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Document for : Discussion

Views on Rel-19 UL Coverage Enhancement

NTT DOCOMO, INC.

- NR has been specifying multiple features for extending cell coverage
 - Rel-17: Specify repetition for UL channels for most of UL channels
 - Rel-18: Specify repetition for a remaining channel (PRACH), and study/specify other approaches (e.g., power domain enhancement)

- In real field, the following directions are being considered for practical deployment
 - Deploying NTN scenario
 - Deploying high-power UE
 - Improving FR2 operation

- General view on coverage enhancement features
 - For the above listed scenarios/features, the existing “CovEnh” features may not be sufficient yet
 - » Topics that seem important for us are described in the subsequent slides
 - Considering the works in previous releases, this topic shouldn't consume so many TUs

■ Motivation:

- Until Rel-18, repetition-based coverage enhancements are (to be) specified
 - » PUSCH after RRC connection
 - » Msg3 PUSCH
 - » PUCCH
 - » PRACH
- However, PUSCH scheduled by DCI format 0_0 with CRC scrambled by C-RNTI does not support repetition
 - » Including “Msg5 PUSCH”, a PUSCH after Msg3 PUSCH and before reception of dedicated PUSCH config
- Without Msg5 PUSCH repetition, NW-wise coverage is still limited, which is not sufficient for some use cases (e.g., NTN)
- RAN1 had a corresponding discussion in Rel-18 TEI, where some companies argued this topic should be proceeded in a normative work, rather than TEI

■ View:

- **[High priority] Specify repetition for PUSCH scheduled by DCI format 0_0 with CRC scrambled by C-RNTI**

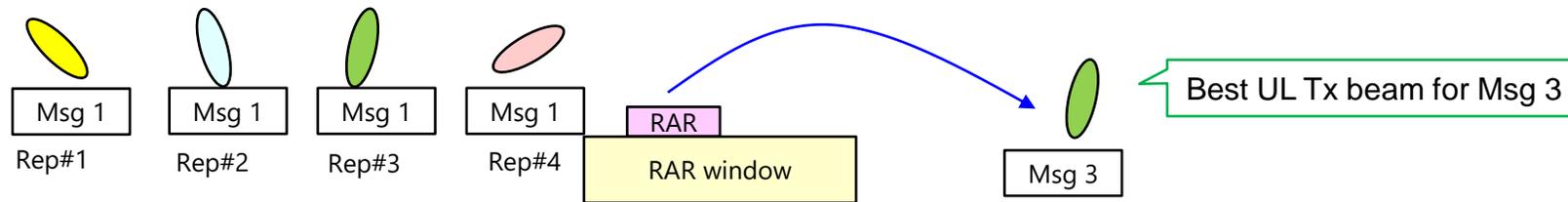
■ Leading WGs: RAN1, RAN2

- Motivation
 - UE Tx power availability is important to determine proper UL scheduling
 - » Legacy PHR can report PCMAX for the corresponding band, which plays an important role
 - With high-power UE being deployed, it is expected that UEs adjust its maximum transmit power in a dynamic manner to e.g., compliant with SAR
 - » There are multiple approaches that UE can implement for this purpose, e.g., using $\Delta P_{\text{PowerClass}}$ or P-MPR
 - » Only $\Delta P_{\text{PowerClass}}$ reporting is supported in Rel-18
 - As a result of such maximum transmit power adjustment, actual availability of some other features may also be changed
 - » For example, full-power UL MIMO feature
- View: Specify enhancements by which NW-side awareness on UE power availability is improved, e.g.,
 - **[High priority] Specify P-MPR reporting for FR1**
 - » Additional information (e.g., when the reported P-MPR is expired) can also be considered
 - Study, and if needed specify, the impact to other features (e.g., full-power UL MIMO) caused by maximum output power adjustment
- Leading WGs: RAN4, RAN1 and RAN2

Multi-PRACH with different beams: Motivation

■ Motivation:

- In Rel-18, multiple PRACH transmissions with same Tx beam is supported.
- Multiple PRACH transmissions with different Tx beams is NOT supported in Rel-18.
- Potential benefit of multiple PRACH transmissions with different Tx beams:
 - » Multiple PRACH transmissions with different Tx beams can provide performance gain for some cases, especially when UE has no prior knowledge about the best narrow UL Tx beam.
 - » Best UL Tx beam identification for Msg3 PUSCH is possible, which is beneficial for Msg 3 PUSCH coverage.



■ View:

- With small standardization effort, Rel-19 can consider specifying multi-PRACH transmissions with different beams
 - » Potential objectives are captured in the next slide

■ Leading WGs: RAN1 and RAN2

- Supported case:
 - Multiple PRACH transmissions with different Tx beams associated with same SSB/CSI-RS
- Detail design:
 - PRACH resource
 - » Study whether Rel-18 multi-PRACH with the same beam is reused or not.
 - Determination for number of PRACH transmissions
 - » Study whether Rel-18 multi-PRACH with the same beam is reused or not.
 - RAR monitoring
 - » Study whether Rel-18 multi-PRACH with the same beam is reused or not.
 - Indication of UL Tx beam for Msg 3 PUSCH transmission
 - » Specify the method to inform UE of the best beam for Msg3 PUSCH transmission

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