3GPP TSG-RAN Meeting #90-eRP-20xxxx

Electronic Meeting, 7-11 December 2020

Agenda Item: 9.11

Source: Email discussion moderator (Intel)

Title: Report from Email Discussion [90E][06][Positioning\_WI\_scoping]

Document for: Discussion and decision

# 1 Introduction

This documents reports on the following email discussion during RAN#90-e:

**[90E][06][Positioning\_WI\_scoping]**

Goal: Generate an agreeable WID

Input contributions covered: 2214, 2266, 2305, 2325, 2558, 2586, 2639, 2653, 2664, 2754, 2351, 2709, 2710.

During the 'early items' webinar session on Monday the chair stated that the further discussion should focus on items where RAN1 can work unobstructed in Q1 2021 and that the WID can be updated at RAN#91 when the study item is completed in all WGs. Consequently, this email discussion is structured to focus on RAN1-centric objectives.

The rapporteur's proposal for the WID is contained in RP-202710. The discussion below is structured to collect company opinion on the proposed objectives. Finally, there is an opportunity to give opinion on RAN1 centric objectives that were not proposed to be included by the rapporteur, and also an opportunity to provide any other comments on the proposed WID. In providing feedback companies should keep mind what is a reasonable amount of work to include in the WI given the time that will be available, in particular considering that additional RAN1 work may be added as a result of the SI conclusion in other WGs.

## 2 Discussion

### 2.1 Mitigating UE Rx/Tx and/or gNB Rx/Tx timing errors

The rapporteur's proposed WID contains the following WID

* Specify the methods, measurements, signalling, and procedures of mitigating UE Rx/Tx and/or gNB Rx/Tx timing errors for improving positioning accuracy of NR RAT dependent positioning [RAN1]

Companies are invited to give feedback related to above objective. For the "Support [Yes/No]" column, companies are invited to indicate whether they generally support an objective on this topic; a company may indicate "Yes" in this column and still have more detailed comments on the wording, etc.

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| **Company** | **Support****[Yes/No]** | **Comments** |
| CATT | Yes |  |
| Futurewei | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Qualcomm | Yes | The wording of this objective should be better aligned with the RAN1 conclusions as summarized in section 11 of TR 38.857; e.g.:* Specify methods, measurements, signaling, and procedures for improving positioning accuracy by mitigating UE Rx/Tx and/or gNB Rx/Tx timing delays, including
	+ DL, UL and DL+UL positioning methods
	+ UE-based and UE-assisted positioning solutions
 |
| Intel | Yes |  |
| ZTE | Yes |  |
| OPPO | Yes | It is recommended by RAN1 for normative work  |
| Apple | Yes |  |
| InterDigital | Yes |  |
| vivo | Yes (if RAN4 is involved) | RAN4 may need to get involved to check whether UE Rx/Tx and gNB Rx/Tx timing delays can be monitored and calibrated for positioning purposes. So, we prefer to research it in RAN4 first. |
| Nokia | Yes |  |

### 2.2 UL AoA and DL-AoD

The rapporteur's proposed WID contains the following objective:

* Specify the procedure, measurements, reporting, and signalling for improving the accuracy of [RAN1]
	+ UL AoA for network-based positioning solutions.
	+ DL-AoD for UE-based and network-based (including UE-assisted) positioning solutions.

Note: RAN1 will discuss the candidate solutions and provide updates for this objective in RAN#91e.

Companies are invited to give feedback related to above objective. For the "Support [Yes/No]" column, companies are invited to indicate whether they generally support an objective on this topic; a company may indicate "Yes" in this column and still have more detailed comments on the wording, etc.

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| **Company** | **Support****[Yes/No]** | **Comments** |
| CATT | Yes | During the SI, different candidate approaches were proposed for the enhancements of angle-based positioning methods. However, due to the time constraint of the SI, it is undecided on which of them should be adopted for the WI [16]. At the start of the WI, we may need to decide more specifically on which of the approaches will be adopted to narrow down the WI scope, and then make the corresponding update to the WI scope. For this purpose, we support adding the note “RAN1 will discuss the candidate solutions and provide updates for this objective in RAN#91e.” |
| Futurewei | Yes | CATT suggestion the note is ok for us. |
| Huawei, HiSilicon | Yes | The objective is led by RAN1 but RAN2 and RAN3 should also be listed as secondary WGs. The note from CATT is fine although it is unclear if one meeting will be sufficient. |
| Qualcomm | Yes | This objective is currently less specific and may be rather broad in scope. Therefore, we support the Note that this objective should be made more specific in a future WID update. |
| Intel | Yes |  |
| ZTE | Yes | Agree with CATT. We have discussed a lot of potential enhancements for this topic during SI phase, but we didn’t agree which parts we should focus on due to lack of time. The current wording implies a quite broad scope, so it is beneficial to shrink the scope of this item with more details spelled out. It can be done at the beginning of the WI as the note says. |
| OPPO | Yes | Support CATT’s note. The current objective is too general and down-selection on the candidate solution/approach is needed. |
| Apple  | Yes | With the note added by CATT. |
| InterDigital | Yes |  |
| vivo | Yes | Fine with the note added by CATT. |
| Nokia | Yes | RAN1 will discuss candidate solution and provide update in RAN91e. The progress may be limited, and the conclusion may not be available already in March.  |

