**3GPP TSG RAN WG1 Meeting #101-e R1-2005102**

**e-meeting, 8th June - 11th June 2020**

**Source: Moderator (CATT)**

**Title: Summary of Email Discussion [101-e-Post-NR-Pos-Enh]**

**Agenda item: 8.2**

**Document for: Discussion and Decision**

# Introduction

This document provides a summary of the following email discussion:

🖂[101-e-Post-NR-Pos-Enh] Email discussion/approval prioritizing remaining  evaluation assumptions till 6/17 – Ren Da (CATT)

* Focusing on high priority proposals first, target 6/11 for early approvals
* Followed by medium priority/low priority proposals

This summary covers the follow-up discussion of the following issues (R1-2005049):

* **Proposal 2.1-1: Rel-17 target positioning requirements**
* **Proposal 2.1-2: Metric of positioning accuracy requirements**
* **Proposal 4.1-3: (Optional) UE RX/TX timing error for antenna panel**
* **Proposal 4.1-4: (Optional) hand blockage model in evaluation**
* **Proposal 5.1-3: (Optional) UE mobility model**
* **Proposal 5.1-8: (Optional) Base station spacing**
* **Proposal 6.1-1: Evaluation scenario(s) for commercial use cases**
* **Proposal 6.1-2(new): Absolute time scenario(s) for commercial use cases**
* **Proposal 8.1-3: Physical layer and higher layer positioning latency**
* **Proposal 8.1-5: Evaluation of UE power consumption**
* **TR 38.857 skeleton**

Please note of the following highlights will be used in this summary:

* The Pink highlights are proposals and issues for discussion with high priority in this email discussion
* The Yellow highlights are proposals and issues for discussion with medium priority in this email discussion
* The Dark Yellow highlights are proposals and issues for discussion with low priority in this email discussion
* The Turquoise highlights are offline consensus/conclusion based on offline discussion or comments
* The Grey sections are issues that have been discussed/revised/ resolved in this meeting email discussion

Note: The fact that a proposal is listed with a priority in this email discussion should not be interpreted as a suggestion that the proposal will have the same priority in future meetings.

# Proposals for Discussion

Note: See R1-2005049 [1] for the discussions of previous proposals.

### Proposal 2.1-1

FL Comments

In previous discussion, most companies support the Proposal 2.1-1 (Revision #3)[1]. Two companies suggest removing the FFS bullets for Physical layer latency, one company suggest using the same target accuracy as shown in SID, one company suggest adding 1m of Horizontal position accuracy into IIoT use cases, and one company suggest removing 20ms delays as in SID. Given that all of the suggestions of the changes are for either the numbers in brackets or FFS, it might be better for us minimize the effort on the discussion of the proposals at this moment, since we may need to further investigation (e.g., marketing requirements, the evaluation results based on R16 positioning, the potential R17 enhancements, etc.) to decide the reasonable and realistic target positioning performance for Rel-17.

Note: It is worthy to point out that the target positioning performance for Rel-17 shows what we are targeting in R17. It is not defined nor bounded by the simulation results based on Rel-16 positioning technologies. The target positioning performance for Rel-17 will be used for us to identify the gap between the positioning performance based on Rel-16 positioning technologies and what we are targeting to achieve in Rel-17.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 2.1-1** | Revision #4   * + In Rel-17 target positioning requirements for **commercial use cases** are defined as follows:     - * + Horizontal position accuracy (<1 m)         + Vertical position accuracy (< [2 or 3] m)         + End-to-end latency for position estimation of UE (<[100m]s)         + FFS: whether to define target hysical layer latency for position estimation of UE (<[10ms])   + In Rel-17 target positioning requirements for **IIoT use cases** are defined as follows:     - * + Horizontal position accuracy (< X m)   X = [ 0.2 or 0.5]m   * + - * + Vertical position accuracy (< Y m)   Y = [0.2 or 1]m   * + - * + End-to-end latency for position estimation of UE (<[10ms, 20ms, or 100ms])         + FFS: whether to define target physical layer latency for position estimation of UE (<[10ms]) | CATT: Support Revision #4 with the following values of target positioning requirements:   * + In Rel-17 target positioning requirements for **commercial use cases** are defined as follows:     - * + Horizontal position accuracy (<1 m)         + Vertical position accuracy (< 3 m)         + End-to-end latency for position estimation of UE (<100ms)         + FFS: whether to define target hysical layer latency for position estimation of UE (<[10ms])   + In Rel-17 target positioning requirements for **IIoT use cases** are defined as follows:     - * + Horizontal position accuracy (< X m)   X = 0.2m   * + - * + Vertical position accuracy (< Y m)   Y = 1m   * + - * + End-to-end latency for position estimation of UE (<100ms)         + FFS: whether to define target physical layer latency for position estimation of UE (<[10ms])   OPPO:   * Ok to keep the position accuracy open for IIOT use cases. * We shall add the CDF percentile value for each position accuracy target, otherwise, [x]m accuracy alone does not make sense. Suggest to add 80% for commercial use cases and 90% for IIoT use cases.   Huawei/HiSilicon: OK.  vivo：At least，we believe physical layer latency for IIoT is needed if RAN 1 wants to focus on phy latency. Otherwise, RAN1 will spend more time to evaluate the ratio of phy latency. So, we propose to delete “whether to define target”  ZTE： From our perspective, different scenarios may have different target requirements. So it’s better to keep the note in the previous version, i.e.  Note: Target positioning requirements may not necessarily be reached for all scenarios.  Fraunhofer: Agree with ZTE  Nokia/NSB: OK.  Qualcomm: OK with Revision #4 as it is. Keep all the numbers in the brackets. There is no need to finalize the target values in this meeting.  CATT-v2: As the compromise, we can accept the target requirements with all the numbers in the brackets. However, we prefer to take the scenario into account, i.e. there are different target requirements for InF-SH and InF-DH scenarios. Moreover, we propose the target for InF-DH scenario should aiming to the modified InF-DH scenario with baseline clutter parameters (40%, 2m, 2m) which we had agreed last week  Revision #5   * + In Rel-17 target positioning requirements for **commercial use cases** are defined as follows:     - * + Horizontal position accuracy (<1 m)         + Vertical position accuracy (< [2 or 3] m)         + End-to-end latency for position estimation of UE (<[100m]s)         + FFS: whether to define target hysical layer latency for position estimation of UE (<[10ms])   + In Rel-17 target positioning requirements for **IIoT use cases** are defined as follows:     - * + Horizontal position accuracy (< X m)   X = [ 0.2 or 0.5]m for InF-SH scenario  X = [1]m for InF-DH scenario with baseline clutter parameters { 40%, 2m, 2m}   * + - * + Vertical position accuracy (< Y m)   Y = [0.2 or 1]m for InF-SH scenario  Y = [3]m for InF-DH scenario with baseline clutter parameters { 40%, 2m, 2m}   * + - * + End-to-end latency for position estimation of UE (<[10ms, 20ms, or 100ms])         + FFS: whether to define target physical layer latency for position estimation of UE (<[10ms])   LG: We are generally supportive of the revision #4, but we prefer to remove “whether to define target” for physical layer latency.  CMCC: So far we are fine with the layout of the proposals, and to leave the target accuracy open. A follow-up comment for CATT’s 2nd reply, no objections to define separate target performance for different IoT scenarios, but as per the last note in the agreement “Note: Target positioning requirements may not necessarily be reached for all scenarios”, does it imply that only one target performance is defined for all InF scenarios?  Lenovo, Motorola Mobility: Support Revision #4 but also prefer to remove the “whether to define target” statement. Since physical layer latency is an important component in the overall end-to-end latency analysis/evaluation in Rel-17, we feel that it is not a question of “whether to define target physical layer latency” but rather to study the feasibility of achieving the physical layer latency targets in the context of the overall end-to-end latency requirements.  CATT-v3: Agree with CMCC that maybe only one target performance is enough, as there is a note “Note: Target positioning requirements may not necessarily be reached for all scenarios” in the agreement. What we worried about is that the LOS probability of InF-DH scenario is much less than InF-SH scenario, so it will be better for InF-DH scenario to have relaxed target performance. In addition, there is another note “Note: Target performance and performance gap identification will be discussed separately” in the agreement, therefore, it may be better to set different target performances for InF-SH and InF-DH.  Intel: OK with proposed revision.  Sony: 1) We prefer to keep the previous note:  Note: Target positioning requirements may not necessarily be reached for all scenarios.  2) Remove the suggested text: “whether to define target”.  Ericsson: We can support revision 4. Our view is that the target requirement should not be coupled with the scenarios (e.g. SH or DH) but rather that the study should evaluate whether the requirement can be met in these scenarios. We are ok to have multiple requirements, but then for each set of requirement on accuracy and latency, there must be a clear identified use case. In addition, we agree with VIVO, LG, and Lenevo that ‘whether to define target’ should be deleted. Physical layer latency is an important consideration during RAN1 study in our view.  CATT-v4: Since majority support original Revision#4, we can accept the original Revision#4(with all the numbers in the brackets) as target requirements for commercial use cases and IIoT use cases and avoid a long time discussion on this issue.  Qualcomm-v2: support Revision #4. Agree with VIVO, LG, Lenevo and Ericsson that ‘whether to define target’ should be removed from the FFS bullet . |

