**3GPP TSG RAN WG1#117**  **R1-** **2405351**

**Fukuoka City, Fukuoka, Japan, May 20th – 24th, 2024**

Agenda Item: 8.1

Source: Moderator (CATT)

Title: FL Summary for maintenance on NR DL and UL carrier phase positioning

Document for: Discussion and Decision

# Introduction

This document provides a summary of the maintenance issues on NR DL and UL carrier phase positioning based on the proposals from the submitted contributions ([1-3]).

# Draft CR on PRS for carrier phase positioning

***Submitted draft CR in R1-2404153 [2]:***

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| ***Title:***  | Draft CR on PRS for carrier phase positioning |
|  |  |
| ***Source to WG:*** | vivo |
| ***Source to TSG:*** | RAN1 |
|  |  |
| ***Work item code:*** | NR\_Pos\_enh2-Core |  | ***Date:*** | 2024-05-20 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | 1. According to the latest TS37.355, *NR-PRU-RSCP-MeasInfo* which only contains DL RSCP measurement, cannot contain the RSTD measurement, it is different from the current description “which contains DL RSCP/RSCPD measurements together with DL RSTD, DL PRS-RSRP, and/or DL PRS-RSRPP measurement(s)”
2. The higher layer parameter within the bracket should be aligned with the latest TS37.355
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| ***Summary of change:*** | 1. Update *NR-PRU-RSCP-MeasInfo* as optional for RSCP only, and can be provided with *nr-PRU-DL-TDOA-MeasInfo* together to provide DL RSCPD measurements together with DL RSTD, DL PRS-RSRP, and/or DL PRS-RSRPP measurement(s)
2. Replace higher layer parameter within the bracket with *phaseQualityValue*.
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| ***Consequences if not approved:*** | Inconsistent parameter name and description for PRS on carrier phase positioning between TS38.214 v18.2.0 and TS37.355 v18.1.0. |
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| ***Clauses affected:*** | 5.1.6.5.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  |  |
| ***affected:*** |  | **X** |  Test specifications |  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
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| ***Other comments:*** |  |
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| ***This CR's revision history:*** |  |
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#### 5.1.6.5 PRS reception procedure

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##### 5.1.6.5.2 PRS for carrier phase positioning

The UE may be provided with DL RSCP measurements by *nr-PRU-RSCP-MeasInfo* or DL RSCPD measurements by *nr-PRU-DL-TDOA-MeasInfo.* The DL RSCP or DLRSCPD measurements can be provided together with DL RSTD, DL PRS-RSRP, and/or DL PRS-RSRPP measurement(s) performed by a positioning reference unit (PRU) [20, TS 38.305] , and the timestamps associated with the measurements, and the location information of the PRU.

The UE may be configured to report quality metrics *NR-PhaseQuality*corresponding to the DL RSCP and RSCPD measurements which include the following fields [17, TS 37.355]:

*- phaseQualityValue* which provides the uncertainty of the measurement

*- phaseQualityResolution* which specifies the resolution levels used in the *phaseQualityValue* field.

<omitted text>

FL Comments:

From FL’s view, the proposed changes in draft CR in R1-2404153 are reasonable. Interested companies are encouraged to provide their views.

### Proposal 2-1

Endorse the draft CR in R1-2404153 [2]:

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| **Company** | **comments** |
| Qualcomm | We don’t think that this restructuring is needed, and It may create some confusion actually. For example, the “or” in the first sentence may be interpreted as if a UE may be provided with either RSCP or RSCPD, and not both. The current structure in RAN2 allows for both to be reported.  |
| vivo | SupportReply to Qualcomm, in the previous description also only one higher-layer parameter can be provided, and those higher-layer parameters include either RSCP or RSCPD, so the problem exists in the previous version. In addition, NR-PRU-RSCP-MeasInfo which only contains DL RSCP measurement, cannot contain the RSTD measurement, it is different from the current description “which contains DL RSCP/RSCPD measurements together with DL RSTD, DL PRS-RSRP, and/or DL PRS-RSRPP measurement(s)” So if companies still have some concerns, we are okay to modify the first sentence as follows, but anyway the modification is neededThe UE may be provided with DL RSCP measurements by *nr-PRU-RSCP-MeasInfo* and/ or DL RSCPD measurements by *nr-PRU-DL-TDOA-MeasInfo.* |
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# Draft CR for carrier phase positioning

