**3GPP TSG RAN Meeting #109 RP-25xxxx**

**Beijing, China, September 15th-18th, 2025**

## Status Report to TSG

**Agenda item:** 9.3.1.1

|  |  |
| --- | --- |
| **WI / SI Name** | NR MIMO Phase 6 |
| included in this status report | Study Item: No | Core part: Yes | Performance part:Yes | Testing part:No |
| **Acronym** | NR\_MIMO\_Ph6 |
| **Unique ID** | 1080083 |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-251856 |
| **Target Completion Date****(indicate if changed)** | Study Item: n/a | Core part: 05/2027 | Performance part: 09/2027 | Testing part: n/a |
| **Overall Completion level** | Study Item: n/a | Core part: 10% | Performance Part: 0% | Testing part: n/a |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |
| --- | --- |
| **Leading WG** | RAN1 |
| **Rapporteur (primary)** | **Name** | Darcy Tsai |
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## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | Yes |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.
 One time unit (TU) corresponds to ~ 2 hours in the meeting.
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.
 Note: If no Excel table is attached, then this means no time budget change.*

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

According to the current NR MIMO Phase 6 WID, the applicable conditions and requirements from the legacy RAN4 specifications for DMRS bundling are assumed to be reusable for multiple frequency-domain starting positions of SRS repetition symbols within each SRS frequency hop. This assumption requires confirmation by RAN4 RF experts, however, there is no RAN4 RF TU in current WI. Therefore, the RD TU for the first 3 RAN4 meetings is re-allocated to RF TU. RAN4 RF can spend the first 3 meeting to confirm the assumption.

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

 NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

**In RAN1#122, the following agreements were made.**

Improvement of SRS capacity and coverage

**Agreement:**

For a P/SP cross-slot SRS resource, the slot offset configured to the SRS resource refers to the first of the two slots spanned by the SRS resource.

**Agreement:**

When there is a cross-slot SRS resource in the end of a S slot and the beginning of a U slot in a serving cell, support transmitting PUSCH with a priority index 0and corresponding DMRS after this cross-slot SRS in the U slot in the serving cell.

**Agreement**:

For SRS configured with RPFS (P­F>1) and multiple repetitions (R > 1), support multiple frequency-domain starting positions across SRS repetition symbols within each SRS frequency hop based on the followings:

* For SRS repetition symbols within each SRS frequency hop, the starting position patterns across the K different frequency locations are determined by network configuration
* The R repetition symbols are equally divided into K subgroups
	+ *K is number of starting positions for SRS repetition symbols within each SRS frequency hop*
* Within each subgroup of R/K symbols, the SRS is transmitted at the same starting position in frequency domain.
* Start position pattern for SRS repetition symbols within each SRS frequency hop is the same during the legacy SRS frequency hopping period (for a same value of )

FFS: whether/how to support enabling legacy RPFS start RB index hopping across multiple legacy SRS frequency hopping periods and intra-repetition hopping for SRS repetition symbols within each SRS frequency hop simultaneously.

**Agreement:**

Support at least the following scenario~~s~~ for cross-slot SRS transmission:

* Scenario 1: a periodic, semi-persistent, or aperiodic SRS resource set which includes at least one SRS resource with time-domain resource transmitted across a first S slot and a second consecutive U slot.
* FFS whether Scenario 2 below is supported.
	+ Scenario 2: an aperiodic SRS resource set which includes at least one SRS resource with time-domain resource transmitted in a first S slot, and at least one another SRS resource with time-domain resource transmitted in a second consecutive U slot.

**Agreement:**

For a given AP-SRS resource set in case of SRS transmission across two adjacent S+U slots, study the following alternatives and down-select one to determine “available slot” in the next meeting:

* Alt-0 (per SRS resource set): The available slot(s) can include one slot or two consecutive S and U slots satisfying there are UL or flexible symbol(s) for the time-domain location(s) for all the SRS resources in the resource set and it satisfies UE capability on the minimum timing requirement between triggering PDCCH and all the SRS resources in the resource set.
* Alt-1 (per SRS resource): The available slot(s) can include one slot or two consecutive S and U slots satisfying there are UL or flexible symbol(s) for the time-domain location(s) for at least one of the SRS resources in the resource set and it satisfies UE capability on the minimum timing requirement between triggering PDCCH and all the SRS resources in the resource set.
* Alt-2 (per slot): An available slot is a slot satisfying there are UL or flexible symbol(s) for the time-domain location(s) for a subset of SRS resource(s) with same slot offset in the SRS resource set, and it satisfies UE capability on the minimum timing requirement between triggering PDCCH and all the SRS resources in the resource set.

**Agreement:**

To determine the time-domain location of cross-slot SRS,

* One set of time-domain resource allocation related parameters (i.e., startPosition, nrofSymbols, and repetitionFactor) is configured for the SRS resource without restriction on “within a slot”.
	+ For the index of each SRS symbol , it is the same as legacy spec., i.e., .

