

[97e-06-R18-RANLevel-xIoT]
Variant of [97e-06-R18-RANLevel-xIoT] Version 0.0.7
RAN

3GPP TSG RAN#97e

Electronic Meeting, September 12~16, 2022

TDoc number: RP-222566

Agenda item: 9.1

Source: Huawei, HiSilicon

Title: Moderator's summary for discussion [97e-06-R18-RANLevel-xIoT]

Document for: Discussion/Decision

1 Introduction

This email discussion [97e-06-R18-RANLevel-xIoT] is about the new Rel-18 RAN level study on x-IoT. This topic was originally discussed in email thread “[RAN94e-R18Prep-28] Passive IoT”.

This RAN level item proposal is to start to study a new 3GPP IoT technology, suitable for cellular deployment, which relies on ultra-low complexity devices with ultra-low power consumption for the very-low end IoT applications. It shall aim for an IoT segment not addressed by current 3GPP IoT technologies (NB-IoT, eMTC, Redcap).

The latest SID proposal is in RP-222453. The proposed timeline is to approve the SID in RAN#97e, start the RAN-level study at RAN#98e and complete the SI in RAN#100. Some general considerations on the RAN level SI are summarized in RP-222457.

2 Initial round

Q1: Is it agreeable that the study shall focus on use cases that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technology (incl. with reduced peak Tx power), as stated in RP-222335?

Feedback Form 1: Comments to Q1

1 – MediaTek Inc.

As co-author of RP-222335, we certainly agree.

2 – CATT

We would like to clarify whether x-IoT is the evolution of 3GPP IoT technology in general or the vertical of existing 3GPP LPWA technology. The proposal stated in RP-222335 is to consider the x-IoT as the vertical of 3GPP LPWA IoT technology. We would prefer to generalize the requirement and target of x-IoT as the evolution of 3GPP IoT technology instead of the vertical of existing 3GPP LPWA IoT technology.

3 – Deutsche Telekom AG

The confusion on this topic starts already with the naming ! Initially it was called "passive IoT", then in SA1 "Ambient-IoT", now it is called "x-IoT" ... this is absolutely confusing and should be clarified ! -> The draft SID in RP-222453 does not even attempt to clarify what "x-IoT" should be ?! ... x— what ? eXtended ? eXtreme ? eXit ? eXotic ? eXtra-Terrestrial ?

We do not agree calling it "x-IoT"

Obviously we agree that there should be a clear difference between whatever we do and the established 3GPP LPWA technologies NB-IoT and LTE-M/Cat-M !

4 – AT&T GNS Belgium SPRL

We agree that a RAN-level study should be limited in scope to use cases and scenarios that are not fulfilled by existing 3GPP LPWA IoT technology.

We also agree with the Deutsche Telekom comment that we should have some alignment/consistency with SA terminology and understanding of e.g., passive, ambient, x-IoT terms in the latest SID proposal in RP-222453.

5 – T-Mobile USA Inc.

While T-Mobile supports Ambient power-enabled devices, we do not see any urgency to complete a SID before June 2023 when R19 topics are discussed. Proposed SID (RP-222453) duplicates several of the SA objectives in SP-220085 "Study on Ambient power-enabled Internet of Things".

RAN level SID is premature and needs to start after SA1 to provides conclusions in TR 22.840 in December 2022. RAN can expect SA to provide use cases, service requirements, deployment scenarios, traffic scenarios, and market gap analysis. This is a really good starting point for the RAN SID and prevents duplication of work.

See approved objectives in SA-220085 below:

The objectives include:

Ø Study use cases of ambient power-enabled Internet of Things and identify potential service requirements, including:

· Security aspects, e.g., authentication and authorization, etc.

- Network selection, access control, connection, mobility and identification management
- Charging (e.g., per data volume, per message)
- Aspects related to stakeholder models (e.g., involving interactions in PLMNs, NPNs or other parties)
- Positioning
- Aspects on device life cycle management related to 3GPP system.

Ø Study traffic scenarios, device constraints (e.g., power consumption) and identify potential performance requirements and KPIs

Ø Gap analysis between the identified requirements for ambient power-enabled Internet of Things and what is already defined by existing 3GPP requirements.

Note 1: Specifics of how the device performs energy harvesting are not in the scope of the study.

6 – Sierra Wireless

Having the SA1 study complete will be useful but there are many RAN items that SA1 will not study such as coverage/range vs complexity/cost, what bands to operate on, modulation (e.g. backscattering), and a competitive analysis (e.g. what advantages can we bring over RFID and lower end LPWA's). It would be a good idea to take this meeting 97e to start to develop the SID and then try to approve it next meeting.

7 – Qualcomm Incorporated

We can agree in general, as long as the RAN-level study is clearly limited to this case only, i.e. not one among multiple options to study.

8 – InterDigital

Agree with the statement.

9 – Futurewei Technologies

We agree with this statement.

10 – ZTE Corporation

It's generally agreeable that the study shall focus on use cases that cannot be fulfilled based on existing 3GPP LPWA IoT technology.

As we are not sure in current context, whether companies could have consistent understanding on the meaning of "evolution of 3GPP IoT technology" or "vertical of existing 3GPP LPWA IoT technology", for avoiding any vague or misunderstanding, we prefer to call it as a new IoT segment. Such new IoT segment shall provide complexity and power consumption orders of magnitude lower than the existing 3GPP LPWA technologies (e.g. NB-IoT and eMTC). For example, its typical power consumption can be 1uW to 100uW which is far below the peak power consumption of legacy IoT device, e.g., higher than 10mW. Meanwhile,

its capabilities on coverage, reliability, mobility, positioning and security would be higher than the existing passive system, e.g., RFID.

In a short, from RAN perspective, we think the most important thing is to first confirm some main requirements with quantitative criteria, e.g., ultra-low power consumption and ultra-low complexity /cost, and a certain coverage.

We also agree with some above comments that, for the terminology of x-IoT, it's not clear what the expected functions of this new study are. Since from RAN perspective, we care much about the characteristics of ultra-low power consumption and cost/complexity, we prefer a terminology of "Ultra-Low Power Consumption and Complexity/cost IoT (Ultra-LPCC IoT)". If there is more preference on the consistency of SA1 and RAN, the naming "Ambient power-enabled IoT" is also acceptable to us.

11 – III

Agree with the statement

12 – Panasonic Corporation

We agree the comment from Deutsche Telekom and AT&T on the relation with SA1.

We also agree the study shall focus on use cases that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technology.

13 – Telstra Corporation Limited

We agree with the proposal. We echo comment from DT that we align on terminology.

14 – vivo Communication Technology

Agree

15 – TELECOM ITALIA S.p.A.

We agree with the comments from DT and AT&T

16 – Nokia Denmark

We agree that a RAN-level study should be limited in scope to use cases and scenarios that are not fulfilled by existing 3GPP LPWA IoT technology.

We also agree with the Deutsche Telekom comment that we should have some alignment/consistency on the naming.

17 – Samsung Electronics Co.

We agree that the study should focus on the use cases that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technology. The SI name could be clarified taking into account the agreed scope.

<p>18 – KT Corp.</p> <p>Agree. Use case needs to be clearly differentiated from existing 3GPP LPWA technologies.</p>
<p>19 – Fujitsu Limited</p> <p>We agree. The target of this potential SI should be different from existing 3GPP LPWA. Also, we agree with the comment by DT: the naming x-IoT is confusing</p>
<p>20 – Huawei Tech.(UK) Co.. Ltd</p> <p>Yes, we agree.</p>
<p>21 – Orange</p> <p>yes, agreed</p>
<p>22 – Spreadtrum Communications</p> <p>We agree with the proposal, and we also agree to align terminology/naming mentioned by other companies.</p>
<p>23 – Philips International B.V.</p> <p>We agree with the proposal (including agreeing with DT).</p>
<p>24 – Kyocera Corporation</p> <p>We support the proposal.</p>
<p>25 – Telia Company AB</p> <p>We agree the proposal. We agree also with DT’s valid comment on the fuzz on the naming versions. The name should be reflecting the alignment and work with SA1 and there should be then only one name - forget the other variant, please!.</p>
<p>26 – Sony Europe B.V.</p> <p>Yes, we agree with the statement that the RAN study should focus on use cases that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technologies. We believe the point on reduced peak Tx power is not relevant when we talk about use cases so we prefer to remove it. The RAN SI scope should be linked to the SA1 SI on “Ambient IoT” and we think it is fine to address a subgroup of the use cases identified in SA1.</p> <p>Like it was previously commented, we find the term “X-IoT” pretty confusing and prefer to use other terminology.</p>
<p>27 – NEC Corporation</p> <p>Yes, we agree.</p>

28 – China Telecommunications

Yes, we agree.

29 – VODAFONE Group Plc

We should avoid re-designing NB-IoT/cat-M. Hence a focus on use cases that they cannot solve is useful.

30 – Shenzhen YZF Network Technolog

[OPPO]Yes, it is reasonable, we agree.

31 – Lenovo (Beijing) Ltd

We agree with the new 3GPP IoT technology study with the ultra-low complexity devices with ultra-low power consumption target. Along with the output of SA, we can focus on the coverage/complexity/cost and some general RAN level study (e.g., frequency band, waveform) as soon as possible.

32 – China Unicom

Yes, we agree with the proposal.

33 – China Mobile Com. Corporation

1) We have a similar proposal in our contribution RP-222126 that this study targets for an IoT segment below the existing 3GPP LPWA IoT technologies, i.e., lower than NB-IoT, eMTC, RedCap, etc. Not aim to replace existing 3GPP LPWA technologies.

However, we need to clarify what the overlapping use cases means. We should avoid the overlapping of the UE capabilities for the use cases. The UE capability for tag device may include power consumption, coverage, cost, data rate, battery dependency, security requirement, etc, which should be much lower than existing LPWA. We are fine with that. But for each single aspect in the capability, it should be allowed to have some overlapping. For example, from the aspect of device life time, one specific use case may require more than 10 years of device life time, which both x-IoT and NB-IOT can meet the requirement.

2) Regarding to companies' comments on the naming, to our understanding, since we are aiming an new IoT segment which is extension of the existing 3GPP IoT ecosystem and use cases. We suggest to use the term "extended IoT", or "e-IoT" for short.

34 – Ericsson LM

We agree that X-IoT should address a market segment below existing 3GPP IoT technologies. But we also consider X-IoT to be a cellular technology that should be able to operate within existing cellular deployments. Based on this, we only see a very limited need for a passive X-IoT solution which would only support a very limited coverage of 10-30m (see e.g. the link budget in RP-222140 with a distance to the closest node ranging from 3m to 14m).

35 – NOVAMINT

1) we are very supportive to have a RAN study in release 18 as we believe it has a very strong potential especially for verticals perspective and should really be addressed by 3GPP. We also share the view stated in RP-222335 that we should not define another LPWAN so we agree that the study shall focus on use cases that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technology (incl. with reduced peak Tx power). One way forward is to identify and prioritize 2 or 3 significant and flagship use cases (RFID type of devices and at least one indoor and one outdoor) in the same spirit of what was done for RedCap for defining its Release 17 scope. If we do not succeed to agree the list of top3 use cases to study at RAN97 let's still kick off the process a bit in line with what Sierra Wireless suggested

2) maybe it is simpler to call it "x-IoT" for the time being as we already spent countless hours across all 3GPP (SA1, RAN in particular) to try to define a name for something for which everyone had different understanding and interest and anyway naming should be aligned with what we are going to develop and should be understandable by outside of 3GPP - at the end marketing perspective will likely have their say on this topic.

36 – TURKCELL

We agree with the proposal.

37 – Intel Belgium SA/NV

We agree with the statement

38 – NTT DOCOMO INC.

We can agree with the statement.

Q2: Is it agreeable to focus only on passive tags and UE as reader at this stage, as stated in RP-222335?

Feedback Form 2: Comments to Q2

1 – MediaTek Inc.

As co-author of RP-222335, we certainly agree. However, we would like to raise a few important points.

- Any reference of Tags communicating directly with a **gNB is misleading**. The term "gNB" comes loaded with a lot of assumptions esp. wrt NR that we do find problematic at this stage e.g. it suggests compatibility with NR.
- We think it is really important, in the context of PIIoT Tags, that the functionality and behavior of the Tags be agnostic of where the Reader is deployed i.e. whether the Reader is deployed in a UE or in a base station should make no difference to the Tag itself.
- **Given the above points we think the SID clarify should clarify:**
 - o xIoT shall be implementable in existing gNB hardware (*a comparable statement was used with CIIoT in the past*)
 - o Reader functionality can be deployed in a base station ("gNB") or in a UE

- The behavior and functionality of the Tag is agnostic of where the Reader functionality is deployed (i.e. in a UE or in a base station)

2 – MediaTek Inc.

We also want to emphasize that this work articulates first and foremost around the target devices i.e. Tags that are being addressed and their characteristics - it is these characteristics that need to be quantified from the outset (we have made a number of proposals in RP-222335).

We also note that "Energy Harvesting" is indefinite thus meaningless as such. E.g. one can plug solar panels to any device (whether tag or UE, and never run in any power consumption issue whatsoever). Stating "Energy Harvesting" neither qualifies nor quantifies the limitations imposed on the device itself. We consider such limitations really important to be set.

3 – CATT

We don't quite agree with the proposed scope of objective in RP-222335 with specific solutions in mind. The ambient passive IoT devices or low-power IoT devices have different receiver characteristics and receiver sensitivity to reflect the device power consumption. We should have the target study of x-IoT with the requirements of power consumption less than the target value and the range of receiver sensitivity of the x-IoT devices as the first step. This would help to identify different solutions of x-IoT devices and the associated use cases and deployment scenarios.

4 – T-Mobile USA Inc.

It depends on the conclusion of the SA1 TR 22.840

5 – Sierra Wireless

We think both passive tags with energy storage (for longer range) and without energy storage (small/inexpensive) should be considered at this point. UE's as a reader should be consider but a dedicated readers (e.g. base station) should also be considered

6 – Qualcomm Incorporated

We can possibly agree, as long as the RAN-level study is clearly limited to this case only, and there is a verified consensus that 3GPP is the right place to develop (potentially) future specification for this case.

7 – InterDigital

Yes, we also prefer the RAN-level study is limited to this case only.

8 – Futurewei Technologies

Agree that this is the main use cases for the study

9 – CHTTL

We support to consider both eNB and gNB at this stage as described in MTK's paper RP-222335.

10 – ZTE Corporation

No.

SA1 has identified two types of device as below that can help shape the scope of device type of RAN level study:

- Type-A Ambient IoT devices: a type of IoT device, which is battery-less, powered by harvesting from energy sources characterized by lowest lower bounds of power density among the commonly known energy sources (e.g. RF),
- Type-B Ambient IoT devices: a type of IoT device, which is battery-less and can have limited energy storage capability (i.e. using a capacitor), powered by typically harvesting non-RF ambient energy sources characterized by higher power density.....

