**3GPP TSG RAN WG1 #107-e R1-21zzzzz**

**e-Meeting, November 11th – 19th, 2021**

**Source: Moderator (Intel Corporation)**

**Title: Summary of Preparation Phase for Rel.16 NR Positioning Maintenance [107-e-Prep-AI7.2.8]**

**Agenda item: 7.2.8**

**Document for:**  **Discussion and Decision**

# Introduction

This document provides overview of contributions submitted for R16 NR Positioning maintenance [1]-[8]. In addition, it provides feature lead recommendation and summary of the following RAN1 e-mail discussion assigned by RAN1 chair:

* [107-e-Prep-AI7.2.8] Preparation phase for Rel-16 NR Positioning maintenance: Alexey (Intel)

# Overview of Contributions

## Aspect #1: Correction to PRS QCL Type D

In [1], it is noticed that there is no *qcl-Type* field/IE in LPP to indicate the PRS-PRS Type D QCL for FR2, however it is referred in TS38.214 clause 5.1.6.5. The following CR is proposed to fix this

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| 5.1.6.5 PRS reception procedure ========================= Unchanged parts =========================  If the UE is configured with *DL-PRS-QCL-Info* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are associated with the same *dl-PRS-ID*. If *DL-PRS-QCL-Info* is configured to the UE with QCL 'type-D' with a source DL PRS resource then the *nr-DL-PRS-ResourceSetId* and the *nr-DL-PRS-ResourceId* of the source DL PRS resource are expected to be indicated to the UE.  ========================= Unchanged parts ========================= |

## Aspect #2: Correction to the Time Stamp

In [2], it is noticed that there is potential ambiguity on the time stamp for UE Rx – Tx time difference measurement. It is proposed to clarify whether the time stamp corresponds to the PRS reception time or positioning SRS transmission time. In addition, corrections to parameter name *nr-DL-PRS-ExpectedRSTD-Uncer****t****ainty* is proposed. Finally, the change of “DL RSTD, UE Rx-Tx time difference” to “DL RSTD or UE Rx-Tx time difference, respectively” is suggested as indicated in provided draft CR below:

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| 5.1.6.5 PRS reception procedure ========================= Unchanged parts =========================  The UE may be indicated by the network that DL PRS resource(s) can be used as the reference for the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements in a higher layer parameter *nr-DL-PRS-ReferenceInfo*. The reference indicated by the network to the UE can also be used by the UE to determine how to apply higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty*. The UE expects the reference to be indicated whenever it is expected to receive the DL PRS. This reference provided by *nr-DL-PRS-ReferenceInfo* may include a *dl-PRS-ID*, a DL PRS resource set ID, and optionally a single DL PRS resource ID or a list of DL PRS resource IDs [17, TS 37.355]. The UE may use different DL PRS resources or a different DL PRS resource set to determine the reference for the RSTD measurement as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met. If the UE chooses to use a different reference than indicated by the network, then it is expected to report the *dl-PRS-ID*, the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference.  The UE may be configured to report quality metrics *NR-TimingQuality* corresponding to the DL RSTD and UE Rx-Tx time difference measurements which include the following fields:  *- timingQualityValue* which provides the best estimate of the uncertainty of the measurement  *- timingQualityResolution* which specifies the resolution levels used in the *timingQualityValue* field.  The UE expects to be configured with higher layer parameter *nr-DL-PRS-ExpectedRSTD*, which defines the time difference with respect to the received DL subframe timing the UE is expected to receive DL PRS, and *nr-DL-PRS-ExpectedRSTD-Uncertainty*, which defines a search window around the *nr-DL-PRS-ExpectedRSTD*.  For DL UE positioning measurement reporting in higher layer parameters *NR-DL-TDOA-SignalMeasurementInformation* or *NR-Multi-RTT-SignalMeasurementInformation* the UE can be configured to report the DL PRS resource ID(s) or the DL PRS resource set ID(s) associated with the DL PRS resource(s) or the DL PRS resource set(s) which are used in determining the UE measurements DL RSTD or UE Rx-Tx time difference, respectively.  For the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements the UE can report an associated higher layer parameter *nr-TimeStamp*. The *nr-TimeStamp* can include the *dl-PRS-ID*, the SFN and the slot number for a subcarrier spacing corresponding to the reception time of the DL-PRS. These values correspond to the reference which is provided by *nr-DL-PRS-ReferenceInfo*.  ========================= Unchanged parts ========================= |

