**3GPP TSG RAN WG1 Meeting #101-e R1-2005188**

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

**Source: Moderator (CATT)**

**Title: Summary #2 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 (R1-2005102):

* **Proposal 4.1-3: (Optional) UE RX/TX timing error for antenna panel**
* **Proposal 4.1-4: (Optional) hand blockage model in evaluation**
* **Proposal 5.1-8: (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**
* **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 R1-2005102[1] for the previous discussions of proposals.

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.

|  |  |  |
| --- | --- | --- |
| **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.

|  |  |  |
| --- | --- | --- |
| **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   Ericsson: Our original proposal was to only consider FR2 where the UE is likely to have multiple UE panels with different group delays. But as a few other companies pointed out, group delays also exist in FR1 and also at the gNB side. This is the reason the proposal got expanded to cover both FR1/FR2 and UE/gNB timing errors. We are fine to leave the values of T1 as X and Y for now as proposed by QC. Depending on what we choose for X and Y, the following scenarios are possible to evaluate:   1. **In FR1 considering timing errors only at the UE**: In this case, the UE will likely only have a single panel and will perform measurements using the same panel. There is no impact on TDOA measurements since the timing error will be cancelled during measurements. But the error may impact Rx-TX measurements. 2. **In FR1 considering timing errors at both the UE and the TRPs**: Similar to case a), Rx-Tx measurements may be impacted by the timing error. But considering timing errors at TRPs will also likely impact TDOA measurements as the different TRPs may likely have different timing errors. 3. **In FR2 considering timing errors only at the UE**: In this case, the UE may be equipped with multiple panels with different group delays per panel. Depending on which panels are used for measurements, Rx-Tx and TDOA measurements may all get impacted by the different group delays in the UE panels.   **In FR2 considering timing errors at both the UE and the TRPs**: In this case, timing errors will be different at different UE panels and also different TRPs. Hence, Rx-Tx and TDOA measurements may all get impacted by the different group delays in the UE panels and in TRPs. |

Proposal 4.1-3 (Revision #3)

FL Comments

In previous discussion, there are comments on keeping the T1 values as FFS. An updated proposal is provided based on the comments.

|  |  |  |
| --- | --- | --- |
| **Proposals** | **Description** | **Comments** |
| **Proposal 4.1-3** | * (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: X, Y * Note: RX and TX timing errors are generated per panel independently | CATT: Support.  Huawei/HiSilicon: OK.  Intel: Support  vivo：Support  Nokia/NSB: Ok.  Ericsson: OK  Qualcomm: We are Ok with the changes. We just think that there is still some clarifications that are needed though: how are these random variables being applied? For example, in DL-only positioning, a UE receives PRS from multiple TRPs. If these are close in time (which likely they are), the Rx timing error of a antenna/panel would be the same amongst all the PRS, so the random variable of Rx-error would be the same (single sample for all the measurements). Similarly, if the UE transmits single SRS in UL, there is clearly single Tx timing error, so the different RTOA measurements in the TRPs are not indepedently perturbed by a different Tx-timing-error random variable. Not sure there is time to decide these details now, and since T1 values are set to “X,Y” with FFS, we suggest to add one more FFS:  FFS: Details on how the Rx and Tx timing errors are applied  ZTE: Support in principle. Agree with QC on how to apply this model.  OPPO: share the same view as ZTE. Ok with the proposal in principle and the view from QC is necessary.  Huawei/HiSilicon0616: To QC/all, regarding QC’s comments, our understanding is that in the baseline evaluation a single Rx time error and a single Tx time error are applied per drop per UE/gNB throughout the time evolution. Indeed there could be real time drift, but without providing statistic information on time coherence or drift rate, it does not make much of alignment between companies when it comes to a common evaluation assumption. Therefore, our suggestion is as follows   * Note: RX and TX timing errors are generated per panel independently and are fixed throughout the entire time evolution as the baseline   Fraunhofer: Support  CEWiT: Our understanding this proposal is to have fix Rx and Tx timing error per UE /gNB per panel and fix for simulation duration. So agree with Huawei’s modification on note. |

FL Comments

All feedbacks are supportive to Proposal 4.1-3 (Revision #3). For the comments from QC/ZTE/OPPO on adding an “FFS: Details on how the Rx and Tx timing errors are applied”, Huawei’s response “applied per drop per UE/gNB” seems reasonable. However, given that we may not have the time to have another round email discussion on the response to this FFS, I would suggest adding “FFS: how the Rx and Tx timing errors are applied” for now and discuss the exact wording to address the issue in the next meeting.

