**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:

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| **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

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| --- | --- |
| 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. |
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* Draft\_v01\_Moderator
* 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.