**3GPP TSG RAN WG1 Meeting #102-E R1-2009239**

**E-meeting, October 26th – November 13th, 2020**

**Source: Moderator (Intel Corporation, CATT, Ericsson, Qualcomm)**

**Title: Feature Lead Summary for NR Positioning Maintenance AI 7.2.8**

**Agenda item: 7.2.8**

**Document for: Discussion and Decision**

1. Introduction

In this contribution, we provide overview of open aspects raised by companies in contributions [1]-[15] submitted for Rel.16 NR Positioning Maintenance AI. In addition, we provide feature lead responses and recommendations to organize two e-mail discussions including their scope.

1. List of Remaining Opens on NR Positioning

## Aspect #1: Relationship of *dl-PRS-ID,* TRP and Multiple Positioning Frequency Layers?

* In [Huawei,[1]], there is a discussion on whether dl-PRS-ID can be used to associate a single TRP across multiple positioning frequency layers? It is proposed to conclude in RAN1 that the same dl-PRS-ID on different positioning frequency layers implies the same TRP serving the respective positioning frequency layers
* In [vivo, [12]], it is proposed that TRP ID (dl-PRS-ID-r16) can be reused across frequency layers and that RAN1 should clarify it and send an LS to RAN2 as well as adopt the following text proposals into TS38.214.

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| < Unchanged parts are omitted >  The UE expects that it will be configured with *dl-PRS-ID-r16* each of which is defined such that it is associated with multiple DL PRS resource sets from the same cell, and if the DL PRS resource sets are included by different positioning frequency layers, they should be associated with the same *dl-PRS-ID-r16*. The UE expects that one of these *dl-PRS-ID-r16* along with a *nr-DL-PRS-ResourceSetId-r16* and a *nr-DL-PRS-ResourceId-r16* can be used to uniquely identify a DL PRS resource.  < Unchanged parts are omitted > |

**Feature Lead Response**

* The aspect is discussed by two companies that seems to have the same understanding and which is expected to be common in RAN1.
* Motivation for further actions/changes is not clear.

## Aspect #2: On DL PRS periodicity and DL PRS processing capability

In [Huawei, [1]], it is discussed how to select considering the RAN4 definition of DL PRS report delay which is dependent on UE reported capability and the calculated . The following is proposed:

is selected to be the maximum PRS periodicity among the DL PRS resource sets in a positioning frequency layer.

* Capture it in RAN4 spec or in RAN1 spec
* In case it is required to be captured in the RAN4 spec, send an LS to RAN4.
* In case it is required to be captured in the RAN1 spec, agree the draft CR in R1-2008789, where the following reasons for change are provided:
  + The P-msec window selection is undefined in the specification, which results in ambiguity of K-msec PRS duration calculation, as a different P corresponds to a different K. It will further result in ambiguity in calculation of the PRS measurement latency requirement defined in TS 38.133. The selection of P-msec is non-trivial as PRS resource (sets) on a positioning frequency layer can have various periodicities, and it should be clarified which periodicity should be used for the selection of P.
  + The specification number referenced for PRS processing capability is not correct, as LPP capabilities are not captured in TS 38.306, but in TS 37.355.

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| 5.1.6.5 PRS reception procedure ============================== Unchanged parts ==============================  For the case when measurement gap is configured, the UE DL PRS processing capability is defined in [TS37.355]. For the purpose of DL PRS processing capability, the duration *K* *ms* of DL PRS symbols within any *P* *ms* window corresponding to the maximum PRS periodicity in a positioning frequency layer, is calculated by  *-* Type 1 duration calculation with UE symbol level buffering capability  *-* Type 2 duration calculation with UE slot level buffering capability  ============================== Unchanged parts ============================== |

**Feature Lead Response**

* It is proposed to discuss TP and decide whether / how to capture it
* Reference needs to be corrected

## Aspect #3: On handling DL PRS periodicity which is not LCM

* In [Huawei,[1]], it is also proposed that “UE is not expected to handle the case that the maximum PRS periodicity in a positioning frequency layer is not the least common multiple of the periodicities in the positioning frequency layer”.

**Feature Lead Response**

* Proposed modification seems to be a restriction / optimization, aiming to simplify implementation. It is proposed to discuss whether it needs to be introduced in specification.

