**3GPP TSG RAN WG1 #106-e R1-210nnnn**

**e-Meeting, August 16th – 27th, 2021**

**Source: Moderator (CATT)**

**Title: Summary on email discussion [106-e-NR-Pos-04] for optional content in nr-DL-PRS-ReferenceInfo**

**Agenda item: 7.2.8**

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

Introduction

This contribution summarizes the discussions and outcomes of email discussion [106-e-NR-Pos-04] triggered by the following Chair’s decision:

[106-e-NR-Pos-04] Email discussion/approval on optional content in nr-DL-PRS-ReferenceInfo (Aspect #4) until August 20 – Xiaotao (CATT)

Discussion

Optional content in *nr-DL-PRS-ReferenceInfo*

**Background**

In draft CR for TS 38.214(R1-2106994) [1], it is proposed that for DL RSTD, when network indicates a reference, a DL PRS resource set ID should be revised to be optional. Further, in addition to different PRS Resources, UE may also use a single different DL PRS Resource to determine the reference.

During the discussion in preparation phase in RAN1#106-e, the consensus was achieved that updating the scope of the issue to potential revision in the following sentence “*This reference provided by nr-DL-PRS-ReferenceInfo may include a dl-PRS-ID, and optionally a DL PRS resource set ID, a single DL PRS resource ID or a list of DL PRS resource IDs [17, TS 37.355]*.” to align it with signaling in TS 37.355.

Firstly, let’s review the RAN1 agreements related to this email discussion. In RAN1#96bis meeting [2], the reference determinations for RSTD measurements have been agreed as follows:

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| Agreement:* The network can indicate one or more of the following for the UE to use to determine a reference (reference time based on the DL PRS Resource ID(s)) for DL RSTD measurements.
	+ A DL PRS Resource ID
	+ A subset of DL PRS Resource IDs from a single DL PRS Resource set
	+ A DL PRS Resource set

Agreement:* The UE may use different DL PRS Resource ID(s) (with the condition that the multiple DL PRS Resource IDs belong to a single DL PRS Resource set) or a different DL PRS Resource set for determining the reference for the RSTD measurement, and if it chooses to do so, it should report the DL PRS Resource ID(s) and/or the information on the DL PRS Resource set used to determine the reference
 |

According to the above agreements, when network indicates a reference, it may optionally select a DL PRS Resource ID, a subset of DL PRS Resource IDs or a DL PRS Resource set. None of the three items is mandatory.

Moreover, as shown in the following descriptions in TS37.355 (section 6.4.3) [3], the *dl-PRS-ID* is mandatory, but DL PRS Resource ID and DL PRS resource set ID is optional, which match the above RAN1 agreements.

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| 6.4.3 Common NR Positioning Information Elements [TS 37.355]– *DL-PRS-ID-Info*The IE *DL-PRS-ID-Info* provides the IDs of the reference TRPs' DL-PRS Resources.-- ASN1STARTDL-PRS-ID-Info-r16 ::= SEQUENCE { dl-PRS-ID-r16 INTEGER (0..255), nr-DL-PRS-ResourceID-List-r16 SEQUENCE (SIZE (1..nrMaxResourceIDs-r16)) OF NR-DL-PRS-ResourceID-r16 OPTIONAL, -- Need ON nr-DL-PRS-ResourceSetID-r16 NR-DL-PRS-ResourceSetID-r16 OPTIONAL -- Need ON}-- ASN1STOP< Uncorrelated parts are omitted > |

However, in section 5.1.6.5 of TS 38.214, we can see everything is optional (including *dl-PRS-ID*, DL PRS resource set ID and DL PRS resource ID), since the word “may” is used marked in YELLOW colour in the following paragraph in section 5.1.6.5.

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| 5.1.6.5 PRS reception procedure [TS 38.214]< Uncorrelated parts are omitted >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-Uncerainty*. 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. < Uncorrelated parts are omitted > |

Therefore, at least dl-PRS-ID can be observed to be mandatory in TS 37.355, but it is optional in TS 38.214.

***Issue 1: dl-PRS-ID is mandatory in TS 37.355, but it is optional in TS 38.214.***

In addition, UE is allowed to use a single different DL PRS Resource to determine the reference, according the second RAN1 agreement above. This option is missed in the specification, as only ‘different DL PRS resources’ is mentioned in section 5.1.6.5 of TS 38.214.

