**3GPP TSG RAN WG1 Meeting #113 R1-230xxxx**

Incheon, Korea, May 22nd – May 26th, 2023

**Agenda item: 9.17**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Summary on email discussion on** **NR Enhanced Positioning**

**Document for: Discussion and Decision**

# 1 Introduction

This thread will discuss the draft CR to 38.214 for the NR Enhanced Positioning.

First checkpoint for this discussion: **June 7th, UTC 12.00**!

# 2 Discussion – first round

The comments in this section are based on version 0 of the the draft CR available in the **Post RAN1#113 discussion.**

|  |  |  |
| --- | --- | --- |
| Company | Comments | Editor reply/Notes |
| CATT | Comment 1: **Agreement**Introduce DL reference carrier phase (DL RSCP) and NR DL reference carrier phase difference (DL RSCPD) as DL carrier phase measurements.* Note: It is up to RAN4 to decide whether and how to define the requirements for DL RSCP and/or DL RSCPD. No LS needed to RAN4 for this note.
* DL RSCP can be reported together with UE Rx – Tx time difference measurement
* DL RSCPD can be reported together with RSTD measurement
* …

Based on above agreement, we need to switch RSCPD and RSCP in the following paragraph: *In 5.1.6.5 PRS reception procedure**….**For DL UE positioning measurement reporting in higher layer parameter NR-DL-TDOA-SignalMeasurementInformation,* the UE may be configured to report the DL Reference Signal Carrier Phase Difference (RSCPD) [7, TS 38.215] measurement along with the DL RSTD. When the UE reports RSCPD measurements the reference is the same as the one configured, or reported, for the RSTD measurements. For DL UE positioning measurement reporting in higher layer parameter *NR-Multi-RTT-SignalMeasurementInformation* the UE may be configured to report the DL Reference Signal Carrier Phase (RSCP) measurement [7, TS 38,215] along with the UE Rx-Tx time difference.Comment 2: **Agreement**If a UE reports RSCPD measurements together with RSTD measurements in a measurement report element, the reference TRP for RSCPD is the same as the reference TRP reported for RSTD.* The target and the reference TRP are in the same PFL

Based on above agreement, suggest making the following change to the reference of the RSCPD: *In 5.1.6.5 PRS reception procedure**….**For DL UE positioning measurement reporting in higher layer parameter NR-DL-TDOA-SignalMeasurementInformation,* the UE may be configured to report the DL Reference Signal Carrier Phase (RSCP) [7, TS 38.215] measurement along with the DL RSTD. When the UE reports RSCPD measurements, the reference TRP is the same as the one reported for the RSTD measurements. For DL UE positioning measurement reporting in higher layer parameter *NR-Multi-RTT-SignalMeasurementInformation* the UE may be configured to report the DL Reference Signal Carrier Phase Difference (RSCPD) measurement [7, TS 38,215] along with the UE Rx-Tx time difference. |  |
| Qualcomm | 1)On the following: For DL UE positioning measurement reporting in higher layer parameter NR-DL-TDOA-SignalMeasurementInformation, the UE may be configured to report the DL Reference Signal Carrier Phase (RSCP) [7, TS 38.215] measurement along with the DL RSTDThe agreement says RSCPD: * DL RSCPD can be reported together with RSTD measurement

And similarly, for Rx-Tx is the RSCP:* DL RSCP can be reported together with UE Rx – Tx time difference measurement