FL Comments

It looks most companies are supportive the revision#4. The main comments are: a) remove ‘whether to define target’ and add “Note: Target positioning requirements may not necessarily be reached for all scenarios”, which was already agreed for IIoT scenarios. In addition, with the consideration of the comments for Proposal 2.1-2, the CDF percentages for the accuracy are now included into the target positioning requirements.

### Proposal 2.1-1(Revision #5)

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| **Proposals** | **Description** | **Comments** |
| **Proposal 2.1-1** | Revision #5   * + In Rel-17 target positioning requirements for **commercial use cases** are defined as follows:     - * Horizontal position accuracy (<1 m) for [90%] of UEs         + Vertical position accuracy (< [2 or 3] m) for [90%] of UEs         + End-to-end latency for position estimation of UE (<[100m]s)         + FFS: Physical layer latency for position estimation of UE (<[10ms])   + In Rel-17 target positioning requirements for **IIoT use cases** are defined as follows:     - * + Horizontal position accuracy (< X m) for [90%] of UEs   X = [ 0.2 or 0.5]m   * + - * + Vertical position accuracy (< Y m) for [90%] of UEs   Y = [0.2 or 1]m   * + - * + End-to-end latency for position estimation of UE (<[10ms, 20ms, or 100ms])         + FFS: Physical layer latency for position estimation of UE (<[10ms]) * Note: Target positioning requirements may not necessarily be reached for all scenarios | CATT: Support.  CEWiT: Support the Revision 5. We believe now there is no need of FFS. But any specific reason for it, we would like to understand.  Nokia/NSB: Support. We guess the last sub-bullet under the first main bullet is not needed anymore.  FL: Nokia’s comment is correct. I deleted the last sub-bullet under the first main bullet.  Qualcomm: Support. |

FL Comments

Given that the revision is supportive for all companies based on the feedback, I would propose Proposal 2.1-1 (Revision #5) (after removing the change marks) as “Offline Consensus”. We will continue the discussion on the remaining issues in the future meetings.

### Proposal 2.1-1(Proposed Offline Consensus)

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| **Proposals** | **Description** | **Comments** |
| **Proposal 2.1-1** | * + In Rel-17 target positioning requirements for **commercial use cases** are defined as follows:     - * Horizontal position accuracy (<1 m) for [90%] of UEs         + Vertical position accuracy (< [2 or 3] m) for [90%] of UEs         + End-to-end latency for position estimation of UE (<[100m]s)         + FFS: Physical layer latency for position estimation of UE (<[10ms])   + In Rel-17 target positioning requirements for **IIoT use cases** are defined as follows:     - * + Horizontal position accuracy (< X m) for [90%] of UEs   X = [ 0.2 or 0.5]m   * + - * + Vertical position accuracy (< Y m) for [90%] of UEs   Y = [0.2 or 1]m   * + - * + End-to-end latency for position estimation of UE (<[10ms, 20ms, or 100ms])         + FFS: Physical layer latency for position estimation of UE (<[10ms]) * Note: Target positioning requirements may not necessarily be reached for all scenarios |  |

### Proposal 2.1-2

FL Comments

In previous discussion, most companies support the Proposal 2.1-2 (Revision #2) [1] in principle with the suggestion of changing “availability of [90%]” either to “[90%] of CDF values” or “[90%] of UEs”, which is used in TR 38.855 in Rel-16. Thus, it might be better to follow TR 38.855 to use “[90%] of UEs”.

