**3GPP TSG RAN WG1 #117 R1-240xxxx**

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

Agenda Item: 8.1

Source: Moderator (vivo)

Title: FL Summary on Measurements and reporting for SL positioning

Document for: Discussion and Decision

# Introduction

The following agenda has been finished in RAN1 #114 for measurements and reporting for SL positioning.

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| --- |
| * Specify measurements to support RTT-type solutions using SL, SL-AoA, and SL-TDOA [RAN1, RAN2]. |

In this summary, we summarize some proposals and submitted text proposals for measurements and reporting for SL positioning of Rel-18 expanded and improved positioning.

# Discussion information

The following papers have been identified and related to the measurements and reporting for SL positioning.

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| --- | --- | --- |
| **R1-2404052** | Maintenance on Expanded and Improved NR Positioning | Nokia |
| **R1-2405321** | Correction to the provision of RTD in SL positioning | Huawei, HiSilicon |

# Measurements and reporting for SL positioning

## Resource pool/PRS resource bandwidth information

The following proposals are identified to be related to this issue.

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| Nokia  **R1-2404052** | **Proposal 1:** Support the following text proposal of Clause 8.4.4 of TS 38.214   |  | | --- | | 8.4.4 SL PRS reception procedure  <omitted text>  The UE may include SL PRS resource ID(s) and SL PRS resource pool ID when it reports one or more of the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, SL PRS-RSRP, and SL PRS-RSRPP measurements.  <omitted text> |  |  |  | | --- | --- | | ***Reason for change:*** | A key motivation for reporting the SL PRS resource ID to LMF/UE is to allow LMF/UE to uniquely identify the SL PRS resource that is associated with a certain SL PRS transmission. However, the SL PRS resource ID alone does not give the complete information on the time frequency resource of the SL PRS transmission. In a case where multiple resource SL PRS pools are multiplexed in an FDM manner, SL PRS resource ID alone is ambiguous since the resource IDs are defined within a resource pool. Hence, the resource pool information is also desired at the LMF/UE. | |  |  | | ***Summary of change:*** | Add SL PRS resource ID into Clause 8.4.4 of TS 38.214. | |  |  | | ***Consequences if not approved:*** | The LMF may not be able to know the detailed resource information used for the reported measurement as the reported SL PRS resource ID. |   **Proposal 2:** Send an LS to RAN2 to support reporting of SL PRS resource pool ID in sidelink positioning measurement report. |

### Collection of views

This issue was discussed in multiple meetings. Companies are encouraged to share views in the following table.

Table 3.1.1 Collection of views on FL proposal 3.1.1-v1

|  |  |
| --- | --- |
| Company | Views on FL proposal 3.1.1-v1 |
| Huawei, HiSIlicon | We think we should stop discussing resource pool ID reporting. |
| Nokia | Support. It is unclear how the LMF can use the reported resource ID without information on the pool ID. |
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## Antenna port for SL PRS

One TP was raised by Nokia which is about antenna port of SL PRS.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Nokia  **R1-2404052** | **Proposal 3:** Support the following text proposal of Clause 8.4.4 of TS 38.214   |  | | --- | | 8.2.4 SL PRS transmission procedure  <omitted text>  The UE may report the association information between the already transmitted SL PRSs of SL PRS resources and UE Tx ARP ID. The association information includes ARP ID(s) indicated by *sl-POS-ARP-ID-Tx*, SL PRS transmission timestamp(s) indicated by *sl-TimeStamp*, and optional SL PRS resource ID(s) indicated by *sl-PRS-ResourceID*.  The UE may report whether transmitted SL PRSs of SL PRS resources can be used to perform sidelink positioning measurements with multiple measurement samples.  <omitted text> |  |  |  | | --- | --- | | ***Reason for change:*** | RAN4 is now considering both single measurement sample and multiple measurement samples of SL PRS measurements. In RAN1, a specific SL PRS resource is uniquely defined within a slot, so a receiving UE can perform a positioning measurement based on a single measurement sample only. There is no way for the Rx UE to assume the same Tx antenna across different SL PRS resources. In order for Rx UE to perform SL PRS measurement with multiple measurement samples, RAN1 should support additional feature. At least, the Rx UE needs information which SL PRS resources have been transmitted with the same Tx antenna port.  It should be noted that antenna port number of DL PRS resources is the same, but it does not mean that the UE can use measurements from different DL PRS resources as multiple measurement samples to derive a single measurement. The UE reports a specific positioning measurement based on multiple measurement samples from **a single DL PRS resource** which is transmitted periodically. The positioning measurement based on multiple measurement samples cannot be done by randomly selecting different SL PRS resources by the Rx UE. | |  |  | | ***Summary of change:*** | Add the proposed text in Clause 8.2.4 of TS 38.214. | |  |  | | ***Consequences if not approved:*** | The Rx UE cannot obtatin positioning measurements with multiple measurement samples based on SL PRS, which is not aligned with the current RAN4 discussion. If this is not approved, RAN1 needs discussion with RAN4 to address the issue. | |

Based on TS 38.214, the association information between the already transmitted SL PRSs of SL PRS resources and UE Tx ARP ID can be provided.