## Aspect #3: QCL information for a DL PRS resource

In [3], it is noticed that according to current descriptions in TS 38.214, QCL information for a DL PRS resource can be an SSB from a serving cell or non-serving cell. The proposed correction clarifies that an SSB as the QCL information for a DL PRS resource should be from a same serving cell or same non-serving cell as the DL PRS resource.

Specification has ambiguity on which SSB should be used as QCL information for a DL PRS resource.

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| ---- Unchanged texts omitted ----  5.1.6.5 PRS reception procedure  <Unchanged parts are omitted>  A DL PRS resource is defined by:  *- nr-DL-PRS-ResourceID* determines the DL PRS resource configuration identity. All DL PRS resource IDs are locally defined within a DL PRS resource set.  *- dl-PRS-SequenceID* is used to initialize cinit value used in pseudo random generator as described in Clause 7.4.1.7.2 of [4, TS 38.211] for generation of DL PRS sequence for a given DL PRS resource.  *- dl-PRS-CombSizeN-AndReOffset* defines the starting RE offset of the first symbol within a DL PRS resource in frequency. The relative RE offsets of the remaining symbols within a DL PRS resource are defined based on the initial offset and the rule described in Clause 7.4.1.7.3 of [4, TS 38.211].  *- dl-PRS-ResourceSlotOffset* determines the starting slot of the DL PRS resource with respect to corresponding DL PRS resource set slot offset.  *- dl-PRS-ResourceSymbolOffset* determines the starting symbol of a slot configured with the DL PRS resource.  *- dl-PRS-QCL-Info* defines any quasi co-location information of the DL PRS resource with other reference signals. The DL PRS may be configured with QCL 'typeD' with a DL PRS associated with the same *dl-PRS-ID*, or with *rs-Type* set to 'typeC', 'typeD', or 'typeC-plus-typeD' with a SS/PBCH Block from a same serving or same non-serving cell as the DL PRS resource.  ---- Unchanged texts omitted ---- |

## Aspect #4: Correction on DL PRS Resource Time Gap

In [4], it is proposed to change the parameter ‘*nr-DL-PRS-ResourceSetId*’ to ‘*nr-DL-PRS-ResourceID*’, since it is noticed that there is a misalignment with RAN1 agreement:

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| Agreement (RAN1#98bis):   * Parameter DL-PRS-ResourceRepetitionFactor is configured for a DL PRS Resource Set and controls how many times each DL-PRS Resource is repeated for a single instance of the DL-PRS Resource Set   + Values: 1, 2, 4, 6, 8, 16, 32 * Parameter DL-PRS-ResourceTimeGap is configured for a DL-PRS Resource Set   + DL-PRS-ResourceTimeGap indicates offset in units of slots between two repeated instances of a DL PRS Resource corresponding to the same DL-PRS Resource ID within a single instance of the DL PRS Resource Set   + DL-PRS-ResourceTimeGap is provided only if DL-PRS-ResourceRepetitionFactor is configured and is greater than 1   + Values: 1, 2, 4, 8, 16, 32 * The time duration spanned by one DL PRS Resource set containing repeated DL PRS Resources should not exceed DL-PRS-Periodicity * Note: UE RX beam sweeping is up to UE implementation |

The following correction was proposed in [4]:

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| 5.1.6.5 PRS reception procedure  < Unchanged parts are omitted >  *- dl-PRS-ResourceTimeGap* defines the offset in number of slots between two repeated instances of a DL PRS resource with the same *nr-DL-PRS-ResourceID~~SetId~~* within a single instance of the DL PRS resource set. The UE only expects to be configured with *dl-PRS-ResourceTimeGap* if *dl-PRS-ResourceRepetitionFactor* is configured with value greater than 1. The time duration spanned by one instance of a *nr-DL-PRS-ResourceSet* is not expected to exceed the configured value of DL PRS periodicity. All the DL PRS resources within one resource set have the same value of *dl-PRS-ResourceTimeGap.*  < Unchanged parts are omitted > |