* + The offset counts symbols backwards from the end of the starting slot of the resource

**Agreement:**

For intra-repetition hopping for SRS repetition symbols within each SRS frequency hop, study the following configuration combinations:

* PF=2 and K=2
* PF =4 and K=2
* PF =4 and K=4

Enhancing downlink CSI acquisition

**Agreement:**

For UE transition from IDLE/INACTIVE to CONNECTED mode, support at least aperiodic SRS-AS transmission triggered via MSG4 of 4-Step RACH.

**Agreement:**

For UE transition from IDLE/INACTIVE to CONNECTED mode, support aperiodic CSI reporting triggered via MSG4 of 4-Step RACH based on the followings:

* The aperiodic CSI reporting is transmitted on PUSCH.
* Support at least aperiodic CSI-RS for CSI associated with the aperiodic CSI reporting
* Support PMI-based reporting with wideband PMI based on Rel-15 Type-I SP codebook and wideband CQI
	+ FFS: Which report quantity(s) can be configured
* Support PMI-free reporting with wideband CQI
	+ FFS: Which report quantity can be configured

**Agreement:**

For a UE transition from IDLE to CONNECTED mode, support the following procedure at least for early aperiodic SRS-AS/CSI-RS/CSI triggering (i.e., early triggering of aperiodic SRS-AS transmission, aperiodic CSI-RS reception, aperiodic CSI reporting):

* Step-1: The UE receives the resource/reporting configuration(s) for early SRS-AS/CSI-RS/CSI triggering provided in the system information before MSG3.
	+ FFS: Which SIB is used to carry the resource/reporting configuration(s) for early SRS-AS/CSI/CSI-RS triggering
* Step-2: The UE reports its capability on early SRS/CSI-RS/CSI triggering through MSG3
* Step-3: The UE receives MSG4 that triggers early SRS-AS/CSI-RS/CSI based on the capability reported by the UE.
* Step-4: The UE performs aperiodic SRS-AS transmission, aperiodic CSI-RS reception, and/or aperiodic CSI reporting.
	+ FFS: Timeline of the aperiodic SRS-AS transmission, aperiodic CSI-RS reception, aperiodic CSI reporting

Note: The term “capability” above does not mean legacy RRC based UE capability.

FFS: For a UE transition from INACTIVE to CONNECTED mode, whether above procedure can be reused at least for early aperiodic SRS-AS/CSI-RS/CSI triggering

Note: Whether the aperiodic SRS-AS transmission, aperiodic CSI-RS reception, and/or aperiodic CSI reporting can be configured/triggered simultaneously will be discussed separately

**Agreement:**

CSI-RS frequency-domain density ρ = 1/4 can be configured to the K NZP CSI-RS resources at least for the following cases:

* + K=2 24-port NZP CSI-RS resources in a CSI-RS resource set aggregating 48 CSI-RS ports
	+ K=4 16-port NZP CSI-RS resources in a CSI-RS resource set aggregating 64 CSI-RS ports
	+ K=2 32-port NZP CSI-RS resources in a CSI-RS resource set aggregating 64 CSI-RS ports
	+ K=4 32-port NZP CSI-RS resources in a CSI-RS resource set aggregating 128 CSI-RS ports

FFS: K=3 16-port NZP CSI-RS resources in a CSI-RS resource set aggregating 48 CSI-RS ports

Note: It’s not precluded that the frequency-domain density configured to the K NZP CSI-RS resources in the same CSI-RS resource set for 48/64/128 CSI-RS ports aggregation can be different

**Agreement:**

CSI-RS frequency-domain density ρ = 1/3 and 1/6 can be configured to the K NZP CSI-RS resources at least for the following cases:

* + K=3 16-port NZP CSI-RS resources in a CSI-RS resource set aggregating 48 CSI-RS ports

FFS: K=2 24-port NZP CSI-RS resources in a CSI-RS resource set aggregating 48 CSI-RS ports

Note: It’s not precluded that the frequency-domain density configured to the K NZP CSI-RS resources in the same CSI-RS resource set for 48 CSI-RS ports aggregation can be different

**Agreement:**

For early triggering of SRS-AS when SCell transition from deactivation to activation, support at least aperiodic SRS-AS transmission on a SCell, triggered based on legacy SCell activation command activating the SCell.

* FFS: Timeline of the aperiodic SRS-AS transmission (requirement is up to RAN4)
* FFS: How to trigger the aperiodic SRS-AS transmission based on legacy SCell activation command
* FFS: Whether/what new information is provided in SCell activation command?

**Agreement:**

For early triggering of CSI/CSI-RS when SCell transition from deactivation to activation, support aperiodic CSI reporting for a SCelltriggered based on legacy SCell activation command activating the SCell.

* The aperiodic CSI reporting is assosicated with at least aperiodic CSI-RS for CSI on the SCell
* FFS: Timeline of the aperiodic CSI reporting and corresponding aperiodic CSI-RS for CSI (requirement is up to RAN4)
* FFS: How to trigger the aperiodic CSI reporting and corresponding aperiodic CSI-RS for CSI based on legacy SCell activation command?
* FFS: Whether/what new information is provided in SCell activation command?

