**3GPP TSG-RAN WG4 Meeting #113 R4-241xxxxx**

**Orlando, US, 18th – 22nd November, 2024**

**Agenda item:** 7.20.4

**Source:** Samsung

**Title:** Coffee break discussion minutes s for SBFD RRM

**Document for:** Approval

# 1 Introduction

This document provides ad-hoc minutes for [113][223] NR\_duplex\_evo:

Issue 1-2-4: Requirements for scheduling restriction

Issue 1-1-6: Measurement period

Issue 1-1-9: Scheduling and measurement restriction

Issue 1-1-2: Measurement methods

Issue 1-1-3: Rx beam

Issue 1-1-4: Measurement resources

Issue 1-1-5: Side condition

# 2 Discussion

**Issue 1-2-4: Requirements for scheduling restriction**

* Proposals
	+ Proposal 1 (CATT, CMCC, HW, MTK):
		- RAN4 not to update existing scheduling restriction requirements to account for DL/UL transition time, unless triggered by other WGs
	+ Proposal 1 (CATT):
		- RAN4 does not define measurement restriction requirements for SSB/CSI-RS not fully contained in DL subbands.
	+ Proposal 2 (HW):
		- RAN4 to discuss scheduling restriction when SSB for L3 measurement is not completely contained in active DL subbands on SBFD symbols/slots.
	+ Proposal 3 (Samsung):
		- For inter-frequency measurement w/o gap, additional scheduling availability rule shall be introduced when neighboring cell SSB/CSI-RS based L3 measurement is not completely contained in active DL sub-bands on SBFD symbols/slots i.e.
			* UE is not expected to receive PDCCH/PDSCH/TRS/CSI-RS for CQI on the configured CSI-RS symbols/SSB symbols for RRM mobility measurement during SBFD symbols
* Recommended WF
	+ RAN4 confirms no scheduling restriction requirements are needed for DL/UL transition, e.g. after SSB measurement.
	+ RAN4 to discuss whether scheduling restriction applies when inter-frequency SSB/CSI-RS for L3 measurement is not completely contained in active DL sub-bands on SBFD symbols/slots.

**Discussion:**

* + QC: If UE needs to switch from UL to DL for measurement, there is transition time required. We need to further ebvaluated.
	+ Ericsson: For 1st bulluet, RAN1 has agreement aligned with 1st bulluet. No need to have extra sheduling restrction.

**Agreement:**

* For DL/UL transition, e.g. after SSB measurement, further check RAN1 agreements and potential impact to RAN4 scheduling restriction.
* Further discuss the impact to inter-frequency SSB measurement without gap case

**Issue 1-1-6: Measurement period**

* Proposals for L1-SRS-RSRP
	+ Proposal 1 (CATT, Nokia, CTC):
		- Follow L1-RSRP measurement approach, and both 1 and 3 samples are considered based on network configuration, e.g. timeRestrictionForChannelMeasurement.
	+ Proposal 2 (LGE, vivo):
		- Measurement period requirements are defined based on 1 sample.
		- The final decision should be based on simulation results.
	+ Proposal 3 (MTK):
		- Further define single set of requirements for the following options based on simulation performance results:
			* single set of requirements based on 1 sample,
			* single set of requirements based on 2-3 sample.
	+ Proposal 4 (Samsung):
		- With residual timing error assumption case 2, single shot measurement can be specified with unified L1-SRS-RSRP accuracy for all SCSs i.e., 3dB with RF margin.
* Proposals for L1-CLI-RSSI
	+ Proposal 1 (Nokia, CMCC, CTC, HW, ZTE, E///, QC, MTK):
		- Requirements based on 1 sample measurement assumption should be used.
	+ Proposal 2 (E///, Samsung):
		- DL reference timing should be used for method #1 when setting RAN4 measurement requirement. For L1-CLI-RSSI, reuse the Rel-16 CLI-RSSI requirement for method#1 with update of the measurement reference timing.
* **Recommended WF**
	+ For L1-SRS-RSRP, further discuss the following options based on simulation results.
		- Option 1: single set of requirements based on [1] sample
		- Option 2: two sets of requirements based on [1] and [3] samples based on NW configuration, e.g. timeRestrictionForChannelMeasurement
		- Other options are not precluded
	+ For L1-CLI-RSSI,
		- Confirm measurement period requirements are defined based on 1 sample, and
		- Clarify in the requirements that the measurement is based on DL timing.