### 2.3 Multipath/NLOS mitigation

The rapporteur's proposed WID contains the following objective:

* Study and specify, if supported, the enhancements of information reporting from UE and gNB for multipath/NLOS mitigation [RAN1]

Companies are invited to give feedback related to above objective. For the "Support [Yes/No]" column, companies are invited to indicate whether they generally support an objective on this topic; a company may indicate "Yes" in this column and still have more detailed comments on the wording, etc.

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| **Company** | **Support****[Yes/No]** | **Comments** |
| CATT | Yes | The enhancement for supporting multipath/NLOS mitigation attracted significant attention during the study item, and the recommendation “*Enhancements of information reporting from UE and gNB for supporting multipath/NLOS mitigation can be studied further, and if needed, specified during normative work for improving positioning accuracy*”, was reached after long and intensive discussion in RAN1 during the SI. The companies hold different views on the priority, effectiveness and the necessity of the enhancements. The enhancement is critical for improving positioning accuracy. We support including the enhancement in the WI as recommended from the SI.  |
| Futurewei | Yes | NLOS is an important factor in degrading positioning accuracy in indoor factory environment. Standards supported solutions are essential rather than relying on the arguments that there are implementations-based method which can’t be verified and evaluated objectively.  |
| Huawei, HiSilicon | Yes | We suggest listing the candidate reporting to be down-selected by the study phase:o LOS/NLOS statuso Time of arrival, signal power and/or relative power, and/or angle of the multi-path componentso Power delay profileo Polarization informationo Coherence bandwidthThis objective should be treated with the same priority as aggregation of PRS and aggregation of SRS since RAN1 has not provided any priority among those. |
| Qualcomm | Yes | We support this objective. However, we consider the aggregation of PRS (section 2.4 and 2.5 below) to be more significant for achieving the accuracy targets of e.g., <0.2 m. |
| Intel | Yes | It is a major degradation factor and proper solutions to address it should be specified |
| ZTE | Yes | Agree with the proposal. According to simulation results provided by multiple companies, additional information for NLOS mitigation is superior to implementation-based approaches in terms of accuracy. We should specify the method that can be verified/tested rather than based on implementation-based ways. |
| OPPO | No | Multipath/NLOS mitigation (2.3) and the aggregation of PRS/SRS (2.4/2.5) are with a lower priority than 2.1 and 2.2 according to RAN1’s conclusion. Moreover, based on RAN1 recommendation, the priority of these objectives is also lower than that of some other topics, e.g., on-demand PRS (O1) , positioning for RRC\_INACTIVE state (O2), latency reduction (O3). According to RAN1 discussion and conclusions, there will be a lot of RAN1 workload for O1/O2/O3, no matter whether they are RAN1-centric or RAN2-centric. Thus, regarding the topics recommend by RAN1 with high priority, less than 50% of the corresponding RAN1 workload has been reflected in the draft WID.In order to keep a manageable RAN1 workload for the final scope of WID (to be determined in RAN#91e), we only need to approve the objectives recommended by RAN1 with high priority in RAN#90e. In RAN1#91e, when we include all high-priority objectives in RAN1#91e, we can better evaluate the whole RAN1 workload and check whether there are still have some space or TUs for some low-priority objective(s). |
| InterDigital | Yes | Reporting related to LoS/NLoS and multipath channel is critical for improving positioning accuracy which is the whole purpose of this WI. |
| vivo | No | We cannot agree with this bullet.On the one hand, it is not a high priority item in the RAN1 conclusion. We don’t think it should be captured in WI scope before other recommended items. On the other hand, it has the same problem as UL-AOA/DL-AOD above, different candidate approaches were proposed for multipath/NLOS mitigation. We don’t think it can be directly captured in WID without any constraint. |
| Nokia | Yes | It is an important enhancement to meet the accuracy requirements.  |

### 2.4 Aggregation of PRS

The rapporteur's proposed WID contains the following objective:

* Study and specify, if supported, the enhancements to simultaneous transmission by the gNB and aggregated reception by the UE of DL PRS for positioning for one or more contiguous carriers in one or more contiguous PFLs [RAN1/RAN4]
	+ The applicability and feasibility of this enhancement need to be further studied from both gNB and UE perspectives for different scenarios, configurations, particular bands and RF architectures.

