**3GPP TSG RAN Meeting #103 RP-** **240827**

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

**Agenda Item: 9.2.3**

**Source: Moderator (Huawei)**

**Title: Moderator's summary on R19 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
	+ One device’s charging by energy harvesting can be assumed up to several tens of seconds
		- Note: this value can be revisited in future RAN plenary meetings, if necessary
	+ 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, spectrum, etc.
* No SID revision is necessary

**Proposal 3v2**

* Regarding the objective in the SID: *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.*
	+ This objective allows 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, spectrum, 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

**Offline conclusion**

Let RAN1 progress on cases related to spectrum used for D2R and CW transmission.

# 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: 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.

**Offline conclusion**

No revision to the SID in response to the proposal in RP-240336.

# 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).

**Proposal 7**

Implement the following objective revision in a SID revision:

* Study the feasibility and required functionalities for proximity determination, which is the determination of whether BS or intermediate UE and ambient IoT device are near each other or not (coordination with SA3 is required for privacy aspects).

# Proposals for the main session

**Proposal**

Approve the SID revision in RP-240826.

* Note: this implements proposal 1 and proposal 7.

**Proposal 3v2**

* Regarding the objective in the SID: *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.*
	+ This objective allows 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, spectrum, etc.
* No SID revision is necessary

**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
	+ One device’s charging by energy harvesting can be assumed up to several tens of seconds
		- Note: this value can be revisited in future RAN plenary meetings, if necessary
	+ 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

**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: 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*.”

# References

RP-240116 Views on Ambient IoT scope Qualcomm Tech. Netherlands B.V

RP-240156 Revised SID: Study on solutions for Ambient IoT (Internet of Things) in NR CMCC

RP-240305 Discussion on clarifying Ambient IoT SID OPPO

RP-240336 Study on solutions for Ambient IoT (Internet of Things) in NR CEWiT

RP-240514 Clarification of scope of Rel-19 Ambient IoT SI Ericsson