



MediaTek Rel-16 Priorities

AS Aspects

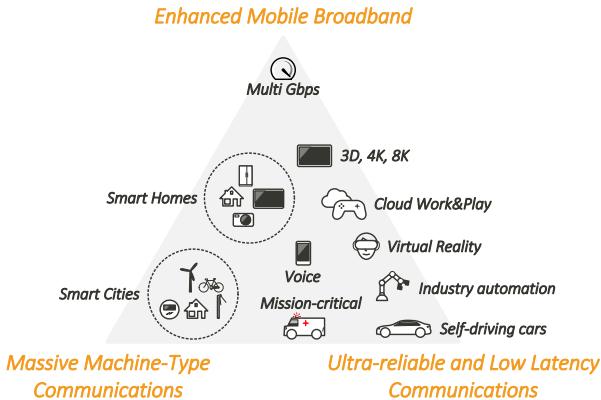
Companion to SP-180347

Outline

- Key directions
- Priorities
- Cross-TSG harmonization

Key Directions

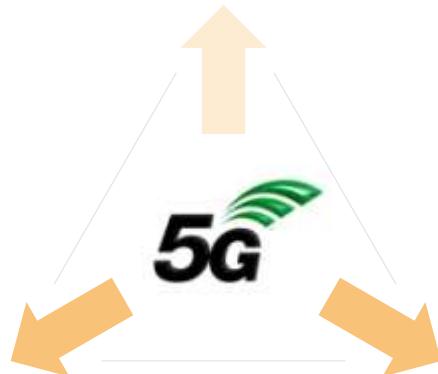
Rel-15 – 3GPP foundation for IMT2020



Technology enablers for IMT2020

eMBB focus, URLLC enablers, IoT LPWA leverage (EPS), V2X

Rel-16 – Improve, while leveraging, Rel-15



“Service”-driven
enablers and enhancements

URLLC, IoT, Verticals, eMBB enh.



Overall
efficiency improvements

System-wide enhancements from AS to NAS

MediaTek Priorities

NR and E-UTRA

Priorities

NR – Establish a solid base	E-UTRA – Leverage existing base	NB-IoT – Grow beyond existing base
<ul style="list-style-type: none">• Maximize re-use of Rel-15 implementation• Expand NR footprint beyond<ul style="list-style-type: none">• eMBB• traditional MNO markets• Increase NR overall efficiency	<ul style="list-style-type: none">• Evolution with strong justification only i.e. clear undeniable market demand	<ul style="list-style-type: none">• LPWA as target• Increase overall efficiency• 5GC connectivity

Priorities – Summary

NR		
High	Mid	Neutral
NR Unlicensed (<i>ongoing</i>)	NR V2X	NR NTN
NR MIMO	Positioning	Data collection, MDT, SON
NR Voice/Video/TCP	NR mmW mobility	6-24GHz
NR Power Consumption	NR NOMA (<i>ongoing</i>)	NR IAB (<i>ongoing</i>)
NR URLLC		Remote interf. management
NR Spectrum utilization (Fast Scell activation, mmW DL Sub-6 UL)		NR-IoT
		NR aerials

E-UTRA		
High	Mid	Neutral
Mobility enhancements (robustness)	TDD DL MIMO SRS Enhancements	WTTc/UL CPE enh
High speed train		V2X Advanced Rx
IoT (NB-IoT-based)		

NR High Priority Items

NR Low Power – Scope

RAN1-led

Scope

- eMBB
- FR1
- Connected mode enhancements for L1 setting switching, access procedure and assistance, carriers management and measurements
- Idle mode enhancements for paging, measurements and mobility management
- Applicability to NR unlicensed

RAN1: 2 TUs / meeting Aug 2018 – June 2019

RAN2: at least 1 TU / meeting

NOTE: DRX, Schedule Request deemed part of access procedure and assistance

NR Low Power – Motivation

RAN1-led

- NR UE power consumption driven by
 - Wide bandwidth operation
 - 4-Rx and 4-layer operations
 - Shorter TTI and timing requirements
 - Reduced and distributed sync resources
- Goal to make NR energy efficient
 - a) Improvements in user experience brought by NR (e.g. data rates) should not be challenged by a potential deterioration of UE battery life
 - b) Need to outperform LTE
 - c) Need to provide minimal power consumption whenever possible
- Need to study fundamental improvements to major power-consuming operations:
 - PDCCH-only
 - (Small) data delivery
 - Synchronization for long DRX and IDLE
- See [RP-180350](#) (RAN#79) and [R1-1804070](#) (RAN1#92-Bis)
- NOTE: Rel-15 UE may also benefit from the study

