

[eMBB] MIMO Enhancements

eMBB consumer

MIMO

- CSI enh.
- BM: [subject to R17]
- Stationary: 8Rx, overhead redux
- UL sub-band precod.
- UL 4+ layers

DC/CA Enh.

- X-carrier HARQ: feedback & re-Tx
- Fast re-Tx split bearer
- Temporal RS PScell act
- Scalable x-carrier sch.

XR/CG Enh.

- QoS+, x-layer opt

MBS

- SFN+
- QoS+ (Tput, reliab.)
- TV (ATSC3.0 ref)

NW Topology

Sidelink LLeMBB

- SL-U esp. <7GHz, FR2
- Low latency 1Gbps
- SL-U RedCap

Sidelink Relay

- U2U relay
- UE scheduling UE
- mPath, mHop
- Mobility (Remote, Relay)
- Network coding

Smart Repeaters

- Beamforming
- Interf. Mgmt (T/F DD)
- Integration (UE authorization)

NTN Evolution

NTN NR

- Mobility
- Regenerative arch
- HD-FDD, VoNR, MBS
- R17 leftovers

NTN IoT

- Mobility (connected)
- R17 leftovers

SID Spectr. sharing

- Study scenarios, target spectrum and regulation status

Long-term explor.

SID AI/ML integr.

- NG-RAN/AS integrat.
- DMRS ch. est., Rx noise suppress, CSI-RS overhead, CSI feedback
- (UE-based) Mobility predict., Pos. enh.
- NW functions (load balancing, radio resource planning..)

SID AI traffic

- Traffic and arch.
- Overhead optim.

SID >71GHz

- Spectrum charac.

Common tech.

[FR2] Mobility

- L1/L2 trig. CHO
- Inter-/intra-cell beam switching delay redux
- RRC DAPS HO mPanel

System Energy

- DCI-based pwr sav mTRP and mPanel
- gNB/TRP dormancy (UE -trig. / -imposed)
- Eval. Methodology (Pwr. Cons. Models)

POS (NR, SL, RedCap)

- cm-level (Tx + meas related to signal ϕ)
- SL (-based, -assisted)
- RedCap UE
- R17 leftovers

SID gNB Full Duplex

- Partitioning, scenarios, interf.

Verticals

URLLC

- DL control efficiency
- NR-U enh

RedCap

- PA-less
- (POS)
- NO LPWA

(UAV: neutral)

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XR/CG Enh. [SA-led]

- QoS+, x-layer opt.

NTN NR

- R17 leftovers
- Mobility
- Regenerative arch
- VoNR, MBS, HD-FDD

MBS

- SFN+
- QoS+ (Tput, reliab.)
- TV (ATSC3.0 ref)

(may also be seen as non-eMBB)

Non-eMBB

URLLC

- DL control efficiency
- NR-U enh

RedCap

- PA-less
- (POS)
- NO LPWA

NTN IoT

- R17 leftovers
- Mobility (connected)

(UAV: neutral)

X-areas New areas

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SID AI traffic

- Traffic and arch.
- Overhead optim.

MIMO Enhancements

High resolution, low overhead CSI for MIMO evolution toward > 2 mTRP and coherent JT.
Continued FR2 enhancement for link robustness.
Continued parametric optimization.

Objective I: CSI enhancement [RAN1, 2, 4]

- Increased CSI feedback resolution with limited overhead (using time-domain i.e. Doppler compression)
- Support for high mobility
- PDSCH/DMRS-based

Objective II: Beam management [RAN1, 4]

- L1/L2 mobility and UE-initiated beam change (TCI state activation) >> See [mobility enhancements](#)

Objective III: Enhancements for stationary devices [RAN1, 4]

- Support for 8Rx UE
- Overhead reduction

Objective IV: Uplink enhancements [RAN1, 4]

- Sub-band precoding
- 4+ layers

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

SA/CT Dependency: No

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

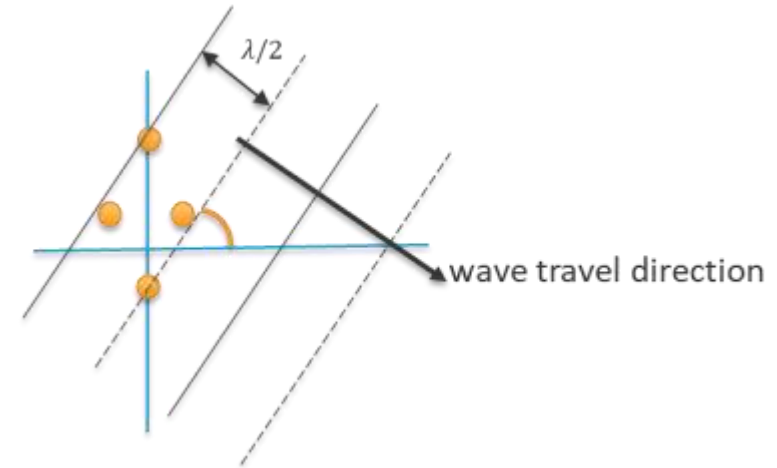
Rel-19+

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!

MediaTek TDocs to RAN Rel-18 Workshop

RWS-210092	MediaTek Views on Rel-18 content	MediaTek Inc.
RWS-210093	[eMBB] MIMO Enhancements	MediaTek Inc.
RWS-210094	[eMBB] DC/CA Enhancements	MediaTek Inc.
RWS-210095	[eMBB] XR/CG Enhancements	MediaTek Inc.
RWS-210096	[eMBB/Other] MBS Enhancements	MediaTek Inc.
RWS-210097	[eMBB] Sidelink Enhancements - LLeMBB	MediaTek Inc.
RWS-210100	[eMBB] NTN NR Enhancements	MediaTek Inc.
RWS-210101	[non-eMBB] NTN IoT Enhancements	MediaTek Inc.
RWS-210108	[non-eMBB] URLLC Enhancements	MediaTek Inc.
RWS-210109	[non-eMBB] NR RedCap Enhancements	MediaTek Inc.
RWS-210098	[x-area] Sidelink Relay Enhancements	MediaTek Inc.
RWS-210099	[x-area] Smart Repeaters Enhancements	MediaTek Inc.
RWS-210102	[x-area] NTN/TN Spectrum Sharing	MediaTek Inc.
RWS-210103	[x-area] AI/ML Integration	MediaTek Inc.
RWS-210104	[x-area] AI/ML Traffic	MediaTek Inc.
RWS-210105	[x-area] Mobility Enhancements	MediaTek Inc.
RWS-210106	[x-area] System Energy Enhancements	MediaTek Inc.
RWS-210107	[x-area] Positioning Enhancements	MediaTek Inc.
RWS-210197	[x-area] Sub-band Full-duplex for gNB	MediaTek Inc.
RWS-210110	Draft WID: System Energy Enhancements	MediaTek Inc.
RWS-210111	Draft WID: Mobility Enhancements	MediaTek Inc.
RWS-210112	Draft WID: DC/CA Enhancements	MediaTek Inc.
RWS-210113	Draft WID: NTN IoT Evolution	MediaTek Inc.