## Aspect #4: Measurement Gap and PRS Reception procedure

* In [ZTE] it is proposed to remove the following sentences from PRS reception procedure:
  + “When the UE is expected to measure the DL PRS resource outside the active DL BWP, it may request a measurement gap in higher layer parameter *measGapConfig*.”
  + “UE is not expected to process DL PRS without configuration of measurement gap.
* Reasoning:
  + When UE expects to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP, UE doesn’t always need to request measurement gap. UE may request a measurement gap in higher layer parameter measGapConfig only if measurement gaps are either not configured or not sufficient.
  + UE can process DL PRS without configuration of measurement gap according to agreement made in previous meeting, but RAN4 will not define the requirement for this case.

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| 5.1.6.5 PRS reception procedure ========================== unchanged parts omitted==================================  The UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP if the measurement is made during a configured measurement gap.  ========================== unchanged parts omitted==================================  If the UE is configured with *dl-PRS-QCL-Info-r16* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are from the same cell. If *dl-PRS-QCL-Info-r16* is configured to the UE with 'QCL-Type-D' with a source DL-PRS-Resource then the *nr-DL-PRS-ResourceSetId-r16* and the *nr-DL-PRS-ResourceId-r16* of the source DL PRS resource are expected to be indicated to the UE.  ============================== unchanged parts omitted============================== |

**Feature Lead Response**

* The similar change was proposed at the previous meeting. The change is not considered as critical and necessary.

## Aspect #5: Change/Clarification to Expected RSTD Definition

* In [ZTE], the following reasoning is provided to change definition of *nr-DL-PRS-expectedRSTD-r16*
  + “Definition of *nr-DL-PRS-expectedRSTD-r16* is unclear in the current specification. In previous agreements, *nr-DL-PRS-expectedRSTD-r16* actually defines the time difference between the received DL subframe timing that UE is expected to receive DL PRS and the received DL subframe timing that UE is expected to receive DL PRS provided by *nr-DL-PRS-ReferenceInfo-r16*. In other words, *nr-DL-PRS-expectedRSTD-r16* provided to any TRP should follow the same reference timing, which is the received DL subframe timing the UE is expected to receive DL PRS provided by *nr-DL-PRS-ReferenceInfo-r16*.”

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| **5.1.6.5 PRS reception procedure**  ========================== unchanged parts omitted ================================  The UE expects to be configured with higher layer parameter *nr-DL-PRS-expectedRSTD-r16*, which defines the time difference between the received DL subframe timing the UE is expected to receive DL PRS and the received DL subframe timing the UE is expected to receive DL PRS provided by *nr-DL-PRS-ReferenceInfo-r16*, and *DL-PRS-expectedRSTD-uncertainty-r16*, which defines a search window around the *nr-DL-PRS-expectedRSTD-r16*.  =========================== unchanged parts omitted ================================= |

**Feature Lead Response**

* Current formulation seems clear enough

## Aspect #6: Configuration of the spatial relation for SRS for positioning

In [CATT, [4]], it is noticed that DL PRS and SSB of a non-serving cell are configured by two different higher layer parameters. In order to avoid ambiguity and make the configuration of DL PRS and SSB of a non-serving cell more clear the following TP is suggested:

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| **Proposed TP-A**  *-----------------------------------------------Start of Text Proposal for 38.214---------------------------------------------* **6.2.1 UE sounding procedure** ---------------------------------------------------- Unchanged part omitted ------------------------------------------------  - The configuration of the spatial relation between a reference RS and the target SRS, where the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16*, if configured, contains the ID of the reference RS. The reference RS may be an SS/PBCH block, CSI-RS configured on serving cell indicated by higher layer parameter *servingCellId* if present, same serving cell as the target SRS otherwise, or an SRS configured on uplink BWP indicated by the higher layer parameter *uplinkBWP*, and serving cell indicated by the higher layer parameter *servingCellId* if present, same serving cell as the target SRS otherwise. When the target SRS is configured by the higher layer parameter *SRS-PosResourceSet-r16*, the reference RS may also be a DL PRS configured on a serving cell or a non-serving cell indicated by the higher layer parameter *dl-PRS-r16*, or an SS/PBCH block of a non-serving cell indicated by the higher layer parameter *ssb-Ncell-r16*.  *------------------------------------------------* Unchanged part omitted *-----------------------------------------------------*  *-----------------------------------------------End of Text Proposal -----------------------------------------------------------* |

**Feature Lead Response**

* It seems useful clarification. Further RAN WG1 discussion is needed whether to adopt it.