One company asks what happens if the target positioning accuracy can only be achieved at a percentile lower than [90%]. To address the question, our understanding is that one of the main purposes of the simulation evaluation is to identify the gap between the positioning performance based on Rel-16 positioning technologies, which are currently used for simulation evaluation, and the target positioning performance defined for Rel-17. In another word, the target positioning performance requirements in R17, including the percentile of CDF values, are not bounded by the simulation results. We may expect reasonably a gap between the evaluation results based on Rel-16 positioning technologies and the target positioning accuracy for Rel-17.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 2.1-2** | Revision #3   * The target horizontal and vertical positioning accuracy requirements are defined based on [90%] of UEs. | CATT: Support.  OPPO: 90% for IIoT use cases and 80% for common commercial use cases.  Huawei/HiSilicon: OK.  vivo: Support  ZTE: OK.  Fraunhofer: Ok  Nokia/NSB: Support.  Qualcomm:  Thanks for the clarification by FL. Considering the main purpose is to identify the performance gap between Rel-16 technology and Rel-17 target, we are ok with Revision #3 as long as the target percentile is set without compromising the Rel-17 target accuracy stated in SI (i.e. do not relax the accuracy for (I)IOT use cases to 0.5m).  Regarding the target percentile, we believe there is no need to conclude on the value in this meeting, meaning we can leave the brackets there in Revision #3. Also, we share similar view with OPPO on keeping different percentiles for IIOT and commercial use cases, which can be added to the proposal as FFS in a subbullet.  LG: OK  CMCC: Support.  Lenovo, Motorola Mobility: Supportive of Revision#3.  Intel: OK  Sony: Support Rev#3. Let’s start with the value in the bracket [].  Ericsson: OK with revision 3. We also want to confirm that the 90th percentile apply to each requirement separately. |

FL Comments

Based on the feedback, most companies support using “[90%] of UEs”. Two companies made a suggestion to allow the consideration of different percentage values for the IIoT use cases and commercial use cases. Based on the suggestion, the proposal 2.1-2 is now merged with Proposal 2.1-1 (Revision #5), which makes it easier for us to finalize the target positioning performance for each of the scenarios.

### Proposal 4.1-3

FL Comments

In previous discussion, it seems most companies are in favour of the option to model The UE/gNB RX-TX timing error. Near the end of the meeting, there was a discussion of the revision proposed by the proponents. Interested companies are welcome to present their views on the revision.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 2.1-2** | Revision #1  (Optional)The UE/gNB RX-TX timing error, in FR1/FR2, can be modelled as a truncated Gaussian distribution of (T1 ns) rms values, subject to a largest timing difference of T2 ns, where T2 = 2\*T1   * That is, the range of timing errors is [-T2, T2] * T1: [2] ns for gNB and [8] ns for UE (realistic Rx-Tx calibration) * Note: RX-TX timing errors are generated per panel | CATT: Support. We are fine with including FR1 case for modelling of RX-TX timing error in the Revision #1.  OPPO: support  Huawei/HiSilicon:   * Just would like to clarify the following, when we agreeing with this, whether it means that DL-TDOA and UL-TDOA are going to suffer from additional [1.4]ns of Tx chain (DL-TDOA) or Rx chain (UL-TDOA) group delay error or not?   ZTE: Agree.  Fraunhofer: OK  Nokia/NSB: Okay.  Qualcomm: Support Revision #1.  The proposed Rx-TX timing error modeling is applicable for DL+UL positioning (m-RTT). For TDOA, the performance is mainly affected by network synchronization error, where the group delay error can be omitted in the modeling.  Huawei/HiSilicon: To our understanding, if there is unresolved random group delay (i.i.d. across gNB panel) for Rx – Tx time difference, it should also be reflected in DL-TDOA and UL-TDOA, even if those gNBs shares the same clock source.  Basically it is our understanding that each gNB should calibrate the group delay with a very small residual error, which will affect both gNB Rx – Tx time difference and TDOA-based positioning methods. For UE side, we think the common residue group delay will be cancelled for TDOA measurements.  So here is our suggestion:  (Optional)The UE/gNB RX and TX timing error, in FR1/FR2, can be modelled as a truncated Gaussian distribution of (T1 ns) rms values, subject to a largest timing difference of T2 ns, where T2 = 2\*T1   * That is, the range of timing errors is [-T2, T2] * T1: [1.4] ns for gNB and [5.6] ns for UE (realistic Rx-Tx calibration) * Note: RX-TX timing errors are generated per panel   Intel: Suppor the revision.  Ericsson: We agree with Huawei regarding the applicability of the timing error to all timing based methods (DL-TDOA, UL RTOA, mRTT). We also think that the definition of the truncated gaussian process could be clarified. Suggest to rephrase as follow:  (Optional)The UE/gNB RX and TX timing error, in FR1/FR2, can be modelled as a truncated Gaussian distribution with zero mean and standard deviation of (T1 ns) ~~rms values~~, with truncation of the distribution to the [-T2,T2] range, and with T2=2\*T1. ~~at subject to a largest timing difference of T2 ns, where T2 = 2\*T1~~   * ~~That is, the range of timing errors is [-T2, T2]~~ * T1: [1.4] ns for gNB and [5.6] ns for UE (realistic Rx-Tx calibration) * Note: RX and TX timing errors are generated per panel   Qualcomm-v2: agree with Huawei/Ericsson on the new proposal but with the removal of “(realistic Rx-Tx calibration)” from the 2nd bullet since the revised model is more generic than Rx-Tx. Also note that the numbers in the brackets should be regarded as placeholder for now. Interested companies can bring in their proposals on T1 in the next meeting to finalize the model.  (Optional)The UE/gNB RX and TX timing error, in FR1/FR2, can be modelled as a truncated Gaussian distribution with zero mean and standard deviation of (T1 ns) ~~rms values~~, with truncation of the distribution to the [-T2,T2] range, and with T2=2\*T1. ~~at subject to a largest timing difference of T2 ns, where T2 = 2\*T1~~   * ~~That is, the range of timing errors is [-T2, T2]~~ * T1: [1.4] ns for gNB and [5.6] ns for UE ~~(realistic Rx-Tx calibration)~~ * Note: RX and TX timing errors are generated per panel |

### Proposal 4.1-3 (Revision #2)

FL Comments

In previous discussion, most companies are supportive to the proposal for model the Tx/Rx timing errors of UE/gNB Rx-Tx timing difference measurements, while two companies propose to extend the proposal to further cover the Tx/Rx timing errors for all timing measurements. Based on the email discussion, an updated proposal is provided.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 2.1-2** | Revision #2   * (Optional) The UE/gNB RX and TX timing error, in FR1/FR2, can be modelled as a truncated Gaussian distribution with zero mean and standard deviation of T1 ns, with truncation of the distribution to the [-T2,T2] range, and with T2=2\*T1: * T1: [1.4] ns for gNB and [5.6] ns for UE * Note: RX and TX timing errors are generated per panel independently | CATT: Support.  CEWiT: Support  Nokia/NSB: We would like to better understand where the number 1.4 and 5.6 ns are coming from. Can the proponents justify them? We would also like to better understand why this is now being applied for all measurements across all FRs when this started as something for one measurement at FR2 for antenna panels. We think that we are rushing to a conclusion on an issue that RAN1 has had little time to discuss and analyze. As this is optional suggest proponents to bring contributions to next meeting where we can discuss this topic.  FL: Made the modification: “T1: [1.4] ns for gNB and [5.6] ns for UE” based on a comment from Ericsson in email.  FL: Made the modification: “Note: RX and TX timing errors are generated per panel independently” based on the comment from OPPO in email.   * T1: [1.4] ns for gNB and [5.6] ns for UE   Qualcomm: We share the same view with Nokia. The value of T1 has major impact on the performance and the number in the square brackets requires further justification and discussion, which can happen in the next meeting. In the meantime, to avoid confusion and concerns, we propose to replace [1.4] and [5.6] with [X] and [Y] respectively and put the study of X and Y in FFS.   * (Optional) The UE/gNB RX and TX timing error, in FR1/FR2, can be modelled as a truncated Gaussian distribution with zero mean and standard deviation of T1 ns, with truncation of the distribution to the [-T2,T2] range, and with T2=2\*T1: * T1: [X] ns for gNB and [Y] ns for UE * FFS: the standard deviations of truncated Gaussian model for gNB and UE. * Note: RX and TX timing errors are generated per panel independently |