### Proposal 4.1-3 (Revision #4)

|  |  |  |
| --- | --- | --- |
| **Proposals** | **Description** | **Comments** |
| **Proposal 4.1-3** | * (Optional) The UE/gNB RX and TX timing error, in FR1/FR2, can be modeled 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: X, Y * Note: RX and TX timing errors are generated per panel independently * FFS: how the Rx and Tx timing errors are applied | Huawei/HiSilicon: As proposed earlier, we suggest to remove the last FFS and replace the last Note with   * Note: RX and TX timing errors are generated per panel independently and are fixed throughout the entire time evolution as the baseline |

Proposal 4.1-4

FL Comments

In the previous discussion, the number of companies (4) that are supportive of 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 the hand blockage model, and the SI may not 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.

|  |  |  |
| --- | --- | --- |
| **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.  The following are copied from the email discussions:  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 (e.g. TR captures hand blockage is not studied during SI …. and no further discussion … we move on).  FL: About the suggestion to make an agreement on “TR to capture hand blockage is not studied during SI”, in general, TR may not need to capture the list of issues that are not considered in the simulation assumption, e.g., TR 38.855 does not provide the list of issues (e.g., the hand/human body blockage) not considered in the simulation assumptions. But, I assume this can be discussed in the next meeting when we work on TP. In this meeting, we are focusing on the simulation assumptions that need to be considered. One way to handle this might be adding a row in the table of the simulation assumption, indicating “hand blockage = 0dB” or “hand and human body blockage = 0dB”. I assume this assumption is valid especially for IIoT scenarios when the UE is not handhold by a human.  Sony: As a compromise and also to make a progress, your suggestion to make an additional row indicating “hand/human body blockage=0dB” could be as a way forward. |

FL Comments

Based on the feedback, most companies support FL suggestion of no further discussion of modeling hand blockage in this meeting. One possible way to address Ericsson and Sony’s comments might be adding a row in the table of the common scenario parameters applicable for all scenarios, indicating “hand blockage = 0dB” or “hand and human body blockage = 0dB”.

### Proposal 4.1-4 (Revision #1)

|  |  |  |
| --- | --- | --- |
| **Proposals** | **Description** | **Comments** |
| **Proposal 4.1-4** | (Revision #1)  Add the following row to the table of “Common scenario parameters applicable for all scenarios”:   |  |  |  | | --- | --- | --- | |  | **FR1 Specific Values** | **FR2 Specific Values** | | hand and human body blockage | 0dB | 0dB | | CATT: Support.  Huawei/HiSilicon: OK  Intel: 0 dB means no blockage, so we don’t see the reason for discussing it and propose not to add any information about hand and human body blockage  vivo：Support  Nokia/NSB: Similar comment as Intel. We do not need to list all the things we are not modeling as 0 values. Don’t support.  Ericsson: Support  Qualcomm: We don’t think it is necessary but we could accept it.  ZTE: Not necessary.  OPPO: Not necessary. Modeling blockage = 0dB is equal to not modeling. Then why do we model that?  SONY: Support  Fraunhofer: Not needed.  CEWiT: Do not understand the purpose of this proposal. If it means not to model then no need of this proposal.  LG: Support |

FL Comments

The feedback shows 5 companies support the proposal, while 5 companies do not. Based on the feedback, it seems we may not be able to reach a consensus on this proposal in this meeting.

Offline Conclusion

* No offline consensus on Proposal 4.1-4 (Revision #1).

### Proposal 5.1-8

FL Comments

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

|  |  |  |
| --- | --- | --- |
| **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.  Fraunhofer: Support.  LG: We have no strong view on this proposal,but we are fine with as an optional scenario. |

FL Comments

Similar to the previous discussion, five companies are supportive of the proposal, three companies don’t support, and three companies do not have a strong view. Based on the feedback, it seems we may not be able to reach a consensus on this proposal in this meeting.

