



Further Enhancements on MIMO for NR

Ericsson

Rel-17 feMIMO WI scope



— Justification

- Rel-15 NR MIMO features are being currently implemented
 - Feedback on specifications shortcomings is being received from product development units
- Rel-16 NR eMIMO standardization is converging
 - Major objectives are likely to be met for type-II CSI feedback, low-PAPR RS, and full-power UL MIMO
 - Several enhancements are likely still open for multi-TRP/panel transmission and multi-beam operation

— Objectives

- Address **real issues** identified from Rel-15 **product** development
- Complete a **selection** of the unfinished Rel-16 eMIMO objectives

Rel-17 feMIMO WI

Efficient P*SCH resource mapping

Early CSI & improved timeline

Lean RS configuration & triggering

Better UL RS coverage & TDD reciprocity

Addressing Rel-15 MIMO issues

Faster UE RX beam selection

Reliable P*CCH/P*SCH for multi-TRP

Completing Rel-16 eMIMO

Efficient PDSCH/PUSCH resource mapping

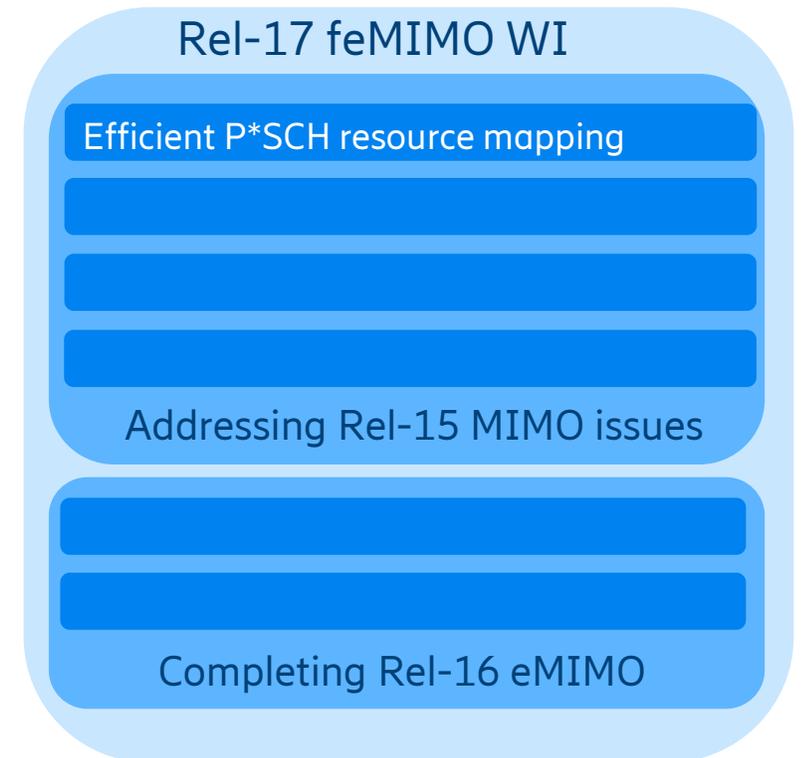


— Justification

- Large performance loss due to lack of frequency domain diversity for large scheduling BWs and high data rates due to poor distribution of a CB across scheduled BW
- Current DMRS and codebook interaction implies power imbalance which is a problem that needs to be resolved

— Objectives

- Enhanced distribution of PDSCH/PUSCH code blocks for large BWs
 - E.g., introduce enhanced VRB-2-PRB interleaving
- Resolve all power imbalance issues for PDSCH and PUSCH
 - E.g., across symbol and across transmit antenna
 - E.g., introduce DMRS OCC cycling as specified in LTE to resolve NR power imbalance issue for PDSCH and PUSCH