### Proposal 4.1-4

FL Comments

In previous discussion, the number of companies (4) that are supportive to the Proposal 4.1-4 [1] is fewer than the number of companies (6) that do not support it. The proponents of the Proposal 4.1-4 suggested to explicitly state in the TR that 'Hand blockage aspects were not taken into account in the study item phase.' Given that TR 38.901 does not define hand blockage model, and it is obvious the SI may not be consider all practical issues, it may not be necessary to have the statement in TR. But, this issue can be discussed when we prepare the TR.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 4.1-4** | • (Optional) In FR2, a loss of 10 dB can be applied for a randomly chosen blocked panel to model hand blockage | FL suggestion: no further discussion on the proposal in this meeting.  CATT: Support FL suggestion that no further discussion this proposal.  OPPO: Agree with the FL suggestion. We do not see need for this proposal  vivo: Agree with FL suggestion  ZTE: Support the FL suggestion.  Fraunhofer: Agree with the FL suggestion  Nokia/NSB: Support FL suggestion.  Qualcomm: Support the FT suggestion.  LG: Support FL suggestion  Lenovo, Motorola Mobility: Agree with FL’s suggestion.  Intel: Agree with FL suggestion.  Sony: We are still in the early phase of the study item, we prefer to keep this as an optional assumption  Ericsson: Our previous proposal was to close the issue with a TR note. We think it’s important to capture the decision not to treat this option in the TR as it was discussed and it seems that the majority agrees not to model hand blockage. We appreciate the FL need to close issues for this meeting, but since it is clear that most companies want to exclude hand blockage, we should agree to mention this in the TR and move on. Then we won’t need to reopen the discussion in future meetings.  Sony: We believe that the hand-blocking issue is critical to the performance of radio-based positioning: One or more UE panels may suffer from it, thereby limiting the amount of TRPs available for positioning. Hence, it is important to study the impact of hand-blocking on positioning performance. However, given that most companies prefer not to further discuss this proposal and in order to make a progress (i.e FL needs to close the open issues), we are fine with Ericsson proposal. |

FL Comments

Based on the beedback, it is unlike to reach consense to this proposal in this meeting. Suggest no further discussion of this proposal in this meeting.

### Proposal 5.1-3

FL Comments

In previous discussion, it seems most companies are supportive to the Proposal 5.1-3 (Revision #2)[1]. Four companies prefer to have the common model, and one company suggests let each company to choose their own model. In the revision#3, we include the common model proposed in previous email discussion for further comments.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 5.1-3** | Revision #3   * (Optional) UE mobility can be considered in evaluation with the consideration of the spatial consistency procedure defined in TR 38.901.   + Individual companies are encouraged to consider using the following mobility model:   + Track mode: linear track   + Velocity & acceleration (velocity acceleration values decided by companies)     - Option 1: constant speed [30km/h], zero acceleration.     - Option 2: initial constant acceleration period + constant speed period   + Position update rate: describes the time when the position of a track is updates >1ms (values decided by companies)   + Direction: describes the travel direction along the track. The direction is a random value if either 0, pi/2 and -pi/2 in rad.   + Additional assumptions:     - Spatial Consistency according to TR 38.901 (Section 7.6.3) * Note1: UE dropping procedure in Table 5-1 applies * Note 2: For InF UE positions not within the Hall are not considered for evaluation | CATT: We prefer to have the common model. We are generally fine with the proposed common model in the left column. And a fixed path trajectory maybe need to be agreed in order to facilite the convergence of simulation results. That is to say, interested companies use the same path trajectory to model the movement of UE.  Our proposed change to the Revision #2 as follows,   * + Track mode: linear track with fixed path trajectory.   OPPO: Wording change suggestion:   * Individual companies ~~are encouraged to~~ may consider using the following mobility model as starting point:   Huawei/HiSilicon:   * This is too much for a single meeting. Suggest to consider in the next meeting. For example, it is unclear * how linear track can have this random bearing {0, pi/2, -pi/2}, and why there is no pi; * how to model the displacement error between two positioning measurements; * how to evaluate the positioning error (real time or long term); * how LOS condition is changed throughout the track. * what Table 5-1 is. * what the usage of Note 2 especially considering when we have fixed trajectory.   vivo: we think the detailed model only can be a start point rather than agreement.  Furthermore, for detailed mobility model, maybe also needs an error model of the velocity, acceleration, relative time, etc. And we also have a question about the position update rate, we want to know what information will be updated and how to update. In our platform, all of UE is fixed position and fixed velocity, So which one is your mean   * Update the velocity & acceleration with time for one fixed UE * there is a list UE with a fixed position and Velocity & acceleration，but Velocity & acceleration of different UE is different according to the  Position or position update rate   ZTE: Agree with OPPO since it’s an optional feature. Our suggestion is we only keep the first bullet, it’s up to interested companies to elaborate other details.  Fraunhofer: we support to have an common model for mobility. Since the proposal changed to a fixed trajectory, I assume the direction [0, pi/2 pi, -pi/2] and Notes 1 (Table 5-1 in the last FL summary referred to the normal dropping procedure) and Note2 are no longer needed (as indicated by HW).  One comparable example can be found in TR36.855 (A.1.2): for simplicity the current proposal did not include turn probabilities to keep things simple (go straight track).  On the other comments:   * The LOS condition changes according to LOS/NLOS probability and spatial consistency procedure in 38.901. * A UE position on the track can correspond to an SRS transmission or an PRS reception and this determines the “UE-position update rate” or the UE fixes on the track. I think it should be fine as a starting point to apply constant speed (we are also fine with option2). * The evaluation of the UE position on a track is a different discussion not directly related with the mobility model itself. We support to evaluate the number of occasions on a track per positioning estimate to have a direct comparison with the baseline approach.     Nokia/NSB: Agree with Huawei. Too complex for a short post meeting email discussion. Companies wanting to do mobility modeling can do it over the summer and then bring detailed papers. No need to agree this now.  Qualcomm: It does not seem we have time to agree on the details. However, we can try to reach an agreement to cover at least the following:  Linear track  Spatial consistency according to TR38.901  If the reduced list cannot be agreed upon, we are ok with keeping only the first bullet.  LG: We understand this could be considered as a meaningful work, but we it is difficult to agree the details regarding mobility model, so we prefer to agree with only the first bullet and to leave it up to each company for evaluation.  Lenovo, Motorola Mobility: We also agree that the mobility model parameters may be too detailed to converge at this stage of the Post RAN1#101-e meeting email discussion. However, a common mobility model with a fixed linear trajectory could be a reasonable and basic starting point for further discussions.  Intel: For NR Positioning evaluations RAN1 hasn’t had sufficient time for analysis of mobility model details. Current proposal seems incomplete, as also commented by other companies we prefer to postpone the discussion and we do not support the revised proposal right now.  Sony: This is an optional feature. It is too complex to discuss these details in the post-meeting e-mail discussions. We propose further discuss this in the next meeting (if necessary).  Ericsson: We agree with Huawei, Nokia, and Sony. To agree on all these details within a short span of 1 week does not seem feasible. Without a detailed model, just agreeing on the first bullet is not meaningful. We don’t see an urgent need to agree on this in this email thread. We can discuss this further once there is clarity on a common model which seems more feasible for next meeting. |

