**3GPP TSG RAN Meeting #109 RP-25xxxx**

**Beijing, P.R. China, September 15-18, 2025**

**Agenda Item: 9.2.3**

**Source: Moderator (RAN1 Vice-Chair)**

**Title: Moderator summary on R20 Ambient IoT**

**Document for: Discussion and decision**

# Introduction

At RAN#109, contributions were submitted to address the decision point for the Rel-20 study item on Ambient IoT [1] pertaining to the potential addition of a study objective on positioning:

* RAN#109 to decide whether to include an objective on positioning / proximity determination in the scope for Rel-20 study item

One contribution additionally provided a discussion on the coverage target for the Rel-20 study.

Contributions were also submitted for scope clarification of the Rel-20 work item on Ambient IoT [2], regarding the architecture solution for Topology 2, and asking for clarification on the support for handover.

This document provides a summary of the proposals in these contributions, and a discussion on how to address these proposals.

# Summary of contributions for the SID

Release 19 Ambient IoT supports Device localization based on Reader ID, which will remain applicable with inventory and command for active device(s) in Rel-20 based on protocols specified in Rel-19. At RAN#109, some companies are proposing to study more accurate localization methods or proximity determination solution 2 in Rel-20.

The discussion on positioning at RAN#108 resulted in a checkpoint for RAN#109. A proposed study objective discussed during RAN#108 was the following:

* Study the support of A-IoT positioning in indoor and outdoor scenarios for active device(s), focusing on UL, i.e. in D2R, and network based positioning, and considering the findings from the Rel-19 study of proximity determination solution 2 [RAN1~~-led, RAN3, RAN2~~]
* D1T1 for indoor and D4T1 for outdoor
* Representative use cases rUC3 (indoor positioning) and rUC7 (outdoor positioning).
* Evaluate the achievable positioning accuracy [RAN1]
* ~~Support of A-IoT positioning procedure [RAN3, RAN2]~~
* ~~Coordination with relevant SA WGs is expected.~~
* Note: positioning solutions studied under this objective are expected to be equally applicable for outdoor and indoor scenarios for Device 2b/Device C
* RAN#109 to decide whether to include this objective in the scope for Rel-20, and attempt to further narrow-down the targeted candidate network-based positioning technique(s).
* RAN#111 (March 2026) will make a decision on whether to include positioning in Rel-20 normative work.

For companies who provided a contribution to RAN#109, the views on studying positioning for Ambient IoT in Rel-20 are the following:

* Support studying techniques for more accurate Device localization than Reader-ID:
  + Huawei, HiSilicon (D2R-based fingerprinting e.g., RSRP fingerprint)
  + CATT (single-reader D2R-based and network-based)
  + IIT Kanpur (solutions with higher accuracy than studied for Rel-19 proximity determination)
  + CMCC (positioning/proximity determination based on measurement at the Reader side)
* Consider proximity determination:
  + Spreadtrum, UNISOC (based on proximity determination enhancement)
  + Qualcomm (Simple single-point ranging like technique based on e.g., RSRP (inc. reader side or device side measurement), RTT measurements, etc)
  + Apple (if considered feasible for outdoor scenarios, consider specifying proximity determination solution 2 rather than studying positioning methods)
* Could accept a study with limited scope without additional TU:
  + OPPO (E-CID based positioning as a starting point, no or minimal additional device impact)
  + Ericsson (cell-ID-like solutions and/or proximity determination solution 2, no additional TU, no impact to system architecture, measurements based on existing signals)
* Do not support adding a study objective on positioning in Rel-20:
  + ZTE Corporation, Sanechips (concerns on workload and TU availability)
  + NTT Docomo (concerns on workload and TU availability)
  + Xiaomi (unless TU is made available, if so study both proximity determination and positioning)
  + MediaTek (online): need additional TU in RAN1. Can it be discussed in June 2026?

