

Newport Beach, USA, September 16-20, 2019

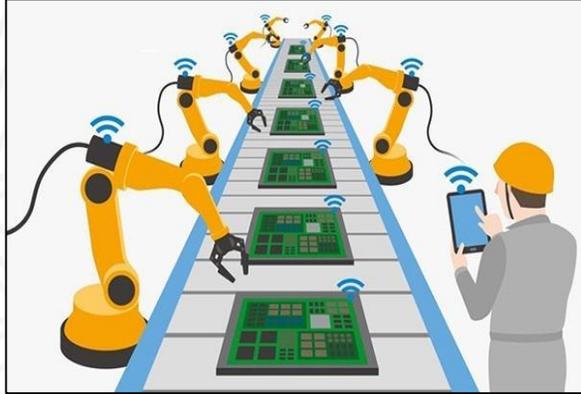
Agenda item: 8.2.1

# Views of Rel-17 NR-Light

Lenovo, Motorola Mobility



# + Requirements of new use cases



## Industrial Sensors

Temperature/humidity/  
thermometer/CO<sub>2</sub> sensors



## Smart City

Video surveillance



## Smart Home

Smart camera, smart lock,  
intelligent speaker



## Wearable Devices

Smart watch, smart  
glasses, smart band

	Industrial Sensors	Smart City	Smart Home	Wearable Devices
Data rate	1~30Mbps	10~100Mbps	1~50Mbps	10~100Mbps
Latency	tens to hundreds of ms	tens to hundreds of ms	hundreds of ms to several seconds	tens to hundreds of ms
Battery life	1~3 years	N/A	several weeks	several days
Coverage	wider than eMBB	similar to eMBB	similar to eMBB	similar to eMBB or by a companion smart phone
Mobility	low	low	low	high
Complexity	low	low	low	low

## + Motivation of NR-Light (1/2)

- Existing NR eMBB/URLLC UE cost in terms of implementation, complexity, power consumption is very high, e.g.,
  - mandatory UE bandwidth of 100MHz for FR1 and 200MHz for FR2,
  - at least 2/4 Rx antennas,
  - dynamic slot format variation,
  - multiple numerologies (15/30/60kHz SCSs for FR1, 60/120kHz SCSs for FR2),
  - high UE power class (23/26dBm)
- It does not make sense to reuse existing high UE capabilities for such IoT applications. Existing NR coverage and UE battery life may not meet some use cases.
- Requirements of the new use cases can't be met by LTE eMTC or NB-IoT in terms of comparably high data rate and low latency.

## + Motivation of NR-Light (2/2)

- A new SI is needed to **lighten** existing NR features in terms of cost, implementation complexity and power consumption for new IoT applications.
  - high data rate
  - low latency
  - low complexity/cost
  - wider NR coverage
  - longer UE battery life

### Objectives

- Identify requirements on diverse use cases
- Study potential solutions to fulfill the identified requirements

## + Potential technical areas of Rel-17 NR-Light

- Below technical areas are intended for Rel-17 NR-light.
  - UE complexity reduction
  - UE power saving
  - control overhead reduction
  - coverage enhancement
- UE complexity reduction should be discussed in Rel-17 NR-light and new UE capabilities may need to be defined.
- It is noted that some areas, e.g., UE power saving, control overhead reduction or coverage enhancement may be discussed in other SI or WI as long as the target enhancement for the SI or WI can satisfy the identified requirements of Rel-17 NR-light.

# + Potential technical areas of Rel-17 NR-Light

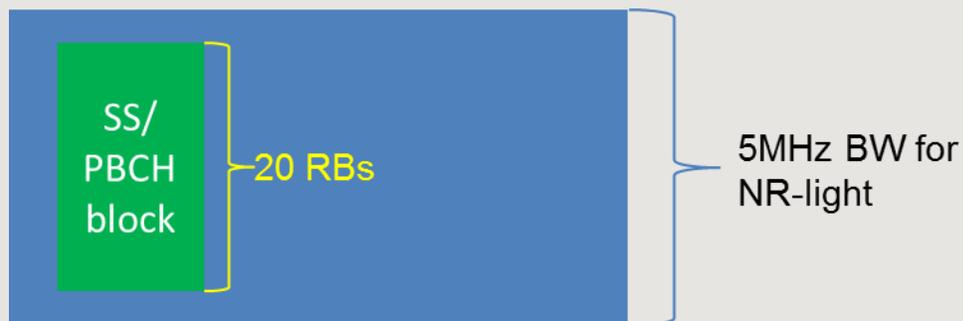
Complexity

Power

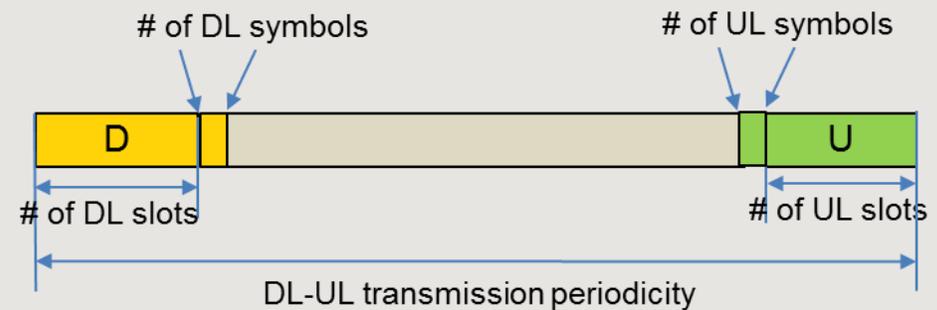
Overhead

Coverage

- Complexity reduction:
  - Physical layer channel/procedure design based on minimum UE bandwidth of 5MHz for 15kHz subcarrier spacing and 10MHz for 30kHz subcarrier spacing to fully reuse existing SSB design
  - Reduced number of receiving antennas, e.g., 1 or 2 Rx antennas
  - Reduced UE power class
  - Half-duplex design without support of dynamic TDD