Offline Conclusion

* No offline consensus on Proposal 5.1-8.

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.

|  |  |  |
| --- | --- | --- |
| **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 specifically mentioned by several companies, so suggest remove the bracket for IOO scenario. About 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)

|  |  |  |
| --- | --- | --- |
| **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.  Ericsson: we would like to remove ”without modification”from the first bullet, as it seem to contradict the FFS. Otherwise the proposal is okay. |

FL Comments

From the comments received the interest to evaluate the positioning performance of commercial scenarios is low, and so far no company has explicitly says it plans to evaluate all of the commercial scenarios. So, it is unclear whether it is necessary to spend time discussing the additional model, e.g., the absolute time of arrival models for all of the scenarios.

### Proposal 6.1-1 (Revision#6)

|  |  |  |
| --- | --- | --- |
| **Proposals** | **Description** | **Comments** |
| **Proposal 6.1-1** | In Rel-17 SI for the evaluation of the positioning enhancements for commercial use cases, no baseline scenario is defined. UMi, UMa and IOO scenario(s) defined in TR 38.855 can be considered as optional scenarios without modifications of existing configuration parameters.  FFS: absolute time of arrival model for UMi, UMa and IOO scenarios | CATT: Support.  Huawei/HiSilicon: OK.  Intel: Support the first bullet. Propose to delete the second bullet with FFS since we don’t see the reasons for modification of channel models in Rel-16 scenarios.  vivo：Support  For the second bullet，we think the evaluation in R16 without absolute time for NLOS is not realistic. And this is the reason for us to re-evaluate the accuracy  Nokia/NSB: Okay.  Ericsson: support. We agree with vivo on the addition of absolute time of arrival for NLOS, which is critical to obtain realistic performance evaluation at high accuracy levels.  Qualcomm: OK  ZTE: Support.  OPPO: Ok  Sony: Support  Fraunhofer: Ok  CEWiT: Okay with proposal and FFS bullet is important as explained by vivo and Ericsson  LG: Support |

FL Comments

10 companies are supportive of Proposal 6.1-1 (Revision #6), 1 company is supportive of the main bullet, but proposes to remove the bullet: “FFS: absolute time of arrival model for UMi, UMa and IOO scenarios”. Given that the bullet is “FFS”, and most companies prefer keeping it, it would be better to keep it. Hopefully, the proposal can be accepted by all.

### 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 the 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.

|  |  |  |
| --- | --- | --- |
| **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.  CATT-v4: We hope Proposal 6.1-2 is acceptable to all companies to facilitate the performance evaluation task of commerial use caes before August meeting.  Huawei/HiSilicon: We do not really think it is really important. Instead of modeling additional delay which only has negative impact on positioning in IOO compared to Rel-16, we should focus more on e.g. wall reflection, ground reflection, that can make use of the reflecting path to better localize UE. It is strange that Rel-17 IOO will suffer from negative impact on modelling additional TOA for NLOS yet achieving a better accuracy target than Rel-16.  Intel: We don’t support the proposal and assume that commercial use cases can be evaluated reusing Rel-16 scenarios.  Ericsson: we can agree to the model, but leave the number FFS for the next meeting.  ZTE: FFS in the next meeting.  OPPO: prefer to FFS for next meeting  Sony: Re-use the scenario as in Rel-16 or at least FFS in the next meeting.  Fraunhofer: we are fine applying the ATOA model for other scenarios including IOO. There is no need now to determine or agree on parametes not included in TR38.901.  CATT-v5: Since majority support FFS in the next meeting, we can accept to further discuss this issue in August meeting. However, we want to remind that it is very impotant to model absolute time of arrival for IOO scenario, which is missed in the evaluation phase of Rel-16 positioning.  LG: We prefer to keep FFS and discuss it for the next meeting. |

FL Comments

There are diverged views on Proposal 6.1-2. Based on the feedback, it seems we may not be able to reach a consensus to this proposal in this meeting.

Offline Conclusion

* No offline consensus on Proposal 6.1-2.