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| **< text omitted >**  The UE may report the association information between the already transmitted SL PRSs of SL PRS resources and UE Tx ARP ID. The association information includes ARP ID(s), SL PRS transmission timestamp(s) [*sl-prs-time-stamp*], and optional SL PRS resource ID(s).  **< text omitted >** |

In this case, FL understands positioning measurements with multiple measurement samples can be obtained by SL PRS(s) from same Tx ARP since FR2-specific feature is not pursued in this release.

### Collection of views

Companies are encouraged to share views in the following table.

Table 3.2.1 Collection of views on FL proposal 3.2.1-v1

|  |  |
| --- | --- |
| Company | Views on FL proposal 3.2.1-v1 |
| Huawei, HiSilicon | This information is only available when the Tx UE finished the transmission, and thus not very useful for Rx combining. |
| CATT | Not needed. |
| ZTE | Not support. Also it seems this TP is under discussion in both here and Debdeep’s summary. |
| Nokia | We are not sure if RAN4 is aware if only the non-coherent combining to obtain the measurements with multiple measurement samples is possible. Shouldn’t RAN1 support this feature clearly? |
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## Correction to the provision of RTD in SL positioning

The following CR was raised by Huawei which is about the provision of RTD in SL positioning.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Huawei  [R1-2405321] | |  | | --- | | 8.4.4 SL PRS reception procedure The UE may be configured to measure and report one or more of the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL PRS-RSRPP, for the first detected path and up to 8 additional detected paths, and SL PRS-RSRP measurements. The UE may be configured to measure and report one or more of the SL AoA, SL PRS-RSRPP for the first path and up to 2 additional detected paths, and SL PRS-RSRP measurement.  The UE may report an ARP ID associated with the reported measurements. The UE may provide the ARP location information via *sl-ARP-LocationInfoPerTxUE*.  The UE uses the same ARP for both the transmission and reception of sidelink positioning reference signals while performing an SL Rx-Tx time difference measurement.  The UE may include SL PRS resource ID(s) when it reports one or more of the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, SL PRS-RSRP, and SL PRS-RSRPP measurements.  For the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, SL PRS-RSRP, and SL PRS-RSRPP measurements, the UE reports an associated SL PRS reception timestamp via higher layer parameter *Timestamps*. For SL Rx-Tx time difference, the UE may report an associated SL PRS transmission timestamp via higher layer parameter *tx-TimeInfo* and the UE may be configured to report a SL PRS transmission timestamp via *associatedSL-PRS-TxTimeStampRequest*. The timestamp includes the SFN, slot number, and optionally *nr-PhysCellID*, *nr-ARFCN*, *nr-CellGlobalID*, or the timestamp includes DFN and slot number. The timestamp of DFN and slot number may include synchronization source indication of DFN.  The UE may be configured to report up to N Rx-Tx time difference measurements for the same SL PRS transmission associated with N different SL PRS receptions for the same pair of UE(s). The UE may be configured to report up to N Rx-Tx time difference measurements for the same SL PRS reception associated with N different SL PRS transmissions for the same pair of UE(s).  The UE may report, LoS/NLoS indicator(s) via *los-NLOS-Indicator* associated with each SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, SL PRS-RSRP, and SL PRS-RSRPP measurements.  The UE may report synchronization source type via *syncSourceType*. If reported *syncSourceType* is *gNB-eNB*, the UE may report cell identity information.  The UE may be provided with synchronization source type of a UE and/or the relative time difference with the associated quality metric, via *syncSourceType* and *sl-RTD-Info, respectively*.  For the SL RSTD measurement, the UE may report a reference UE information.  < Unchanged parts are omitted > |  |  |  | | --- | --- | | ***Reason for change:*** | 1. UE (except as a server) should not be able to generate the RTD towards another UE.  2. The reception of sync source type should not be limited to UE-based positioning per the agreement. | |  |  | | ***Summary of change:*** | 1. Delete the UE report of RTD.  2. Delete “For UE-based positioning” from the paragraph on the reception of sync source type and RTD, and start a new paragraph.  3. Start a new paragraph for SL RSTD reporting. | |  |  | | ***Consequences if not approved:*** | Specification is not aligned with UE behaviour. | |

We can check if the draft CR in R1-2405321 can be agreed.

