3GPP RAN#101

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Views on Ambient IoT for R19

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Brief conclusions from R18 RAN study

Use case		Topology
Grouping A: - Indoor - Outdoor - Indoor/outdoor	**Grouping B:** - Inventory - Sensors - Positioning - Command	**Topology 1:** BS ↔ Ambient IoT device **Topology 2:** BS ↔ intermediate node ↔ Ambient IoT device **Topology 3:** BS ↔ assisting node ↔ Ambient IoT device ↔ BS **Topology 4:** UE ↔ Ambient IoT device
Device category		**RAN design targets**
- **Device A:** No energy storage, no independent signal generation/amplification, i.e. backscattering transmission. - **Device B:** Has energy storage, no independent signal generation, i.e. backscattering transmission. Use of stored energy can include amplification for reflected signals. - **Device C:** Has energy storage, has independent signal generation, i.e., active RF components for transmission.		- Device power consumption - Device complexity - Coverage - User experienced data rate - Maximum message size - Latency - Positioning accuracy - Connection/device density - Moving speed of device

- **Observation 1**: The high level study of Ambient IoT in RAN shows extensive use cases and commercial prospects.

Discussions

- RAN SI concludes on use case grouping, representative use case and corresponding deployment scenarios, actions in RAN WGs are necessary on further details of use cases and evaluations
- 4 topologies are identified in RAN SI. The combination of two or more topologies are also suggested by companies in the discussion. Consequently, all possible operations are allowed in RAN SI. Prioritization of certain topologies is then necessary if limited TU is available
- 3 categories of devices (i.e., Device A/B/C) are identified in RAN SI. Device A and B share the same property of backscatter transmission, while Device C can do active transmission. Device A/B provides the larger benefit for energy saving and complexity reduction, hence should be prioritized if TU is limited
- There is only limited discussion on energy sources for harvest in RAN discussion. However, the availability of an energy source, especially radio wave largely impacts the operation of ambient IoT device. The impact of energy sources should be studied in RAN WGs
- In general, two options to organize works in Rel-19 can be considered,
  - Option 1: RAN WGs do SI first, followed by a WI with limited scale in Rel-19
  - Option 2: RAN WGs only do SI in Rel-19
- Considering the limited TU and large scope for study, Option 2 is preferred

- **Proposal 1:** Support R19 SI for Ambient IoT for detailed technical discussions.

Objectives for R19 SI

Proposal 2: It is preferred to agree on only study item for ambient IoT in Rel-19.

Proposal 3: Based on RAN study, suggest RAN to consider the following objectives for R19 SI,

(1) Study waveforms for low power consumption for ambient IoT air interface, including evaluations on data rate/coverage/detection performance/coexistence performance.

(2) Study L1 channels design based on low power waveform.

(3) Study L1 procedures, including scheduling/resource collision avoidance, for the following devices and topologies

- *Device categories:*
  - *Device A*
  - *Device B*
  - *Device C*
- *Topologies:*
  - *without intermediate/assisting node between gNB and ambient IoT device*
  - *with intermediate /assisting node between gNB and ambient IoT device.*
- *Study impact of different kinds of energy sources.*

(4) Study lightweight protocol stack and convenient data transmission procedure based on non-state transition and non-dedicated bearer.

(5) Study the mobility and tracking of ambient IoT device.

(6) Study identification and lifecycle management of ambient IoT device.

Note: device A/B can be prioritized if to downsize the SI scope

Thanks