**3GPP TSG-RAN4 Meeting #104-e *R4-221xxxx***

**Electronic Meeting, 15 – 26 August, 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **2539** | **rev** | **1** | **Current version:** | **17.6.0** |  |
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| *For* [***HELP***](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:***  | CR on PRS measurement requirements in INACTIVE |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_pos\_enh-Core |  | ***Date:*** | 2022-07-19 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | 1. The definition of NRXBeam,i needs to be updated based on latest RAN1 agreement.
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| ***Summary of change:*** | 1. Update the definition of NRXBeam,i based on latest RAN1 agreement.
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| ***Consequences if not approved:*** | Requirements for PRS measurement in INACTIVE are incomplete. |
|  |  |
| ***Clauses affected:*** | 5.6.2.5, 5.6.3.5, 5.6.4.5 |
|  |  |
|  | **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 Change 1>

#### 5.6.2.5 Measurements Period Requirements

After receiving both *NR-TDOA-ProvideAssistanceData* message and *NR-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 *lowerRxBeamSweepingThan8-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingThan8-FR2* in *NR-TDOA-RequestLocationInformation*.

- equals to 8, otherwise.

- [ is a scaling factor for PRS-based NR positioning measurements in RRC\_INACTIVE. If the UE supports [Parallel PRS measurements in RRC\_INACTIVE state], 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 with 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]:

- 𝑁𝑅𝑥,,, if the UE is not capable of receiving same DL PRS resource simultaneously from multiple Rx TEGs. Where P is the maximum number of UE-RxTEGs 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].

- , if the UE is capable of receiving the same DL PRS resource simultaneously from multiple Rx TEGs. Where is the maximum 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 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 number of PRS RSTD samples, where

- = 1 if the UE supports *supportedDL-PRS-ProcessingSamples* [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* [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, = + ,

- 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 the DRX cycle length

- 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-ProcessingSysmbols*] in TS 37.355 [34], T (ms) corresponds to [*durationOfPRS-ProcessingSymbolsInEveryTms*] 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*] specified in TS 37.355 [34].

The time *s*tarts from [the first DRX cycle containing] 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 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 5.x1.1.

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 5.5.2 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\_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.X.

<End of Change 1>

<Start of Change 2>

#### 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 [Parallel PRS measurements in RRC\_INACTIVE state], = 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 *lowerRxBeamSweepingThan8-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingThan8-FR2* in *NR-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 the PRS resources unmuted 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 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* 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* [34], and the LMF indicates 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 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 UE supports *supportedDL-PRS-ProcessingSamples* [34], and the LMF indicates the UE to perform positioning measurements with reduced number of samples by *requestedDL-PRS-ProcessingSamples* [34], and 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 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 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 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 PRS-RSRP measurements are configured for DL-AoD, the time starts from [the first DRX on duration] aligned with 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.

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 5.5.2.

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.x1.4.

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.x1.3 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 compete 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 can 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.X.

<End of Change 2>

<Start of Change 3>

#### 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.x1.4.3) 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, and if positioning frequency layer *i* is in FR2

- equals to the value as UE reported in *lowerRxBeamSweepingThan8-FR2* if the capability is reported by the UE for the band containing positioning frequency layer i, and LMF indicates *lowerRxBeamSweepingThan8-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 [34].

- = measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17 if UE is configured by LMF to measurement same DL PRS with multiple UE RxTx TEGs [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 *supportedDL-PRS-ProcessingSamples* defined in [34].

- = 1 if the UE is capable of *supportedDL-PRS-ProcessingSamples* 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 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* 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 active 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 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 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.

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

If the RRC state transion 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.

The requirements in clause 5.x1.4 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 Change 3>