3GPP TSG RAN Meeting #84
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Motivation for Rel-17 WID on LTE-MTC and NB-IoT

Outlook

- **Background**
  - LTE-M and NB-IoT have been designed as versatile and low complexity mMTC access technologies.
  - Network roll-outs and device uptake have started to take off, and the number of connected devices is expected to grow rapidly in the coming years.

- **Our vision**
  - LTE-M and NB-IoT continue to address the LPWA use cases in the 5G era.
  - Evolve both technologies through careful selection of new features of commercial interest, while continuing to follow the LTE-M and NB-IoT design principles.
  - Focus on improved UE power consumption, higher spectral efficiency, and new use cases when requested by the market.

Improved DL scheduling flexibility for high spectral efficiency

Justification:

- Improved scheduling flexibility can improve spectral efficiency for both LTE-M and NB-IoT and potentially also for other (LTE or NR) traffic in case of in-band operation.
- It is important that the physical downlink control channel (MPDCCH/NPDCCH) itself can be transmitted efficiently.
- It is also important that the physical data channels can be scheduled at the time when the required resources are available and with the most efficient modulation and coding scheme.

Objective:

- **Introduce additional NPDCCH time offsets and scheduling delays in NB-IoT**
  - E.g. with respect to NPDCCH-related parameters alpha and k_0
- **Introduce additional MPDCCH time offsets in LTE-M**
  - E.g. MPDCCH offset similar to DRX offset
- **Support higher PDSCH code rates in 1-6 PRBs in LTE-M**
  - E.g. similar MCS-to-TBS mapping as for PUSCH in Rel-14

Minimization of interference and resource waste in UL

Justification:

- LTE-M and NB-IoT networks need to manage a growing number of connected devices efficiently.
- Transmissions that use large numbers of repetitions for coverage enhancements can cause excessive resource usage and inter-cell interference if they use the wrong power or repetition levels.
- Transmissions with the wrong power level or wrong repetition level may also cause unnecessary UE power consumption.

Objective:

- **Reduce interference and resource waste for (N)PRACH**
  - Prevent (N)PRACH coverage enhancement level ramping for UE with high (N)RSRP
  - Improve (N)PRACH time domain distribution for mobile-terminated access
- **Support closed-loop UL power control and PHR in connected mode in NB-IoT**
  - UL transmit power control command in DCI
  - Power headroom report in connected mode

Further UE power saving through efficient procedures

Justification:

- Unnecessary battery drain is caused when the UE has to spend time and energy acquiring paging messages intended for other UEs. It would be good to avoid this at least in cases where the network tries to reach other UEs camping in cells different from the last known cell.
- Massive IoT networks need to manage a growing number of connected devices efficiently. By enabling system information change notification and acquisition in connected mode, the need to release UEs to idle mode can be avoided and the signaling load and latency can be reduced. This is important especially for delay-sensitive services such as VoLTE, especially in scenarios where configuration changes are needed.

Objective:

- **Introduce means for UE to differentiate paging between escalated paging and paging in the last known cell**
  - Differentiate if the paging is escalated, e.g. via time/frequency resource choice or RNTI value
- **Support system information notification and acquisition in connected mode**
  - Support providing system information in connected mode through dedicated and/or broadcast signaling without releasing UEs to idle mode