### FL proposal 3.3.1-1

* Endorse the following TP for TS 38.214.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | ***Reason for change:*** | 1. UE (except as a server) should not be able to generate the RTD towards another UE.  2. The reception of sync source type should not be limited to UE-based positioning per the agreement. | |  |  | | ***Summary of change:*** | 1. Delete the UE report of RTD.  2. Delete “For UE-based positioning” from the paragraph on the reception of sync source type and RTD, and start a new paragraph.  3. Start a new paragraph for SL RSTD reporting. | |  |  | | ***Consequences if not approved:*** | Specification is not aligned with UE behaviour. | |
| |  | | --- | | 8.4.4 SL PRS reception procedure The UE may be configured to measure and report one or more of the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL PRS-RSRPP, for the first detected path and up to 8 additional detected paths, and SL PRS-RSRP measurements. The UE may be configured to measure and report one or more of the SL AoA, SL PRS-RSRPP for the first path and up to 2 additional detected paths, and SL PRS-RSRP measurement.  The UE may report an ARP ID associated with the reported measurements. The UE may provide the ARP location information via *sl-ARP-LocationInfoPerTxUE*.  The UE uses the same ARP for both the transmission and reception of sidelink positioning reference signals while performing an SL Rx-Tx time difference measurement.  The UE may include SL PRS resource ID(s) when it reports one or more of the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, SL PRS-RSRP, and SL PRS-RSRPP measurements.  For the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, SL PRS-RSRP, and SL PRS-RSRPP measurements, the UE reports an associated SL PRS reception timestamp via higher layer parameter *Timestamps*. For SL Rx-Tx time difference, the UE may report an associated SL PRS transmission timestamp via higher layer parameter *tx-TimeInfo* and the UE may be configured to report a SL PRS transmission timestamp via *associatedSL-PRS-TxTimeStampRequest*. The timestamp includes the SFN, slot number, and optionally *nr-PhysCellID*, *nr-ARFCN*, *nr-CellGlobalID*, or the timestamp includes DFN and slot number. The timestamp of DFN and slot number may include synchronization source indication of DFN.  The UE may be configured to report up to N Rx-Tx time difference measurements for the same SL PRS transmission associated with N different SL PRS receptions for the same pair of UE(s). The UE may be configured to report up to N Rx-Tx time difference measurements for the same SL PRS reception associated with N different SL PRS transmissions for the same pair of UE(s).  The UE may report, LoS/NLoS indicator(s) via *los-NLOS-Indicator* associated with each SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, SL PRS-RSRP, and SL PRS-RSRPP measurements.  The UE may report synchronization source type via *syncSourceType*. If reported *syncSourceType* is *gNB-eNB*, the UE may report cell identity information.  The UE may be provided with synchronization source type of a UE and/or the relative time difference with the associated quality metric, via *syncSourceType* and *sl-RTD-Info, respectively*.  For the SL RSTD measurement, the UE may report a reference UE information.  < Unchanged parts are omitted > | |

Companies are encouraged to provide input in the following table on above proposal.

Table 3.3.1 Collection of views on FL proposal 3.3.1-v1

|  |  |
| --- | --- |
| Company | Views on FL proposal 3.3.1-v1 |
| Huawei, HiSilicon | Support. |
| ZTE | Agree with the point that it is not clear on how a UE (not a server UE) can get the RTD.  For deleting “For UE-based positioning”, generally we think that paragraph do only apply for UE-based SL positioning. |
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## Others

Companies are encouraged to share views in the following table on any issue that want to be discussed.

Table 3.4 Collection of issues on aspects of measurement and report

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| Company | Views |
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# The LS response on SLPP agreement(R1-2403825)

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| **1. Overall Description:**  RAN2 discussed the support of sidelink positioning, and made following agreements which may have RAN1 impact:  Agreements:  Use the LPP value ranges for the expected AoA uncertainty (i.e., +/- 60 degrees for Azimuth, and +/- 30 degrees for the Zenith). LS to RAN1 to notify them of the difference.  The Zenith angle value range is from 0 to 180 degrees. Inform RAN1 of the divergence from RAN3 value range.  **2. Actions:**  **To RAN1**  **ACTION:**   * RAN2 respectfully asks RAN1 to take RAN2’s agreements into account in their future work. |

In addition, ZTE suggests as follows

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| **[RAN1’s reply]**  RAN1 agrees with RAN2 that the zenith angle value range for SL AoA should be from 0 to 180 degrees. Moreover, RAN1 notices that in 38.455 the Zenith AoA value range is from 0 to 1799 degrees.  However, based on 38.133, the reporting range of UL Angle of Arrival, is defined from 0 degree to +180 degree for zenith angle of arrival and the reporting resolution is 0.1 degree. The reporting range of Z-AoA is 0-1799 in 38.455, and the value 1799 is mapped to 179.9≤Z-AoA≤180 as defined in 38.133 table 13.4.1-2. If LMF receives a reported Z-AoA with a value 1799 from a TRP, it is confusing for LMF to determine whether the Z-AoA representing 179.9 degree or 180 degree.  RAN1 believe the value 1800 should be included for both Zenith AoA Value range and the expected Zenith AoA Value range for UL-AOA positioning method in 38.455. And RAN1 would like to suggest RAN4 to define the report mapping for Zenith AoA with value 1800.  **2. Actions:**  **To RAN3**  **ACTION:** RAN1 respectfully asks RAN3 to include the value 1800 for both Zenith AoA Value range and the expected Zenith AoA Value range |

### Collection of views

Companies are encouraged to share views about whether the response LS is needed or not in the following table.

Table 4.1.1 Collection of views on response LS

|  |  |  |
| --- | --- | --- |
| Company | Agree with response LS? | More comments/suggestions? |
| Huawei, HiSilicon | No |  |
| CATT | No |  |
| ZTE | Yes | Our point is: 1. Z-AOA should include the value of 180 degree; 2. currently in 38.133, the value 1799 can be mapped to both 179.9 degree and 180 degree, it it not accurate for LMF to determine the actual value. |

### FL proposal 4.1.2-1

Response LS to RAN2 and RAN3 for SLPP measurement if the response LS is needed

* RAN1 agrees with RAN2 that the zenith angle value range for SL AoA should be from 0 to 180 degrees. Moreover, RAN1 notices that in 38.455 the Zenith AoA value range is from 0 to 1799 degrees.
* RAN1 respectfully asks RAN3 to include the value 1800 for both Zenith AoA Value range and the expected Zenith AoA Value range