**Discussion:**

* + Apple: Any reason for 1 sample on L1-CLI-RSRI?
	+ HW: L1-CLI-RSRI measurement has no accuracy issue which different compared to RSRP.
	+ MTK: With 1 sample, do we need to consider processing time for multi sub-blocks?
	+ Huawei: For measurement behavior on across two sub-blocks, we may need to further clarify.
	+ QC: We believe no issue for RSSI measurement.
	+ Apple: It may be related to UE capability to handle different DL sub-blocks.
	+ Nokia: Any clarification on 2 set of requirements?
	+ QC: Does “timeRestrictionForChannelMeasurement” still applied for L1\_RSRP measurement.

**Agreement:**

For L1-SRS-RSRP, further discuss the following options based on simulation results:

* Option 1: requirement specified with [1] sample measurement assumption
* Option 2: requirement specified based on [1] and [3] samples according to NW configuration, e.g. timeRestrictionForChannelMeasurement

For L1-CLI-RSSI,

* Confirm measurement period requirements are defined based on 1 sample, and
* Clarify in the requirements that the measurement is based on DL timing.

**Issue 1-1-9: Scheduling and measurement restriction**

* Proposals on scheduling restriction
	+ Proposal 1 (CATT, QC):
		- R16 CLI scheduling restriction requirements can be used as baseline.
	+ Proposal 1a (E///):
		- R16 CLI scheduling restriction requirements for FR1 can be used as baseline.
	+ Proposal 1b (MTK, Samsung):
		- Reuse Rel-16 CLI rules and values as starting point with necessary update by taking following changes into account:
			* Rx beam assumptions
			* measurement timing offsets
		- RAN4 to clarify whether existing R16 scheduling restrictions requirements already considered ‘Rx beam assumptions’ and ‘measurement timing offsets’.
		- RAN4 RRM shall further discuss the restriction/limitation of enabling method#2: UE measures RSRP of aggressor UE within UL subband.
	+ Proposal 2 (Nokia):
		- RAN4 shall wait for RAN1 conclusion on the CLI measurement methods before discussing the scheduling restriction.
	+ Proposal 3 (HW):
		- For L1-SRS-RSRP, R16 requirements are re-used as baseline, and exact number of restricted symbols is FFS.
		- For L1-CLI-RSSI, scheduling restriction applies only in OFDM symbols on which the UE performs the measurements. For DL, scheduling restriction applies when the measurement resource is not type-D QCL-ed with the DL reception in FR2.
	+ Proposal 4 (ZTE):
		- For L1-SRS-RSRP, the scheduling restriction defined in R16 can be set as starting point for FR1 with the consideration of time offset assumption. For FR2, the Rx beam assumption of CLI measurement should be considered.
		- For L1-CLI-RSSI, the scheduling restriction defined in R16 can be set as starting point for FR1. For FR2, the Rx beam assumption of CLI measurement should be considered.
* Proposals on measurement restriction
* Background: in R16 we have the following measurement restriction for L3 CLI measurement.

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| 9.7.2.5 SRS-RSRP measurement periodIf the SRS resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for TSRS\_RSRP\_measurement\_period.9.7.3.5 CLI-RSSI measurement periodIf the CLI-RSSI measurement resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for TCLI\_RSSI\_measurement\_period. |