## Aspect #5: Misalignment b/w TS 37.355 and TS 38.214

The following misalignment between TS 37.355 and TS 38.214 is noticed in [5]:

* In TS 37.355 (section 6.4.3), the TRP ID, i.e., ‘dl-PRS-ID-r16’, has to be reported in the NR-TimeStamp. In addition, according to the descriptions in TS 37.355, for DL-TDOA, DL-AoD and Multi-RTT positioning, the parameter ‘NR-TimeStamp’ also has to be reported.
* In TS 38.214, either ‘dl-PRS-ID-r16’ or ‘NR-TimeStamp’ seems to be an optional parameter in the measurement report.

To address misalignment across specifications, it is proposed to remove the word ‘can’ in TS 38.214 as suggested in the CR below:

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| 5.1.6.5 PRS reception procedure  ===================== Unchanged parts =====================  For the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements the UE reports an associated higher layer parameter *nr-TimeStamp*. The *nr-TimeStamp* includes the *dl-PRS-ID*, the SFN and the slot number for a subcarrier spacing. These values correspond to the reference which is provided by *nr-DL-PRS-ReferenceInfo*.  ===================== Unchanged parts ===================== |

## Aspect #6: Others

References [6]-[8], are not covered in this document as those are not available in [Docs](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_107-e/Docs) folder.

Discussion on Preparation Phase

Round #1

From FL perspective, all aspects provided in submitted tdocs deserve clarifications and can be recommended for subsequent RAN1 e-mail discussions.

Companies are invited to provide their views on maintenance aspects to be further discussed by RAN1.

Comments from companies:

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| Company Name | Comments |
| Huawei, HiSilicon | OK to discuss them.  However, we do not think changes in Aspect #3 is correct, but open to discuss it. |
| Nokia/NSB | We are okay to discuss Aspect 1, 2, 3.  On Aspect 4, the meaning of the sentence does not seem to change the meaning of the spec as the parameter is configured at the set level so the value for each resource is also the same. So, we don’t support discussing this aspect as it is not essential.  On Aspect 5, If you read 214 and LPP together there is no ambiguity, so we don’t feel that this change is essential. |
| Qualcomm | We do not think that Aspect 2 has any ambiguity that needs to be solved. In 37.355, it says clearly, for each method:   * DL-TDOA:   ***nr-TimeStamp***  This field specifies the **time instance at which the TOA and DL PRS-RSRP (if included) measurement is performed**. The *nr-SFN* and *nr-Slot* in IE *NR-TimeStamp* correspond to the TRP provided in *dl-PRS-ReferenceInfo* as specified in TS 38.214 [45]. Note, the TOA measurement refers to the TOA of this neighbour TRP or the reference TRP, as applicable, used to determine the *nr-RSTD* or *nr-RSTD-ResultDiff*.   * DL-AoD and MRTT:   ***nr-TimeStamp***  This field specifies the time instance **at which the measurement is performed**.  We think it is clear enough, and there is no need to discuss Aspect #2.  Similar view with Nokia on Aspect 5 with similar justification.  To the issue that Nokia brought up in R1-2112415, we don’t think that the “P” is needed to be associated with the 38.133 reference. No matter what is the observation window to derive L\_PRS in 38.133, 38.214 is written generically: 38.214 just says, for any Period P msec, how can one determine what is K? 38.214 is not supposed to say how the observation window is calculated. We had pointed this out before in the discussion we did a couple of meeting agos, when also a CR was agreed accordingly.  <https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106-e/Inbox/drafts/7.2.8/106-e-NR-Pos-05/R1-21xxxxx_%5B106-e-NR-Pos-05%5D_summary_v017_Moderator.docx> |
| ZTE | For Aspect#1, we are OK, but prefer to let editor handle this.  For Aspect#2, OK with first change and second change. While for the third change , we share the same view with Qualcomm as there is no ambiguity in 37.355.  For Aspect#3, we think it should be discussed.  For Aspect#4, it can be fixed according to the agreement.  For Aspect#5 and R1-2112415 from Nokia, we think the spec is clearly enough and the wording change is unnecessary. |
| vivo | We are okay to discuss aspect#1, #2, #3, #4 and #5.  We disagree with Nokia’s comment toward aspect #4. The aspect #4 is essential as it is to correct an obvious mistake of 38.214 where the definition of the parameter *dl-PRS-ResourceTimeGap* is wrong. This is regardless whether *dl-PRS-ResourceTimeGap* is configured at set level and/or all resources share the same value.  On aspect #6 in R1-2112415, we have the same understanding as Qualcomm that the issue was already discussed/addressed in RAN1#106-e and hence no need to discuss any further of the proposed CR in R1-2112415. |
| OPPO | We are ok to discuss Apsect#1, #2 and #3.  Aspect #4: the change is not needed. The “a DL PRS resource with the same nr-DL-PRS-ResourceIDSetId” means one DL PRS resource in one PRS resource set. The current text has no ambiguity.  Aspect #5: we do not support to change the spec. The current text in 38.214 has no issue. The wording change is not needed. |
| CATT | OK to discuss Aspect#1, #2, #4 and #5.  On Aspect#5, we prefer to discuss it in this meeting. The CR wants to solve the issue of misalignment between TS 37.355 and TS 38.214 as follows,   * In TS 37.355, both ‘dl-PRS-ID-r16’ and ‘NR-TimeStamp’ are mandated to be reported. * In TS 38.214, either ‘dl-PRS-ID-r16’ or ‘NR-TimeStamp’ is optional parameter in the measurement report.   Therefore, we prefer to solve this issue via this CR.  On Aspect#3, we think the current descriptions in the specification are clear and seem no need to change it.  On the change in R1-2112415, we share the same view with Qualcomm that we had discussed the issue of “*P msec window*” in RAN1#106-e ([106-e-NR-Pos-05]), seem no need to re-open the discussion. |
| ZTE2 | To CATT on Aspect#3,  We think current specification has ambiguity on which SSB should be used as QCL information for a DL PRS resource. According to current descriptions in TS 38.214, QCL information for a DL PRS resource can be an SSB from a serving cell or non-serving cell. However, it’s not clear the SSB is transmitted from which serving cell or non-serving cell. There could be some cases that the SSB is not from the same TRP or the same frequency band as the DL PRS resource, which breaks the basis that the QCL information can facilitate the reception the DL PRS resource. Therefore, it should be clarified that the SSB and the DL PRS resource should be from a same serving cell or same non-serving cell.  If some companies have different views on how to address this issue, we could further discuss the solution in next phase. |

**Round-1 Summary:**

* Aspect #1: 7 companies are OK to discuss it further
* Aspect #2: 2 companies do not see ambiguity (reason: definitions in 37.355 resolve it)
* Aspect #3: 1 company commented that current specification is clear, and 1 company commented that changes are not correct but is fine to discuss further
* Aspect #4: 2 companies do not see correction as essential (current text is not aligned with agreement but it does not change the meaning)
* Aspect #5: 4 out of 7 companies do not support the change and do not consider it as essential correction

Round #2

Based on analysis of responses, it is suggested to continue discussion on Aspects 1-4:

* Aspect 1: – further discussion is supported by all companies that expressed views so far
* Aspect 2: – draft CR provides additional editorial corrections + it is worthwhile to clarify (at least for Multi-RTT) time instance at “which the measurement is performed”
* Aspect 3: – it is worthwhile to reach common understanding across companies
* Aspect 4: – it is worthwhile to align with RAN1 agreement to avoid potential inconsistencies
* [Aspect 5: - CATT proposed to continue discuss the Aspect 5.]