But the draft CR says: For DL UE positioning measurement reporting in higher layer parameter NR-Multi-RTT-SignalMeasurementInformation the UE may be configured to report the DL Reference Signal Carrier Phase Difference (RSCPD) measurement2) On PRS aggregation, and with regards to the following text: When the UE is expected to perform joint measurements for bandwidth aggregation across DL PRS positioning frequency layers, the UE expects to be configured with linkage information, via higher layer parameter [*linkage*], between DL PRS resource sets across DL PRS positioning frequency layers associated with a *dl-PRS-ID*The linked PRS resource sets will be associated with a different dl-PRS-ID. Observ that we have 256 PRS-IDs because it is up to 8 sets (2 sets per PFL), for up to 64 TRPs. So total 64\*8=256. Therefore, the sets that belong on different PFL will actually have a different dl-PRS-ID. R-DL-PRS-AssistanceDataPerTRP-r16 ::= SEQUENCE {    dl-PRS-ID-r16                 INTEGER (0..255),    nr-PhysCellID-r16              NR-PhysCellID-r16          OPTIONAL,   -- Need ON    nr-CellGlobalID-r16            NCGI-r15                  OPTIONAL,   -- Need ON    nr-ARFCN-r16                  ARFCN-ValueNR-r15          OPTIONAL,   -- Need ON    nr-DL-PRS-SFN0-Offset-r16      NR-DL-PRS-SFN0-Offset-r16,    nr-DL-PRS-ExpectedRSTD-r16     INTEGER (-3841..3841),    nr-DL-PRS-ExpectedRSTD-Uncertainty-r16                                 INTEGER (0..246),    nr-DL-PRS-Info-r16             NR-DL-PRS-Info-r16,NR-DL-PRS-Info-r16 ::= SEQUENCE {    nr-DL-PRS-ResourceSetList-r16      SEQUENCE (SIZE (1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF                                                              NR-DL-PRS-ResourceSet-r16,    ...}nrMaxSetsPerTrpPerFreqLayer-r16        INTEGER ::= 2      -- Maximum resource sets for one TRPTherefore, our suggestion is to keep the agreement wording for now: “per TRP”:When the UE is expected to perform joint measurements for bandwidth aggregation across DL PRS positioning frequency layers, the UE expects to be configured with linkage information on a per TRP basis, via higher layer parameter [*linkage*], between DL PRS resource sets across DL PRS positioning frequency layers ~~associated with a~~ *~~dl-PRS-ID~~* 3) We think the following sentence from the agreement needs to be captured and it may related to the last part of the paragraph below. ***It is assumed that the PRS resources across the linked PRS resource sets are linked if the conditions are satisfied. For the non-linked PRS resource sets, no aggregation is assumed*** Our understanding of the agreement and proposal is as follows: For the linked PRS resource sets, the UE is expected to be configured with the same values of QCL, *dl-PRS-Periodicity-and-ResourceSetSlotOffset, dl-PRS-NumSymbols*,*dl-PRS-ResourceTimeGap, dl-PRS-ResourceSymbolOffset,* *dl-prs-MutingBitRepetitionFactor,* CP, comb size, power per subcarrier, *NR-MutingPattern*, and *NR-DL-PRS-SFN0-Offset,* and the UE is expected to be configured with PRS resources that maintain uniformly spaced PRS RE pattern within a symbol across aggregated DL PRS positioning frequency layers. The UE may assume that PRS resources across the linked PRS resource sets which satisfy the above conditions are linked for PRS bandwidth aggregation, otherwise, the UE does not assume that PRS resources from the linked DL PRS resource sets are linked. Note: More comments will be added later from our side. Thanks! |  |

|  |  |  |
| --- | --- | --- |
| Qualcomm2 | 3) With regards to the following:When an SRS resource configured in a CC without PUSCH or PUCCH is linked for bandwidth aggregation with an SRS resource configured in an active UL BWP of another [UL data transmission] CC, a [guard period] is provided during which the UE is not expected to transmit or receive other signals or channels.* 1. We think it should clearly say that it is “SRS resource configured with *SRS-PosResource*” since this is only for SRS for Positioning.
	2. There is another sentence in the same section of 38.214 saying:

The UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission.* 1. The [UL data transmission] CC could just be: “CC configured for PUSCH/PUCCH transmission”

