China Academy of Telecommunication Technology

3GPP TSG RAN Meeting #101
Bangalore, India, September 11-15, 2023

RP-232069

Rel-19 coverage enhancement

CATT

Multiple PRACH transmission with different Tx beams

- The following objective is included in Rel-18 CE WID
  - Study, and if justified, specify PRACH transmissions with different beams for 4-step RACH procedure
- Observations from evaluation results during Rel-18 study

  Note: It is summarized by FL that for the same number of PRACH transmissions per source,
  - 1 source [Ericsson] shows that: Multiple PRACH transmitted by beam sweeping, where a UE has no prior knowledge of channel and sweeps Tx beams across 360 degrees horizontally and 180 degrees vertically, outperforms multiple PRACH transmissions with the same Tx wide beam (omni direction) by at least 1 dB, provided gNB configures only one SSB and receives PRACH with a wide beam.
  - 3 sources [ZTE, Nokia, vivo] show that: A gain from about 1~3 dB of beam sweeping is observed if a UE is able to direct at least one of its Tx beams in the right direction or to narrow down the azimuth and/or zenith range of 360 degrees and/or 180 degrees for beam sweeping compared with multiple PRACH transmissions with the same Tx wide beam.
  - 1 source [Huawei] shows that: compared to the same wide beam for multiple PRACH transmission, if different Tx beams are finer beams, then 3.9~5 dB gains are observed assuming that only one PRACH occasion with the best detected SINR is selected at the gNB reception, where the beam gain of fine beam is 4 times that of wide beam.
  - 1 source [vivo] shows that: The performance of PRACH repetition with beam sweeping among beams far apart is 3 dB worse than PRACH repetition with single best beam
  - 1 source [vivo] shows that: The performance of PRACH repetition with beam sweeping among beams in the directions close to the best Tx beam is 1dB worse than PRACH repetition with single best beam.
  - 1 source [vivo] shows that: PRACH repetition via random beam directions performs 1 dB worse than PRACH repetition with omni beam.

Multiple PRACH transmission with different Tx beams

- Conclusion:
  - There is no consensus to support Multiple PRACH transmission with different Tx beams in Rel-18.

- Potential enhancements for Rel-19:
  - Specify PRACH transmissions with different Tx beams over ROs associated with same SSB/CSI-RS for 4-step RACH procedure
    - Design of Rel-18 PRACH transmissions with same Tx beams is reused when applicable to minimize the specification efforts
  - Study, and if justified, specify mechanism to indicate UL beam for Msg3 transmission based on multiple PRACH transmissions with different Tx beams

Msg5 PUSCH repetition

- Msg5 PUSCH could be the bottleneck for UL coverage due to lack of support of repetition
- Msg5 PUSCH repetition was proposed in Rel-18 TEI but not agreed
- Potential enhancements in Rel-19:
  - Support Msg 5 PUSCH repetition
    - Reuse mechanism of Msg3 PUSCH repetition as much as possible to minimize the specification efforts

THANK YOU