Moreover, we don't think "Energy Harvesting" is meaningless. On the one hand, having "Energy Harvesting" capability is a characteristic that makes this new IoT segment different from legacy IoT devices with traditional battery. That is, this new IoT segment can tolerate a very low, inefficient and intermittent power supply (we do not think the existing IoT/LPWA technology can enable the operation of "any device plugged solar panel"). On the other hand, it also makes (some of) the new IoT segment devices different from other existing pure battery-less devices (e.g., RFID). Then some new IoT segment devices can support active traffic so that they can be applied in more use cases with ultra-low power consumption requirement and diverse services.

Furthermore, taking the requirement to support efficient communication for the ultra-low power consumption devices within a certain coverage in mind, we think a new design for air interface between network and devices will be a basic need (e.g., by introducing backscatter technology). We assume such new design can also be applied to the interface between device and device (some adaptation still can be allowed). We don't think focusing solely on design for the interface between device and device could fulfill the identified RAN design targets.

Last, we suggest to try to avoid the term like "reader" as we certainly don't want to specify a 3GPP version of RFID. From RAN perspective, a new IoT segment is aimed and we are open to discuss the potential deployment options or architectures (e.g., directly connecting to gNB, or via relay or repeater), with main purposes on extending the coverage and improving the transmission for such new Ultra-LPCC IoT segment.

11 – Panasonic Corporation

We agree the comment from T-Mobile that depends on the conclusion on the SA1.

12 – vivo Communication Technology

1. We are fine with limiting the scope to Passive and Semi-passive Tag.
2. We support to include the case with UE as the reader, however, we see difficult to exclude the case with gNB as the reader, at least at current stage.

13 – TELECOM ITALIA S.p.A.

We agree with T-Mobile. There is a dependency on the conclusions in SA1

14 – Nokia Denmark

We agree with T-Mobile. There is a dependency on the conclusions in SA1

15 – Samsung Electronics Co.

We do not want to broaden the scope. However, we don't think {passive tags and UE as reader} scenario is really an important use case that requires standardization effort in 3GPP. If the base station directly communicates with the X-IoT device, there might be an advantage of using the NR network and ecosystem. Such benefit will not be significant if the reader UE collects the data from tags and tags only communicate with the reader UEs, since the gNB-UE link could be well supported by the existing technology and the UE-tag link could simply use the existing reader-RFID link.

16 – KT Corp.

This depends on the outcome of SA1 Ambient power IoT SI

17 – Fujitsu Limited

Passive tags plus UE as reader is definitely one use case, but we think it is too early to limit the scenario. gNB as reader is also a potential scenario as pointed out by other companies.

18 – Huawei Tech.(UK) Co., Ltd

We think use cases relevant to both indoor and outdoor deployments will be studied in this item. The coverage thus ranges from tens of meters (for indoor) to a couple of hundred meters (for outdoor). Therefore our view is that this study should not be limited to only passive tags at this stage.

For indoor and outdoor deployments, different types of node can act as the activator/reader. We would rather let the SI discussions look into what are the appropriate deployments, since there will be tradeoffs among the different RAN topologies and such tradeoff needs to be analyzed to provide guidance to any potential follow-up RAN WG level study. If too much is excluded in the SID, suitable use cases, topologies, etc. may get passed over without being investigated at all. Therefore, our view is that this study is not limited to UE as reader at this stage.

Overall, we expect the peak power consumption to not exceed a few hundreds of μW , which provides a clear distinction to existing 3GPP IoT technologies. The details of tag characteristics, RAN topologies, etc. would be discussed in the RAN level SI, with the aim to fulfil the requirements of relevant use cases.

19 – Orange

While we do think passive tags with a UE reader is definitely an important use case (ie. RFID), we do not want to restrict the SI to this use case. Devices equipped with storage capabilities (from ambient harvesting) will be necessary for use cases requiring an improved link budget, together with base stations used as a reader (e.g. trackers, basic sensors with nationwide coverage).

20 – Spreadtrum Communications

We disagree only focus on passive tags and UE as reader at this stage, which may lose the competitiveness of 3GPP IoT technology comparing with the existing RFID.

21 – Philips International B.V.

We think that also base stations should be considered as readers, not only UEs.

22 – Kyocera Corporation

We think the primary focus may be the passive tags and the UE as reader, but we're open to other architectures, e.g., the gNB as reader.

23 – Telia Company AB

Depends on SA1 outcome. We are open to other use cases also besides tags+EU as reader.

24 – Sony Europe B.V.

We are not so enthusiastic on focusing only on passive tags and we believe that the effort in 3GPP should be to offer a solution that goes well beyond RFID, therefore active tags should also be included. We think the direct connection with the gNB could offer an additional differentiation compared to existing solutions however, we acknowledge the challenges of addressing all use cases in one go.

25 – NEC Corporation

We have similar view as vivo, we cannot exclude the case gNB as reader at this stage.

26 – VODAFONE Group Plc

We think that the RAN plenary study needs to examine multiple architectures/topologies with the objective to down select to a single topology for subsequent work in Rel 19.

27 – China Telecommunications

We disagree with this proposal.

28 – Lenovo (Beijing) Ltd

As comments previously, we hope we can study IoT device with limited energy storage to store the harvested energy, and without energy storage at this stage. The study should include passive, semi-passive and active tags, where transmitting and receiving information from sensor attached to the device should be possible. We should first define what all the necessity functionality of reader that needs to be integrated to 3GPP and then we can further check whether the integration of reader functionality in a UE or in a BS. We can further conclude the scope after the study.

29 – Shenzhen YZF Network Technolog

[OPPO] We have see a lot of advantages of using UE as the reader, e.g., to extend the coverage, to have a reasonable of deployment cost, to extend to more use cases. But we share similar view that at current stage it is beneficial to investigate different deployment modes (including both gNB based and UE based).

30 – China Unicom

No, it is too early to limit the scope. And it is depending on SA1 outcome. From our view, both gNB based and UE based architectures should be studied.

31 – China Mobile Com. Corporation

It is too early to rule out any option of which facility node should serve as reader. RAN study item needs to first study the design targets for radio interface for each use cases defined by SA1, e.g., power consumption, coverage, cost, data rate, battery dependency, security requirement, traffic type, etc. After that, we can further study what kind of RAN architecture can fulfil the RAN design targets. So, without RAN or WG level study, we cannot conclude that only UE should serve as the reader.

Therefore, our suggestion is that we don't limit which facility to serve as reader at this stage. And this should be studied only after RAN study level has a clear understanding on the RAN design targets for the use cases.

32 – Ericsson LM

No. This is already possible today with a RFID-reader in a smartphone, and unclear why 3GPP should bother with pure RFID enhancements (which should instead be pursued in the RFID standard).

Moreover, for backscattering communication range of 3m-14m (see e.g. RP-222140), it is more natural to add backscattering capabilities to existing short-range solutions like Bluetooth and keep 3GPP focus on longer range solutions taking advantage of existing NW deployments. Therefore, we believe that an ultra-low complexity device supported by energy harvesting and communicating actively with adequate coverage (few hundreds of meters) and data rates, addressing a wider range of use cases, is more relevant for 3GPP. The study should thus prioritize ultra-low complexity devices that support energy harvesting, energy storage, and active signal generation/reception.

33 – NOVAMINT

Let's identify the 2 or 3 use cases which are significant enough (indoor and outdoor) and in someway disruptif and therefore we should not be limit the study to only passive tags at this stage.

34 – TURKCELL

It's too early to limit the scope. Based on SA1 studies, we support the devices that have energy storage or harvesting capacity.

35 – Intel Belgium SA/NV

Though passive tag and UE as reader are critical case for study, we prefer to not limit to it in the early stage

36 – NTT DOCOMO INC.

We share similar concern with several companies in terms of the value/gain provided by 3GPP system compared with existing technology such as RFID.

Q3: With respect to the categorization in RP-222062, moderator’s understanding is that this is a natural part of the SI, thus would like to check if this is common understanding? If so, any further clarification on the objectives in RP-222453 needed?

Feedback Form 3: Comments to Q3

1 – MediaTek Inc.

We see some value in RP-222062 in defining upfront what the study would address, thus we welcome discussion on these points to they can be set before the study starts.

2 – CATT

The aspects discussed in RP-222062 are good references for the consideration of requirements and use cases for the x-IoT study. However, the detail of those aspects should be included in the working group discussion.

3 – T-Mobile USA Inc.

RP-222062 are good references, however this should be discussed after SA1 concludes TR 22.840.

4 – Sierra Wireless

Yes some of the specific aspects and question in RP-222062 should be added to the scope.

5 – Qualcomm Incorporated

We support RP-222062, of course.

Would like to clarify though that the intent was to make the necessary selections even before starting the RAN-level study, so that there is a good common understanding of the study scope and the scope is manageable.

6 – Futurewei Technologies

We in general think the categorizations in RP-222062 are a good starting point for the RAN-level study

7 – ZTE Corporation

We think it’s not so needed to discuss the device type categorizations in RP-222062 as we can mainly follow SA1 guideline for this aspect. The other aspects in RP-222062 are kind of specific and can be left to the RAN level study, or even to the RAN WGs level study.

In the current stage, we mainly need to achieve common understanding on RAN-centric aspects and also identify the suitable RAN design targets for this new study.

8 – vivo Communication Technology

We also see that RP-222062 provide good reference for the study. In our understanding, most questions can be further clarified in RAN SI.

9 – III

RP-222062 is a good reference. The RAN SI can make further clarification based on it.

10 – Nokia Denmark

RP-222062 are good references, however this should be discussed after SA1 concludes TR 22.840.

11 – Fujitsu Limited

Similar to other companies, we agree RP-222062 is a good reference and starting point of our potential SI. Further discussion/refinements can be performed under the SI.

12 – Huawei Tech.(UK) Co.. Ltd

Yes, as with other companies we think the aspects mentioned in RP-222062 would be discussed during the RAN level SI. Aspects such as use cases, tag characteristics, RAN topology, etc. are connected to each other during the course to assess whether the requirements can be fulfilled. We think the current draft SID in RP-222453 already covers the major aspects in RP-222062, such as energy source, energy harvesting, RAN topology, etc.

From our point of view, we would welcome inputs such as those in RP-222062 during the SI and, in discussion among companies, RAN would determine how to reflect such in the TR

13 – Samsung Electronics Co.

The categorization proposed in RP-222062 can be used as an input for discussion during the study.

14 – Orange

We think the categorization in RP-222062 is a good reference, and can be used for discussion during the RAN level SI.

15 – Spreadtrum Communications

We think RP-222062 can serve as a good reference for SI research.

16 – Philips International B.V.

Categorization can be added as an objective to the SID. If everyone agrees with RP-222062 then it will be quick. If not, then at least it allows for some discussion on potential improvements.

17 – Kyocera Corporation

We agree with the analysis in RP-222062. We prefer to aim to find a single/common solution for both battery-less devices and energy storage-capable devices, e.g., in terms of waveform design, etc.

<p>18 – Telia Company AB</p> <p>RP-222062 serves as baseline for the study, but clarifications needed after SA1 concludes TR 22.840.</p>
<p>19 – Sony Europe B.V.</p> <p>The categorization in RP-222062 is useful and should be further discussed within the SI. However, the RAN SI should not be discussing those things that are under SA1's remit.</p>
<p>20 – NEC Corporation</p> <p>We think categorization in RP-222453 are good references, and we see no need for further clarification on the objective parts in the SID.</p>
<p>21 – VODAFONE Group Plc</p> <p>We in general think the categorizations in RP-222062 provide a good vocabulary for use in the RAN-level study</p>
<p>22 – Lenovo (Beijing) Ltd</p> <p>The aspects mentioned in RP-222062 can be good references for the study. However, it is too early/hard to include any in the SI.</p>
<p>23 – China Telecommunications</p> <p>We think that the categorization could be a potential study point in the SI.</p>
<p>24 – China Mobile Com. Corporation</p> <p>We think RP-222062 is a good reference for the RAN level study on the use cases and design targets. The capabilities of energy sources, energy storage, waveform generation, RAN architecture all depend on the use cases and design targets. We suggest to keep it open for now. After we achieve the conclusion on the RAN design targets, e.g., coverage, data rate, traffic type, power consumption, it would be more clear which kind of device categories can be taken as baseline for WG SI or WI.</p>
<p>25 – China Unicom</p> <p>We think RP-222062 provides good reference for the study, while all the questions can be further clarified in RAN SI.</p>
<p>26 – Shenzhen YZF Network Technolog</p> <p>[OPPO] RP-222062 provides good reference for device categorization and the study. But the details can be discussed in RAN study or even in RAN WG study. And we shall also wait for the output of SA1 use case discussions.</p>

27 – Ericsson LM

We think the categorization in RP-222062 is good and useful. I.e., one of the more important aspects of a RAN plenary level SI would be to better understand the merits of the two very different solutions tracks ('passive Tx/Rx' and 'active Tx/Rx') and, as brought up in RP-222062, the service availability, DL reachability, security, charging, mobility, and over all the need and benefit from integrating the solution in a cellular 3GPP NW, should be very important output from the SI. The SI proposal in RP-222453 is currently written in the form of introducing one new radio access technology, but it is becoming clearer that a comparison of the 'passive Tx/Rx' and 'active Tx/Rx' solutions should be the main purpose. The SI objectives should reflect that.

28 – NOVAMINT

We believe the categorisation proposed in RP-222062 provides a good reference and can be used as an input for discussion during the study.

29 – TURKCELL

We think that the categorisation in RP-222062 will be a good starting point.

30 – Intel Belgium SA/NV

We are supportive to the categorization in RP-222062

31 – NTT DOCOMO INC.

We also think the categorization in RP-222062 is good and useful for the discussion in SI.

Q4: Is there any further scoping refinement needed for the SID in RP-222453, e.g. from any of the submissions to RAN#97e? Please provide detailed revision comments.

Feedback Form 4: Comments to Q4**1 – MediaTek Inc.**

Yes - see above. We think the proposal in 2453 is too open-ended at the moment and it will benefit the study to constrain the scope. We would like to note that SA1 study TR22.840 is only 50% completed at the moment and the TR is not provided for information to SA#97e plenary thus could be deemed premature at this stage for RAN to dive into (e.g. no consolidated KPIs/service req. let alone draft versions thereof are available)

It is important to set boundaries of the Tags from the outset e.g.

- Power consumption: 1 – 10 μ W
- Complexity: ultra-low i.e. comparable to commercial sub-GHz RFID applications
- Coverage: [10-30m]

- We note **the vast majority of use cases in SA1 study (22.840 v0.2.0) propose a communication range of 10-30/35m**
- We note **only 2 use cases propose a range higher than that** i.e. one up to 100m and one up to 200m

- Form-factor: "sticker" ~5cm x 5cm

The RAN-level study should focus on:

- Reader <-> Tag interface only, whether the Reader is in a UE or in a base station. This will considerably simplify the scenarios to investigate, whilst ensuring the core defining scenarios are actually the focus of the work.

