3GPP TSG-RAN WG4 Meeting #111 R4-2409370

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

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.133** | **CR** | **DraftCR** | **Rev** | **-** | **Current version:** | **18.5.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:*** | Draft CR to 38.133 on SL positioning RRM core requirements | | | | | | | | | |
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| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos\_enh2-Core | | | | |  | ***Date:*** | | | 2024-05-13 |
|  |  | | | |  | |  | | |  |
| ***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 can be 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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Missing references, editor’s note and square brackets remaining | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * The CR is based on the endorsed big CR from RAN4#110-bis (R4-2405983). * Added references, removed editor’s note, clarifies UE behaviour | | | | | | | | |
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| ***Consequences if not approved:*** | | Missing references, editor’s note and square brackets remaining | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 12A.1, 12A.2, 12A.3, 12A.4, 12A.5, 12A.6, 12A.7 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.533 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

# 12A NR Sidelink Measurements for Positioning

12A.1 Introduction

Clause 12A contains requirements for UE capable of V2X or 5G ProSe operation, which is also capable of performing SL positioning measurements defined in TS 38.215 [4], including SL RSTD, SL PRS-RSRP, SL Rx-Tx time difference, SL PRS-RSRPP measurements, SL AoA, and SL RTOA, provided that:

- The SL-PRS are received on NR PC5 interface within a single sidelink BWP on a single carrier,

- The UE is in any cell selection state or the UE is inside NG-RAN coverage while configured for SL positioning operation on a sidelink carrier, which is dedicated to only sidelink operation, and configured with only a PCell on WAN carrier, and

- The measuring UE is the location target UE or an anchor UE, and

- The UE is not required to monitor PSCCH, which is associated with SL-PRS in the same slot, outside the SL-DRX active time.

NOTE 1: Any cell selection state refers to a UE that is out of network coverage and is not associated with a serving cell on any carrier as defined in TS 38.304 [1].

NOTE 2: When a UE in RRC\_CONNECTED state is performing transmissions and/or reception for SL positioning operation, the UE shall meet all the requirements specified in Clause 9 assuming that UE has a dedicated RX/TX chain for the sidelink operation. Otherwise, the UE may interrup the SL positioning measurements in order to meet the measurement requirements specified in Clause 9.

NOTE 3: When a UE in RRC\_CONNECTED state is performing transmissions and/or reception for SL positioning operation, the UE shall meet all the requirements specified in Clause 6, assuming that UE has a dedicated RX/TX chain for the sidelink operation. Otherwise, the UE may interrup the SL positioning measurements or SL-PRS transmissions in order to meet the measurement requirements specified in Clause 6.

Prior to performing SL-PRS based measurements, the target UE may need to perform the discovery procedure to discover anchor UEs according to TS 38.305 [22].

12A.2 SL RSTD measurements

12A.2.1 Introduction

The requirements in clause 12A.2 apply for SL RSTD measurements of the first and additional paths.

The requirements in clause 12A.2 shall apply provided the UE has received a *RequestLocationInformation* message from LMF or another UE via SLPP [37] requesting the UE to measure and report SL RSTD measurements defined in TS 38.215 [4] based on SL-PRS.

12A.2.2 Requirements Applicability

The requirements in clause 12A.2 apply for periodic, aperiodic, and triggered RSTD measurements, provided:

- SL RSTD related side conditions given in clause 10.4A.2.2 for FR1 are fulfilled, for a corresponding Band.

12A.2.3 Measurement Capability

UE SL RSTD measurement capability is as indicated by the UE in:

*SL-TDOA-ProvideCapabilities*, according to TS 38.355 [37].

12A.2.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE reporting to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

For UE reporting to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the transmitted STCH. The delay uncertainty is: 2 x TTISTCH where TTISTCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

This measurement reporting delay excludes any delay caused by no SL resources for UE to send the measurement report.

The reported SL RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.4A.2.1.

