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Views on Rel-19 MIMO Evolution

AT&T
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Overview

Share our views on the proposals for R19 MIMO evolution:

1. CSI Enhancements for multi-TRP
2. Enhancements to CSI framework to support 64/128 CSI-RS ports
3. Enhancements for Beam Management
4. RP-232975*: the short list of five objectives that are proposed by many companies

* **RP-232975**: Views on Rel-19 MIMO enhancement

CSI Enhancements for multi-TRP

Motivation and justification

- Rel. 18 specified multi-TRP CJT with ideal backhaul and time/frequency synchronization
 - These assumptions may suit better the co-located TRPs (intra-site CJT).
- Realistic deployment scenarios include Inter-site distributed (non-collocated) TRPs which impose non-ideal backhaul conditions and imperfect time/frequency synchronization
- Enhancement is needed for multi-TRP CJT in realistic deployment scenarios with imperfect time/frequency synchronization

Key objectives

1. Specify enhancements that improve multi-TRP CJT in realistic deployment scenarios with imperfect time/frequency synchronization
2. Support UE assisted measurements and reporting to enable multi-TRP CJT with imperfect time/frequency synchronization

Enhancements to CSI framework to support 64/128 CSI-RS ports

Motivation and justification

- Capacity & coverage enhancements with higher resolution CSI-RS (64/128 CSI-RS ports)
- Extension of the vertical direction to $N_2 > 1$ when $N_1 = 16$ (Table 5.2.2.1-2) can provide more degrees of freedom in the elevation direction for the MU pairing.
- Enhancement of “cri-RI-PMI-CQI” reporting with multi-CRIs (CQI/PMI/RI per CRI and 32 CSI-RS ports per CRI) for hybrid beamforming to optimize MU-MIMO & interference.
 - Multi-CRI reporting can reduce the complexity required to make optimized MU-Pairing decision.

Table 5.2.2.1-2: Supported configurations of (N_1, N_2) and (O_1, O_2)

Number of CSI-RS antenna ports, $P_{\text{CSI-RS}}$	(N_1, N_2)	(O_1, O_2)
4	(2,1)	(4,1)
	(2,2)	(4,4)
8	(4,1)	(4,1)
	(3,2)	(4,4)
12	(6,1)	(4,1)
	(4,2)	(4,4)
16	(8,1)	(4,1)
	(4,3)	(4,4)
24	(6,2)	(4,4)
	(12,1)	(4,1)
32	(4,4)	(4,4)
	(8,2)	(4,4)
	(16,1)	(4,1)

Key objectives

1. Specify enhancements to extend number of CSI-RS ports for Type I CB (1st priority) and Type II CB (2nd Priority) to 64 & 128
2. Specify the enhancement to enable “cri-RI-PMI-CQI” reporting with multi-CRIs (CQI/PMI/RI per CRI and 32 CSI-RS ports per CRI) for hybrid beamforming with up to total of 128 CSI-RS ports

Enhancements for Beam Management

Motivation and justification

- Beam management enhancements are still needed for improved beam acquisition and tracking building on Rel. 17/18 multi-beam operation enhancements
- Enhancement of latency and overhead reduction in beam management for FR2 through UE-initiated/event-driven
 - UEs have a better knowledge about the channel conditions and beam quality

Key objective

1. Specify enhancements to enable UE-initiated/event-driven beam management for reducing overhead and/or latency considering the beam reporting and beam switching

RP-232975*: Support the short list of five objectives that are proposed by many companies

1. Specify enhancement to facilitate UE-initiated/event-driven beam management for reducing overhead and/or latency, assuming the unified TCI while leveraging (as much as possible) legacy CSI measurement and reporting configuration frameworks, targeting FR2 and sTRP with intra- and inter-cell beam management
 - a. UL signaling content(s) for UE-initiated/event-driven beam reporting facilitating fast beam switching
 - b. UL signaling medium/container considering the UE-initiated/event-driven nature of the UL transmission, designed primarily for the purpose of beam reporting
2. Specify CSI support for up to 128 CSI-RS ports, targeting FR1
 - a. Type-I codebook refinement supporting up to a total of 128 CSI-RS ports across all resources, assuming legacy CSI-RS resources (with up to 32 CSI-RS ports per resource), based on extension of legacy codebooks
 - b. Type-II codebook refinement supporting up to a total of 128 CSI-RS ports across all resources, assuming legacy CSI-RS resources (with up to 32 CSI-RS ports per resource), based on extension of legacy codebooks, without modifying any codebook parameter other than introducing additional values for the number of ports codebook parameter(s)
 - c. Extension of CRI(s)-based CSI reporting (CQI/PMI/RI calculated per CRI for ≥ 1 CRIs) for hybrid beamforming supporting up to a total of 128 CSI-RS ports across all resources, with up to 32 CSI-RS ports per resource, without new codebook design
3. Specify UE reporting enhancement for CJT deployments under non-ideal synchronization and backhaul, targeting FR1, both FDD and TDD
 - a. Inter-TRP time misalignment and frequency/phase offset measurement and reporting, assuming legacy CSI-RS design, with stand-alone aperiodic reporting on PUSCH
4. Specify non-coherent UL codebook to facilitate 3-antenna-port codebook-based transmissions, without enhancement on UL full power transmission and without enhancement on SRS resource
5. Specify enhancement for asymmetric DL sTRP/UL mTRP deployment scenarios, assuming intra-band intra-DU non-co-located mTRP scenarios, without changing existing cell definition or defining a new cell (e.g. UL-only cell), assuming the Rel-17/18 unified TCI framework and fully reusing the legacy QCL/UL spatial relation rules, targeting FR1 and FR2
 - a. Two closed-loop PC adjustment states for SRS, both separate from PUSCH; and pathloss offset configurations for pathloss calculation to UL TRP(s), when the pathloss RS is from DL sTRP.

* RP-232975: Views on Rel-19 MIMO enhancement



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