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.

|  |  |  |
| --- | --- | --- |
| **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.

|  |  |  |
| --- | --- | --- |
| **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.  Ericsson: we do not agree with this proposal. Our preference is with the revision 4 of this proposal (see our previous comments). |

Proposal 8.1-3 (Revision#6)

FL Comments

We should separate the evaluation of positioning delays and the investigation of new positioning techniques that may potentially reduce positioning latency. For the evaluation of positioning delays of existing technologies, RAN1’s focus should only be on physical layer latency, which is also clearly presented in the SID. For the investigation of new positioning techniques for reducing positioning latency, my understanding is that RAN1’s investigation is not limited to the methods for reducing physical latency.

|  |  |  |
| --- | --- | --- |
| **Proposals** | **Description** | **Comments** |
| Proposal 8.1.-3 | Both Physical layer and higher layer positioning latency can be evaluated through analysis and, optionally, numerical evaluation.   * Note: For the evaluation of positioning delays, RAN1 discussions focus on physical layer latency. * Note: For the investigation of positioning enhancements, RAN1’s discussion is not limited to the potential reduction of the physical layer. latency, but also the high layer latency. * Note: RAN2 may need to be involved for higher layer latency analysis | CATT: Support. We prefer both RAN1 and RAN2 should be involved in the evaluation and investigation of positioning latency.  Huawei/HiSilicon: To our understanding, not all higher layer delay analysis can be evaluated by RAN2 or even RAN3, e.g. some fall into expertise of SA2. It is very difficult to model or evaluate the positioning service delay. There has been precedent in Rel-16. RAN1 should not take it for granted that thing cannot done in RAN1 can and will be done by RAN2. Suggest to remove the third note.  Intel: Support  vivo：Support  Nokia/NSB: Support. We agree with Huawei that even other WGs could have expertise here. We would be okay to change the third note to be “RAN2 (or other WGs)” if this addresses their concern. The other WGs do not have TUs for this SI so that is why we suggested to have RAN2 only at first.  Ericsson: We still have the same concern with the second note, which put the responsibility of investigating higher layer latency on RAN1.  Qualcomm: We believe adding all these notes, would confuse the discussion. Agreeing that in Rel-17 we would evaluation both physical and End-to-end latency is a good start. Keeping the first sentence should be enough at this point, and add: “FFS: Details”.  ZTE: Support.  OPPO: Ok with the main bullet. However, the sub-bullets are confusing. We are ok with QC’s suggestion to keep the first sentence and add FFS details.  Sony: Same view as Qualcomm.  Fraunhofer: Support  CEWiT: Fine with proposal. |

FL Comments

It seems there are still different opinions on Proposal 8.1-3 (Revision#6) around the evaluation of the high-layer latency. It seems unlikely to address all opinions in this email discussion. Given that it is clear that RAN1 needs to evaluate the physical layer positioning latency as defined in SID, it would be better for us to separate the discussion of the evaluation of the physical layer latency and the higher-layer latency. In addition, we also need to discussion the method for the evaluation of the high-layer as well as which layers should be evaluated if we want to work on the evaluation for the higher layer positioning latency.

### Proposal 8.1-3 (Revision#7)

|  |  |  |
| --- | --- | --- |
| **Proposals** | **Description** | **Comments** |
| Proposal 8.1.-3(a) | Physical layer latency can be evaluated through analysis and, optionally, numerical evaluation. | CATT: Support.  Huawei/HiSilicon: OK  vivo：OK  LG: Support |
| Proposal 8.1.-3(b) | Higher layer positioning latency can be evaluated in this SI.   * FFS: how to evaluate higher-layer positioning latency * FFS: which higher-layers should be included in the evaluation | CATT: Support.  Huawei/HiSilicon: OK  vivo：OK  LG: Support |

# 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

|  |  |  |
| --- | --- | --- |
| **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

Based on the email discussion, the proposals in the following Table 4-1 seem stable. They are suggested for approvals.