Table 4.1.2 Collection of views on FL proposal 4.1.2-1

|  |  |
| --- | --- |
| Companies | views |
| Huawei, HiSilicon | Do not support.  This is related to generic RAN4 mapping table design, and also related to quantization, similar to legacy ToA, RSRP/RSRPP mapping. The quantization mapping should be corresponding to a range, instead of a single point. |
| CATT | There is no need to provide reply LS from RAN1, since it is an issue related to RAN4. |
|  |  |

# OFFLINE Sessions Outcome

## 1st offline

## 2nd offline

# Proposal for Online Discussion

## 1st online

## 2nd online

# Previous Agreements for Measurements and Reporting for SL positioning

## Agreements from RAN1 #112 (202302 Athens meeting)

**Agreement**

SL PRS reference signal received power (SL PRS-RSRP)

* is defined as the linear average over the power contributions (in W) of the resource elements that carry SL PRS reference signals configured for RSRP measurements within the considered measurement frequency bandwidth

With regard to the reference point

* For frequency range 1, the reference point for the SL PRS-RSRP shall be the antenna connector of the UE.
* For frequency range 1, if receiver diversity is in use by the UE, the reported SL PRS-RSRP value shall not be lower than the corresponding SL PRS-RSRP of any of the individual receiver branches.

**Agreement**

SL PRS reference signal received path power (SL PRS-RSRPP),

* is defined as the power of the linear average of the channel response at the i-th path delay of the resource elements that carry SL PRS signal configured for the measurement, where SL PRS-RSRPP for the 1st path delay is the power contribution corresponding to the first detected path in time.

With regard to the reference point

* For frequency range 1, the reference point for the SL PRS-RSRPP shall be the antenna connector of the UE.
* For frequency range 1, if receiver diversity is in use by the UE, the reported SL PRS-RSRPP value shall not be lower than the corresponding SL PRS-RSRPP of any of the individual receiver branches.

**Agreement**

SL-PRS based RTOA TSL-RTOA is defined as the beginning time of SL subframe #i containing SL-PRS received from a UE, relative to the RTOA Reference Time. The SL RTOA reference time is defined as , where

* T0 is the nominal beginning time of SFN 0 or DFN0.
  + FFS on how to select between SFN 0 or DFN 0 for determination of T0.
  + FFS: the source for the reference timing
* tSL-PRS = (10nf + nsf) x 10-3, where nf and nsf are the SFN or DFN and the subframe number of the SL-PRS, respectively
  + FFS on how to select between SFN or DFN

**Agreement**

Support both GCS and LCS for SL-PRS based Azimuth of arrival (AoA) and zenith of arrival (ZoA) measurement.

* FFS on the applicable scenario/service for AoA/ZoA relative to LCS without translation of the LCS to GCS

**Agreement**

For definition of SL-PRS based Rx-Tx measurement, downselect one of the following alternatives in RAN1# 112b to minimize the impact of UE reference timing offset and mobility

* Alt1: actual SL-PRS transmission time is used for the definition of SL-PRS based Rx-Tx time difference measurement
* Alt2: SL-PRS transmission time based on the sidelink PRS receiving symbol is used for the definition of SL-PRS based Rx-Tx time difference measurement
* Alt3: based on the Rel-16/17 definition for gNB Rx-Tx time difference/UE Rx-Tx time difference in Uu.

**Agreement**

Study measurement report content for both the cases of sidelink positioning measurement reported to LMF and UE.

**Agreement**

For SL-PRS based Rx-Tx measurement for double sided RTT, consider sidelink PRS transmission without order restriction between multiple rounds of PRS transmission of involved UEs.

* FFS on how to differentiate different PRS transmissions for sidelink PRS Rx-Tx measurement and report
* FFS on impact of Scheme 2 resource allocation when the different orders in double sided RTT is considered and whether and how to minimize number of different orders
  + Aspects related to scheme 2 resource allocation are to be discussed in agenda 9.5.1.3

**Agreement**

Study the necessity and scenarios of including location information and quality information of the location of a UE in sidelink positioning measurement report, considering different measurements and different reporting targets (LMF and UE).

**Agreement**

Study the following candidates for identification information in sidelink positioning report, considering different measurements and different reporting targets (LMF and UE):

* SL-PRS resource ID/SL-PRS resource set ID if multiple resources/resource sets are configured to a UE
  + FFS: whether SL-PRS resource set is supported
* Source ID and/or destination ID
* Other identification information not precluded

**Agreement**

LoS/NLoS indicator can be included in a sidelink positioning measurement report, considering different reporting targets (LMF and UE).

* LOS/NLOS indicator specified in Rel-17 positioning is reused as much as possible.
* No specification impact for how to set this indicator.
* From RAN1 perspective, no performance requirements are expected to be defined for setting indicator in Rel-18.

**Agreement**

Companies are encouraged to provide expected measurement report content in the following table to facilitate discussion in RAN1 #112bis-e.

Note: this does not imply a different measurement report content for reporting to LMF or to UE.