NR MIMO – Scope

RAN1-led

Scope

- (N1) MU-MIMO enhancements
 - Linear combination codebook beyond rank 2
- (N2) Multi-TRP/panel Tx/Rx, including
 - Downlink control signaling enhancement
 - CSI feedback enhancement
 - QCL assumptions
- (N4) UL-MIMO enhancements
 - Codebook enhancement
- (N6) Beam management
 - Beam selection/reporting
 - UL beam management
 - Control channel BM

RAN1: min. 3 TUs / meeting

MIMO topics are big (e.g. Multi-TRP is comparable to CoMP in LTE that was a dedicated WID) hence large amount of TU

NR MIMO – Motivation

RAN1-led

- (N1) Boost system throughput in all scenarios
- (N2) Improve NR robustness, especially for mmW
 - Positive side-effect on URLLC
- (N4) Fix Rel-15 UL MIMO sub-optimal codebooks
- (N6) Good support for mobility, especially for mmW

NR Voice, Video, TCP Enh. – Scope RAN2-led

Scope	
Voice	<ul style="list-style-type: none">UDC (for initial SIP message) <p>NOTE: from system standpoint all mobility/IW mechanisms are defined in Rel-15 except SRVCC to UTRAN CS (Rel-16)</p>
	~1 TU for two meeting cycles (UDC)
Video	<ul style="list-style-type: none">TCP Ack prioritization <p>See TCP (i.e. same TU used)</p>
TCP	<ul style="list-style-type: none">Achieving and maintaining TCP high throughput in presence of time-varying mmW blockingTCP Ack prioritization <p>1 – 2 TU / meeting for all of the above</p>

NR Voice, Video, TCP Enh. – Motivation

RAN2-led

- Large SIP messages can result in e.g. HO failure in bad channel conditions (e.g. cell edge)
 - Compression can reduce the likelihood of RLF
 - SIP/SigComp (allowing DEFLATE and LZSS) is complex and not used with E-UTRA/NR (see IR.92, TS24.229)
- Significant drop of TCP throughput results from
 - Head-of-line blocking i.e. ACKs blocked by pending data
 - Blocking at high frequencies – frequent with mmW
- Solutions to tackle the above are required to prevent significant degradation of performance, and to fully exploit data rates offered by NR
- Other: TCP ACK volume increases as data rate increases, using valuable radio resources
 - Reduction of TCP ACK can preserve high throughput while ensuring better use of radio resources

NR URLLC – Scope RAN1-led

Scope

- UL Grant-Free transmission enhancements
 - Framework enhancement
 - Intra-UE multiplexing
- CSI feedback enhancements
- PUCCH reliability enhancements
- HARQ feedback procedures for URLLC
- URLLC specific power sharing with eMBB
- Performance improvements for cell-edge UEs

RAN1: 3 TU / meeting, RAN2: 1TU / meeting

NR URLLC – Motivation

RAN1-led

- Complete Rel-15

Enhancements	Motivation	Reliability	Latency	Spectral Efficiency
UL grant-free	Current framework does not meet Reliability+Latency joint targets	✓	✓	
CSI feedback	To boost performance in terms of reliability and spectrum efficiency	✓		✓
PUCCH reliability	NACK-to-ACK errors impact reliability in DL Tx. Power efficient schemes need to be adopted to satisfy the URLLC requirements.	✓		
HARQ feedback procedures	Rel-15 HARQ feedback designed for eMBB – not suitable for low latency		✓	
Per-UE power sharing with eMBB	Simultaneous URLLC and eMBB use not accounted for in Rel-15	✓	✓	
Cell-edge performance	Improve coverage for services with high reliability	✓		

NR Spectrum utilization – Scope RAN1-led

Scope

- Enhanced CA operation for fast Scell activation
- Pairing between SUL in sub6 & DL in mmWave

RAN1: 1~2 TU / meeting (Note new BC expected from RAN4)

NR Spectrum utilization – Motivation

RAN1-led

- Fast SCell activation for improved UE performance in terms of throughput and power consumption
 - Increased usage of small cells with NR
 - Increased challenges with high frequencies e.g. frequent blocking, needing prompt recovery
 - Better CA use
- Tackling challenging deployments with mmW
 - Enabling UL in sub-6 when DL uses mmW

IoT – Scope RAN1-led

Scope

NB-IoT

- Efficiency, power consumption, mobility
- Mobility During Data transmission
- IRAT Cell Reselection (GERAN, LTE)
- Higher Order modulation DL
- HARQ Ack feedback enh. for UL transmission
- Link Adaptation Enhancements
- Scheduling enhancements (multi-TB, cross-carrier)
- Also 5GC connectivity (RAN2-led) need to be addressed

NR

- Co-existence/co-deployment with NB-IoT
- (Non LPWA NR-IoT)