Reusing existing SSB



Semi-static DL-UL configuration

# + Potential technical areas of Rel-17 NR-Light

Complexity

Power

Overhead

Coverage

- Power saving:
  - Power saving for idle/inactive mode, e.g.,
    - wake-up signal,
    - eDRX
  - PDCCH blind detection reduction (light CORESET/Search Space configuration, reduced max number of blind detections and CCEs per slot)

# + Potential technical areas of Rel-17 NR-Light

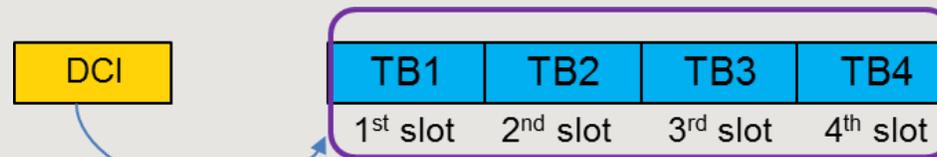
Complexity

Power

Overhead

Coverage

- Control overhead reduction:
  - Configured grant-based transmission for uplink in idle/inactive/connected mode
  - Early data transmission in non-connected mode
    - 2-step RACH/4-step RACH are considered
  - Multi-TTI scheduling
    - Downlink
    - Uplink



Multi-TTI scheduling

# + Potential technical areas of Rel-17 NR-Light

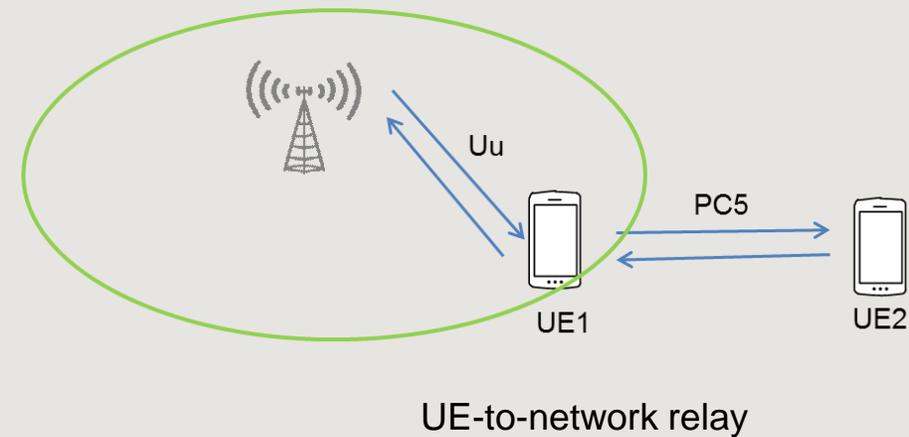
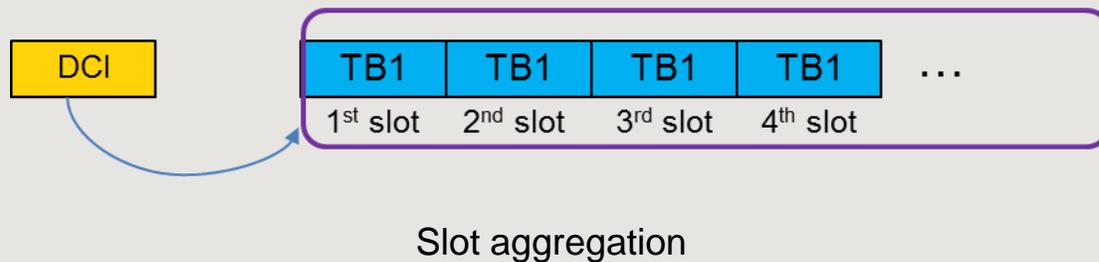
Complexity

Power

Overhead

Coverage

- Coverage enhancement:
  - Coverage enhancement by downlink/uplink transmission repetitions
    - PDCCH/PDSCH repetition
    - PUCCH/PUSCH repetition
  - Coverage enhancement via UE-to-network relay
    - Sidelink



# + Spectrum

- Licensed and unlicensed spectrum are considered.
- Unlicensed spectrum for industrial scenarios and smart home
  - using unlicensed spectrum to provide communications among sensors in large factories or appliances at home can offload traffic from licensed spectrum and reduce operation cost.
- It is beneficial to extend Rel-16 NR-U to 5G IoT applications.
  - The study can be more focused on sub-7G unlicensed spectrum (e.g., 5GHz, 6GHz).
- Regulation requirements and fair coexistence on unlicensed spectrum should be guaranteed, e.g., by Listen-Before-Talk (LBT) mechanism.
  - FBE (Frame-based equipment)
  - LBE (Load-based equipment)