Some companies also proposed detailed objectives, as shown below:

|  |  |
| --- | --- |
| **Source** | **Proposed objective** |
| Huawei | * Identify the candidate technique: fingerprint-based (e.g., RSRP fingerprint) solution is feasible for A-IoT outdoor positioning. * Define the evaluation assumption.Most simulation parameters can leverage existing positioning assumptions from 3GPP TR 38.855, TR 38.859, and A-IoT-specific assumptions in TR 38.769, ​​except for the following aspects**:**   + **​​**Positioning Reference Signal: A-IoT communication signals/channels as the starting point, e.g., PDRCH.   + Device-dependent factors: E.g. SFO and CFO for active device as per Rel-20 SI agreements. * Evaluate positioning performance of the candidate techniques. |
| CMCC | * Study and evaluate potential positioning solutions based on reader measurements * Study necessary signals/procedures/interfaces to support potential positioning solutions * Note: the solutions applicable for both indoor and outdoor scenarios, and for all device types. |
| CATT | Study the support of A-IoT positioning in indoor and outdoor scenarios for active device(s), focusing on UL, i.e. in D2R signal(s) to a single reader, and network based positioning, and considering the findings from the Rel-19 study of proximity determination solution 2 [RAN1]   * D1T1 for indoor and D4T1 for outdoor * Representative use cases rUC3 (indoor positioning) and rUC7 (outdoor positioning). * Evaluate the achievable positioning accuracy [RAN1] * Note: positioning solutions studied under this objective are expected to be equally applicable for outdoor and indoor scenarios for Device 2b/Device C |
| Qualcomm | * Study the feasibility of positioning/proximity techniques for Device 2b/C considering   + Simple single-point ranging like technique based on e.g., RSRP (inc. reader side or device side measurement), RTT measurements, etc.   + Target accuracy to be decided accordingly   + Applicability to both T1 and T2 |

# Possible SID update

Based on the online discussion on Monday, a proposal with minimal scope is provided below. It is assumed that the proposal would not require TU adjustment but be handled as best-effort in RAN1.

**Proposal 1: Update the SID with the addition of the following study objective:**

Study D2R measurements (e.g., RSRP-like), and the involved A-IoT signal(s)/channel(s), which are feasible for network-based positioning technique(s) for Device 2b/Device C with more accurate Device localization than based on Reader-ID [RAN1].

* Findings from the Rel-19 study of proximity determination solution 2 can be considered.
* Evaluation of positioning accuracy by RAN1 is not expected as part of this study objective

