

Views on RAN4 Rel-18: NR and MR-DC RRM enhancements

Agenda Item: 9.1.4.3

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Introduction

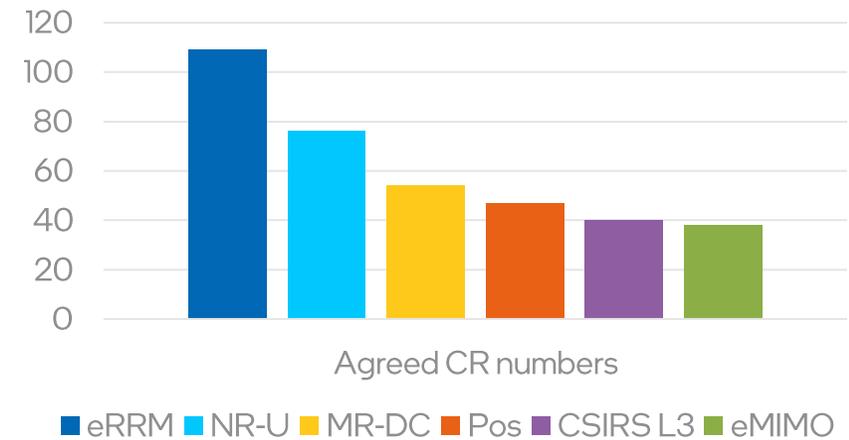
Background

- Multiple RAN4-led RRM enhancements were defined in the scope of Rel-16 and Rel-17
 - Rel-16 NR RRM enhancements WI [RP-201883]
 - Rel-16 NR L3 CSI-RS measurements WI [RP-210590]
 - Rel-17 NR Further RRM enhancements WI [RP-202874]
 - Rel-17 NR MG Enhancements WI [RP-210679]
- Many objectives of Rel-16/17 focus on the introduction of the requirements not covered by initial Release 15
- Many candidate objectives were deprioritized in Rel-16/17 discussion and may be further considered to ensure proper 5G networks operation under various practical scenarios

The work on the definition of RRM requirements shall continue in Rel-18 with the goal to cover additional use cases to ensure proper 5G deployments and operations

Potential scope of Rel-18 items shall balance between RRM “leftovers” (i.e., items deprioritized in previous releases due to TU constraints) and new RRM areas

Big Discussions in Rel-16 RRM



Introduction

Extensive discussion on Even Further RRM enhancement for NR and MR-DC objectives took place as a part of email thread [RAN95e-RAN4-R18Prep-03] during February email discussions, with the following Final proposals captured in [RP-220021]

- Working Area #1: FR2 RRM enhancements

- Prioritized objectives for further discussion
 - 1.7 FR2 delay reduction enhancements
 - 1.3. SCell activation enhancements in FR2
 - 1.4 FR2 BWP switching time enhancements
- Note: further prioritization of objectives can be required in RAN #95e

- Working Area #2: RRM enhancements

- Prioritized objectives for further discussion
 - 2.2 FR1-FR1NR-DC RRM requirements
 - 2.4 HO with PSCell requirements for new scenarios
 - 2.5 TCI switching enhancements
- Note: further prioritization of objectives can be required in RAN #95e

The objectives from Working Area #1 and #2 were further categorized into 3 parts

- FR2 RRM requirements delay reduction enhancements
- Extension of requirements for existing features to new scenarios
- TCI state switching enhancements

In this contribution we provide motivations and justifications to each of the prioritized objectives in the scope of Even Further RRM enhancement for NR and MR-DC work item in Rel-18

Views on Prioritization

Further discussion on scope refinement/prioritization of selected work items is required in RAN #95e to meet practical RAN4 TU constraints

Intel's view: Recommend to down-select 3-4 candidate objectives (prioritized topics are shown below)

- (1) FR2 RRM requirements delay reduction enhancements
 - (1-1) Cell identification and measurement delay reduction
 - (1-2) FR2 SCell activation delay reduction
- (2) Extension of requirements for existing features to new scenarios
 - (2-1) FRI-FR1 NR-DC RRM requirements
- (3) TCI state switching enhancements
 - (3-1) Reduced TCI switch delay requirements considering UE using temporary RS for fast measurements

Objective #1: FR2 RRM Delay Reduction (1)

Candidate sub-objectives based on pre-RAN95 email discussion

- Cell identification and measurement delay reduction
- FR2 SCell activation delay reduction
- FR2 BWP switching time enhancements

