



3GPP TSG RAN Plenary Meeting #84  
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Agenda item 8

RP-190832

Lenovo

# Views on Release 17

Motorola Mobility, Lenovo



# R17 NR Overview

- Left-over Items in R16 NR WIDs
  - Avoid exhausting R17 NR TUs on left-over R16 NR items.
  - WIs with left-overs: MIMO, NR-U, V2X, URLLC/IIoT
- NR Enhancements
  - NR-U, URLLC, MIMO, V2X/Sidelink(public safety, NR flavor), IAB; FR2 Coverage; FR4 Coverage;
- New NR Topics
  - '>52.6GHz' : i) 60GHz (Rel-15 waveform - 120kHz SCS) in R17, ii) New RAT (Rel-18) mainly considered for >71GHz
  - NR-Lite/NR-MTC
    - Industrial Sensors (low latency, long battery life, 3-5 Mbps → 5 MHz, complexity < eMBB, ultra-low tx power, 15kHz)
    - NR 5MHz Cat0 : (single/dual antenna (low complexity), long battery life, 20dBm, 15kHz) → supports video
      - Smart Watch, Surveillance Camera
      - June 2016, SA CAT1 (10Mbps DL, 5Mbps UL) devices recognized as valid design choice to facilitate smart watches, etc
  - Indoor Positioning (IIoT positioning needs 20cm. Inbound logistics for manufacturing (for storage of goods))
  - NTN WI



# R17 LTE Overview

- New LTE Topics
  - Indoor Positioning (positioning for IIoT needs 20cm. Inbound logistics for manufacturing (goods storage))
  - Industrial Sensors (not only NR, LTE IoT technology (NB-IoT/eMTC) lifetime at least 10 more years)
  - LTE based 5G Broadcast (new SCS) – *low priority feature* ?
    - Individual on-demand streaming of content is typical today
    - Live Sports broadcast, Public Safety, ... are main broadcast use cases
- LTE Enhancements
  - NB-IoT, eMTC, MIMO
- LTE EVOLUTION (NR and LTE separate tracks)
  - Sensors (Also a hole in LTE based IoT – LTE IoT (NB-IoT/eMTC) technology lifetime at least 10 more years);
  - Unlicensed operation of NB-IoT/eMTC



# R17 : RAN Feature list preferences

New Feature —  
Leftover areas or Enhancement —

- FR4**
- Low cost backhaul
  - Verticals
  - NRU, IAB, IIoT

- Industrial Sensors**
- 5G IoT hole: NR-Lite
  - URLLC, NB-IoT/eMTC
  - S-IoT

- VERTICAL RELATED**
- URLLC/IIoT
  - Positioning
  - Drones/UAVs/ATG
  - V2X/Sidelink
  - NRU,
  - NR-Lite

- FR1: 0.4 - 7GHz
- FR2: 24 - 52.6 GHz
- FR3: 6 - 24GHz
- FR4: 52.6 - 114 GHz
- FR5: 114 - 275 GHz

**>52.6GHz (FR4)**

- SI/WI Rel-15 waveforms up to 71GHz in Rel-17.
- New waveforms Rel-18

52.6 GHz – 114 GHz

**NRU**

- FR2 (Spatial LBT e.g.)
- Leftover (6GHz)
- FR4(R17, R18)

**URLLC/IIoT**

- FR2, FR4(R17, R18)
- Time Synchronous
- CSI, DL pre-emption.enh

**Positioning**

- 20 cm accuracy
- Factory: goods storage

**NR-Lite/mMTC**

- Sensors(ULTP), CAT0
- 5MHz BW, Video, 15kHz
- LowLat, 1-2 Antennas

CAT0: Smartwatch, surveillance camera

**NB-IoT/LTE-M**

- Relays, Async UL
- L2 enhancements
- Unlicensed

**V2X/Sidelink**

- FR2, Beam Mgmt
- Relay, Public Safety
- Positioning, MCarrier

**MultiSIM**

**Drones/UAVs/ATG**

- core networks
- Architecture
- RAN

**IAB**

- Mobile IAB, FR4(R18)
- FDM/SDM, CLI
- 256QAM, 1024QAM

**MIMO**

- >52.6GHz BF issues
- Multi-panel UL
- UL Beam Management

**Small Data**

- Fast transition for RRC inactive and Idle modes
- 2-step RACH needed

**LTE S-IoT** ?

- Sensors(ULTP)
- 5MHz BW, Video, 15kHz
- LowLat, 1-2 Antennas

**NTN**

- NR for satellite link

**AI/ML** – 3GPP provides interfaces to NW; Improve QoS predictability in Smart Factory, automation, data retrieval, data management/inference;