**Table 4-1: Proposals suggested for Approvals**

|  |  |
| --- | --- |
| Proposals | **Description** |
| Proposal 4.1-3 (Revision #4) | * (Optional) The UE/gNB RX and TX timing error, in FR1/FR2, can be modeled 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: X, Y   + Note: RX and TX timing errors are generated per panel independently   + FFS: how the Rx and Tx timing errors are applied |
| Proposal 6.1-1 (Revision#6) | * In Rel-17 SI for the evaluation of the positioning enhancements for commercial use cases, no baseline scenario is defined. UMi, UMa and IOO scenario(s) defined in TR 38.855 can be considered as optional scenarios without modifications of existing configuration parameters. * FFS: absolute time of arrival model for UMi, UMa and IOO scenarios |
| Proposal 8.1-3 (Revision#7) (a) | * Physical layer latency can be evaluated through analysis and, optionally, numerical evaluation. |
| Proposal 8.1-3 (Revision#7) (b) | * Higher layer positioning latency can be evaluated in this SI.   + FFS: how to evaluate higher-layer positioning latency   + FFS: which higher-layers should be included in the evaluation |

There is no offline consensus in the discussion of the following proposals.

* **Proposal 4.1-4: (Optional) hand blockage model in evaluation**
* **Proposal 5.1-8: (Optional) Base station spacing**
* **Proposal 6.1-2(new): Absolute time scenario(s) for commercial use cases**

In addition, the revise TR Skeleton [R1-20NNNN skeleton for TR38857 v001\_ericsson.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) also seems stable and the clean version R1-200xxxx is suggsted to be endorsed.

1. References
2. R1-2005102 Summary of Email Discussion [101-e-Post-NR-Pos-Enh] CATT
3. R1-2005049 FL Summary #4 for NR Positioning Enhancements CATT
4. R1-2004649 TR skeleton for TR 38.857 Ericsson
5. RP-193237, “New SID on NR Positioning Enhancements”, Qualcomm Incorporated, Sitges, Spain, December 9th – 12th, 2019
6. [R1-2003284](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003284.doc) IIoT Scenarios for Positioning Futurewei
7. [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
8. [R1-2003427](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003427.doc) Discussion on additional scenarios for NR positioning evaluation vivo
9. [R1-2003479](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003479.doc) Additional scenarios for evaluation on positioning enhancements ZTE
10. [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
11. [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
12. [R1-2003767](file:///E://1%20Meetings//RAN1//2020%2005_TSRR1_101//Inbox//R1-2003767.doc) I-IoT scenarios for NR positioning evaluations Intel Corporation
13. [R1-2003906](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003906.doc) Additional scenarios for evaluation Samsung
14. [R1-2003963](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003963.doc) Discussions on IIoT scenarios for positioning CMCC
15. [R1-2004063](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004063.doc) Discussion on Scenarios for Evaluation OPPO
16. [R1-2004141](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004141.doc) Discussion on additional scenarios for evaluation LG Electronics
17. [R1-2004190](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004190.doc) Considerations on Scenarios for Evaluations of IIoT Positioning Sony
18. [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
19. [R1-2004490](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004490.doc) Considerations on Additional Scenarios for Evaluation Qualcomm Incorporated
20. [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
21. [R1-2004650](file:///E:\\1%20Meetings\\RAN1\\2020%2005_TSRR1_101\\Inbox\\R1-2004650.doc) Additional scenarios for performance evaluations , Ericsson
22. [R1-2003296](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003296.doc) Performance evaluation for Rel-17 positioning Huawei, HiSilicon
23. [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
24. [R1-2003480](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003480.doc) Evaluation results of additional scenarios for positioning ZTE
25. [R1-2003547](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003547.doc) Evaluation of Rel-16 Positioning for IIoT Futurewei
26. [R1-2003641](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003641.doc) Discussion of evaluation of NR positioning performance CATT
27. [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.
28. [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
29. [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
30. [R1-2003907](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003907.doc) Evaluation of achievable positioning accuracy and latency Samsung
31. [R1-2003964](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003964.doc) Discussions on evaluation methodology of latency CMCC
32. [R1-2004064](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004064.doc) Evaluation of NR positioning in IIoT scenario OPPO
33. [R1-2004191](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004191.doc) Considerations on Evaluation of Positioning Accuracy and Latency Sony
34. [R1-2004491](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004491.doc) Initial Evaluation of achievable Positioning Accuracy & Latency Qualcomm Incorporated
35. [R1-2004518](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004518.doc) Evaluation of positioning enhancements Fraunhofer IIS, Fraunhofer HHI
36. [R1-2004651](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004651.doc) Evaluation of Achievable Positioning Accuracy and Latency Ericsson
37. [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