

Views on RAN4 Rel-18: RRM Enhancements

Agenda Item: 8A.4

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Introduction

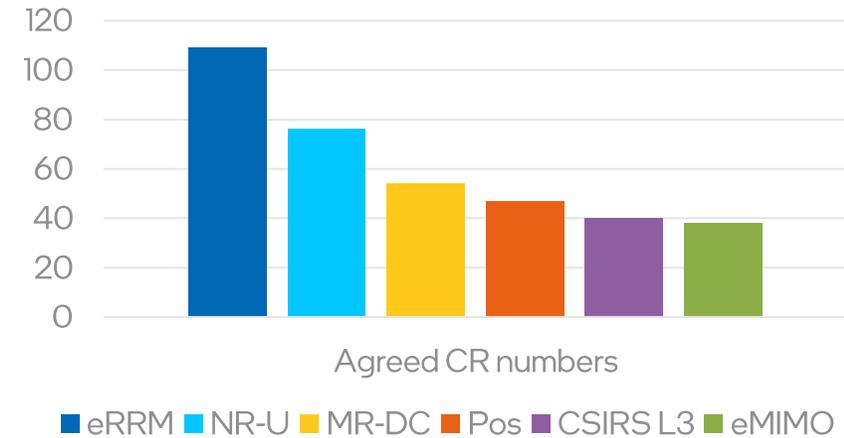
Background

- 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
- Several additional objectives were identified after the Rel-17 WI scope was stabilized and those can be considered in Rel-18

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 Rel-18 RRM objectives took place as a part of email thread [RAN94e-R18Prep-22] with the following Final proposals [RP-212682]

- *Proposal #9-1: for RRM requirements enhancement topic, the following high level working areas can be endorsed*
 - *FR2 RRM enhancements*
 - *General RRM requirement enhancement and leftover*
 - *Measurement gap related enhancement and leftover*
- *Proposal #9-2: companies are encouraged to provide more details on the motivation, benefit and specification impacts for each proposed objective for RRM requirement enhancement in RAN#94-e.*

In this contribution we provide views on more detailed proposals relevant to FR2 RRM enhancements General RRM requirement enhancement and leftovers, Measurement gap related enhancement and leftover and FR2 HST relevant RRM enhancements

Candidate Rel-18 objectives

FR2 enhancements

- FR2 delay reduction enhancements
- FR2-FR2 DAPS HO requirements
- Network controlled gaps for UE Rx beam switching
- FR2-2 enhancements & leftovers

General RRM requirements/leftovers

- FR1 + FR1 NR-DC RRM requirements
- CMTC
- RLM enhancements
- TCI state switch enhancements

Note 1: Identification of Rel-17 leftovers is confirmed at a later stage (e.g., Q1'2022)

Measurement Gap related enhancements

- Per-FR gap UE capability enhancement
- NeedForGapInfoNR requirements
- MG sharing enhancements
- Rel-17 leftovers (MG Enhancements and MUSIM)

FR2 HST enhancements

- HST FR2 multi-panel receptions (e.g., reduced number of Rx beams)
- HST CA FR2
- HST FR2 UE type enhancements

Note 2: Further prioritization of the candidate objectives shall take place to ensure that Rel-18 addresses the most urgent market requests

FR2 Enhancements

FR2 delay reduction enhancements

Background

- FR2 RRM requirements consider the number of UE Rx beams, and this leads to rather long delay of procedures
- Practical scenarios require much less delays
- Selected RRM requirements in FR2 can be revisited to reduce the delay caused as much as reasonable

Candidate objectives

- General measurement delay reduction by assuming reduced number of Rx beams
- SCell activation delay reduction in FR2
- BWP switching delay reduction in FR2

FR2-2 enhancements & leftovers

Background

- Further enhancements in the frequency of above 52GHz are expected to be carried out in RAN WG-s in Rel-18
- RRM requirements are expected to be defined for both the leftovers from R17 and newly for R18 enhancements
- Some of the deployment scenarios are deprioritized in Rel-17 (R4-2115351), while they still received popularity among operators and vendors

Candidate objectives

- RRM requirements for leftover deployment scenarios in Rel-17 incl. FR2-2 NR-DC and FR2-1 - FR2-2 NR CA/DC
- *Note: Identification of RRM scope due to enhancements in Rel-18 of the FR2-2 frequency bands in other WGs shall further take place*

FR2 Enhancements

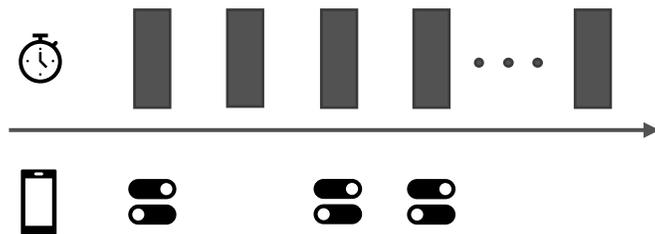
Network controlled gaps for UE Rx beam switching