Feel free to provide comments on proposal 1 using the table below

|  |  |
| --- | --- |
| Company | Comment on the proposal |
| CATT | The positioning use cases are most critical indoor and outdoor deployments to allocate the position of the A-IoT device. The positioning technique for A-IoT could be refrained to the reader-based positioning techniques to minimize the complexity of the A-IoT devices. RAN1 had agreed in RAN1#122 to study the potential enhancement of the D2R signals to achieve the functionalities for A-IoT devices 2b/C in outdoor deployment scenarios as follows,  Agreement  For D2R signal(s), study at least the following functionalities (if needed), and study whether to reuse/enhance existing D2R signal(s) or to introduce new D2R signal(s) for the following functionalities (if needed):  • CFO estimation  • SFO estimation  • timing acquisition  • channel estimation  • measurement (e.g., signal strength, interference estimation)  • Device differentiation e.g. for collision resolution, for interference randomization  The potential enhancement of D2R signals for the functionalities of the CFO estimation, SFO estimation, timing acquisition, channel estimation, and signal strength could be potentially applied to the positioning techniques, such as RSRP and RTT measurements. The framework of the D2R signal enhancement study for the single reader Positioning techniques had been established based on the potential functionalities enhancements of generic D2R signal detection and demodulation. The addition time and effort of including the positioning/proximity determination would be minimal.  Since the positioning objective was discussed with common understanding of the scope in RAN#108. The simple update of the draft objective with addition of the restriction to the single reader network based solution should be feasible as follows,  Proposed positioning objective  Study the support of A-IoT positioning in indoor and outdoor scenarios for active device(s), focusing on UL , i.e. in D2R signal(s) to a single reader, and network based positioning, and considering the findings from the Rel-19 study of proximity determination solution 2 [RAN1]   * D1T1 for indoor and D4T1 for outdoor * Representative use cases rUC3 (indoor positioning) and rUC7 (outdoor positioning). * Evaluate the achievable positioning accuracy [RAN1]   Note: positioning solutions studied under this objective are expected to be equally applicable for outdoor and indoor scenarios for Device 2b/Device C |
| DOCOMO | We are OK in general with the proposed direction. Some clarification questions:   * As clarified in the 2nd sub-bullet, Evaluation of positioning accuracy by RAN1 is not expected during study phase. Then, it is unclear whether/how to meet the positioning requirements during the study phase. Assuming we will include some objectives for positioning in the WID, can we assume the evaluation for positioning to verify whether/how to meet the positioning requirements is to be done during work phase? * If Yes, what if the evaluation finds the any identified measurement schemes does not meet the requirement? Could we set a checkpoint to confirm whether to proceed the work? |
| Nokia | Support the spirit of Moderator’s proposal. However, we also agree with CATT that positioning solutions for Rel-20 A-IoT should be based on measurements performed by a single reader. This would ensure simpler operations at NW level and reduced workload for the WGs.  It is also unclear to us why evaluation of the position accuracy should not be part of the study. This seems a crucial aspect to consider before taking a decision on what could be specified during the work phase. |
| Samsung | We don’t support the above proposal.  First of all, current RAN 1 workload is already quite heavy, we don’t see there is a chance to add more objective for study without increasing TU.  Secondly, it is unclear on how to do the study without “Evaluation of positioning accuracy”. Without evaluation, it is unclear on how to prove the feasibility, how to identify the potential signal(s)/channel(s), and how to provide “**more accurate** Device localization than based on Reader-ID”? Moreover, there was no evaluation on proximity determination solution 2 in Rel-19 TR, but only one sentence. Therefore, what is the “findings” referring to is not clear.  In short, we don’t support to include “position” as additional study item objective in this study item. |
| Qualcomm | We support the proposal, conditional on making two amendments:   * + The solution(s) apply to both base station and UE as the reader   + The solution(s) are device-transparent   We also had another topic in our contribution, which was whether there should be a change in the max 500m communication coverage target. We would kindly ask to start a discussion on this as well. |
| Spreadtrum | If evaluation of positioning accuracy is not needed in SI phase, study of proximity determination solution 2 is also not needed, as this study had been done in R19 A-IoT SI phase.  We suggest to delay the decision whether including positioning for R20-A-IoT at RAN#111 taking the overall workload and TU for R20-A-IoT WI into consideration after finishing R20-A-IoT SI. |
| Apple | We do not support the current proposal.  First and foremost, the discussion here should focus on the ‘workload’ or ‘WI scope management’ aspects, rather than the usefulness of the ‘positioning/proximity’ feature for outdoor use cases. In the context of any 3GPP WI, it’s a common practice to ‘phrase in’ and rank the features, and then plan accordingly on a release basis. R20 Ambient IOT WI is a new WI due to new use cases, device types, and deployment scenarios. The scope based on the approved WID has been proven to be significantly large, requiring numerous designs to establish the foundation of the R20 Ambient IOT framework. From this perspective, it’s already quite challenging to complete these approved objectives within the allocated TU. Adding any new objective, such as positioning, should be carefully considered and realistic to ensure that the R20 Ambient IoT framework remains intact and well-designed for commercial deployment.  Secondly, we have strong concerns about the second sub-bullet. We understand that the evaluation is time-consuming and impact on TU, but it is the core and most critical part of determining the position performance. Preciesly, it is only way to determine wheter we can leverage the existing D2R signal/channel to achieve the necessary positioning granularity. Without this practise, we cannot determine the standard effort and feasibility of the ‘position/proximity’ feature for the WI Scope. This work cannot be simply disregarded.  In any case, from our perspective, it’s crucial to define the scope in a realistic manner and ensure that it doesn’t compromise the fundamental building block of the R20 Ambient IOT interface. |
