**3GPP TSG RAN Meeting #103 RP-240xxx**

**Maastricht, Netherlands, March 18-21, 2024**

**Agenda Item: 9.2.3**

**Source: Moderator (Huawei)**

**Title: Discussion on proposals for clarifications to the scope of the study on Ambient IoT**

**Document for: Discussion and decision**

# SID revision

Background: a SID revision is proposed in RP-240156, with a similar proposal in RP-240305.

**Proposal 1**

* The SID revision in RP-240156 is agreeable, including the following revision:
  + ≤ a few hundred *µ*W peak power consumption1, has energy storage, initial sampling frequency offset (SFO) up to 10*X* ppm, ~~both~~ DL and/or UL amplification in the device. The device’s UL transmission may be generated internally by the device, or be backscattered on a carrier wave provided externally.

# Energy harvesting

Background: RP-240336 and RP-240116 asked to clarify how to consider energy harvesting for device charging in the study.

**Proposal 2**

* Confirm that study of design of energy harvesting signal/waveform is out of SI scope in Rel-19
* The potential impact of energy harvesting on device availability for transmission and reception procedures can be considered for the study by RAN2 first and RAN1 if needed
  + One device’s charging by energy harvesting can be assumed up to [several tens of seconds]
  + TR 38.848 clause 5.6 statement on latency remains the case with respect to a single device, i.e.: “*NOTE: The time for charging the Ambient IoT device storage (if present) is not included in the latency defined above. Time for energy harvesting, charging, etc. is regarded as an implementation issue only.*”
* No SID revision is necessary

# CW node control

Background: RP-240336 asked RAN to clarify the carrier wave provided is under the control of the reader.

The SID includes as objective:

* *Study necessary characteristics of carrier-wave waveform for a carrier wave provided externally to the Ambient IoT device, including for interference handling at Ambient IoT UL receiver, and at NR basestation.*

**Proposal 3**

* Confirm that study of control of CW node (inside or outside topology) is out of SI scope in Rel-19
  + This does not preclude studying CW waveform characteristics which would need control of the CW node(s), e.g. waveform characteristics that impact interference such as when CW is transmitted or not transmitted, power, bandwidth, etc.
* No SID revision is necessary

# Spectrum for D2R and CW transmission

Background: RP-240514 proposed to clarify the meaning of the SID statements “Transmission from Ambient IoT device (including backscattering when used) can occur at least in UL spectrum” and “For Topology 2, no difference in physical layer design from Topology 1”.

Below are copied two agreements from RAN1#116 for the cases that D2R backscattering is transmitted in the same carrier as CW for D2R backscattering:

Agreement (RAN1#116)

For the case that D2R backscattering is transmitted in the same carrier as CW for D2R backscattering, and for topology 1, the following cases for CW transmission are studied.

* Case 1-1: CW is transmitted from inside the topology, transmitted in DL spectrum
* Case 1-2: CW is transmitted from inside the topology, transmitted in UL spectrum
* Case 1-4: CW is transmitted from outside the topology, transmitted in UL spectrum

Agreement (RAN1#116)

For the case that D2R backscattering is transmitted in the same carrier as CW for D2R backscattering, and for topology 2, the following cases for CW transmission are studied.

* Case 2-2: CW is transmitted from inside the topology (i.e., intermediate UE), transmitted in UL spectrum
* Case 2-3: CW is transmitted from outside the topology, transmitted in DL spectrum
* Case 2-4: CW is transmitted from outside the topology, transmitted in UL spectrum

**Proposal 4**

* Alt1:
  + Transmission from A-IoT BS in Topology 1 is in FDD DL spectrum
    - This include R2D
    - This includes CW transmission when CW is transmitted from inside topology 1
  + Transmission from nodes other than BS in Topology 1 is in FDD UL spectrum
* Alt2: let RAN1 progress on these cases and potential other cases.

# Feasibility assessment of RAN design targets

Background: there were questions in RAN1 and RAN plenary (RP-240514) on whether the study should evaluate these RAN design targets: user experienced data rate, maximum message size, moving speed of device, latency, connection/device density.

**Proposal 5v1**

* In addition to evaluations for coverage, evaluations of other RAN design targets are allowed by the Rel-19 SID and observations on those evaluations can be captured in the TR38.769 in relation to the candidate techniques being studied for meeting those requirements
  + Note: evaluations for latency and connection/device density are expected to be provided by analysis rather than by system-level simulations.
* Note: this is as per the SID: “*NOTE: Assessment performance of the design targets is within the study of feasibility and necessity of proposals in the following objectives, e.g. by inspection of reference implementations in the field, simulations, analytically*.”

**Proposal 5v2**

* RAN design targets for user experienced data rate, maximum message size, and moving speed of device: those can be used as assumptions in coverage evaluations, i.e. the coverage evaluations are done under the conditions that meet those targets.
* Evaluations of RAN design targets for latency and connection/device density are allowed by the Rel-19 SID and observations on those evaluations can be captured in the TR38.769 in relation to the candidate techniques being studied for meeting those targets
  + Note: evaluations for latency and connection/device density are expected to be provided by analysis rather than by system-level simulations.
* Note: this is as per the SID: “*NOTE: Assessment performance of the design targets is within the study of feasibility and necessity of proposals in the following objectives, e.g. by inspection of reference implementations in the field, simulations, analytically*.”

# Clarification of harmonized design

Background: RP-240336 proposes RAN to clarify harmonized design in SID as a baseline design, which is common for all categories of Ambient IoT devices, on top of which solutions/techniques can be designed for each device category depending on the constraints and capabilities of the device category.

**Proposal 6**

* No clarification to the SID is necessary
  + The SID already allows “*study a harmonized air interface design with minimized differences (where necessary)*”

# Proximity determination

Background: RP-240305 proposes to make following clarification on the objective for proximity:

* Study the feasibility and required functionalities for ~~proximity~~ determination of whether reader and ambient IoT device are in proximity to each other or not (coordination with SA3 is required for privacy aspects).