2 – CATT

We are generally OK with the proposed objective in RP-222453. However, we would like to have the RAN design target and requirements "Formulate a set of RAN design targets based on the requirements from the relevant SA1's agreed use cases" as the basis for identification of the use cases and deployment scenarios of x-IoT.

3 – T-Mobile USA Inc.

Scope needs to be further refined after SA concludes TR 22.840 in December.

4 – Sierra Wireless

The proposal in 2453 is too open-ended at the moment - see above

5 – Xiaomi Communications

We think that the proposed objectives in RP-222453 are general ok. We think that it is probably too early to exclude any candidate solution at the RAN study item phase.

6 – Futurewei Technologies

We agree with the SID objectives in RP-222453. The narrowing down and elaboration of scope and objectives is the work of the RAN-level study in order to craft a proper WG level study for Rel-19.

7 – CHTTL

We hope to consider both eNB and gNB at this stage as described in MTK's paper RP-222335.

8 – ZTE Corporation

We want to make some clarifications/suggestions for the objectives in RP-222453:

1) We think the current classification about traffic, e.g., MO and MT, may be too general. We feel the traffic mode for this new IoT segment may be much different from that of legacy terminal or even legacy IoT devices. So we should pay more attention on that. For example, DL-triggered reporting service would be the dominate traffic mode for the pure battery-less devices with no energy storage capability, in the use case of automated warehousing or logistics. We are not sure whether companies have common understanding

on how to categorize such traffic, e.g., is it MO or MT? So we suggest to have more specific discussion on the concept of traffic modes for this new IoT segment.

2) We understand here the “connectivity topologies” are mainly refer to the RAN-side deployment, not the end-to end architecture. The main requirement for the RAN-side deployment would be to facilitate the communication of Ultra-LPCC devices with the required coverage. Firstly, we want to suggest to add “repeater” as it’s also an option for extend the coverage. Moreover, we are not so clear the meaning of the term of “activator and/or reader”. In our assumption, the question may be which node(s) can be the communication endpoint of the “Tag” or which node(s) can be the energy sources of the “Tag”, with consideration on the coverage requirement in different use cases. So we suggest to use a bit general term as below:

Connectivity topologies, including which node(s) can be ~~activator and/or reader~~ the peer node for communicating with the new IoT devices, e.g. gNB, UE, relay, repeater etc.

3) It’s not easy to understand the note that “*The study shall not prioritize deployment aspects that should be coordinated with SA, e.g. public or private network, with or without CN connection*”. In our view, with CN connection is the basic or original assumption for 3GPP technologies. We doubt whether other aspects can be discussed effectively without any basic assumptions about CN connectivity. From our company’s view, leveraging the management functions of the core network is one of the attractiveness of this new IoT segment over existing non-3GPP passive technologies. Moreover, we see the requirement on supporting security and mobility in SA1 use cases (which generally need involvement of core network), so we suggest that architecture with CN connection should be taken as baseline for RAN study.

4) Except for the ones already listed, we suggest the following RAN design targets should also be taken into account:

- Number of connections in a certain area: The reason for mentioning this is that we should be clear that it’s not to further pursue the increased number of connections (or connection density), e.g., than LPWA, but to consider how to efficiently support more devices in a certain area (with increased number compared to the number of tags supported by legacy passive technique, e.g., by a RFID reader)
- Mobility and Security: We see the requirements on supporting security and mobility from use cases which has agreed by SA1.

9 – vivo Communication Technology

As co-sourcing company, we are fine with the current scope in RP-222453. We are open to discuss further scope narrow-down, if possible. Otherwise, we can move forward with the current scope.

10 – Nokia Denmark

We are fine with the current scope in RP-222453

11 – Huawei Tech.(UK) Co.. Ltd

The latest SID in RP-222453 is certainly fine to us. We are open to revision if agreeable by the group.

12 – LG Electronics France

We think use case is the basic requirement to discuss the necessity or scope of the study, which is under discussion in SA1. Therefore, while we think further scope refinement is necessary, it seems premature to define the scope at this meeting.

13 – Fujitsu Limited

We are basically fine with the scope in RP-222453

14 – Spreadtrum Communications

We support RP-222453 as one of co-source companies; while we are open to further polish the scope.

15 – Orange

We are supportive of the SI and fine with the current wording. Refining the scope and prioritising the use case should be done within the SI itself, not before.

16 – Samsung Electronics Co.

In our view, outdoor, macro, and micro deployment scenarios would clearly be impractical taking into account the purposes being discussed and they can already be removed from the scope.

In case of pure batteryless devices with no energy storage capability at all, the latency that is required for energy harvesting would be an important parameter. Hence, we would like to add the following bullet point in the set of RAN design targets.

- Latency that should be allowed for enabling the energy harvesting

17 – Sony Europe B.V.

In the justification section, we believe the statement "Existing cellular devices cannot work well with energy harvesting due to their peak power consumption of higher than 10mW." is a subjective statement and therefore should be removed. In addition we think there are existing cellular devices that do operate on energy harvesting.

We believe the reason that x-IoT could not be a replacement to existing 3GPP LPWA solutions is potentially the coverage, topology, data rate, coexistence ability.

18 – NEC Corporation

We are fine with the scope in RP-222453.

19 – Philips International B.V.

It would be good to consider Opportunistic/Delay Tolerant Networks for x-IoT. Whereas in some use cases a maximum latency may be required (e.g. to be able to actively read a value from a luggage tag), in other use cases (e.g. a carbon-emission sensor) a delay of multiple hours may be tolerated. Hence we would propose to add "Delay tolerance" to the set of RAN design targets.

20 – Telia Company AB

We are ok with the SID in RP-222453 and the current wording. To be refined after SA concludes TR 22.840.

21 – Lenovo (Beijing) Ltd

We are fine with the SID in general, in order to focus on several “essential” issues and make the study more efficient, we had better to prioritize some items.

22 – VODAFONE Group Plc

To avoid confusion in discussions with topologies that involve a UE as a reader, change

”• Mobile originated and/or mobile terminated traffic assumption”

to

”• Device originated and/or device terminated traffic assumption”

23 – China Telecommunications

As one of the co-sourcing companies of RP-222453, we are fine with current scope in the proposal.

24 – China Mobile Com. Corporation

We are ok with the current scope in RP-222453.

Regarding to companies’ concerns on the manageable, here are our suggestions:

1) SA1 will conclude their study of use cases and requirements at Nov 2022. So all the SA1 conclusions will be taken as baseline for RAN level study in Dec 2022. And we should avoid any duplicated discussion on the use cases and requirements. But only to check if any further RAN requirement or design targets is missing.

2) Regarding to MTK’s comments, we are fine to further clarify the scope. We suggest to rewording MTK’s proposal as follows:

- Study requirements for radio interface between Reader/Activator and Tag, where the reader/activator can be implemented/deployed in base station or UE

3) If companies still have strong requirement to further narrow down the scope, our suggestion is to leave the study of RAN connectivity topology to WG SI phase.

25 – China Unicom

we are fine with current scope in RP-222453.

26 – Shenzhen YZF Network Technolog

[OPPO] We are fine with the current scope. And we are open to further revision based on the discussion. We share similar view that scope may need to be further refined after SA concludes TR 22.840 in December.

27 – Ericsson LM

We think the most important outcome of the SI would be pros and cons for the two solution tracks ‘passive Tx/Rx’ and ‘active Tx/Rx’, and the benefits to support them in 3GPP, and the SID in RP-222453 could be updated to better capture that (see our reply to Q3).

We also provide these more detailed revision comments:

The justification section contains claims about energy harvester output (“ $1\mu W$ to a few hundreds of μW ”) and peak power consumption (“*higher than 10mW*”) that we do not recognize, and suggest revising to the following:

“Considering the limited size and complexity required by practical applications for batteryless devices with no energy storage capability or devices with energy storage that do not need to be replaced or recharged manually, the output power of energy harvester is typically from $1\mu W$ to a few tens of mW ~~few hundreds of μW~~ . Existing cellular devices may not work well with energy harvesting due to their peak power consumption of $50\text{-}500\text{ mW}$ ~~higher than 10mW~~ .”

It is further important that the maximal output power of devices is not artificially limited. Such a constraint should only stem from the energy storage constraints and the traffic model in our understanding. (There are already NB-IoT modules with energy harvesters in the market, so saying that such “cannot work well” is too strong).

We are also not supportive of the reference to the “*agreed SA1 use cases*” in the objective section. SA1 is currently studying use cases for X-IoT, and RAN should await normative work in SA1 before referring to agreed SA1 use cases.

28 – Ericsson LM

I forgot to highlight one change above: ”...Existing cellular devices may not ~~cannot~~ work well with energy harvesting...”

29 – NOVAMINT

We are ok with the current scope in RP-222453.

ok with Vodafone’s suggestion

30 – MediaTek Inc.

Some *initial* changes vs. the proposal in 453 are proposed hereafter.

This study targets at a new 3GPP IoT technology, suitable for cellular deployment, which relies on ultra-low complexity devices “Tags with ultra-low power consumption for the very-low end IoT applications. In terms of energy storage, the study will consider the following:

- Pure batteryless devices “Tags with no energy storage capability at all, and completely dependent on the availability (and lack thereof)of an external ~~the ambient~~ source of energy ~~it is harvesting~~

- Devices “Tags with very limited energy storage capability (~~e.g. up to that available from ambient sources via energy harvesting~~) that do not need to be replaced or recharged manually, and which can manage short periods of energy source outage/ambient energy unavailability.”

Device characteristics other than energy storage are assumed to be investigated under the second objective below.

- Identify the suitable deployment scenarios and their characteristics, ~~at least for~~ taking into account the use cases/services agreed in SA1’s “Study on Ambient power-enabled internet of Things”, comprising among at least the following aspects

- Indoor/outdoor environment
- Basestation characteristics, e.g. macro/micro/pico cells-based deployments
- Connectivity topologies, including which node(s) can be activator and/or reader, ~~e.g. gNB~~ i.e. base station, UE, relay, etc.
- The behavior and functionality of a Tag is expected to be agnostic of whether an activator/reader is a base station or a UE
- TDD/FDD, and frequency bands in licensed or unlicensed spectrum
- Coexistence with UEs and infrastructure in frequency bands for existing 3GPP technologies
- Mobile originated and/or mobile terminated traffic assumption

NOTE: There can be more than one deployment scenario identified for a use case, and a deployment scenario may be common to more than one use case.

NOTE: Where more than one deployment scenario is identified for a use case, the trade-offs between them should also be studied.

NOTE: The study shall not prioritize deployment aspects that should be coordinated with SA, e.g. public or private network, with or without CN connection.

- Formulate a set of ~~RAN~~ design targets based on the above identified deployment scenarios and their characteristics/requirements from the relevant SA1’s agreed use cases, at least including

- Power consumption and max Tx power of the “Tag
- Complexity of the “Tag
- Coverage
- Traffic characteristics incl. Data rate, latency, reliability
- Positioning accuracy

NOTE: The study shall aim to provide better coverage compared to existing non-3GPP technologies for the relevant use cases.

- Compare and assess the feasibility of meeting the design targets for each of the above identified deployment scenarios and their characteristics ~~agreed SA1 use case on the basis of the deployment scenario(s) appropriate to it~~, and identify assumptions on required functionality to be supported. Gaps vs. existing 3GPP IoT technologies shall be documented.

NOTE: This is not to require a detailed WG-level of analysis.

Note: This study shall target for an IoT segment well below the existing 3GPP IoT technologies, e.g. NB-IoT, eMTC, RedCap, etc. The study shall not aim to replace existing 3GPP LPWA technologies.

31 – TURKCELL

We need to be refined the scope after SA concludes TR 22.840

32 – NTT DOCOMO INC.

We are basically fine with the scope in RP-222453, and we also think that the important outcome is to identify value/gain to support the scenarios in 3GPP system compared with other existing technologies.

Q5: Do you agree with the following timeline: approval at RAN#97e, start the RAN-level study at RAN#98e and complete the SI at RAN#100?

Feedback Form 5: Comments to Q5

1 – CATT

We are supportive of having the study in RAN as early as possible with sufficient study time and approved in RAN#97e if we would like to have the x-IoT study in RAN. Delay the approval to future RAN would not help to improve the quality of study.

2 – Deutsche Telekom AG

As stated already very often: We need to see first a consolidated clearly focussed SID to decide what RAN should study and why. We also do not see any urgency approving a potential SID at this RAN#97e. Given the timeline of the SA1 SI and the Rel-18 timeline we can accept approving a well focussed RAN level SI at RAN#98e and start the work from RAN#99 onwards. We see 3Q as a realistic timeline and after the finalisation the outcome will be part of the normal Rel-19 prioritisation process like any other proposal.

3 – AT&T GNS Belgium SPRL

Although it is good to have some of this scoping discussion as early as possible, we do not see any urgency to have a RAN-level SID approved at this meeting. Given SA work is still progressing, and this work is targeting normative definition in Rel-19, we propose that the approval of this RAN-level study can wait until at least RAN#98-e. This will give proponents further time to consolidate views on a concise RAN-led SI while also allowing SA to progress their work further.

4 – T-Mobile USA Inc.

We generally agree with DT and ATT's comments, however there's no need to start the RAN level SI until March 2023 (RAN#99).

5 – Sierra Wireless

I do not feel that we will have a clearly focused SID this meeting and also do not see any urgency approving a potential SID at this RAN#97e.

6 – Qualcomm Incorporated

We can potentially agree with the timeline as proposed. However, understandably, only after converging on the objectives can we give a more definite answer.

7 – Xiaomi Communications

We are supportive to the proposed timeline.

8 – Futurewei Technologies

We support of the proposed timeline. It is preferable to start the SI right now so that more time can be spent towards a properly scoped WG SI.

9 – ZTE Corporation

It's acceptable to us to start the RAN-level study at RAN#98e (or from RAN#99 is also fine). But it may be hasty to complete the SI at RAN#100. One more quarter is needed and that also matches the time plan for Rel-19.

10 – vivo Communication Technology

We support the proposed timeline.

11 – TELECOM ITALIA S.p.A.

Looking to Rel 19 possible timeframe and dependency on SA1 activity, we support the view of DT, AT&T and T-Mobile

12 – Nokia Denmark

We are flexible with the start timing for this study. However, the initial discussion might be easier in the F2F meeting in March than in e-meeting settings in December?

13 – Huawei Tech.(UK) Co.. Ltd

Yes, we agree with the above timeline. According to the current Rel-18 timeline, RAN will approve the Rel-19 package in September 2023. If approval of the Rel-18 RAN level SI is delayed to December 2022, there will be only two RAN plenary meetings (Mar and Jun 2023) for this study, which clearly is not sufficient.