The SL RSTD measurements performed and reported according to this section shall meet the SL RSTD measurement accuracy requirements in clause 10.4A.2.2, for each measured SL-PRS resource.

12A.2.5 Measurements Period Requirements

When the physical layer receives the last of *SL-TDOA-ProvideAssistanceData* and *SL-TDOA-RequestLocationInformation* from LMF or another UE via SLPP [37]*,* the UE shall be able to perform multiple SL RSTD measurements based on SL-PRS from one or more other SL UEs (up to the UE capability specified in Clause 12A.2.3), with each SL RSTD measurement based on SL-PRS from the reference UE and SL-PRS from the second anchor UE, as defined in TS 38.215 [4]. The SL RSTD measurement shall be performed during the measurement period defined as:

,

where

S is the number of samples for SL-PRS from the second anchor UE, defined below:

= 1 for SL-PRS bandwidth>48 PRBs,

= 4 for SL-PRS bandwidth≤48 PRBs, and

for each SL-PRS sample *s* of the target measured link, which is received within a slot where the UE receives SCI and the associated SL-PRS within its capabilities [Components 2 and 3 of FG 41-1-1], is defined as:

, for *s*<*S*, where and are the beginning of the first slot of SL-PRS sample *s+1* and SL-PRS sample *s*, respectively,

for *s*=*S*,

is the duration of the slot carrying SL-PRS sample *s* of the SL RSTD measurement,

is the processing time given by the UE capability in [Components 4 of FG 41-1-1].

[A UE may drop one or more SL PRS measurement samples if the number of active slots and number of active resources per slot for the ongoing SL PRS measurement exceed the UE capabilities in [FG 41-1-1]. For a single-sample measurement, the whole measurement may not be performed.]

If the synchronization reference source changes during at the measuring UE or at the reference or second anchor UE configured to transmit SL-PRS for the SL RSTD measurement, e.g., known from the UE’s own synchronization source or from *SL-RTD-Info* [37], while the UE is performing the SL RSTD measurement, then the UE shall restart the SL RSTD measurement after the synchronization reference source change and shall send the measurement report during a measurement period, which can be longer than .

The requirements in this clause apply, provided that no SL-PRS symbols are dropped due to, e.g., selection or reselection of synchronization reference source according to clause 12.4 during the measurement period . Otherwise, the measurement period can be longer.

The requirements in this clause apply, provided that the reception of slots containing SL-PRS is not interrupted during the measurement period . Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be longer.

12A.3 SL PRS-RSRP measurements

12A.3.1 Introduction

The requirements in clause 12A.3 apply for SL PRS-RSRP measurements and for SL PRS-RSRP path measurements of the first and additional paths.

The requirements in clause 12A.3 shall apply provided the UE has received a *RequestLocationInformation* message from LMF or another UE via SLPP [37] requesting the UE to measure and report SL PRS-RSRP measurements defined in TS 38.215 [4] based on SL-PRS.

12A.3.2 Requirements Applicability

The requirements in clause 12A.3 apply for periodic, aperiodic, and triggered SL PRS-RSRP measurements, provided:

- SL PRS-RSRP related side conditions given in clause 10.4A.3.2 for FR1 are fulfilled, for a corresponding Band.

12A.3.3 Measurement Capability

UE SL PRS-RSRP measurement capability is as indicated by the UE in:

*SL-TDOA-ProvideCapabilities, SL-RTT-ProvideCapabilities, SL-AOA-ProvideCapabilities,* or *SL-TOA-ProvideCapabilities*, according to TS 38.355 [37].

12A.3.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE reporting to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

For UE reporting to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the transmitted STCH. The delay uncertainty is: 2 x TTISTCH where TTISTCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

This measurement reporting delay excludes any delay caused by no SL resources for UE to send the measurement report.

The reported SL PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.4A.3.1.