Early CSI & improved timeline

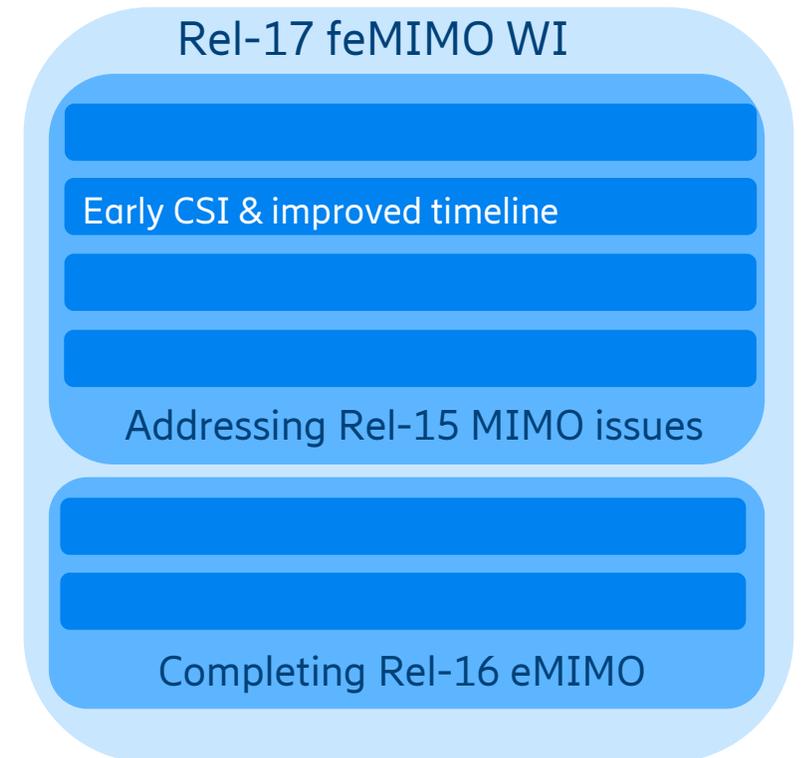


— Justification

- The latency for enabling efficient transmission during connection setup needs to be reduced
- Only basic CSI processing timeline requirements were defined in Rel-15, which enforced much larger scheduling offset compared to regular PUSCH

— Objectives

- Obtain CSI measurements already at connection setup
 - E.g., using Msg3/MsgA
- Improved CSI timeline requirements
 - E.g., introduction of advanced CSI processing capability or streamlined CSI requirement for single CSI report triggering



Lean RS configuration & triggering



— Justification

- RS triggering is not designed to simultaneously trigger many UEs (e.g., for SRS in TDD reciprocity based operation) and leads to PDCCH congestion
- Operation flexibility and overhead reduction are needed, e.g., by combining functionalities that are duplicated in the specifications

— Objectives

- Avoid PDCCH congestion when triggering RS for multiple UEs simultaneously
 - E.g., introduce triggering offset flexibility of SRS and CSI-RS (DCI indicated delay)
- Avoid duplicated SRS configurations for same purpose and associated overhead
 - E.g., allow re-use of an SRS resource set configured for usage='codebook' also for UL channel sounding purposes

Rel-17 feMIMO WI

Lean RS configuration & triggering

Addressing Rel-15 MIMO issues

Completing Rel-16 eMIMO

Better UL RS coverage & TDD reciprocity



— Justification

- Although NR supports reciprocity-based operation in TDD, it is far from optimized for it
- Coverage of UL RS is the main limiting factor to UL operation and reciprocity-based DL operation

— Objectives

- Time bundling for channel estimation of SRS and DMRS to improve UL RS coverage
 - E.g., UE capability that allows gNB to coherently combine SRS estimates and DMRS estimates across slots
- Extend flexibility and coverage of aperiodic SRS transmission
 - E.g., 14-symbol SRS resource, for repetition and faster frequency hopping or antenna switching

Rel-17 feMIMO WI

Better UL RS coverage & TDD reciprocity

Addressing Rel-15 MIMO issues

Completing Rel-16 eMIMO

Faster UE RX beam selection & Reliable multi-TRP transmission



— Justification

- UE TX beam selection can follow the RX beam selection but not vice versa
- Multi-TRP transmission needs to be further enhanced to achieve the URLLC objectives

— Objectives

- Faster RX beam selection for the UE
 - E.g., extend TCI framework so that UL measurements can also be used for indicating an UE RX beam
- Enhancement of PDCCH/PUCCH/PUSCH and if needed further enhancements for PDSCH for reliability and latency for multi-TRP/panel operation
 - Rel-16 leftovers and new features, e.g., CSI reporting enhancements, FR2 operation, and reception from two panels

Rel-17 feMIMO WI

Addressing Rel-15 MIMO issues

Faster UE RX beam selection

Reliable P*CCH/P*SCH for multi-TRP

Completing Rel-16 eMIMO