### Proposal 5.1-3 (Revision #4)

FL Comments

Based on the feedback, a number of companies suggest to leave the details of the mobility models to the next meeting. Suggest only make the agreement for the main bullets and FFS for the

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| **Proposals** | **Description** | **Comments** |
| **Proposal 5.1-3** | Revision #4   * (Optional) UE mobility can be considered in evaluation with the consideration of the spatial consistency procedure defined in TR 38.901.   + FFS: the details of the mobility models | CATT: Support.  CEWiT: Support  Nokia/NSB: Support.  Qualcomm: Support. |

### Proposal 5.1-3 (Proposed Offline Consensus)

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| **Proposals** | **Description** | **Comments** |
| **Proposal 5.1-3** | Offline Consensus   * (Optional) UE mobility can be considered in evaluation with the consideration of the spatial consistency procedure defined in TR 38.901.   + FFS: the details of the mobility models |  |

### Proposal 5.1-8

FL Comments

In previous discussion, seven companies are supportive to the Proposal 5.1-8[1], but three companies don’t support. Suggest having a further discussion to have further understanding of the motivation as well as the concerns.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 5.1-8** | * (Optional) Base station spacing of D=10m can be considered for BS layout in small hall (L=120m x W=60m). | CATT: Support this proposal and we are fine for it to be optional.  OPPO: do not see need for this proposal. So not support it.  Huawei/HiSilicon: Too many base stations (5x11=55). Suggest postponing.  vivo: No needed, considering the costing and the LOS probability have been modified to ensure 95% UE has more than 4 LOS path.  ZTE: Support. It may be useful to investigate DL PRS interference, NLOS identification and so on.  Fraunhofer: Ok.  Nokia/NSB: Support. As mentioned previously the additional base stations could be positioning only TP or RP which address the cost consideration. We think achieving the performance needed in Rel-17 should consider this type of deployment.  Qualcomm: We don’t think it is necessary but can go with the majority if most companies want to include D=10m in small hall as optional.  CMCC: We have no strong views to support or object this proposal. Just for notification, even by defining a smaller value of the BS spacing can provide a better performance, we may not be able to deploy such a dense base station spacing in reality due to the cost.  Intel: Considering comment from CMCC, we don’t see strong motivation for this scenario. Ok as an optional scenario if majority wants to have it  Sony: Support this as an optional feature.  Ericsson: No strong view. Fine to go with majority view on this.  Nokia/NSB2: Again there seems to be no strong concern to include this as optional. We agree fully with CMCC that a denser deployment comes with higher cost but feel we have addressed the technical concern with our response. We suggest this is agreed. |

FL Comments

Similar to previous discussion, five companies are supportive to the proposal, three companies don’t support, and three companies do not have strong view. Based on the beedback, it seems we may not be able to reach consensus to this proposal in this meeting. It seems no revision is needed. We may check back to see if we can have the consensus next week.

### Proposal 6.1-1

FL Comments

Five companies prefer Proposal 6.1-1 (Revision #3)[1], three companies do not see the need for the proposal, while one company prefer Revision #2. Even if we do not define the baseline scenario for the evaluation of the positioning enhancements for commercial use cases, it may still be useful to have a conclusion that no baseline scenario is defined. In addition, it might be better to exclude the scenarios that no company is interested in.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 6.1-1** | Revision #4   * In Rel-17 SI for the evaluation of the positioning enhancements for commercial use cases, no baseline scenario is defined. [UMi, UMa, IOO] scenario(s) defined in TR 38.855 can be considered as optional scenarios. | FL: Interested companies are encoraged propose the scenario(s) they may evaluate. We may exclude the scenario that no company is interested in.  CATT: we prefer to adopt IOO scenario defined in TR38.855 as optional scenario for commercial use cases evaluations.  OPPO: Ok to be optional and ok to not define baseline. Suggest to model absolute time of arrival in the evaluation, especially for IOO scenarios.  Huawei/HiSilicon: IOO most likely.  We would like to also clarify the understanding of evaluating general enhancement is to introduce NLOS propagation delay compared Rel-16 evaluation or not. If so, it is unclear how NLOS delay is modelled for IOO as it was not considered for IIoT channel model SI.  vivo:Agree with Huawei and we worried UMa can reach the Target, whether we add the note for the proposal like before   * + Note: Target positioning requirements may not necessarily be reached for all scenarios.   ZTE: We don’t see the intention of this proposal since we have evaluated the UMi, IOO and UMa during the Rel-16 study phase.  Fraunhofer: Support.  Nokia/NSB: Support. If we have no baseline scenario how are we supposed to know if we meet the target?  Qualcomm:  We should not spend time on debating which Rel-16 scenarios to be included/excluded considering they are already listed as optional.  We are ok with VIVO’s proposal on the note that target positioning requirements may not necessarily be reached for all scenarios. Also, we agree with OPPO/Huawei that the applicability of absolute time of arrival model for non-InF channels must be clarified. Currently, the parameters for absolute time of arrival model are only specified for InF-SL/SH/DL/DH in TR38.901. The discussion on the parameters to use for UMi/UMa/IOO can take place in the next meeting.  CATT-v2: For absolute time of arrival model for IOO model, as IOO layout has 12BSs per 120m x 50m, Inter-gNB distance= 20m, then IOO has similar hall size and ISD as InF scenarios and it could therefore be reasonable to reuse the same parameters of the absolute time of arrival model for the InF model in Table 7.6.9-1 in 38.901 as follows, as least the following values of parameters for InF can be start point of the modelling of NLOS excess delay for IOO scenario,   |  |  |  |  | | --- | --- | --- | --- | | Scenarios | | InF-SL, InF-DL | InF-SH, InF-DH | |  |  | -7.5 | -7.5 | |  |  | 0.4 | 0.4 | | Correlation distance in the horizontal plane [m] | | 6 | 11 |   LG: Support and we are fine with leaving a note suggested from Vivo.  Lenovo. Motorola Mobility: Support Revision #4, with Vivo’s note  CATT-v3: As suggested by vivo, I am fine to delete the last row in the table as we don’t need consider correlation distance when modeling absolute time of arrival model. Maybe we can reuse the same parameters of the absolute time of arrival model of InF scenario as that of IOO scenario, as shown in the table below:   |  |  |  |  | | --- | --- | --- | --- | | Scenarios | | InF-SL, InF-DL  InF-SH, InF-DH | IOO | |  |  | -7.5 | -7.5 | |  | 0.4 | 0.4 |   Intel: Support. Suggest to modify last sentence as follows: scenario(s) defined in TR 38.855 can be considered as optional scenarios without modifications.  Sony: The current version says “optional scenario” then it sounds like there is mandatory scenario for the evaluation of commercial requirements. The sentence has already said “considered” and this is sufficient. We propose these wording: ….can be considered ~~as optional scenarios~~  or … can be considered ~~as optional scenarios~~ without modifications.  Ericsson: If all scenarios have to be kept in the proposal, then we prefer to add the note suggested by vivo. We are ok with the table proposed by CATT-v3.  Qualcomm-v2: support CATT-v3 proposal of extending the absolute time of arrival model to IOO. However, removing the correlation distance even for existing InF scenarios should be discussed separately as it may depend on the application of spatial consistency, which we think is important for the mobility scenario discussed in Proposal 5.1-3. |