* + Proposal 1 (QC):
		- R16 CLI measurement restriction requirements can be used as baseline.
	+ Proposal 1a (E///):
		- R16 CLI measurement restriction requirements for FR1 can be used as baseline.
	+ Proposal 2 (Nokia):
		- RAN4 shall wait for RAN1 conclusion on the CLI measurement methods before discussing the measurement restriction.
	+ Proposal 3 (HW):
		- For L1-SRS-RSRP, R16 requirements are re-used as baseline.
		- For L1-CLI-RSSI, no measurement requirements apply if the L1-CLI-RSSI measurement resources are overlapping with
			* Measurement gaps in FR1 or FR2, or
			* SMTC window or SSB in FR2, or
			* CSI-RS in FR2 when the measurement resource is not type-D QCL-ed with the DL reception.
	+ Proposal 4 (ZTE):
		- For L1-SRS-RSRP, no need to define measurement restriction.
		- For L1-CLI-RSSI, measurement restriction should also be defined.
	+ Proposal 5 (CATT):
		- FFS whether to define requirements for measurement restrictions.
	+ Proposal 6 (MTK):
		- RAN4 RRM shall further discuss the restriction/limitation of enabling method#2: UE measures RSRP of aggressor UE within UL subband.
		- FFS the impact of measurement methods and Rx beam assumption.
* **Recommended WF**
	+ For scheduling restriction,
		- For L1-SRS-RSRP,
			* For FR1, R16 requirements are re-used as baseline, FFS exact number of restricted symbols considering the impact of timing assumption
			* For FR2, FFS whether R16 requirements are re-used as baseline, considering the impact of Rx beam determination, and timing assumption
		- For L1-CLI-RSSI, FFS whether R16 requirements are re-used as baseline, considering the measurement is based on DL timing.

ZTE: The recommended WF fine for us, we need to consider timing assumption and QCL assumption. Given the difference compared L3 CLI measurement, we are not sure whether existing values can be applied.

Apple: RAN1 agreed QCL information will be indicated.

Huawei: Rx switching time and whether measurement is QCLed with PDCCH/PDSCH, both need to be considered.

Ericsson: For Rx beam switching is independent from 1 shot and multi-shots. It’s per measurement occasion.

LGE: Do need to consider intra-cell and inter cell case as well?

* + For measurement restriction, check whether the following general principle is agreeable.
		- Requirements for L1 CLI measurement do not apply when the L1 CLI measurement resource collides with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps.
			* FFS whether need to consider the exception cases where L1 CLI measurement can be performed with other measurement in parallel.

Nokia: If there is one collision, then no requirements appliable?

**Issue 1-1-2: Measurement methods**

* Background

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| **Agreement (from RAN1#118)**For L1 UE-to-UE CLI measurement and reporting, CLI measurements is performed within the active DL BWP and the following are supported* Method#1: UE measures RSSI within DL subband
* Method#2: UE measures RSRP of aggressor UE within UL subband
* FFS: Method#3: UE measures RSSI within UL subband
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* Proposals
	+ Proposal 1 (Nokia):
		- RAN4 to define the CLI measurement requirements in SBFD as the following:
			* SRS-RSRP measurement requirements for Method#2.
			* CLI-RSSI measurement requirements for Method#1 and Method#3.
	+ Proposal 2 (LGE, CMCC, CTC, vivo, HW, ZTE, E///, Samsung):
		- RAN4 shall specify L1 CLI measurement requirements at least for below methods:
			* Method#1: UE measures RSSI within DL subband
			* Method#2: UE measures RSRP of aggressor UE within UL subband
		- Additional methods can be considered based on further RAN1 agreements.
	+ Proposal 2a (MTK):
		- RAN4 shall specify L1 CLI measurement requirements at least for below methods:
			* Method#1: UE measures RSSI within DL subband
			* **FFS the restriction/limitation of enabling** Method#2: UE measures RSRP of aggressor UE within UL subband
		- Additional methods can be considered based on further RAN1 agreements.
	+ Proposal 3 (CTC, vivo):
		- Differentiation on requirements based on different methods should be considered, based on further RAN1 conclusions
* Recommended WF
	+ RAN4 shall specify L1 CLI measurement requirements at least for below methods:
		- Method#1: UE measures RSSI within DL subband
		- Method#2: UE measures RSRP of aggressor UE within UL subband
	+ Additional methods can be considered based on further RAN1 agreements.
	+ Differentiation on requirements based on different methods should be considered, based on further RAN1 conclusions.