Comments from companies:

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| Company Name | Comments |
| CATT | To FL:  Since 3 companies support to further discuss Aspect 5, we think it is worthwhile to further discuss Aspect 5 in Round 2. Therefore, we add Aspect 5 in the candidate list for Round 2 discussion. |
| CATT-2 | To Nokia, Qualcomm, ZTE and OPPO:  On Aspect 5, in current spec 38.214, the parameters ‘dl-PRS-ID-r16’ and ‘NR-TimeStamp’ are optional in the measurement report, this is wrong and should be corrected. Since this CR try to address the error in TS 38.214, it should be an essential CR and need to be discussed. |
| Qualcomm | For Aspect #2, there is nothing ambiguous with “the measurement is performed”. We don’t see the need to discuss it. |
| Apple | OK to discuss 1-5, although we share same view as QC on #2. |
| Nokia/NSB | We prefer to keep the scope reasonable and focused on essential corrections. To us Aspect #4 is not essential, and neither is aspect #5. If we don’t do anything on those aspects nothing will be broken. |
| vivo | As stated in round 1, we’re okay to discuss aspect 1 to 5.  In particular, we agree with moderator’s reasoning on the need for companies to discuss on these aspects. |
| CATT-3 | OK to discuss Aspect 1 to 5.  To Nokia:  Considering that there are only 5 R16 Pos CRs submitted at this meeting and seem to be not complex (as a comparison, there are 23 R16 V2X CRs submitted in AI7.2.4 at this meeting), we do not think that controlling the scale is an valid reason to decide whether the 5 CRs need to be further discussed. For Aspect 5, it does correct the errors in the TS 38.214. Since UE is expected to mandatory report these two parameters, but according to 214, UE may not report these two parameters, then LMF cannot obtain the necessary parameters, and the system may be broken. Therefore, Aspect 5 is indeed an essential CR. |
| Huawei, HiSilicon | To Qualcomm:  On aspect#2, yes LPP says “measurement is performed”, is it that what the “measurement” refers to only PRS Rx time measurement, instead of SRS Tx time measurement if calibration done in Rel-16 is considered? So is Qualcomm’s understanding either time can be selected by the UE? |
| OPPO | Only essential correction can be made.  As we explained in first round, Aspect #4 and #5 are not essential changes and they are not needed. We do not support to discuss them. |
| CATT-4 | To OPPO:  For Aspect 5, as we replied above, it does correct the errors in the TS 38.214. Since UE is expected to mandatory report these two parameters, but according to 214, UE may not report these two parameters, then LMF cannot obtain the necessary parameters, and the system may be broken. Therefore, Aspect 5 is indeed an essential CR and should be discussed. |

**Round-2 Summary:**

* Aspect #1: 7 companies are OK to discuss it further - situation is the same as in the 1st round
* Aspect #2: 1 company still do not see the need for further discussion and does not see ambiguity
  + Question on
* Aspect #3: No concerns raised by companies in the 2nd round
* Aspect #4: 2 companies do not see correction as essential
  + current text is not aligned with agreement, but it does not change the meaning
* Aspect #5: 2 companies do not support the change and do not consider it as essential correction

From FL perspective, it is worthwhile to continue discussion and resolve all five aspects if sufficient e-mail thread budget can be available.

* Aspect #1: Correction to PRS QCL Type D
* Aspect #2: Correction to the Time Stamp
* Aspect #3: QCL information for a DL PRS resource
* Aspect #4: Correction on DL PRS Resource Time Gap
* Aspect #5: Misalignment b/w TS 37.355 and TS 38.214

Given that there is no full consensus in the group, the final decision is left up to RAN1 chair.

Conclusions

In this document, we have provided overview of the contributions submitted to RAN1#107e for R16 NR positioning maintenance.

References

1. R1-2110847 Correction to PRS QCL Type D Huawei, HiSilicon
2. R1-2110848 Correction to the time stamp Huawei, HiSilicon
3. R1-2110968 Draft CR on QCL information for a DL PRS resource ZTE
4. R1-2110989 Maintenance on Rel-16 NR positioning vivo
5. R1-2111220 Draft CR on the parameter NR-TimeStamp for Rel-16 Positioning CATT
6. R1-2112265 Remaining issues for Positioning Qualcomm Incorporated
7. R1-2112337 Maintenance for NR positioning support Ericsson
8. R1-2112415 Draft CR on PRS processing Google Inc.