The SL PRS-RSRP measurements performed and reported according to this section shall meet the SL PRS-RSRP measurement accuracy requirements in clause 10.4A.3.2, for each measured SL-PRS resource.

12A.3.5 Measurements Period Requirements

When the physical layer receives the last of:

- *SL-TDOA-ProvideAssistanceData* and SL*-TDOA-RequestLocationInformation*, or

- *SL-AOA-ProvideAssistanceData* and *SL-AOA-RequestLocationInformation*, or

- *SL-TOA-ProvideAssistanceData* and *SL-TOA-RequestLocationInformation*, or

- *SL-RTT-ProvideAssistanceData* and *SL-RTT-RequestLocationInformation*,

from LMF or another UE via SLPP [37]*,* the UE shall be able to perform multiple SL PRS-RSRP measurements based on SL-PRS from one or more other SL UEs (up to the UE capability specified in Clause 12A.3.3), as defined in TS 38.215 [4]. The SL PRS-RSRP measurement shall be performed during the measurement period defined as:

,

where

S is the number of samples per measured link, defined below:

= 1 for SL-PRS bandwidth>48 PRBs,

= 4 for SL-PRS bandwidth≤48 PRBs,

For each SL-PRS sample *s* of the target measured link, which is received within a slot where the UE receives SCI and the associated SL-PRS within its capabilities [Components 2 and 3 of FG 41-1-1], is defined as:

, for *s*<*S*, where and are the beginning of the first slot of SL-PRS sample *s*+1 and SL-PRS samples *s*, respectively,

for *s*=*S*, is the time for completing the last sample of the SL PRS-RSRP measurement,

is the duration of the slot carrying SL-PRS sample *s* of the SL PRS-RSRP measurement,

is the processing time given by the UE capability in [Components 4 of FG 41-1-1].

If the synchronization reference source changes during at the measuring UE or at the UE configured to transmit SL-PRS for the SL PRS-RSRP measurement, while the measuring UE is performing the SL PRS-RSRP measurement, e.g., known from the UE’s own synchronization source or from *SL-RTD-Info* [37], then the UE shall continue performing the SL PRS-RSRP measurement after the synchronization reference source change, while meeting the measurement period defined in this clause and the accuracy requirements in clause 10.4A.3.2.

The requirements in this clause apply, provided that no SL-PRS symbols are dropped due to, e.g., selection or reselection of synchronization reference source according to clause 12.4 during the measurement period . Otherwise, the measurement period can be longer.

The requirements in this clause apply, provided that the reception of slots containing SL-PRS is not interrupted during the measurement period . Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be longer.

## 12A.4 SL Rx-Tx measurements

### 12A.4.1 Introduction

The requirements in clause 12A.4 apply for SL Rx-Tx measurements of the first and additional paths.

The requirements in clause 12A.4 shall apply provided the UE has received *SL-RTT-RequestLocationInformation* from LMF or another UE via SLPP [37] requesting the UE to measure and report SL Rx-Tx time difference measurements defined in TS 38.215 [4] based on SL-PRS.

### 12A.4.2 Requirements Applicability

The requirements in clause 12A.4 apply for periodic, aperiodic, and triggered SL Rx-Tx time difference measurements, provided:

- SL Rx-Tx time difference related side conditions given in clause 10.4A.4.2 for FR1 are met for a corresponding Band.

- The actual time difference between the corresponding SL-PRS transmission and reception used to derive the measurement is no larger than 160 ms.

### 12A.4.3 Measurement Capability

SL Rx-Tx time difference measurement capability is as indicated by the UE in *SL-RTT-ProvideCapabilities* according to TS 38.355 [37].

### 12A.4.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE report to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

For UE report to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the sidelink STCH. The delay uncertainty is: 2 x TTISTCH where TTISTCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

The measurement reporting delay excludes any delay caused by no SL resources for UE to send the measurement report.

The reported SL Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.4A.4.1.