***Issue 2: The following option is missed in the specification TS 38.214.***

* ***UE is allowed to use a single different DL PRS Resource to determine the reference.***

**Proposed change**

The following text proposal is prepared to address raised above issues:

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| 5.1.6.5 PRS reception procedure < Unchanged parts are omitted >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-Uncerainty*. 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* include a *dl-PRS-ID*, and optionally a DL PRS resource set ID, 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 resource(s) 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. < Unchanged parts are omitted > |

Discussion Round #1

Companies are invited to provide views on the text proposal above:

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| Company Name | Comments |
| OPPO | According to the RAN1 agreement and description in 37.355, the following cases can be supported:1. Only dl-PRS-ID is provided
2. dl-PRS-ID and PRS resource set ID are provided
3. dl-PRS-ID, PRS resource set ID and one or more PRS resource IDs are provided.

However, the wording in proposed TP seems to suggest that only 1) and 3) are supported. Here is another alternative for TP: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-Uncerainty*. 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* includes a *dl-PRS-ID*, and may include a DL PRS resource set ID, 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 resource(s) 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.  |
| Huawei, HiSilicon | Based on the discussion during the preparation phase, we tend to agree with Qualcomm on the need to DL-PRS resource set ID to be used whenever a resource ID or a list of resource set IDs are used. Omission of the resource set ID even if the AD only provides a single resource set is an over optimization.Getting back to the current specification in TS 37.355, our understanding is that the AD reference could either take the form as agreed by RAN1 (single set, or single resource, or a list of resources), or the form as introduced by RAN1 (the whole TRP).In that sense, we think the OPPO proposed by OPPO is aligned with the current LPP, and we are OK to take that. |
| vivo | First of all, we don’t see any issue of current wording in the specification. We don’t think the purpose of RAN1 specification is to make it clear wherever a particular IE in high layer specification is mandatory or optional to begin with. That is up to high layer specification. Given TS37.355 is cited here, we don’t see any confusion.We prefer not to change anything if it’s not broken. Our understanding is that “Only essential corrections” but not optimizations are allowed for AI 7.2.  |
| Nokia/NSB | As commented during the preparation phase we view this TP as breaking the spec rather than fixing it. If the UE does not report the resource set ID then reporting the resource ID alone is useless at the LMF as that ID is not unique.CATT also commented that we could specify some fallback behavior for the case that there is only a single resource set that the UE could be referring too. So, the TP seems to create a problem rather than solve it. The spec is clear in our view and we should not focus on non-critical issues at this stage.  |
| Qualcomm | As commented earlier, having a fallback behavior for the case of single-set, is an unnecessary signaling optimization, which, even though it is not wrong, it gives the wrong message that such optimizations are needed/useful in this stage. Glad to see that technically it seems that views are aligned (OPPO provided the options above, and didn’t seem that companies have concerns with that). We are OK with the current spec, or with the OPPO’s proposal; which is not wrong, just a bit unnecessary; if majority wants OPPO’s proposal, we will live with it, otherwise our vote goes to not change it.  |
| Intel | We prefer to keep current spec. Our understanding is that both dl-PRS-Id and DL PRS resource set ID are expected to be provided since those anyway needed to uniquely identify resource.If above IDs are not provided for reference determination, there is also no issue since UE can autonomously determine it and report. Therefore, we do not see critical issue.The potential correction that can be acceptable is:“This reference provided by *nr-DL-PRS-ReferenceInfo* includes 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” |
| ZTE | Although we thin it’s non-essential, we can live with OPPO’s version aligned with RAN2 signaling design. |

Conclusion

TBD

Reference

1. R1-2106994, “Draft CR on PRS reception procedure in NR positioning”, CATT.
2. 3GPP TSG RAN WG1 Meeting RAN1#96bis Chairman's Notes, May.2019.
3. TS 37.355, “LTE Positioning Protocol (LPP) (Release 16)”, V16.5.0 (2021-06).
4. TS 38.214, “NR; Physical layer procedures for data (Release 16)”, V16.6.0 (2021-06).