

3GPP TSG RAN Meeting #103

Maastricht, Netherlands, March 18-21, 2024

RP-240545

Views on Rel-19 RAN4 RRM topics

Agenda Item:

9.1.4.4

Source:

Intel Corporation

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Discussion & Decision



Introduction

This contribution provides Intel's views on the scope of RAN4 Rel-19 RRM-centric objectives taking into consideration discussion and proposals in RAN #102 and RAN #103

- RAN #102: RP-233951 "Moderator's summary for RAN4 Candidate Demodulation/RRM Topics for Rel-19 "
- RAN #103: RP-240019 "Proposed Summary for RAN Rel-19 Package: RAN4 Part" by RAN & RAN4 Chair

In the following slides we provide Intel views on:

- Candidate RRM topics identified in RAN #102 in RP-233951
- Objectives of RRM enhancements WI based on proposals in RP-240019

Views on RAN #102 candidate topics

Background

RP-233951 Moderator's summary for RAN4 Candidate Demodulation/RRM Topics for Rel-19

Summary/conclusions for RRM topics:

From moderator point of view, these below high level descriptions can be used as starting point

- 1.1 FR2 L3/L1 measurement delay reduction with reduced Rx beam sweeping and enhanced CSSF for connected mode
 - 1.1.1 FFS on applied scenarios, justification and feasibility on reduced number of Rx beam sweeping
- 1.2 Parallel measurement with NCSG
- 1.3 Pre-configured NCSG
- 1.4 HO with PScell for scenarios for NR SA to NR DC
- 1.5 Extend the R17 RLM/BFD relaxation requirements to RedCap UEs
- 1.6 Enhancements to maintain the UE reception and transmission during the period (or part of period) of DL, UL and joint DL/UL active TCI state switching
- 1.7 Specify the requirements for inter-frequency and intra-frequency L1 measurement based on NCSG
 - 1.7.1 Further study on RAN1/2 impact
- 1.8 A-TRS based TCI switch delay and Scell activation
- 1.9 Scell with UL only transmission with study on RAN1/2 impact
- 1.10 Dynamic RTD/TTD status update
 - 1.10.1 FFS on the applied scenario and also the performance gain for network and UE
 - 1.10.2 FFS on RAN2 impact on designing the report, e.g. event triggered report
 - 1.10.3 Further check with RAN1 MIMO item if the reporting has been already included
- 1.11 Fast Scell activation with EMR with both delay requirements for Scell activation and enhanced measurement accuracy requirements.
- 1.12 Combination of different gap types, e.g., Pre-MG and NCSG and combination of gap enhancement and other features, e.g., NTN, POS, MUSIM

Views on RAN #102 candidate topics

Summary (RAN#102)	Intel views
RRM related	
<p>FR2 L3/L1 measurement delay reduction with reduced Rx beam sweeping and enhanced CSSF for connected mode</p> <ul style="list-style-type: none"> • FFS on applied scenarios, justification and feasibility on reduced number of Rx beam sweeping 	<p>Medium priority. Measurement delay reductions are important for FR2; however, the specific enhancements need investigation before being introduced and a study stage is recommended. The work needs to be differentiated from multi-Rx panel type of devices and focus on UEs with single active Rx panel.</p>
<p>Scell with UL only transmission with study on RAN1/2 impact</p>	<p>High priority. The scenarios with SCell with UL only transmissions was deprioritized during Rel-18 NES work, while is expected to provide potential benefits in deployments allowing operators to flexibly disable DL transmissions providing energy savings.</p>
<p>Dynamic RTD/TTD status update (operation with RTD > CP)</p> <ul style="list-style-type: none"> • FFS on the applied scenario, and also the performance gain for network and UE • FFS on RAN2 impact on designing the report, e.g. event triggered report • Further check with RAN1 MIMO item if the reporting has been already included 	<p>High priority. The support of RTD > CP and dynamic RTD/TTD status update can be beneficial to improve the overall mTRP deployments operation, relax the constraints of very dense mTRP deployments and fully exploit the benefits of enhanced UE implementation.</p> <p>The work is expected to focus on scenarios with mTRP operation with RTD > CP on the same carrier, and also dynamic change of respective conditions.</p>