| Huawei, HiSilicon | **On the moderator proposal**  By focusing on the feasible measurements, in D2R, the moderator proposal covers what is common among the various proposals, i.e. whatever finer-grained positioning is done, it will need measurements. Companies can bring analysis of measurement according to what kind of positioning or localization they think is needed.  Feasibility of a D2R signal/channel for positioning can be checked by a company at the same time as they propose and explain their design for it, so this study can be almost an embedded part of the Rel-20 study and specification effort.  We see two main reasons not to demand evaluations at SI stage:   1. The nature of most likely measurements is already fairly well known in specification terms from many earlier efforts on positioning. E.g., when introducing NR E-CID based on RSRP measurements in Rel-16, there were no evaluations. 2. Achieving a particular positioning accuracy is mainly about setting the evaluation and deployment assumptions to permit it, rather than discovering if sufficient accuracy can ever be achieved. Given the nature of the objective to simply be more accurate than reader-ID based, the outcome of an organized evaluation campaign is not obvious.   A company can always bring an evaluation demonstrating the cases-of-merit of their solution, but no organized evaluations campaign is essential in RAN1.  Then, if RAN approves an objective for positioning in March at the start of the WI, more detailed evaluations for positioning can be conducted. These will have the benefit of more concrete design knowledge for the involved signals/channels.  **On time allocation**  We note that Rel-19 A-IoT maintenance proceeded quickly in August RAN1#121, and some of its time was re-allocated to Rel-20 A-IoT and other items, effectively reducing the total TU allocated to Rel-19 maintenance already. This could be formalized by reducing Rel-19 maintenance by 0.5 TU/meeting (e.g. from 8 to 7.5 TU per meeting in Q4-2025), with 0.5 TU added to Rel-20 A-IoT SI.  Otherwise, we can live with the proposed handling, since companies can check their proposed design for a D2R signal/channel for feasible use in positioning measurement at the same time as the general discussion of its design motivations. This approach may not even need a dedicated agenda item in RAN1.  **On proximity determination**  To those who have proposed proximity determination, our online comment on this was based on the definition given (after RAN debates during 2024) in the Rel-19 SID:  *“Study the feasibility and required functionalities for proximity determination, which is the determination of whether BS or intermediate UE and ambient IoT device are near each other or not”*  Hence proximity determination does not tell how close, or where, the device is, regardless of whether solution 1 or solution 2 is used. The two solutions are just methods by which “near” vs. “not near” is determined. Especially if determined “not near”, we would know nothing about where the device actually is.  **Reader-ID based location**  The objective mentions localization based on reader-ID, i.e. a Rel-19 solution. We also assume this will automatically become part of the Re-20 specs, so a kind of cell ID-like localization will be available, but only at the coarse scale of an outdoor cell. |
| CMCC | We are generally fine with the direction of the proposal that the positioning solution should rely on D2R measurements at the reader side. However, the current proposal is a bit limit on the application cases and we have the following comments:  1) The positioning solution should be a common scheme. It is preferred to be applicable for both network and UE as a reader, and be applicable for both outdoor scenario and indoor scenario. In addition, we don’t think it is necessary to limit that the positioning solution is only for Device 2b/C, a common solution should be applicable for all device types.  2) For the D2R measurements, on top of RSRP-like measurement, we prefer to add also RSSI-like measurement. RSRP-like measurement relies on a D2R signal, which may require more study in RAN1, but RSSI-like measurement is simply the linear average of the total received power observed in the configured resources for measurements, which is an easier measurement than RSRP-like measurement and also worth study.  Based on the comments, we suggest the following change to the proposal:  Study D2R measurements (e.g., RSRP-like, RSSI-like) at reader side (considering both network and UE as a reader), and the involved A-IoT signal(s)/channel(s), which are feasible for D2R~~network~~-based positioning technique(s) ~~for Device 2b/Device C~~ in both outdoor and indoor scenarios with more accurate Device localization than based on Reader-ID [RAN1]. |
| ZTE, Sanechips | Firstly, we think the workload in RAN1 has already been overloaded considering the new air interface of the active device 2b/C in outdoor/indoor scenario. If positioning is included and requires RAN1 involvement, it will be questionable whether RAN1 can complete the SI in time. Even with the suggested objective for RAN1, it is unclear about the expected outcome of the study.  Secondly, the gNB based measurement for more accurate localization can be up to implementation except for the potential information exchange in higher layer. Therefore, if a minimal scope has to be considered, we think we can directly move forward to normative phase, instead of initiating SI in RAN1. The following objective is suggested as second priority from our perspective:  Specify signaling and procedure of network-based positioning for Device 2b/Device C with finer granularity device location than Reader-ID [RAN3]. |