Table 6.2 Collection of measurement report content

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| --- | --- | --- |
|  | reporting to LMF | reporting to UE |
| SL-PRS based Rx-Tx measurement |  |  |
| SL-PRS based RSTD measurement |  |  |
| SL-PRS based RSRP measurement |  |  |
| SL-PRS based RSRPP measurement |  |  |
| SL-PRS based RTOA measurement |  |  |
| SL-PRS based Azimuth of arrival (AoA) and SL zenith of arrival (ZoA) measurement |  |  |
| etc |  |  |

## Agreements from RAN1 #112bis-e (202304 eMeeting)

**Conclusion**

* For SL-PRS based RTOA definition, the selection between SFN0 vs DFN0 and SFN vs DFN is determined based on the selection of the synchronization source for SL PRS transmission, as in legacy specifications.
  + When the UE selects a cell as the synchronization reference source, SFN0/SFN is used for SL-PRS based RTOA.
  + Otherwise, DFN/DFN0 is used for the definition of the SL-PRS based RTOA.
* FFS on indication of whether SFN or DFN is used along with the RTOA measurement reporting

**Agreement**

* SFN/DFN Initialisation Time can be provided by UE or by LMF.
  + FFS: which UEs can provide initialisation time (note: which may be decided by other WGs)
  + FFS: further details of the definition of DFN Initialisation Time
* For the definition of SL-PRS based RTOA, update the definition of reference timing as:
  + the reference timing is defined as , where
    - T0 is the nominal beginning time of SFN 0 or DFN0 provided by SFN/DFN Initialisation Time
    - tSL-PRS = (10nf + nsf) x 10-3, where nf and nsf are the SFN or DFN and the subframe number of the SL-PRS, respectively
    - FFS: The timing of SFN0/SFN for RTOA reference timing is determined by advancing DL SFN0/SFN with TA/2 when the UE is in-coverage and in connected state

**Agreement**

Support both the case with and without translation of the LCS to GCS for SL-PRS based Azimuth of arrival (AoA) and zenith of arrival (ZoA) measurement.

**Agreement**

SL Angle of Arrival (SL AoA) is defined as the estimated azimuth angle and vertical angle of a transmitting UE with respect to a reference direction, wherein the reference direction is defined:

* In the global coordinate system (GCS), wherein estimated azimuth angle is measured relative to geographical North and is positive in a counter-clockwise direction and estimated vertical angle is measured relative to zenith and positive to horizontal direction
* In the local coordinate system (LCS), wherein estimated azimuth angle is measured relative to x-axis of LCS and positive in a counter-clockwise direction and estimated vertical angle is measured relative to z-axis of LCS and positive to x-y plane direction. The bearing, downtilt and slant angles of LCS are defined according to TS 38.901.

The SL AoA is determined at the receiving UE’s antenna(s) for a SL channel corresponding to the transmitting UE.

**Agreement**

Support SL-based RSTD, Rx-Tx time difference, RToA, AoA, RSRPP measurement and report for the first path and optionally additional path.

* No specification impact for how to set the additional path measurements
* From RAN1 perspective, no performance requirements are expected to be defined for the additional-path measurements in Rel-18.

**Agreement**

For provision of assistance information for absolute SL positioning, the anchor UE location information can be provided to LMF or UE.

FFS: which UEs can receive the anchor UE location information (note: which may be decided by other WGs)

FFS on quality information of anchor UE location information.

**Agreement**

Support per ARP based measurement in sidelink positioning. The ARP related information can be reported along with the SL measurement.

FFS on details of ARP related information, including whether TEG ID can be reused for such purpose.

**Agreement**

For definition of SL-PRS based Rx-Tx measurement, further consider Alt1 and Alt3 until RAN1#113:

* Alt1: actual SL-PRS transmission time is used for the definition of SL-PRS based Rx-Tx time difference measurement
* Alt3: based on the Rel-16/17 definition for gNB Rx-Tx time difference/UE Rx-Tx time difference in Uu

**Agreement**

SL reference signal time difference (SL RSTD) is the SL relative timing difference between the UE j and the reference UE i, defined as TSubframe\_SL-Rxj – TSubframe\_SL-Rxi, where:

* TSubframe\_SL-Rxj is the time when the UE receives the start of one subframe from UE j.
* TSubframeSL-Rxi is the time when the UE receives the corresponding start of one subframe from UE i that is closest in time to the subframe received from UE j.

FFS: whether or not impact due to mobility or synchronization timing change should be considered for SL RSTD

**Agreement**

Support higher layer signaling for sidelink positioning measurement report and report triggering.

* Up to RAN2 to discuss detailed signaling design.

FFS on SCI based report triggering.

## Agreements from RAN1 #113 (202305 Incheon meeting)

**Agreement**

For definition of SL-PRS based Rx-Tx measurement, the actual SL-PRS transmission time is used for the definition of SL-PRS based Rx-Tx time difference measurement if the UE optionally reports the Tx time information, otherwise use the Rel-16/17 definition for gNB Rx-Tx time difference/UE Rx-Tx time difference in Uu.

* FFS: details of the Tx time information
* FFS: whether additionally the network or LMF can request the UE to report the Tx time information
* Note: the value of Rx-Tx measurement is within [-0.5 0.5] ms

**Agreement**

For provision of assistance information for sidelink positioning, the ARP location information can be provided to LMF or UE.

