Qualcomm

3GPP TSG RAN meeting #92e
Electronic meeting, Jun 14-18, 2021
A.I. 10.5.1

RP-211142

Views on scope of NB-IoT/eMTC support for NTN WI

Background

- IoT NTN study item can be considered closed from RAN1 / RAN2 perspective.

- For Rel-17, we should focus only on essential features:
  - Further studies may be required in Rel-18 as some study areas have not been completed in Rel-17

- **Issues for discussion:**
  - Due to acceleration, further evolution in Rel-18 is expected to achieve efficient operation.
  - Study item only had RAN1/RAN2 components. RAN needs to scope the potential RAN3/system aspects (with minimal impact)

Confidential and Proprietary – Qualcomm Technologies, Inc. and/or its affiliated companies.

RAN1 related issues

- **Downlink synchronization**
  - Increase the NB-IoT channel raster step size, or indicate a portion of the ARFCN in NB-MIB, to handle the large doppler frequency offsets in NTN, e.g., in the S-band
- **Uplink synchronization**
  - Specify validity timers for uplink synchronization (e.g., for ephemeris, GNSS), and UE behavior (e.g., triggering RLF) upon timer expiry
  - Ensure that ephemeris and GNSS are not required to be read *during* a (short) connection
- **Timing Relationships**
  - UE reporting of UE-specific TA to the network, to facilitate UL/DL scheduling for half-duplex UEs
  - Incorporate the impact of UE-specific TA in the definition of downlink subframes that are interrupted due to an uplink transmission for half-duplex UEs
- Important issues **beyond Release 17**
  - HARQ-ACK feedback disabling, at least in the downlink
  - Closed-loop frequency corrections, to support long connections and minimize GNSS fixes
  - Facilitate L1/L2-based beam management for LEO satellites with earth-moving beams

Confidential and Proprietary – Qualcomm Technologies, Inc. and/or its affiliated companies.

RAN2 related issues

- **Minimal changes** to make Rel-16 IoT devices work in NTN deployment are considered.
  - **Support of existing cellular IoT features** specified up to Rel-16 can be enabled in NTN deployment unless problems are found (i.e., only minor change for adaptation without impacting core network can be assumed).
    - Example includes EDT, PUR in GEO, DRX, eDRX, PSM, mobility etc.
  - Adaptation of **random-access procedure**, DRX **timers** and other timers.
  - Earth **fixed tracking area** management.
  - Provisioning of ephemeris and timing advance/location reporting.
- Support for **discontinuous coverage** requires work in other groups (SA2 and CT1).
- Due to lack of time in Rel-17, **the following can be completed in Rel-18**.
  - Resolving HARQ stalling state:
    - Disabling HARQ feedback for DL HARQ process and disabling HARQ retransmission for UL HARQ process.
  - SIB acquisition enhancement
    - RAN2 agreed and captured in TR that expected that system Information (SI) enhancements, based on same SI provided in multiple cells, can bring power consumption benefits.
  - Mobility enhancements using time/location/satellite/beam information
    - RLF/re-establishment enhancements, Measurements and cell selection/reselection, serving cell/neighbor cell relaxed monitoring, Conditional handover for eMTC.
  - Enhancements to existing features
    - For example, PUR, PDCCH-based HARQ ACK, Multiple-TB scheduling, (G)WUS, UP C-IoT optimization, RRC_INACTIVE, channel quality report, SON.

Confidential and Proprietary – Qualcomm Technologies, Inc. and/or its affiliated companies.

Impact to other working groups

- Porting NR NTN 5GS solution to IoT NTN EPS requires **work in RAN3, SA2 and CT1**.
- Current specification status:
  - EPC and 5GC support IoT via LTE access (E-UTRA)
  - 5GC will support NR NTN ("eMBB") access in rel-17
- LS Traffic on IoT-NTN:
  - SA2 in (RP-210223) indicates that output of existing study / WID on NTN can serve as baseline for NTN IoT
    - May be handled as alignment if impacts are kept small
  - RAN3 (in RP-210961) also indicates a similar way forward (using existing work as baseline / model)
    - Feasibility depends on additional IoT specific aspects in NTN which RAN3 has not studied
- Proposed way forward for rel-17:
  - Focus on **achievable goals** in RAN3/SA2 and assume current rel-17 functionality is applicable for IoT access as a starting point (unless issues are found)
  - In addition:
    - Enable existing CIoT functionality for satellite RAT IoT in 5GC
    - Check consistency of basic CIoT and other functionality (NAS/CN timers) with satellite access including possible additional latency compared to TN NB-IoT/eMTC
    - Address <u>only essential requirements</u> to enable system to function in rel-17

Confidential and Proprietary – Qualcomm Technologies, Inc. and/or its affiliated companies.

Qualcomm

Thank you

Follow us on:

For more information, visit us at:

www.qualcomm.com & www.qualcomm.com/blog

Nothing in these materials is an offer to sell any of the components or devices referenced herein.

©2018 Qualcomm Technologies, Inc. and/or its affiliated companies. All Rights Reserved.

Qualcomm is a trademark of Qualcomm Incorporated, registered in the United States and other countries. Other products and brand names may be trademarks or registered trademarks of their respective owners.

References in this presentation to "Qualcomm" may mean Qualcomm Incorporated, Qualcomm Technologies, Inc., and/or other subsidiaries or business units within the Qualcomm corporate structure, as applicable. Qualcomm Incorporated includes Qualcomm's licensing business, QTL, and the vast majority of its patent portfolio. Qualcomm Technologies, Inc., a wholly-owned subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, substantially all of Qualcomm's engineering, research and development functions, and substantially all of its product and services businesses, including its semiconductor business, QCT.