**3GPP TSG-RAN WG4 Meeting #112 R4-2414043**

**Maastricht, Netherlands, Aug 19 – Aug 23, 2024**

**Title:** WF on RRM requirements for XR\_Ph3

**Agenda Item:** 8.24.3

**Source:** Nokia

**Document for:** Approval

# Topic #1: Scenarios for XR enhancements

## Issue 1-1: Workscope

**< Agreement>**:

* As starting point, RAN4 to discuss the Tx/Rx in occasions of L3 measurement.
	+ The progress in RAN1/2 should be taken into account.
* FFS whether/when to start the discussion of Tx/Rx in occasions of scheduling restriction due to L1 operation.
* RAN4 to discuss
	+ The potential impact on measurement requirements due to measurement cancellation
	+ The corresponding solution to address the impact if needed.

## Issue 1-2: Deployment scenarios

**<Way forward>: Discuss considering the following proposals:**

* Proposal 1: RAN4 to perform a clear selection of the applicable deployment cases when considering skipping of measurement occasions.
* Proposal 2: Measurement skipping apply for FR1 and FR2-1 measurements
* Proposal 3: To avoid limiting the XR operation to good network radio conditions only and hereby limiting the XR service coverage, RRM measurement requirements are enhanced for UEs under XR operation.
* Other proposals are not precluded.

## Issue 1-3: Types of measurement gaps to consider

In this issue we discuss the types of measurement gaps to be considered in this WID. In order to help the discussion, we reuse the definition of Type-1 and Type-2 measurement gaps as agreed in Rel-18 NR\_MG-enh2:

|  |
| --- |
| * Type-1 MG: Gap(s) configured via GapConfig without suffix
* Type-2 MG: Gap(s) configured via GapConfig-r17 without preConfigInd-r17 or ncsgInd-r17
* Rel-18 Concurrent Gap: gap with assigned priority which includes at least either NCSG or Pre-MG
 |

**<Way forward>: Discuss considering the following options:**

* Proposal 1: Type 1 MG
	+ Option 1: First priority
	+ Option 2: Second priority
* Proposal 2: Type 2 MG
	+ Option 1: First priority
	+ Option 2: Second priority
* Proposal 3: NCSG
	+ Option 1: First priority
	+ Option 2: Second priority
* Proposal 4: PreMG
	+ Option 1: First priority
	+ Option 2: Second priority
* Proposal 5: Rel-18 Concurrent gap
	+ Option 1: First priority
	+ Option 2: Second priority
* Proposal 6: MUSIM gaps
	+ Option 1: First priority
	+ Option 2: Second priority
* Proposal 7: MG for positioning
	+ Option 1: First priority
	+ Option 2: Second priority

## Issue 1-4: Types of measurements without gaps to consider

**<Way forward>: Discuss considering the following proposals:**

* Proposal 1: RAN4 to study whether and how to define new core requirements when some of SMTC occasions that need to be used for measurements outside gaps are enabled for data transmission/reception when scheduling restrictions exists.
* Proposal 2: Prioritize measurement skipping for measurements without gaps without interruptions, in intra-frequency for FR2

## Issue 1-5: Whether L1 measurements are considered for XR measurement skipping

**<Way forward>: Discuss considering the following options:**

* Option 1: XR measurement skipping does not include L1 measurements.
* Option 2: XR measurement skipping does include L1 measurements.

## Issue 1-6: Whether L1/L2 triggered mobility measurements are considered for XR measurement skipping

**<Way forward>: Discuss considering the following proposal:**

* Proposal 1: FFS the L1/L2 triggered mobility measurement.

# Topic #2: Need/feasibility of UE assistance information

## Issue 2-1: General on UAI

**<Way forward>: Discuss considering the following proposal:**

* Option 1: No efficient way is identified to let UE provide assistance information in a static manner.
* Option 2: discuss the necessary of each candidate UAI one by one
	+ Option 2a: The UAI mechanism is tradeoff between the overhead and the system efficiency, RAN4 could discuss the necessary of each candidate UAI one by one.
	+ Option 2b: Any further RAN4 impact analysis shall account for UE assistance information signaling latency impacts to mobility/triggered events.
* Option 3: Discuss the details of candidate UAI on how it actually works, and pros and cons.

## Issue 2-2: Expected gNB behaviour

**<Way forward>: Discuss considering the following proposals:**

* Proposal 1:
	+ RAN4 will not specify any explicit or implicit requirement on gNB behaviour in relation to the UE assistance data.
	+ UE assistance containing patterns still cannot guarantee that gNB configuration will follow the UE pattern, since the configuration is ultimately the network decision.
* Proposal 2: The UAI shall not restrict NW behavior for scheduling which is up to NW implementation.
* Other proposals are not precluded.

## Issue 2-3: Information related to measurement occasions for L3 measurements

**<Way forward>: Discuss considering the following options:**

* Option 1: No UE assistance information related to measurement occasion is needed.
* Option 2: Introduce UE assistance information related to measurement occasions:
* Option 3: Discuss feasibility of UAI.
	+ Option 3a: When considering the feasibility of UAI related to measurement occasions, it should be ensured that measurement delay and measurement accuracy is not impacted by measurement skipping
	+ Option 3b: Any proposals for UAI related to measurement occasions should be justified by clear performance benefit.
* Option 4: It is up to RAN2 to discuss and decide what UE assistance information related to measurement occasions should be supported.