## Aspect #7: Definition of SFN-SSBoffset

In [CATT, [5]], it is proposed to change the description of ***SFN-SSBoffset*** parameter. The following reasoning is provided:

“In RAN1’s LS on RRC parameters to RAN2 (R1-1913675), the description of the ***SFN-SSBoffset*** is given as“Four LSBs of the SFN of the TRP in which SSB is transmitted”. We may have two interpretations of the description: a) ***SFN-SSBoffset*** is 4 LSBs of the SFN of the TRP. This may not make sense since it is unclear what “the SFN of a TRP” is; and b) ***SFN-SSBoffset*** is 4 LSBs of the SFN of the SSB. This may make sense, however, the problem is the 4 LSBs of the SFN of an SSB changes in different SSB periods, but not a fixed number. For example, if we assume SSB transmission periodicity is 40ms, the 4LSBs of an SSB can be mod({x, 4+x, 8+x, …},16). Then, which of the 4 LSBs of the SFN should be configured as the ***SFN-SSBoffset.***

In our view, the *SFN-SSBoffset* should be described as the SFN offset of an SSB related to the start of the SSB period, instead of the 4 LSBs of the SFN of the SSB as shown in the following figure. Consider the largest transmission periodicity is 160ms, the current value range {0, .., 15} of ***SFN-SSBoffset*** alsoindicates uniquely the SSB position in an SSB transmission period”.

Finally the following proposal is made:

* Change the description of the parameter SFN-SSBoffset to “the SFN offset of SSB in the SSB period”, and send an LS to RAN2 on the change.

**Feature Lead Response**

* It is recommended to discuss and decide on proposal to avoid potential misinterpretations

During the e-mail discussion it was noticed and clarified that in the latest version of the TS 37.355 the description field has the following description that resolves the aspect 7:

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| ***sfn-SSB-Offset***  Indicates the 10 msec system frame offset of the SSB within the SSB periodicity. |

## Aspect #8: SRS power split

In [CATT, [5]], it is proposed to adopt the following text proposal for linear value of SRS Power split by UE (in section 7.3 of 38.213) with a reasoning that statement is applicable for SRS-MIMO only

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| **Proposed TP-A**  *-----------------------------------------------Start of Text Proposal for 38.213--------------------------------------------------*  **7.3 Sounding reference signals**  For SRS configured by the higher parameter *SRS-Resource*,a UE splits a linear value  of the transmit power  on active UL BWP  of carrier  of serving cell  equally across the configured antenna ports for SRS.  *-----------------------------------------------------* Unchanged part omitted *----------------------------------------------- -----------------------------------------------------End of Text Proposal ----------------------------------------------------------* |

**Feature Lead Response**

* Given that SRS for positioning has only single port the proposed change is not needed technically, however, it is worthwhile to clarify the specification to avoid potential future inconsistencies.

## Aspect #9: DL PRS Reception w/ Numerology Different from Active BWP

In [OPPO,[7]], the following reason for changes and TP are proposed with respect to DL PRS reception when the numerology of DL PRS is different from that of the active BWP.

Reason for changes:

During measurement gap, the UE can measure DL PRS outside the active DL BWP or a DL PRS with a numerology different from the one of the active DL BWP. It is specified in TS 38.214 that if the UE is expected to measure DL PRS resource outside the active BWP, the UE can request a measurement gap. But in contrast, the current specification has not specified that the UE can request a measurement gap when the UE is expected to measure expected to measure DL PRS resource with a different numerology. That is a critical issue. The consequence is that the UE is not able to measure a DL PRS resource if the UE is configured with DL PRS resource with a numerology different from the numerology of the active BWP with no measurement gap. Then the UE would have to skip the measurement. A change in TS 38.214 is need to resolve the issue.