Note that the rapporteurs proposal in RP-202710 placed this objective in []. These have been removed from the text above as this discussion should make a firm conclusion whether the objective is supported, and hence the WID approved at this meeting should not contain any objective in [].

Companies are invited to give feedback related to above objective. For the "Support [Yes/No]" column, companies are invited to indicate whether they generally support an objective on this topic; a company may indicate "Yes" in this column and still have more detailed comments on the wording, etc.

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| **Company** | **Support****[Yes/No]** | **Comments** |
| CATT | Yes | Whether to support simultaneous transmission by the gNB and reception by the UE of intra-band contiguous carriers in Rel-17 was discussed intensively during study phase, including the potential benefits of improving the positioning accuracy and the potential issues related to the applicability, feasibility and the implementation complexity. Thus, the agreement made during the SI was that the enhancements can be studied further and if needed, specified during normative work, including the applicability and feasibility of this enhancement for different scenarios, configurations, bands and RF architectures.We think this could be a distinguish feature for 3GPP NR positioning for 5G in comparison with 4G and other positioning techniques in the industry. The implementation complexity, applicability and feasibility of the enhancement is closely related to RAN4’s expertise and responsibility, e.g., UE and gNB RF architectures, the timing alignment error between carriers, the phase continuity, etc. However, RAN4 is not involved the evaluation during the study phase. Thus, it is critical to include RAN4 at the start of the WI to determine the applicability and feasibility to support the enhancements. |
| Futurewei | Yes | While we support this, we think RAN4 needs to evaluate the feasibility aspects. We propose this to be jointly shared with RAN4 with RAN4 taking the initial responsibility during the WI. |
| Huawei, HiSilicon | Yes | Agree with Futurewei. RAN4 should conclude on the feasibility and if the conclusion is positive then normative work can proceed. No need to re-discuss feasibility in RAN1.The study phase should account for impairment factors including timing offset, phase offset, frequency error, and power imbalance across CCs based considering RF architecture. |
| Qualcomm | Yes | Increasing the bandwidth of the positioning signals would more fundamentally improve accuracy. Larger signal bandwidth means that signal time can be more accurately resolved (there is an inverse relationship between time resolution and signal bandwidth). Therefore, larger signal bandwidth offers an improved ability to resolve multipath effects.We suggest to combine the aggregation of DL-PRS and UL-PRS (SRS) into a single objective.  |
| Intel | Yes | Beneficial for accuracy |
| ZTE | Yes | We consider it as a high priority for improving time resolution. We should study further in WI phase with RAN4’s involvement on RF architectures and impairment models to check the feasibility and evaluation assumptions. One way to do this is to let RAN1 specify the solution first, and then RAN4 can define the relevant requirement based on the specified solution in RAN1 and the target accuracy requirement. |
| OPPO | No | Same comments as 2.3Multipath/NLOS mitigation (2.3) and the aggregation of PRS/SRS (2.4/2.5) are with a lower priority than 2.1 and 2.2 according to RAN1’s conclusion. Moreover, based on RAN1 recommendation, the priority of these objectives is also lower than that of some other topics, e.g., on-demand PRS (O1) , positioning for RRC\_INACTIVE state (O2), latency reduction (O3). According to RAN1 discussion and conclusions, there will be a lot of RAN1 workload for O1/O2/O3, no matter whether they are RAN1-centric or RAN2-centric. Thus, regarding the topics recommend by RAN1 with high priority, less than 50% of the corresponding RAN1 workload has been reflected in the draft WID.In order to keep a manageable RAN1 workload for the final scope of WID (to be determined in RAN#91e), we only need to approve the objectives recommended by RAN1 with high priority in RAN#90e. In RAN1#91e, when we include all high-priority objectives in RAN1#91e, we can better evaluate the whole RAN1 workload and check whether there are still have some space or TUs for some low-priority objective(s). |
| Apple | Yes | Agree with CATT and Futurewei. |
| vivo | No | We cannot agree with this bullet.* Firstly, it is not a high priority item in the RAN1 conclusion. We don’t think it should be in WI scope before other recommended items.
* Secondly, the accuracy requirement is achieved based on evaluation results of most companies without PRS/SRS aggregation. In FR2, the 0.2m target is achieved without aggregation by most companies; in FR1, most companies can meet the relaxed requirement of 0.5m and some companies can meet the requirement of 0.2m.
* Thirdly, Application scenarios for RS aggregation is unclear. For example, it is not clear that the performance requirement can be achieved by limited bandwidth of intra-band continuous CA in actual FR1 scenarios.
* Lastly, applicability and feasibility shouldn’t be led by RAN1.
 |
| Nokia | Yes | Nokia have provided their view in RP-20265. It would be ok to included but should be lower priority than some other topics |