* FFS: which UEs can receive the location information (note: which may be decided by other WGs)
* FFS: details on the location information, e.g., relative location information
* Note: different ARPs have their own location information

**Agreement**

For per ARP measurement

* The ARP ID of an ARP used for reception can be reported along with SL positioning measurement in measurement report.The ARP ID is used to uniquely identify an ARP associated with a UE
* FFS: UE can indicate whether different ARPs for Rx and Tx are used for UE Rx-Tx time difference, if the UE optionally reports the Tx time information
* FFS: ARP ID of an ARP used for transmission, and details if supported

**Agreement**

Support at least the following mechanism to mitigate the impact of synchronization errors between anchor UEs for SL-TDoA based measurement

* Exchange of synchronization information of anchor UEs between a UE and LMF or another UE.
* FFS detailed synchronization information. E.g: synchronization source, relative time difference (RTD), synchronization quality information
* FFS other mechanisms

**Agreement**

Location information of the target UE based on sidelink positioning measurements can be reported at least to LMF.

* FFS: on whether quality information of location is included, e.g., uncertainty etc
* Up to other WGs to determine whether location information of the target UE can be reported to another UE
* Up to RAN2 for signaling details
* FFS: whether and how to report per ARP location information.

**Agreement**

For definition of SL-PRS based RSRP measurement in frequency range 2

* SL PRS-RSRP shall be measured based on the combined signal from antenna elements corresponding to a given receiver branch.
* If receiver diversity is in use by the UE, the reported SL PRS-RSRP value shall not be lower than the corresponding SL PRS-RSRP of any of the individual receiver branches.

For definition of SL-PRS based RSRPP measurement in frequency range 2

* SL PRS-RSRPP shall be measured based on the combined signal from antenna elements corresponding to a given receiver branch.
* If receiver diversity is in use by the UE, the reported SL PRS-RSRPP value shall not be lower than the corresponding SL PRS-RSRPP of any of the individual receiver branches.

**Agreement**

Support reporting parameters needed for converting LCS to GCS in a similar way as in TS 38.455.

* The translation of the LCS to GCS uses the set of angles (bearing angle), (downtilt angle), (slant angle), which can be reported together with the AoA (ϕ) and ZoA (θ) in LCS.

**Agreement**

For provision of assistance information for SL AoA measurement, expected SL-AoA value and uncertainty range can be provided to measuring UE.

* No specification impact on how to set the uncertainty range
* From RAN1 perspective, no performance requirements are expected to be defined for the uncertainty range in Rel-18

**Agreement**

A time stamp associated to each SL positioning measurement within the report includes at least the followings:

* SFN, slot number, and optionally including nr-PhysCellID, nr-ARFCN, nr-CellGlobalID
  + FFS if at least one of nr-PhysCellID, nr-ARFCN, nr-CellGlobalID is always included
* Or DFN and slot number
  + FFS: sidelink synchronization identity

FFS: SL-PRS resource ID is included within the measurement report

FFS: symbol number

**Agreement**

When GNSS is used for synchronization reference, DFN Initialisation Time is defined based on Tref and OffsetDFN defined for sidelink communications (Subclause 5.8.12 in 38.331).

**Agreement**

For SL-PRS based RSTD measurement report, the reference UE information is included in measurement reporting.

* FFS: details of the reference UE information

## Agreements from RAN1 #114 (202308 Toulouse meeting)

Agreement

For SL-PRS based Rx-Tx measurement, the Tx time information in the measurement report is the associated SL-PRS transmission timestamp.

Working assumption

Support to indicate to UE(s) with higher layer signaling to report multiple Rx-Tx measurements for the same SL PRS transmission (resp. reception) and different SL PRS receptions (resp. transmissions) for the same pair of UE(s).

* FFS: whether the different SL PRS receptions correspond to the same or different SL PRS resources
* Note: reporting a single Rx-Tx measurement is also supported

Agreement

To mitigate the impact of synchronization errors between anchor UEs for SL-PRS based measurement, the exchanged synchronization information of anchor UEs between a UE and LMF or another UE includes the following:

* [The synchronization source type (GNSS, gNB/eNB, and UE) of anchor UEs,
  + If the synchronization source of an anchor UE is SyncRef UE, the anchor UE can optionally indicate the coverage status and synchronization connection status (whether the SyncRef UE is directly or indirectly synchronized to GNSS/gNB, or other SyncRef UE) of the SyncRef UE
  + If the synchronization source of an anchor UE is gNB, the anchor UE can further provide cell identity information]
* [Synchronization quality/accuracy information]
* The RTD between anchor UEs

Agreement

For provision of the ARP location information in assistance data for sidelink positioning, support the following:

* The ARP location information can be a position relative to a ‘reference point’.
* Note: RAN1 will not define “reference point”. The “reference point” definition can be up to other WGs

Agreement

For location calculation, the ARP ID of SL PRS transmission can be informed to another UE or LMF by Tx UE informing the association between ARP ID and the already transmitted SL PRS resource(s) as assistance data.

Agreement

The following quality information can be reported in a similar way as in legacy Uu positioning:

* timing quality corresponding to the timing related measurements
* angle quality corresponding to the AoA measurement

No specification impact on how to set the quality information and from RAN1 perspective, no performance requirements are expected to be defined for the quality information in Rel-18.

It is up to RAN2 whether location quality information can be reported when location information is reported.