FL Comments

Based on the feedback, all companies are supportive to the proposal. IOO scenario is specically mentioned by a number of companies, so suggest remove the bracket for IOO scenario. About the adding the note: “Note: Target positioning requirements may not necessarily be reached for all scenarios”, yes, we could do it here or in Proposal 2.1-1. If Proposal 2.1-1 is agreed, then the note here can be removed. About Intel and Sony’s comment on adding “without modifications”, we assume this does not mean we cannot consider the absolute time of arrival models for these scenarios.

### Proposal 6.1-1 (Revision#5)

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| **Proposals** | **Description** | **Comments** |
| **Proposal 6.1-1** | Revision #5   * In Rel-17 SI for the evaluation of the positioning enhancements for commercial use cases, no baseline scenario is defined. IOO, [UMi, UMa]scenario(s) defined in TR 38.855 can be considered as optional scenarios without modifications. * FFS: absolute time of arrival model for UMi, UMa and IOO scenarios | CATT: Support.  CEWiT: We believe IOO and UMi can be studied as optional as per TR 38.855. Support this proposal  Nokia/NSB: Support.  Qualcomm: We disagree with the change of removing brackets only for IOO. As the proposal says no baseline is defined, all scenarios IOO/UMi/Uma should be regarded as equally important. Otherwise, it promots IOO unecessarily over other scenarios. |

### Proposal 6.1-2 (New)

FL Comments

Based on the feedback in the discussion of Proposal 6.1-1, there is a need to define absolute time of arrival model for the evaluation scenario(s) (e.g., UMi, UMa, IOO) if they are adopted for the evaluation of the positioning performance. For the IOO scenario, it is proposed to have the same absolute time of arrival model as InF scenarios.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 6.1-2** | * For the absolute time of arrival model of IOO scenario, the and are defined in the table below:  |  |  |  | | --- | --- | --- | | Scenarios | | IOO | |  |  | -7.5 | |  | 0.4 |  * FFS: the correlation distance for the absolute time of arrival model of IOO scenario | CATT: Support.  CEWiT: We can discuss this proposal in next meeting  CATT-v2: Since RAN1 had agreed to model absolute time of arrival for InF scenarios, it is critical to model it for IOO scenarios when IOO is selected as the scenario for Commercial use cases. In our point of view, it is important to have a common understanding on how to model the absolute time of arrival for the massive performance evaluation task of Rel-17 Positioning before August meeting. Therefore, we hope Proposal 6.1-2 is acceptable to all companies to facilitate the future evaluation task. To address Qualcomm’s comments in Proposal 6.1-1 Revision #4, we want to say the table in left column is only for modelling of absolute time of arrival model of IOO scenario, the correlation distance in the deleted row can be continued to discuss in Proposal 5.1-3. We can keep it if spatial consistency is agreed to model.  Nokia/NSB: We agree that this modeling is important but feel that given the time constraint it may be difficult to agree on this. As FL has pointed out the model for InF was discussed for a long time and tailored to the specific scenario. We don’t think it is appropriate to quickly agree to this here.  CATT-v3: About the reason why we suggest to reuse the same parameters of the absolute time of arrival model for the InF model in Table 7.6.9-1 in 38.901, we want to clarify that as IOO layout has 12BSs per 120m x 50m, Inter-gNB distance= 20m, then IOO has similar hall size, the number of BS and ISD as InF scenarios, it could therefore be reasonable to reuse the same parameters of the absolute time of arrival model for the InF model as shown in the table in Proposal 6.1-2.  Qualcommm: agree with Nokia/NSB. We don’t need to rush for an agreement on this model, especailly this is already listed as FFS in Proposal 6.1-1. |

### Proposal 8.1-3

FL Comments

In previous discussion, all companies are supportive to the main bullet of the Proposal 8.1-3 (Revision #3) [1]. One company made a comment to reword of the note, saying RAN1’s discussion will only focus on physical layer latency. Given that the main bullet says “Both Physical layer and higher layer positioning latency can be evaluated”, it would not better to remove “only”, but “RAN1 discussions focus on physical layer latency”, which we assume is the common understanding anyway.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 8.1.-3** | Revision #4   * Both Physical layer and higher layer positioning latency can be evaluated through analysis and, optionally, numerical evaluation.   + Note: RAN1 discussions focus on physical layer latency.   + Note: RAN2 may need to be involved for higher layer latency analysis | CATT: Support.  OPPO: Ok  Huawei/HiSilicon: OK.  vivo:Support  ZTE: OK.  Fraunhofer: Support  Nokia/NSB: Support.  Qualcomm: With regards to the additional first Note: We don’t see the need to be so definite that RAN1 cannot have views on high layer signaling. This is a RAN1-led SI, and we need to think about the overall latency reduction. Even if RAN1 reduces the triggering/processing/reporting to a few msec, if the high layer latency is 100+ msec, then the targets would not be met. At this point, the discussion needs to stay generic and after the conclusions are written of the SI, during the WID discussions, delegation of topics to each WG can happen more effectively (e.g. RAN2 work on high layer enhancements to achieve low latency and RAN1 to work on physical layer enhancements to achieve low latency).  LG: Support.  Lenovo, Motorola Mobility: Generally supportive of Revision#4, but we also share Qualcomm’s view about the first Note, in not excluding RAN1’s understanding of the overall positioning impacts to latency and this can be achieved with close co-coordination with other WGs, e,g. RAN2.  Intel: OK  Sony: Support  Ericsson: We disagree with the comment from Qualcomm. We prefer to keep the first Note. In order to get a meaningful picture of the overall latency including higher layer signaling, RAN1 will have to consult e.g. RAN2 or RAN3. Of course we can take into account the full latency budget to assess how much the physical layer latency can be, but we cannot lead the discussion on evaluating the higher layer latency. |

