**3GPP TSG RAN WG1 #122 R1-250XXXX**

**Bengaluru, India, Aug 25th – 29th, 2025**

Agenda Item: 10.2

Source: Ad-Hoc Chair (Ericsson)

Title: Session notes for 10.2 NR MIMO Phase 6

Document for: Discussion, Decision

## NR MIMO Phase 6

*Please refer to RP-251856 for detailed scope of the WI.*

[122-R20-MIMO] Email discussion on Rel-20 MIMO – xxx

* To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc

R1-2505948 Rel-20 NR MIMO Phase 6: Initial Rapporteur Workplan Rapporteur (MediaTek, CATT)

### Improvement of SRS capacity and coverage

*Including a) Multiple frequency-domain starting positions for SRS repetition, and b) Cross-slot SRS between one U slot and one adjacent S slot.*

**R1-2505274** Discussion on improvement of SRS capacity and coverage ZTE Corporation, Sanechips

**R1-2505812** Improvement of SRS capacity and coverage Lenovo

R1-2505164 Discussion on improvement of SRS capacity and coverage Spreadtrum, UNISOC

R1-2505209 Improvement of SRS capacity and coverage Huawei, HiSilicon

R1-2505242 NR MIMO Phase 6: SRS Enhancement InterDigital, Inc.

R1-2505283 Discussion on improving of SRS capacity and coverage TCL

 Withdrawn

R1-2505286 Discussion on improving of SRS capacity and coverage TCL

R1-2505288 Improvement of SRS capacity and coverage MediaTek Inc.

R1-2505302 On improvement of SRS capacity and coverage CATT

R1-2505408 Discussion on improvement of SRS capacity and coverage vivo

R1-2505455 Discussion on the improvement of SRS capacity and coverage Xiaomi

R1-2505512 Discussion on SRS capacity and coverage improvement China Telecom

R1-2505576 Views on improvement of SRS capacity and coverage Samsung

R1-2505635 Improvement of SRS capacity and coverage Tejas Network Limited

R1-2505749 Discussion on enhancement of SRS capacity and coverage for MIMO phase 6 OPPO

R1-2505905 On Rel-20 MIMO SRS capacity and coverage improvement Apple

R1-2505936 Discussion on improvement of SRS capacity and coverage NEC

R1-2505946 Enhancements for SRS capacity and coverage Transsion Holdings

R1-2505965 Discussion on improvement of SRS capacity and coverage Fujitsu

R1-2505987 Improvement of SRS Capacity and Coverage Nokia

R1-2505997 Discussion on improvement of SRS capacity and coverage HONOR

R1-2506110 Discussion on improvements of SRS capacity and coverage Sony

R1-2506144 Discussion on Improvement of SRS Capacity and Coverage Rakuten Mobile, Inc

R1-2506210 SRS enhancements in 5G MIMO Phase 6 Qualcomm Incorporated

R1-2506267 Improvement of SRS capacity and coverage Sharp

R1-2506297 Discussion on Improvement of SRS capacity and coverage NTT DOCOMO, INC.

R1-2506367 On Rel-20 improvement of SRS capacity and coverage Ericsson

R1-2506369 Discussion on improvement of SRS capacity and coverage NICT

R1-2506381 Views on enhancements for Improvement of SRS capacity and coverage KDDI Corporation

**R1-2506461**

**R1-2506532**

**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.

**R1-2506571**

**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.

**R1-2506585**

**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 DL CSI acquisition

*Including a) Early SRS/CSI/CSI-RS triggering, and b) CSI-RS density reduction for 48, 64, and 128 CSI-RS ports.*

**R1-2506166** On Rel-20 Enhanced DL CSI acquisition Ericsson

**R1-2506211** DL CSI acquisition enhancements in 5G MIMO Phase 6 Qualcomm Incorporated

R1-2505152 Enhancing DL CSI acquisition FUTUREWEI

R1-2505165 Discussion on enhancing DL CSI acquisition Spreadtrum, UNISOC

R1-2505210 DL CSI acquisition enhancment Huawei, HiSilicon

R1-2505243 NR MIMO Phase 6: DL CSI Enhancement InterDigital, Inc.

R1-2505275 Discussion on enhancing DL CSI acquisition ZTE Corporation, Sanechips

R1-2505284 Discussion on enhancing DL CSI acquisition TCL

R1-2505289 Enhancing DL CSI acquisition MediaTek Inc.

R1-2505303 On enhancements for DL CSI acquisition CATT

R1-2505409 Discussion on enhancing DL CSI acquisition vivo

R1-2505456 Discussion on enhancing DL CSI acquisition Xiaomi

R1-2505577 Views on enhancing DL CSI acquisition Samsung

R1-2505636 Enhancing DL CSI acquisition Tejas Network Limited

R1-2505647 Enhancing DL CSI acquisition Lenovo

R1-2505750 Discussions on Enhancing DL CSI Acquisition OPPO

R1-2505822 Discussion on enhancing DL CSI acquisition LG Electronics

R1-2505864 On DL CSI Acquisition Enhancements for FR1 Nokia

R1-2505906 On Rel-20 MIMO CSI enhancement Apple

R1-2505931 Discussion on Enhancing DL CSI acquisition NEC

R1-2505966 Discussion on enhancing DL CSI acquisition Fujitsu

R1-2505998 Discussion on enhancing DL CSI acquisition HONOR

R1-2506015 Discussions on enhancing DL CSI acquisition China Telecom

R1-2506016 DL CSI acquisition enhancements for Rel. 20 MIMO Fraunhofer IIS, Fraunhofer HHI

R1-2506060 Discussion on enhancing DL CSI acquisition for NR MIMO Phase 6 ETRI

R1-2506111 Discussion on DL CSI acquisition enhancements Sony

R1-2506137 Discussion on Early DL CSI Acquisition Enhancements Panasonic

R1-2506145 Discussion on Enhancement of CSI DL Acquisition Rakuten Mobile, Inc

R1-2506234 DL CSI Enhancements for NR Rel-20 AT&T

R1-2506266 Enhancing DL CSI acquisition Sharp

R1-2506298 Discussion on Enhancing DL CSI acquisition NTT DOCOMO, INC.

R1-2506319 Discussion on DL CSI acquisition ITRI, Acer Incorporated

R1-2506351 Discussion on enhancing DL CSI acquisition Google

R1-2506355 Views on DL Channel acquisition enhancements CEWiT, IITM

R1-2506370 Discussion on enhancing DL CSI acquisition NICT

R1-2506371 Discussion on Enhancing DL CSI acquisition IIT Kanpur

**R1-2506450**

**R1-2506539**

**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

R1-2506576

**Proposal 2.1B:**

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

**R1-2506583**

**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.