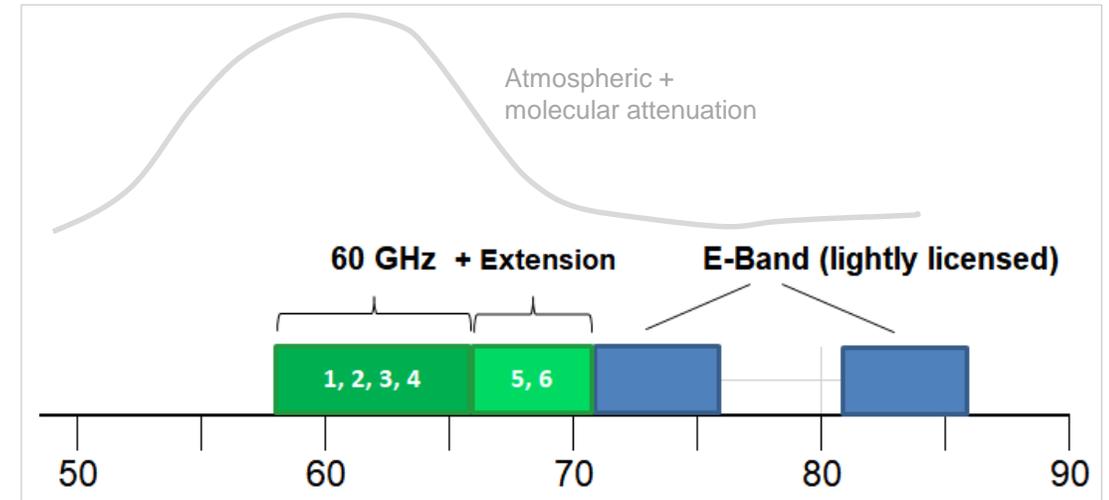
# R17 : '>52.6GHz'

- Existing 5G waveform (SCS 120kHz, OFDM, 16QAM) may be adequate for 60GHz indoor
  - Use of PTRS improves 16QAM and may better enable 64QAM
  - permits NR-U 60GHz band SI/WI to start in late R17 TF once B52.6GHz completed for Rel-15 waveforms
- '>52.6GHz' R18 SI : Single Carrier Waveform, SCS>=480kHz for >71GHz (E, W-Band) → New RAT
  - Also address beamforming differences and consider new control as needed (or in NR MIMO SI)

SCS (kHz)	Achievable SIR (dB) per LO frequency				Guard Int. ( μs )
	20 GHz	40 GHz	60 GHz	80 GHz	
120	47.5	42.0	38.0	35.5	0.59
240	48.5	43.0	39.0	36.5	0.29
480	49.5	44.0	40.0	37.5	0.15
Indoor Max D.S. ( μs )	0.8	0.7	0.6	< 0.6	

60 GHz Band

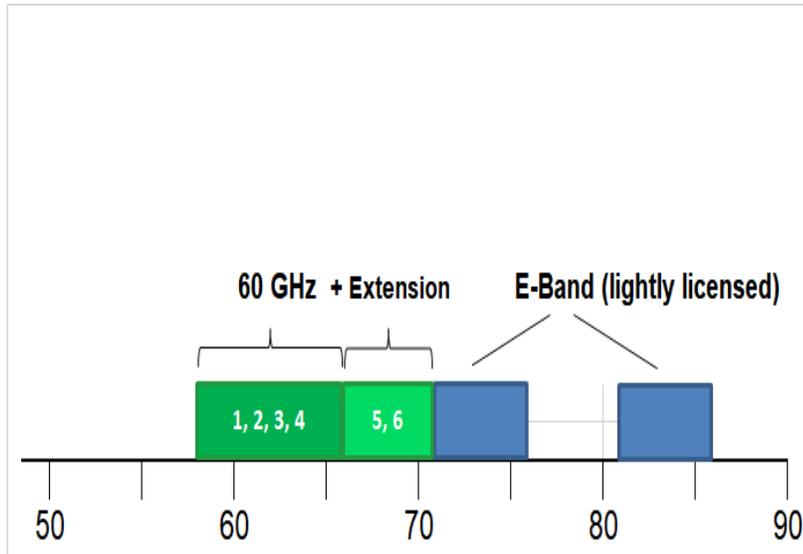
Region	lower frequency	upper frequency	usable channels
USA	57.05 GHz	71.00 GHz	1, 2, 3, 4, 5, 6
Canada	57.05 GHz	64.00 GHz	1, 2, 3, 4, 5, 6 (2021)
South Korea	57.00 GHz	64.00 GHz	1, 2, 3
EU	57.00 GHz	66.00 GHz	1, 2, 3, 4, 5, 6 (RSPG recommended)
Japan	57.00 GHz	66.00 GHz	1, 2, 3, 4
Australia	57.00 GHz	66.00 GHz	1, 2, 3, 4
China	59.00 GHz	64.00 GHz	2, 3





