3GPP TSG-RAN WG4 Meeting #111 R4-2410150

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** | **xxxx** | **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 Big CR to 38.133 on RRM core requirements for Positioning Enhancements | | | | | | | | | |
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| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos\_enh2-Core | | | | |  | ***Date:*** | | | 2024-05-28 |
|  |  | | | |  | |  | | |  |
| ***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:*** | | The core requirements are not complete | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * The big CR is based on the following endorsed CRs:   From RAN4#111:   1. RedCap:   **R4-2410152**, draftCR on RRM requirements for RedCap positioning, Huawei, HiSilicon.  **R4-2410153**, DraftCR to 38.133 on core requirements for RedCap positioning, Ericsson.  **R4-2410151**, (NR\_Pos\_enh2-Core) 38.133 CR addressing the use of expected to in normative text, BeammWave, Nokia.   1. BW aggregation:   **R4-2410154**, draftCR on RRM requirements for PRS CA, Huawei, HiSilicon.  **R4-2409584**, DraftCR to 38.133 on core requirements for bandwidth aggregation for positioning measurements, Ericsson.   1. SL:   **R4-2410155**, Draft CR to 38.133 on SL positioning RRM core requirements, Ericsson.   1. CPP:   **R4-2410409**, draftCR on RRM requirements for CPP, Huawei, HiSilicon.  **R4-2410410**, DraftCR to 38.133 on core requirements for CPP, Ericsson.   1. LPHAP:   **R4-2410156**, Draft CR – Corrections to PRS measurement period with eDRX in RRC\_IDLE state, Qualcomm Inc.  **R4-2410157**, draftCR on RRM requirements for LPHAP, Huawei, HiSilicon.  **R4-2410158**, DraftCR to 38.133 on Core requirements for LPHAP, Ericsson.  From RAN4#110-bis:  **R4-2405983**, including the following changes:   1. General:   **R4-2406484**, (NR\_pos\_enh2-Core) Modify positioning measurements related in RRC\_INACTIVE state, ZTE corp.   1. RedCap:   **R4-2406375**, Draft CR on core requirements of RedCap UE positioning, CATT  **R4-2406376**, DraftCR to TS38.133 RedCap positioning core requirements, Ericsson  **R4-2406377**, draftCR on RRM requirements for RedCap positioning, Huawei, HiSilicon   1. PRS aggregation:   **R4-2406378**, Draft CR on core requirements of BW aggregation positioning, CATT  **R4-2406379**, draftCR on RRM requirements for PRS CA, Huawei, HiSilicon   1. SL positioning:   **R4-2406370**, Draft CR for 38.133 on SL positioning RRM core requirements, Ericsson  **R4-2406494**, Draft CR on core requirement for SL positioning measurement, vivo   1. CPP:   **R4-2406371**, DraftCR to TS38.133 Carrier phase based positioning core requirements, Ericsson  **R4-2406372**, draftCR on RRM requirements for CPP, Huawei, HiSilicon  **R4-2406493**, Draft CR 38.133 Corrections to measurement period requirements for NR CPP, Nokia   1. LPHAP:   **R4-2406374**, DraftCR to TS38.133 LPHAP core requirements, Ericsson  **R4-2406422**, draftCR on RRM requirements for LPHAP, Huawei, HiSilicon  ==================  The following changes are included in this big CR:  **Change #1:**  (R4-2406374): Correction of IEs.  (R4-2406375): Update the positioning signallings based on latest RAN2 specification. Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together. Correct some typos and clarify some unclear contents.  (R4-2410158): FFS in 4.5.2.5 is removed. The core requirement in clause 4.5.2.5 is accordingly updated.  **Change #2**:  (R4-2406378): Update the positioning signallings based on latest RAN2 specification. Correct some typos and reduce the redundancy.  (R4-2410154): Add the condition on single Tx chain for requirements for PRS CA in RRC\_IDLE.  (R4-2410156): Correct the start of the measurement period for DL RSTD with PRS BW aggregation (cl. 4.5.2.6).  **Change #2a** (R4-2410157): Align the wording for the conditions when PRS measurement start is limited to PTW acorss all clauses.  **Change #3** (R4-2406375): Requirements applicability clarification.  **Change #4**:  (R4-2406371): Core requirements for DL RSCPD reported with RSTD in RRC\_IDLE state is rectified.  (R4-2406372): For RSCPD measurement with RSTD in RRC\_IDLE, clarify that when time window is not configured, legacy requirements for RSTD apply, for multiple PFL case.  (R4-2410409): For RSCPD measurement with RSTD in RRC\_IDLE, clarify that when time window is not configured, legacy requirements for RSTD apply, for multiple PFL case. Clarify that RSTD measurement is not performed within the time window only, legacy requirements for RSTD apply but UE is not required to report RSCPD.  (R4-2410156): Correct the start of the measurement period for DL RSCPD reported with DL RSTD (cl. 4.5.5.5).  **Change #5** (R4-2406376): Correction of clause numbers. Defining core requirement for Rx FH.  **Change #6**:  (R4-2406375):  Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together.  (R4-2410153): Corrections to clarify core requirements for RedCap positioning measurements in RRC\_INACTIVE/IDLE state are made.  (R4-2410156): Correct the start of the measurement period for DL RSTD without Rx hopping for RedCap (cl. 4.6.2.5).  **Change #7**:  (R4-2406377): RSTD in RRC\_IDLE, define FH requirements by re-using the RRC\_CONNECTED requirements and replacing MG with measurement window.  (R4-2410152): Add the requirements on the BW with multiple hops are not captured in the requirements.  **Change #8:**  (R4-2406375): Removing editor’s note.  (R4-2410153): Corrections to clarify core requirements for RedCap positioning measurements in RRC\_INACTIVE/IDLE state are made.  (R4-2410157): Align the wording for the conditions when PRS measurement start is limited to PTW acorss all clauses.  **Change #9:**  (R4-2406376): Correction of clause numbers. Defining core requirement for Rx FH.  (R4-2410153): Corrections to clarify core requirements for RedCap positioning measurements in RRC\_INACTIVE/IDLE state are made.  **Change #10**:  (R4-2406375): Clarifying requirements applicability.  (R4-2410153): Corrections to clarify core requirements for RedCap positioning measurements in RRC\_INACTIVE/IDLE state are made.  **Change #11** (R4-2406379): Update requirements for RSTD and UE Rx-Tx measurement with PRS CA in RRC\_INACTIVE: Remove the condition on single Tx chain from clauses generic for all PRS measurement in RRC\_INACTIVE to clauses for aggregated measurement.  **Change #12**  (R4-2406375): Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together.  (R4-2410158): Unnecessary square brackets are removed from clause 5.6.2.5.  **Change #13**:  (R4-2406484): Specify the measurement requirements for positioning in RRC-Inactive state.  (R4-2406379) Update requirements for RSTD and UE Rx-Tx measurement with PRS CA in RRC\_INACTIVE: The exact clause number in RAN1 spec is added. Replace the UE capability for reduced sample number for aggregated measurement with the correct one. Add requirements for PRS-RSRPP (measured over same measurement period) which were missing.  **Change #13a** (R4-2410157): Align the wording for the conditions when PRS measurement start is limited to PTW acorss all clauses.  **Change #14** (R4-2406379): Update requirements for RSTD and UE Rx-Tx measurement with PRS CA in RRC\_INACTIVE: Remove the condition on single Tx chain from clauses generic for all PRS measurement in RRC\_INACTIVE to clauses for aggregated measurement. Also, the exact clause number in RAN1 spec is added. Replace the UE capability for reduced sample number for aggregated measurement with the correct one. Add requirements for PRS-RSRPP (measured over same measurement period) which were missing.  **Change #15**  (R4-2406375): Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together. Typo corrections.  (R4-2410157): Align the wording for the conditions when PRS measurement start is limited to PTW acorss all clauses.  **Change #16**  (R4-2406379): Update requirements for RSTD and UE Rx-Tx measurement with PRS CA in RRC\_INACTIVE: Remove the condition on single Tx chain from clauses generic for all PRS measurement in RRC\_INACTIVE to clauses for aggregated measurement. Also, the exact clause number in RAN1 spec is added. Replace the UE capability for reduced sample number for aggregated measurement with the correct one. Add requirements for PRS-RSRPP (measured over same measurement period) which were missing.  (R4-2409584): Notations for measurement period for aggregated and non-aggregated measurements are corrected.  **Change #16a** (R4-2410410):Core requirement when time window is not configured is clarified.  **Change #17**  (R4-2406493): In case of UL Tx timing change due to TA command or TA offset change, it is corrected, that the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements shall not apply. Some names are also corrected and typos are removed.  (R4-2410410):Core requirement when time window is not configured is clarified.  **Change #18**:  (R4-2406484): Clarify the measurement requirements for positioning in RRC-Inactive state.  (R4-2406375): Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together.  (R4-2410153): Corrections to clarify core requirements for RedCap positioning measurements in RRC\_INACTIVE/IDLE state are made.  **Change #19**:  (R4-2406376): Correction of clause numbers. Defining core requirement for Rx FH.  (R4-2406375): In 5.6A.6.5, clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together.  (R4-2410153): Corrections to clarify core requirements for RedCap positioning measurements in RRC\_INACTIVE/IDLE state are made.  **Change #20** (R4-2406422): Updating requirements for UE Tx timing for positioning measurement to solve the following issues:   1. Gradual timing adjustment only applied when RTD is < CP/4, but the current wording means it applies even when RTD is > CP/4 and when auto TA adjustment is applied. 2. It is unclear the DL timing difference is between what. 3. It is unclear to which direction (plus or minus) UE should adjust the TA based on twice of RTD.   **Change #20a** (R4-2410154): Remove the condition on single Tx chain from clauses generic for all PRS measurement in RRC\_CONN to clauses for aggregated measurement. Also, the exact clause number in RAN1 spec is added.  **Change #21** (R4-2406375): Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together. Correct some typos and clarify some unclear contents.  **Change #22**  (R4-2406378): Update the positioning signallings based on latest RAN2 specification. Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together. Correct some typos and reduce the redundancy.  (R4-2410154): Remove the condition on single Tx chain from clauses generic for all PRS measurement in RRC\_CONN to clauses for aggregated measurement. Also, the exact clause number in RAN1 spec is added.  **Change #22a** (R4-2410154): Remove the condition on single Tx chain from clauses generic for all PRS measurement in RRC\_CONN to clauses for aggregated measurement. Also, the exact clause number in RAN1 spec is added.  **Change #23** (R4-2406375): Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together. Correct some typos and clarify some unclear contents.  **Change #24**  (R4-2406378): Update the positioning signallings based on latest RAN2 specification. Correct some typos and reduce the redundancy.  (R4-2410154): Remove the condition on single Tx chain from clauses generic for all PRS measurement in RRC\_CONN to clauses for aggregated measurement. Also, the exact clause number in RAN1 spec is added.  **Change #24a** (R4-2410410):Core requirement when time window is not configured is clarified.  **Change #25**  (R4-2406493): In case of UL Tx timing change due to TA command or TA offset change, it is corrected, that the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements shall not apply. Some names are also corrected and typos are removed.  (R4-2410410):Core requirement when time window is not configured is clarified.  **Change #25a** (R4-2410151): The requirement is phrased as that the UE “is expected to” perform an action. As “expected to” is not a requirement, it is changed to “shall”.  **Change #26** (R4-2406375): Update the positioning signallings based on latest RAN2 specification. Clarify that the PRS-RSRP(P) shall be performed over the DL-TDOA/ Multi-RTT measurement period when PRS-RSRP(P) is requested with DL-TDOA/Multi-RTT together. Correct some typos and clarify some unclear contents.  **Change #27:**  (R4-2406377): In clauses 9.9A.2.6 and 9.9A.3.6, RSTD and PRS-RSRP in RRC\_CONNECTED, align the requirements with Rx-Tx in 9.9A.4.8 and remove []. In clause 3. 9.9A.4.8, Rx-Tx in RRC\_CONNECTED, remove [].  (R4-2410152): Add the requirements on the BW with multiple hops are not captured in the requirements.  **Change #28**:  (R4-2406370) Added references, removed editor’s note, clarifies UE behaviour for SL positioning.  (R4-2410155): Corrections to SL positioning core requirements.  **Change #29**:  (R4-2406494) Add the requirements for the scenario that SL-PRS transmission/reception is dropped due to the selection/reselection of synchronization reference source. Add the requirements for the scenario when synchronization reference change or network coverage change happen. Some editorial correction. Reference correction.  (R4-2410155): Corrections to SL positioning core requirements. | | | | | | | | |
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| ***Consequences if not approved:*** | | The core requirements are not complete. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | R4-2406374: 4.5.2.5;  R4-2406375: 4.5.2.5, 4.5.4.5, 4.6.2.5, 4.6.3.5, 4.6.4.5, 4.6.4.6,  5.6.2.5, 5.6.4.5, 5.6A.4.5, 5.6A.6.5,  9.9.2.5, 9.9.2.7, 9.9.4.5, 9.9.4.6, 9.9A.2.5.1, 9.9A.2.5.2.  R4-2410158: 4.5.2.5, 5.6.2.5;  R4-2406378: 4.5.2.6, 9.9.2.10, 9.9.4.9;  R4-2410154: 4.5.2.6, 9.9.2.2, 9.9.2.10, 9.9.4.2, 9.9.4.9;  R4-2410156: 4.5.2.6, 4.5.5.5, 4.6.2.5;  R4-2410157: 4.5.3.5, 4.6.3.5, 5.6.3.5, 5.6.4.5;  R4-2406371: 4.5.5.5;  R4-2406372: 4.5.5.5;  R4-2410409: 4.5.5.5;  R4-2406376: 4.6.1, 4.6.2.4, 4.6.3.6, 5.6A.4.6, 5.6A.5.5, 5.6A.5.6, 5.6A.6.5, 5.6A.6.6;  R4-2410153: 4.6.2.5, 4.6.3.5, 4.6.3.6, 4.6.4.6, 5.6A.4.5, 5.6A.4.6, 5.6A.5.5, 5.6A.5.6, 5.6A.6.5;  R4-2406377: 4.6.2.6, 9.9A.2.6.1, 9.9A.3.6.1, 9.9A.4.8;  R4-2410152: 4.6.2.6, 9.9A.2.6.1, 9.9A.3.6.1, 9.9A.4.8;  R4-2406379: 5.6.2.2, 5.6.2.6, 5.6.4.2, 5.6.4.6;  R4-2406484: 5.6.2.6, 5.6A.4.5;  R4-2409584: 5.6.4.6;  R4-2406493: 5.6.8.5, 9.9.8.5;  R4-42109410: 5.6.7.5, 5.6.8.5, 9.9.7.5, 9.9.8.5;  R4-2406422: 7.1.2.4;  R4-2410151: 9.9A.1.3;  R4-2406370: 12A.2, 12A.3, 12A.4, 12A.5;  R4-2406494: 12A.6, 12A.7;  R4-2410155: 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:*** | | R4-2409368, R4-2405983, R4-2405528 | | | | | | | | |

## **--- Start of Change #1 ---**

#### 4.5.2.5 Measurements Period Requirements

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34]*,* the UE shall be able to measure multiple (up to the UE capability specified in Clause 4.5.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

,

Where:

- is the UE Rx beam sweeping factor:

- = 1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation* .

- equals to 8, otherwise.

- is a scaling factor for PRS-based NR positioning measurements in RRC\_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, Kcarrier\_PRS = 1; otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in clause 4.2.2.4

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where is defined in clause 4.2.2.7.

- is the Rx TEG specific scaling factor:

- =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

- is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- , if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case ‘n0’ is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

- is the time duration of available PRS in positioning frequency layer *i* to be measured , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the number of PRS RSTD samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

- is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, = + ,

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

=

Where:

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between and , where is the DRX cycle of the UE, defined in TS 38.304 [1], clause 7.1.

- is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

- , is the PRS periodicity with muting per PRS resource,

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where

- is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- is the UE capability combination per band for RRC\_IDLE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot in RRC\_IDLE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the UE DRX cycle changes during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 4.5.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.5.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC\_IDLE to RRC\_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC\_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2.

## **--- End of Change #1 ---**

## **--- Start of Change #2 ---**

#### 4.5.2.6 Measurements Period Requirements with Bandwidth Aggregation

The requirements in this clause apply provided that UE receives requests from LMF to perform PRS measurement on aggregated positioning frequency layers (PFLs) via *nr-DL-PRS-JointMeasurementRequestedPFL-List* in *NR-DL-TDOA-RequestLocationInformation*.