Based on the above, our **proposal** is to merge these 2 sentences (one existing and a new one as follows) using the following paragraphs:The UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission, unless, subject to UE capability, this *SRS-PosResource* is linked for bandwidth aggregation with an SRS resource configured with *SRS-PosResource* in an active UL BWP of another CC configured for PUSCH/PUCCH transmission. When an SRS resource configured with *SRS-PosResource* in a CC without PUSCH or PUCCH is linked for bandwidth aggregation with an SRS resource configured with *SRS-PosResource* in an active UL BWP of another CC configured for PUSCH/PUCCH transmission, a [guard period] is provided during which the UE is not expected to transmit or receive other signals or channels.4) With regards to this part of the agreement on SRS BW aggregation:It is assumed that the SRS resources across the linked SRS resource sets are linked if the conditions are satisfied. For the non-linked SRS resource sets, no aggregation is assumed even if the conditions are satisfied. We believe it is needed to be captured, otherwise the UE doesn’t now which SRS resource is linked with which one. Note that, at least with regards to the “startPosition” it is in an SRS resource level, so there cannot be that the sets are configured with the same value. Our **proposal** is shown below: The UE is expected to be configured with linkage information [*linkage*] on SRS resource sets for positioning across two or three CCs which are linked for bandwidth aggregation. SRS resources across the linked SRS resource sets are linked for bandwidth aggregation when the the same values of *startPosition, nrofSymbols,* *periodicityAndOffset, slotOffset, alpha, p0,* subcarrier spacing, CP, and comb size are configured, otherwise, the UE does not assume that the SRS resources from the linked SRS resource sets are linked.  ~~aggregated measurement across CCs from the transmission of the linked SRS resource sets.~~5) We believe this agreement needs to be captured in 38.214:**Agreement**When the UE receives a request to perform aggregated measurements, * TRP(s) that include PRS aggregation have higher priority than the TRPs that do not include PRS aggregation
	+ If 2 or more TRPs include linked resources, then their priority follows the legacy priority, i.e., sorted in the configuration according to priority
* If a PRS resource set is linked for aggregation, then it has higher priority compared to the PRS resource set not linked for aggregation.
	+ If both sets in a PFL are linked for aggregation, then their priority follows the legacy priority, i.e., sorted in the configuration according to priority

And it is related to the following existing *paragraph in the same section*: *Within a positioning frequency layer, 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 being the highest priority for measurement, and the following priority is assumed:**- Up to 64 NR-SelectedDL-PRS-IndexPerTRP of the DL PRS positioning frequency layer are sorted according to priority if nr-SelectedDL-PRS-IndexListPerFreq is provided, or up to 64 NR-DL-PRS-AssistanceDataPerTRP of the frequency layer are sorted according to priority otherwise;**- Up to 2 DL-SelectedPRS-ResourceSetIndex per dl-PRS-ID of the DL PRS positioning frequency layer are sorted according to priority if dl-SelectedPRS-ResourceSetIndexList is provided, or up to 2 NR-DL-PRS-ResourceSet per dl-PRS-ID of the DL PRS positioning frequency layer are sorted according to priority otherwise.*We make a **proposal** with changes in the existing paragraph as follows: *Within a positioning frequency layer, 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 being the highest priority for measurement, and the following priority is assumed:**- Up to 64 NR-SelectedDL-PRS-IndexPerTRP of the DL PRS positioning frequency layer are sorted according to priority if nr-SelectedDL-PRS-IndexListPerFreq is provided, or up to 64 NR-DL-PRS-AssistanceDataPerTRP of the frequency layer are sorted according to priority otherwise; unless** *A TRP includes DL PRS bandwidth aggregation linkage, in which case it has higher priority than a TRP(s) without DL PRS bandwidth aggregation linkage. If multiple TRP(s) in the nr-SelectedDL-PRS-IndexListPerFreq, if provided, or NR-DL-PRS-AssistanceDataPerTRP, otherwise, include DL PRS bandwidth aggregation linkage, then they are sorted according to priority.*

*- Up to 2 DL-SelectedPRS-ResourceSetIndex per dl-PRS-ID of the DL PRS positioning frequency layer are sorted according to priority if dl-SelectedPRS-ResourceSetIndexList is provided, or up to 2 NR-DL-PRS-ResourceSet per dl-PRS-ID of the DL PRS positioning frequency layer are sorted according to priority otherwise, unless** *A DL PRS resource set associated with a dl-PRS-ID includes a DL PRS bandwidth aggregation linkage, in which case it has higher priority than a DL PRS resource set associated with the same dl-PRS-ID without a DL PRS bandwidth aggregation linkage. If multiple DL PRS resource sets associated with a dl-PRS-ID include PRS bandwidth aggregation linkage, then they are sorted according to priority.*
 |  |
|  |  |  |
|  |  |  |
|  |  |  |