# R17 : NR-U

- Left-over R16 NR-U items (TBD) – R17 WI
- Potential New Item: 60GHz band NR-U – R17 SI
  - NR-U coexistence, channel access (e.g. directional LBT), control, ... for 60GHz band
  - Existing 5G waveform (120kHz SCS, OFDM, 16QAM) may be sufficient for 60GHz indoor
    - NR-U can progress unlicensed 60GHz band in late R17 time frame after 'B52.6GHz' addresses Rel-15 waveforms
    - Single Carrier Waveform and  $\geq 480\text{kHz}$  SCS addressed by '>52.6GHz' R18 SI especially for >71GHz (E,W-band)



	Units	NR	NR	NR	802.11ad	802.11ay	802.11ay
<b>TTI Duration</b>	ms	0.125	0.03125	0.03125	1	1	1
<b>FFT Size</b>	samples	4096	4096	4096	512	512	512
<b>OFDM Sample rate</b>	Msp/s	491.52	1966.08	1966.08	2640	2640	2640
<b>Tu</b>	us	8.33	2.08	2.08	0.194	0.194	0.194
<b>Inter-carrier Separation</b>	kHz	120.0	480.0	480.0	5156.25	5156.25	5156.25
<b>Guard Period (CP)</b>	us	0.59	0.15	0.15	0.04848	0.04848	0.04848
<b>OFDM Symbol Duration</b>	us	8.92	2.23	2.23	0.2424	0.2424	0.2424
<b>OFDM Symbols Per TTI</b>	syms/TTI	14.015	14.015	14.015	4125.0	4125.0	4125.0
<b>#Subcarriers</b>	sc	17100	4272	17100	355	355	1420
<b>#Resource Blocks (12 sc)</b>	RBs	1425	356	1425			
<b>Channel Bandwidth</b>	MHz	2160	2160	8640	2160	2160	8640
<b>total subcarriers/TTI</b>	sc/TTI	239400	59808	239400	1464375	1464375	5857500
<b>Bandwidth occupancy</b>		0.9500	0.9493	0.9500	0.85	0.85	0.85
<b>Rank (#streams per channel)</b>	#s/chan	1	1	4	1	4	4
<b>Modulation</b>	bits/msym	4	4	6	4	6	6
<b>peak data rate (FDD)</b>	Mbps	5816	5812	139575	4521	27128	108510



# R17 : URLLC

- Potential new Items
  - [TBD] improvements/enhancements for R17 URLLC
- Left-over R16 eURLLC and eMIMO items
  - Enhancement of aperiodic CSI report
    - DL DCI based A-CSI triggering; A-CSI reporting on PUCCH;
    - PDSCH/DM RS based A-CSI measurement and reporting (e.g. delta CQI)
  - PDCCH/PUCCH reliability enh. (i.e. repetition) if not specified under R16 NR eMIMO multi-TRP contexts
  - Enhanced DL pre-emption indication if not specified under R16 NR eMIMO
    - Spatial-layer based pre-emption



Photo credit Worcestershire 5G Consortium



# R17 : MIMO

- Potential New Items (R17/18 SI)
  - Address beamforming/MIMO issues for >52.6GHz if not addressed in '>52.6GHz' R17/18 SI
- Left-over R16 Items (R17 WI)
  - Multi-panel UL transmission
  - Low power RS
    - Power imbalance in frequency and time domain
- Enhancements
  - Overhead reduction
    - Beam management
    - CSI measurement and feedback
  - Interference management for dynamic TDD
    - Cross-UE interference estimation and feedback for DL-UL interference
      - UE/TPMI pairing



# R17 : V2X/Sidelink

- Potential New V2X Items (R17 SID)
  - Beam Management for FR2 [RAN1, RAN2, RAN4]
  - FR2 support for V2X [RAN1, RAN2, RAN4]
  - Support of rank>2 SL MIMO for V2X, CSI feedback [RAN1]
  - Introduction of remote UE to NW relay with one or more hops [RAN1,RAN2]
    - Mode 2d – support of relaying resource pool configuration to member UEs [RAN1, RAN2]
  - Support of V2X message delivery over Uu interface [RAN1,RAN2,RAN3]
    - Group HO
- Left-overs/enhancements to R16 V2X Items (R17 WID)
  - MR-DC based NR V2X, in which SN (secondary node) is control of the SL [RAN2]
  - Support of Interworking between R17 and R16 V2X UEs [RAN1, RAN2, RAN4]
- Potential New Sidelink items (R17 SID)
  - NR based SL Enhancement to support VR/AR-like services (based on NR V2X outputs)
  - Support Relay scenario
  - Support of rank>2 SL MIMO, CSI feedback [RAN1]
  - Public safety
  - Sidelink in unlicensed
  - Enhancement for group HO