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34],the UE shall be able to measure multiple (up to the UE capability specified in Clause 4.5.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the total measurement period for aggregated measurements, and

- is the total measurement period for non-aggregated measurements, and

- When both and are non-zero, , where the maximum is across all the PFL combination(s) and non-aggregated PFL(s) configured for positioning measurements; otherwise is equal to zero.

is zero if every resource set on every PFL is linked for aggregation to at least one other resource set on another PFL. Otherwise, is as defined in clause 4.5.2.5 except that

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in

- on each PFL , only resource set(s) not linked to any other resource set(s) are considered in , and

- = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-Inactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

is zero if no resource sets on any PFL are linked for aggregation with other resource sets on other PFLs. Otherwise, is defined as

where:

- is the index of PFL combination,

- is total number of PFL combinations,

- is the periodicity of the PRS measurement in PFL combination ,

- is the measurement period for PRS RSTD measurement in PFL combination as specified below.

where:

- is a scaling factor for PRS measurements in RRC\_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, = 1. Otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, equals to the sum of Kcarrier in 4.2.2.4 and one positioning layer.

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, equals to the sum of Nlayer in 4.2.2.7 and one positioning layer.

- is the Rx TEG specific scaling factor:

- =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

- is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- , if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case ‘n0’ is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- is a scaling factor for PRS measurements with multiple Rx beams, and is defined as

- = 1 if PFL combination *m* is in FR1,

- is defined as follows if PFL combination *m* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing PFL combination *m*, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*,

- equals to 8 otherwise

- is the maximum number of DL PRS resources in PFLcombination *m* configured in a slot, and only the PRS resources in resource set(s) linked to other resource set in PFL combination *m* are counted

- is the UE capability on maximum number of DL PRS resources that can be processed in a slot for PFL combination *m* as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot* specified in TS 37.355 [34].

- is the time duration of available PRS resources in PFL combination *m* to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources in resource set(s) linked to other resource set in PFL combination *m* and that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the UE capability on duration of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN* specified in TS 37.355 [34].

- is number of PRS measurement samples,

- = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,

- = 4 otherwise.

- is the periodicity of the PRS measurement in PFL combination ,

- is the UE capability on time for processing of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* specified in TS 37.355 [34].

- , the least common multiple between and the DRX cycle length , defined in TS 38.304 [1], clause 7.1.

- is the periodicity of DL PRS resource with muting on PFL combination .

- If more than one PRS periodicities are configured in PFL combination , the least common multiple of PRS periodicities among all DL PRS resource sets that are linked to other resource set in PFL combination , is used to derive , and for each applicable PRS resource set,

- , is the PRS periodicity with muting per PRS resource, and

- is the periodicity of PRS resource set given by the higher-layer parameter *DL-PRS-Periodicity*, and

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- is the measurement duration for the last PRS sample in PFL combination , including the sampling time and processing time, .

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements satisfy all the conditions specified in clause 5.1.6.5.3 in TS 38.214 [26].

Note: No separate requirement on aggregated measurement based on or on non-aggregated measurement based on is applied.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is also reported by UE together with RSTD measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRP are performed over the measurement period defined in 4.5.2.6.

When PRS-RSRPP is also reported by UE together with RSTD measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRPP are performed over the measurement period defined in 4.5.2.6.

Longer RSTD measurement period is expected when there are collisions between PRS resources in any of the PFLs configured for aggregation and other higher-priority DL signals/channels.

If changes for any PFL or any PFL combination during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.5.2.6 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC\_IDLE to RRC\_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC\_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.x.x.x.

## **--- End of Change #2 ---**

## **--- Start of Change #2a ---**

4.5.3.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in Clause 4.5.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within ms.

Where:

*- i* is the index of positioning frequency layer,

- L is total number of positioning frequency layers,

- is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

Where:

- is a scaling factor for PRS-based NR positioning measurements in RRC\_IDLE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, = 1. Otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, equals to the sum of Kcarrier in 4.2.2.4 and one positioning layer.

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, equals to the sum of Nlayer in 4.2.2.7 and one positioning layer.

- is the scaling factor for Rx beam sweeping:

* =1 if positioning frequency layer *i* is in FR1, and
* If positioning frequency layer *i* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AoD-RequestLocationInformation*.

- equals to 8, otherwise.

- is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],

- is the number of PRS-RSRP measurement samples and

- = 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are not met

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise

*= +* is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

- is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- the least common multiple between and *.*

- is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

- is the DRX cycle length if UE is not configured with eDRX\_IDLE cycle, and is defined as T in TS 38.304[1] if UE is configured with eDRX\_IDLE cycle.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, , the least common multiple of among the DL PRS resource sets is used to derive , where:

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 4.5.2.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC\_IDLE state.

The requirements in clause 4.5.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If the DRX cycle is reconfigured during the PRS-RSRP measurement period then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRPP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE’s RRC state changes from the RRC\_IDLE to RRC\_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC\_CONNECTED state. The PRS-RSRP measurement period can be longer.

The UE shall meet the PRS-RSRP measurement accuracy requirements in clause 10.1.24.2.

## **--- End of Change #2a ---**

## **--- Start of Change #3 ---**

#### 4.5.4.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and the PRS-RSRPP measurement is performed in RRC\_IDLE state, measurement period requirements for PRS-RSRP defined in 4.5.3.5 is re-used for PRS-RSRPP measurement.

## **--- End of Change #3 ---**

## **--- Start of Change #4 ---**

### 4.5.5 Measurement requirements for DL RSCPD reported with RSTD

#### 4.5.5.1 Introduction

The requirements in clause 4.5.5 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message with *nr-DL-PRS-RSCPD-Request* from the LMF via LPP [34] requesting the UE to measure and report DL RSCPD with DL RSTD measurements defined in TS 38.215 [4].

#### 4.5.5.2 Requirements Applicability

The requirements in clause 4.5.5 apply for periodic and triggered RSTD and DL RSCPD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding Band.

- DL RSCPD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding Band.

#### 4.5.5.3 Measurement Capability

The UE PRS RSTD measurement capability in RRC\_IDLE state is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355 [34].

#### 4.5.5.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE is ready to transmit the measurement report over the air interface. The UE will transition to RRC\_CONNECTED state prior to transmitting the measurement report.

For RSTD and DL RSCPD measurements performed by the UE in RRC\_IDLE state, the measurement reporting delay excludes all of the following:

- additional delay caused by other LPP signalling on the DCCH,

- delay uncertainty introduced when inserting the measurement report in the TTI of the uplink DCCH, equal to 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,

- any delay caused by unavailability of UL resources to transmit the measurement report,

- the time needed to transition to RRC\_CONNECTED state to report the measurements.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.23.3. The reported DL RSCPD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.x.y2.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2, for each measured DL PRS resource. The DL RSCPD measurements performed and reported according to this section shall meet the DL RSCPD measurement accuracy requirements in clause 10.1.23.2, for each measured DL PRS resource.

4.5.5.5 Measurements Period Requirements

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] with *nr-DL-PRS-RSCPD-Request*, the UE shall be able to measure multiple (up to the UE capability specified in Clause 4.5.5.3) DL RSTD and DL RSCPD measurements, defined in TS 38.215 [4].

When LMF does not configure measurement time window(s):

- When a single PFL is configured, requirements in clause 4.5.2.5 apply to both DL RSTD and DL RSCPD.

- When multiple PFLs are configured, the UE performs DL RSCPD measurement on a single PFL that is common between the reference TRP and the target TRP, and requirements in clause 4.5.2.5 apply to both DL RSTD and DL RSCPD.

When LMF configures measurement time window(s), but UE does not support *supportOfRSCPD-MeasurementInTimeWindow*:

- The UE performs DL RSCPD measurement on the indicated PFL by the network. The requirement in clause 4.5.2.5 apply to both DL RSTD and DL RSCPD measurements.

When LMF configures measurement time window(s), and UE supports *supportOfRSCPD-MeasurementInTimeWindow* but does not support *supportOfLegacyMeasurementInTimeWindow*:

- The requirements in the Clause 4.5.2.5 apply to DL RSTD measurement.

- The requirements in Clause 4.5.5.5 apply to DL RSCPD measurement for the PRS resource(s) that have occasions only within the measurement time window.

When LMF configures measurement time window(s), and UE supports *supportOfRSCPD-MeasurementInTimeWindow* and *supportOfLegacyMeasurementInTimeWindow*:

- The requirements in Clause 4.5.5.5 apply to DL RSTD measurement and DL RSCPD measurement.

If a periodic time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in Clause 4.5.5.3) DL RSTD and DL RSCPD measurements, defined in TS 38.215 [4], based on the indicated PRS resource sets occurring inside the time window during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

,

Where:

- is the UE Rx beam sweeping factor:

- = 1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*.

- equals to 8, otherwise.

- is a scaling factor for PRS-based NR positioning measurements in RRC\_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, Kcarrier\_PRS = 1; otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in clause 4.2.2.4

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where is defined in clause 4.2.2.7.

- is the Rx TEG specific scaling factor:

- =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

- is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- , if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case ‘n0’ is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

- is the time duration of available PRS in positioning frequency layer *i* to be measured , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the unmuted PRS resources in the indicated resources sets that are not fully overlapped with other higher-priority DL signals/channels and overlapped the time window(s) are considered if PFL *i* is associated with the time window are considered, otherwise only the unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the number of PRS RSTD samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

- is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, = + ,

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

=

Where:

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between the time window periodicity , and the DRX cycle length , defined in TS 38.304 [1], clause 7.1, if PFL *i* is associated with the time window, otherwise ,

- is the periodicity of DL PRS resource with muting on positioning frequency layer *i,* and when calculating , only the PRS resources in the indicated resources sets and overlapped with the indicated time window(s) are considered if PFL *i* is associated with the time window,

- is the maximum periodicity of the indicated time window(s).

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

- , is the PRS periodicity with muting per PRS resource,

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where

- is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- is the UE capability combination per band for RRC\_INACTIVE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], [ and T-N (>0) is the time required to process duration N of DL PRS symbols already buffered in memory], for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot [in RRC\_INACTIVE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.x1.5 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSTD and DL RSCPD measurements are being performed, then the UE shall continue and complete the on-going RSTD and DL RSCPD measurements after the cell selection is completed. The RSTD and DL RSCPD measurement period can be longer.

If the RRC state transition occurs from RRC\_IDLE to RRC\_CONNECTED state during the measurement period then the UE shall continue the RSTD and DL RSCPD measurement in the RRC\_CONNECTED state. The RSTD and DL RSCPD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2.

The UE shall meet the DL-RSCPD measurement accuracy requirements in clause 10.x.x.x.

## **--- End of Change #4 ---**

## **--- Start of Change #5 ---**

### 4.6 NR measurements for positioning for RedCap

### 4.6.1 Introduction

This clause contains requirements for RedCap UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, and PRS-RSRPP, in RRC\_IDLE state.

The requirements in clauses 4.6.2, 4.6.3, and 4.6.4 are applicable to PRS resources that do not collide with other DL signals/channels which include SSB, SIB1, CORESET0, MSG2/MSGB, paging and DL SDT. In addition, a UE is not expected to receive PRS resources that collide with a time interval starting at symbol *m* and ending at symbol *m + N2*, where symbol *m* is the last symbol in which the UE is configured to receive PDCCH and *N2* is defined in clause 6.4 of [26, TS 38.214] for the subcarrier spacing μ of the DL PRS.

If a PRS resource is outside or partially overlapped with the intitial DL BWP, a PRS resource instance collides with another DL signals/channel~~s~~ if any portion of the other DL signal/channel overlaps with the time interval starting X symbols before the PRS instance and ending X symbols after the PRS instance, taking into account *nr-DL- PRS-ExpectedRSTD-Uncertainty* and *nr-DL-PRS-ExpectedRSTD.* Where X is defined in Table 5.6.1-1.

All measurement requirements specified in clauses 4.6.2, 4.6.3, and 4.6.4 shall apply for DRX and eDRX configurations specified in TS 38.331 [2] for RRC\_IDLE state.

The requirements in clauses 4.6.2, 4.6.3, and 4.6.4 are applicable provided that the cell selection procedure for the selected PLMN defined in TS 38.304 [1] is not triggered during PRS measurement period.

The requirements in clauses 4.6.2, 4.6.3, and 4.6.4 apply provided that all PRS resources within a PFL are within up to 2 separate windows withinTPRS,i for each positioning frequency layer *i*, where each window is up to 10ms and TPRS,i is defined in in clauses 4.6.2, 4.6.3, and 4.6.4.

The UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

When the UE is configured with measurement for more than one positioning requests, the measurement period for each request may be longer than measurement period when UE is configured with measurement for single positioning request.

### 4.6.2 RSTD measurements for RedCap

#### 4.6.2.1 Introduction

The requirements in clause 4.6.2 shall apply provided the RedCap UE performing PRS measurement with Rx FH or without RX FH in RRC\_IDLE state has received *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

#### ---unchanged clauses omitted---

#### 4.6.2.4 Measurement Reporting Requirements

The measurement reporting delay shall satisfy the requirements defined in clause 4.6.2.4, with the exception of the applicable measurement accuracy requirements, which are specified below.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause [TBD], for each measured DL PRS resource by 1 Rx RedCap UE without RX FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2, for each measured DL PRS resource by 2 Rx RedCap UE without RX FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause [TBD], for each measured DL PRS resource by 2 Rx RedCap UE with RX FH.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause [TBD], for each measured DL PRS resource by 1 Rx RedCap UE with RX FH.

## **--- End of Change #5 ---**

## **--- Start of Change #6 ---**

#### 4.6.2.5 Measurement Period Requirements without RX FH

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34]*,* and UE is not configured to perform DL RSTD measurement with RX FH, the UE shall be able to measure multiple (up to the UE capability specified in Clause 4.6.2.3) DL RSTD measurements without RX FH, defined in TS 38.215 [4], during the measurement period defined in 4.5.2.5.

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 4.6.2.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 4.6.2.5 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC\_IDLE to RRC\_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC\_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2.

## **--- End of Change #6 ---**

## **--- Start of Change #7 ---**

#### 4.6.2.6 Measurement Period Requirements with RX FH

The requirements in this clause apply when a RedCap UE is requested by the LMF to perform measurements with FH, and UE reports measurement based on multiple hops.

The requirements in clause 4.5.2.5 shall apply with the following modifications.

- = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *[supportedDL-PRS-ProcessingSamples-RRC-Inactive]* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- A measurement sample with FH is defined as a PRS measurement over multiple hops within a single time window.

- , where

- is the number of hops that UE can do in an measurement window occasion as defined in the following, and

- is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with the sampling duration in each hop are considered;

The sampling window per hop is the first symbols in each hop, where , is the applicable length per hop as defined in Table 4.6.2.6-1, and is the retuning time between Rx hops as reported by UE in *dl-PRS-MeasurementWithRxFH-RRC-Connected* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop within a measurement window instance starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement window instance taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

**Table 4.6.2.6-1: Applicable number of hops per slot and applicable length of each hop**

|  |  |  |  |
| --- | --- | --- | --- |
|  | (comb size, Number of PRS symbols) | Applicable number of hops per slot | Applicable length per hop () in number of symbols |
|  | (2, 12) with SCS 15kHz, 30kHz, 60kHz in FR2, 120kHz | 2 | 7 |
| All others | 1 | 14 |
|  | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
|  | Any combination | ½ | 28 |

The number of hops within a single measurement window occasion is defined as

where

- is the maximum number of Rx hops signaled as reported by UE in *dl-PRS-MeasurementWithRxFH-RRC-Connected* via *NR-DL-PRS-ProcessingCapability*

- is the effective number of Rx hops within a single time window,

- , if = 2,

- , if = 1,

- , if = 1/2 and >1,

- , if = 1/2 and =1,

- where is the number of PRS repetitions within the measurement window occasion, is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap* and is the applicable number of hops per slot as defined in Table 4.6.2.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions within a measurement window instance and the same PRS repetition interval , otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of defined as

where

* is the minimum among

- configured PRS BW, and

- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18*, and

- total BW of all hops requested by LMF via *maximumPRS-BandwidthAcrossAllHopsFR1-r18*

* is number of hops within a single time window as define above
* is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16*
* is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18*.