### Proposal 8.1-3 (Revision#5)

FL Comments

All companies are supportive to the main bullet of the Proposal 8.1-3. But, there are different views on the first note. In our view, RAN1 focus should be on the analysis of physical layer latency, which does not mean RAN1 cannot discuss higher layer positioning latency.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 8.1.-3** | Revision #5   * Both Physical layer and higher layer positioning latency can be evaluated through analysis and, optionally, numerical evaluation.   + Note: RAN1 discussions focus on physical layer latency (It does not imply RAN1 cannot discuss high layer latency)   + Note: RAN2 may need to be involved for higher layer latency analysis | CATT: Support.  CEWiT: We support the proposal  Nokia/NSB: Support.  Qualcomm: we can not agree on the first note. The reasons are explained in our last reponse. |

### Proposal 8.1-5

FL Comments

Most companies are supportive to the proposal 8.1-5 Revision #3 [1], while one company suggests emphasizing the evaluation of UE power consumption is optional, which is actually clearly covered in Revision #3. The comment also suggests using the model developed in TR 38.840 as baseline model for the evaluation. But, TR 38.840 actually does not define the UE power consumption model for DL PRS processing and UL SRS for positioning. Thus, it would be better to simply suggest interested companies to use the UE power consumption models in TR 38.840 as the starting points to define the UE power consumption model suitable for NR positioning, but not spend the time to discuss the common model in this SI.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 8.1.-5** | Revision #4   * UE power consumption for NR positioning can be evaluated in the SI. * Note: It is up to each company on how to evaluate the power consumption for positioning. The UE power consumption models developed in TR38.840 can be used as the starting point for defining the UE power consumption model for the evaluation for NR positioning. | CATT: Support.  OPPO: ok  Huawei/HiSilicon: OK.  vivo:Support  ZTE: OK.  Fraunhofer: Support  Nokia/NSB: Support but the last sentence of the note seems not needed. If it is up to individual companies then they can do what they like.  Qualcomm: OK.  LG: Support, but we have not discussed if the UE power consumption models in TR 38.840 is applicable to PRS measurement and PRS processing, so we suggest to remove the last sentence, or we have a modified suggestion for this sentence. “The UE power consumption models developed in TR38.840 can be ~~used~~considered as the starting point for defining the UE power consumption model for the evaluation for NR positioning.”  Lenovo, Motorola Mobility: Support.  Intel: OK  Sony: Support  Ericsson: we want to confirm that evaluation of UE power consumption is optional. We support keeing the last sentence. If completely leaving the power consumption model to each company, how will we compare the evaluations from different companies. If we want to get any meaningful outcome from these evaluations, it is better to start with a common model. The model in TR38.840 is a good starting point. But we suggest to add another sentence to the note saying ‘To take into account PRS measurement and PRS processing, further modifications to the model in 38.840 can be FFS’ |

### Proposal 8.1-5 (Revision #5)

FL Comments

Most companies are supportive to the proposal 8.1-5, but there are suggestions on the modification. One comment wants to confirm that evaluation of UE power consumption is optional. We assume all these comments are already covered in proposal, but we can make this clearer. One comment suggests add “To take into account PRS measurement and PRS processing, further modifications to the model in 38.840 can be FFS”. We assume this is not needed, since the note has clearly states the models in TR38.840 can be considered as the starting point for defining the model for NR positioning. Thus, from the nore it is clear we need to modify the model in 38.840 and the modification will take NR positioning into account.

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| **Proposals** | **Description** | **Comments** |
| **Proposal 8.1.-5** | Revision #5   * UE power consumption for NR positioning can be optionally evaluated in the SI. * Note: It is up to each company on how to evaluate the power consumption for positioning. The UE power consumption models developed in TR38.840 can be considered as the starting point for defining the UE power consumption model for the evaluation for NR positioning | CATT: Support.  CEWiT: Support  Nokia/NSB: ok.  Qualcomm: support. |

### Proposal 8.1-5 (Proposed Offline Consensus)

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| **Proposals** | **Description** | **Comments** |
| **Proposal 8.1-5** | * UE power consumption for NR positioning can be optionally evaluated in the SI. * Note: It is up to each company on how to evaluate the power consumption for positioning. The UE power consumption models developed in TR38.840 can be considered as the starting point for defining the UE power consumption model for the evaluation for NR positioning |  |

# TR skeleton for TR 38.857

The skeleton for TR 38.857 [2] was discussed in the meeting [1]. Based on the comments, an update version is provided in the draft folder “[R1-20NNNN skeleton for TR38857 v001.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_101-e/Inbox/drafts/8.2%20Study%20on%20NR%20Positioning%20Enhancements/R1-20NNNN%20skeleton%20for%20TR38857%20v001_ericsson.docx)” by TR Rapporteur. Interested companies are encouraged to provide further comments to the revised TR skeleton.

