**3GPP TSG RAN WG1 Meeting #101-e R1-** **200xxxx**

**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 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

# 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 |

### 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 |

### 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 |

### 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 |

### 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. |

### 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. |

### 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 5.1-8** | 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. |

### 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 |

### 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 |

# 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. |
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# Summary of Proposals

TBD

References

1. R1-2005049 FL Summary #4 for NR Positioning Enhancements CATT
2. R1-2004649 TR skeleton for TR 38.857 Ericsson
3. RP-193237, “New SID on NR Positioning Enhancements”, Qualcomm Incorporated, Sitges, Spain, December 9th – 12th, 2019
4. [R1-2003284](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003284.doc) IIoT Scenarios for Positioning Futurewei

1. [R1-2003295](E:\\1 Meetings\\RAN1\\2020 05_TSRR1_101\\Inbox\\R1-2003295.doc) Discussion on scenarios and evaluation methodology for Rel-17 positioning Huawei, HiSilicon
2. [R1-2003427](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003427.doc) Discussion on additional scenarios for NR positioning evaluation vivo
3. [R1-2003479](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003479.doc) Additional scenarios for evaluation on positioning enhancements ZTE
4. [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
5. [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

1. [R1-2003767](E:\\1 Meetings\\RAN1\\2020 05_TSRR1_101\\Inbox\\R1-2003767.doc) I-IoT scenarios for NR positioning evaluations Intel Corporation
2. [R1-2003906](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003906.doc) Additional scenarios for evaluation Samsung
3. [R1-2003963](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003963.doc) Discussions on IIoT scenarios for positioning CMCC
4. [R1-2004063](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004063.doc) Discussion on Scenarios for Evaluation OPPO
5. [R1-2004141](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004141.doc) Discussion on additional scenarios for evaluation LG Electronics
6. [R1-2004190](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004190.doc) Considerations on Scenarios for Evaluations of IIoT Positioning Sony
7. [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
8. [R1-2004490](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004490.doc) Considerations on Additional Scenarios for Evaluation Qualcomm Incorporated
9. [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

1. [R1-2004650](file:///E:\\1%20Meetings\\RAN1\\2020%2005_TSRR1_101\\Inbox\\R1-2004650.doc) Additional scenarios for performance evaluations , Ericsson
2. [R1-2003296](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003296.doc) Performance evaluation for Rel-17 positioning Huawei, HiSilicon
3. [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
4. [R1-2003480](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003480.doc) Evaluation results of additional scenarios for positioning ZTE
5. [R1-2003547](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003547.doc) Evaluation of Rel-16 Positioning for IIoT Futurewei
6. [R1-2003641](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003641.doc) Discussion of evaluation of NR positioning performance CATT
7. [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.
8. [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
9. [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
10. [R1-2003907](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003907.doc) Evaluation of achievable positioning accuracy and latency Samsung
11. [R1-2003964](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2003964.doc) Discussions on evaluation methodology of latency CMCC
12. [R1-2004064](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004064.doc) Evaluation of NR positioning in IIoT scenario OPPO
13. [R1-2004191](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004191.doc) Considerations on Evaluation of Positioning Accuracy and Latency Sony
14. [R1-2004491](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004491.doc) Initial Evaluation of achievable Positioning Accuracy & Latency Qualcomm Incorporated
15. [R1-2004518](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004518.doc) Evaluation of positioning enhancements Fraunhofer IIS, Fraunhofer HHI
16. [R1-2004651](file:///E:\1%20Meetings\RAN1\2020%2005_TSRR1_101\Inbox\R1-2004651.doc) Evaluation of Achievable Positioning Accuracy and Latency Ericsson
17. [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