Therefore our view is that the proposed timeline is the appropriate way to fit into the current Rel-18 timeline. Further delaying the approval of this item may signal inside and outside 3GPP that Rel-18 is already likely to be delayed, which should not be associated with the approval of this item.

14 – LG Electronics France

We think the purpose or objectives of the potential study should be based on the conclusion of ambient IoT SI in SA1. Therefore, it seems premature to open a SI at RAN#97e.

<p>15 – Spreadtrum Communications</p> <p>We agree with this timeline arrangement.</p>
<p>16 – Orange</p> <p>We agree</p>
<p>17 – Fujitsu Limited</p> <p>Our view is similar with ZTE. Of course it's good if we can finish all the scope discussion at this meeting, but it would not be so easy given the comments from companies. Approving at RAN#98e and completing at RAN#101 can also meet the timeline.</p>
<p>18 – Samsung Electronics Co.</p> <p>While we are fine for having a RAN-level SI, we are flexible regarding the start timing because we don't see critical urgency in time.</p>
<p>19 – Kyocera Corporation</p> <p>We agree with the moderator's suggestion.</p>
<p>20 – Sony Europe B.V.</p> <p>The study can start in RAN#98e and should finish by the end of Rel-18.</p>
<p>21 – NEC Corporation</p> <p>We agree with the timeline.</p>
<p>22 – Philips International B.V.</p> <p>We support the proposed timeline.</p>
<p>23 – Telia Company AB</p> <p>No rush to approve the SI. Would be better to start after SA1 work (TR22.840) is finalised and RAN study clarifications would be ready and agreeable. That would lead to start the work in earliest in after SA&RAN#98.</p>
<p>24 – Lenovo (Beijing) Ltd</p> <p>We agree with the timeline as proposed, but if companies need more time to refine the scope of study, we are OK to postpone 1 meeting to study.</p>
<p>25 – VODAFONE Group Plc</p> <p>We support the proposed timeline. Starting the SI right now gives more time to properly scope any WG SI.</p>

<p>26 – Shenzhen YZF Network Technolog</p> <p>[OPPO]We support the proposed timeline.</p>
<p>27 – China Telecommunications</p> <p>Yes, we agree with it.</p>
<p>28 – China Mobile Com. Corporation</p> <p>We support the proposed timeline as it is generally aligned with our timeline in RP-222126.</p> <p>We support to approve the SID in RAN#97. And start discussion in RAN#98 in Dec 2022, right after SA1 concludes in Nov 2022. And no strong view on whether to complete RAN level SI in RAN#100 or RAN#101.</p>
<p>29 – China Unicom</p> <p>We support the proposed timeline.</p>
<p>30 – MediaTek Inc.</p> <p>Though the timeline seems right, we first need to understand what the scope is - for now it is way too open-ended as commented above.</p>
<p>31 – Ericsson LM</p> <p>It would be beneficial to start the RAN-level SI in Rel-18 timeframe, but we see no urgency motivated by a market pull. It would be good to let the SA1 discussion stabilize to ensure the technical solution is targeting the right use cases and service requirements.</p>
<p>32 – NOVAMINT</p> <p>We support to start the RAN-level SI in Rel-18 timeframe and we would prefer to have the proposed timeline in line with Huawei’s argument on Rel-19 package</p>
<p>33 – TURKCELL</p> <p>We support DT and ATT’s comments.</p>
<p>34 – NTT DOCOMO INC.</p> <p>We would be fine with the proposed timeline once we could converge on the scope of SI.</p>

2.1 Summary of initial round on Q1

Q1: Is it agreeable that the study shall focus on use cases that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technology (incl. with reduced peak Tx power), as stated in RP-222335?

Summary:

There is general agreement that the study shall focus on use cases that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technology (incl. with reduced peak Tx power). The moderator will capture this sentence in the objective section of SID.

There are comments about the naming. As discussed in the offline session in RAN#96 at Budapest, a temporary name “x-IoT” is given to avoid spending too much time on the naming discussion, and the group will get back to the naming discussion when the SI gets closer to approval. The moderator will include question for collecting feedback on the naming discussion in the intermediate round.

2.2 Summary of initial round on Q2

Q2: Is it agreeable to focus only on passive tags and UE as reader at this stage, as stated in RP-222335?

Summary:

Majority of companies’ view is not to focus only on passive tags and UE as reader at this stage. Therefore, the moderator will not pursue further scope restriction along the line of “focus only on passive tags and UE as reader”. This does not preclude an outcome of the SI being to make such a focus, but it is clear from the comments received that it is not something that is agreeable prior to the SI.

At the same time, a few companies would like to see some scope reduction. The moderator provides the following suggestions:

- To clarify in the objective section that “The device peak power consumption in this study shall not exceed a few hundreds of μW .” This would provide some boundaries on the scope. The exact peak power consumption is certainly to be discussed during the SI.
- To clarify in the objective section that “NOTE: A representative use case can be studied for a group of use cases that have similar requirements.” This would mean that RAN SI does not need to have repeated work for every use case from SA1.

A few companies think that answer to Q2 shall be dependent on the SA1 outcome. The moderator notes that SA1 completes its study in Nov 2022, which is ahead of the first RAN discussion in Dec 2022. Further, from the majority companies’ view, it is clearly not possible to “focus only on passive tags and UE as reader at this stage.”

The moderator also would like to provide the following responses to some of the detailed comments received:

- To MTK: The moderator will replace “gNB” by “basestation” in the next revision of SID. The moderator thinks that without detailed technical study, it is difficult to make any conclusion on “xIoT shall be implementable in existing gNB hardware” and “The behavior and functionality of the Tag is agnostic of where the Reader functionality is deployed” at this stage.
- To MTK: Regarding the comment “one can plug solar panels to any device”, the moderator would like to add “The devices’ peak power consumption shall be limited by its practical form factor for the intended use cases” to address the comment. There is clearly no commercial relevance to attach a large solar panel to a small tag.

Below is moderator’s assessment (on a first order only) on companies’ positions.

- Limit to passive tag only and UE as reader only: MTK, Qualcomm, InterDigital, FutureWei
- Not to limit: CATT, Sierra Wireless, CHTTL, ZTE, vivo, Samsung, Fujitsu, Huawei/HiSilicon, Orange, Spreadtrum, Philips, Kyocera, Telia, Sony, NEC, VDF, CTC, Lenovo, OPPO, CUC, CMCC, Ericsson, NOVAMINT, TURKCELL, Intel, NTT DOCOMO
- No detailed feedback (depending on SA1): T-Mobile, Panasonic, TIM, Nokia, KT

2.3 Summary of initial round on Q3

Q3: With respect to the categorization in RP-222062, moderator’s understanding is that this is a natural part of the SI, thus would like to check if this is common understanding? If so, any further clarification on the objectives in RP-222453 needed?

Summary:

Majority of the companies think the categorization in RP-222062 can be discussed during the RAN SI. Moderator notes that if the SI begins in RAN#96 (December), this is equivalent to being after SA1, since the SA1 item is due to finish in November. There was not much detailed proposal on revision of SID in relation to RP-222062.

The moderator feels that the most of the aspects in RP-222062 are already covered by the current SID in RP-222453, but would like to propose the following addition to the SID to make it clearer: “Device categorization based on corresponding characteristics (e.g. energy source, energy storage capability, passive/active transmission, etc.) may be discussed during the study, in relation with the relevant use cases.”

Below is moderator’s own assessment (on a first order only) on companies’ positions.

- Discuss categorization before SI approval: MTK, Qualcomm,
- Discuss categorization within SI: CATT, Sierra Wireless, FutureWei, ZTE, vivo, III, Fujitsu, Huawei/HiSilicon, Samsung, Orange, Spreadtrum, Philips, [Kyocera], Sony, NEC, VDF, Lenovo, CTC, CUC, CMCC, OPPO, Ericsson, NOVAMINT, [TURKCELL], [Intel], NTT DOCOMO
- Discuss after SA1: T-Mobile, Nokia, Telia

2.4 Summary of initial round on Q4

Q4: Is there any further scoping refinement needed for the SID in RP-222453, e.g. from any of the submissions to RAN#97e? Please provide detailed revision comments.

Summary:

Majority of companies are fine with the current scope in RP-222453. Some companies provided detailed revision comments. Moderator would like to provide the following responses:

- Regarding “1 – MediaTek Inc.”: MTK comment is in relation to Q2. As it is not possible to limit the scope to passive tag and UE reader only at this stage, the moderator feels difficult to incorporate such revisions into the SID. The moderator notes that it does not preclude an outcome of the SI being to make such a focus, but it is clear from the comments received that it is not something that is agreeable prior to the SI.
- Regarding “8 – ZTE Corporation”: 1) This is already covered by the bullet “Mobile originated and/or mobile terminated traffic assumption”. Specific discussion seems best taken within that scope on a contribution basis during the SI; 2) the moderator feels it is not critical to replace “activators/readers” with some other terminology since RAN can define during the SI what this means as a function of the identified deployments; “repeater” is added but note that bullet already has “etc.”; 3) The moderator thinks this RAN level study shall focus on RAN-centric aspects. CN aspects need to be discussed and coordinated with SA2; 4) the objective already contain “at least”, but moderator would like to propose the following addition to the objectives to make it clearer “NOTE: Other RAN design targets in relation to connection density, mobility, security etc. may be discussed, if necessary for the relevant use cases.”
- 16 – Samsung Electronics Co.: 1) The moderator feels it is not possible to remove the outdoor scenarios at this stage, and if they do prove to be clearly impractical then removal (or reporting of impracticality) should be a straightforward step after due analysis in the SI; 2) Added latency in “NOTE: Other RAN design targets in relation to connection density, mobility, security, latency, etc. may be discussed, if necessary for the relevant use cases.”
- 17 – Sony Europe B.V.: Moderator revise “cannot” to “may not”.
- 19 – Philips International B.V: Latency is explicitly added in the note “NOTE: Other RAN design targets in relation to connection density, mobility, security, latency, etc. may be discussed, if necessary for the relevant use cases.”
- 22 – VODAFONE Group Plc: Revised accordingly by replacing “mobile” with “device”.

- 27 – Ericsson LM: 1) the moderator thinks comparison between ‘passive Tx/Rx’ and ‘active Tx/Rx’ is naturally included in the study as it has to be discussed together with the use cases and requirements. See the new sentence added: “Device categorization based on corresponding characteristics (e.g. energy source, energy storage capability, passive/active transmission, etc.) may be discussed during the study, in relation with the relevant use cases.”; 2) the moderator thinks “higher than 10mW” is consistent with “50-500 mW”; 3) the moderator thinks RAN can start with some SA1 use cases to discuss the RAN centric aspects.
- 28 – Ericsson LM: revised accordingly.
- 30 – MediaTek Inc. The moderator took some suggested revisions. The moderator thinks RAN should take SA1 output as the starting point thus did not include some of MTK’s revisions.

Below is moderator’s own assessment (on a first order only) on companies’ positions, and may not be accurate.

- Refinement with detailed comments: MTK, ZTE, Samsung, Sony, Philips, Ericsson
- Refinement without detailed comments: Sierra Wireless
- Wait until SA1 completes: T-Mobile, LGE, TURKCELL
- OK with SID in RP-222453: CATT, Xiaomi, Futurewei, vivo, Nokia, Huawei/HiSilicon, Fujitsu, Spreadtrum, Orange, NEC, Telia, Lenovo, VDF, CTC, CUC, OPPO, NOVAMINT, NTT Docomo

2.5 Summary of initial round on Q5

Q5: Do you agree with the following timeline: approval at RAN#97e, start the RAN-level study at RAN#98e and complete the SI at RAN#100?

Summary:

Majority of the companies are supportive to approve the item in RAN#97e. Some companies would like to approve it later within Rel-18 timeframe and commented on the relation to SA1 work. The moderator noted that SA1 study complete in Nov 2022, i.e. before the first discussion of this RAN item at RAN#98e.

The moderator suggests to focus on improving the scope and objectives in the intermediate round and discuss the timeline in the last round.

Below is moderator’s own assessment (on a first order only) on companies’ positions

- Approve in RAN#97e: CATT, [Qualcomm], Xiaomi, Futurewei, ZTE, vivo, Huawei/HiSilicon, Spreadtrum, Orange, Kyocera, NEC, Philips, VDF, OPPO, CTC, CMCC, CUC, NOVAMINT, NTT Docomo

- Approve later within Rel-18: DT, AT&T, T-Mobile, Sierra Wireless, TIM, LGE, Sony, Telia, Ericsson, TURKCELL
- Approve in either RAN#97e or later within Rel-18: Nokia, Fujitsu, Samsung, Lenovo, [MTK]

3 Intermediate round

Q6: Do you have any remaining points that are missing from the revised SID or cannot be addressed during the study according to the moderator’s response? The latest revised SID is available at https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_97e/Inbox/Drafts/%5B97e-06-R18-RANLevel-xIoT%5D/Rev1%20of%20RP-222453.doc

Feedback Form 6: Comments to Q6

1 – AT&T GNS Belgium SPRL

In the draft SID objectives, we have introduced some dependencies on the SA1 Rel-19 Study Item (SP-220085), i.e., ”Compare and assess the feasibility of meeting the design targets for each agreed SA1 use case” and ”Formulate a set of RAN design targets based on the requirements from the relevant SA1’s agreed use cases”. Given the TR will be finalized and agreed at SA#98 in Dec, it only seems logical to scope the RAN work as well as align terminology (i.e., Question 7) for the RAN SI at RAN#98. We don’t see the urgency at this meeting given the normative work is slated for Rel-19. If we don’t plan to wait for the conclusion of the SA1 TR, we should remove these dependencies.

2 – CATT

SA1 works and use cases are good references for RAN in defining the design target of x-IoT device. However, it would be very challenged to fully align the RAN study of x-IoT with that in SA1. RAN should have the basic target design based on available technologies in low-power active devices and passive devices to address the some use cases identified by SA1. However, some use cases identified by SA1 might not have immediate solution in RAN and should be considered later. Thus, we believe that the objective of x-IoT study in RAN should has its own target design based on available technologies with the reference from SA1 requirements and use cases.

3 – Panasonic Corporation

We agree the comment from AT&T on the linkage to SA1.

On ”the device peak power consumption in this study shall not exceed a few hundreds of μW ”, the actual device peak power consumption would depend on what energy source even after the standardization is finalized. We proposed to to modify it as ”the **assumed** device peak power consumption in this study shall not exceed a few hundreds of μW .”

4 – Xiaomi Communications

The revised SID is fine to us. We are also open to either keep or remove the dependence on the SA1, as we consider that companies' inputs may anyway use the SA1 conclusions as reference.