Views on RAN #102 candidate topics

Summary (RAN#102)	Intel views
RRM related (cont.)	
HO with PScell for scenarios for NR SA to NR DC	Low priority. HO with PScell for scenarios for NR SA to NR DC was discussed in the past and was de-prioritized in previous releases.
Extend the R17 RLM/BFD relaxation requirements to RedCap Ues	Low priority.
Enhancements to maintain the UE Rx and Tx during the period (or part of period) of DL, UL and joint DL/UL active TCI state switching	Medium priority. The proposed enhancement is an easy and straightforward approach to improve the performance during TCI state switching.
Requirements for inter-frequency and intra-frequency L1 measurement based on NCSG.	Low priority.
A-TRS based TCI switch delay and Scell activation	Low priority.
Fast Scell activation with EMR with both delay requirements for Scell activation and enhanced measurement accuracy requirements.	Low priority.

Views on RAN #102 candidate topics

Summary (RAN#102)	Intel views
Measurement Gap related	
Parallel measurement with NCSG	High priority. The proposal has a good level of support in RAN#102. UEs with vacant RF chain(s) can utilize them for parallel measurements for the multiple gaps no matter they are collided or not. Limited work efforts are expected.
Pre-configured NCSG	High priority. Automatic (de)activation of NCSG upon SCell activation/deactivation has minimum spec impact. Mainly SCell activation delay requirements. Limited work efforts are expected.
Combination of different gap types, e.g., Pre-MG and NCSG and combination of gap enhancement and other features, e.g., NTN, POS, MUSIM	Low priority. Further combination of different gap types can make the specification overcomplicated

WI: RRM Enhancements

RRM Enhancements WI

RP-240019 “Proposed Summary for RAN Rel-19 Package: RAN4 Part”

RRM

📶 References: [RP-233951](#)

📶 Potential objectives:

- FR2 L3/L1 measurement delay reduction with reduced Rx beam sweeping and enhanced CSSF for connected mode
 - FFS on applied scenarios, justification and feasibility on reduced number of Rx beam sweeping
 - For single Rx, focus on the case of CA/DC where it is currently specified that the delay is scaled with the number of CCs
 - For multi-Rx, focus on the single carrier case
 - Other scenarios (if so, clearly defined)?
 - Parallel measurement with NCSG
 - Pre-configured NCSG
 - HO with PScell for scenarios for NR-SA to NR-DC
 - Extend the R17 RLM/BFD relaxation requirements to RedCap UEs
 - Enhancements to maintain the UE reception and transmission during the period (or part of period) of DL, UL and joint DL/UL active TCI state switching
- Specify the requirements for inter-frequency and intra-frequency L1 measurement based on NCSG
 - Further study on RAN1/2 impact
 - A-TRS based TCI switch delay and Scell activation
 - Scell with UL only transmission with study on RAN1/2 impact
 - Dynamic RTD/TTD status update
 - FFS on the applied scenario and also the performance gain for network and UE
 - FFS on RAN2 impact on designing the report, e.g. event triggered report
 - Further check with RAN1 MIMO item if the reporting has been already included
 - Fast Scell activation with EMR with both delay requirements for Scell activation and enhanced measurement accuracy requirements.
 - To start from Q3'2024 and aim for completion in Dec'2024
 - Workplan for this bullet can be discussed in May'2024
 - Combination of different gap types, e.g., Pre-MG and NCSG and combination of gap enhancement and other features, e.g., NTN, POS, MUSIM

Slide 22

RRM Enhancements WI

Views on WI scope

The proposed RRM WI scope in RP-240019 includes the following objectives

1. FR2 L3/L1 measurement delay reduction with reduced Rx beam sweeping and enhanced CSSF for connected mode
2. Fast Scell activation with EMR with both delay requirements for Scell activation and enhanced measurement accuracy requirements.