Agreement

For SL Positioning measurement report content, the following can be included:

* [SL PRS resource ID]
* ARP ID used for reception
* Measurement results
  + Rx-Tx timing difference and quality
  + RSTD measurement and quality
  + RTOA measurement and quality
  + AoA measurement and quality
* RSRP, RSRPP measurement Time stamp
  + Rx timestamp
  + Tx timestamp
* LoS/NLOS indicator
* [UE identity information or information related UE identity information]

Note1: unified or separate report for different SL positioning methods is up to other WGs (e.g., RAN2)

Note2: whether to include UE identity information or information related UE identity information is up to RAN2, including whether this is optional in the report.

Agreement

Regarding the reference point of SL-RTOA, support the following

* For frequency range 1, the reference point for TSL-RTOA measurement shall be the Rx antenna connector of the UE. For frequency range 2, the reference point for TSL-RTOA measurement shall be the Rx antenna of the UE

Regarding the reference point of SL-RSTD, support the following.

* For frequency range 1, the reference point for SL RSTD measurement shall be the Rx antenna connector of the UE. For frequency range 2, the reference point for SL RSTD measurement shall be the Rx antenna of the UE

Agreement

For SL-PRS based Rx-Tx measurement, the same ARP is used for Rx and Tx for Rx-Tx time difference measurement.

Agreement

SL positioning measurements is applicable for RRC\_CONNECTED and RRC\_IDLE states.

* Note: if RRC\_INACTIVE is supported for SL communication, then RRC\_INACTIVE will be supported for SL positioning

Agreement

Support to include the following in the exchanged synchronization information of anchor UEs between a UE and LMF or another UE:

* The synchronization source type (GNSS, gNB/eNB, and UE) of anchor UEs,

Agreement

Support to include SL PRS resource ID in sidelink positioning measurement report.

Note: RAN1 will not further discuss how LMF/UE could use reported resource ID.

## Agreements from RAN1 #114bis (202310 Xiamen meeting)

Agreement

Confirm the following working assumption with update:

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| Working assumption  Support to indicate to UE(s) with higher layer signaling to report multiple Rx-Tx measurements for the same SL PRS transmission (resp. reception) and different SL PRS receptions (resp. transmissions) for the same pair of UE(s).   * ~~FFS: whether the different SL PRS receptions correspond to the same or different SL PRS resources~~ * Note: reporting a single Rx-Tx measurement is also supported * Note: The indicated Rx-Tx time difference measurement is based on actual Tx time. |

Agreement

For SL RSTD measurement, reference UE information is the information needed to identify the reference UE

* Up to RAN2 to determine details

Agreement

Regarding the association information report between ARP ID and the already transmited SL PRS resource(s):

* The association information includes {ARP ID, Tx time stamp, SL PRS resource ID (optional)}.

Agreement

Support to indicate to UE(s) with higher layer signaling to report multiple Rx-Tx measurements for the same SL PRS transmission (resp. reception) and up to N different SL PRS receptions (resp. transmissions) for the same pair of UE(s).

* FFS: value range of N

Agreement

For the indicated number N of different SL PRS receptions (resp. transmissions) associated with the same SL PRS transmission (resp. reception), the value range of N is {2, 3, 4}.

Agreement

The TP in section 8.3 of R1-2310344 is endorsed for TS38.215 clause 5.1.37.