The SL Rx-Tx time difference measurements performed and reported according to this section shall meet the SL Rx-Tx time difference measurement accuracy requirements in clause 10.4A.4.2, for each measured SL-PRS resource.

### 12A.4.5 Measurement Period Requirements

When the physical layer receives *SL-RTT-ProvideAssistanceData* message from *SL-RTT-RequestLocationInformation* message from LMF or another UE via SLPP [37], the UE shall be able to perform multiple SL Rx-Tx time difference measurements based on SL-PRS from one or more other SL UEs (up to the UE capability specified in Clause 12A.4.3), as defined in TS 38.215 [4]. For each individual SL-PRS resource measured by a UE, the SL Rx-Tx time difference measurement is performed during defined as:

where,

S is the number of samples for a single SL Rx-Tx measurement defined below:

= 1 for SL-PRS bandwidth > 48 PRBs,

= 4 for SL-PRS bandwidth≤48 PRBs.

For SL-PRS sample s, which is received within a slot where the UE receives SCI and the associated SL-PRS is within its capabilities [Components 2 and 3 of FG 41-1-1], is defined as:

, for s<S, where and are the start of the *s*-th and *(s+1)*-th slot of SL-PRS samples *s* and SL-PRS samples *s*+1, respectively.

for *s* = *S*,

is the duration of the slot carrying SL-PRS sample s of SL Rx-Tx measurement.

is the processing time as indicated via capability [component 4 of FG 41-1-1] of the UE performing the SL Rx-Tx time difference measurement.

is defined as below:

If the UE reports the transmission timestamp of a SL PRS as defined in TS 38.215 [4], and the SL PRS transmission occurs after the SL PRS reception used to derive the measurement, is the additional time delay from the SL PRS reception until the actual SL PRS transmission.

Otherwise, .

[A UE may drop one or more SL PRS measurement samples if the number of active slots and number of active resources per slot for the ongoing SL PRS measurement exceed the UE capabilities in [FG 41-1-1].

* For a single-sample measurement, the whole measurement may not be performed.]

If the synchronization reference source changes during at the measuring UE or at the anchor UE configured to transmit SL-PRS for the measurement, while the measuring UE is performing the SL Rx-Tx time difference measurement, , e.g., known from the UE’s own synchronization source or from *SL-RTD-Info* [37], then the measuring UE shall restart the SL Rx-Tx time difference measurement and shall send the measurement report during a measurement period, which can be later than .

The requirements in this clause apply, provided that no SL-PRS symbols are dropped due to, e.g., selection or reselection of synchronization reference source according to clause 12.4 during the measurement period . Otherwise, the measurement period can be longer.

The requirements in this clause apply, provided that the reception of slots containing SL-PRS is not interrupted during the measurement period . Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be longer.

## 12A.5 SL PRS-RSRPP measurements

### 12A.5.1 Introduction

The requirements in clause 12A.5 shall apply provided the UE has received *SL-TDOA-RequestLocationInformation or SL-AOA-RequestLocationInformation or SL-TOA-RequestLocationInformation or SL-RTT-RequestLocationInformation* from LMF or another UE via SLPP requesting the UE to measure and report SL PRS-RSRPP measurements defined in TS 38.215 [4].

### 12A.5.2 Requirements Applicability

The requirements in clause 12A.5 apply for periodic and triggered SL PRS-RSRPP measurements, provided:

- SL PRS-RSRPP related side conditions given in clause 10.4A.5.2 for FR1 are met for a corresponding Band.

### 12A.5.3 Measurement Capability

SL PRS-RSRPP measurement capability is as indicated by the UE in *SL-TDOA-ProvideCapabilities, SL-RTT-ProvideCapabilities, SL-AOA-ProvideCapabilities,* or *SL-TOA-ProvideCapabilities* according to TS 38.355 [37].

### 12A.5.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE report to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

For UE report to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the sidelink STCH. The delay uncertainty is: 2 x TTISTCH where TTISTCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

This measurement reporting delay excludes any delay caused by no SL resourcesfor UE to send the measurement report.