5 – Futurewei Technologies

We are fine with the revised SID. As moderator mentioned in the summary of initial round, SA1 SI will conclude by December plenary, there should be no issue for this SI to take the outcomes there into account.

6 – T-Mobile USA Inc.

We echo AT&T's comments

"In the draft SID objectives, we have introduced some dependencies on the SA1 Rel-19 Study Item (SP-220085), i.e., "Compare and assess the feasibility of meeting the design targets for each agreed SA1 use case" and "Formulate a set of RAN design targets based on the requirements from the relevant SA1's agreed use cases". Given the TR will be finalized and agreed at SA#98 in Dec, it only seems logical to scope the RAN work as well as align terminology (i.e., Question 7) for the RAN SI at RAN#98. We don't see the urgency at this meeting given the normative work is slated for Rel-19."

The scope and length of the SID depends on the outcome of SA1 Rel-19 Study Item (SP-220085). We should discuss the scope again in December and move forward with the SID in March '23.

7 – vivo Communication Technology

We are fine with the latest SID from moderator.

8 – vivo Communication Technology

We are fine with the latest SID from moderator.

9 – vivo Communication Technology

We are fine with the latest SID from moderator.

10 – MediaTek Inc.

We remain confused with parts of the SID:

- A first objective is: "Identify the suitable deployment scenarios and their characteristics, at least for the use cases/services agreed in SA1's "Study on Ambient power-enabled internet of Things", comprising among at least the following aspects [...]"
- But the follow-up objectives ignore the above which is very strange. That's why our proposed revisions restricted the remaining objectives to the outcome of this first objective. So we would request again to update these objectives according to the identified suitable deployment scenarios and their characteristics.

We have recommended to consider latency and reliability requirements beyond data rates: we consider these are essential design criteria that need to be taken into account. We acknowledge it says "at least including" but we would ask to have these explicitly listed.

We have also requested a gap analysis vs. existing 3GPP LPWA - we consider this very important so we don't reinvent the wheel, unlike what a few companies are actually suggesting.

11 – Spreadtrum Communications

We are fine with the latest revised SID.

12 – LG Electronics France

As we commented in initial round, we are not sure it is necessary or efficient way to settle down the scope of the study at this meeting since many aspects are based on or related to ongoing SA1 study (as already written in the current draft SID). We may have to reformulate or revise many of the study scope depending on SA1 conclusion. Since current draft scope is quite general and large, we think it may be better to have more refined scope for discussion reflecting SA1 conclusion especially on use cases.

13 – LG Electronics France

As we commented in initial round, we are not sure it is necessary or efficient way to settle down the scope of the study at this meeting since many aspects are based on or related to ongoing SA1 study (as already written in the current draft SID). We may have to reformulate or revise many of the study scope depending on SA1 conclusion. Since current draft scope is quite general and large, we think it may be better to have more refined scope for discussion reflecting SA1 conclusion especially on use cases.

14 – Nokia Denmark

We are fine with the current SID

15 – Nordic Semiconductor ASA

"The study shall provide clear differentiation, i.e. addressing use cases and scenarios that *cannot* otherwise be fulfilled based on existing 3GPP LPWA IoT technology e.g. NB-IoT including with reduced peak Tx power. " we would like to echo MTK comment, that it is not very clear what does "cannot otherwise be fulfilled" means. This should be changed to "...use cases and scenarios in which potential xIoT devices would provide significant benefits over 3GPP LPWA .. in terms of

- Power consumption
- Complexity
- Coverage
- Data rate
- Positioning accuracy

16 – Orange

We are fine with the latest wording of the SI.

17 – NEC Corporation

We are fine with the scopes in the latest SID.

18 – NOVAMINT

We agree with MediaTek that a Gap analysis vs. existing 3GPP LPWA would be needed and it is important to include it in the study.

We also agree with suggestion from Nordic

19 – Telia Company AB

The latest SID looks ok for us, but would be good to wait for the conclusion of the SA1 TR.

20 – Sony Europe B.V.

- In the justification section we believe that the following wording gives the wrong impression regarding what the SID aims to achieve. Saying that “***The new IoT technology shall provide complexity and power consumption orders of magnitude lower than the existing 3GPP LPWA technologies (e.g. NB-IoT and eMTC), and thus is not to be a replacement for them.***” implies that we plan to design something better than the existing 3GPP LPWA technologies and yet ... the new better solution will not replace the old ones. We think that the message should be that “x-IoT” can do something different or cannot do something that 3GPP LPWA can do and hence is not meant to be a replacement for them.
- As we commented before we would like to see the text “***e.g. NB-IoT including with reduced peak Tx power.***” removed from the scope because in the statement in which it is included, it has nothing to do with “use cases and scenarios” and also we see no reason to start mentioning specific features (from either NB-IoT or eMTC).

21 – Qualcomm Incorporated

First, we would have a few questions regarding the following part:

”Device characteristics other than energy storage are assumed to be investigated under the second objective below. The device’s peak power consumption shall be limited by its practical form factor for the intended use cases, and shall consider its energy source. The device peak power consumption in this study shall not exceed a few hundreds of μW . Device categorization based on corresponding characteristics (e.g. energy source, energy storage capability, passive/active transmission, etc.) may be discussed during the study, in relation with the relevant use cases.”

Does ”device peak power consumption” here mean the maximum energy discharge rate from its internal power storage element, if it has such an element, or does peak power consumption mean the maximum energy input rate the device can get from its external energy source (that can be used for either operation or charging or both)? It would be worthwhile to clarify unless it’s obvious to everyone else.

How does the last sentence above starting with ”Device characterization...” relate to the first sentence that says device characterization is under the second objective? Shouldn’t passive/active transmission determination then be part of the second objective, too? To be clear, our first preference would be to decide at this Plenary whether passive or active device is the focus. But if this is pushed into the study then at least it should be listed in an objective.

There should be a requirement target added in terms of coverage.

For example, the outage rate of devices in the target network should be 5%?, 50%?, 95%?, without that, it is kind of difficult to know what the objectives mean.

Overall, the objectives are a bit too broad and would prefer to have a bit more disciplined setting of targets. For example, we could have been ok with either selecting passive/semi-passive devices or active devices now. (Therefore capturing our view in the first round as preferring to limit to passive only was not entirely accurate; but it is ok, probably we should have been clearer). We believe that many companies made up their mind already about which one we should go ahead with eventually, so to keep studying both can be a waste of time.

22 – China Unicom

We are fine with the current version of this SID.

23 – China Telecommunications

We are fine with the latest SID.

24 – TURKCELL

The latest SID is fine for us. It would be good to wait for the conclusion of SA1.

25 – China Mobile Com. Corporation

Current SID looks good to us.

Regarding to linkage of SA1:

SA1 SI will complete in Nov this year, and TR 22.840 will be stable at that time. Traditionally, SA plenary in Dec will not change any technical part of the SA1 TR before approve it in Dec. So we think it is just in time to start the first meeting of RAN level SI in RAN#98 December.

We would like to echo MediaTek’s comment on the SID. The second objective of SID should take the outcome of first object into consideration, i.e., “the identified suitable deployment scenarios and their characteristics”. And we are also ok to include “latency and reliability” into the design targets in the second objective.

Regarding to the gap between x-IoT and LPWA:

We would like to clarify that, x-IoT would not replace LPWA. The UE capability for tag device may include power consumption, coverage, cost, data rate, battery dependency/device lifetime, security requirement, etc, which should be much lower than existing LPWA.

However, for each single aspect in the capability, it may happen that some overlapping may be difficult to avoid. For example, from the aspect of device life time, one specific use case may require more than 10 years of device life time, which both x-IoT and NB-IOT can meet the requirement.

26 – Ericsson LM

NB-IoT using 14 dBm corresponds to 25mW output power (roughly 50mW peak power), and it is clearly the intention among companies that the peak power of X-IoT should be lower to clearly differentiate and provide lower device complexity. The new SID addition however suddenly suggests limiting the device peak power to “*a few hundreds of μW* ”, which we do not agree with since it may lead to too short coverage.

Such low peak power will limit the coverage to a few tens of meter, which would render the solution infeasible for cellular deployments.

So, a more reasonable upper limit is an order of magnitude lower than NB-IoT, i.e., ~5mW peak power (corresponding to ~0dBm output power). With that, X-IoT can achieve a few hundreds of meter coverage (LOS, depending on BS sensitivity). We therefore strongly think that the SID addition should be revised to:

“The device peak power consumption in this study shall not exceed a few ~~hundreds of~~ μ W-mW.”

Alternatively, the max. peak power consumption can be left open in the SID and become a desired output of the SI instead.

Note that, energy harvesting can generate power up to a few mW (e.g. 100 mW per 1 cm² solar panel), and energy can of course be harvested over longer periods of time.

27 – ZTE Corporation

It is still not so clear what the intention of this NOTE *“The study shall not prioritize deployment aspects that should be coordinated with SA, e.g. public or private network, with or without CN connection”*. As we have said, at least in some companies’ thoughts, with CN connection may be the basic or original assumption for development of 3GPP technologies. Yes, technically speaking, without CN connection could be another assumption. Without considering on these assumptions, it’s doubtful that other RAN aspects can be discussed efficiently, e.g. aspects like complexity, security, etc can be also related to whether CN connection is assumed.

So the moderator’s feedback “RAN level study shall focus on RAN-centric aspects. CN aspects need to be discussed and coordinated with SA2” seems not so relevant. We agree that details of core network technologies are not suitable to be discussed in this RAN study (but it may anyway be involved as the impact on the devices may still need to be assessed). This part is clear and no need to be mentioned. If there is another intention that deployment options with CN involvement needs to be deprioritized, we think it’s incorrect or should be avoided in current stage, e.g., when we define the scope of the study item (if at the end of the study, companies have common analysis that some options can be deprioritized, that would be fine).

In a summary, we understand that “identify the suitable deployment scenarios and their characteristics” may involve the discussion of “public or private network, with or without CN connection”. So we need to clarify that any possible assumptions related to CN aspect would be allowed. Therefore, our suggestions is:

NOTE: The study shall not prioritize deployment aspects that should be coordinated with SA, e.g. public or private network, with or without CN connection based on some basic assumptions related to CN aspect, e.g. public or private network, with or without CN connection. Coordination with SA on these deployment aspects are expected.

If “with CN connection” cannot be one of the assumptions for the study item, we think it will need more discussion to find the consensus on what assumption it should be before starting this study item. In this case, we are okay with starting this item later after when there is a clear understanding on what assumption is allowed in the study.

28 – VODAFONE Group Plc

We are fine with the revised SID. As the moderator mentioned in the summary of the initial round, the SA1 SI will conclude before the December RAN plenary, so there should be no issue for this SI to take the outcomes there into account.

29 – Huawei Tech.(UK) Co.. Ltd

The current SID is good, and the discussions seem to be converging towards it.

30 – Huawei Tech.(UK) Co.. Ltd

The current SID is good, and the discussions seem to be converging towards it.

Q7: Do you have suggestion on the naming of the RAN level study item, e.g. Extended IoT (eIoT), Ambient IoT (AmbIoT), etc.? Flexibility from companies are encouraged to avoid excessive discussion on the naming.

Feedback Form 7: Comments to Q7

1 – AT&T GNS Belgium SPRL

See comments above for Q6. We should align with SA1 study item terminology in the RAN SID.

2 – CATT

Ambient in technology has been identified as "relating to the immediate surroundings". Ambient IoT would be a confused technology terminology in our term. The terminology in Extended IoT or Augmented IoT would be close to our target study objective of IoT device.

3 – Fujitsu Limited

Just to clarify our thinking behind our comment Q1: "x" sometimes means anything/everything, it looks as if the existing use case, e.g. LPWA, are also covered in this study. If we adopt Extend IoT, "eIoT" should be avoided because people may think "e" means "enhanced", which is a normal naming rule in RAN. ExIoT would be OK.

4 – Panasonic Corporation

During the study of "identify the suitable deployment scenarios and their characteristics", SA1 linked wording like "Ambient IoT" could be sufficient. After this study, we expect more clear understanding of the deployment scenarios and their characteristics are known. Then we propose to use more technically suitable naming, which corresponding to the outcome of this study, can be discussed.

5 – Xiaomi Communications

We have not strong preference on the naming issue, but would slightly prefer to align the naming used in SA1 so that we can easily link some concepts between SA and RAN.

6 – China Mobile Com. Corporation

We propose to use “Extended IoT (e-IoT)”.

Since we are aiming a new IoT segment which is extension of the existing 3GPP IoT ecosystem and use cases. We suggest to use the term “extended IoT”, or “e-IoT” for short.

7 – Xiaomi Communications

Since operators are considering to extend the existing 3GPP IoT ecosystem and use cases, we also see the benefits of using “extended IoT”, or “e-IoT” and are also supportive to use “extended IoT”, or “e-IoT”.

8 – Futurewei Technologies

We are open to any term that is reasonable and not confusing. There is no need to spend a lot of time and energy arguing about it.

9 – T-Mobile USA Inc.

Align with SA Release 19 terminology.

10 – vivo Communication Technology

We are fine with “Extended-IoT” or “e-IoT” as proposed by CMCC. Ex-IoT as suggested by Fujitsu could also be fine with us.

11 – MediaTek Inc.

“eIoT” knowing e is typically associated with “enhanced” in 3GPP which may not be suitable here.

We actually like the “x-IoT” of the original proposal.

We advise against using Ambient.

12 – Spreadtrum Communications

Align with SA naming (Ambient IoT) is preferred to avoid any potential confusion in future, especially for vertical customers. Just liking RAN side first named RedCap, and SA side take RedCap directly without adding any nickname from SA perspective.

13 – Sony Europe B.V.

We prefer to align with the naming used in SA1.

14 – NEC Corporation

We are open to the naming, and we slightly prefer Extended IoT (eIoT).

15 – Nokia Denmark

Extended IoT is kind of misleading, as capabilities are far from extended.

We agree with align the naming with SA1: Ambient IoT

16 – Shenzhen YZF Network Technolog

[OPPO] All the 3GPP working groups shall work as a whole and try to avoid any potential confusion due to using different name for the same technology. Align with SA1 study item terminology is necessary and strongly suggested. BTW, for clarification, the name in SA1 is "Ambient power-enabled IoT" and Ambient IoT is the acronym.

17 – Samsung Electronics Co.

We also think it is good to have naming alignment between RAN and SA.

18 – Telia Company AB

Align with SA1 study item terminology in the RAN SID.

19 – NOVAMINT

Alignment in term of naming across 3GPP would be nice even desirable however the terms proposed such as extended IoT or even SA1 Ambient IoT are somehow misleading (hence the extreme difficulty to reach consensus on a definition in SA1).

So we would prefer to use the term "x-IoT" as it is generic without misleading, it doesn't preclude device like passive tags and will allow marketing to find a proper naming once we have developed it.