Intel views

- Proposed objectives provide a reasonable set of improvements to be specified in Rel-19 timeframe
- The Objective #2 (Fast Scell activation with EMR) is expected to have a limited impact on the specification and the work is expected to complete by Dec 24.
- Taking into account proposed 1.5 TU budget for the WI in 2025 it is reasonable to consider additional RRM objectives to be considered upon completion of objective #2. The set of additional objectives to be considered is provided in Slides 14-17
- A number of proposed objectives in RP-233951 are anticipated to require a minimum efforts and can be potentially handled as TEI in case of urgent commercial interests.

Proposal #1: Discuss WI scope update and additional RRM objectives in Dec 24 upon completion of objective #2 (Fast Scell activation with EMR).

Proposal #2: Discuss whether any additional candidate objectives in RP-233951 can be handled as TEI in case of a clear commercial interest from operators.

RRM Enhancements WI

FR2 L3/L1 measurement delay reduction

Intel views

- The specific solutions for FR2 L3/L1 measurement delay reduction are yet unclear at this moment. RAN4 had multiple discussions in the previous releases on the feasibility of beam sweeping factor reduction. Therefore, the WI shall consider a study stage to identify proper solutions and their impact on the performance.
- Candidate enhancements may depend on whether UE supports simultaneous multi-panel reception
 - For UEs without simultaneous multi-Rx panel reception capabilities the scope is proposed to be limited to CA scenarios (and CSSF), since the feasibility of single carrier beam sweeping factor reduction may have impact on the performance
 - For UEs with simultaneous multi-Rx panel reception capabilities there is a room to improve the performance via providing more intelligent parallel measurements using two panels (i.e., reduce beam sweeping factor) on a single carrier

Candidate objectives

Study and if needed specify solutions and requirements for FR2 -1 L3/L1 measurement delay reduction for RRC Connected mode

- *The solutions for measurement delay reduction are based on reduced Rx beam sweeping and/or enhanced CSSF*
- *For UEs without simultaneous multi-Rx panel reception capabilities the scope is limited to CA scenarios and focus on solutions based on enhanced CSSF*
- *For UEs with simultaneous multi-Rx panel reception capabilities the scope is limited to single carrier case*
- *The enhancements shall ensure a limited impact on the overall performance*

RRM Enhancements WI

Work Item Objectives

Core part:

1. Study and if needed specify solutions and requirements for FR2 -1 L3/L1 measurement delay reduction for RRC Connected mode
 - The solutions for measurement delay reduction are based on reduced Rx beam sweeping and/or enhanced CSSF
 - For UEs without simultaneous multi-Rx panel reception capabilities the scope is limited to CA scenarios and focus on solutions based on enhanced CSSF
 - For UEs with simultaneous multi-Rx panel reception capabilities the scope is limited to single carrier case
 - The enhancements shall ensure a limited impact on the overall performance
2. Specify requirements for fast SCell activation based on previous EMR measurements
 - The requirements include
 - SCell activation delay
 - Enhanced measurement accuracy, if justified.
 - Specify conditions for EMR measurements validity
 - Note: the work shall start after RAN#104 and complete by RAN#106

Performance part:

