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

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

**Source: RAN4 VC (Qualcomm Incorporated)**

**Title: New WID Simultaneous RxTx band combinations for NR CA/DC, NR SUL and LTE/NR DC in Rel-19**

**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: Simultaneous Rx/Tx band combinations for NR CA/DC, NR SUL and LTE/NR DC in Rel-19

## Acronym: LTE\_NR\_R19\_Simult\_RxTx

## Unique identifier:

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

Potential target Release: Rel-19

## 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Affects:** | UICC apps | ME | AN | CN | Others (specify) |
| **Yes** |  | **X** |  |  |  |
| **No** | **X** |  | **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 …

|  |  |
| --- | --- |
|  | Feature |
| X | 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 |
| 970084 | Simultaneous Rx/Tx band combinations for NR CA/DC, NR SUL and LTE/NR DC in Rel-18 | This is the relevant Rel-18 basket WI. |
| 911018 | Simultaneous Rx/Tx band combinations for NR CA/DC, NR SUL and LTE/NR DC | This is the relevant Rel-17 basket WI. |

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

LTE/NR DC for Rel-19:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |

NR CA/NR DC for Rel-19:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |

SUL for Rel-19:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | C | WI |  | REL-19 |
|  |  | P | WI |  | REL-19 |

**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

Simultaneous Rx/Tx capability for inter-band CA, SUL and EN-DC band combinations were introduced from Rel-15. Specifically, for inter-band CA and EN-DC combination, the capability is used for TDD-TDD and TDD-FDD band combinations. According to the description of the capability, it is conditional mandatory and the condition is described in the field, i.e. indicated in the RAN4 spec which combinations should mandatorily support simultaneous Rx/Tx. For the combinations which have no such indication, the capability is optional, i.e. for UE supporting simultaneous Rx/Tx, the capability should be reported, otherwise, the capability is absent or not reported. Since the capability is important for network scheduling, it should be reported accurately.

In Rel-17, the principles for judging the mandatory capability for a band combination have been discussed, and the cases include:

* FR1+FR1 FDD-TDD band combination
* FR1+FR1 TDD-TDD band combination
* FR1+FR2 FDD-TDD band combination
* FR1+FR2 TDD-TDD band combination
* FR2+FR2 TDD-TDD band combination

In Rel-18, a basket WI for simultaneous Rx-Tx was created. In Rel-18 WI, as the capability is defined for CA, SUL, MR-DC and NR-DC band combinations, and applicability of the corresponding requirements cover different specifications, e.g. TS 38.101-1 and TS 38.101-3, the way to treat simultaneous Rx/Tx capability as well as the requirements is aligned among the specifications.

In the process of discussion under the Rel-18 basket WI, companies pointed out more issues related to the requirement of simultaneous Rx-Tx, and there would be specification impact.

* Firstly, there are plenty of complicated Notes for simultaneous Rx-Tx to band combinations with overlapped implications and redundant functions in current specification, which cause difficulties in understanding in field implementation. The necessary simplification on the Note for simultaneous Rx-Tx is required.
* Secondly, for some higher order EN-DC with more carriers or bands, mandatory simultaneous Rx/Tx notes are missing, such as DC\_XA\_nYC, DC\_XC\_nYA, DC\_XA\_nY(2A), and so on, due to the lack of Table for EN-DC operation bands, which may cause confusion to vendors for implementation and RAN5 for conformance test. The clarification on the simultaneous Rx-Tx feature for DC band combinations with same band but different configurations of carrier number is required.
* Thirdly, for the simultaneous Rx-Tx of CA\_n40-n41, there is concern with respect to the 4Rx requirement of n41, or decoupling simultaneous Rx-Tx and UL MIMO/TxD or SRS antenna switching for the two bands. How to implement relaxation to simultaneous Rx-Tx requirements to CA\_n40-n41 need further discussion.
* Last but not least, case by case analysis on band combinations applied with simultaneous Rx-Tx is needed to avoid the ambiguity for application of the general principles agreed in Rel-17 and the analysis and conclusion should be captured in the TR, as the extension of Rel-18 basket WI.