***Submitted draft CR in R1-2404992 [3]:***

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| ***Title:***  | Draft CR for carrier phase positioning |
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| ***Source to WG:*** | ZTE |
| ***Source to TSG:*** | R1 |
|  |  |
| ***Work item code:*** | NR\_pos\_enh2-Core |  | ***Date:*** | 2024-05-10 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | 1. UE will report the DL RSCPD measurement together with DL RSTD measurement instead of DL RSTD. The current description in TS 38.214 is not aligned with other measurement report and the following agreement:

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| **Agreement in RAN1#112bis-e**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
* FFS: details on how to eliminate unknown initial Rx phase with RSCP/RSCPD reporting can be further discussed
 |

1. The description for PRU measurement information is not clear in current TS 38.214. nr-PRU-RSCP-MeasInfo and nr-PRU-DL-TDOA-MeasInfo includes the timestamp. Conjunction is required before ‘the timestamps associated with the measuremts’.

In current TS 37.355, NR-PRU-DL-Info includes the following information:

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| NR-PRU-DL-Info-r18 ::= SEQUENCE { nr-PRU-LocationInfo-r18 LocationCoordinates OPTIONAL, -- Need ON nr-PRU-DL-TDOA-MeasInfo-r18 NR-DL-TDOA-SignalMeasurementInformation-r16 OPTIONAL, -- Need ON nr-PRU-DL-AoD-MeasInfo-r18 NR-DL-AoD-SignalMeasurementInformation-r16 OPTIONAL, -- Need ON nr-PRU-RSCP-MeasInfo-r18 NR-PRU-RSCP-MeasurementInformation-r18  OPTIONAL, -- Need ON ...} |

wherein nr-PRU-LocationInfo contains the PRU’s location information, nr-PRU-RSCP-MeasInfo contains the RSCP measurement information, and nr-PRU-DL-TDOA-MeasInfo contains the RSTD, RSRP, RSRPP and RSCPD measurement information. nr-PRU-RSCP-MeasInfo or nr-PRU-DL-TDOA-MeasInfo only provides the measurement information of PRU, whereas the location information of PRU is a separate IE. Providing location information of PRU to UE should be a separate description, and the IE name corresponding to PRU location information is not included in the current specification.1. For Rel-18 CPP, UE may be configured report quality metrics corresponding to phase measurement. However, the IE name *[phase quality index]* in the current TS 38.214 is not aligned with higher layer parameter.
2. There are several typos in 5.1.6.5.2, duplicate spaces in ‘*nr-PRU-RSCP-MeasInfo* or’ and ‘*phaseQualityValue* which’, missing spaces in ‘*NR-PhaseQuality*corresponding’ and ‘measurementfrom’.
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| ***Summary of change:*** | 1. Correct the DL RSCPD measurement report.
2. Clarify the description for PRU information provided to the target UE.
3. Correct the IE name *[phase quality index] -> phaseQualityValue.*
4. Correct several typos in 5.1.6.5.2.
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| ***Consequences if not approved:*** | 1. The description of DL RSCPD measurement report is not aligned with other measurement report and agreement.
2. The description for PRU information provided to the target UE is not clear.
3. The IE name *[phase quality index]* is not aligned with higher layer parameter.
4. There are several typos in 5.1.6.5.2.
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| ***Clauses affected:*** | 5.1.6.5.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

##### 5.1.6.5.2 PRS for carrier phase positioning

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 measurement. When the UE reports RSCPD measurements, the reference *nr-DL-PRS-ReferenceInfo* 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 (RSCP) measurement [7, TS 38,215] along with the UE Rx-Tx time difference measurement. When the UE reports DL RSCPD measurement(s) along with DL RSTD measurement(s) or DL RSCP measurement(s) along with UE Rx-Tx time difference measurement(s), the DL RSCPD and/or DL RSCP measurement(s) should be measured from a single DL PRS positioning frequency layer. For a UE in RRC\_CONNECTED state, DL RSCP/RSCPD measurements are measured within the configured measurement gap.

<omitted text>

The UE may be provided with *nr-PRU-RSCP-MeasInfo* or *nr-PRU-DL-TDOA-MeasInfo* which contains DL RSCP/RSCPD measurements together with DL RSTD, DL PRS-RSRP, and/or DL PRS-RSRPP measurement(s) associated with the RSCP/RSCPD measurements performed by a positioning reference unit (PRU) [20, TS 38.305], and the timestamps associated with the measurements. The UE may be provided with *nr-PRU-LocationInfo* which contains the location information of the PRU.