1. Specify RRM performance requirements and test cases

Additional Rel-19 RRM
objectives for consideration in Dec 24

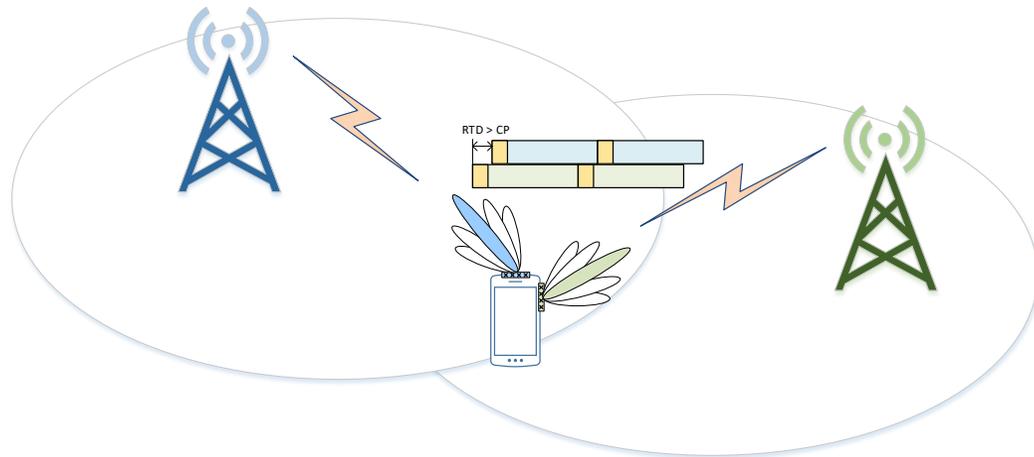
Additional RRM objectives for Dec 24

Operation with $RTD > CP$

Background

- In practical deployments it is challenging to guarantee that timing offsets between signals from different TRPs on the same carrier are within a CP, especially for FR2 operation with a high SCS, which limits the efficiency of mTRP operation
- Many existing baseline RRM/Demod requirements for mTRP scenarios are defined under an assumption that receive timing difference (RTD) between signals is less than CP

- Support of $RTD > CP$ on the same carrier was discussed under several Rel-18 work items, but a relatively limited support is expected to be introduced
 - **Rel-18 NR MIMO:** New UE capabilities are defined by RAN1 to enable Rx timing difference between the two DL reference timings $> CP$. A very limited set of RAN4 requirements is being introduced (MRTD/MTTD).
 - **Rel-18 NR FR2 HST:** $RTD > CP$ is supported FR2 UE PC6. RRM requirements are limited to MRTD. Demod requirements are FFS.
 - **Rel-18 NR FR2 Multi-Rx Chain:** $RTD > CP$ scenario is de-prioritized.
 - **Rel-18 NR MobEnh:** $RTD > CP$ support depends on UE capability. Separate RRM requirements are discussed corresponding to different UE capabilities.



Additional RRM objectives for Dec 24

Operation with $RTD > CP$

RRM requirements for $RTD > CP$

- A systematic and generic approach is desirable to introduce the support of mTRP operation with time offsets larger than CP including RRM and Demodulation requirements to facilitate feature adoption for different device types
- At least the following RAN4 requirements are defined under an assumption of $RTD < CP$ and limit mTRP operation

➤ RRM

- Inter-cell beam management
- TCI state activation
- LTM – L2 triggered mobility
- CSI-RS based L3 measurements (intra-frequency)

➤ Demodulation

- Simultaneous demodulation of mTRP DL signals

Dynamic RTD/TTD status update

- Support of dynamic RTD/TTD status update was proposed in Rel-19 and included in the list of candidate topics together with $RTD > CP$ proposal
- Both topics (RRM for $RTD > CP$ and dynamic status update) are complementary and can be handled together
- Dynamic RTD/TTD status update may allow UE to activate RTD/TTD dependent features/requirements dynamically depending on specific conditions and same time align understanding with gNB side.
- Dynamic RTD/TTD status update requires 1) UE measurements of RTD/TTD; 2) reporting mechanism
- For UE measurements and reporting of respective metrics it is possible to potentially reuse RAN1 Rel-19 MIMO reporting for CJT (Obj3) and details can be discussed in the WI stage.
- Some RAN2 impact can be expected for reporting mechanism, but details need discussion in the WG-level and no dedicated RAN2 objectives are expected.