**The text proposal for TS 38.214 V16.3.0 is:**

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| 5.1.6.5 PRS reception procedure \*\*\* Unchanged text is omitted \*\*\*  The UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP if the measurement is made during a configured measurement gap. When the UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP, it may request a measurement gap in higher layer parameter *measGapConfig*.  The UE assumes that the DL PRS from the serving cell is not mapped to any symbol that contains SS/PBCH block from the serving cell. If the time frequency location of the SS/PBCH block transmissions from non-serving cells are provided to the UE then the UE also assumes that the DL PRS from a non-serving cell is not mapped to any symbol that contains the SS/PBCH block of the same non-serving cell.  \*\*\* Unchanged text is omitted \*\*\* |

**Feature Lead Response**

* Similar TP was discussed at the previous meeting and group was close to consensus. Finally, the TP was not agreed due to additional comments raised and lack of time.
* It is recommended to not repeat discussion seems correction does not seem to be critical one.
* UE can measure DL PRS with numerology different from active BWP when MG is configured.

## Aspect #10: SRS Transmission w/o Spatial Relation Info

In [OPPO,[7]], the following reason for changes and TP are proposed with respect SRS Transmission w/o Spatial Relation Info configured.

Reason for changes:

The higher layer parameter *spatialRelationInfoPos-r16* is used to provide spatial setting information for an SRS resource. When the higher layer parameter *spatialRelationInfoPos-r16* is not provided to one SRS resource, the UE shall derive the Tx beam for that SRS resource by implementation of the UE, which shall not be specified in the specification. But in contrast, the current TS 38.214 includes text that describes the UE implementation. That is not the correct way for a technical specification. The text description on UE implementation shall be deleted.

**The text proposal for TS 38.214 V16.3.0 is:**

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| 6.2.1.4 UE sounding procedure for positioning purposes \*\*\* Unchanged text is omitted \*\*\*  When the SRS is configured by the higher layer parameter *SRS-PosResource-r16* and if the higher layer parameter *spatialRelationInfoPos-r16* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Resource* or *SRS-PosResource-r16*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell.  The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.  The UE is only expected to transmit an SRS configured the by the higher layer parameter *SRS-PosResource-r16* within the active UL BWP of the UE.  \*\*\* Unchanged text is omitted \*\*\* |

**Feature Lead Response**

* It seems not essential correction, since system can work with current text which does not limit any UE implementation.

## Aspect #11: Replacement of “cell” on “*dl-PRS-ID-r16*”

In [OPPO,[8]]. the following gives the corresponding text proposal to change “cell” on “*dl-PRS-ID-r16*”.

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| **In TS 38.214 Section 5.1.6.5**  **5.1.6.5 PRS reception procedure**  *<omitted text>*  The UE may be configured to measure and report, subject to UE capability, up to 4 DL RSTD measurements per pair of ~~cells~~ *dl-PRS-ID-r16* with each measurement between a different pair of DL PRS resources or DL PRS resource sets within the DL PRS configured for those cells. The up to 4 measurements being performed on the same pair of ~~cells~~ *dl-PRS-ID-r16* and all DL RSTD measurements in the same report use a single reference timing.  The UE may be configured to measure and report, subject to UE capability, up to 8 DL PRS RSRP measurements on different DL PRS resources ~~from the same cell~~ associated with the same *dl-PRS-ID-r16*. When the UE reports DL PRS RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS RSRP measurements associated with the same higher layer parameter *nr-DL-PRS-RxBeamIndex* have been performed using the same spatial domain filter for reception if for each *nr-DL-PRS-RxBeamIndex* reported there are at least 2 DL PRS-RSRP measurements associated with it within the DL PRS resource set..  The UE may be configured to measure and report, subject to UE capability, up to 4 UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in different positioning frequency layers.  The UE may be configured to measure and report, subject to UE capability, the timing and the quality metrics of up to 2 additional detected paths that are associated with each RSTD or UE Rx – Tx time difference. The timing of each additional path is reported relative to the path timing used for determining *nr-RSTD-r16* or *nr-UE-RxTxTimeDiff-r16*.  If the UE is configured with *dl-PRS-QCL-Info-r16* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are ~~from the same cell~~ associated with the same *dl-PRS-ID-r16*. If *dl-PRS-QCL-Info-r16* is configured to the UE with 'QCL-Type-D' with a source DL-PRS-Resource then the *nr-DL-PRS-ResourceSetId-r16* and the *nr-DL-PRS-ResourceId-r16* of the source DL PRS resource are expected to be indicated to the UE.  UE is not expected to process DL PRS without configuration of measurement gap.  *<omitted text>* |

**Feature Lead Response**

* It is recommended to agree on TP to avoid confusion

## Aspect #12: Simultaneous SRS-MIMO and SRS-Pos Transmission

In [LGE, [9]] it is proposed that SRS transmission configured by *SRS-Resource* has high priority than SRS transmission configured by *SRS-PosResource-r16*, given that in the previous meeting, a new UE capability for the simultaneous transmission of SRS for MIMO and SRS for positioning was introduced.