The UE may be configured to report quality metrics *NR-PhaseQuality* corresponding to the DL RSCP and RSCPD measurements which include the following fields [17, TS 37.355]:

*- phaseQualityValue* which provides the uncertainty of the measurement

*- phaseQualityResolution* which specifies the resolution levels used in the *phaseQualityValue* field.

The UE in RRC\_INACTIVE or RRC\_IDLE mode is expected to perform the DL RSCP or DL RSCPD measurement from the bandwidth of a DL PRS resource including outside of the initial downlink bandwidth part.

<omitted text>

FL Comments:

From FL’s view, the proposed changes in draft CR in R1-2404992 are reasonable. Interested companies are encouraged to provide their views.

Note: Both R1-2404992 and R1-2404153 include the change of “*phaseQualityValue”.* We will remove the change from one of draft CRs if both of them are agreeable.

### Proposal 3-1

Endorse the draft CR in [R1-2404992](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2404992.zip) [3]:

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| **Company** | **comments** |
| Qualcomm  | We don’t think the split into a separate sentence for the PRU location is needed. Unnecessary change and there is no problem with the current text.  |
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# RSCP measurements for UE-based CPP

***Submitted Proposal:***

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| *Nokia[1]* | **Proposal 4:** Support the following text proposal of Clause 5.1.6.5.2 of TS 38.214

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| 5.1.6.5.2 PRS for carrier phase positioning<omitted text>The UE may be provided with [*nr-PruInformation-Ue-based-DL-CPP* ] which contains DL ~~RSCP/~~RSCPD measurements together with DL RSTD, DL PRS-RSRP, and/or DL PRS-RSRPP measurement(s) associated with the RSCP/RSCPD measurements performed by a positioning reference unit (PRU) [20, TS 38.305] the timestamps associated with the measurements, and the location information of the PRU. The UE is not expected to be provided with [*nr-PruInformation-Ue-based-DL-CPP* ] which does not contain DL RSCPD measurements.<omitted text> |

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| ***Reason for change:*** | RAN1 made an agreement about providing PRU RSCP measurements to a UE, but there is no use case as UE-based positioning based on multi-RTT technique is not supported. RAN1 needs to resolve this issue. This issue is also under discussion in RAN2 based on RAN1 agreement, but the use case would be also unclear from their view. RAN1 should fix this issue to avoid unnecessary signalling of PRU measurement to a target UE.  |
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| ***Summary of change:*** | Remove provision of the PRU RSCP measurement to a target UE. |
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| ***Consequences if not approved:*** | It may cause confusion to RAN2 about the necessity of the signaling, which is under discussion. If they just add the signaling, an unnecessary signaling information will be added, but LMF actually will never provide this information to the UE for UE-based positioning. |

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FL Comments:

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| **Agreement**For UE-based carrier phase positioning, support enabling LMF to forward the DL carrier phase measurement reported by a PRU, with additional information of the same PRU to a target UE for UE-based carrier phase positioning in the positioning assistance data.* Note: Whether the forwarded DL carrier phase measurement is DL RSCP and/or DL RSCPD depends at least on which of them is (are) supported by UE capability.
* additional information of the same PRU includes at least PRU location.
	+ FFS: additional PRU information, e.g. the AoD of PRU to each TRP, etc.
 |

Based on the above agreement, the forwarded DL carrier phase measurements to the UE can be DL RSCP and/or DL RSCPD. DL RSCPD measurements can be derived from DL RSCP measurements. It will be up to the LMF to determine whether to provide DL RSCP or DL RSCPD to the UE if the RSCP measurements are provided by the PRU. Therefore, the proposed TP in Proposal 4 from [1] may not be necessary in FL’s view.

Note: Proposal 4 from [1] was discussed in the last meeting [4]. Five companies provided feedback, with the majority (four) not supporting the proposal. If the proposal cannot gain majority support in this meeting, FL suggests no further discussion on this proposal during this meeting.

### Question 4-1

Please provide your view on above Proposal 4 from [1]:

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| **Company** | **comments** |
| Qualcomm | Not support. The agreement is clear.  |
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# References

1. [R1-2404052](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2404052.zip) Maintenance on Expanded and Improved NR Positioning Nokia
2. [R1-2404153](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2404153.zip) Draft CR on PRS for carrier phase positioning vivo
3. [R1-2404992](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_117/Docs/R1-2404992.zip) Draft CR for carrier phase positioning ZTE
4. R1-2403420 FL Summary #2 for maintenance on NR DL and UL carrier phase positioning Moderator (CATT)