3GPP TSG RAN #93-e

13th – 17th September 2021

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Rel-18 NR MIMO

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DL/UL multi-TRP enhancements

Motivation:

- Rel-15/16/17 Rx timing assumption (less than CP) for multi-TRP is not realistic for practical deployment scenario, esp., for inter-cell cases, even with ideally sync-ed network
- Rel-18 enhancements should consider real life deployment assumption

Objectives:

- Study measurements and reporting to assist inter-cell multi-TRP operation with “noticeable” (>CP) propagation delay difference and non-perfect sync TRPs
  - Rx branch-specific single FFT operation, Rx spatial panel isolation for FR2, multiple FFT for FR1, etc.
  - Single DCI and multiple DCIs
  - Multiple TAs for uplink transmission

Uplink multi-TRP enhancements

Multi-panel spatial multiplexing (eMBB)

Multi-panel repetition (URLLC)

Motivation:

- Rel-16 NR supports simultaneous DL multi-panel reception in FR2. Rel-17 further enhance multi-panel operation for URLLC to support TDM-based UL transmission with repetition across multiple panels of the UE.
- Support of simultaneous uplink transmission from multiple panels of the UE is not yet supported.

Objectives:

- Introduce support of simultaneous multi-panel UL transmission:
  - Consider both eMBB (peak throughput enhancements) and URLLC (reliability enhancements) scenarios
  - Target uplink physical channels for enhancements are PUSCH and PUCCH.

UL enhancement to FR2 deployment scenario

Conventional deployment

High density deployment with lower power TRP

High density deployment with Rx only capable TRPs

Motivation:

- NR coverage in FR2 is limited due to higher propagation losses
- Conventional way to address the coverage issue is to increase the density of the deployment
  - More cost-efficient approach to improve coverage is to deploy low-power TRPs with smaller number of the antenna elements
  - Further cost reduction can be achieved by reducing TRP functionality to Rx only, i.e., DL and UL transmission links could be different

Objectives:

- Study support of a new FR2 deployment scenarios (e.g., HetNets including TRPs with Rx capability only) in Rel-18 and specify enhancements, if needed
  - E.g., separate beam reporting for DL/UL, beam management for UL, power control, etc.

CSI enhancements for Multi-TRP URLLC

Motivation:

- Rel-16 NR supports multi-TRP repetition schemes for URLLC:
  - Scheme 2a, 2b (FDM)
  - Scheme 3, 4 (TDM)
- Although CSI for URLLC in single TRP scenario is specified in Rel-15, even basic CSI reporting for multi-TRP scenarios is still missing for 5G NR. At the same time accurate link adaptation is critical for URLLC to operate @BLER = 0.00001 without relying on slow outer-loop link adaptation.

Objectives:

- Enhance CSI reporting in Rel-18 by matching CSI with the actual multi-TRP transmission schemes for URLLC
  - e.g., alignment of RI reports across TRPs to facilitate more accurate MCS selection for mTRP repetition schemes

Further Multi-Beam enhancements

Motivation:

- Several beam management enhancements were introduced in Rel-16/Rel-17 NR primarily focusing on latency and overhead reduction for *beam indication* procedures (e.g., DCI-based beam indication using unified TCI framework)
- The performance bottleneck in *beam acquisition* latency is still not addressed resulting in highly sub-optimal performance in mobility scenarios

Objectives:

- Study beam acquisition latency reduction solutions, e.g., for scenarios with large number of beams
  - e.g., additional QCL assistance to reduce beam acquisition latency, enhancement to hierarchical beam management, etc.

Illustration of the RSRP degradation due to beam acquisition latency

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