## Agreements from RAN1 #115(202311 Chicago meeting)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Agreement  Regarding the time stamp information in measurement report, support the following:   * For the timestamp of SFN and slot number, at least one of nr-PhysCellID, nr-ARFCN, nr-CellGlobalID is included. * For the timestamp of DFN and slot number, the synchronization reference source indication ‘GNSS or UE’ can be optionally included.   Note: The number of SL-PRS symbols is not signalled in the SL positioning measurement report.  Agreement  Define the maximum number of additional paths for SL-RSTD, SL-RTOA and SL Rx – Tx time difference to be equal to 8. The maximum number of additional paths for SL-AoA is equal to 2.  Agreement  Update previous agreement on synchronization information exchange with the following modification:   |  | | --- | | To mitigate the impact of synchronization errors between anchor UEs for SL-PRS based measurement, the exchanged synchronization information of anchor UEs between a UE and LMF or another UE includes the following:   * The synchronization source type (GNSS, gNB/eNB, and UE) of anchor UEs,   + ~~[If the synchronization source of an anchor UE is SyncRef UE, the anchor UE can optionally indicate the coverage status and synchronization connection status (whether the SyncRef UE is directly or indirectly synchronized to GNSS/gNB, or other SyncRef UE) of the SyncRef UE]~~   + If the synchronization source of an anchor UE is gNB/eNB, the anchor UE can further provide cell identity information * ~~[Synchronization quality/accuracy information]~~ * The RTD between anchor UEs |   Agreement  The TP below is endorsed for TS38.214 clause 8.4.4.   |  |  | | --- | --- | | Reason for change | In current spec, UE may provide the ARP location information in assistance data for the ARP ID reported in the measurement report. However, those two reporting should be decoupled, for example, a UE can provide ARP location information in assistance data but do not report any ARP ID in measurement report. | | Summary of change | Section 8.4.4 in TS 38.214:  Decouple ARP ID report in measurement report and ARP location information provision in assistance data | | Consequences if not approved | unnecessary association between the provision of ARP location information in assistance data and the reporting of ARP ID in measurement report. | | Text proposal | 8.4.4 SL PRS reception procedure The UE may be configured, via [*higher layer parameter(s)*], to measure and report one or more of the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, SL PRS-RSRP, and SL PRS-RSRPP measurements, for the first detected path and/or additional detected paths. The UE may report an ARP ID associated with the reported measurements. The UE may provide the ARP location information via [*higher layer parameter(s)*]. |   Agreement  The TP below is endorsed for TS38.214 clause 8.4.4.   |  |  | | --- | --- | | Reason for change | * + Based on current agreements, the exchanged synchronization information of anchor UEs between a UE and LMF or another UE includes: (1) synchronization source type; (2) RTD between anchor UEs. The description in 38.214 is redundant.   + Based on the description in TS38.214, it seems that UE may report synchronization source type and/or RTD via the same higher layer parameter, however, they should be associated with different higher layer parameters. | | Summary of change | Section 8.4.4 in TS 38.214:   * + Change “The UE may report synchronization information synchronization source type and/or…” to “The UE may report synchronization source type and/or…”   + Add separate higher layer parameter for ‘synchronization source type’. | | Consequences if not approved | * + Redundant specification.   + Incorrect higher layer parameter association for synchronization source type and RTD. | | Text proposal | **< Unchanged text omitted >**  The UE may report synchronization source type via [*higher layer parameter(s)*] and/or relative time difference with the associated quality metric~~,~~ via [*higher layer parameter(s)*]. For the SL RSTD measurement, the UE may report a reference UE information.  **< Unchanged text omitted >** |   Agreement  The TP below is endorsed for TS38.214 clause 8.2.4.   |  |  | | --- | --- | | Reason for change | 1. In TS 38.214 section 8.2.4, the bracket around ‘SL PRSs of SL PRS resources’ should be addressed.  2. It has been agreed that SL PRS resource ID is ‘optional’ for the association information between the already transmitted SL PRSs of SL PRS resources and UE Tx ARP ID. But the agreement is not correctly captured in the current RAN1 specification. | | Summary of change | Section 8.2.4 in TS 38.214:  1. Remove brackets around ‘SL PRSs of SL PRS resources’.  2. Capture ‘optional’ SL PRS resource ID included in the association information between the already transmitted SL PRS resource and UE Tx ARP ID. | | Consequences if not approved | 1. Unclear specification for [SL PRSs of SL PRS resources] in TS38.214.  2. The agreement is not correctly captured for SL PRS resource ID. | | Text proposal | **< Unchanged text omitted >**  The UE may report the association information between the already transmitted ~~[~~SL PRSs of SL PRS resources~~]~~ and UE Tx ARP ID. The association information includes ARP ID(s), SL PRS transmission timestamp(s) [*sl-prs-time-stamp*], and optional SL PRS resource ID(s).  **< Unchanged text omitted >** |   Agreement  The TP below is endorsed for TS38.214 clause 8.4.4.   |  |  | | --- | --- | | Reason for change | SL PRS-RSRP measurement is not defined for the first detected path and/or additional paths, which is not correctly captured by the specification. | | Summary of change | Section 8.4.4 in TS 38.214:  Delete the association between the first detected path and/or additional detected paths and SL PRS-RSRP measurement. | | Consequences if not approved | Incorrect description for the association between the first detected path and/or additional detected paths and SL PRS-RSRP measurement. | | Text proposal | **< Unchanged text omitted >**  The UE may be configured, via [*higher layer parameter(s)*], to measure and report one or more of the SL RSTD, SL Rx-Tx time difference, SL RTOA, SL AoA, ~~SL PRS-RSRP, and~~ SL PRS-RSRPP ~~measurements~~, for the first detected path and/or additional detected paths and SL PRS-RSRP measurements. The UE may report an ARP ID associated with the reported measurements. The UE may provide the ARP location information of the ARP ID via [*higher layer parameter(s)*]  **< Unchanged text omitted >** |   Agreement  For SL RTT, support LMF/UE to request with higher layer signaling the measuring UE to report the associated SL-PRS transmission timestamp.   * Up to RAN4 to determine conditions (if any) for reporting of the associated SL-PRS transmission timestamp. |

## Agreements from RAN1 #116(202402 Athens meeting)

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| Agreement  Endorse the TP 3.1-1 in section 8.1 of R1-2401611 for TS 38.214 clause 8.4.4.  Agreement  Endorse the TP 3.2-1 in section 8.1 of R1-2401611 for TS 38.214 clause 8.4.4.  Agreement  Endorse the TP 5.1-1 in section 8.1 of R1-23401611 for TS 38.214 clause 8.4.4. |

## Agreements from RAN1 #116 bis(202404 changsha meeting)

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| Agreement  Support the scenario that the SL-PRS Rx UE reports measurements for multiple Rx ARP-IDs for the same resource or different resource(s) from the same Tx UE in a single measurement report.  Indicate this agreement in the reply LS to RAN2 LS on decisions on SLPP.  Agreement  Respond in the reply LS to RAN2 LS on decisions on SLPP that:   * From RAN1 perspective, for location calculations for UE-based SL positioning, it should be possible that the Rx UE can be provided the information about association between Tx ARP-ID and already transmitted SL PRS. It is unclear whether current signalling design from RAN2 can support this scenario.   **R1-2403621**  Agreement  The draft LS in R1-2403621 is endorsed. Final LS in R1-2403622. |

# References

* + - 1. RP-223549 “New WID on Expanded and Improved NR Positioning”, RAN 98e, Dec.12-16, 2022