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| Agreements:   * A new UE capability of simultaneous positioning SRS and MIMO SRS transmission across multiple CCs within a band is introduced. With the candidate value {2}. * A new UE capability of simultaneous positioning SRS and MIMO SRS transmission for a given BC is introduced. With the candidate value {2}. |

The following TP on Section 7.5 of TS 38.213 is proposed:

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| **7.5 Prioritizations for transmission power reductions**  *---- Unchanged parts omitted ----*  The total UE transmit power in a symbol of a slot is defined as the sum of the linear values of UE transmit powers for PUSCH, PUCCH, PRACH, and SRS in the symbol of the slot.  - PRACH transmission on the Pcell  - PUCCH or PUSCH transmissions with higher priority index according to Clause 9  - For PUCCH or PUSCH transmissions with same priority index  - PUCCH transmission with HARQ-ACK information, and/or SR, and/or LRR, or PUSCH transmission with HARQ-ACK information  - PUCCH transmission with CSI or PUSCH transmission with CSI  - PUSCH transmission without HARQ-ACK information or CSI and, for Type-2 random access procedure, PUSCH transmission on the PCell  - SRS transmission, with aperiodic SRS having higher priority than semi-persistent and/or periodic SRS, or PRACH transmission on a serving cell other than the PCell  - SRS transmission, with SRS resource configured by *SRS-Resource* having higher priority than SRS resource configured by *SRS-PosResource-r16* where both SRS resources have the same *resourceType*  *---- Unchanged parts omitted ----* |

**Feature Lead Response**

* It is recommended to discuss and decide on the proposed TP.

## Aspect #13: DL PRS Processing Priority

The following TPs was provided in [LGE, [9]] aiming to reflect RAN1 agreements on DL PRS processing order.

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| **5.1.6.5 PRS reception procedure**  *---- Unchanged parts omitted ----*  When a UE is configured with a number of PRS resources beyond its capability, the DL PRS resources are sorted in the decreasing order of priority for measurement to be performed by the UE, with the reference indicated by *nr-DL-PRS-ReferenceInfo-r16* being the highest priority for measurement, and the following priority is assumed.   1. The 64 TRPs per frequency layer are sorted according to priority, 2. The 2 sets per TRP of the frequency layer are sorted according to priority, |

In [CMCC, [6]], the following proposals were made

* When a UE is configured in the assistance data of a positioning method with a number of PRS resources beyond its capability, the 4 positioning frequency layers are sorted according to priority.
* When a UE is configured in the assistance data of a positioning method with a number of PRS resources beyond its capability, the 64 resources of the set per TRP per frequency layer are sorted according to priority.

Finally, the following proposals were made in [vivo, [11]] with respect to DL PRS priority of processing

* In Rel-16, DL PRS positioning frequency layers in NR are not sorted according to priority of UE processing.
* In Rel-16, DL PRS resources within DL PRS Resource Set are not sorted according to priority of UE processing.
* When a UE is configured in the assistance data of a positioning method with a number of PRS resources beyond its capability (FG 13-2,13-3,13-4 for AoD, TDOA, MRTT respectively), the UE is expected to process at least the DL-PRS Resources in a group indicated in the assistance data for a PRS resource set of a TRP in a frequency layer.
* The sorted PRS resource priority is assumed only within the measurement gap window on the UE side.

**Feature Lead Response**

* This topic was extensively discussed at the previous meeting and there was no consensus reached to make any additional agreements. Given such outcome from the previous meeting, it is proposed to capture the latest RAN WG1 agreement
* Check if it was not captured across RAN1/RAN2 specs and if so discuss and decide how to capture the following text proposal as a starting point:

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| **5.1.6.5 PRS reception procedure**  *---- Unchanged parts omitted ----*  When a UE is configured with a number of PRS resources beyond its capability, the DL PRS resources are sorted in the decreasing order of priority for measurement to be performed by the UE, with the reference indicated by *nr-DL-PRS-ReferenceInfo-r16* being the highest priority for measurement, and the following priority is assumed:   1. The 64 TRPs per frequency layer are sorted according to priority; 2. The 2 sets per TRP of the frequency layer are sorted according to priority. |

## Aspect #14: Reference Correction in the TS 38.211

In [E///], it was identified that “In 38.211, the clause referenced for description of how a DL PRS resource is transmitted in incorrect. Change the incorrect reference to clause 5.1.6.4 in 38.214 to 5.1.6.5.”