### 2.5 Aggregation of SRS

The rapporteur's proposed WID contains the following objective:

* Study and specify, if supported, the enhancements to simultaneous transmission by the UE and aggregated reception by the gNB of the SRS for positioning in multiple contiguous intra-band carriers [RAN1/RAN4]
	+ The applicability and feasibility of this enhancement need to be further studied from both gNB and UE perspectives for different scenarios, configurations, particular bands and RF architectures.

Note that the rapporteurs proposal in RP-202710 placed this objective in []. These have been removed from the text above as this discussion should make a firm conclusion whether the objective is supported, and hence the WID approved at this meeting should not contain any objective in [].

Companies are invited to give feedback related to above objective. For the "Support [Yes/No]" column, companies are invited to indicate whether they generally support an objective on this topic; a company may indicate "Yes" in this column and still have more detailed comments on the wording, etc.

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| **Company** | **Support****[Yes/No]** | **Comments** |
| CATT | Yes | Similar comments as 2.4 for Aggregation of PRS |
| Futurewei | Yes | Same comments as 2.4 |
| Huawei, HiSilicon | Yes | Agree with Futurewei. RAN4 should conclude on the feasibility and if the conclusion is positive then normative work can proceed. No need to re-discuss feasibility in RAN1.The study phase should account for impairment factors including timing offset, phase offset, frequency error, and power imbalance across CCs based considering RF architecture. |
| Qualcomm | Yes | As commented in 2.4 above, this objective could be combined with aggregation of DL-PRS. For example:* Study and specify, if supported, the enhancements
	1. to simultaneous transmission by the gNB and aggregated reception by the UE of DL PRS for positioning for one or more contiguous carriers in one or more contiguous Positioning Frequency Layers;
	2. to simultaneous transmission by the UE and aggregated reception by the gNB of the SRS for positioning in multiple contiguous intra-band carriers.
 |
| Intel | Yes | We are OK to leave it for future considerations based on study outcome for DL PRS aggregation |
| ZTE | Yes | Same comments as 2.4 |
| OPPO | No | Same comments as 2.3Multipath/NLOS mitigation (2.3) and the aggregation of PRS/SRS (2.4/2.5) are with a lower priority than 2.1 and 2.2 according to RAN1’s conclusion. Moreover, based on RAN1 recommendation, the priority of these objectives is also lower than that of some other topics, e.g., on-demand PRS (O1) , positioning for RRC\_INACTIVE state (O2), latency reduction (O3). According to RAN1 discussion and conclusions, there will be a lot of RAN1 workload for O1/O2/O3, no matter whether they are RAN1-centric or RAN2-centric. Thus, regarding the topics recommend by RAN1 with high priority, less than 50% of the corresponding RAN1 workload has been reflected in the draft WID.In order to keep a manageable RAN1 workload for the final scope of WID (to be determined in RAN#91e), we only need to approve the objectives recommended by RAN1 with high priority in RAN#90e. In RAN1#91e, when we include all high-priority objectives in RAN1#91e, we can better evaluate the whole RAN1 workload and check whether there are still have some space or TUs for some low-priority objective(s). |
| Apple  | Yes | Same comments as 2.4 |
| vivo | No | Same comments as 2.4 |
| Nokia | Yes | Nokia have provided their view in RP-20265. It would be ok to included but should be lower priority than some other topics |

### 2.6 Additional RAN1 centric objectives

Companies are invited to indicate if they propose to include any RAN1 centric objectives that were not already covered by the proposals from the rapporteur.