## **--- End of Change #7 ---**

## **--- Start of Change #8 ---**

#### 4.6.3.5 Measurement Period Requirements without RX FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and UE is not configured to perform measurement with RX FH, the UE shall be able to measure multiple (up to the UE capability specified in Clause 4.6.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within .

Where:

*- i* is the index of positioning frequency layer,

- L is total number of positioning frequency layers,

- is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

Where:

- is a scaling factor for PRS-based NR positioning measurements in RRC\_IDLE. If the UE is capable of performing RRM measurement and PRS measurement in parallel to each other, = 1. Otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in 4.2B.2.4.

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where Nlayer is defined in 4.2.2.7.

- is the scaling factor for Rx beam sweeping:

* =1 if positioning frequency layer *i* is in FR1 or UE has only 1 Rx branch, and if positioning frequency layer *i* is in FR2 or UE has 2 Rx branches

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AoD-RequestLocationInformation*.

- equals to 8, otherwise.

- is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17*in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],

- is the number of PRS-RSRP measurement samples and

- = 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are not met

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise

*= +* is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

- is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between and .

- is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

- is the DRX cycle length if UE is not configured with eDRX. Otherwise, is defined as T in TS 38.304 [1].

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, , the least common multiple of among the DL PRS resource sets is used to derive , where:

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* messages are delivered from LMF to the UE via LPP [34].

- UE is configured with CN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- CN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-TDOAProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* messages are delivered from LMF to the UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 4.6.2.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC\_IDLE state.

The requirements in clause 4.6.3 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If the DRX cycle is reconfigured during the PRS-RSRP measurement period then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE’s RRC state changes from the RRC\_IDLE to RRC\_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC\_CONNECTED state. The PRS-RSRP measurement period can be longer.

## **--- End of Change #8 ---**

## **--- Start of Change #9 ---**

#### 4.6.3.6 Measurement Period Requirements with RX FH

When physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34]*,* and UE is configured to perform PRS-RSRP measurement with RX FH via *nr-DL-PRS-RxHoppingRequest-r18* as defined in TS 37.355 [34], the UE shall be able to measure multiple (up to the UE capability specified in 4.6.3.3) PRS-RSRP measurements, defined in TS38.215 [4], during the measurement period defined in Clause 4.6.3.5 with using the following definition for and .

is the number of PRS-RSRP measurement samples, where

- = 2 if the RedCap UE supports *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- = 4 otherwise.

A measurement sample under RX FH is defined as a PRS measurement over multiple hops.

is the time duration of available PRS in the positioning frequency layer *i* to be measured, and is calculated by:

where,

- is the number of hops that UE can perform as defined in the following, and

- is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered;

The sampling duration per hop is the first symbols in each hop, where , is the applicable length per hop as defined in Table 4.6.3.6-1, and is the retuning time between Rx hops indicated by UE via *dl-PRS-MeasurementWithRxFH-RRC-Connected*. The first hop starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement time window, defined in clause 4.6.1, taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table 4.6.3.6-1: Applicable number of hops per slot and applicable length of each hop

|  |  |  |  |
| --- | --- | --- | --- |
|  | (comb size, Number of PRS symbols) | Applicable number of hops per slot | Applicable length per hop () in number of symbols |
|  | (2, 12) with SCS 15kHz, 30kHz in FR1, and 60kHz, 120kHz in FR2 | 2 | 7 |
| All others | 1 | 14 |
|  | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
|  | Any combination | ½ | 28 |

The number of hops within a single time window is defined as

where

- is the maximum number of Rx hops signaled by UE via *dl-PRS-MeasurementWithRxFH-RRC-Connected*.

- is the effective number of Rx hops within a single time window,

- , if = 2,

- , if = 1,

- , if = 1/2 and >1,

- , if = 1/2 and =1,

- where is the number of PRS repetitions within a single time window excluding the retuning times, is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, is the applicable number of hops per slot as defined in Table 4.6.3.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions within a time window instance and the same PRS repetition interval , otherwise the measurement period can be longer.

## **--- End of Change #9 ---**

## **--- Start of Change #10 ---**

#### 4.6.4.5 Measurement Period Requirements without RX FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and the PRS-RSRPP measurement is performed in RRC\_IDLE state, measurement period requirements for PRS-RSRP defined in 4.6.3.5 is re-used for PRS-RSRPP measurement.

#### 4.6.4.6 Measurement Period Requirements with RX FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], requesting RedCap UE to measure DL PRS-RSRPP measurement with FH via *nr-DL-PRS-RxHoppingRequest-r18*, measurement period requirements defined in 4.6.3.6 apply.

## **--- End of Change #10 ---**

## **--- Start of Change #11 ---**

#### 5.6.2.2 Requirements Applicability

The requirements in clause 5.6.2 apply for periodic and triggered RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23.2 for FR1 and FR2 are fulfilled, for a corresponding Band.

## **--- End of Change #11 ---**

## **--- Start of Change #12 ---**

#### 5.6.2.5 Measurements Period Requirements

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34]*,* the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

,

Where:

- is the UE Rx beam sweeping factor:

- = 1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation* .

- equals to 8, otherwise.

- is a scaling factor for PRS-based NR positioning measurements in RRC\_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, Kcarrier\_PRS = 1; otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in clause 4.2.2.4

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where is defined in clause 4.2.2.7.

- is the Rx TEG specific scaling factor:

- =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

- is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- , if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case ‘n0’ is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

- is the time duration of available PRS in positioning frequency layer *i* to be measured , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the number of PRS RSTD samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

- is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, = + ,

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

=

Where:

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between and

- is defined as following:

- is DRX cycle length, defined in clause 7.1 TS 38.304, when no extended DRX (eDRX) cycle is configured

- is defined as T in clause 7.1 TS 38.304 when RAN eDRX <= 10.24s and CN eDRX <= 10.24s

- is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304, when RAN eDRX <= 10.24s and CN eDRX > 10.24s

- is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24s

- is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

- , is the PRS periodicity with muting per PRS resource,

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where

- is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- is the UE capability combination per band for RRC\_INACTIVE state where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot in RRC\_INACTIVE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note 1: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC\_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.2.

## **--- End of Change #12 ---**

## **--- Start of Change #13 ---**

#### 5.6.2.6 Measurements Period Requirements with Bandwidth Aggregation

The requirements in this clause apply provided that UE receives requests from LMF to perform PRS measurement on aggregated positioning frequency layers (PFLs) via *nr-DL-PRS-JointMeasurementRequestedPFL-List [34]*.

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34],the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the total measurement period for aggregated measurements, and

- is the total measurement period for non-aggregated measurements, and

- When both and are non-zero, , where the maximum is across all the PFL combination(s) and non-aggregated PFL(s) configured for positioning measurements; otherwise is equal to zero.

is zero if every resource set on every PFL is linked for aggregation to at least one other resource set on another PFL. Otherwise, is as defined in clause 5.6.2.5 except that

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in

- on each PFL , only resource set(s) not linked to any other resource set(s) are considered in , and

- = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-Inactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

is zero if no resource sets on any PFL are linked for aggregation with other resource sets on other PFLs. Otherwise, is defined as

where:

- is the index of PFL combination,

- is total number of PFL combinations,

- is the periodicity of the PRS measurement in PFL combination ,

- is the measurement period for PRS RSTD measurement in PFL combination as specified below.

where:

- is a scaling factor for PRS measurements in RRC\_INACTIVE,

- if the UE supports *parallelPRS-MeasRRC-Inactive-r17*,

- otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in clause 4.2.2.4

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where is defined in clause 4.2.2.7.

- is a scaling factor for PRS measurements with multiple Rx TEGs

- =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

- is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- , if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case ‘n0’ is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- is a scaling factor for PRS measurements with multiple Rx beams, and is defined as

- = 1 if PFL combination *m* is in FR1,

- is defined as follows if PFL combination *m* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing PFL combination *m*, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*,

- equals to 8 otherwise

- is the maximum number of DL PRS resources in PFLcombination *m* configured in a slot, and only the PRS resources in resource set(s) linked to other resource set in PFL combination *m* are counted

- is the UE capability on maximum number of DL PRS resources that can be processed in a slot for PFL combination *m* as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18* for FR1 and *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18* for FR2 specified in TS 37.355 [34].

- is the time duration of available PRS resources in PFL combination *m* to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources in resource set(s) linked to other resource set in PFL combination *m* and that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the UE capability on duration of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18* specified in TS 37.355 [34].

- is number of PRS measurement samples,

- = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,

- = 4 otherwise.

- is the periodicity of the PRS measurement in PFL combination ,

- is the UE capability on time for processing of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* specified in TS 37.355 [34].

- , the least common multiple between and the DRX cycle length , where is the periodicity of DL PRS resource with muting on PFL combination .

- If more than one PRS periodicities are configured in PFL combination , the least common multiple of PRS periodicities among all DL PRS resource sets that are linked to other resource set in PFL combination , is used to derive , and for each applicable PRS resource set,

- , is the PRS periodicity with muting per PRS resource, and

- is the periodicity of PRS resource set given by the higher-layer parameter *DL-PRS-Periodicity*, and

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- is the measurement duration for the last PRS sample in PFL combination , including the sampling time and processing time, .

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements are transmitted by the TRP using single Tx chain as defined in clause 5.1.6.5.3 in TS 38.214 [26].

If PRS resources in one or more of the aggregated PFLs in PFL combination are dropped because of collision with other signals, can be longer than specified above.

The timestarts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note: No separate requirement on aggregated measurement based on or on non-aggregated measurement based on is applied.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period. When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If changes for any PFL or any PFL combination during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the RSTD measurement period then the UE shall continue the RSTD measurement in the RRC\_CONNECTED state. The RSTD measurement period can be longer.

The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.

## **--- End of Change #13 ---**

## **--- Start of Change #13a ---**

5.6.3.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within ms.

Where:

*- i* is the index of positioning frequency layer,

- L is total number of positioning frequency layers,

- is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

Where:

- is a scaling factor for PRS-based NR positioning measurements in RRC\_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, = 1. Otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, equals to the sum of Kcarrier in 4.2.2.4 and one positioning layer.

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, equals to the sum of Nlayer in 4.2.2.7 and one positioning layer.

- is the scaling factor for Rx beam sweeping:

* =1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-AoD-RequestLocationInformation*.

- equals to 8, otherwise.

- is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17*in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],

- is the number of PRS-RSRP measurement samples and

- = 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are not met

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise

*= +* is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

- is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- the least common multiple between and ,

- is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

- is defined as following:

- is DRX cycle length when no extended DRX (eDRX) cycle is configured

- is defined as T in clause 7.1 TS 38.304 when RAN eDRX <= 10.24s and CN eDRX <= 10.24s

- is the maximum of the T inside and outside of the CN PTW, where T inside and outside of the CN PTW are defined in clause 7.1 TS 38.304, when RAN eDRX <= 10.24s and CN eDRX > 10.24s

- is the maximum of the DRX cycles within the CN PTW and the RAN PTW when RAN eDRX > 10.24s

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, , the least common multiple of among the DL PRS resource sets is used to derive , where:

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note 1: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 5.6.2.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 5.6.4.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC\_INACTIVE state.

The requirements in clause 5.6.3 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If the DRX cycle is reconfigured during the PRS-RSRP measurement period then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE’s RRC state changes from the RRC\_INACTIVE to RRC\_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC\_CONNECTED state. The PRS-RSRP measurement period can be longer.

## **--- End of Change #13a ---**

## **--- Start of Change #14 ---**

#### 5.6.4.2 Requirements Applicability

The requirements in clause 5.6.4 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25.2 are met for a corresponding band.

- SRS is configured on the PCell.

- UE has valid SRS configuration in the current camping cell.

## **--- End of Change #14 ---**

## **--- Start of Change #15 ---**

#### 5.6.4.5 Measurement Period Requirements

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34]*,* UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period ms.

Where:

- is the index of positioning frequency layer,

- is the measurement period for UE Rx-Tx time difference measurements in positioning frequency layer *i* as further defined in this clause,

- L is total number of positioning frequency layers,

- is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

Where:

- =1 if the UE is capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34].

- if the UE is not capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34] and if Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ; where is defined in clause 4.2.2.7.

- if the UE is not capable of *parallelPRS-MeasRRC-Inactive-r17* defined in [34] and if Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ; where is defined in clause 4.2.2.4.

- is the scaling factor for UE Rx beam sweeping:

- =1 if positioning frequency layer *i* is in FR1, and if positioning frequency layer *i* is in FR2.

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT -RequestLocationInformation*.

- equals to 8, otherwise.

is the Rx TEG specific scaling factor:

- = 1 if UE is not configured by LMF with measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17 or measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17 [34].

- = measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17 or measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17 if UE is configured by LMF to measurement same DL PRS with multiple UE RxTx TEGs or multiple UE Rx TEGs [34], and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in clause 4.2.7.2 of TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot corresponding to *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* as specified in clause 6.4.3 of TS 37.355 [34],

- is the number of UE Rx-Tx time difference measurement samples:

- = 4 if the UE is not capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] or not configured to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34].

- = 1 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] and LMF requests the UE to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34] and the following conditions are met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-Inactive* defined in [34] and the LMF requests the UE to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34] but the following conditions are not met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time,  *= +*  ,

- is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

Where:

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between and .

- When UE is configured with RAN eDRX ≤ 10.24s:

- is defined as T in TS 38.304 [1] when CN eDRX ≤ 10.24s.

- is the maximum of the T inside and outside of the CN PTW when CN eDRX > 10.24s, where T inside and outside of the CN PTW are defined in TS 38.304 [1].

- When UE is configured with RAN eDRX > 10.24s:

- is the maximum of the DRX cycles within the CN PTW and the RAN PTW.

- Otherwise, is the DRX cycle of the UE in the serving cell.

- is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, , the least common multiple of among DL PRS resource sets is used to derive , where:

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note 1: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the new serving cell.

If cell reselection occurs, and UE reselects to a cell out of the positioning validity area or if UE performs autonomous TA adjustment at reselection, then UE shall restart the measurement.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the UE Rx-Tx time difference measurement period then the UE Rx-Tx time difference measurement period can be longer.

If during UE Rx-Tx time difference measurement period PRS resources overlap with other DL signals/channels then the UE Rx-Tx time difference measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 5.6.4 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

The UE shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1.25.2.

## **--- End of Change #15 ---**

## **--- Start of Change #16 ---**

5.6.4.6 Measurement Period Requirements with Bandwidth Aggregation

The requirements in this clause apply provided that UE receives requests from LMF to perform PRS measurement on aggregated positioning frequency layers (PFLs) via *nr-DL-PRS-JointMeasurementRequestedPFL-List [34]*.

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34],the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6.4.3) UE Rx-Tx time difference measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the total measurement period for aggregated measurements, and

- is the total measurement period for non-aggregates measurements, and

- is , if both and are non-zero, where is the from both PFL combination(s) and non-aggregated PFL(s) which are configured for positioning measurement; otherwise equals to zero.

is zero if every resourse set on every PFL is linked for aggregation with at least one other resource set on another PFL. Otherwise, is as defined in clause 5.6.4.5 except that

- only PFLs containing resource set(s) not linked to any other resource set(s) are considered in

- on each PFL , only resource set(s) not linked to any other resource set(s) are considered in , and

- = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-Inactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

is zero if no resource sets on any PFL are linked for aggregation with other resource sets on other PFLs. Otherwise, is defined as

where:

- is the index of PFL combination,

- is total number of PFL combinations,

- is the periodicity of the PRS measurement in PFL combination ,

- is the measurement period for UE Rx-Tx time difference measurement in PFL combination as specified below.

where:

- is a scaling factor for PRS measurements in RRC\_INACTIVE, and is defined as:

- if the UE supports *parallelPRS-MeasRRC-Inactive-r17*,

- otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in clause 4.2.2.4

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where is defined in clause 4.2.2.7.

- is a scaling factor for PRS measurements with multiple Rx TEGs, and is defined as:

- =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

- is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- , if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case ‘n0’ is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- is a scaling factor for PRS measurements with multiple Rx beams, and is defined as

- = 1 if PFL combination *m* is in FR1,

- is defined as follows if PFL combination *m* is in FR2

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2* if the capability is reported by the UE for the band containing PFL combination *m*, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*,

- equals to 8 otherwise

- is the maximum number of DL PRS resources in PFLcombination *m* configured in a slot, and only the PRS resources in resource set(s) linked to other resource set in PFL combination *m* are counted

- is the UE capability on maximum number of DL PRS resources that can be processed in a slot for PFL combination *m* as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18* for FR1 and *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18* for FR2 specified in TS 37.355 [34].