20 – China Unicom

Prefer the name of Extended IoT (eIoT) than Ambient IoT (AmbIoT). There is no need to align the name in RAN and SA.

21 – Huawei Tech.(UK) Co.. Ltd

We are generally flexible on naming, and we agree that the name can be the same or different between SA1 and RAN.

22 – TURKCELL

We prefer to use a common name in all 3GPP groups. We agree with aligning the naming with SA1, Ambient IoT.

23 – Ericsson LM

We think that Extended IoT (eIoT) is misleading as we do not extend neither coverage nor performance of today's IoT solution, we rather restrict them further. Any of the following would be acceptable to us:

- APE-IoT (ambient power enabled IoT)
- ZE-IoT (zero energy IoT)

24 – ZTE Corporation

Ultra-Low Power Consumption and Complexity/cost IoT (Ultra-LPCC IoT): In the initial round discussion, some companies have mentioned that SI name could be clarified taking into account the agreed scope. We think this terminology clearly articulate the devices we aim at in this new study and their characteristics. So it would be the most suitable one for this RAN-level study.

”**Extended IoT**” is also acceptable to us if it’s the majority’s preference.

If these cannot be agreed, following the SA1 terminology i.e. “**Ambient power-enabled IoT**” seems to be the most agreeable option.

25 – VODAFONE Group Plc

No strong opinion, but perhaps (Very) Low Energy IoT could be a name? VLE-IoT

3.1 Summary of initial round on Q6

Q6: Do you have any remaining points that are missing from the revised SID or cannot be addressed during the study according to the moderator’s response? The latest revised SID is available at https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_97e/Inbox/Drafts/%5B97e-06-R18-RANLevel-xIoT%5D/Rev1%20of%20RP-222453.doc

Summary:

On the dependency with SA1, the moderator thinks earlier discussion has clarified the timeline, i.e. the SA1 completes in Nov 2022 and the first RAN discussion will be in Dec 2022. Further, the moderator expects that the first discussion in Dec 2022 will primarily set the stage for further discussion, e.g. aligning the definitions of detailed terminologies, receiving companies’ detailed views and preferences via submitted tdocs, discussion on how to structure the TR skeleton, etc.

Detailed response to companies’ feedback included below:

- Detailed response to AT&T: Based on the past discussion, e.g. in Budapest, companies generally do not think it proper to completely decouple the RAN level SI from the SA1 work. At the same time, companies generally have the common understanding that SA1 will not be able to discuss many of the RAN details. Please also see the revision in response to MTK’s comment below.
- Detailed response to comments from MTK: 1) Revision is made to associate the second/third bullets of objectives with the first bullet; 2) Latency is already explicitly listed in Rev1. Reliability is added as well now; 3) on the gap analysis, the moderator is unsure whether it is necessary to explicitly include it in the objective. It is agreed that this study will NOT look at the use cases which can be fulfilled by 3GPP existing LPWA technologies. Therefore there is no such gap analysis per say. During the study, the moderator expects if a use case is deemed to be supported by existing 3GPP LPWA technologies, then such use case will not be discussed during this study.
- Detailed response to Nordic Semiconductor ASA: Please see the moderator response to MTK suggestion above. Further, please note “The study shall provide clear differentiation, i.e. addressing use cases and scenarios that *cannot* otherwise be fulfilled based on existing 3GPP LPWA IoT technology e.g. NB-IoT including with reduced peak Tx power.” is already agreeable from the initial round of discussion.

- Detailed response to NOVAMINT: Please see the above response to MTK on gap analysis.
- Detailed response to Sony: 1) The moderator would suggest revising the sentence as “The new IoT technology shall provide complexity and power consumption orders of magnitude lower than the existing 3GPP LPWA technologies (e.g. NB-IoT and eMTC), and shall address use cases and scenarios that cannot otherwise be fulfilled based on existing 3GPP LPWA IoT technologies”. Please also note that there is such a sentence in the objective section “The study shall not aim to replace existing 3GPP LPWA technologies.”; 2) On the suggestion to remove “e.g. NB-IoT including with reduced peak Tx power”, the moderator thinks this is from initial round of discussion with all companies agreeing to it, therefore moderator feels it is proper to keep this phrase.
- Detailed response to QC: 1) The moderator suggested the sentence “The device peak power consumption in this study shall not exceed a few hundreds of μ W.” as an attempt to set some boundary. The moderator’s understanding is “maximum energy discharge rate from its internal power storage element”, but the moderator does not intend to open detailed technical discussion on the definition now. Thus, this sentence will be removed. Please note that power consumption is listed already in the objective section; 2) Device categorization is part of the study, as discussed in the initial round and also reflected in Rev1. The moderator will remove the sentence “Device characteristics other than energy storage are assumed to be investigated under the second objective below.” to avoid misunderstanding, and also move the sentence on device categorization as the first sentence of that objective; 3) on the definition for coverage, the moderator would add a new note “NOTE: Detailed definitions of the RAN design targets should be discussed during the study.”, as such discussion may be needed for other design targets as well. 4) Given the responses from companies in the initial round, the moderator would not suggest for down-selection at this stage.
- Detailed response to CMCC: Please see the above response to MTK.
- Detailed comments to Ericsson: The moderator removed this sentence. Please also see the response to QC above.
- Detailed comments to ZTE: The moderator shares the views expressed by ZTE that assumptions on CN is important. It is also clear that SA WG needs to get involved. The wording of the current note was carefully chosen based on the views expressed in the Budapest offline discussion, and mentions both with and without CN. The note does not have the effect of (de-)prioritizing either with or without CN – rather to de-prioritize attempting to decide the issue either way, in preference to the SA WGs . The moderator hopes this clears up the question, and thinks it should not be the blocking point to progress discussion on other aspects that this RAN SI needs to conduct.

Below is moderator’s own assessment (on a first order only) on companies’ positions

- Dependency on SA1: AT&T, Panasonic, T-Mobile, LGE,
- OK with the latest revision: CATT, Xiaomi, Futurewei, vivo, Spreadtrum, Nokia, Orange, NEC, Telia, CUC, CTC, TURKCELL, CMCC, VDF, Huawei/HiSilicon
- Detailed revision suggestions: MTK, Nordic, NOVAMINT, Sony, CMCC, Ericsson, ZTE

3.2 Summary of initial round on Q7

Q7: Do you have suggestion on the naming of the RAN level study item, e.g. Extended IoT (eIoT), Ambient IoT (AmbIoT), etc.? Flexibility from companies are encouraged to avoid excessive discussion on the naming.

Summary:

Based on the feedback from companies, moderator would like to suggest go with the naming aligned with SA1 item, i.e. Ambient Power Enabled IoT, for this RAN level item. Moderator would like to ask for flexibility if this is not your first choice on the naming. Note that naming for any potential future WG level item is for future discussion and decision.

Below is moderator's own assessment (on a first order only) on companies' positions

Ambient IoT: AT&T, Panasonic, T-Mobile, Spreadtrum, Sony, Nokia, OPPO, Samsung, Telia, TURKCELL, Ericsson, ZTE

Extended IoT: CATT, Fujitsu, CMCC, Xiaomi, vivo, NEC, CUC, ZTE

x-IoT: MTK (not OK with Ambient IoT), NOVAMINT

ZE-IoT: Ericsson

Ultra-Low Power Consumption and Complexity/cost IoT (Ultra-LPCC IoT): ZTE

(Very) Low Energy IoT: VDF

Flexible: Futurewei, Huawei/HiSilicon, VDF

4 Final round

The moderator hopes and believes all comments are adequately addressed based on the discussion in the first and intermediate round. The latest SID (Rev2) is available at https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_97e/Inbox/Drafts/%5B97e-06-R18-RANLevel-xIoT%5D/Rev2%20of%20RP-222453.doc.

The moderator would like to remind companies that earlier discussion from the initial and intermediate round has clarified SA1 completes in Nov 2022 and the first RAN discussion will be in Dec 2022. Further, the moderator expects that the first discussion in Dec 2022 will primarily set the stage for further discussion, e.g. aligning the definitions of detailed terminologies, receiving companies' detailed views and preferences via submitted tdocs, discussion on how to structure the TR skeleton, etc.

Q8: Are there any **major** concerns on approving the latest SID in RAN#97e? Please note all the discussion and responses in first and intermediate round. The latest SID (Rev2) is available at

Feedback Form 8: Comments to Q8

1 – AT&T GNS Belgium SPRL

To rephrase the question differently, what are the concerns, risks, and urgency if the SI is not started at RAN#98 for work that will not begin in the WGs until the Release-19 time frame? From a content perspective, it seems a majority of companies are ok with most of the text in the latest SID (Rev2). As a compromise and with SA potentially approving the SA1 TR in December, we propose that we can approve the SID in this meeting (RAN#97) and start the SI in RAN at RAN#99 (March 23). If necessary, we can further align the SID with SA conclusions and terminologies in RAN#98.

2 – Nokia Denmark

We are fine with the latest SID (Rev2).

3 – InterDigital

We are ok with the latest SID.

4 – Xiaomi Communications

We are fine with the latest SID.

5 – Futurewei Technologies

We are also fine with the latest SID

6 – Spreadtrum Communications

We are fine with the latest SID, and happily continue to be one of supporters.

7 – MediaTek Inc.

We can live with the latest proposal. Oddly enough, it is now called APE IoT ☐ :)

8 – MediaTek Inc.

We can live with the latest proposal. Oddly enough, it is now called APE IoT ☐ :)

9 – MediaTek Inc.

We can live with the latest proposal. Oddly enough, it is now called APE IoT ☐ :)

10 – Qualcomm Incorporated

We have concerns and suggest corresponding changes regarding the following two points:

Regarding the following text: *”Devices with limited energy storage capability that do not need to be replaced or recharged manually, and which can manage short periods of external energy source outage.”*, we do not agree with the implication that energy storage is only to manage periods of energy source outage. As a matter of fact, a more relevant use case for energy storage is to bridge the power level difference between the power required for communication and the power supplied by energy harvesting even when the external energy source is continuously available. This is achieved by accumulating energy for a longer period and storing it, and then discharging the stored energy in a shorter burst, thereby creating a step up in power level. For many energy harvesting options, the available energy flow is extremely low, so such accumulation is essential for powering the communication function even with modest power requirements.

Therefore we suggest the following change to be made:

”Devices with limited energy storage capability that do not need to be replaced or recharged manually, ~~and which can manage short periods of external energy source outage.~~”

Regarding the following text: *”Connectivity topologies, including which node(s) can be activator and/or reader, e.g. basestation, UE, relay, repeater, etc.”*, we see a problem that by using the terms ”activator” or ”reader”, the end device effectively becomes limited to be passive device only. However; the outcome of the intermediate round discussion has been that such limitation is not pursued. The terms ”activator” and ”reader” should be replaced with a reference to a device that can communicate with either passive or active devices.

Therefore, we suggest the following change to be made:

”Connectivity topologies, including which node(s) ~~can be activator and/or reader~~, e.g. basestation, UE, relay, repeater, etc. can communicate with target devices.”

11 – Deutsche Telekom AG

Yes, as indicated earlier, we do not see any need to approve the SID at this Plenary. Let’s use the discussion we had during this week to gain a better understand and develop a reasonable well scoped SID for the Dec. plenary.

In December - when we had the discussion on where Rel-18 stands - we might be happy support approving it, but not now.

12 – Shenzhen YZF Network Technolog

[OPPO] We are generally fine with the latest proposal. But we have some additional comments after further check:

1) ”The study shall provide clear differentiation, i.e. addressing use cases and scenarios that *cannot* otherwise be fulfilled based on existing 3GPP LPWA IoT technology e.g. NB-IoT including with reduced peak Tx power.” It is a little bit confusing here what ”including with reduced peak Tx power” is for? It is the NB-IoT including with reduced peak Tx power? Or the ambient IoT to address use case including with reduced peak Tx power? If it is NB-IoT, it is suggested to modify it as ”e.g. NB-IoT □including it with reduced peak Tx power□”. If it is the latter, it is suggested to modify it as ”e.g. NB-IoT including with reduced peak Tx/Rx power etc.”

2) agree with the comments from Qualcomm

3) For the bullet”Basestation characteristics, e.g. macro/micro/pico cells-based deployments” suggest to remove macro since it is infeasible to have a macro cell deployment for the target ambient devices.

13 – Shenzhen YZF Network Technolog

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14 – Deutsche Telekom AG

Contentwise – focussing only on the objectives part:

- "Ambient Power Enabled IoT" is not a title for the work we are ok with ... this is too techy !
- What does "suitable for cellular deployment" mean ? There is no cellular deployment required for the technologies under discussion. It should be reworded to "suitable for 3GPP architecture based deployment"
- It should be clarified that we address use cases which are LOWER than NB-IoT, not higher ... The text is not clear about this
- "completely dependent on the availability of an external source of energy" is misleading, as this can also include permanent connection to a DC power supply -> this is not what we are aiming for !
- "do not need to be replaced or recharged manually" – what does this mean ? Automatic (robot based) replacement or re-chargement is acceptable ? This needs to be reworded.
- "The device's peak power consumption shall be limited by its practical form factor for the intended use cases" -> clear, hence we FIRST need Use Cases and Deployment scenario and not immediately start discussion SOLUTIONS !
- "Basestation characteristics" is misleading ... we need to define the deployment scenarios taking different Basestation types into account
- How can a repeater be an activator and/or reader ? A repeater per definition is transparent and does not provide higher layer processing.
- What are "frequency bands for existing 3GPP technologies" ? -> all bands we defined in 3GPP !?
- Do we really need all the notes throughout the objectives ? -> if these notes are needed, the text for the objectives is not good □ —

15 – Panasonic Corporation

We support the update from Qualcomm. We are ok with the other part. Thanks for your effort.

16 – Transsion Holdings

We are fine with the latest SID.

17 – Samsung Electronics Co.

One comment about the planned completion date of SA1 study. In SA1 chair’s status report (SP-220931), the completion date of FS_AmbientIoT is indicated as Dec-2022 in page 13 and 03/2023 in page 18. We suspect if SA1 expects that their study would be completed on Mar-2023 while the original plan is Dec-2022. Clarification seems needed in relation to the discussion about proper time to start RAN study.

18 – Orange

we are fine with the latest SID and support the approval at this plenary

19 – NOVAMINT

We are fine with the latest revision of the SID (though we still do not like the naming). We are OK as well with Qualcomm’s suggestions.

20 – Kyocera Corporation

We are fine with the latest version of SID and Qualcomm’s suggestions.

21 – NEC Corporation

We are fine with the latest SID.

22 – Wiliot Ltd.

We are fine with latest SID, and supportive of Qualcomm’s suggestions.

23 – Wiliot Ltd.

We are fine with latest SID, and supportive of Qualcomm’s suggestions.