Intel's views

- Cell identification and measurement delay reduction and FR2 SCell activation delay reduction can provide meaningful system performance improvement and recommended to be considered. Recommend to deprioritize BWP switch delay reduction objective since we already have two sets of delay requirement, and it is inclusive in terms of different UE implementations
- Cell identification and measurement delay reduction: Since the L1-RSRP measurement and reporting are not always configured, it is preferred that we should first consider L3 measurements in Rel-18 and further apply the outcome to L1 measurements in future releases
- **Recommend to prioritize the following sub-objectives**
 - 1) Cell identification and measurement delay reduction
 - 2) FR2 SCell activation delay reduction

Objective #1: FR2 RRM Delay Reduction (2)

Objective #1-1: FR2 cell identification and measurement delay reduction

- *FR2 cell identification and measurement delay reduction [RAN4, RAN2]*
 - *Identify cases where FR2 cell identification and L3 measurement delay can be reduced and specify reduced delay requirements for such cases in IDLE/INACTIVE/CONNECTED modes [RAN4]*
 - ~~Identify cases where measurement/evaluation time of FR2 L1-RSRP can be reduced, and specify reduced delay requirements for such cases [RAN4]~~
 - *Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN4, RAN2]*
 - *Note: the work on RRC CONNECTED mode enhancements shall be prioritized*
 - *Note: delay reduction enhancements for UE supporting multi-Rx chain simultaneous DL reception are not in the scope*

Objective #1-2: FR2 SCell activation delay reduction

- *FR2 SCell activation delay reduction [RAN4, RAN2]*
 - *Identify cases where FR2 SCell activation delay can be reduced (e.g., ~~unknown target cell cases~~), and specify reduced delay requirements for such cases [RAN4]*
 - *Specify, if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN4, RAN1, RAN2]*
 - *Note: the technical solutions can be extended to FR1, when applicable*

Note: updated objectives are highlighted in red

Objective #2: Extension to new scenarios

Candidate sub-objectives based on pre-RAN95 email discussion

- FR1 + FR1 NR-DC requirements
- HO with PSCell requirements

Intel's views

- FR1 + FR1 NR-DC BC were introduced in Rel-16 and the relevant deployment scenarios are expected to be used globally. However, the RRM requirements for FR1 + FR1 NR-DC are missing, which may negatively affect the overall performance in NR-DC scenarios and shall be specified.
- Requirements for HO with PSCell were defined in the scope of Rel-17 NR and MR-DC further RRM enhancements WI, while the work on several scenarios was deprioritized. Additional work on this direction can be considered, however with lower priority considering other enhancements. For instance, RAN can further assess the work item progress in the mid of Rel-18 to identify if additional work on HO with PSCell can be considered.
- **Recommend to prioritize FR1 + FR1 NR-DC requirements work**

Objective #2: Extension of requirements for existing features to new scenarios

- (2-1) *RRM requirements for FR1-FR1 NR-DC scenarios [RAN4]*
 - *RRM requirements include the number of serving carriers, PSCell addition/release delay requirement, PSCell change and conditional PSCell change delay, scheduling availability, and CSSF. Other Rel-15 requirements are not precluded and are subject to WI stage discussion*

Objective #3: TCI state switching enhancements

Candidate sub-objectives based on pre-RAN95 email discussion

- Reduced TCI switch delay requirements using temporary RS for fast measurements
- Simultaneous TCI state switching requirements over multiple carriers
- Allow UE to receive DL data after TCI state switch command decoding and before TCI state switch starts

Intel's views

- All 3 sub-objectives can provide meaningful system performance improvements, however given workload constraints it is recommended to down-select a single objective
- **Recommend to prioritize work on reduced TCI switch delay requirements using temporary RS**
- For MAC CE based and RRC based TCI state switch, and active TCI state list update, one SSB is needed for timing/frequency tracking if target TCI state is not in the active TCI state list for PDSCH, which will result in a very long TCI switch delay due to waiting for the SSB. Temporary RS has been introduced for fast SCell activation in Rel-17 and has been identified that it can serve the purpose of timing/frequency tracking.

Objective #3: TCI state switching enhancements

- (3-1) Define reduced TCI switch delay requirements considering UE using temporary RS for fast measurements [RAN4, RAN1, RAN2]
 - Note: RAN1/RAN2 work can be triggered by RAN4 LS

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