**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: Draft CR on 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

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 |
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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.