- is the time duration of available PRS resources in PFL combination *m* to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources in resource set(s) linked to other resource set in PFL combination *m* and that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the UE capability on duration of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18* specified in TS 37.355 [34].

- is number of PRS measurement samples,

- = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples,

- = 4 otherwise.

- is the periodicity of the PRS measurement in PFL combination ,

- is the UE capability on time for processing of DL PRS resources in ms for PFL combination *m* as indicated by *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* specified in TS 37.355 [34].

- , the least common multiple between and the DRX cycle length , where is the periodicity of DL PRS resource with muting on PFL combination .

- If more than one PRS periodicities are configured in PFL combination , the least common multiple of PRS periodicities among all DL PRS resource sets that are linked to other resource set in PFL combination , is used to derive , and for each applicable PRS resource set,

- , is the PRS periodicity with muting per PRS resource, and

- is the periodicity of PRS resource set given by the higher-layer parameter *DL-PRS-Periodicity*, and

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- is the measurement duration for the last PRS sample in PFL combination , including the sampling time and processing time, .

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements are transmitted by the TRP using single Tx chain as defined in clause 5.1.6.5.3 in TS 38.214 [26].

If PRS resources in one or more of the aggregated PFLs in PFL combination are dropped because of collision with other signals, can be longer than specified above.

The timestarts from the first DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message are delivered from LMF to the UE via LPP [34].

Note: No separate requirement on aggregated measurement based on or on non-aggregated measurement based on is applied.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the new serving cell.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the UE Rx-Tx time difference measurement period then the UE Rx-Tx time difference measurement period can be longer.

If changes for any PFL or any PFL combination during the measurement period, the measurement period could be longer.

If during UE Rx-Tx time difference measurement period PRS resources overlap with other DL signals/channels then the UE Rx-Tx time difference measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period. When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP are performed over the same measurement period.

The requirements in clause 5.6.4 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

The UE shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1.25.

## **--- End of Change #16 ---**

## **--- Start of Change #16a ---**

#### 5.6.7.5 Measurements Period Requirements

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message with *nr-DL-PRS-RSCPD-Request* from the LMF via LPP [34]*,* when LMF configures measurement time window(s) for a PFL, the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6.7.3) DL RSTD and RSCPD measurements, defined in TS 38.215 [4], during the time window configured to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig* during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD with RSCPD measurement in positioning frequency layer *i* as specified below:

,

where:

- , , , , , , , and are defined in clause 5.6.2.5

- is the time duration of available PRS in the positioning frequency layer to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- When periodic time window(s) are configured by the LMF, , the least common multiple between , the DRX cycle length and Twindow being the maximum periodicity of the indicated time window(s). is defined in clause 5.6.2.5.

- When periodic time window(s) are not configured by the LMF, , the least common multiple between and the DRX cycle length . is defined in clause 5.6.2.5.

- and are calculated by only considering the PRS resources in the indicated resources sets overlapping with the indicated time window(s).

The time *s*tarts from the first time window (TDL RSCPD) configured by LMF within DRX cycle containing the DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

When LMF does not configure measurement time window(s):

- When a single PFL is configured, requirements in Clause 5.6.2.5 apply to both RSCPD and RSTD measurements.

- When multiple PFLs are configured for legacy measurements, the UE performs RSCPD measurement on a single PFL that is common between the reference TRP and the target TRP. The requirement in Clause 5.6.2.5 apply to both RSTD and RSCPD measurements.

When LMF configures measurement time window(s), but UE does not support *supportOfRSCPD-MeasurementInTimeWindow*:

* The UE performs RSCPD measurement on the indicated PFL by the network. The requirement in Clause 5.6.2.5 apply to both RSTD and RSCPD measurements.

When LMF configures measurement time window(s), but UE does not support *supportOfLegacyMeasurementInTimeWindow* but supports *supportOfRSCPD-MeasurementInTimeWindow*:

* The requirements in the Clause 5.6.2.5 apply to RSTD measurements.
* The requirements in Clause 5.6.7.5 apply to RSCPD measurement for the PRS resource(s) that have occasions only within the measurement time window.

If the DRX cycle is reconfigured during the measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6.1.

Longer measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If changes for the PFL during the measurement period, the measurement period can be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6.7 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSCPD together with RSTD measurements are being performed, then the UE shall continue and complete the on-going RSCPD and RSTD measurements after the cell re-selection is completed. The measurement period can be longer.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the measurement period then the UE shall continue the RSCPD and RSTD measurements in the RRC\_CONNECTED state. The measurement period can be longer.

## **--- End of Change #16a ---**

## **--- Start of Change #17 ---**

#### 5.6.8.5 Measurement Period Requirements

When the physical layer receives the last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] with *nr-UE-RSCP-Request* and configuring a measurement time window via *nr-DL-PRS-MeasurementTimeWindowsConfig*, subject to UE capabilities *supportOfRSCP-MeasurementInTimeWindow* and *supportOfLegacyMeasurementInTimeWindow*, the UE shall be able to measure multiple (up to the UE capability specified in clause 5.6.8.3) UE Rx-Tx and DL RSCP measurements, defined in TS 38.215 [4], during the time window only.

When LMF does not configure measurement time window(s):

- When a single PFL is configured, requirements in Clause 5.6.4.5 apply to both RSCP and UE Rx-Tx measurements.

- When multiple PFLs are configured for legacy measurements, the UE performs RSCP measurement on a single PFL that is common between the reference TRP and the target TRP. The requirement in Clause 5.6.4.5 apply to both RSCP and UE Rx-Tx measurements.

When LMF configures measurement time window(s), but UE does not support *supportOfRSCP-MeasurementInTimeWindow*:

* The UE performs RSCP measurement on the indicated PFL by the network. The requirement in Clause 5.6.4.5 apply to both UE Rx-Tx and RSCP measurements.

When LMF configures measurement time window(s), but UE does not support *supportOfLegacyMeasurementInTimeWindow* but supports *supportOfRSCP-MeasurementInTimeWindow*:

* The requirements in the Clause 5.6.4.5 apply to UE Rx-Tx measurement.
* The requirements in Clause 5.6.8.5 apply to RSCP measurement for the PRS resource(s) that have occasions only within the measurement time window.

If a periodic time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6.8.3) UE Rx-Tx and DL RSCP measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for DL RSCP with UE Rx-Tx measurement in positioning frequency layer *i* as specified below:

,

where:

* , , , , , , , and are defined in clause 5.6.4.5.
* DL RSCP performed during is a single sample measurement where DL RSCP and UE Rx-Tx measurements are performed on the same PFL.

- is the time duration of available PRS resources in the positioning frequency layer, to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- When periodic time window(s) are configured by the LMF, , the least common multiple between , and Twindow being the maximum periodicity of the indicated time window(s).

- When periodic time window(s) are not configured by the LMF, , the least common multiple between and the DRX cycle length .

- and are calculated by only considering the PRS resources in the indicated resources sets overlapping with the indicated time window(s).

The time starts from the first time window (TDL RSCP) configured by LMF within DRX cycle containing the DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the measurement period then the UE shall continue the DL RSCP measurement and shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the measurement period then the UE shall restart the DL RSCP and UE Rx-Tx time difference measurements after it obtains SRS configuration and Timing Advance command from the new serving cell.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the measurement period then the measurement period can be longer.

If during the measurement period, PRS resources overlap with other DL signals/channels then the measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

The requirements in clause 5.6.8 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the DL RSCP with UE Rx-Tx measurement period, then the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the DL RSCP with UE Rx-Tx measurement period, then the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the measurement period, then:

- DL RSCP and UE Rx-Tx measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in section 7.1.1) for SRS transmission.

- DL RSCP and UE Rx-Tx measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in section 7.1.1) for SRS transmission. The DL RSCP with UE Rx-Tx time difference measurement period may be restarted in such case.

## **--- End of Change #17 ---**

## **--- Start of Change #18 ---**

#### 5.6A.4.5 Measurement Period Requirement without RX FH

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from the LMF via LPP [34]*,* and UE is not configured to perform measurement with RX FH, the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6A.4.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

,

Where:

- is the UE Rx beam sweeping factor:

- = 1 if positioning frequency layer *i* is in FR1 or UE has only 1Rx branch,

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2,* if positioning frequency layer *i* is in FR2 or the UE has 2Rx branches, and the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*.

- equals to 8, otherwise.

- is a scaling factor for PRS-based NR positioning measurements in RRC\_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, Kcarrier\_PRS\_RedCap = 1; otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in clause 4.2B.2.4

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where is defined in clause 4.2.2.7.

- is the Rx TEG specific scaling factor:

- =1 if the UE is not configured by the LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34].

- is defined as follows if the UE is configured by the LMF with *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] to perform measurement on same DL PRS resource of a TRP using different Rx TEGs in *NR-DL-TDOA-RequestLocationInformation* [34]:

- , if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, where P is the number of UE Rx TEGs that the UE is requested by LMF to measure the same DL-PRS Resource of a TRP indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* in [34], and in case ‘n0’ is indicated, P is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*.

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs, where is the number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17* in [34].

- is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

- is the time duration of available PRS in positioning frequency layer *i* to be measured , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the number of PRS RSTD samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

- is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time, = + ,

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

=

Where:

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between and the DRX cycle length

* When UE is configured with RAN eDRX\_INACTIVE ≤ 10.24s:

TDRX is calculated as T defined in TS 38.304 [1] when CN eDRX\_INACTIVE ≤ 10.24s.

TDRX is calculated as max(Tinside, Toutside), where Tinside and Toutside of the CN PTW as defined in TS 38.304 [1].

* When UE is configured with RAN eDRX\_INACTIVE > 10.24s:

TDRX is calculated as max(TDRX\_RAN, TDRX\_CN), TDRX\_RAN and TDRX\_CN are DRX cycles with the RAN PTW and CN PTW defined in TS 38.304 [1].

Otherwise, TDRX is the DRX cycle of the UE in the serving cell.

- is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

- , is the PRS periodicity with muting per PRS resource,

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where

- is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- is the UE capability combination per band for RRC\_INACTIVE state where N is the duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34], T (ms) corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34], and T-N (>0) is the time required to process duration N of DL PRS symbols already buffered in memory, for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot in RRC\_INACTIVE state as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* specified in TS 37.355 [34].

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-TDOAProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

If the DRX cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

If eDRX\_INACTIVE cycle is reconfigured during the RSTD measurement period, then the measurement period can be longer.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the same measurement period.

The measurement requirements do not apply to any PRS resource that always collides with other higher-priority DL signals/channels, as specified in clause 5.6A.1.

Longer RSTD measurement period is expected when there are collisions between PRS resources and other higher-priority DL signals/channels.

If changes for any PFL during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 5.6A.4.5 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If cell re-selection occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements after the cell selection is completed. The RSTD measurement period can be longer.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the RSTD measurement period, then the UE shall continue the RSTD measurement in the RRC\_CONNECTED state. The RSTD measurement period can be longer.

## **--- End of Change #18 ---**

## **--- Start of Change #19 ---**

#### 5.6A.4.6 Measurement Period Requirement with RX FH

When physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* requesting RedCap UE to measure DL RSTD measurement with RX FH via *nr-DL-PRS-RxHoppingRequest-r18* as defined in TS 37.355 [34], the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in Clause 5.6A.4.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined in Clause 5.6A.4.5 with using the following definition for and .

is the number of PRS RSTD measurement samples, where

- = 2 if the RedCap UE supports *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- = 4 otherwise.

A measurement sample under RX FH is defined as a PRS measurement over multiple hops.

is the time duration of available PRS in the positioning frequency layer i to be measured, and is calculated by:

where,

- is the number of hops that UE can perform as defined in the following, and

- is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered;

The sampling duration per hop is the first symbols in each hop, where , is the applicable length per hop as defined in Table 5.6A.4.6-1, and is the retuning time between Rx hops indicated by UE via *dl-PRS-MeasurementWithRxFH-RRC-Connected*. The first hop starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement time window, defined in clause 5.6A.1, taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table5.6A.4.6-1: Applicable number of hops per slot and applicable length of each hop

|  |  |  |  |
| --- | --- | --- | --- |
|  | (comb size, Number of PRS symbols) | Applicable number of hops per slot | Applicable length per hop () in number of symbols |
|  | (2, 12) with SCS 15kHz, 30kHz in FR1, and 60kHz, 120kHz in FR2 | 2 | 7 |
| All others | 1 | 14 |
|  | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
|  | Any combination | ½ | 28 |

The number of hops within a single time window is defined as

where

- is the maximum number of Rx hops signaled by UE via *dl-PRS-MeasurementWithRxFH-RRC-Connected,*

- is the effective number of Rx hops within a single time window,

- , if = 2,

- , if = 1,

- , if = 1/2 and >1,

- , if = 1/2 and =1,

- where is the number of PRS repetitions within a single time window excluding the retuning times, is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, is the applicable number of hops per slot as defined in Table 5.6A.4.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions within a time window instance and the same PRS repetition interval , otherwise the measurement period can be longer.

#### ---unchanged clauses omitted---

#### 5.6A.5.5 Measurement Period Requirements without RX FH

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], and UE is not configured to perform measurement with RX FH, the UE shall be able to measure multiple (up to the UE capability specified in Clause 5.6A.5.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within .

Where:

*- i* is the index of positioning frequency layer,

- L is total number of positioning frequency layers,

- is the periodicity of the PRS-RSRP measurement in positioning frequency layer *i*.

Where:

- is a scaling factor for PRS-based NR positioning measurements in RRC\_INACTIVE. If the UE supports *parallelPRS-MeasRRC-Inactive-r17*, Kcarrier\_PRS = 1; otherwise,

- If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, , where is defined in clause 4.2B.2.4

- If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, , where is defined in clause 4.2.2.7.

- is the UE Rx beam sweeping factor:

- = 1 if positioning frequency layer *i* is in FR1 or UE has only 1Rx branch,

- equals to the value as UE reported in *supportedLowerRxBeamSweepingFactor-FR2,* if positioning frequency layer *i* is in FR2 or the UE has 2Rx branches, and the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*.

- equals to 8, otherwise.

- is the time duration of available PRS to be measured in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered.

- is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

- is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSymbols-r17* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

- is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17* in clause 6.4.3 of TS 37.355 [34],

- is the number of PRS-RSRP measurement samples and

- = 1, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamplesrequestedDL-PRS-ProcessingSamples* [34], and the following conditions are met:

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2, if UE supports *supportedDL-PRS-ProcessingSamples-RRC-Inactive* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34], and the following conditions are not met

- PRS bandwidth is within the initial BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise

-  *= +* is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time,

- is the periodicity of PRS-RSRP measurement in positioning frequency layer *i*,

- corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms-r17* in TS 37.355 [34],

- , the least common multiple between and the DRX cycle length

* When UE is configured with RAN eDRX\_INACTIVE ≤ 10.24s:

TDRX is calculated as T defined in TS 38.304 [1] when CN eDRX\_INACTIVE ≤ 10.24s.

TDRX is calculated as max(Tinside, Toutside), where Tinside and Toutside of the CN PTW as defined in TS 38.304 [1].

When UE is configured with RAN eDRX\_INACTIVE > 10.24s:

TDRX is calculated as max(TDRX\_RAN, TDRX\_CN), TDRX\_RAN and TDRX\_CN are DRX cycles with the RAN PTW and CN PTW defined in TS 38.304 [1].

Otherwise, TDRX is the DRX cycle of the UE in the serving cell.

- is the maximum PRS resource periodicity among all PRS resources in positioning frequency layer i,

- is the DRX cycle length.

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities with muting, , the least common multiple of among the DL PRS resource sets is used to derive , where:

- is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

- is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

When UE is configured with DRX\_cycle, the time starts from the first DRX cycle containing the DL PRS resources in the assistance data after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

If the following conditions are met, the time starts from the first DL PRS resource(s) instances inside a PTW after both the *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* messages are delivered from LMF to the UE via LPP [34].