Background

- To have awareness of the UE RX beam switching and apply scheduling restrictions accordingly, network can allocate certain time intervals for UE to switch its beam.
- The UE will be allowed to change its beam during these configured intervals, and with this awareness the system performance with very short CP length is boosted

Candidate objectives

- Study and define mechanisms to schedule gaps for UE Rx beam switching



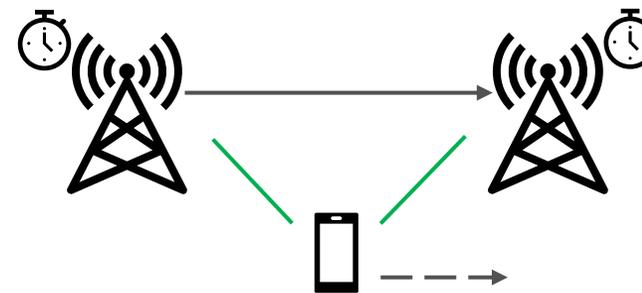
FR2 – FR2 DAPS handover

Background

- FR2-FR2 DAPS handover requirements are missing in the current RRM spec
- For UE with capability of FR2 MR-DC, it is beneficial in terms of mobility performance if they can make use of DAPS handovers

Candidate objectives

- RRM requirements for FR2-FR2 DAPS handover: sync conditions, delay and interruption



General/Leftover Enhancements

FRI + FRI NR-DC RRM requirements

Background

- FRI + FRI NR-DC band combinations were introduced in R16 timeframe
- A very limited set of RRM requirements was defined in R16: only MRTD/MTTD requirements were defined.

Candidate objectives

- Specify RRM requirements for FRI + FRI NR-DC
 - Number of serving carriers requirement
 - PSCell addition and release delay requirement
 - PSCell change and conditional PSCell change delay requirements
 - Scheduling availability of UE during RLM and BFD
 - CSSF for NR-DC
- Study possibility of release independence from R16

CMTC

Background

- CMTC concept for L3 CSI-RS based measurements has been proposed since R16
- Group consensus is that CMTC is beneficial to both UE and network in terms of efficient measurement configuration for UE mobility

Candidate objectives

- CMTC configurations
 - CMTC lengths, periodicities and offsets
 - Multiple CMTC configurations
- CSI-RS measurement requirement updates with CMTC

General/Leftover Enhancements

RLM enhancement

Background

- The second IS/OOS BLER has already been supported in RAN1 since R15. However, it cannot be correctly implemented since no corresponding RAN4 requirements
- RAN4 is to specify the second RLM BLER pair for voice traffic

Candidate objectives

- Specify the second IS/OOS BLER pair for VoNR service



TCI state switch enhancement

Background

- In Rel-16 TCI switching requirement, there was a time gap where UE is not required to receive DL data; it will have impact on the throughput performance in case the first SSB arrives relatively later
- RAN4 is to further discuss if UE behavior can be enhanced to receive DL data during the time gap of T_{first-SSB}

Candidate objectives

- Enhancement to maintain the UE reception and transmission during the period (or part of period) of MAC CE based TCI switching
- Enhancement to maintain the UE reception and transmission during the period (or part of period) of RRC based TCI switching

Measurement Gap Related Enhancements

Per-FR gap indication enhancement

Background

- In Rel-16 RAN4 discussed enhancements in indicating UE per-FR gap capabilities. Per-BC indication of per-FR gap capabilities was proposed by several companies
- No final conclusions were reached, and companies indicated interest to continue the work to study UE baseband constraints

Candidate objectives

- Enhance indication of UE per-FR gap capabilities
- Study Per-BC indication of per-FR gap capabilities impacts
 - All DL interruptions involving FR1+FR2 BC
 - Delay at activation of multiple DL Scells
 - Delay at all kinds of BWP switch on multiple CCs
 - Additional delay of measurement reporting upon SRS carrier switch
 - Autonomous gaps
- Other indication is not precluded

NeedForGapInfoNR requirements

Background

- RAN2 introduced NeedForGapInfoNR capability in TEI16
- RAN4 impact is non-trivial for UEs capable of no-gap measurements
- RAN4 consensus is that measurement requirements need to be updated

Candidate objectives

- Specify interruption due to retuning the vacant chain
- Impacts on RRM measurement requirements with gaps
 - CSSF
 - Measurement period
 - Scheduling restrictions
- Study possibility of release independence from R16