**Agreement:**

For early triggering of SRS-AS/CSI-RS/CSI when UE transition from IDLE to CONNECTED mode, study the following at least three options for Step-1 and Step-2:

* Option-1: NW can provide the resource/report configuration in SIBx based on only one UE capability assumption, and UE can report through MSG3 whether the resource/report configuration received in SIBx is supported.
* Option-2: NW can provide the resource/report configuration(s) in SIBx based on one or multiple UE capability assumptions, and UE can report through MSG3 which resource/report configuration(s) received in SIBx is/are supported.
* Option-3: NW can provide the resource/report configuration(s) in SIBx based on one or multiple UE capability assumptions, and UE can report through MSG3 the supported capability(s) of early SRS/CSI/CSI-RS triggering (e.g., whether to support this feature, max number of CSI-RS ports, xTyR for SRS-AS, max bandwidth of the CSI-RS/SRS-AS etc.).

Note: The term “capability” or “UE capability” above does not mean legacy RRC based UE capability.

#### 2.1.2 Remaining Open issues

Improvement of SRS capacity and coverage

* Remaining details on enhancing UL capacity and coverage, specify the following enhancements:
	1. Remaining details on multiple frequency-domain starting positions for SRS repetition symbols within each SRS frequency hop for RB-level partial frequency sounding
	2. Remaining details on cross-slot SRS between one U slot and one adjacent S slot within a single SRS resource set

Enhancing downlink CSI acquisition

* Remaining details on enhancing DL CSI acquisition, targeting FR1, specify the following enhancements:
	1. Remaining details on early SRS/CSI/CSI-RS triggering for UE transitioning from IDLE/INACTIVE to CONNECTED mode via MSG4 of 4-step RACH, as well as for SCell activation and switching out of SCell dormancy in CONNECTED mode via the legacy signaling mechanisms (based on legacy SCell activation MAC CE, and legacy switching DCI out of SCell dormancy, respectively)
	2. For 48, 64, and 128 CSI-RS ports aggregated over multiple CSI-RS resources per legacy specification: Remaining details on CSI-RS density of 1/3, 1/4, 1/6, and 1/8 RE/RB/port while fully reusing legacy CSI-RS RE mapping per RB for CDM group generation (including OCC length, CDM group type, number of CDM groups), without impacting the legacy specification for rate matching on CSI-RS Res.

## 2.2 RAN2

#### 2.2.1 Agreements

Not yet started

#### 2.2.2 Remaining Open issues

Not yet started

## 2.3 RAN3

n/a

#### 2.3.1 Agreements

#### 2.3.2 Remaining Open issues

## 2.4 RAN4

#### 2.4.1 Agreements

Not yet started

#### 2.4.2 Remaining Open issues

Not yet started

## 2.5 RAN5

n/a

#### 2.5.1 Agreements

#### 2.5.2 Remaining Open issues

#### 2.5.3 Remaining Open issues with cross-WG dependencies

## 2.6 RAN6

n/a

#### 2.6.1 Agreements

#### 2.6.2 Remaining Open issues

## 3. Detailed progress in SA/CT WGs since last TSG meeting (for all involved WGs)

NOTE: This section only needs to be filled in for WI/SIs where there is a corresponding relevant WI/SI in SA/CT.

n/a

## 3.1 SAx/CTs

#### 3.1.1 Agreements with cross-TSG impacts

#### 3.1.2 Remaining Open issues with cross-TSG impacts

NOTE: This section should also flag any critical dependencies that need TSG attention.

## 4. References

NOTE: This can be e.g. a list of all related Tdocs in the affected WGs since last TSG, references to LSs, produced TRs/TSs, the work/study item description or status reports of previous TSGs.

v04.81 31.07.2018 simplification of template and addition of cross-TSG aspects

v04.80 21.05.2018 minor adaptations for RAN #80

v04.79 26.02.2018 minor adaptations for RAN #79

v04.78 18.11.2017 minor adaptations for RAN #78

v04.77 06.08.2017 minor adaptations for RAN #77

v04.76 15.05.2017 minor adaptations for RAN #76

v04.75 31.01.2017 minor adaptations for RAN #75

v04.74 28.10.2016 minor adaptations for RAN #74

v04.73 01.09.2016 adaptations for RAN #73 (time units in extra Excel table, RAN6 reporting included)

v04.72 26.05.2016 adaptations for RAN #72 (introduction of NR & GERAN TUs)

v04.71 10.02.2016 minor adaptations for RAN #71

v04.70 30.10.2015 minor adaptations for RAN #70

v04.69 12.08.2015 minor adaptations for RAN #69

v04.68 21.05.2015 minor adaptations for RAN #68

v04.67 01.02.2015 minor adaptations for RAN #67

v04.66 16.11.2014 minor adaptations for RAN #66

v04.65 16.08.2014 minor adaptations for RAN #65

v04.64 22.05.2014 minor adaptations for RAN #64

v04.63 24.01.2014 restructuring for RAN #63 to cover Core & Perf. in one doc file

v03.62 11.11.2013 section 1.2.3 adapted for RAN #62

v03 11.08.2013 section 1.2.3 added on time budget

v02 07.05.2010 history added, some spelling corrections

v01 13.11.2009 First version of the template