- UE is configured with RAN eDRX > 10.24s, and

- periodic PRS measurement reporting is configured, and

- RAN eDRX cycle is smaller or equal to the PRS measurement reporting periodicity configured via higher layer parameter *reportingInterval* in TS 37.355 [34], and

- there is one or more PRS resources occurring in PTW.

Otherwise, the timestarts from the first DL PRS resource(s) after both the *NR-DL-TDOAProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* messages are delivered from LMF to the UE via LPP [34].

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When the PRS-RSRP measurement is configured together with RSTD measurement then the PRS-RSRP measurement shall meet the RSTD measurement requirements defined in clause 5.6A.4.5.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement then the PRS-RSRP measurement shall meet the UE Rx-Tx time difference measurement requirements defined in clause 5.6A.6.5.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

Longer PRS-RSRP measurement period is expected when there is collision/overlap between other DL signals/channels and PRS resources in RRC\_INACTIVE state.

The requirements in clause 5.6A.5.5 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-AoD-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If the DRX cycle is reconfigured during the PRS-RSRP measurement period, then the PRS-RSRP measurement period can be longer.

If the eDRX\_INACTIVE cycle is reconfigured during the PRS-RSRP measurement period, then the PRS-RSRP measurement period can be longer.

If cell reselection occurs while PRS-RSRPP measurement is being performed, then the UE shall continue and complete the on-going PRS-RSRP measurement after the cell selection is completed. The PRS-RSRP measurement period can be longer.

If the UE’s RRC state changes from the RRC\_INACTIVE to RRC\_CONNECTED during the PRS-RSRP measurement period, then the UE shall continue the PRS-RSRP measurement in the RRC\_CONNECTED state. The PRS-RSRP measurement period can be longer.

#### 5.6A.5.6 Measurement Period Requirement with RX FH

When physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34]*,* and UE is configured to perform PRS-RSRP measurement with RX FH via *nr-DL-PRS-RxHoppingRequest-r18* as defined in TS 37.355 [34], the UE shall be able to measure multiple (up to the UE capability specified in 5.6A.5.3) PRS-RSRP measurements, defined in TS38.215 [4], during the measurement period defined in Clause 5.6A.5.5 with using the following definition for and .

is the number of PRS-RSRP measurement samples, where

- = 2 if the RedCap UE supports *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- = 4 otherwise.

A measurement sample under RX FH is defined as a PRS measurement over multiple hops.

is the time duration of available PRS in the positioning frequency layer i to be measured, and is calculated by:

where,

- is the number of hops that UE can perform as defined in the following, and

- is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered;

The sampling duration per hop is the first symbols in each hop, where , is the applicable length per hop as defined in Table 5.6A.5.6-1, and is the retuning time between Rx hops indicated by UE via *dl-PRS-MeasurementWithRxFH-RRC-Connected*. The first hop starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement time window, defined in clause 5.6A.1, taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table5.6A.5.6-1: Applicable number of hops per slot and applicable length of each hop

|  |  |  |  |
| --- | --- | --- | --- |
|  | (comb size, Number of PRS symbols) | Applicable number of hops per slot | Applicable length per hop () in number of symbols |
|  | (2, 12) with SCS 15kHz, 30kHz in FR1, and 60kHz, 120kHz in FR2 | 2 | 7 |
| All others | 1 | 14 |
|  | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
|  | Any combination | ½ | 28 |

The number of hops within a single time window is defined as

where

- is the maximum number of Rx hops signaled UE via *dl-PRS-MeasurementWithRxFH-RRC-Connected,*

- is the effective number of Rx hops within a single time window,

- , if = 2,

- , if = 1,

- , if = 1/2 and >1,

- , if = 1/2 and =1,

- where is the number of PRS repetitions within a single time window excluding the retuning times, is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, is the applicable number of hops per slot as defined in Table 5.6A.5.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions within a time window instance and the same PRS repetition interval , otherwise the measurement period can be longer.

#### ---unchanged clauses omitted---

#### 5.6A.6.5 Measurement Period Requirements without FH

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34]*,* and UE is not configured to perform measurement with RX FH,UE shall be able to measure multiple (up to the UE capability specified in clause 5.6A.6.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period defined in 5.6.4.5.

If the RRC state transition occurs from RRC\_INACTIVE to RRC\_CONNECTED state during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the serving cell.

If cell reselection occurs during the UE Rx-Tx time difference measurement period then the UE shall restart the UE Rx-Tx time difference measurement after it obtains SRS configuration and Timing Advance command from the new serving cell.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If the DRX cycle is reconfigured during the UE Rx-Tx time difference measurement period then the UE Rx-Tx time difference measurement period can be longer.

If during UE Rx-Tx time difference measurement period PRS resources overlap with other DL signals/channels then the UE Rx-Tx time difference measurement period can be longer.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 5.6.4 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

The UE shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1.25.2.

#### 5.6A.6.6 Measurement Period Requirements with RX FH

When physical layer receives *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34]*,* the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in Clause 5.6A.6.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4], during the measurement period defined in Clause 5.6.4.5 with using the following definition for and :

is the number of PRS RSTD measurement samples, where

- = 2 if the RedCap UE supports *reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- = 4 otherwise.

A measurement sample under RX FH is defined as a PRS measurement over multiple hops.

is the time duration of available PRS in the positioning frequency layer i to be measured, and is calculated by:

where,

- is the number of hops that UE can perform as defined in the following, and

- is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only unmuted PRS resources that are not fully overlapped with other higher-priority DL signals/channels are considered;

The sampling duration per hop is the first symbols in each hop, where , is the applicable length per hop as defined in Table 5.6A.6.6-1, and is the retuning time between Rx hops indicated by UE via *dl-PRS-MeasurementWithRxFH-RRC-Connected*. The first hop starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the measurement time window, defined in clause 5.6A.1, taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

Table5.6A.6.6-1: Applicable number of hops per slot and applicable length of each hop

|  |  |  |  |
| --- | --- | --- | --- |
|  | (comb size, Number of PRS symbols) | Applicable number of hops per slot | Applicable length per hop () in number of symbols |
|  | [(≤ 2, 12)] | 2 | 7 |
| All others | 1 | 14 |
|  | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
|  | Any combination | ½ | 28 |

The number of hops within a single time window is defined as

where

- is the maximum number of Rx hops signaled UE via *dl-PRS-MeasurementWithRxFH-RRC-Connected,*

- is the effective number of Rx hops within a single time window,

- , if = 2,

- , if = 1,

- , if = 1/2 and >1,

- , if = 1/2 and =1,

- where is the number of PRS repetitions within a single time window excluding the retuning times, is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, is the applicable number of hops per slot as defined in Table 5.6A.6.6-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions within a time window instance and the same PRS repetition interval , otherwise the measurement period can be longer.

## **--- End of Change #19 ---**

## **--- Start of Change #20 ---**

7.1.2.4 UE transmit timing for positioning measurements

If cell reselection occurs in RRC\_INACTIVE within *srs-PosRRC-InactiveValidityArea area*, the UE shall have capability to follow the frame timing change of the reference cell when transmiting SRS for positioning. The uplink frame transmission takes place before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. The UE shall use the current camping cell as reference cell for deriving the UE transmit timing.

When *autonomousTA-AdjustmentEnabled-r18* is configured, the following requirements apply to the UE supporting [*AutonomousAdjustOneStepUL-Timing-r18*] upon cell reselection to a new camping cell within the SRS validity area (*srs-PosRRC-InactiveValidityArea*):

If the absolute value of the DL timing difference between the new camping cell and the previous camping cell immediately after cell reselection is ≥ CP/4, UE shall autonomously adjust the TA as

where and are the TA after adjustment in the new camping cell and TA applied in previous camping cell, respectively, is the DL timing of the new camping cell immediatedly after cell reselection and is the DL timing of the previous camping cell immediately before cell reselection.

- The UE UL transmission timing error after autonomous TA adjustment shall be less than or equal to ±Te in clause 7.1.2.

- If the TA value would be negative after applying the autonomous TA adjustment, the TA is set to zero. i.e. the TA applied in the new camping cell shall be set to .

If the DL timing difference is < CP/4, UE follows the DL timing of the new camping cell by performing gradual timing adjustment as defined in clause 7.1.2.1.

## **--- End of Change #20 ---**

## **--- Start of Change #20a ---**

9.9.2.2 Requirements Applicability

The requirements in clause 9.9.2 apply for periodic and triggered RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23 for FR1 and FR2 are fulfilled, for a corresponding Band.

## **--- End of Change #20a ---**

## **--- Start of Change #21 ---**

#### 9.9.2.5 Measurements Period Requirements

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where ,

is the index of positioning frequency layer,

is total number of positioning frequency layers, and

is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

,

where:

is the UE Rx beam sweeping factor. In FR1, = 1;

and in FR2, is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in*NR-DL-TDOA-RequestLocationInformation*. is equal to 8, otherwise.

is the carrier-specific scaling factor for NR PRS-based positioning measurements in positioning frequency layer *i* as defined in clause 9.1.5.2.

is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

=1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

=, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

= if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

is the number of Rx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap or MUSIM gap or both concurrent measurement gap and MUSIM gap, and = 1 for UE not configured with concurrent measurement gap.

- For a window W of duration max(, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer [and periodic MUSIM gaps], and starting at the beginning of any associated gap occasions covering the PRS occasion:

- Ntotal is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

- Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG [and MUSIM gaps] collisions by applying the selected gap collision rule

- Requirements do not apply if Navailable =0.

is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

is the time duration of available PRS in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with MG are considered.

is the number of PRS RSTD measurement samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the

sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during Tavailabe, = +MGL. Otherwise, = + ,

is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

*=*

Where,

corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

*,* the least common multiple between and .

is the repetition periodicity of the measurement gap applicable for measurement in the PRS frequency layer i. is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

, is the PRS periodicity with muting per PRS resource,

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. , where

is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34].

is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

Except for deferred MT-LR as defined in clause 4.1a.5 [TS 23.273], the time *s*tarts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the timestarts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the UE shall perform the RSTD measurement in each reporting period and activate the location report at the time when the periodic timer expires.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When PRS-RSRP is configured for DL-TDOA, RSTD and PRS-RSRP are performed over the measurement period defined in 9.9.2.5.

When PRS-RSRPP is configured for DL-TDOA, RSTD and PRS-RSRPP are performed over the measurement period defined in 9.9.2.5.If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period TRSTD,Total within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.

#### ---unchanged clauses omitted---

#### 9.9.2.7 Measurements Period Requirements without Measurement Gaps

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

, if any of the positioning frequency layers are in Case 1, or

, if all the positioning frequency layers are in Case 2,

Where,

is the index of positioning frequency layer, and

is total number of positioning frequency layers, and

is the periodicity of the PRS RSTD measurement in positioning frequency layer i, and

is the time from the start of the first PPW occasion for positioning frequency layer i to the start of measurement period .

A positioning frequency layer is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below.

,

where:

is the UE Rx beam sweeping factor. In FR1, = 1; and in FR2, is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. is equal to 8, otherwise.

is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

=1 if UE is not supported *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

=, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

= if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

is the number of Rx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

is the time duration of available PRS in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of ,

only the PRS resources unmuted and fully or partially overlapped with PPW are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

is the number of PRS RSTD measurement samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- =2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- =4 otherwise.

is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time.

If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during Tavailable, then = +PPWL, else

if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during Tavailable, then = PPWL;

otherwise, = + .

is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

*=*

Where,

corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw-*durationOfPRS*-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

, the least common multiple between and .

is the repetition periodicity of the PRS processing window applicable for measurements in the positioning frequency layer *i*.

is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

, is the PRS periodicity with muting per PRS resource,

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*,

is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

Note: For the purpose of calculating , only the PRS resources that meet the conditions for PRS measurement outside measurement gaps as defined in clause 9.9.1.2 are considered.

is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if positioning frequency layer i is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer i is in Case 2.

is UE capability for number of DL PRS resources that it can process in a slot as indicated by *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

The time *s*tarts from the first instance of the activated PPW for measurement of positioning frequency layer *i* aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation*message are delivered from LMF to the physical layer of UE via LPP [34].

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and RSRPP are performed over the same measurement period.

If during the measurement period of one or more positioning frequency layers, the PPW is re-configured or reactivated, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period within PPW due to collisions with other signals; otherwise, the measurement period can be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

## **--- End of Change #21 ---**

## **--- Start of Change #22 ---**

#### 9.9.2.10 Measurements Period Requirements with Bandwidth Aggregation

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34] with a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequestedPFL-List,* the UE shall be able to perform RSTD measurement by aggregating PRS resources from multiple PFLs (up to the UE capability specified in Clause 9.9.2.3) defined in TS 38.215 [4], during the measurement period TRSTD\_aggregate, Total defined as:

TRSTD\_aggregate, Total = Tnon\_aggregate\_RSTD + Taggregate\_RSTD + Tmargin,

where,

Tnon\_aggregate\_RSTD is the total measurement period for RSTD measurement on PFLs that do not contain PRS resources for aggregation.

Calculation of Tnon\_aggregate\_RSTD is based on clause 9.9.2.5, such that Tnon\_aggregate\_RSTD is calculated by considering PRS resources that are not aggregated by UE, based on the configuration received from the LMF.

Tnon\_aggregate\_RSTD is equal to zero if UE is not configured to perform non-aggregated measurements by the LMF.

Tmargin is delay margin to account for delay between RSTD measurement performed by UE on PFLs that contain PRS resources for aggregation and RSTD measurement performed by UE on PFLs that do not contain PRS resources for aggregation. Tmargin is calculated as max(Teffect,i), by considering both aggregated PFLs and non-aggregated PFLs configured for positioning measurement. Tmargin is only applicable when UE is configured to perform measurements on PFLs that contain PRS resources for aggregation and on PFLs that do not contain PRS resources for aggregation.

If UE is only configured to perform measurements on PFLs that contain PRS resources for aggregation or if UE is only configured to perform measurements on PFLs that do not contain PRS resources for aggregation, then Tmargin = 0.

If UE is capable of performing latency reduced positioning measurements and is configured to perform latency reduced positioning measurement by LMF via *reducedDL-PRS-ProcessingSamples-r17* [34], then Nsample = 2 shall be considered in calculations of Taggregate\_RSTD and Tnon-aggregate\_RSTD.

If UE is not capable to perform latency reduced positioning measurements or is not configured to perform latency reduced positioning measurement by LMF via *reducedDL-PRS-ProcessingSamples-r17* [34], then Nsample = 4 shall be considered in calculations of Taggregate\_RSTD and Tnon-aggregate\_RSTD.

Taggregate\_RSTD, total measurement period for RSTD measurements performed by UE by aggregating PRS resources from multiple PFLs as defined in TS 38.214 [26], is defined as:

where

is the index of effective PFL, corresponding to the group of PFLs containing linked PRS resource sets to be aggregated for RSTD measurement,

G denotes the number of effective PFLs that UE is configured to perform aggregated measurements on. G is configured by LMF and is provisioned to UE via *nr-DL-PRS-AggregationInfo.*

is the measurement period for PRS RSTD measurement in the effective PFL *i* as specified below:

,

where:

is the UE Rx beam sweeping factor.

In FR1, = 1.

In FR2, is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing effective PFL , and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in*NR-DL-TDOA-RequestLocationInformation*. is equal to 8, otherwise.

is the carrier-specific scaling factor for NR PRS-based positioning measurements in effective PFL as defined in clause 9.1.5.2.

is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

= 1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

= , if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

= if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

is the number of Rx TEGs with which UE is requested to measure aggregated PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

is a scaling factor for effective PFL to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap, and = 1 for UE not configured with concurrent measurement gap.

For a window W of duration max(, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the effective PFL, and starting at the beginning of any associated gap occasions covering the PRS occasion:

- Ntotal is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

- Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

- Requirements do not apply if Navailable = 0.

is the maximum number of DL PRS resources in effective PFL configured in a slot.

is the time duration of available PRS in the effective PFL to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with MG and satisfying the conditions for PRS BW aggregation are considered.

is the number of PRS RSTD measurement samples.

is the measurement duration for the last PRS RSTD sample in the effective PFL, including the sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during Tavailabe\_agg, = + MGL. Otherwise, = Tagg,i + ,

is the periodicity of the PRS RSTD measurement in the effective PFL defined as:

=

where,

, the least common multiple between and . is the repetition periodicity of the measurement gap applicable for measurement in the effective PFL i.

is the periodicity of DL PRS resources meeting the bandwidth aggregation conditions with muting on effective PFL . If more than one PRS periodicities are configured in effective PFL the least common multiple of PRS periodicities among all DL PRS resource sets in the effective PFL is used to derive , where,

, is the PRS periodicity with muting per PRS resource configured for aggregation,

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- Note: For the purpose of calculating TPRS\_agg,i, only the PRS resources fully or partially covered by the MG and PRS resources that satisfy the conditions for PRS BW aggregation are considered.