Measurement Gap Related Enhancements

MG sharing enhancement

Background

- MG sharing was design to coordinate MG resource allocation between intra-frequency MOs and inter-frequency MOs
- The signaling bit string is quite limited to indicate the MG sharing ratio, and therefore it's far from enough to adequately cover all the prioritization preference from network operators

Candidate objectives

- Enhance network indication of measurement gap sharing
- Enhance UE behaviors to cope with enhanced network indication of measurement gap sharing

Rel-17 leftovers

Background

- RAN4 consensus in Rel-17 is that the mixture among subtopics and the joint requirements in Rel-17 MG_enh WI are considered in Rel-18
- Enhancements of MG in several dedicated use cases are not done completely in Rel-17: e.g., MUSIM dedicated gaps.

Candidate objectives

- Joint requirements among pre-configured measurement gaps, multiple concurrent measurement gaps, and network controlled short gaps
- Measurement gap enhancements for MUSIM operations
- *Note: detailed objectives subject to further confirmation*

FR2 HST Enhancements

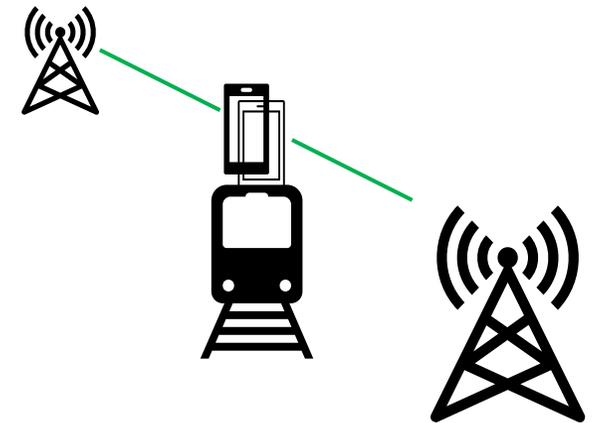
HST FR2 multi-panel reception

Background

- Support of FR2 multi-panel simultaneous reception was assumed in the scope of Rel-16 eMIMO WI but no RAN4 requirements were defined
- FR2 UE capability for simultaneous multi-beam reception was introduced in Rel-16 (simultaneousReceptionDiffTypeD-r16)
- Multi-panel simultaneous reception CPEs can be considered for generic FR2 deployments and in application to FR2 HST scenario
- Support of IBM (Independent Beam Management) and CBM (Common Beam Management) framework with simultaneous reception on different component carriers from the co-located and non-col-located TRPs was defined in RAN4 in Rel-16/17
- IBM concept implies simultaneous reception on different UE panels using separate beams on different component carriers and requires improved UE baseband and RF capabilities (multiple BB chains and support of multiple antenna panels)

Candidate objectives:

- Specify enhanced HST RRM requirements for CPE UE with simultaneous multi-panel reception



FR2 HST Enhancements

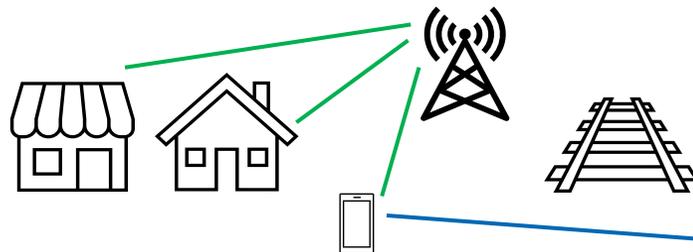
HST FR2 CA RRM requirements

Background

- HST mounted UE is powerful in terms of RF and BB resources; and does not bother by battery life
- Carrier aggregation helps boost performance further for HST mounted UE, but Rel-17 considers only single carrier

Candidate objectives

- Specify Carrier Aggregation RRM requirements for mounted HST UE in FR2; at least intra-band CA shall be considered, and inter-band CA could depend on vendor and operator inputs



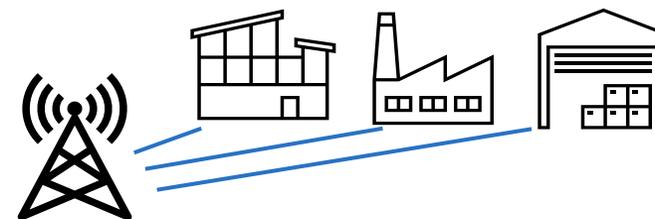
HST FR2 UE type enhancements

Background

- Rel-17 does not allow non-HST to access to the HST FR2 network
- Network does not clearly differentiate different types of UE in the network

Candidate objectives

- Specify applicable RRM requirements for non-HST UE-s in HST network
- Introduce, if necessary, UE capability signaling to ensure clear alignment between UE and network knowledge on applicable RRM requirements to different types of UE-s



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