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| 7.4.1.7.4 Mapping to slots in a downlink PRS resource set ---------------------------------------------Unchanged parts are omitted----------------------------------------------------  For a downlink PRS resource in a downlink PRS resource set configured, the UE shall assume the downlink PRS resource being transmitted as described in clause 5.1.6.5 of [6, TS 38.214].  ---------------------------------------------Unchanged parts are omitted---------------------------------------------------- |

**Feature Lead Response**

* Agree with proposed change to update reference

## Aspect #15: Alignment of Parameter Names and Reference Correction in TS 38.214

In [14], it is stated that there is misalignment between TS 37.355 and TS 38.214 when it comes to the fields present in positioniong frequency layer, DL PRS resource set, and DL PRS resource.

The following changes are proposed:

* The fields *dl-PRS-CombSizeN-r16, dl-PRS-ResourceBandwidth-r16,* and *dl-PRS-StartPRB-r16* are moved to positioning frequency layer to align with TS 37.355.
* The field *dl-PRS-ResourceList-r16* is moved to DL PRS resource set to align with TS 37.355.
* Reference clause numbers related to TS 38.211 are corrected
* Reference clause numbers related to TS 37.355 are corrected

The following TP is proposed:

**Text Proposal #1**

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| 5.1.6.5 PRS reception procedure -------------------------------------- unchanged parts omitted -----------------------------------------------  The UE assumes that the following parameters for each DL PRS resource(s) are configured via higher layer parameters *nr-DL-PRS-PositioningFrequencyLayer-r16, nr-DL-PRS-ResourceSet-r16* and *nr-DL-PRS-Resource-r16* defined by Clause 6.4.3 [17, TS 37.355].  A positioning frequency layer consists of one or more DL PRS resource sets and it is defined by Clause 6.4.3 [17, TS 37.355]:  *- dl-PRS-SubcarrierSpacing-r16* defines the subcarrier spacing for the DL PRS resource. All DL PRS resources and DL PRS resource sets in the same DL PRS positioning frequency layer have the same value of *dl-PRS-SubcarrierSpacing-r16*. The supported values of *dl-PRS-SubcarrierSpacing-r16* are given in Table 4.2-1 of [4, TS38.211].  *- dL-PRS-CyclicPrefix* defines the cyclic prefix for the DL PRS resource. All DL PRS Resources and DL PRS Resource sets in the same DL PRS positioning frequency layer have the same value of *DL-PRS-CyclicPrefix.* The supported values of *DL-PRS-CyclicPrefix* are given in Table 4.2-1 of [4, TS38.211].  *- dl-PRS-PointA-r16* defines the absolute frequency of the reference resource block. Its lowest subcarrier is also known as Point A. All DL PRS resources belonging to the same DL PRS resource set have common Point A and all DL PRS resource sets belonging to the same DL PRS positioning frequency layer have a common Point A.  34,  ------------------------------------unchanged parts omitted---------------------------------------------------  *- nr-DL-PRS-SFN0-Offset-r16* defines the time offset of the SFN0 slot 0 for the transmitting cell with respect to SFN0 slot 0 of reference cell.    A DL PRS resource is defined by:  ------------------------------------ unchanged parts omitted -------------------------------------------------  *- dl-PRS-NumSymbols-r16* defines the number of symbols of the DL PRS resource within a slot where the allowable values are given in Clause 7.4.1.7.3 of [4, TS38.211].  ------------------------------------ unchanged parts omitted ------------------------------------------------- |

In [OPPO,[8]], it was also proposed that fields *dl-PRS-CombSizeN-r16, dl-PRS-ResourceBandwidth-r16,* and *dl-PRS-StartPRB-r16* are moved to positioning frequency layer to align with TS 37.355.

In the same contribution [OPPO,[8]], it is proposed to rearrange *dl-PRS-ResourceList-r16* which is consistent with a change proposed above i.e. capture it under DL PRS resource set paragraph.