{Nagg, Tagg,i}is UE capability combination per band to aggregate PRS resources from multiple PFLs within an effective PFL where Nagg is a duration of DL PRS symbols in ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18* in TS 37.355 [34] processed every Tagg,i ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *maximumOfTwoAggregatedDL-PRS-Bandwidth* or *maximumOfThreeAggregatedDL-PRS-Bandwidth* in TS 37.355 [34].

is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18* for FR1 and *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18* for FR2 specified in TS 37.355 [34].

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements satisfy all the conditions specified in clause 5.1.6.5.3 in TS 38.214 [26].

Except for deferred MT-LR as defined in clause 4.1a.5 [TS 23.273], the time *s*tarts from the first MG instance aligned with DL PRS resources in the assistance data for aggregation after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34] including a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequestedPFL-List*.

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the timestarts from the first MG instance aligned with DL PRS resources in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the UE shall perform the aggregated RSTD measurement in each reporting period and activate the location report at the time when the periodic timer expires.

When PRS-RSRP is also reported by UE together with RSTD measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRP are performed over the measurement period defined in 9.9.2.10.

When PRS-RSRPP is also reported by UE together with RSTD measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRPP are performed over the measurement period defined in 9.9.2.10.

If during the measurement period of one or more effective PFLs, the MG pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period TRSTD\_aggregate,Total within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for aggregated PRS resources, if the PRS resources to be aggregated are across two sampling duration of Nagg within duration .

The measurement requirements do not apply, if time span of the instance of the PRS resources to be aggregated (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability Nagg.

The requirements in clause 9.9.2.10 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which aggregated PRS resources are measured, subject to UE measurement capabilities*.*

If handover occurs while aggregated RSTD measurements are being performed, then the UE shall continue and complete the on-going aggregated RSTD measurements. The aggregated RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.x.

## **--- End of Change #22 ---**

## **--- Start of Change #22a ---**

9.9.4.2 Requirements Applicability

The requirements in clause 9.9.4 apply for periodic and triggered UE Rx-Tx time difference measurements, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25 are met for a corresponding band.

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25.x are met for PRS aggregation from multiple PFLs.

- SRS is configured on at least one of the PCell, PSCell and SCell.

- The UE transmits SRS within [-160, 160] msec of at least one DL PRS resource of each of the TRPs in the assistance data.

## **--- End of Change #22a ---**

## **--- Start of Change #23 ---**

#### 9.9.4.5 Measurement Period Requirements

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34]*,* UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period ms.

*.*

where is the index of positioning frequency layer,

is the measurement period for UE Rx-Tx time difference measurements in positioning frequency layer *i* as further defined in this clause,

L is total number of positioning frequency layers, and

is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

Where

is the carrier-specific scaling factor for NR PRS-based measurement in the positioning frequency layer *i* as defined in clause 9.1.5.2,

is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

=1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*;

otherwise,

=, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

= if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

is the number of Rx TEGs or RxTx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*, and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap or MUSIM gap or both concurrent measurement gap and MUSIM gap, and = 1 for UE not configured with concurrent measurement gap.

For a window W of duration max(, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer [and periodic MUSIM gaps], and starting at the beginning of any associated gap occasions covering the PRS occasion:

Ntotal is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG [and MUSIM gaps] collisions by applying the selected gap collision rule

Requirements do not apply if Navailable =0.

is the scaling factor for Rx beam sweeping, and =1 if positioning frequency layer *i* is in FR1 and if positioning frequency layer *i* is in FR2, is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT-RequestLocationInformation*. is equal to 8, otherwise.

is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with MG are considered.

is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in clause 4.2.7.2 of TS 37.355 [34],

is UE capability for number of DL PRS resources that it can process in a slot corresponding to *maxNumOfDL-PRS-ResProcessedPerSlot* as specified in clause 6.4.3 of TS 37.355 [34],

is the number of UE Rx-Tx time difference measurement samples:

- = 1 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* defined in [34] and LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34] and the following conditions are met:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* defined in [34] and the LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34] but the following conditions are not met:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time,  *= +*  ,

is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

where

corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

, the least common multiple between and

is the measurement gap repetition periodicity in positioning frequency layer *i*.

is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, , the least common multiple of among DL PRS resource sets is used to derive , where

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap

Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

Except for deferred MT-LR as defined in clause 4.1a.5 [TS 23.273], the time starts from the first MG instance aligned with DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the timestarts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the UE shall perform the PRS-RSRP measurement in each reporting period and activate the location report at the time when the periodic timer expires.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

The UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period TUERxTx,Total within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 9.9.4 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

When PSCell or SCell addition or release does not cause SRS reconfiguration during the measurement period, UE continues the UE Rx-Tx time difference measurement, and the measurement period requirements apply.

When PSCell or SCell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

When SRS is reconfigured without serving cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration is complete.If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

When a serving cell change occurs during the measurement period, the UE shall continue and complete the UE Rx-Tx time difference measurement provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx time difference measurement.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the UE Rx-Tx measurement period, then:

- UE Rx-Tx measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in section 7.1.1) for SRS transmission.

- UE Rx-Tx measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in section 7.1.1) for SRS transmission. The UE Rx-Tx time difference measurement period may be restarted in such case.

#### 9.9.4.6 Measurement Period Requirements without Measurement Gaps

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34]*,* UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period ms.

, if any of the positioning frequency layers are in Case 1, or

, if all the positioning frequency layers are in Case 2*.*

Where,

is the index of positioning frequency layer, and

is total number of positioning frequency layers, and

is the periodicity of the PRS RSTD measurement in positioning frequency layer i, and

is the time from the start of the first PPW occasion for positioning frequency layer i to the start of measurement period .

A positioning frequency layer is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

is the measurement period for UE Rx-Tx time difference measurement in positioning frequency layer *i* as specified below.

Where

is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer *i* as defined further in this clause.

is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

=1 if UE is not supported *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*;

otherwise,

=, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

= if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

is the number of Rx TEGs or RxTx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*, and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

is the scaling factor for Rx beam sweeping, and =1 if positioning frequency layer *i* is in FR1. If positioning frequency layer *i* is in FR2, is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT-RequestLocationInformation*. is equal to 8, otherwise.

is the time duration of available PRS resources in the positioning frequency layer *i*, to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of ,

only the unmuted PRS resources that meet the applicability conditions and fully or partially overlapped with PRS processing window are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

is the maximum number of DL PRS resources of positioning frequency layer i configured in a slot,

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN*  in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

- is UE capability for number of DL PRS resources that it can process in a slot corresponding to *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* as specified in clause 6.4.3 of TS 37.355 [34],

- is the number of UE Rx-Tx time difference measurement samples:

- = 1 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* defined in [34] and LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34] and the following conditions are met:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE is capable of *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* defined in [34] and the LMF requests the UE to perform positioning measurements with reduced number of samples by *reducedDL-PRS-ProcessingSamples* [34] but the following conditions are not met:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

- is the measurement duration for the last UE Rx-Tx time difference measurement sample in the positioning layer i, including the sampling time and processing time.

If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during Tavailable, then = +PPWL, else

if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during Tavailable, then = PPWL;

otherwise, = + .

- is periodicity of UE Rx-Tx time difference measurement in positioning frequency layer *i*:

where

corresponds to *ppw-durationOfPRS-ProcessingSymbolsT*  in TS 37.355 [34]if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

, the least common multiple between and

is the PRS processing window repetition periodicity in positioning frequency layer *i*.

is the PRS resource periodicity in positioning frequency layer *i*. If the positioning frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities with muting, , the least common multiple of among DL PRS resource sets is used to derive , where

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap

Note: For the purpose of calculating TPRS,i, only the PRS resources that meet the applicability conditions and fully or partially covered by the PRS processing window are considered.

The time starts from the first PRS processing window instance aligned with DL PRS resources in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

The UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of one or more positioning frequency layers, the PRS processing window is reconfigured or reactivated either per UE request or not per UE request, the measurement period can be longer.

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period within PRS processing window due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

When PRS-RSRPP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRPP measurements are performed over the same measurement period.

The requirements in clause 9.9.4.6 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

When PSCell or SCell addition or release does not cause SRS reconfiguration during the measurement period, UE continues the UE Rx-Tx time difference measurement, and the measurement period requirements apply.

When PSCell or SCell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

When SRS is reconfigured without cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the UE Rx-Tx measurement period, then:

- UE Rx-Tx measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in section 7.1.1) for SRS transmission.

- UE Rx-Tx measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in section 7.1.1) for SRS transmission. The UE Rx-Tx time difference measurement period may be restarted in such case.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

## **--- End of Change #23 ---**

## **--- Start of Change #24 ---**

#### 9.9.4.9 Measurements Period Requirements with Bandwidth Aggregation

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] with a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequestedPFL-List,* the UE shall be able to perform UE Rx-Tx time difference measurement by aggregating PRS resources from multiple PFLs (up to the UE capability specified in Clause 9.9.2.3) defined in TS 38.215 [4], during the measurement period TUE\_RxTx\_aggregated, Total defined as:

TUE\_RxTx\_aggregated, Total = Tnon-aggregate\_RxTx + Taggregated\_RxTx + Tmargin,

where,

Tnon\_aggregate\_RxTx is the total measurement period for UE Rx-Tx time difference measurement on PFLs that do not contain PRS resources for aggregation.

Calculation of Tnon\_aggregate is based on clause 9.9.4.5, such that Tnon\_aggregate\_RxTx is calculated by considering PRS resources that are not aggregated by UE, based on the configuration received from the LMF.

Tnon\_aggregate\_RxTx is equal to zero if UE is not configured to perform non-aggregated measurements by the LMF.

Taggregate\_RxTx is the total measurement period for UE Rx-Tx time difference measurements performed by UE by aggregating PRS resources from multiple PFLs as defined in TS 38.214 [26].

Tmargin is delay margin to account for delay between Rx-Tx measurement performed by UE on PFLs that contain PRS resources for aggregation and Rx-Tx measurement performed by UE on PFLs that do not contain PRS resources for aggregation. Tmargin is calculated as max(Teffect,i), by considering both aggregated PFLs and non-aggregated PFLs configured for positioning measurement. Tmargin is only applicable when UE is configured to perform measurements on PFLs that contain PRS resources for aggregation and on PFLs that do not contain PRS resources for aggregation.

If UE is only configured to perform measurements on PFLs that contain PRS resources for aggregation or if UE is only configured to perform measurements on PFLs that do not contain PRS resources for aggregation, then Tmargin = 0.

If UE is capable of performing latency reduced positioning measurements and is configured to perform latency reduced positioning measurement by LMF via *reducedDL-PRS-ProcessingSamples-r17* [34], then Nsample = 2 shall be considered in calculations of Taggregate\_RxTx and Tnon-aggregate\_RxTx.

If UE is not capable to perform latency reduced positioning measurements or is not configured to perform latency reduced positioning measurement by LMF via *reducedDL-PRS-ProcessingSamples-r17* [34], then Nsample = 4 shall be considered in calculations of Taggregate\_RxTx and Tnon-aggregate\_RxTx.

Taggregate\_RxTx, total measurement period for UE Rx-Tx time difference measurements performed by UE by aggregating PRS resources from multiple PFLs as defined in TS 38.214 [26], is defined as:

where

is the index of effective PFL, corresponding to the group of PFLs containing linked PRS resource sets to be aggregated for UE Rx-Tx time difference measurement,

G denotes the number of effective PFLs that UE is configured to perform aggregated measurements on. G is configured by LMF and is provisioned to UE via *nr-DL-PRS-AggregationInfo.*

is the measurement period for UE Rx-Tx time difference measurement in the effective positioning frequency layer *i* as specified below:

,

where:

is the UE Rx beam sweeping factor.

In FR1, = 1.

In FR2, is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing effective positioning frequency layer , and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-Multi-RTT-RequestLocationInformation*. is equal to 8, otherwise.

is the carrier-specific scaling factor for NR PRS-based positioning measurements in effective positioning frequency layer as defined in clause 9.1.5.2.

is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

= 1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*;

otherwise,

= , if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

= if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

is the number of Rx TEGs with which UE is requested to measure aggregated PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17* [34] in *NR-Multi-RTT-RequestLocationInformation*, and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

is a scaling factor for effective positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap, and = 1 for UE not configured with concurrent measurement gap.

For a window W of duration max(, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the effective positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

- Ntotal is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

- Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

- Requirements do not apply if Navailable = 0.

is the maximum number of DL PRS resources in effective positioning frequency layer configured in a slot.

is the time duration of available PRS in the effective positioning frequency layer to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with MG and satisfying the conditions for PRS BW aggregation are considered.

is the number of UE Rx-Tx time difference measurement samples.

is the measurement duration for the last UE Rx-Tx time difference measurement sample in the effective positioning frequency layer, including the sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during Tavailabe\_agg, = + MGL. Otherwise, = Tagg,i + ,

is the periodicity of the UE Rx-Tx time difference measurement in the effective positioning frequency layer defined as:

=

where,

, the least common multiple between and . is the repetition periodicity of the measurement gap applicable for measurement in the effective PRS frequency layer i.

is the periodicity of DL PRS resources meeting the bandwidth aggregation conditions with muting on effective positioning frequency layer . If more than one PRS periodicities are configured in effective positioning frequency layer the least common multiple of PRS periodicities among all DL PRS resource sets in the effective positioning frequency layer is used to derive , where,

, is the PRS periodicity with muting per PRS resource configured for aggregation,

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

Note: For the purpose of calculating TPRS\_agg,i, only the PRS resources fully or partially covered by the MG and PRS resources that satisfy the conditions for PRS BW aggregation are considered.

{Nagg, Tagg,i}is UE capability combination per band to aggregate PRS resources from multiple PFLs within an effective PFL where Nagg is a duration of DL PRS symbols in ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsN* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsN* in TS 37.355 [34] processed every Tagg,i ms corresponding to *prs-durationOfTwoPRS-BWA-ProcessingSymbolsT* or *prs-durationOfThreePRS-BWA-ProcessingSymbolsT* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *maximumOfTwoAggregatedDL-PRS-Bandwidth* or *maximumOfThreeAggregatedDL-PRS-Bandwidth* in TS 37.355 [34].

is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfAggregatedDL-PRS-ResourcePerSlot* specified in TS 37.355 [34].

The requirements in this clause for aggregated measurements apply provided that the linked PRS resource sets on multiple PFLs for aggregated measurements satisfy all the conditions specified in clause 5.1.6.5.3 in TS 38.214 [26].

Except for deferred MT-LR as defined in clause 4.1a.5 [TS 23.273], the time *s*tarts from the first MG instance aligned with DL PRS resources in the assistance data for aggregation after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* messagemessage are delivered from LMF to the physical layer of UE via LPP [34] including a request to perform measurement by aggregating PRS resources from multiple PFLs via *nr-DL-PRS-JointMeasurementRequested*.

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the timestarts from the first MG instance aligned with DL PRS resources in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the UE shall perform the aggregated UE Rx-Tx time difference measurement in each reporting period and activate the location report at the time when the periodic timer expires.

When PRS-RSRP is also reported by UE together with UE RX-Tx measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRP are performed over the measurement period defined in 9.9.4.9.

When PRS-RSRPP is also reported by UE together with UE Rx-Tx measurement based on aggregated DL-PRS resources from multiple-PFLs, PRS-RSRPP are performed over the measurement period defined in 9.9.4.9.

If during the measurement period of one or more effective positioning frequency layers, the MG pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period TUE\_RxTx\_aggregated,Total within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

The requirements in clause 9.9.4.9 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which aggregated PRS resources are measured, subject to UE measurement capabilities*.*

When PSCell or SCell addition or release does not cause SRS reconfiguration during the measurement period, UE continues the UE Rx-Tx time difference measurement, and the measurement period requirements apply.

