3GPP TSG-RAN WG1#81

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TITLE: SI CONCLUSION AND SUGGESTION FOR WI PHASES

AGENDA ITEM: 6.2.5.5

DOCUMENT FOR: DISCUSSION AND DECISION

OBSERVATIONS FOR NON-PRECODED CSI-RS MODE

- 2D codebook with up to 32 CSI-RS antenna ports is shown beneficial
  - Example: **34%** Cell edge and **13%** mean gain over Rel.12 for 16 antenna ports (8x4 UMi)
  - Flexible design supporting feedback for “any” 2D planar dual polarized array necessary for implementation freedom (e.g. 3x3, 10x1 arrays)
    - Gains from ‘wide’ arrays (2x8, 2x16, etc.) particularly beneficial
  - Kronecker codebook structure is baseline, further enhancements possible by non-CM codebooks if power back-off can be allowed
  - Performance is highly sensitive to interference, avoid transmissions towards e.g. horizon
  - More ports, up to 64, using MU-MIMO and/or hybrid operation has not been sufficiently examined
    - CSI-RS design enhancements can consider power boosting, if needed
  - No RRM enhancements identified for this mode
  - Need for efficient codebook subset restriction identified

OBSERVATIONS FOR BEAMFORMED CSI-RS MODE

- Beamformed CSI-RS enhancements are beneficial
  - Enhancements targeting robustness, DRS and CSI-RS overhead:
    - Dynamic configuration of NZP CSI-RS resources (beams) and associated signalling
    - Dynamic NZP CSI-RS (beam) selection and associated feedback
    - Disabling of NZP CSI-RS interpolation across subframes
    - Disabling of CSI-IM averaging across subframes
    - Potential RRM enhancements
      - Disabling of DRS averaging across frames
      - Increasing the number of reported CSI-RSRP
      - Avoiding CSI-RSRP reporting of near parallel beams
  - Enhancements by hybrid operation mode
    - Combination of 2D Codebook mode and beamformed mode
  - Enhancements that utilize channel flattening due to beamforming of CSI-RS
    - Limited study, e.g. some on PRG size increase, no reduction in CSI-RS density has been evaluated

OTHER OBSERVATIONS

- No clear need for MU-MIMO enhanced DMRS orthogonally shown
  - Mixed results on benefits so far; also depends on MU-MIMO enhancements
- MU-CSI not sufficiently discussed or evaluated
- SRS enhancements may be needed in future

FD-MIMO WI – FUNDAMENTAL ENHANCEMENTS

- WI scope must consider also RAN4 aspects of FD-MIMO
  - RAN4 support explicitly limited to 8TXRU for Release 13
    - Rel-13 RAN4 AAS requirements are limited to 8 TXRU (i.e. Rel.12 RAN1 functionality)
    - Building further RAN4 support in Rel-13 would endanger Rel-13 timescale
    - RAN4 will build further AAS specifications in Rel-14 based on RAN1 specifications

- For a limited scope (i.e. Rel.13) FD-MIMO WI:
  - Based on the observation of short time remaining in Rel.13 and of current RAN4 progress
  - Parts of the proposed enhancements from FD-MIMO SI are considered for Rel.13
  - Allow RAN1 to run somewhat ahead of RAN4 in Rel.13
    - Focus on extending existing LTE MIMO codebook framework to 2D arrays
      - Codebook based operation is closed loop and thus robust, works equal for FDD and TDD
      - Extend current CSI-RS resource to 6,10,12,14,16 ports, scalable 2D codebook and associated CSI feedback for up to 16 ports
        - Framework should be flexible, allowing extension in future releases.
    - Straightforward enhancements for beamformed CSI-RS mode may also be considered
    - No specification work of a hybrid mode necessary in this release (due to only 16 port CSI-RS)

FD-MIMO WI – FURTHER ENHANCEMENTS

- For further FD-MIMO enhancements (e.g Rel-14), RAN1 may specify support for
  - Further enhancements for codebook mode:
    - CSI-RS design and feedback for >16 ports as motivated by the SI outcome in TR 36.897
    - More ports also enables hybrid mode operation
  - Additional enhancements such as
    - Related to beamformed CSI-RS (relevant for >16 TXRU)
    - Hybrid mode operation
    - CSI-RS resource design (e.g. for enhanced efficiency and/or coverage)
    - SRS

- RAN4 need also to specify support for
  - Antenna count agnostic AAS requirements (>8 ports)

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