Comments

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| **Company** | | **Comments** |
|  | Huawei/HiSilicon | According to SID  1b. Evaluate the achievable positioning accuracy and latency with the Rel-16 positioning solutions in (I)IoT scenarios and identify any performance gaps. [RAN1]  The section 8.1 should be limited to IIoT cases. Suggest to change it to “Performance analysis of Rel-16 positioning solutions for IIoT use case” |
|  | vivo | For the 1b Evaluate the achievable positioning accuracy and latency with the Rel-16 positioning solutions in (I)IoT scenarios and identify any performance gaps. [RAN1]  We think may include IoT, it better for (I)IoT scenarios. |
|  | Nokia/NSB | To Huawei and vivo: From SID  1a. Define additional scenarios (e.g. (I)IoT) based on TR 38.901 to evaluate the performance for the use cases (e.g. (I)IoT).  We don’t think it is right to limit Section 8.1 to IIoT at this stage. (I)IoT is given as one example but the justification section of the SID and the main bullet of objective one are clear that general commercial use cases are included. We can discuss later in the SI what is included in section 8.1 or not. |
|  | Huawei/HiSilicon | From the reading, objective 1b was cited under section 8.1, which means that section 8.1 serves for objective 1b. If general commercial requirement is important, we suggest Nokia to propose another section in the TR.  To us, a dedicated section for the explicit objective 1b is important, which should be one of the main target of the SI. |
|  | Ericsson | We agree with Nokia. if the rapporteur note is not clear, it can be reworded to include the header section of objective 1, or removed altogether. It is true that objective 1b does not mention explicitely commercial use cases. However based on the cited paragraph below, the commercial use case is part of the study. Therefore evaluation for commercial AND IIOT cases do qualify for inclusion in section 8.   * + - * 1. Study enhancements and solutions necessary to support the high accuracy (horizontal and vertical), low latency, network efficiency (scalability, RS overhead, etc.), and device efficiency (power consumption, complexity, etc.) requirements for commercial uses cases (incl. general commercial use cases and specifically (I)IoT use cases as exemplified in section 3 above (Justification)) |
|  | Huawei/HiSilicon | Reply to E///, then we suggest to add another to section include evaluation for general commercial use case.   * + - * I can imagine what section 8.1 would look like after the SI; it will be even worse if evaluation for general commercial use case is minged with that. |
|  | CEWiT | Agree with Nokia not to limit section 8.1 to only IIoT use cases. Both commercial and IIoT use cases should be included in this section. But for more clarity perspective 8.1 can devided into further sub sections for IIoT and commercial use cases. |
|  | Nokia/NSB2 | Reply to Huawei. Again, what is eventually included in the Section is up to further discussion. Any sub-objective of a main objective clearly also needs to take into account the main objective (as highlighted by E///). For progress if needed we can have two subsections 1 for IIoT and 1 for commercial use cases but don’t really see this as critical at this stage.We can always add another sub-section later if needed. |

# Summary of Proposals

## 4.1 Interim Summary (6/11)

Based on the email discussion from 6/8 to 6/10, the following proposals seem stable. They are suggested for the early approvals (6/11).

* **Proposal 2.1-1 (**Proposed Offline Consensus)**: Rel-17 target positioning requirements**
* **Proposal 5.1-3(**Proposed Offline Consensus)**: (Optional) UE mobility model**
* **Proposal 8.1-5(**Proposed Offline Consensus)**: Evaluation of UE power consumption**

Notes:

* For Proposal 2.1-2: Metric of positioning accuracy requirements, it is merged to Proposal 2.1-1;
* For Proposal 4.1-4: (Optional) hand blockage model in evaluation, it seems unlikely to reach consensus in this meeting to support the option. We may further discuss whether and how to indicate the fact that this option is not supported.

We will continue the discussion of the remaining proposals and TR 38.857 skeleton until (6/17).

1. References
2. R1-2005049 FL Summary #4 for NR Positioning Enhancements CATT
3. R1-2004649 TR skeleton for TR 38.857 Ericsson
4. RP-193237, “New SID on NR Positioning Enhancements”, Qualcomm Incorporated, Sitges, Spain, December 9th – 12th, 2019
5. [R1-2003284](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003284.doc) IIoT Scenarios for Positioning Futurewei
6. [R1-2003295](file:///E://1%20Meetings//RAN1//2020%2005_TSRR1_101//Inbox//R1-2003295.doc) Discussion on scenarios and evaluation methodology for Rel-17 positioning Huawei, HiSilicon
7. [R1-2003427](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003427.doc) Discussion on additional scenarios for NR positioning evaluation vivo
8. [R1-2003479](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003479.doc) Additional scenarios for evaluation on positioning enhancements ZTE
9. [R1-2003640](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003640.doc) IIoT use cases and scenarios for evaluation of NR Positioning Enhancements CATT
10. [R1-2003719](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003719.doc) Additional scenarios for evaluation of NR positioning Nokia, Nokia Shanghai Bell
11. [R1-2003767](file:///E://1%20Meetings//RAN1//2020%2005_TSRR1_101//Inbox//R1-2003767.doc) I-IoT scenarios for NR positioning evaluations Intel Corporation
12. [R1-2003906](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003906.doc) Additional scenarios for evaluation Samsung
13. [R1-2003963](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003963.doc) Discussions on IIoT scenarios for positioning CMCC
14. [R1-2004063](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004063.doc) Discussion on Scenarios for Evaluation OPPO
15. [R1-2004141](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004141.doc) Discussion on additional scenarios for evaluation LG Electronics
16. [R1-2004190](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004190.doc) Considerations on Scenarios for Evaluations of IIoT Positioning Sony
17. [R1-2004199](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004199.doc) View on scenarios and evaluation parameters for Rel 17 positioning enhancement CEWiT
18. [R1-2004490](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004490.doc) Considerations on Additional Scenarios for Evaluation Qualcomm Incorporated
19. [R1-2004517](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004517.doc) Additional scenarios and considerations for NR positioning Fraunhofer IIS, Fraunhofer HHI
20. [R1-2004650](file:///E:\\1%20Meetings\\RAN1\\2020%2005_TSRR1_101\\Inbox\\R1-2004650.doc) Additional scenarios for performance evaluations , Ericsson
21. [R1-2003296](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003296.doc) Performance evaluation for Rel-17 positioning Huawei, HiSilicon
22. [R1-2003428](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003428.doc) Evaluation of achievable accuracy and latency for NR positioning enhancements vivo
23. [R1-2003480](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003480.doc) Evaluation results of additional scenarios for positioning ZTE
24. [R1-2003547](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003547.doc) Evaluation of Rel-16 Positioning for IIoT Futurewei
25. [R1-2003641](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003641.doc) Discussion of evaluation of NR positioning performance CATT
26. [R1-2003668](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003668.doc) Evaluation of DL-AoD technique under IIoT scenario MediaTek Inc.
27. [R1-2003720](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003720.doc) Views on evaluation of achievable positioning accuracy and latency Nokia, Nokia Shanghai Bell
28. [R1-2004725](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004725.doc) Initial analysis of NR positioning performance in I-IoT scenarios Intel Corporation
29. [R1-2003907](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003907.doc) Evaluation of achievable positioning accuracy and latency Samsung
30. [R1-2003964](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003964.doc) Discussions on evaluation methodology of latency CMCC
31. [R1-2004064](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004064.doc) Evaluation of NR positioning in IIoT scenario OPPO
32. [R1-2004191](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004191.doc) Considerations on Evaluation of Positioning Accuracy and Latency Sony
33. [R1-2004491](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004491.doc) Initial Evaluation of achievable Positioning Accuracy & Latency Qualcomm Incorporated
34. [R1-2004518](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004518.doc) Evaluation of positioning enhancements Fraunhofer IIS, Fraunhofer HHI
35. [R1-2004651](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004651.doc) Evaluation of Achievable Positioning Accuracy and Latency Ericsson
36. [R1-2003585](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003585.doc) Additional Guidelines for RAN1#101 e-Meeting Management RAN1 Chair