3GPP TSG RAN#93-e
Online – September 13th – 17th, 2021

RP-212317
Agenda Item 9.0.2

Rel-18 MIMO enhancements (DL & UL)

MediaTek Inc.

MIMO Enhancements in downlink & uplink

3GPP TUs (Total w/ 9 meetings)			
RAN1	RAN2	RAN3	RAN4
36	9	-	9

SA/CT Dependency: No

High resolution, low overhead CSI for MIMO evolution.
Continued FR2 enhancement for latency reduction and link robustness.
Improving uplink MIMO performance.

Downlink enhancements

- **CSI enhancement [RAN1, 2, 4]**
  - Increased CSI feedback resolution with limited overhead (using time-domain i.e. Doppler compression)
    - In particular for UEs experiencing high mobility
- **Enhanced support for 8Rx UE for CPE – overhead reduction [RAN1/4]**

Beam management enhancements for DL and UL (intra-cell) [RAN1, 4]

- **L1/L2 intra cell mobility improvement to latency**
  - Extending Rel-17 TCI framework for single TRP and multi-TRP scenarios
  - UE initiated beam activation/switching

Uplink enhancements [RAN1, 4]

- **Frequency-selective (sub-band) precoding / high resolution precoding**
- **>4 Tx antennas, considering 4 layers and higher – for non-handheld devices**
  - We are open to evaluate further the exact number of layers

MIMO Enhancements

- Channel State Information (CSI) computation/representation is at the core of MIMO
- Nearly all spectral efficiency enhancement features involve CSI computation
  - DL precoding, UL precoding, 8 antennas at the UE, Coherent/non-coherent CoMP, etc.
- Rel-18 will continue advancing MIMO CSI:
  - Optimizing overhead and accuracy tradeoff by exploiting sparsity nature of physical channel
  - Setting benchmark for future non-parametric solutions such as AI-based CSI representation
- Two Examples
  - Time-to-Doppler Compression – exploiting channel correlation in time
  - UL frequency dependent precoding and high resolution codebook – borrowing DL ideas for UL use

R-18: It is Time for Time-to-Doppler Compression

Per sub-band based, diversity antenna, quantization of multi-dimensional space domain (Householder Transform) — **Rel-8**

Per sub-band based, phased array antennas, quantization in the DFT dual of space domain, i.e., the beam domain — **Rel-10**

Port-growth FD-MIMO

Wide band (eType-II), phased array antennas, quantization in the 2D-DFT dual of space-frequency domain, i.e., the beam-delay domain — **Rel-16**

Wide band, phased array antennas, quantization in the 3D-DFT dual of space-frequency-**time** domain, i.e., beam-delay-**Doppler** domains — **Rel-18**

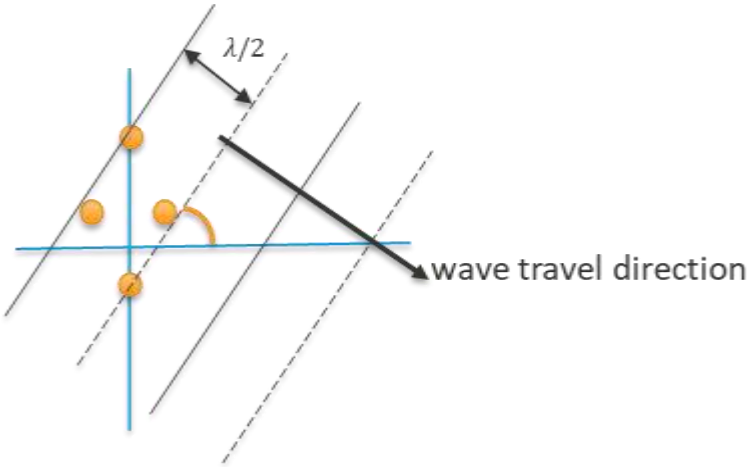
Non-parametric approaches aided by AI — **Rel-19+**

Parametric

Non-Parametric

UL MIMO Enhancement

- Justification:
  - To close UL & DL MIMO capability gap
- Objects
  - Higher rank transmission (> 4 layers)
    - Higher number of TX antennas: e.g., 8TX codebook
  - Frequency-selective precoding
    - Codebook compression
    - Further reduce signaling overhead
  - High resolution UL codebook
    - Adapt to UE antenna architectures



Thank you!