## Issue 2-4: If Information related to measurement occasions for L3 measurements is introduced, which aspects should be considered

**<Way forward>: Discuss considering the following options:**

* Option 1: the number of needed measurement gaps/SMTC with restrictions within a time period, which is beneficial in network indication to skip a measurement gap(s) /restriction(s) in order to enable Tx/Rx.
* Option 2: The information related to the maximum number of measurement occasions allowed for reallocated to XR over a time.
* Option 3: Maximum number of consecutive MGs that can be skipped
* Option 4: maximum number of MGs that can be skipped
* Option 5: MG type that can be skipped
* Option 6: UE should provide assistance information about gaps not used for measurement for enabling transmission/reception in these gaps.
* Option 7: UE should provide assistance information about SMTC occasions not used for measurement for enabling transmission/reception on the SMTC occasions.
* Option 8: The UE assistance information about SMTC occasions not used for measurement should be provided on each CC/MO.
* Option 9: The patterns of gaps/SMTC occasions not used for measurement within a time period should be provided as UE assistance information.

## Issue 2-5: Information related to channel conditions

**<Way forward>: Discuss considering the following proposal:**

* Proposal 1: For UEs configured with search threshold (s-MeasureConfig),
	+ the UE shall inform the network when the condition is met (i.e. defined RSRP threshold is exceeded).
	+ the UE shall inform the network that it is stopping doing RRM measurements because the s-MeasureConfig condition is no longer fulfilled.

## Issue 2-6: Reply LS

**<Way forward>: Discuss considering the following options:**

* Option 1: Reply RAN1 that RAN4 hasn’t identified an efficient way to let UE provide assistance information in a static manner
* Option 2: RAN4 concludes semi-static solution for indication of gaps/SMTC occasions not used for measurement is better from RAN4 perspective and LS to RAN1 if necessary.
* Option 3: RAN4 reply LS to RAN1 that the UAI related to measurement occasions may be beneficial for enabling transmission/reception within MG/SMTC with restriction. RAN4 will further discuss the corresponding RRM behavior/performance related to UAI.

## Issue 2-7: Other proposals on UAI

**<Way forward>: Discuss considering the following options:**

* Proposal 1: NW may indicate the percentage of measurement gaps not used for measurement for UE to provide assistance information about gaps.
* Proposal 2: NW may indicate the percentage about SMTC occasions not used for measurement for UE to provide assistance information about SMTC occasions.
* Proposal 3: No UE assistance information about L1 measurements is provided.
* Proposal 4: UE assistance information is reported in response to RRCReconfiguration.
* Proposal 5: RAN4 to further decide what measurement gaps are considered in this WI, e.g., per-UE gap and per-FR gap, pre-configured measurement gap, concurrent measurement gaps, NCSG and MUSIM gaps etc.
* Proposal 6: RAN4 to further study how UE assistance information is reported when DRX is configured.

# Topic #3 Timeline for measurement skipping processing

## Issue 3-1: Timeline requirement for measurement skipping

**<Way forward>: Discuss considering the following proposals:**

* Proposal 1: The UE processing time for decoding a DCI with RRM measurement skipping indication should be the same as the currently defined processing requirements in 3GPP TS 38.214 for decoding of DCI and PDSCH decoding, or PUSCH preparation.
* Proposal 2: RAN4 shall define processing requirements for a UE to act on a DCI with RRM measurement skipping indication. Inspired by UE requirements for e.g. acting on power control commands and uplink cancellation indication in DCI, the processing could be fraction of a slot.
* Other proposals are not precluded.

# Topic #4 RRM requirement impact of measurement skipping

## Issue 4-1: How measurement skipping impact is considered in RRM measurements

**<Way forward>: Discuss considering the following proposals:**

* Proposal 1: RAN4 to consider extending the L3 requirements with MGs such as cell identification and measurements delays when one or more MGs are deactivated by the network.
	+ The exact extension may depend on further RAN1/RAN2 discussion and agreements.
* Proposal 2: Any further RAN4 impact analysis shall account for XR QoS under measurement gap skipping occasions versus measurement accuracy degradation.
* Proposal 3: RAN4 to discuss possible enhancements to the legacy RRM requirements to account for the UE XR operation, e.g., whether pre-defined or dynamically extended RRM measurement period is to be specified for UE under XR operation to dynamically account for the availability of the RRM measurement occasions for RRM measurements.
* Proposal 4: NW shall have clear expectation on UE RRM behaviour/performance, when the measurement occasion is skipped/cancelled for data transmission/reception.
* Other proposals are not precluded.

## Issue 4-2: Conditions for measurement skipping

**<Way forward>: Discuss considering the following proposals:**

* Proposal 1: RAN4 to discuss which conditions the measurement gap configurations need to meet to be relevant for the UE XR operation, e.g., minimum MGL and/or maximum MGL, maximum MGRP, maximum acceptable time separation between the XR occasions, etc.
* Proposal 2: RAN4 to discuss the impact on RRM samples and how they are combined during the UE XR operation, e.g., maximum acceptable time separation between two measurement occasions available for RRM measurements.
* Proposal 3: Discuss possible pattern for measurement cancellation
* Other proposals are not precluded.