The fallback rules for all basket WIs agreed in Rel-18 are captured as below for reference:

* 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.
* When a proponent requests a new band combination, all the next level fallback configurations shall be listed and recorded in the request template and the status (“New”, “Ongoing”, “Completed”) of all the fallback configurations shall be declared accurately and clearly. For “New” fallback configurations, the proponent shall ensure these fallback configurations are also requested together with the higher order band combination in the same meeting, for these “New” fallback combinations the next level fallbacks need to be determined and if they are not in the specification yet, they need to be requested, too, until there is no missing fallback.
* A band combination configuration can only be considered as completed when all of the fallback configurations are completed and specified in advance or at the same meeting. It is the responsibility of the proponent to ensure the status of all of the fallback mode configurations. Rapporteurs and other companies are encouraged to check the status of all of the fallback configurations once the higher order band combinations are declared as completed.

## 4 Objective

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

### 4.1.1 Objective and scope

1. Identify the unnecessary Notes for simultaneous Rx-Tx applied to band combinations for NR CA/DC, NR SUL and LTE/NR DC. Focus on principles and specific methods of simplification on Notes to simultaneous Rx-Tx case by case.
2. Clarify in the specification on the simultaneous Rx-Tx feature for DC band combinations with same band but different configurations of carrier number.
3. Identify feasibility for each requested FDD-TDD and TDD-TDD band combinations for CA, SUL, MR-DC supporting simultaneous Rx/Tx capability/operation based on technical analysis, especially for those with large MSD values. If needed, specify the MSD requirements for the identified band combinations.
* Note 1: Band combinations considered in this WI have to be introduced first via basket WIs (see 2.3) or completed in previous releases if necessary.
* Note 2: Whether the simultaneous Rx-Tx capability could be supported or not depends on the evaluation of MSD for the requested band combinations case by case.
* Note 3: Applicability of simultaneous Rx/Tx capability to FDD-TDD band pairs should be reviewed
1. Align the specification treatment of simultaneous Rx/Tx capability for CA, SUL, MR-DC and NR-DC band combinations.

### 4.1.2 Way of working

The new request adding CA, SUL, MR-DC and NR-DC band combinations for evaluation of supporting simultaneous Rx/Tx capability should be submitted on RAN4 reflector before tdoc submission deadline to the next RAN4 meeting (1 week before the meeting). The basket WI will then be updated with the new requests (section 4.1.3) and submitted to next RAN4 meeting for endorsement, before submission to RAN meeting for approval.

When the work is completed, all draft CRs related to one request will be submitted in the same RAN4 meeting to check consistency. If they are endorsed, the basket WI Rapporteur will merge all draft CRs from all requests in big CRs (one per TS specification). After the RAN4 meeting preceding a RAN meeting, those big CRs will be sent on RAN4 reflector for email approval (1 week) and, if agreed, they will be submitted to following RAN meeting.

### 4.1.3 Overview of identified combinations for evaluation

An overview of FDD-TDD, TDD-TDD CA, SUL, MR-DC and NR-DC band combinations for evaluation of supporting simultaneous Rx/Tx capability are provided in this section for the identified band combinations to be studied case by case for WIs in section 2.3 when necessary.

Table 4.1.3-1: Identified NR band combinations for evaluation to support simultaneous Rx/Tx

|  |  |  |  |
| --- | --- | --- | --- |
| **Band****combination** | **Power Class** | **Note** | **status** |
| CA\_n40A-n41A | PC3, PC2 | This is a leftover band combination in Rel-18, the following aspects should be further studied:* Study, and specify if needed, diversity receiver relaxation for band combination with narrow frequency separation.
* Evaluate decoupling of simultaneous Rx-Tx and UL MIMO/TxD or SRS antenna switching for the bands in the band combination with narrow frequency separation
 |  |

### 4.2 Objective of Performance part WI

### 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.xxx |  |  |  |  |

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 arts.

|  |
| --- |
| **Impacted existing TS/TR**  |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| 38.101-1  | Simultaneous Rx/Tx capability for the combinations in spec of NR User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone |  | Core part |
| 38.101-3  | Simultaneous Rx/Tx capability for the combinations in the spec of User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios |  | 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

*R4*

## 8 Aspects that involve other WGs

*None*

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 |
| Huawei |
| Hisilicon |
| Murata |
| Apple |
| Skyworks |
| Google Inc |
| CMCC |
| China Unicom |
| China Telecom |
| CHTTL |
| OPPO |
|  |