In [LGE, [11]], the similar opens were discussed and corresponding editorial corrections provided as in the text proposal below:

**Text Proposal #2**

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| **5.1.6.5 PRS reception procedure**  *---- Unchanged parts omitted ----*  A positioning frequency layer consists of one or more DL PRS resource sets and it is defined by Clause 6.4.2.1 [17, TS 37.355]:  *- dl-PRS-SubcarrierSpacing-r16* defines the subcarrier spacing for the DL PRS resource. All DL PRS resources and DL PRS resource sets in the same DL PRS positioning frequency layer have the same value of *dl-PRS-SubcarrierSpacing-r16*. The supported values of *dl-PRS-SubcarrierSpacing-r16* are given in Table 4.2-1 of [4, TS38.211].  *- DL-PRS-CyclicPrefix* defines the cyclic prefix for the DL PRS resource. All DL PRS Resources and DL PRS Resource sets in the same ~~DL-PRS-PositioningFrequencyLayer~~ DL PRS positioning frequency layer have the same value of *DL-PRS-CyclicPrefix.* The supported values of *DL-PRS-CyclicPrefix* are given in Table 4.2-1 of [4, TS38.211].  *- dl-PRS-PointA-r16* defines the absolute frequency of the reference resource block. Its lowest subcarrier is also known as Point A. All DL PRS resources belonging to the same DL PRS resource set have common Point A and all DL PRS resources sets belonging to the same DL PRS positioning frequency layer have a common Point A.  *---- Unchanged parts omitted ----*  A DL PRS resource is defined by:  *- dl-PRS-ResourceList-r16* determines the DL PRS resources that are contained within one DL PRS resource set.  *- nr-DL-PRS-ResourceId-r16* determines the DL PRS resource configuration identity. All DL PRS resource IDs are locally defined within a DL PRS resource set.  *- dl-PRS-SequenceId-r16* is used to initialize cinit value used in pseudo random generator [4, TS38.211, 7.4.1.7.2] for generation of DL PRS sequence for a given DL PRS resource.  *- ~~dl-PRS-CombSizeN-and-ReOffset-r16~~ dl-PRS-CombSizeN-AndReOffset-r16* 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, TS38.211].  *---- Unchanged parts omitted ----*  The UE may be indicated by the network that ~~a~~ 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-r16*.  *---- Unchanged parts omitted ----*  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, UE ~~Tx-Rx~~ Rx-Tx time difference.  *---- Unchanged parts omitted ----*  The UE may be configured to measure and report, subject to UE capability, up to 8 DL PRS RSRP measurements on different DL PRS resources from the same cell. When the UE reports DL PRS RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS RSRP measurements associated with the same higher layer parameter *nr-DL-PRS-RxBeamIndex-r16* have been performed using the same spatial domain filter for reception if for each *nr-DL-PRS-RxBeamIndex-r16* reported there are at least 2 DL PRS-RSRP measurements associated with it within the DL PRS resource set..  *---- Unchanged parts omitted ----* |

**Feature Lead Response**

* Agree with proposed changes of parameter names in both TPs and correction to references
  + Regarding the rearrangement of parameters to frequency layers, strictly speaking it is not necessary since parameters characterize properties of DL PRS resources and are common within DL PRS Resource Sets and DL PRS frequency layer.
* Merge provided TPs into a single TP and present it for discussion /endorsement.

## Aspect #16: RSTD Measurement on Multiple DL PRS Resources

In [OPPO, [8]], it is proposed to change the text when UE performs multiple measurements on DL PRS resources with the following reasoning:

“There was an agreement as below, which is not captured in the spec TS 38.214 correctly. The condition (highlighted by Yellow) is for the case of different DL PRS resource ID(s) in the agreement. However, the conditioned is misplaced for the case of a different DL PRS resource set.”

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| 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 |

The following TP is provided to correct the existing text.

