**3GPP TSG RAN#94-e RP-21XXXX**

**Electronic Meeting, December 6 – 17, 2021**

**Source: CMCC (Moderator)**

**Title:** **SID on Evolution of Duplex Operation**

**Document for: Approval**

**Agenda Item: 8.6.1**

3GPP™ Study Item Description

Information on Study Items can be found at <http://www.3gpp.org/Study-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: Study on Evolution of Duplex Operation

## 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** |  |
| **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-18

## 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 |  |
| **Don't know** |  |  |  |  |  |

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

### 2.1 Primary classification

This work item is a …

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

### 2.2 Parent Work Item

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

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work Items (if any) |
| Unique ID | Title | Nature of relationship |
| 710062 | Study on New Radio (NR) Access Technology |  |
| 800082 | Cross Link Interference (CLI) handling and Remote Interference Management (RIM) for NR |  |

**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

TDD is widely used in commercial NR deployments. In TDD, the time domain resource is split between downlink and uplink. Allocation of a limited time duration for the uplink in TDD would result in reduced coverage, increased latency and reduced capacity. As a possible enhancement on this limitation of the conventional TDD operation, it would be worth studying the feasibility of allowing the simultaneous existence of downlink and uplink, a.k.a. full duplex, or more specifically, subband non-overlapping full duplex at the gNB side within a conventional TDD band.

The NR TDD specifications allow the dynamic/flexible allocation of downlink and uplink in time and CLI handling and RIM for NR were introduced in Rel-16. Nevertheless, further study may be required for CLI handling between the gNBs of the same or different operators to enable the dynamic/flexible TDD in commercial networks. The inter-gNB CLI may be due to either adjacent-channel CLI or co-channel-CLI, or both, depending on the deployment scenario. One of the problems not addressed in the previous releases is gNB-to-gNB CLI.

This study aims to identify the feasibility and solutions of duplex evolution in the areas outlined above to provide enhanced UL coverage, reduced latency, improved system capacity, and improved configuration flexibility for NR TDD operations in unpaired spectrum. In addition, the regulatory aspects need to be examined for deploying identified duplex enhancements in TDD unpaired spectrum considering potential constraints.

## 4 Objective

### 4.1 Objective of SI

The objective of this study is to identify and evaluate the potential enhancements to support duplex evolution for NR TDD in unpaired spectrum.

In this study, the followings are assumed:

* Duplex enhancement at the gNB side
* Half duplex operation at the UE side
* No restriction on frequency ranges

The detailed objectives are as follows:

* Identify applicable and relevant deployment scenarios (RAN1).
* Develop evaluation methodology for duplex enhancement (RAN1).
* Study the subband non-overlapping full duplex and potential enhancements on dynamic/flexible TDD (RAN1, RAN4).
* Identify possible schemes and evaluate their feasibility and performances (RAN1).
* Study inter-gNB and inter-UE CLI handling and identify solutions to manage them (RAN1).
	+ Consider intra-subband CLI and inter-subband CLI in case of the subband non-overlapping full duplex.
* Study the performance of the identified schemes as well as the impact on legacy operation assuming their co-existence in co-channel and adjacent channels (RAN1).
* Study the feasibility of and impact on RF requirements considering adjacent-channel co-existence with the legacy operation (RAN4).
* Study the feasibility of and impact on RF requirements considering the self-interference, the inter-subband CLI, and the inter-operator CLI at gNB and the inter-subband CLI and inter-operator CLI at UE (RAN4).
* Note: RAN4 should be involved early to provide necessary information to RAN1 as needed and to study the feasibility aspects due to high impact in antenna/RF and algorithm design, which include antenna isolation, TX IM suppression in the RX part, filtering and digital interference suppression.
* Summarize the regulatory aspects that have to be considered for deploying the identified duplex enhancements in TDD unpaired spectrum (RAN4).

Note: For potential enhancements on dynamic/flexible TDD, utilize the outcome of discussion in Rel-15 and Rel-16 while avoiding the repetition of the same discussion.

### 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: TBD**

## 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* | *Study on Evolution of Duplex Operation* | *TSG#xx* | *TSG#xx* | *{e.g.: rapporteur:**<FamilyName>, <GivenName>, <Company>, <email address>}* |

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 |
|  |  |  |  |

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)

Fei Wang, CMCC, wangfei@chinamobile.com [RAN1]

Xutao Zhou, Samsung, xutao.zhou@samsung.com [RAN4]

## 7 Work item leadership

Primary: RAN WG1

Secondary: RAN WG4

## 8 Aspects that involve other WGs

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

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| Supporting IM name |
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