The reported SL PRS-RSRPP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.4A.5.1.

The SL PRS-RSRPP measurements performed and reported according to this section shall meet the SL PRS-RSRPP measurement accuracy requirements in clause 10.4A.5.2, for each measured SL-PRS resource.

### 12A.5.5 Measurement Period Requirements

When the physical layer receives

- *SL-TDOA-ProvideAssistanceData* message and *SL-TDOA-RequestLocationInformation* message, or

- *SL-AOA-ProvideAssistanceData* message and *SL-AOA-RequestLocationInformation* message, or

- *SL-TOA-ProvideAssistanceData* message and *SL-TOA-RequestLocationInformation* message, or

- *SL-RTT-ProvideAssistanceData* message and *SL-RTT-RequestLocationInformation* message,

from LMF or another UE via SLPP, the measurement period requirements for SL PRS-RSRP defined in 12A.3.5 are reused for PRS-RSRPP measurement.

## 12A.6 SL AoA measurements

### 12A.6.1 Introduction

The requirements in clause 12A.6 apply for SL AoA measurements of the first and additional paths.

The requirements in clause 12A.6.5 shall apply for azimuth angle of arrival (A-AoA) and zenith angle of arrival (Z-AoA) first path measurement, provided the UE has received *SL-AoA-RequestLocationInformation* from LMF or another UE via SLPP [37] requesting the UE to measure and report SL AoA measurements defined in TS 38.215 [4] based on SL-PRS.

### 12A.6.2 Requirements Applicability

The requirements in clause 12A.6 apply for periodic, aperiodic, and triggered SL AoA measurements, provided:

- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- SL AoA related side conditions given in clause B.4A.1 for FR1 are met for a corresponding Band.

### 12A.6.3 Measurement Capability

SL AoA measurement capability is as indicated by the UE in:

*SL-AoA-ProvideCapabilities* according to TS 38.355 [37].

### 12A.6.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE reporting to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

For UE reporting to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the sidelink STCH. The delay uncertainty is: 2 x TTISTCH where TTISTCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

The measurement reporting delay excludes any delay caused by no SL resources or no SL-PRS resources for UE to send the measurement report.

The reported SL AoA measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.4A.6.1.

### 12A.6.5 Measurement Period Requirements

When the physical layer receives the last of *SL-AoA-ProvideAssistanceData* message from *SL-AoA-RequestLocationInformation* message from LMF or another UE via SLPP, the UE shall be able to measure multiple SL AoA measurements based on SL-PRS from one or more other SL UEs (up to the UE capapbility specified in 12A.6.3), as defined in TS 38.215 [4]. The SL AoA measurement shall be performedduring the measurement period defined as:

,

where,

*S* is the number of samples for the SL AoA measurement, defined as below:

*S* = 1 for SL-PRS bandwidth > 48 PRBs,

*S* = 4 for SL-PRS bandwidth ≤ 48 PRBs,

For each SL-PRS sample s, which is received within a slot where the UE receives SCI and the associated SL-PRS is within its capabilities [Components 2 and 3 of FG 41-1-1]. is defined as below,

for *s* < *S*, where and are the beginning of the slots of SL-PRS sample s and SL-PRS sample s+1, respectively.

for *s* = *S*,

is the duration of slot carrying SL-PRS sample *s* of the SL AoA measurement,

is the processing time indicated via UE capability in [component 4 of FG 41-1-1] of the UE performing SL AoA measurement.

[A UE may drop one or more SL PRS measurement samples if the number of active slots and number of active resources per slot for the ongoing SL PRS measurement exceed the UE capabilities in [FG 41-1-1].

* For a single-sample measurement, the whole measurement may not be performed.]

If the synchronization reference source of the measuring UE or transmitting changes during , , e.g., known from the UE’s own synchronization source or from *SL-RTD-Info* [37], while the UE is performing the SL AoA measurements, then the measuring UE shall continue performing the SL AoA measurement after the synchronization reference source change, while meeting the requirements in this clause.