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| --- |
| **In TS 38.214 Section 5.1.6.5**  *<omitted text>*  The UE may be indicated by the network that a DL PRS resources 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-r16*. 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-r16* and *nr-DL-PRS-expectedRSTD-uncerainty-r16*. 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-r16* may include an *dl-PRS-ID-r16*, a DL PRS resource set ID, and optionally a single DL PRS resource ID or a list of DL PRS resource IDs. The UE may use different DL PRS resources measurement as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met 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-r16*, the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference.  *<omitted text>* |

**Feature Lead Response**

* It is recommended to discuss provided TP and decide on correction

## Aspect #17: DL PRS QCL and SSB/PBCH Block Index

In [OPPO, [8]], it is proposed to change the text on SSB/PBCH block index when DL PRS is configured as both 'QCL-Type-C' and 'QCL-Type-D'. The following reasoning is provided:

“If the DL PRS is configured as both 'QCL-Type-C' and 'QCL-Type-D' with SS/PBCH Block, the SS/PBCH block should be the same one. However, the same value of SS/PBCH block index cannot ensure the same SSB/PBCH block since the SS/PBCH blocks from different cells may have the same SS/PBCH block index.

In order to ensure the same SS/PBCH block, we propose the following text proposal”

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| **In TS 38.214 Section 5.1.6.5**  *<omitted text>*  A DL PRS resource is defined by:  *- dl-PRS-ResourceList-r16* determines the DL PRS resources that are contained within one DL PRS resource set.  *<omitted text>*  *- dl-PRS-QCL-Info-r16* defines any quasi-colocation information of the DL PRS resource with other reference signals. The DL PRS may be configured to be 'QCL-Type-D' with a DL PRS or SS/PBCH Block from a serving cell or a non-serving cell. The DL PRS may be configured to be 'QCL-Type-C' with a SS/PBCH Block from a serving or non-serving cell. If the DL PRS is configured as both 'QCL-Type-C' and 'QCL-Type-D' with a SS/PBCH Block then the SSB index indicated should be the same and should be from the same cell.  *<omitted text>* |

**Feature Lead Response**

* Some clarification may be useful however proposed revision may need to be updated since the cell wording may be confusing.
* It is recommended to discuss provided TP and decide on correction.

1. Input to Preparation Phase

Based on review of submitted contributions in preparation phase, it was proposed by feature leads in RAN1 e-mail discussion “[103-e-Prep-NR-Pos] Summary of AI 7.2.8” to organize the following e-mail discussions during RAN1#103:

* [103-e-NR-Pos-01] Email discussion/approval on DL PRS focusing on aspects 2, 3, 7, 14, 16, in the FL summary – Alexey (Intel)
* [103-e-NR-Pos-02] Email discussion/approval on UL SRS and procedures focusing on aspects 6, 8, 11, 12, 15, 17 in the FL summary – Florent (Ericsson)

Finally, after e-mail discussion the scope of e-mail discussion as reported in Section 4 was approved.

1. Outcome of Preparation Phase

Finally, the following list of RAN1 e-mail discussions was agreed by RAN WG1 as an outcome of preparation phase:

* [103-e-NR-Pos-01] Email discussion/approval on DL PRS on aspects 2, 3, 13 (to capture RAN1 agreement only), 14, 16, in the FL summary until 10/29 with potential CRs by 11/4– Alexey (Intel)
* [103-e-NR-Pos-02] Email discussion/approval on UL SRS and procedures on aspects 6, 8, 11, 12, 15, 17 in the FL summary until 10/29 with potential CRs by 11/5 – Florent (Ericsson)

1. References
2. R1-2007574 Rel-16 positioning corrections Huawei, HiSilicon
3. R1-2007751 Draft CR on measurement gap configuration for DL PRS reception ZTE
4. R1-2007752 Draft CR on the definition of nr-DL-PRS-expectedRSTD-r16 ZTE
5. R1-2007822 Discussion on configuration parameters related to SRS-Pos CATT
6. R1-2007823 Discussion on linear value of SRS power split by UE CATT
7. R1-2007999 Remaining issues on DL PRS CMCC
8. R1-2008214 Text Proposals on NR Positioning Procedure OPPO
9. R1-2008215 Text Proposals on RS for Positioning OPPO
10. R1-2008414 Discussions on remaining issues on Rel-16 NR positioning LG Electronics
11. R1-2008580 Editorial Corrections on Rel-16 NR positioning LG Electronics
12. R1-2008678 Remaining issues on prioritization of positioning assistance data vivo
13. R1-2008679 Remaining issues on TRP ID for NR positioning vivo
14. R1-2008760 Corrections to 38.211 for NR positioning Ericsson
15. R1-2008761 Corrections to 38.214 for NR positioning Ericsson
16. R1-2008789 Correction to PRS duration calculation for PRS processing Huawei, HiSilicon