When PSCell or SCell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

When SRS is reconfigured without serving cell change during the measurement period, UE shall restart the UE Rx-Tx time difference measurement after the SRS reconfiguration is complete. If UE uplink transmission timing changes due to the network-configured Timing Advance command during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

When a serving cell change occurs during the measurement period, the UE shall continue and complete the UE Rx-Tx time difference measurement provided that the serving cell change does not impact SRS configuration for the UE Rx-Tx time difference measurement.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the UE Rx-Tx measurement period, then the UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the UE Rx-Tx measurement period, then:

- UE Rx-Tx measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in section 7.1.1) for SRS transmission.

- UE Rx-Tx measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in section 7.1.1) for SRS transmission. The UE Rx-Tx time difference measurement period may be restarted in such case.

## **--- End of Change #24 ---**

## **--- Start of Change #24a ---**

#### 9.9.7.5 Measurements Period Requirements for DL RSCPD reported with RSTD

After receiving both *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message with *nr-DL-RSCPD-Request* from the LMF via LPP [34]*,* the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.7.3) DL RSTD and RSCPD measurements, defined in TS 38.215 [4], during the time window configured to UE via *nr-DL-PRS-MeasurementTimeWindowsConfig* *,* the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.8.3) RSTD and DL RSCPD measurements, defined in TS 38.215 [4], during the time window only.

When LMF does not configure measurement time window(s):

- When a single PFL, requirements in Clause 9.9.2.5 apply to both RSCPD and RSTD measurements.

- When multiple PFLs are configured for legacy measurements, the UE performs RSCPD measurement on a single PFL that is common between the reference TRP and the target TRP. The requirement in Clause 9.9.2.5 apply to both RSTD and RSCPD measurements.

When LMF configures measurement time window(s), but UE does not support *supportOfRSCPD-MeasurementInTimeWindow*:

* The UE performs RSCPD measurement on the indicated PFL by the network. The requirement in Clause 9.9.2.5 apply to both RSTD and RSCPD measurements.

When LMF configures measurement time window(s), but UE does not support *supportOfLegacyMeasurementInTimeWindow* but supports *supportOfRSCPD-MeasurementInTimeWindow*:

* The requirements in the Clause 9.9.2.5 apply to RSTD measurements.
* The requirements in Clause 9.9.7.5 apply to RSCPD measurement for the PRS resource(s) that have occasions only within the measurement time window.

Otherwise, the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.7.3) RSTD and DL RSCPD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD with RSCPD measurement in positioning frequency layer *i* as specified below:

,

where:

DL-RSCPD measurement performed during is a single sample measurement. The DL-RSCPD measurement of reference TRP and the target TRP is performed on the same PFL.

, , , , , , and are defined in clause 9.9.2.5.

= 1 or 2 or 4 as defined in clause 9.9.2.5.

is the time duration of available PRS in the positioning frequency layer to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26].

When periodic time window(s) are configured by the LMF, , otherwise . is the maximum periodicity of the configured time window(s). and are defined in clause 9.9.2.5.

and are calculated by only considering the PRS resources in the indicated resources sets overlapping with both the MG and the indicated time window(s).

is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap, and = 1 for UE not configured with concurrent measurement gap.

When periodic time window(s) are configured by the LMF, for a window W of duration max(, MGRP\_max, ), where MGRP\_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion and the periodic time window:

Ntotal is the total number of associated gap occasions covering PRS occasions and the periodic time window(s) within the window W, including both dropped and non-dropped instances of the associated measurement gap within the window W, and

Navailable is the number of non-dropped associated gap occasions covering PRS occasions and the periodic time window(s) within the window W, after further accounting for MG collisions by applying the selected gap collision rule

Requirements do not apply if Navailable =0.

Otherwise, for a window W of duration max(, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

Ntotal is the total number of associated gap occasions covering PRS occasions within the window W, including both dropped and non-dropped instances of the associated measurement gap within the window, and

Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

Requirements do not apply if Navailable =0.

Except for deferred MT-LR as defined in clause 4.1a.5 [TS 23.273], the time TRSCPD with RSTD *s*tarts from the first time window (TRSCPD) configured by LMF within MG instance aligned with a DL PRS resource(s) in the assistance data after both the *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the time TRSCPD with RSTD starts from the first time window (TRSCPD) configured by LMF within MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the UE shall perform the RSCPD with RSTD measurement in each reporting period within the time window(TRSCPD) configured by LMF within MG instance and activate the location report at the time when the periodic timer expires.

If during the measurement period, the MG pattern is reconfigured or time window (TRSCPD) for RSCPD measurement is reconfigured, the measurement period can be longer. When PRS-RSRP is also configured to UE, RSCPD with RSTD and RSRP are performed over the same measurement period.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period TRSCPD with RSTD within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9.7 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If handover occurs while RSTD and RSCPD measurements are being performed together by UE, then the UE shall continue and complete the on-going RSTD and RSCPD measurements. The measurement period for RSCPD with RSTD measurement can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23. The UE shall also meet the RSCPD measurement accuracy requirements in clause 10.1.x.

## **--- End of Change #24a ---**

## **--- Start of Change #25 ---**

#### 9.9.8.5 Measurement Period Requirements for DL RSCP and UE Rx-Tx time difference

When the physical layer receives the last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] with *nr-UE-RSCP-Request* and configuring a measurement time window via *nr-DL-PRS-MeasurementTimeWindowsConfig,* subject to UE capabilities *supportOfRSCP-MeasurementInTimeWindow* and *supportOfLegacyMeasurementInTimeWindow,* the UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.8.3) UE Rx-Tx and DL RSCP measurements, defined in TS 38.215 [4], during the time window only.

When LMF does not configure measurement time window(s):

- When a single PFL is configured, requirements in Clause 9.9.4.5 apply to both RSCP and UE Rx-Tx measurements.

- When multiple PFLs are configured for legacy measurements, the UE performs RSCP measurement on a single PFL that is common between the reference TRP and the target TRP. The requirement in Clause 9.9.4.5 apply to both RSCP and UE Rx-Tx measurements.

When LMF configures measurement time window(s), but UE does not support *supportOfRSCP-MeasurementInTimeWindow*:

* The UE performs RSCP measurement on the indicated PFL by the network. The requirement in Clause 9.9.4.5 apply to both UE Rx-Tx and RSCP measurements.

When LMF configures measurement time window(s), but UE does not support *supportOfLegacyMeasurementInTimeWindow* but supports *supportOfRSCP-MeasurementInTimeWindow*:

* The requirements in the Clause 9.9.4.5 apply to UE Rx-Tx measurement.
* The requirements in Clause 9.9.8.5 apply to RSCP measurement for the PRS resource(s) that have occasions only within the measurement time window.

If a periodic time window is configured, the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.8.3) UE Rx-Tx and DL RSCP measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where:

- is the index of positioning frequency layer,

- is total number of positioning frequency layers, and

- is the periodicity of the UE Rx-Tx time difference measurement in positioning frequency layer i

is the measurement period for DL RSCP with UE Rx-Tx measurement in positioning frequency layer *i* as specified below:

,

where:

* DL RSCP performed during is a single sample measurement where DL RSCP and UE Rx-Tx measurements are performed on the same PFL.
* , , , , , , and are defined in clause 9.9.4.5.
* = 1 or 2 or 4 as defined in clause 9.9.4.5.

- is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap, and = 1 for UE not configured with concurrent measurement gap.

* When periodic time window(s) are configured by the LMF, for a window W of duration max(, MGRP\_max, ), where MGRP\_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion and the periodic time window:

Ntotal is the total number of associated gap occasions covering PRS occasions and the periodic time window(s) within the window W, including both dropped and non-dropped instances of the associated measurement gap within the window W, and

Navailable is the number of non-dropped associated gap occasions covering PRS occasions and the periodic time window(s) within the window W, after further accounting for MG collisions by applying the selected gap collision rule

Requirements do not apply if Navailable =0.

* Otherwise, ror a window W of duration max(, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

Ntotal is the total number of associated gap occasions covering PRS occasions within the window W, including both dropped and non-dropped instances of the associated measurement gap within the window W, and

Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

Requirements do not apply if Navailable =0.

- is the time duration of available PRS resources in the positioning frequency layer, to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26].

* When periodic time window(s) are configured by the LMF, , otherwise . is the maximum periodicity of the configured time window(s). and are defined in clause 9.9.8.5.
* and are calculated by only considering the PRS resources in the indicated resources sets overlapping with both the MG and the indicated time window(s).

Except for deferred MT-LR as defined in clause 4.1a.5 [TS 23.273], the time starts from the first time window (TDL RSCP) configured by LMF within MG instance aligned with DL PRS resource(s) in the assistance data after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the time starts from the first time window (TDL RSCP) configured by LMF within MG instance aligned with DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the UE shall perform the DL RSCP with UE Rx-Tx time difference measurement in each reporting period and activate the location report at the time when the periodic timer expires.

The DL RSCP with UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

The measurement requirements do not apply for a PRS resource:

- if the PRS resource is across two sampling duration of N within duration or

- if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

If during the measurement period of the positioning frequency layer, the MG pattern is reconfigured either per UE request or not per UE request, the measurement period can be longer.

The requirements in this section apply, provided no PRS symbols are dropped during the measurement period within measurement gaps due to collisions with other signals; otherwise, a longer measurement period may be used.

When PRS-RSRP is configured for multi-RTT, the UE Rx-Tx time difference measurements and PRS-RSRP measurements are performed over the same measurement period.

The requirements in clause 9.9.8 do not apply if the PRS configuration given by higher layer parameters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-Multi-RTT-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

When PSCell or Scell addition or release does not cause SRS reconfiguration during the measurement period, UE shall continue and complete the DL RSCP and UE Rx-Tx time difference measurements, and the measurement period requirements apply.

When PSCell or Scell addition or release causes SRS reconfiguration during the measurement period, UE shall restart the DL RSCP and UE Rx-Tx time difference measurement after the SRS reconfiguration on the target cell is complete.

When SRS is reconfigured without serving cell change during the measurement period, UE shall restart the DL RSCP and UE Rx-Tx time difference measurement after the SRS reconfiguration is complete.

When a serving cell change occurs during the measurement period, the UE shall restart DL RSCP and UE Rx-Tx time difference measurements.

If UE uplink transmission timing changes due to the network-configured Timing Advance command during the measurement period, then the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the change in the NTA\_offset defined in Table 7.1.2-2 during the measurement period, then the DL RSCP with UE Rx-Tx time difference measurement period is restarted after uplink transmission timing changes, and the DL RSCP and UE Rx-Tx time difference measurement period requirements in this clause shall not apply.

If UE uplink transmission timing changes due to the UE autonomous timing adjustment defined in clause 7.1.2 during the measurement period, then:

- DL RSCP and UE Rx-Tx measurement period requirements in this clause shall apply for a cell, which is also the downlink reference cell (defined in section 7.1.1) for SRS transmission.

- DL RSCP and UE Rx-Tx measurement period requirements in this clause shall not apply for a cell, which is not the downlink reference cell (defined in section 7.1.1) for SRS transmission. The DL RSCP with UE Rx-Tx time difference measurement period may be restarted in such case.

## **--- End of Change #25 ---**

## **--- Start of Change #25a ---**

9.9A.1.3 Scheduling Availability of UE during PRS Measurement without Measurement Gaps for RedCap positioning without FH

The requirements in this clause apply for RedCap UE performing RSTD, PRS-RSRP, UE Rx-Tx time difference and PRS-RSRPP measurement without measurement gaps.

If Cap. 1A UE capable of supporting priority options 1, 2 and 3 is configured with priority state 1 for PRS measurement, then UE is not expected to receive PDCCH/PDSCH/CSI-RS on all symbols within PRS processing window.

If Cap.1A UE capable of supporting priority option 2 is configured with priority state 2 for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS on all symbols within PRS processing window but shall receive PDCCH and URLLC PDSCH within PRS processing window.

If Cap. 1B UE capable of supporting priority options 1, 2 and 3 is configured with priority state 1 for PRS measurement, then UE is not expected to receive PDCCH/PDSCH/CSI-RS from a certain [band or CC] on all symbols within PRS processing window.

If Cap. 1B UE capable of supporting priority option 2 is configured with priority state 2 for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS from a certain [band or CC] but shall receive PDCCH and URLLC PDSCH from a certain [band or CC] on all symbols within PRS processing window.

If Cap. 2 UE capable of supporting priority options 1 2 and 3 is configured with priority state 1 for PRS measurement, then the UE is not expected to receive PDCCH/PDSCH/CSI-RS on the symbols overlapped with DL PRS within PRS processing window.

If Cap. 2 UE capable of supporting priority option 2 is configured with priority state 2 for PRS measurement, then UE is not expected to receive PDSCH/CSI-RS on the symbols overlapped with DL PRS within PRS processing window but shall receive PDCCH and URLLC PDSCH on the symbols overlapped with DL PRS within PRS processing window.

When PRS is lower priority than the DL signals/channels the following applies for cap1A and 1B UEs:

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW no later than N2 symbols, defined in clause 6.4 of [26, TS38.214] for the subcarrier spacing of the DL PRS, before the start of the PPW, UE expects to receive the DL signals/channels and drop all DL PRS in the PPW.

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW later than N2 symbols, defined in clause 6.4 of [26, TS38.214] for the subcarrier spacing of the DL PRS, before the start of the PPW, UE is not required to receive the other DL signals/channels except SSB of higher priority and may receive the DL PRS in the PPW.

When PRS is lower priority than the DL signals/channels the following applies for cap 2 UEs:

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol no later than N2 symbols, defined in clause 6.4 of [26, TS38.214] for the subcarrier spacing of the DL PRS, before the PRS symbol, UE expects to receive the DL signals/channels and drop the PRS symbol.

- If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol later than N2 symbols, defined in clause 6.4 of [26, TS38.214] for the subcarrier spacing of the DL PRS, before the PRS symbol, UE is not required to receive the other DL signals/channels except SSB of higher priority and may receive the PRS symbol.

For inter-band case for FR2 for the DL signals/channels from a different FR2 band than the FR2 band of the DL PRS, if the same Rx beam is used for both FR2 bands and the DL PRS is determined to be higher priority, capability 1B and 2 UEs are not expected to receive the DL signals/channels.

## **--- End of Change #25a ---**

## **--- Start of Change #26 ---**

#### 9.9A.2.5 Measurements Period Requirements without FH

##### 9.9A.2.5.1 Measurements Period Requirements without FH with MG

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in Clause 9.9A.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

Where,

is the index of positioning frequency layer,

is total number of positioning frequency layers, and

is the periodicity of the PRS RSTD measurement in positioning frequency layer i

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below:

,

where:

is the RedCap UE Rx beam sweeping factor. In FR1 (for 2 Rx or 1 Rx RedCap UE), = 1;

and in FR2 (for 2 Rx RedCap UE only), is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. is equal to 8, otherwise.

is the carrier-specific scaling factor for NR PRS-based positioning measurements in positioning frequency layer *i* as defined in clause 9.1A.5.2.

is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

=1 if UE is not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

=, if UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

= if UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

where

is the number of Rx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

is a scaling factor for a positioning frequency layer to be measured within the associated measurement gap pattern, which is defined as = Ntotal / Navailable for UE configured with concurrent measurement gap, and = 1 for UE not configured with concurrent measurement gap.

- For a window W of duration max(, MGRP\_max), where MGRP\_max is the maximum MGRP across all configured per-UE MG and per-FR MG within the same FR as the positioning frequency layer, and starting at the beginning of any associated gap occasions covering the PRS occasion:

- Ntotal is the total number of associated gap occasions covering PRS occasions within the window, including both dropped and non-dropped instances of the associated measurement gap within the window, and

- Navailable is the number of non-dropped associated gap occasions covering PRS occasions within the window W, after further accounting for MG collisions by applying the selected gap collision rule

- Requirements do not apply if Navailable =0.

is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

is the time duration of available PRS in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with MG are considered.

is the number of PRS RSTD measurement samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the

sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during Tavailabe, = +MGL. Otherwise, = + ,

is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

*=*

Where,

corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

*,* the least common multiple between and .

is the repetition periodicity of the measurement gap applicable for measurement in the PRS frequency layer i. is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

, is the PRS periodicity with muting per PRS resource,

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*.

is the scaling factor considering PRS resource muting. , where

is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

- Note: For the purpose of calculating TPRS,i, only the PRS resources fully or partially covered by the MG are considered.

is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34].

is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

Except for deferred MT-LR as defined in clause 4.1a.5 [TS 23.273], the time *s*tarts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

For deferred MT-LR with other event than “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the timestarts from the first MG instance aligned with a DL PRS resource(s) in the assistance data after the associated event(s) occurs.