| LGE | Thanks for drafting this proposal with the spirit of minimizing the scope and the workload and not requiring TU adjustment.  We are okay with this direction, but we think some clarification on the intention of the second bullet is needed to have a common understanding on how we proceed in the WG study if agreed.  Is it correct understanding of the intention of the second bullet that RAN1 captures the study results on positioning/proximity with the techniques and observations on the accuracy, and then whether and which solution(s) to specify in Rel-20 A-IoT WI will be discussed at the end of SI phase or when drafting the WID based on the study results incl. feasibility, positioning accuracy, etc. reported by companies? |
| Ericsson | We have a concern that there will be architecture impacts unless it is clarified that the measurements are based on single-reader. We note that if multiple readers would be involved, it may have considerable impact to the A-IoT system architecture (e.g., GMLC and LMF are not in A-IoT system architecture yet). Our overall view is that if something quite simple can be done for localization, then we are open to study. But clearly, if architecture changes are needed (involving SA2), then this would be too much scope expansion considering that there are only 3 meetings left in the SI.  Our view is similar to that expressed by Nokia: “*Support the spirit of Moderator’s proposal. However, we also agree with CATT that positioning solutions for Rel-20 A-IoT should be based on measurements performed by a single reader. This would ensure simpler operations at NW level and reduced workload for the WGs.*”  On another topic, we agree with Qualcomm’s comment about the coverage target specified in the SID states 50 – 500m. There was discussion in the most recent meeting about aiming for coverage >>500 m, and we think RAN should confirm that the existing design target in the SID is not changed. |
| OPPO | Our first preference is not to carry out this A-IoT positioning/proximity determination objective 2, due to limited remaining WG meetings until March 2026 and the SID objective 1 on studying necessary air interface design change for Device 2b/C is currently going towards the direction of optimization/enhancement rather than the necessary and feasible changes to the Rel-19 version. Therefore, we do have a concern about the workload that this will add to RAN1 as pointed out by some other companies.  If the majority of the group would still like to carry out a study on A-IoT positioning/proximity determination for objective 2, in our view, it needs to be very light/small and constrained as follow.   * + Outdoor scenario only (as stated in the SID title and also in the first sentence of the Objective section)   + Deployment scenario 4 with topology 1 only, aligning with Objective 1   + Solution should be based on measurement of D2R signal(s)/channel(s) by a single BS reader   + Measurement quantity is limited to RSRP or RSSI (to be determined in RAN1), aligning with the purpose of power control as discussed in the last RAN1 meeting   Furthermore, we would be OK/happy to limit the objective 2 scope to only identifying feasible D2R signal(s) / channel(s) for reader measurement within the study as commented by Huawei, and study network-based positioning / proximity determination solution and carry out the accuracy evaluation during the WI phase.  Aligning with the above constrains, the proposal from the moderator could be modified as follow.  Identify D2R measurement(s) (e.g., RSRP-like or RSSI-like), and the involved A-IoT signal(s)/channel(s), which are feasible for outdoor network-based positioning technique(s) by a single BS reader for Device 2b/Device C (e.g., E-CID like) [RAN1].   * Evaluation of positioning accuracy by RAN1 is not expected as part of this study objective |
| FUTUREWEI | We support the moderator’s proposal. Stepping back, overall our goal in 3GPP should be to provide a commercially useful feature. The workload for doing this appears quite small, and within the scope of the TU budget. |
| NEC | Due to limited TUs and scope so large, we have concerns on including positioning into the scope.  However, if proponents of positioning think that there is enough TU, we can accept that positioning is regarded as second priority. In other words, if there is TU left after other higher priority contents, positioning can be studied.  Moreover, we think only simple solution can be considered due to the reason of workload, such as Rel-19 proximity direction 2 or E-CID based positioning mechanism based on one reader, but the main bullet said “technique(s) for Device 2b/Device C more accurate Device localization than based on Reader-ID”, we think this requires more complicated positioning method (e.g., TDOA, RTT and so on) or is necessary to involve more than one reader, which is not acceptable due to it  may bring more and more complexity and workload.  Therefore, following updates are suggested:  Study D2R measurements (e.g., RSRP-like), and the involved A-IoT signal(s)/channel(s), which are feasible for network and single reader-based positioning technique(s) for Device 2b/Device C ~~with more accurate Device localization than based on Reader-ID~~ [RAN1].   * Findings from the Rel-19 study of proximity determination solution 2 can be considered. * Evaluation of positioning accuracy by RAN1 is not expected as part of this study objective |
| IIT Kanpur | We are fine with the overall direction of the moderators’ proposal. However, we suggest clarifying in the proposed SID Scope whether the study will consider architectural impacts of positioning or if it will be limited to single-reader-based positioning techniques. In addition, we recommend including an evaluation of positioning accuracy to assess whether the studied solutions can meet the requirements. This will help in making an informed decision on what should be specified during the work phase. |
| Xiaomi | Thanks moderator for the proposal.  Although we understand the intention to preclude evaluation to reduce the workload, we are unclear how to study and conclude without evaluation, including which signal/channel is used for measurement, what is the measurement metric, whether more accurate localization can be achieved etc. In our view, evaluation is essential for the study, however, the current TU cannot accommodate the additional work required for the positioning/proximity determination study. |