**Issue 1-1-3: Rx beam**

* Background

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| **Agreement (from RAN1#118-bis)**For aperiodic L1 CLI-RSSI/CLI-SRS-RSRP reporting on PUSCH, support the following in the IE *CSI-AperiodicTriggerStateList*:* In *CSI-AssociatedReportConfigInfo* a list of TCI state(s) with *qcl-Type* set to 'typeD' is optionally configured where the TCI state(s) correspond to the resource(s) in the set of CLI measurement resources indicated by *CSI-AssociatedReportConfigInfo*
	+ The list of TCI states can be configured (present) only if *unifiedTCI-StateType* is configured and the CLI measurement resource(s) are aperiodic
* If the list of TCI states is not configured (absent), the UE assumes the following for each CLI measurement resource:
	+ If *unifiedTCI-StateType* is not configured
		- Same assumption as for L3-based CLI measurement as in 38.133: “For performing CLI measurement in FR2, UE can assume the configured CLI measurement resources are QCL-ed with TypeD to one of the latest received PDSCH and the latest monitored CORESET”
	+ If *unifiedTCI-StateType* is configured
		- “Indicated” DL only/joint TCI state as specified in TS 38.214
	+ Note: Above default rules apply to aperiodic reporting based on aperiodic, semi-persistent, and periodic CLI measurement resources

FFS: details of configuration of TCI state(s) for aperiodic reporting based on periodic and semi-persistent CLI measurement resources |

* Proposals
	+ Proposal 1 (CATT, LGE, Samsung):
		- RAN4 should capture the RAN1 agreements for Rx beam requirements.
		- Based on the further discussion of RAN1, RAN4 can revisit this issue.
	+ Proposal 2 (E///, MTK):
		- RAN4 can reuse the Rel-16 legacy QCL assumption for L1-SRS-RSRP and L1-CLI-RSSI measurement requirement.
			* ‘For performing CLI measurement in FR2, UE can assume the configured CLI measurement resources are QCL-ed with TypeD to one of the latest received PDSCH and the latest monitored CORESET’.
	+ Proposal 3 (Nokia):
		- RAN4 to discuss the CLI measurement requirement considering the different Rx beams.
	+ Proposal 4 (HW):
		- RAN4 to confirm that no Rx beam sweeping is assumed in measurement period requirements with Rx beam configuration/determination for L1 CLI measurement.
* Recommended WF
	+ RAN4 to capture the Rx beam determination for L1 CLI measurement based on RAN1 agreement, FFS how to capture, e.g. specify the UE behaviour or use a reference to RAN1 spec.
	+ ~~RAN4 to discuss the impact of Rx beam determination on measurement period requirements, e.g. whether Rx beam sweeping is needed.~~
	+ Rx beam sweeping is not needed for L1 CLI measurement.
	+ ~~Note: the impact of Rx beam determination on scheduling and measurement restriction requirements will be discussed in Issue 1-1-10.~~

Nokia: We can follow RAN1 agreement to discuss RAN4 requirements impact.

Huawei: We don’t need to consider Rx beam sweeping for L1 CLI measurement.

Nokia: We would like to further check.

LGE: We agreed with Huawei, no Rx beam sweeping needed.

CATT: Same view as Huawei.

**Issue 1-1-4: Measurement resources**

* Background

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| **Agreement (RAN1#118)**For frequency resource allocation of a CLI-RSSI measurement resource, the following are supported* Measurement resource type#1: One CLI-RSSI measurement resource is configured within a DL subband
* Measurement resource type#2: One CLI-RSSI measurement resource is configured across two DL subbands
* FFS: Number of resources that can be configured
* FFS: UE behavior for measurement

**Agreement (RAN1#118)**For L1 UE-to-UE CLI measurement and reporting, the following are supported* Wideband CLI-RSRP reporting
* Wideband CLI-RSSI reporting
* FFS: Subband CLI-RSSI reporting