24 – ZTE Corporation

1) Thank you Moderator for further addressing our comments. But sorry the wording of the related NOTE is still confusing to us. It sounds like we are trying to ignore the deployment aspects. From our understanding, the intention of the NOTE is to let companies to do the study based on different assumptions on deployment aspects but RAN will not do detailed discussion/comparison in these aspects. If such understanding is correct, we still suggest to reword the NOTE as follows:

*NOTE: **While the study can be based on different assumptions on deployment aspects, The study shall not prioritize the discussion on deployment aspects that should be coordinated with SA, e.g. public or private network, with or without CN connection.***

2) We also agree with the suggestions from Qualcomm.

25 – TURKCELL

We support the latest SID with Qualcomm’s wording.

<p>26 – Telia Company AB</p> <p>We are fine with the latest SID but maybe better to handle the approval in RAN#98 when final information on SA1 is available, but not s showstopper for us if there is enough resources to start the study after RAN#97.</p>
<p>27 – China Mobile Com. Corporation</p> <p>We are ok with the SID and support the approval at this meeting.</p> <p>If we use the name ambient IoT, don't you think the pronunciation for Amb-IoT sounds like NB-IoT? And it looks also a bit strange to use Ape-IoT which is short for Ambient Power Enabled IoT.</p>
<p>28 – China Mobile Com. Corporation</p> <p>We are ok with the SID and support the approval at this meeting.</p> <p>If we use the name ambient IoT, don't you think the pronunciation for Amb-IoT sounds like NB-IoT? And it looks also a bit strange to use Ape-IoT which is short for Ambient Power Enabled IoT.</p>
<p>29 – Sony Europe B.V.</p> <p>We think there has been quite some progress on the SI scope discussion, but more time seems to be needed and therefore we would support the view to aim for approval of the SID in RAN#98. We also support Qualcomm's comments/suggestions. Finally, it might be that we are the only ones that suggest it ... still we dont see the value to have the text in the scope that talks about "e.g. NB-IoT including with reduced peak Tx power".</p>
<p>30 – NTT DOCOMO INC.</p> <p>We support Qualcomm's suggestions. We are fine with other parts of the latest SID.</p>

Q9: Please indicate if companies would like to be listed as supporting companies, if not already on the list.

Feedback Form 9: Comments to Q9

<p>1 – InterDigital</p> <p>Please list InterDigital as a supporting company</p>
<p>2 – Xiaomi Communications</p> <p>Please add Xiaomi in the supporting IMs of the SID.</p>
<p>3 – Futurewei Technologies</p> <p>Please add Futurewei as a supporting company</p>
<p>4 – Futurewei Technologies</p> <p>Please add Futurewei as a supporting company</p>

<p>5 – Fujitsu Limited</p> <p>Please add Fujitsu as a supporting company</p>
<p>6 – Shenzhen YZF Network Technolog</p> <p>OPPO supports the SID.</p>
<p>7 – Panasonic Corporation</p> <p>Panasonic would like to be a supporting company.</p>
<p>8 – Transsion Holdings</p> <p>Please add Transsion Holdings as a supporting company.</p>
<p>9 – Ericsson LM</p> <p>Please add Ericsson. Thanks!</p>
<p>10 – Kyocera Corporation</p> <p>Please add Kyocera Corporation as a supporting company.</p>
<p>11 – NEC Corporation</p> <p>Please add NEC as a supporting company</p>
<p>12 – MediaTek Inc.</p> <p>Please add MediaTek Inc. - Thanks!</p>
<p>13 – TURKCELL</p> <p>Please add Turkcell as a supporting company.</p>
<p>14 – Telia Company AB</p> <p>Please add Telia Company as a supporting company for the APE SID.</p>
<p>15 – Telia Company AB</p> <p>Please add Telia Company as a supporting company for the APE SID.</p>
<p>16 – Wiliot Ltd.</p> <p>Please add Wiliot as a supporting company. Thank you.</p>
<p>17 – NTT DOCOMO INC.</p> <p>Please add NTT DOCOMO as a supporting company.</p>

Summary

AT&T suggested approving the SID in RAN#97e but start the discussion from RAN#99.

DT/Sony suggested not approving the SID in RAN#97.

Many other companies expressed views to support the SID.

Detailed response to companies' comment below:

- Detailed response to QC: The moderator sees several support for QC's two proposed revision. The moderator also thinks these two revisions are sensible, thus included them in the final version.
- Detailed response to OPPO: 1) this sentence was from the initial round discussion and all companies agreed to it. The moderator prefers not to change it now. Just for your reference, the moderator's understanding on the sentence is this refers to NB-IoT with reduced peak Tx power. 2) See above response to QC's comments; 3) This can be left to study thus the moderator will not make revision for now.
- Detailed response to DT: The moderator would certainly appreciate such comments would have been raised in the initial and intermediate round. Nevertheless, please see below.
 - “Ambient Power Enabled IoT” is not a title for the work we are ok with ... this is too techy !
Response: This is the name favored by most companies. Therefore moderator would like to ask for flexibility.
 - What does “suitable for cellular deployment” mean ? There is no cellular deployment required for the technologies under discussion. It should be reworded to “suitable for 3GPP architecture based deployment”
Response: The suggested wording “3GPP architecture” may have the implication on CN aspects, which is to be de-prioritized in this RAN level SI. The moderator will remove “suitable for cellular deployment”, which does not have any impact on the real work to be conducted in this SI.
 - It should be clarified that we address use cases which are LOWER than NB-IoT, not higher ... The text is not clear about this
Response: This SI certainly shall not address use cases above NB-IoT capability. The moderator believes there is no confusion from the discussion so far.
 - “completely dependent on the availability of an external source of energy” is misleading, as this can also include permanent connection to a DC power supply -> this is not what we are aiming for !
Response: The moderator believes the sentence should be read with good intention. There is perhaps no need of any standardization work if a device is permanently connected to a DC power supply, thus naturally falls out of the scope of this SI.
 - “do not need to be replaced or recharged manually” – what does this mean ? Automatic (robot based) replacement or re-chargement is acceptable ? This needs to be reworded.
Response: The moderator believes the sentence should be read with good intention.
 - “The device's peak power consumption shall be limited by its practical form factor for the intended use cases” -> clear, hence we FIRST need Use Cases and Deployment scenario and not immediately start discussion SOLUTIONS !
Response: The moderator looks forward to companies' contributions on the use cases and deployment scenarios, as included in the objectives.

- “Basestation characteristics” is misleading ... we need to define the deployment scenarios taking different Basestation types into account

Response: Yes, that can be discussed during the study.

- How can a repeater be an activator and/or reader ? A repeater per definition is transparent and does not provide higher layer processing.

Response: The wording of “activator/reader” is now removed. Please see response to QC comment above.

- What are “frequency bands for existing 3GPP technologies” ? -> all bands we defined in 3GPP !?

Response: It will be based on companies’ input during the study. The moderator thinks sub-GHz spectrum is perhaps more relevant, but this will be up to the discussion during the study.

- Do we really need all the notes throughout the objectives ? -> if these notes are needed, the text for the objectives is not good □ —

Response: The moderator took NOTE of this comment.

- Detailed response to Samsung: The moderator’s understanding is that the official completion date of the SA1 item is still Dec 2022.
- Detailed response to ZTE: The moderator thinks this has been clarified in the intermediate round and thus will not make further revision. The moderator reminds that 3GPP discussion is contribution driven.

Conclusions:

The latest version of the SID is now in RP-222643. The moderator believes all comments are addressed. Given the majority support, the moderator proposes to approve the SI in RAN#97e and start the work in RAN#98e, as outcome of the final round discussion.

The moderator would like to thank all participants for your valuable comments.

5 Extended round

The purpose of this extended round is to address the comments raised after the final round is closed. The moderator identifies the following points for discussion and welcomes constructive comments.

There is a discussion on the phrase “suitable for cellular deployment” in the first paragraph of the objective section. Ericsson does not agree to remove this phrase. DT does not agree to keep it in its current wording and suggested “suitable for 3GPP architecture based deployment”.

Moderator proposal: Replace “suitable for cellular deployment” by “suitable for 3GPP architecture-based deployment”

Q10: Please indicate if you have an objection to this change.

Feedback Form 10: Comments to Q10

1 – Deutsche Telekom AG

Just to clarify: Our input was meant to reflect that x-IoT can also be deployed in a radio network which is not deployed in a cellular fashion.

I assume we also have different interpretation of the phrase “suitable for cellular deployment” ?! What I wanted to make clear is that x-IoT also works in ANY deployment type (incl. Industry/NPN but also a single residential cell being deployed) -> from an operator perspective this is not ”cellular deployment”

I am open to other wordings which do not restrict the deployment type, obviously.

2 – MediaTek Inc.

We would suggest ”suitable for deployment in a 3GPP system”

3 – VODAFONE Group Plc

How about ”synergetic with cellular and NPN deployments” ?

4 – Ericsson LM

To clarify, our point is that this new solution must be possible to integrate in cellular networks comprising a RAN and a CN. There is no point in 3GPP working on over-the-top short-range solutions which are completely separate from existing networks. Such solutions are more naturally covered by e.g. Bluetooth or RFID standardization groups.

The statement “suitable for 3GPP architecture-based deployment” seems to bring more confusion than clarity. A compromise could be ”suitable for deployment in a 3GPP system” as proposed by MediaTek.

5 – ZTE Corporation

It seems the previous wording “suitable for cellular deployment” may have some unnecessary implication/preference on pure RAN architecture (e.g., without/deprioritizing CN aspects).

Also thanks to DT for mentioning more possible deployment options as clarification.

Then we are fine to remove “*suitable for cellular deployment*” or change to “*suitable for 3GPP architecture-based deployment*” or “*suitable for deployment in a 3GPP system*”.

Ericsson suggested to add a note “*The study shall assume there is CN connectivity. Deviation from such assumption can only be considered if there are strong motivations (e.g. not able to meet the design targets). Coordination with SA on CN connectivity is necessary.*”. The moderator would like to point out that this note was not included in the submitted SID to RAN#97e.

Q11: Is there any objection to include a new note into the SID “*The study shall assume there is CN connectivity. Deviation from such assumption can only be considered if there are strong motivations (e.g. not*

able to meet the design targets).”

Feedback Form 11: Comments to Q11

<p>1 – KT Corp.</p> <p>KT is still unclear why CN connectivity is necessary. Would like to hear some example or possible use case which needs CN connectivity.</p>
<p>2 – CMDI</p> <p>From CMCC point of view, it is quite premature to assume there is CN connectivity during this RAN level study, let's stick to not mentioning CN connectivity.</p>
<p>3 – AT&T GNS Belgium SPRL</p> <p>Fine to coordinate with SA, but prefer to discuss these aspects during the SI.</p>
<p>4 – Shenzhen YZF Network Technolog</p> <p>[OPPO]We think this clarification is not necessary, considering the study will focus on RAN issues</p>
<p>5 – Futurewei Technologies</p> <p>We think the note in the latest version of SID is good (“NOTE: The study shall not prioritize deployment aspects that should be coordinated with SA, e.g. public or private network, with or without CN connection.”). This is a RAN study. If critical issues are identified for the case with or without CN connection that have impact on RAN work, the companies can bring in contributions for study.</p>
<p>6 – Panasonic Corporation</p> <p>We also think this can be discussed in the study. No need to mention it for now.</p>
<p>7 – Spreadtrum Communications</p> <p>We share the similar view with CMCC.</p>
<p>8 – vivo Communication Technology</p> <p>We agree with most of the comments above that CN connectivity can be discussed during the SI, no need to mention in the SID now.</p>
<p>9 – Nokia Denmark</p> <p>We also think this can be discussed in the study, however we are ok with the assumption.</p>
<p>10 – Xiaomi Communications</p> <p>We agree with most companies that the NOTE is not essential for a RAN-level study.</p>
<p>11 – Xiaomi Communications</p> <p>We agree with most companies that the NOTE is not essential for a RAN-level study.</p>

12 – Deutsche Telekom AG

This entire discussion is also a confirmation that it is premature starting the RAN SID at this point in time. We should wait (as suggested already multiple times by us) until the SA1 concluded and THEN initiate the RAN SI.

13 – Deutsche Telekom AG

This entire discussion is also a confirmation that it is premature starting the RAN SID at this point in time. We should wait (as suggested already multiple times by us) until the SA1 concluded and THEN initiate the RAN SI.

14 – MediaTek Inc.

We object adding such a note - such assumption is clearly *not* a fundamental assumption. CN connectivity is not only vague, it is also highly misleading esp. when understood in relation to today's CN connectivity. We have questioned repeatedly the need for such connectivity for passive devices - that themselves *only* need a connection to a Reader device (whether in a UE or base station).

15 – VODAFONE Group Plc

Provided that we can support data flow from 'device to network' and data flow from 'network to device', the issue of CN connectivity need not be part of the RAN SID.

@KT, having functionality above the RRC layer (e.g. functions that are typically performed with core networks) would be useful to e.g. validate the identity that the device is presenting to the network. The cost vs benefit of this functionality is something for operators to evaluate.

16 – VODAFONE Group Plc

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@KT, having functionality above the RRC layer (e.g. functions that are typically performed with core networks) would be useful to e.g. validate the identity that the device is presenting to the network. The cost vs benefit of this functionality is something for operators to evaluate.

17 – NEC Corporation

We also think it is premature to assume there is a CN connection, we can discuss this issue in the study

18 – Huawei Tech.(UK) Co.. Ltd

We agree to the principle of the new note, but also OK with the current note in the SID, i.e. "NOTE: The study shall not prioritize deployment aspects that should be coordinated with SA, e.g. public or private network, with or without CN connection."

19 – ZTE Corporation

We support Ericsson’s proposal to add the following NOTE since we think connection to CN is an important assumption that should be considered in the study. Also, some coordination with SA on this aspect is expected:

NOTE: The study shall assume there is CN connectivity. Deviation from such assumption can only be considered if there are strong motivations (e.g. not able to meet the design targets). Coordination with SA on CN connectivity is necessary

(BTW: Instead of ”strong motivations”, we are also open to a less stronger wording like ”reasonable justifications”).

With the added NOTE, we think the following note should be removed:

~~NOTE: The study shall not prioritize deployment aspects that should be coordinated with SA, e.g. public or private network, with or without CN connection.~~

20 – Ericsson LM

We support inclusion of the note in the SID, which was actually already included in the SID submitted to RAN#96e, but then removed in the submission to RAN#97e, seemingly without motivation or communication.

Without connection to CN there would be, e.g., no authentication, no charging, no encryption, not even CN paging. Is the intention of the opponents of a CN connection that the X/APE-IoT solution should be free of charge, without security, with very limited mobility support, without a deep power-saving state for the device, etc.? While we agree that CN connectivity will perhaps not affects RAN1 and RAN4 aspects much, but the implications for RAN2/RAN3 aspects will be huge.

21 – MediaTek Inc.