The requirements in this clause apply provided that no SL-PRS symbols for the SL AoA measurement are dropped due to e.g., the selection or reselection of synchronization reference source according to clause 12.4 during the measurement period. Otherwise, the measurement period can be extended.

The requirements in this clause, apply provided that reception of slots containing SL-PRS for the SL AoA measurement is not interrupted e.g., due to network coverage change. Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be extended.

## 12A.7 SL RTOA measurements

### 12A.7.1 Introduction

The requirements in clause 12A.7 apply for SL RTOA measurements of the first and additional paths.

The requirements in clause 12A.7.5 shall apply provided the UE has received *SL-RTOA-RequestLocationInformation* from LMF or another UE via SLPP requesting the UE to measure and report SL RTOA measurements defined in TS 38.215 [4].

### 12A.7.2 Requirements Applicability

The requirements in clause 12A.7 apply for periodic, aperiodic, and triggered SL RTOA measurements, provided:

- Conditions defined in clause 7.3E of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- SL RTOA related side conditions given in clause B.4A.1 for FR1 are met for a corresponding Band.

### 12A.7.3 Measurement Capability

SL RTOA measurement capability is as indicated by the UE in *SL-RTOA-ProvideCapabilities* according to TS 38.355 [37].

### 12A.7.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface.

For UE reporting to LMF, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration.

For UE reporting to another UE, this requirement assumes that the measurement report is not delayed by other SLPP signalling on the STCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the sidelink STCH. The delay uncertainty is: 2 x TTISTCH where TTISTCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PSSCH with subframe or slot or subslot duration.

The measurement reporting delay excludes any delay caused by no SL resources or no SL-PRS resources for UE to send the measurement report.

The reported SL RTOA measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.4A.7.1.

### 12A.7.5 Measurement Period Requirements

When the physical layer receives the last of *SL-RTOA-ProvideAssistanceData* message from *SL-RTOA-RequestLocationInformation* message from LMF or another UE via SLPP, the UE shall be able to measure multiple SL RTOA measurements based on SL-PRS from one or more other SL UEs (up to the UE capapbility specified in 12A.7.3), as defined in TS 38.215 [4]. The SL RTOA measurement shall be performed during defined as:

,

where,

*S* is the number of samples for the SL RTOA measurementdefined as below:

*S* = 1 for SL-PRS bandwidth > 48 PRBs,

*S*4 for SL-PRS bandwidth ≤ 48 PRBs,

For SL-PRS sample s, which is received within a slot where the UE receives SCI and the associated SL-PRS is within its capabilities [Components 2 and 3 of FG 41-1-1]. is defined as below,

, for *s*<*S*, where and are the beginning of the slots of SL-PRS sample s and SL-PRS sample s+1, respectively

for *s* = *S*,

is the duration of the slot carrying SL-PRS sample *s* of the SL RTOA measurement.

is the processing time indicated via capability in [component 4 of FG 41-1-1] of the UE performing SL RTOA measurement.

If the synchronization reference source of the measuring UE or transmitting UE changes during , e.g., known from the UE’s own synchronization source or from *SL-RTD-Info* [37], while the UE is performing the SL RTOA measurements, then the measuring UE shall restart the SL RTOA measurement after the synchronization reference source change and shall send the measurement report during a measurement period, which can be longer than .

The requirements in this clause apply provided that no SL-PRS symbols for the SL RTOA measurement that are dropped due to e.g., the selection or reselection of synchronization reference source according to clause 12.4 during the measurement period. Otherwise, the measurement period can be extended.

The requirements in this clause apply, provided that reception of slots containing SL-PRS for the SL RTOA measurement is not interrupted due to network coverage change. Otherwise, if the reception of the slots containing SL-PRS is interrupted, the measurement period can be longer.