**Agreement (RAN1#118-bis)**For Method#1 (RSSI measurement within DL subband), the frequency resources of CLI-RSSI measurement resource type#2 (One CLI-RSSI measurement resource across two DL subbands) is derived by excluding the frequency resources outside DL usable PRBs.* A single wideband RSSI measurement report is supported
	+ FFS: two per-DL-subband CLI-RSSI measurements reports with wideband report in each DL-subband.
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* Proposals
	+ Proposal 1 (CMCC, ZTE, MTK, Samsung):
		- RAN4 firstly define requirements based on wideband reporting, and further discuss sub-band reporting pending on RAN1 progress.
	+ Proposal 2 (Nokia):
		- RAN4 should define new requirements for the sub-band CLI-RSSI reporting supported by RAN1. Sub-band CLI-RSSI reporting is applicable for both measurement resource type #1 and type #2.
	+ Proposal 3 (CATT, MTK):
		- RAN4 to evaluate whether the legacy CLI-RSSI measurement accuracy requirements are applicable for L1 CLI-RSSI measurements, when one CLI-RSSI resource occupies two discontinuous DL subbands (measurement resource type#2)
	+ Proposal 4 (vivo):
		- For the wide-band reporting when measurement results from different discontinuous DL subbands need be combined (measurement resource type#2), how to combine the measurement results could be up to UE implementation.
	+ Proposal 5 (LGE):
		- RAN4 need to wait for RAN1 conclusion on measurement resources to discuss whether is an impact on the requirements.
	+ Proposal 6 (HW):
		- RAN4 to confirm that measurement delay and accuracy requirements for L1-CLI-RSSI are agnostic to measurement resource or reporting configuration.
	+ Proposal 7 (vivo):
		- RAN4 needs to discuss the applicability of requirements when the number of RBs used for measurement is less than 48.
	+ Proposal 8 (MTK):
		- For measurement resource type#1: One CLI-RSSI measurement resource is configured within a DL subband, existing requirements are applicable provided that the minimum number of resources are satisfied.
	+ Proposal 9 (Samsung):
		- For measurement resource type, RAN4 shall cover semi-static, aperiodic and periodic resource types following the configuration in CSI-ResourceConfig.
* Recommended WF
	+ RAN4 to define requirements for L1-CLI-RSRI and L1-SRS-RSRP measurement for semi-static, aperiodic and periodic resource types.
	+ RAN4 to discuss whether and how L1-CLI-RSSI measurement delay or accuracy requirements would be impacted by measurement resource configuration (e.g. resource type#1 or type#2) or measurement reporting configuration (e.g. wideband or sub-band reporting), as well as whether an applicability condition on number of PRBs is needed for accuracy requirements.

**Issue 1-1-5: Side condition**

Note: For SRS configuration, we already agreed to “re-use Rel-16 side condition as baseline” in RAN4#112-bis, so proposals on re-using SRS configuration from Rel-16 are not captured.

* Proposals for timing offset
	+ Proposal 1 (Nokia):
		- For intra-cell scenario, remove cell phase error from Rel-16 SRS-RSRP side condition.
		- For inter-cell scenario, RAN4 shall define the requirement only if sensible accuracy performance can be achieved based on the simulation results.
	+ Proposal 2 (vivo):
		- From UE perspective, the differentiation on inter-cell aggressor UE or intra-cell aggressor UE maybe not possible even the NW side has this capability. The 3us cell phase synchronization error may still need be considered for the worst case.
	+ Proposal 3 (Samsung):
		- Further discuss residual timing error side condition pending on RAN1 feedback with following candidate options:
			* Option 1: RAN4 specify two sets of requirements based on different residual timing error conditions
			* Option 2: RAN4 specify two sets of requirements based on different residual timing error conditions with NW indication
			* Option 3: RAN4 specify one set requirement based on case 2 for residual timing error condition
* Proposals for SRS Es/Iot
	+ Proposal 1 (CATT, Samsung, ZTE):
		- Re-use Rel-16 side condition (SRS Es/Iot = 1dB) as baseline.
	+ Proposal 2 (Nokia, QC):
		- Define a higher value of SRS Es/Iot as side condition.
* Proposals for SRS BW
	+ Proposal 1 (CATT):
		- Use 24 PRB as baseline and wait for more progress in RF group
	+ Proposal 2 (Rel-16 side condition):
		- 48 PRB
* Recommended WF
	+ For timing offset, wait for RAN1 reply, and at same time check the simulation results, e.g. whether performance with 1-sample and Case 1 condition is acceptable.
	+ For SRS Es/Iot, further discuss. Encourage companies to provide simulation results to check the performance with different Es/Iot conditions.
	+ For SRS BW, further discuss. Encourage companies to provide simulation results to check the performance with 24 RB.

# Reference

[1] R4-2418281 Topic summary for [113][223] NR\_duplex\_evo Moderator (Huawei)