RAN1: 2 TU / meeting RAN2: 1~2 TU / meeting

IoT – Motivation RAN1-led

- NB-IoT footprint is expanding – crucial technology for LPWA IoT
- Power efficiency and deep coverage remain defining characteristics of NB-IoT
- Room for further improvements of NB-IoT capabilities
 - Mobility incl. iRAT mobility to allow service continuity in misc. deployment scenarios
 - Radio resource usage and overall efficiency as a function of coverage/link quality
 - Adaptation to coverage and link quality: better radio resource usage, better power efficiency
 - Faster DL data Tx when possible: better radio resource usage, improved service quality
 - HARQ feedback enhancements: better latency for better power efficiency

NR Medium Priority Items

Motivations

NR Medium Priority Items – Motivations

Topic	Key Motivation
• V2X	<ul style="list-style-type: none">• Complements V2X via E-UTRA• NR V2X to fulfill V2X Stage 1 requirements E-UTRA can fulfill, and latest ones
• Positioning	<ul style="list-style-type: none">• High accuracy can enable new opportunities• Minimizes dependencies on other technologies• Can help when GNSS is unavailable e.g. Indoor• Complements V2X
• NR mobility (mmW)	<ul style="list-style-type: none">• Enable mobile mmW
• NR NOMA	<ul style="list-style-type: none">• Improve spectrum efficiency

LTE Items

LTE Enhancements

LTE		
High	Mid	Neutral
Mobility enhancements (robustness) [SI]	DL MIMO SRS Enhancements	V2X Advanced Rx [SI – RAN4]
High speed train		WTTc/UL CPE enh [SI]
IoT (NB-IoT-based) – see IoT slide		
RAN1: 2TU/meeting RAN2: 1~2TU/meeting		

LTE Enhancements

Motivation

Topic	Key Motivation
Mobility robustness	<ul style="list-style-type: none">• Service continuity
High speed train	<ul style="list-style-type: none">• Realistic scenario with ~500km/h train e.g. in China, Japan
DL MIMO	<ul style="list-style-type: none">• SRS enhancements (Virtual Cell ID, coverage, power control, trigger/configuration of semi-persistent SRS)
V2X Advanced Rx	<ul style="list-style-type: none">• Ok to have new performance requirements
WTTc/UL CPE enh [SI]	<ul style="list-style-type: none">• Clarifications needed

Cross-TSG harmonization

Coherence and timely finalization

Cross-TSG harmonization

- Need to ensure a coherent system-wide evolution in Rel-16
 - Avoid orphan features i.e. AS (resp. NAS) features lacking NAS (resp. AS) enablers in the same release
- The next few slides provide an analysis of the current proposals in RAN (email discussions) and SA2
 - Observation: no fundamental contradiction between ongoing RAN and SA2 discussions however some items need clarification (see next slide ▲)
- Other: alignment work
 - AS (resp. NAS) impacts might not always be envisaged at the inception of a new NAS (resp. AS) feature
 - however it is important that these impacts be identified as soon as possible to avoid detrimental impact on feature completion
 - Proposal:
 - NAS (resp. AS) impacts from a new AS (resp. NAS) proposal should be indicated at SA#82/Dec 2018 at the latest

Ongoing RAN discussions [1/2]

Ongoing WI (SI)

	Topic	TDoc	System-wide impact [To be confirmed by RAN]	Link to ongoing/new Rel-16 Stage 2 SI/WI
Ongoing WI	NR NOMA	RP-171043	No	N/A
	NR Unlicensed ▲	RP-180229	Yes – "USOS-like" ⁽²⁾	No corresponding SI/WI however simple alignment based on EPS USOS should be possible
	NR NTN ⁽¹⁾	RP-171450	No (only channel modelling and deployment scenarios)	N/A
	V2X evaluation ⁽²⁾	RP-171093	No	N/A
	NR IAB	RP-172290	Unknown	N/A

NOTE 1: Channel models and deployment scenarios. NTN = non-terrestrial networks i.e. Satellite

NOTE 2: USOS ([SP-160117](#)) – enabling accounting of unlicensed spectrum use (WiFi, LTE) for charging and network planning purpose

NOTE 3: Evaluation methodology for new V2X *use cases* for NR and LTE

Ongoing RAN discussions [2/2]

Moderated email discussions (No approved WI/SI yet)