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| **Company** | **Comments** |
| CATT | There are other objectives that could be RAN1-led, e.g., the objectives related to aperiodic DL PRS and semi-persistent DL PRS. We are fine either to delay the discussion to the RAN#91e, because these objectives are related to RAN2’s evaluation of positioning latency, or discuss them in RAN#90e. |
| Futurewei | As commented during the GTW, there are support of “On-demand transmission and reception of DL PRS’ that has overwhelming support during the SI and is one of the first item to be agreed for normative work. We think this part can begin in RAN1 without dependency on some minor remining discussion in RAN2.  |
| Huawei, HiSilicon | Other RAN1 objectives that have a dependence on RAN2 should only be added to the WI scope at RAN#91, to have a coherent set of objectives on latency reduction. |
| Intel | Other items are discussed at the next meeting |
| ZTE | Regarding on-demand PRS, we think the major impacts on the specification are from high layers, so it’s a RAN2-led item and can be postponed to next meeting. Without a clear understanding of the main functionality to deliver in RAN2, it is meaningless to discuss it in RAN1 first.In addition, we have observed in TR 38.857 that “DL PRS alignment, transmission, measurement time and report delay” are the major components to physical layer latency. So we think the aperiodic or semi-persistent DL PRS and measurement report through physical layer are the major solutions to reduce the latency from RAN1 perspective, and they are RAN1-centric objectives. Thus it should be considered in the first version of WI. We propose to include one more bullet as follows * Study and specify, if supported, aperiodic/semi-persistent reception of DL PRS from the TRPs of the serving gNB and from the TRPs of the neighbouring gNBs [RAN1]
 |
| OPPO | According to RAN1 discussion/conclusion, a lot of RAN work was expected for these three high-priority topics: on-demand PRS, positioning for RRC\_INACTIVE state and latency reduction. As the positioning for RRC\_INACTIVE state may depend on RAN2 decision on the transmission mechanism, we can leave it to RAN#91e discussion. For on-demand PRS and latency reduction, we think it is beneficial to start work focusing on RAN1 part from the next RAN1 meeting.  |
| InterDigital | In RAN2#112e, the following agreement was made: “Positioning measurement reporting (including location estimates for UE-based) should be supported in RRC\_INACTIVE; involvement of SDT is FFS.  Reporting of specific measurements is pending RAN1 decision.” RAN1 can start discussion on measurements that need to be reported during RRC\_INACTIVE. We propose to add the following item in WID.Study and specify measurements to be reported during INACTIVE positioning [RAN1] |
| vivo | We think the following objectives also impacts RAN1. They are listed in the recommendation list and should be included in the WID in RANP #90e:* Enhancements of latency reduction: measurement gap and measurement time. We think these enhancements hardly require the participation of RAN2.
* UE positioning measurements in idle and inactive state.
* UE and gNB positioning measurement in inactive state.
 |
| Nokia | There are other objectives that have clear RAN1 impact that could be included. For example, Inactive mode support which has progressed in both RAN1 and RAN2 already and has clear RAN1 impact on measurement side at least. There are also latency reduction techniques targeting the PHY layer which were recommended by RAN1 and we agreed to have some requirements for the PHY layer latency component. Those should also be included.  |

### 2.7 Other comments on the WID

Companies are invited to provide any other comments, for example comments on TUs, comments on other sections of the WID, etc

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| **Company** | **Comments** |
| OPPO | Regarding to the notes in the draft WID, we have a comment for the 2nd note “ The WID is subject to further update in RAN #91 for RAN2/3/4 scoping.”As we comment on 2.3/2.4/2.5, there will be a lot of RAN1 workload for on-demand PRS (O1) , positioning for RRC\_INACTIVE state (O2), latency reduction (O3), no matter whether they are RAN1-centric or RAN2-centric. And the draft WID only reflect less than 50% RAN1 workload for the topics with high priority. Thus, in RAN#91e, there will also some updates for RAN1 scoping. Thus, we suggest to modify it as below“ The WID is subject to further update in RAN #91 for RAN1/2/3/4 scoping.” |
| vivo | To improve the efficiency of WI , in addition to some RAN1 centric objectives, we think other objectives currently recommended by RAN1 should also be captured in WID in this meeting, then details can be updated based on further RAN2 conclusions and RAN1 can start the first step work. |
| Nokia | RAN1 spent quite some time discussing and agreeing to requirements for Rel-17 positioning. Maybe those should be directly listed in the WID (e.g., in section 3). From RAN1#103-e: Agreement:* 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 (< 3 m) for 90% of UEs
	+ End-to-end latency for position estimation of UE (< 100 ms)
	+ Physical layer latency for position estimation of UE (< 10 ms)
* In Rel-17 target positioning requirements for IIoT use cases are defined as follows:
	+ Horizontal position accuracy (< 0.2 m) for 90% of UEs
	+ Vertical position accuracy (< 1 m) for 90% of UEs
	+ End-to-end latency for position estimation of UE (< 100ms, in the order of 10 ms is desired)
	+ Physical layer latency for position estimation of UE (<10ms)
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## Annex: Contacts

Please provide a company contact that the email discussion moderator can contact if required.

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| **Company** | **Contact name and email** |
| CATT | Ren Da, renda@CATT.cn |
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