “CS aspects to be removed") - or “Specification to be withdrawn”}* | *{E.g. "TSG#89"}* | *{Free text}* |
| 38.101-1 | Specify UE RF core requirements | #102 | Core part |
| 38.101-3 | Specify UE RF core requirements related to EN-DC | #102 | Core part |
| 38.307 | Specify release independence | #104 | Perf. part |
| 38.101-4 | Specify UE demodulation performance and CSI requirements for >4Rx | #104 | Perf. part |
| 38.104 | Specify BS demodulation performance requirements for >2Tx | #104 | Perf. part |
| 38.133 | Add RRM core requirements if needed | #102 | Core part |
| 38.133 | Add RRM performance requirements if needed | #104 | Perf. part |
| 38.306 | Add impacts on 38.306 User Equipment (UE) radio access capabilities, if needed | #102 | Core part |
| 38.331 | Specify the necessary signalling or capability to support the features | #102 | Core part |
| 38.213 | Add impacts on 38.213 Physical layer procedures for control, if needed | #102 | Core part |
| 38.214 | Add impacts on 38.214 Physical layer procedures for data, if needed | #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: LIU, Ye, Huawei,* *leo.liuye@huawei.com*

*Secondary: Yuta Oguma, NTT DOCOMO,* *yuuta.oguma.yt@nttdocomo.com*

## 7 Work item leadership

R4

## 8 Aspects that involve other WGs

*{Specify all the other WG(s) to be involved and, if specific, their task. E.g.: "SA2, SA3, SA5. CT6 for storage, and potentially SA4". If not applicable, indicate "None" or "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

*{At least 4 supporting Individual Members are needed. There is an expectation that these companies will provide resources to progress the work. Note that having 4 supporting companies is a necessary but not sufficient condition: the usual TSG approval process by consensus is needed for the WID approval.}*

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| Supporting IM name |
| Huawei |
| HiSilicon |
| NTT DOCOMO |
| CMCC |
| Intel Corporation |
| Spreadtrum |
| vivo |
| OPPO |
| Nokia |
| Nokia Shanghai Bell |
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