@Ericsson: CN connectivity is strongly solution-driven. We cannot agree to its inclusion.

DT objects to the naming APE-IoT. Companies may have their first preferred name(s) and may have strong concerns on others. At this stage, the moderator feels it is safer to give a “less descriptive” name, e.g. New IoT Radio, as this is about a new IoT technology for 3GPP and RAN is responsible for the radio aspects.

Q12: Any major objections to naming “New IoT Radio”?

Feedback Form 12: Comments to Q12

1 – KT Corp.

SI on APE-IoT at least gives indication that it is aligned with on-going SA1 SI. Any similar name (not the same) which can indicate this is RAN level SI of SA1’s SI is acceptable to us.

2 – Samsung Electronics Co.

Less descriptive name may be good given the current situation. However, ”New IoT Radio” may imply that 3GPP is moving forward to start a huge work for design of completely new radio for IoT purposes. Perhaps, the SID title could simply be ”New SID: Study on A-IoT”. One can consider that ”A” implies ”Ambient” or ”Ambient Power Enabled” if desired even though it is not mentioned in the official SID.

3 – AT&T GNS Belgium SPRL

We agree with Samsung that "New IoT Radio" suggests that we might be developing a New Radio for IoT. We prefer to align with the ongoing SA1 terminology for A-IoT aka Ambient IoT, even our original "Passive IoT" would be better.

4 – Shenzhen YZF Network Technolog

[OPPO]We had long discussion on the naming in earlier rounds and APE is almost accepted by all companies. The New IoT Radio seems make the study have broader scope. How can we conclude the Radio will be New radio of IoT. Will it be different to NR? Thus, we should make the topic clearer, the Ambient Power Enabled IoT is still best choice.

5 – Futurewei Technologies

We are very open to the name of the study and urge the group be flexible and do not waste time further on this. What Samsung proposed ("A-IoT" or maybe "AP-IoT" to avoid the word "APE") is fine with us.

6 – Panasonic Corporation

Instead of the abbreviation of "APE", always to call "ambient power enabled IoT" or "A-IoT" by Samsung would be preferable. We agree the reason described by Samsung for not tot take New IoT Radio.

7 – Panasonic Corporation

Instead of the abbreviation of "APE", always to call "ambient power enabled IoT" or "A-IoT" by Samsung would be preferable. We agree the reason described by Samsung for not tot take New IoT Radio. AP-IoT by Futurewei is also ok with us.

8 – Spreadtrum Communications

We are fine with Samsung proposal or original APE.

9 – vivo Communication Technology

How about "new IoT" for now and can be replaced by better name in the future?

10 – vivo Communication Technology

How about "new IoT" for now and can be replaced by better name in the future?

11 – Nokia Denmark

That's a bit misleading - it implies replacing eMTC, NB-IoT?
Why not simply keep the SA1 name Ambient IoT or Reactive IoT as an alternative?

12 – Deutsche Telekom AG

As indicated earlier, APE-IoT does not work for us.
We also do not agree on "New IoT Radio" as this, as Nokia correctly says, is misleading and implies replacing eMTC, NB-IoT - which is an absolute no-go for us.

We are OK with keeping x-IoT or suggest "LC-IoT" (LC = low cost, low complexity, love(our)customer, LowPass (like LC circuit)...)

13 – MediaTek Inc.

- the RIoT proposed by Nokia is interesting :D
- A-IoT is not suitable, given it inevitably misleads to "AI" when pronounced. AIoT is already used in the industry with that very meaning.
- Low-Cost IoT is also not suitable - for until it is proven low cost, it's unlikely low cost. It also jeopardizes 3GPP LPWA
- **We suggest to stick to x-IoT for this RAN plenary study, for in fact we still don't know what it is and what it will end up being.**

14 – VODAFONE Group Plc

I think that New IoT Radio would be bad as it implies a redesign of NB-IoT/Cat M.

I'm OK with Ambient IoT to align with SA1's SID and abbreviated to A-IoT.

Or does IoT Enabled by Ambient Power work? ->IoTEAP.

But, let's not spend too much time on this... e.g. x-IoT is fine for now

15 – VODAFONE Group Plc

Thinking a bit more (especially triggered by some companies' concerns on CN connectivity), there is no way that we should have IPv4 or IPv6 stacks on the device, so we should really drop the "Io"...

So we could have Things Enabled by Ambient Power (TEAP) or Devices Enabled by Ambient Power (DEAP)

or

Things Enabled by Ambient Energy (TEAE -> sounding a bit like Tee)

16 – ZTE Corporation

We share the similar concern as Samsung on "New IoT Radio" and fine with "Ambient power enabled IoT".

And we are okay with using abbreviation "A-IoT" for Ambient power enabled IoT.

17 – Ericsson LM

‘New IoT Radio’ is not very descriptive, and it may be interpreted as 3GPP’s new (NB-)IoT solution, which we should avoid. APE-IoT is simply the abbreviation of the agreed name in SA1, with which we and others haven’t had a problem. If needed, we could go for AP-IoT if the abbreviation ‘APE’ is to be avoided. Other names could be ZE-IoT (zero energy IoT) or LE-IoT (low energy IoT).

Q13: Are there any other names you absolutely cannot live with in the study item?

Feedback Form 13: Comments to Q13

1 – MediaTek Inc.

A-IoT should be avoided

2 – MediaTek Inc.

shall

DT, T-Mobile, and TIM prefer to delay the approval to RAN#98e. The moderator thinks this timeline issue has been discussed in multiple rounds, and further discussion is likely to be just a repetition. In order to avoid simply repeating comments from earlier rounds, the moderator would like to propose the following middle ground.

Proposal:

- Approving the SI in RAN#97e and start the work in RAN#98e. The discussion in RAN#98e shall be limited to
 - TR skeleton and work plan
 - Initial discussion on “suitable deployment scenarios and their characteristics” (note this can be based on a subset of the agreed use cases in SA1).
 - Initial discussion on device categorization

Q14: Can you live with the above proposal?

Feedback Form 14: Comments to Q14

1 – KT Corp.

KT shares the same view with DT, T-Mobile, and TIM for delaying the approval to RAN#98e in order to make sure that RAN level requirements to support SA1 use cases are clear and well aligned. At least this can avoid two different groups working on similar things in different way. I’m still unsure whether delaying the start of work at RAN#98e can be good enough.

2 – CMDI

We support Modertor’s proposed wayforward. We don’t see any real value of delaying the work, especially

when the group has unanimously taken it as a plan.

3 – CMDI

We support Modertor's proposed wayforward. We don't see any real value of delaying the work, especially when the group has unanimously taken it as a plan.

4 – China Unicom

We support Modertor's proposed wayforward and there is no need to delay the RAN-level study.

5 – AT&T GNS Belgium SPRL

As we stated in the previous rounds, there is no urgency to start this SI at RAN#98-e. As a compromise, we would be ok to approve the SI at this meeting, and have a delayed SI start. At RAN98-e, we can perhaps revisit some terminology/use cases and update the SID if necessary after SA1 wraps up their work. The SI would begin at RAN#99.

6 – Shenzhen YZF Network Technolog

[OPPO]We had made good progress on the SA1 Ambient Powered enabled IoT. The current SID status is keeping the Target completion of date at Dec. 2022. No further update of finalization time. Thus, plan here to have limited start in RAN#98 is consistent with SA1 status.

7 – Futurewei Technologies

We agree with the moderator's proposal as a good middle ground. As stated by OPPO above and by others several times before, SA1 SI will complete by December plenary. Therefore, it is the right timing to start RAN level study.

8 – Panasonic Corporation

Although it is "business as usual", to have the bullet point of "to update SID if necessary" could alleviate the concern? We are ok with the proposal regardless of such change or not.

9 – Intel Corporation (UK) Ltd

The proposal is fine to us

10 – Spreadtrum Communications

We support Modertor's proposed wayforward.

11 – vivo Communication Technology

We are fine with moderator's proposal.

12 – CHTTL

Sorry that we missed the final round deadline, but please add us to the supporting company of the SID, thanks for the consideration.

13 – Xiaomi Communications

We are fine with the above proposal.

14 – Deutsche Telekom AG

No, we can not.

Even stronger: approving this Rel-18 (!) SI for a SA1 Rel-19 SI is not normal procedure in 3GPP. Normally the work in downstream groups shall follow the release of the SA work or in a later release. We also restate that there is absolutely no urgency to rush with the approval, as the potential WI will anyway only be part of Rel-19 the earliest ! The normal procedure would be a short SI in RAN or preferably in RAN1/(2)/(3) for Rel-19 (!) followed by potential Rel-19 WI depending on the outcome and the normal release content prioritisation. DT does not support bypassing the established 3GPP processes.

15 – NEC Corporation

We are fine with moderator's proposal.

16 – VODAFONE Group Plc

We can accept the moderator's compromise (we would prefer a faster start in RAN #98)

17 – VODAFONE Group Plc

We can accept the moderator's compromise (we would prefer a faster start in RAN #98)

18 – MediaTek Inc.

There is no real urgency approving a SID in this meeting, esp. if an update is expected in December (Re: potential SA1 outcome if relevant). Having said that we don't oppose approving a SID in this RAN#97.

It would be possible to:

- Target approval at RAN#98
- While also inviting inputs *for RAN#98* on
 - o Workplan
 - o TR Skeleton
 - o Deployment scenarios
 - o Device categorization

19 – Huawei Tech.(UK) Co.. Ltd

We can compromise to this. Our assessment here is whether the SI will be more valuable to 3GPP if starting later, with all the risks that entails. Since SA1 has agreed clear use cases which RAN can start to address now, and there are matters in the SID that SA1 will not discuss at all, our assessment is the SI is of high value to start now.

20 – TELECOM ITALIA S.p.A.

We think there is no urgency to approve the work, and looking to the ongoing discussion several aspects seems to still be unclear.

I repeat the comments done in the RAN reflector

- There is no hurry to approve now the study, and we should wait the conclusion of the SA1 study (planned for TSGs#98, in three months). In the meantime companies should contribute to SA1 to ensure they capture their preferred requirements
- The scope looks not really clear, and we believe it would be better to clarify the scope and approve a study with clear objectives at RAN#98 – it is better to have a clear scope rather than spending all the time debating on clarifications...

21 – Orange

We are fine with the compromise proposal

22 – Ericsson LM

We would like to note that Dec. 2022 is the target completion date of the SA1 Study Item. A SI doesn't produce normative output. The work in SA1 will continue in a Work Item until likely June 2023. Any normative requirement will only be available and stable at that point in time.

Hence, RAN would have to revisit its assumptions not only after the SA1 SI completion but also after the SA1's WI completion.

5.1 Summary on Q10

Moderator proposal: Replace “suitable for cellular deployment” by “suitable for 3GPP architecture-based deployment”

Q10: Please indicate if you have an objection to this change.

Summary: Five companies (DT, MTK, VDF, E, ZTE) provided response. Based on the feedback, the moderator feels “suitable for deployment in a 3GPP system” is perhaps the middle ground. The moderator will include this change in the next update of SID.

5.2 Summary on Q11

Q11: Is there any objection to include a new note into the SID “The study shall assume there is CN connectivity. Deviation from such assumption can only be considered if there are strong motivations (e.g. not able to meet the design targets).”

Summary:

There is a vast majority of companies not preferring to include this sentence in the SID. The moderator therefore will not include it in the next update of the SID. SA/RAN in a future time certainly shall discuss and made a decision on this topic.

- Not to include the sentence in SID: KT, CMCC, AT&T, OPPO, Futurewei, Panasonic, Spreadtrum, vivo, Nokia, Xiaomi, MTK, VDF, NEC, Huawei
- OK with the principle: Nokia, Huawei
- Yes to include the sentence in SID: ZTE (with revision), Ericsson

5.3 Summary on Q12/13

Q12: Any major objections to naming “New IoT Radio”?

Q13: Are there any other names you absolutely cannot live with in the study item?

Summary:

Various preferences are indicated again on the naming. New IoT Radio is a no-go. Based on the following summary table, the moderate would suggest “Ambient IoT” as this is the closest to the SA1 naming and nobody indicated objection to it.

Table 1:

	OK	Not OK
APE-IoT	KT, OPPO, Spreadtrum, Nokia, ZTE, Ericsson	DT
A-IoT	Samsung, ATT, Futurewei, Panasonic, Spreadtrum, VDF, ZTE	MTK
new IoT	vivo	
Ambient IoT	Nokia, VDF	
Reactive IoT	Nokia	
x-IoT	DT, MTK, VDF	
LC-IoT	DT	
TEAP, DEAP, TEAE	VDF	
AP-IoT, ZE-IoT, LE-IoT	Ericsson	

5.4 Summary on Q14

Proposal:

Approving the SI in RAN#97e and start the work in RAN#98e. The discussion in RAN#98e shall be limited to

- **TR skeleton and work plan**
- **Initial discussion on “suitable deployment scenarios and their characteristics” (note this can be based on a subset of the agreed use cases in SA1).**
- **Initial discussion on device categorization**

Q14: Can you live with the above proposal?

The moderator tried to propose a middle ground, i.e. to approve the SI in RAN#97e and start limited discussion in RAN#98e. There is a clear majority of companies accepting the compromised proposal from moderator, but still some companies expressing concerns. **The moderator suggests to discuss this proposal in Friday GTW.**

OK to the proposal: CMCC, CUC, OPPO, Futurewei, Panasonic, Intel, Spreadtrum, vivo, xiaomi, NEC, VDF, Huawei, Orange,

Not OK to the proposal: DT

Approval in RAN#98e: KT, TIM

Approving the SI in RAN#97e and start the work in RAN#99: ATT

Don't oppose approval in RAN#97e: MTK

No direct answer to Q14: Ericsson

5.5 Final remarks

The latest SID is in RP-222664, with 30+ supporting companies.

The moderator again thanks all participants for your valuable comments.

6 References

RP-221934 Passive IoT study on use cases and requirements Nokia Denmark

RP-222062 Views on Passive IOT categorization Qualcomm Incorporated

RP-222069 Discussion on ambient power-enabled IoT OPPO

RP-222126 Motivation for RAN-level SI for Extended-IoT in R18 CMCC

RP-222127 New SID: Study on Extended Internet of Things (e-IoT) CMCC

RP-222140 Discussion on RAN level study of Passive IoT vivo

RP-222273 Discussions on x-IoT Intel Corporation

RP-222335 Passive IoT - NOT another 3GPP LPWA MediaTek Inc., Deutsche Telekom

RP-222440 Discussion on Ambient Power-enabled IoT ZTE, Sanechips

RP-222453 New SID: Study on x-IoT Huawei, HiSilicon, Vodafone, China Mobile, China Unicom, Novamint, vivo, Orange

RP-222454 Motivation for a study on x-IoT Huawei, HiSilicon

RP-222457 Considerations on Rel-18 RAN SI on x-IoT Huawei, HiSilicon