**3GPP TSG-RAN4 Meeting #102-e *R4-2207005***

**Electronic Meeting, February 21 – March 03, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** | **DraftCR** | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *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:*** | UE Rx-Tx measurement requirements in RRC inactive state (clause 5.5.4) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos\_enh-Core | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | |  |
|  | *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:*** | | To introduce UE Rx-Tx measurement requirements in RRC inactive state | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | UE Rx-Tx measurement requirements in RRC inactive state include measurement periods and UE behaviour with 4 samples and reduced number of samples.  This is draft CR # 9 according to work split in R4-2202776. | | | | | | | | |
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| ***Consequences if not approved:*** | | UE Rx-Tx measurement performance in RRC inactive state cannot be guaranteed. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.5.4, 5.5.4.1, 5.5.4.2, 5.5.4.3, 5.5.4.4, 5.5.4.5 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

**----------------------START OF CHANGES----------------------------**

5.5.4 UE Rx-Tx time difference measurements

5.5.4.1 Introduction

The requirements in this clause shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

5.5.4.2 Requirements Applicability

The requirements in clause 5.5.4 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.X are met for a corresponding band.

- SRS is configured on the PCell.

5.5.4.3 Measurement Capability

UE Rx-Tx time difference measurement capability is as indicated by the UE in *NR-Multi-RTT-ProvideCapabilities,* according to TS 37.355 [34].

5.5.4.4 Measurement Reporting Requirements

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

This measurement reporting delay excludes the delay caused by any of the following:

* delay caused by other LPP signalling on the DCCH.
* 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.
* delay caused due to lack of UL resources for UE to send the measurement report.
* delay required by SDT for reporting the measurement using SDT resouces.
* delay required for transition to RRC\_CONNECTED state for report the measurement in RRC\_CONNECTED.

The UE Rx-Tx time difference measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clause 10.1.25.3.

The UE Rx-Tx time difference measurement accuracy for all measured DL PRS resourcesshall be fulfilled according to the accuracy requirements specified in clause 10.1.X.

5.5.4.5 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 5.5.4.3) 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 [*Parallel PRS measurements in RRC\_INACTIVE state*] defined in [34].
* if the UE is not capable of [*Parallel PRS measurements in RRC\_INACTIVE state*] 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 [*Parallel PRS measurements in RRC\_INACTIVE state*] defined in [34] and if Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ; where is defined in clause 4.2.2.5.
* is the scaling factor for UE Rx beam sweeping:
* =1 if positioning frequency layer *i* is in FR1
* =[8] if positioning frequency layer *i* is in FR2 and the UE does not support lower Rx beam sweeping factor.
* = [*lower Rx beam sweeping factor*] if positioning frequency layer *i* is in FR2 and the UE is capable of [*lower Rx beam sweeping factor*] defined in [34].
* 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].
* 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:
* = 4 if the UE is not capable of [*M-sample measurements*] defined in [34].
* = TBD if the UE is capable of [*M-sample measurements*] defined in [34] and meets the following conditions:
  + FFS: PRS bandwidth is within the active BWP and
  + FFS: Magnitude of difference between the serving cell’s SS-RSRP and the neighbor cell’s PRS-RSRP is within [6] dB.
* = TBD if the UE is capable of [*M-sample measurements*] defined in [34] but does not meet the following conditions:
  + FFS: PRS bandwidth is within the active BWP and
  + FFS: 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* in TS 37.355 [34],
* , the least common multiple between and .
* 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

The time starts from the first occurrence of 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.

Note: 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.

The UE Rx-Tx time difference measurement period is restarted if cell reselection occurs during the UE Rx-Tx time difference measurement period 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 during the UE Rx-Tx time difference measurement period the DRX cycle is reconfigured 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.

The requirements in clause 5.5.4 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.

**----------------------END OF CHANGES----------------------------**