**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 Withdrawn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.

### 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~~/64/128~~ CSI-RS ports aggregation can be different

**Proposal 2.1C:**

CSI-RS frequency-domain density ρ = 1/8 can be configured to the K NZP CSI-RS resources at least for the following cases:

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

**Proposal 1.1.3:**

For UE transition from IDLE to CONNECTED mode, study the following 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: It’s not precluded to support more than one options depending on the use cases (e.g., early SRS-AS, early CSI-RS for tracking, and CSI-RS for CSI, early aperiodic CSI reporting)

FFS: Whether the UE capability assumption(s) is predefined in the specification or is up to NW implementation

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