For deferred MT-LR with event “Periodic Location” as defined in clause 4.1a.5.1 [TS 23.273], the UE shall perform the RSTD measurement in each reporting period and activate the location report at the time when the periodic timer expires.

Note: No per-positioning frequency layer requirement is applied in scenarios when multiple positioning frequency layers are configured.

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and RSRPP are performed over the same measurement period.

If during the measurement period of one or more positioning frequency layers, the MG pattern is reconfigured, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period TRSTD,Total within measurement gaps due to collisions with other signals; otherwise, the measurement period can be longer.

If CSSF changes during the measurement period, the measurement period could be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9A.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1A.x.

##### 9.9A.2.5.2 Measurements Period Requirements without FH without MG

When physical layer receives last of *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in Clause 9.9A.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:

, if any of the positioning frequency layers are in Case 1, or

, if all the positioning frequency layers are in Case 2,

Where,

is the index of positioning frequency layer, and

is total number of positioning frequency layers, and

is the periodicity of the PRS RSTD measurement in positioning frequency layer i, and

is the time from the start of the first PPW occasion for positioning frequency layer i to the start of measurement period .

A positioning frequency layer is in Case 1 if UE reports *ppw-durationOfPRS-Processing1-r17* for the band containing the positioning frequency layer, and a positioning frequency layer is in Case 2 if UE reports *ppw-durationOfPRS-Processing2-r17* for the band containing the positioning frequency layer.

is the measurement period for PRS RSTD measurement in positioning frequency layer *i* as specified below.

,

where:

is the UE Rx beam sweeping factor. In FR1 (for 2 Rx or 1 Rx RedCap UE), = 1; and in FR2 (for 2 Rx RedCap UE only), is equal to the value reported by the UE in *supportedLowerRxBeamSweepingFactor-FR2* if the UE supports the capability for the band containing positioning frequency layer i, and the LMF indicates *lowerRxBeamSweepingFactor-FR2* in *NR-DL-TDOA-RequestLocationInformation*. is equal to 8, otherwise.

is the scaling factor for measurement of same PRS resource with multiple Rx TEGs.

=1 if UE is not supported *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* or not requested by LMF to measure a PRS resource with multiple Rx TEGs via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*;

otherwise,

=, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs, and

= if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs.

Where

is the number of Rx TEGs with which UE is requested to measure a PRS resource indicated via *measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17* [34] in *NR-DL-TDOA-RequestLocationInformation*, and in case ‘n0’ is indicated, is the maximum number of Rx TEGs with which UE can support to measure the same PRS resource as reported in *NR-UE-TEG-Capability*, and

is the number of Rx TEGs UE can measure simultaneously which is reported via *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul*.

is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

is the time duration of available PRS in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of ,

only the PRS resources unmuted and fully or partially overlapped with PPW are considered, if positioning frequency layer i is in Case 1, or

only the PRS resources unmuted and fully or partially overlapped with the first (PPWL-T2) ms of PPW are considered, if positioning frequency layer i is in Case 2, where PPWL is the PPW length and T2 corresponds to *ppw-durationOfPRS-ProcessingSymbolsT2*.

is the number of PRS RSTD measurement samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and meets the following conditions:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- =2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples, and does not meet the following conditions:

- PRS bandwidth is within the active BWP and

- Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within 6 dB.

- = 4 otherwise.

is the measurement duration for the last PRS RSTD sample in positioning frequency layer *i*, including the sampling time and processing time.

If positioning frequency layer *i* is in Case 1 and all of the PRS resources to be measured are available in the same PPW occasion during Tavailable, then = +PPWL, else

if positioning frequency layer *i* is in Case 2 and all of the PRS resources to be measured are available in the same PPW occasion during Tavailable, then = PPWL;

otherwise, = + .

is the periodicity of the PRS RSTD measurement in positioning frequency layer i defined as:

*=*

Where,

corresponds to *ppw-durationOfPRS-ProcessingSymbolsT* in TS 37.355 [34] if positioning frequency layer *i* is in Case 1, or corresponds to the sum of *ppw-durationOfPRS-ProcessingSymbolsT2* and *ppw-*durationOfPRS*-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer *i* is in Case 2,

, the least common multiple between and .

is the repetition periodicity of the PRS processing window applicable for measurements in the positioning frequency layer *i*.

is the periodicity of DL PRS resource with muting on positioning frequency layer *i*.

If more than one PRS periodicities are configured in positioning frequency layer *i*, the least common multiple of PRS periodicities among all DL PRS resource sets in the positioning frequency layer is used to derive , where,

, is the PRS periodicity with muting per PRS resource,

is the periodicity of PRS resource sets given by the higher-layer parameter *DL-PRS-Periodicity*,

is the scaling factor considering PRS resource muting. , where is the muting repetition factor given by the higher-layer parameter *DL-PRS-MutingBitRepetitionFactor*, and is the size of the bitmap .

Note: For the purpose of calculating , only the PRS resources that meet the conditions for PRS measurement outside measurement gaps as defined in clause 9.9.1.2 are considered.

is a duration of DL PRS symbols in ms corresponding to *ppw-durationOfPRS-ProcessingSymbolsN* in TS 37.355 [34] if positioning frequency layer i is in Case 1, or corresponding to *ppw-durationOfPRS-ProcessingSymbolsN2* in TS 37.355 [34] if positioning frequency layer i is in Case 2.

is UE capability for number of DL PRS resources that it can process in a slot as indicated by *ppw-maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

The time *s*tarts from the first instance of the activated PPW for measurement of positioning frequency layer *i* aligned with a DL PRS resource(s) in the assistance data after both the *NR-DL-TDOA-ProvideAssistanceData* message and *NR-DL-TDOA-RequestLocationInformation* message are delivered from LMF to the physical layer of UE via LPP [34].

When PRS-RSRP is configured for DL-TDOA, RSTD and RSRP are performed over the same measurement period.

When PRS-RSRPP is configured for DL-TDOA, RSTD and RSRPP are performed over the same measurement period.

If during the measurement period of one or more positioning frequency layers, the PPW is re-configured or reactivated, the measurement period can be longer.

The measurement requirements in this clause apply, provided no PRS symbols are dropped during the measurement period within PPW due to collisions with other signals; otherwise, the measurement period can be longer.

The measurement requirements do not apply for a PRS resource, if the PRS resource is across two sampling duration of N within duration .

The measurement requirements do not apply for a PRS resource, if time span of the PRS resource instance (including at least the minimum number of repetitions specified in the accuracy requirements) is greater than UE reported capability N.

The requirements in clause 9.9A.2 do not apply if the PRS configuration given by higher layer paramters *NR-DL-PRS-AssistanceData* exceeds any of the UE measurement capabilities given by *NR-DL-PRS-ResourcesCapability* in *NR-DL-TDOA-ProvideCapabilities*, and it is up to UE implementation which PRS resources are measured, subject to UE measurement capabilities*.*

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The RSTD measurement period can be longer. The UE shall meet the RSTD measurement accuracy requirements in clause 10.1A.x.

If any positioning frequency layer is in Case 2, the requirements in this clause apply provided that the PPWL corresponding to the positioning frequency layer is larger than (T2+X) ms.

The requirements in this clause apply provided that a single positioning frequency layer is configured for measurement in each PPW.

## **--- End of Change #26 ---**

## **--- Start of Change #27 ---**

#### 9.9A.2.6 Measurements Period Requirements with FH

##### 9.9A.2.6.1 Measurements Period Requirements with FH with MG

When physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* requesting RedCap UE to measure DL RSTD measurement with FH, the RedCap UE shall be able to measure multiple (up to the RedCap UE capability specified in Clause 9.9A.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined in Clause 9.9A.2.5.1 with using the following definition for and :

- is the number of PRS RSTD measurement samples, where

- = 2 if the RedCap UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- = 4 otherwise.

- A measurement sample with FH is defined as a PRS measurement over multiple hops within a single measurement gap occasion.

- is the time duration of available PRS in the positioning frequency layer i to be measured during a MG, and is calculated by:

where,

- is the number of hops that UE can do in an MG occasion as defined in the following, and

- is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with the sampling duration in each hop are considered;

The sampling window per hop is the first symbols in each hop, where , is the applicable length per hop as defined in Table 9.9A.2.6.1-1, and is the retuning time between Rx hops as reported by UE in *dl-PRS-MeasurementWithRxFH-RRC-Connected* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop within a MG instance starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the MG instance taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

**Table 9.9A.2.6.1-1: Applicable number of hops per slot and applicable length of each hop**

|  |  |  |  |
| --- | --- | --- | --- |
|  | (comb size, Number of PRS symbols) | Applicable number of hops per slot | Applicable length per hop () in number of symbols |
|  | (2, 12) with SCS 15kHz, 30kHz, 60kHz in FR2, 120kHz | 2 | 7 |
| All others | 1 | 14 |
|  | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
|  | Any combination | ½ | 28 |

The number of hops within a single MG occasion is defined as

where

- is the maximum number of Rx hops signaled in the UE capability (FG 41-5-1)

- is the effective number of Rx hops within a MG instance,

- , if = 2,

- , if = 1,

- , if = 1/2 and >1,

- , if = 1/2 and =1,

- where is the number of PRS repetitions within the MG occasion excluding the gap retuning times, is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, is the applicable number of hops per slot as defined in Table 9.9A.2.6.1-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions within an MG instance and the same PRS repetition interval , otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of defined as

where

* is the minimum among

- configured PRS BW, and

- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18*, and

- total BW of all hops requested by LMF via *maximumPRS-BandwidthAcrossAllHopsFR1-r18*

* is number of hops within a single MG occasion as define above
* is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16*
* is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18*.

#### ---unchanged clauses omitted---

#### 9.9A.3.6 Measurements Period Requirements with FH

##### 9.9A.3.6.1 Measurements Period Requirements with FH with MG

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], requesting RedCap UE to measure PRS-RSRP measurement with FH, the RedCap UE shall be able to measure multiple (up to the RedCapUE capability specified in Clause 9.9A.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured positioning frequency layers, within ms as defined Clause 9.9A.3.5.1 with using the following definition for and :

- is the number of PRS RSRP measurement samples, where

- = 2 if the UE supports *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- = 4 otherwise.

- A measurement sample with FH is defined as a PRS measurement over multiple hops within a single measurement gap occasion.

- is the time duration of available PRS in the positioning frequency layer i to be measured during a MG, and is calculated by:

where,

- is the number of hops that UE can do in an MG occasion as defined in the following, and

- is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with the sampling duration in each hop are considered;

The sampling window per hop is the first symbols in each hop, where , is the applicable length per hop as defined in Table 9.9A.3.6.1-1, and is the retuning time between Rx hops as reported by UE in *dl-PRS-MeasurementWithRxFH-RRC-Connected* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop within a MG instance starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the MG instance taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

**Table 9.9A.3.6.1-1: Applicable number of hops per slot and applicable length of each hop**

|  |  |  |  |
| --- | --- | --- | --- |
|  | (comb size, Number of PRS symbols) | Applicable number of hops per slot | Applicable length per hop () in number of symbols |
|  | (2, 12) with SCS 15kHz, 30kHz, 60kHz in FR2, 120kHz | 2 | 7 |
| All others | 1 | 14 |
|  | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
|  | Any combination | ½ | 28 |

The number of hops within a single MG occasion is defined as

where

- is the maximum number of Rx hops signaled in the UE capability (FG 41-5-1)

- is the effective number of Rx hops within a MG instance,

- , if = 2,

- , if = 1,

- , if = 1/2 and >1,

- , if = 1/2 and =1,

- where is the number of PRS repetitions within the MG occasion excluding the gap retuning times, is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap*, is the applicable number of hops per slot as defined in Table 9.9A.3.6.1-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions within an MG instance and the same PRS repetition interval , otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of defined as

where

* is the minimum among

- configured PRS BW, and

- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18*, and

- total BW of all hops requested by LMF via *maximumPRS-BandwidthAcrossAllHopsFR1-r18*

* is number of hops within a single MG occasion as define above
* is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16*
* is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18*.

#### ---unchanged clauses omitted---

9.9A.4.8 Measurements Period Requirements with FH

The requirements in this clause apply when a RedCap UE is requested by the LMF to perform measurements with FH, and UE reports measurement based on multiple hops.

The requirements in clause 9.9A.4.5 shall apply with the following modifications.

- = 2 if the UE supports the capability of positioning measurements with reduced number of samples as indicated by *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* specified in TS 37.355 [34], and the LMF requests the UE to perform positioning measurements with reduced number of samples.

- A measurement sample with FH is defined as a PRS measurement over multiple hops within a single measurement gap.

- , where

- is the number of hops that UE can do in an MG occasion as defined in the following, and

- is the time duration of available PRS resources in the positioning frequency layer *i* in each hop to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with the sampling duration in each hop are considered;

The sampling window per hop is the first symbols in each hop, where , is the applicable length per hop as defined in Table 9.9A.4.8-1, and is the retuning time between Rx hops as reported by UEin *dl-PRS-MeasurementWithRxFH-RRC-Connected* via *NR-DL-PRS-ProcessingCapability* [34]. The first hop within a MG instance starts at no earlier than the earliest arrival time of the first unmuted PRS resource fully or partially overlapped with the MG instance taking into account the *expectedRSTD* and *expectedRSTD-uncertainty* in the PRS assistance data.

**Table 9.9A.4.8-1: Applicable number of hops per slot and applicable length of each hop**

|  |  |  |  |
| --- | --- | --- | --- |
|  | (comb size, Number of PRS symbols) | Applicable number of hops per slot | Applicable length per hop () in number of symbols |
|  | (2, 12) with SCS 15kHz, 30kHz, 60kHz in FR2, 120kHz | 2 | 7 |
| All others | 1 | 14 |
|  | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
|  | Any combination | ½ | 28 |

The number of hops within a single MG occasion is defined as

where

- is the maximum number of Rx hops signaled in the UE capability (FG 41-5-1)

- is the effective number of Rx hops within a MG instance,

- , if = 2,

- , if = 1,

- , if = 1/2 and >1,

- , if = 1/2 and =1,

- where is the number of PRS repetitions within the MG occasion excluding the gap retuning times, is the PRS repetition interval configured by *dl-PRS-ResourceTimeGap* and is the applicable number of hops per slot as defined in Table 9.9A.4.8-1.

The measurement period requirement with the above modifications applies provided all PRS resources in each PFL have the same number of PRS repetitions within an MG instance and the same PRS repetition interval , otherwise the measurement period can be longer.

UE shall be able to measure PRS resources with multiple hops at least over the BW of defined as

where

* is the minimum among

- configured PRS BW, and

- UE capability of maximum PRS BW across all hops indicated via *maximumPRS-BandwidthAcrossAllHopsFR1-r18* or *maximumPRS-BandwidthAcrossAllHopsFR2-r18*, and

- total BW of all hops requested by LMF via *maximumPRS-BandwidthAcrossAllHopsFR1-r18*

* is number of hops within a single MG occasion as define above
* is the UE capability on PRS BW per hop indicated via *supportedBandwidthPRS-r16*
* is the UE capability on BW of the overlapping RB indicated via *numOfOverlappingPRB-r18*.

## **--- End of Change #27 ---**

## **--- Start of Change #28 ---**

# 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 relevant requirements related to its WAN operation, 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 related to its WAN operation.

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 another 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 per measured link, 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, 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 do not apply, when the synchronization reference source changes during at the UE transmitting SL-PRS for the SL-RSTD measurement.

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, while the measuring UE is performing the SL PRS-RSRP measurement, 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 do not apply, when the synchronization reference source changes during at the UE transmitting SL-PRS for the SL PRS-RSRP measurement.

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, while the measuring UE is performing the SL Rx-Tx time difference measurement, 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 longer than .

The requirements in this clause do not apply, when the synchronization reference source changes during at the UE transmitting SL-PRS for the SL Rx-Tx measurement.

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.

## **--- End of Change #28 ---**

## **--- Start of Change #29 ---**

## 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 changes during , 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 do not apply, when the synchronization reference source changes during at the UE transmitting SL-PRS for the SL AoA measurement.

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 ApplicabilityThe 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 changes during , 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 do not apply, when the synchronization reference source changes during at the UE transmitting SL-PRS for the SL RTOA measurement.

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.

## **--- End of Change #29 ---**