Additional RRM objectives for Dec 24 Operation with $RTD > CP$

Candidate objectives/scope

- Enhancements to mTRP and UE operation with $RTD > CP$ incl. DL/UL operation
 - Scenarios
 - FR1 & FR2 scenarios
 - Handheld, CPE/FWA and HST devices with and without simultaneous data reception capabilities
 - Both single carrier and CA scenarios
 - Specify additional UE RRM requirements for $RTD > CP$
 - Inter-cell beam management
 - TCI state activation
 - LTM – L2 triggered mobility
 - CSI-RS based L3 measurements (intra-frequency)
 - Introduce mechanism for dynamic RTD/TTD status update
 - UE measurements and reporting of RTD/TTD between different TRPs
Note: aim to reuse measurement mechanism introduced in Rel-19 MIMO WI)
 - RRM requirements applicability rules in case of using dynamic RTD/TTD status reporting
 - Define UE demodulation requirements for simultaneous demodulation of mTRP DL signals with $RTD > CP$

Additional RRM objectives for Dec 24

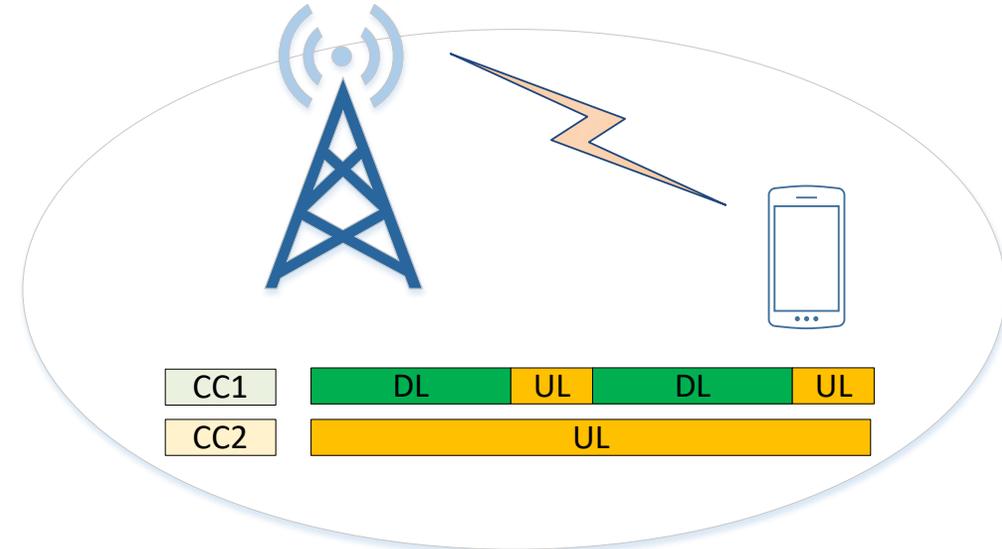
SCell with UL-only transmission

Motivation

- The scenarios with SCell with UL only transmissions was deprioritized during Rel-18 NES work
- The support of **SCell with UL only** is expected to provide potential benefits in deployments allowing operators to flexibly disable DL transmissions providing energy savings.
- The support of SCell with UL only transmissions is not expected to have RAN1 impact
- Limited RAN4 and potentially RAN2 impact can be foreseen
- At least RRM SCell activation requirements can be considered
- UL only SCell for the BC can be supported by UEs with existing RF CA capabilities (e.g., UEs with 2DL and 2 UL CCs) without RF HW changes
- The work can focus on FR1 inter-band CA scenarios

Candidate objectives/scope

- Define the RRM requirement for SCell with UL only transmission including at least SCell activation requirements
- Strive to minimize RAN1/2 impact. The potential RAN1/2 impact can be initially studied in RAN4 if any the work could be triggered by LS.



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