	Topic	TDoc	System-wide impact [To be confirmed by RAN]	Link to ongoing/new Rel-16 Stage 2 SI/WI
Ongoing email discussions (NR)	NR Vo/Vi/TCP	RP-180397	No	N/A – potential alignment work
	NR Low Power	RP-180229	Unknown	N/A – potential alignment work
	NR MIMO	RP-180578	No	N/A
	IoT/MTC	RP-180581	Potential	FS_CIoT_5G
	NR URLLC	RP-180432	Potential	FS_5G_URLLC
	NR Mobility	RP-172515, 2564, 2325, 2414	Unknown (RAN Internal mobility)	N/A
	NR Positioning	RP-180319	Yes	FS_eLCS
	NR V2X	RP-180426	Yes	FS_eV2XARC
	B/Mcast	RP-180499	Yes	Proposed SA2 SI ? (<i>not seen again at SA2#127bis</i>)
	NR Flexible duplex	RP-180323	No	N/A
	Others		<i>Discussions have not started</i>	TBC
	NR spectr. utiliz.	RP-180380	No	N/A
	NR >52.6GHz	RP-180320	No	N/A
	FS 6-24GHz	RP-180455	No	N/A
	NR coverage eval	RP-180220	No	N/A
	FS NR NTN	RP-180182	Yes	Proposed SA2 SI
	NR remote interf.	RP-180311	No	N/A
	MDT, SON etc.	RP-180462	No	N/A
LTE	LTE Enh. ⁽¹⁾	RP-180223, 363, 369, 222, 238, 375, 436	TBC	TBC

NOTE 1: Other than IoT, MIMO, Broadcast

SA2-led studies – Rel-16

Ongoing and new proposals

	WI	TDoc	Title	RAN Impact	Link to ongoing Rel-16 RAN discussion
Ongoing SI	FS_eNA	SP-170383	Study of enablers for Network Automation for 5G	NG-RAN	MDT, SON, Big data
	FS_CIoT_5G	SP-170801	Study on Cellular IoT support and evolution for the 5G System	NG-RAN	Yes – IoT/MTC, Arch. Option 5
	FS_ATSSS	▲ SP-170411	Study on Access Traffic Steering, Switch and Splitting support in the 5G system architecture	NG-RAN + N3IWF	No corresponding RAN discussion
	FS_ENTRADE	SP-170934	Study on encrypted traffic detection and verification	No	N/A
	FS_5WWC	▲ SP-170380	Study on the Wireless and Wireline Convergence for the 5G system architecture	Unknown (RAN3?)	TBC
	FS_eV2XARC	SP-170590	Study on architecture enhancements for 3GPP support of advanced V2X services	E-UTRAN, NG-RAN	Yes – V2X
	FS_eLCS	SP-170937	Study on Enhancement to the 5GC Location Services	NG-RAN	Yes – Positioning
	FS_eIMS5G	SP-171052	Study on Enhanced IMS to 5GC Integration	No	N/A
	FS_LLC_Mob	SP-171069	Study on EPC support for Mobility with Low Latency Communication	E-UTRAN?	TBC – LTE enh.?
	FS_ETSUN	SP-170743	Study on Enhancing Topology of SMF and UPF in 5G Networks	No	N/A
	FS_PARLOS	SP-170382	Study on Stage 2 for PARLOS (NOTE: EPS related)	Unknown	N/A
	FS_5G_SRVCC	▲ SP-180120	Study for single radio voice continuity from 5GS to 3G	NG-RAN	None for RAN2
	FS_eSBA	SP-180117	Study on Enhancements to the Service-Based 5G System Architecture	Unknown	Not necessary
	FS_eNS	SP-180121	Study on Enhancement of Network Slicing	Unknown	Not necessary
	FS_5G_URLLC	SP-180118	Study on enhancement of URLLC supporting in 5GC	Unknown	TBC: URLLC?
	FS_EPS_URACE	SP-180119	Study on enhancement of systems using EPS for Ultra Reliability and Availability using commodity equipment	E-UTRAN	TBC – LTE enh.?
	FS_AAI_LTE_NR	SP-180122	Study on Application Awareness Interworking between LTE and NR	Unknown	Not necessary

SA2-led studies – Rel-16

Ongoing and new proposals

	WI	TDoc	Title	RAN Impact	Link to ongoing Rel-16 RAN discussion
Proposed SI	<TBD>	S2-185519	Study on Architecture aspects of using satellite access in 5G	"NG-RAN + N3IWF" [?]	Yes – NTN
	<TBD>	S2-184505	Study on 5G Multicast / Broadcast Service	NG-RAN	Yes – B/Mcast
	<TBD>	S2-185520	Study on Support of flexible LADN	Unknown	N/A
	<TBD>	S2-185521	Study on Enhanced support of Vertical and LAN Services	Unknown	N/A
	<TBD>	S2-185522	Study on System architecture for next generation real time communication service	No	N/A
	<TBD>	S2-185524	Study on optimisations on UE radio capability signalling	Yes	Not per se however been discussed in RAN2

Thank You!