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* Draft\_v02\_Moderator\_CompanyA
* Draft\_v03\_CompanyA\_CompanyB
* Draft\_v04\_CompanyB\_CompanyC
* Etc

# Conclusions

TBD

# References

1. RP-251884 Rel-20 Ambient IoT outdoor SID, RAN#108
2. RP-251885 Rel-20 Ambient IoT Phase 2 WID, RAN#108
3. RP-251971 Discussion on support of A-IoT positioning or proximity determination in Rel-20 Guangdong OPPO Mobile Telecom.
4. RP-252058 Views on enhancements for Ambient IoT in NR NEC
5. RP-252156 Discussion on R20 A-IoT positioning Spreadtrum, UNISOC
6. RP-252314 Study on Ambient IoT in Outdoor for Active Devices Apple Inc.
7. RP-252345 Revised SID: Study on enhancements for solutions for Ambient IoT (Internet of Things) in NR outdoor for active devices LG Electronics Inc.
8. RP-252363 Addition of study on positioning for Rel-20 Ambient IoT Huawei, HiSilicon
9. RP-252458 Views on Ambient IoT SI in Rel-20 Qualcomm Incorporated
10. RP-252653 Discussion on Rel-20 Ambient IoT SI scope Xiaomi
11. RP-252707 Views on Positioning objective of Ambient IoT works in Rel-20 CATT
12. RP-252757 Views on Rel-20 Ambient IoT SI IIT Kanpur
13. RP-252758 Views on including positioning in the scope of Rel-20 Ambient IoT SI Ericsson Canada Inc.
14. RP-252030 Views on Rel-20 Ambient IoT ZTE Corporation, Sanechips
15. RP-252059 Views on solutions for Ambient IoT in NR Phase 2 NEC
16. RP-252081 TU allocation and WID revision for Rel-20 AIoT in NR Phase 2 Xiaomi
17. RP-252103 Consideration on Ambient IoT positioning for outdoor scenarios CMCC
18. RP-252362 Revised WI: Solutions for Ambient IoT (Internet of Things) in NR Phase 2 Huawei
19. RP-252477 Views on Ambient IoT in Rel-20 NTT DOCOMO, INC.