3GPP TSG-RAN WG2 Meeting #119-e ***R2-22xxxxx***

Electronic Meeting, August 17 – 26, 2022

**Agenda item:** 6.11.1

**Source:** Qualcomm Incorporated

**Title:** Summary of [AT119-e][424][POS] Rel-17 LPP CR (Qualcomm)

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following email discussion:

* [AT119-e][424][POS] Rel-17 LPP CR (Qualcomm)

Scope: Draft a CR to 37.355 taking account of this meeting’s decisions.

Intended outcome: Agreeable CR

Deadline: Tuesday 2022-08-23 1200 UTC

# 2. Discussion

## 2.1 Agreements – Latency Enhancements

Agreement:

Correct the ASN.1 requestedDL-PRS-ProcessingSamples-r17 in a backward compatible manner:

requestedDL-PRS-ProcessingSamples-r17 ENUMERATED { requested, ... }

LS to RAN1/RAN4 to ask about the capability confusion on this point between per-band and per-UE.

Agreement:

The field name lowerRxBeamSweepingThan8-FR2-r17 in IE PRS-ProcessingCapabilityPerBand-r16 should be changed to supportedLowerRxBeamSweepingThan8-FR2-r17.

The above agreements have been implemented in **R2\_22xxxxx\_(CR 37355)\_v01.docx** provided in the same folder as this discussion document.

Please provide your comments (if any) on the corresponding changes in **R2\_22xxxxx\_(CR 37355)\_v01.docx** located in the same folder as this discussion document in the Table below.

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| Company | Comments |
| CATT | Agree |
| Huawei, HiSIlicon | Agree |
| Ericsson | Agree |
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## 2.2 Agreements – On-demand PRS

Agreements:

Add clarification in the field description of On-Demand-DL-PRS-Configuration, e.g., UE ignores the parameters that the LMF cannot meaningfully fill (e.g. TRP dependent). Details to be checked in the LPP email discussion ([424]).

The Table on the next page below summarizes the elements in IEs *NR-DL-PRS-PositioningFrequencyLayer-r16* and *NR-DL-PRS-Info-r16* currently used in IE *On-Demand-DL-PRS-Configuration-r17*:

On-Demand-DL-PRS-Configuration-r17 ::= SEQUENCE {

dl-prs-configuration-id-r17 DL-PRS-Configuration-ID-r17,

nr-DL-PRS-PositioningFrequencyLayer-r17 NR-DL-PRS-PositioningFrequencyLayer-r16,

nr-DL-PRS-Info-r17 NR-DL-PRS-Info-r16,

...

}

Option 3 in R2-2208493 proposes the following field description:

| *NR-DL-PRS-On-Demand-Configurations* field descriptions |
| --- |
| ***dl-prs-configuration-id***  This field provides an identity for the *On-Demand-DL-PRS-Configuration.* |
| ***nr-DL-PRS-PositioningFrequencyLayer***  This field, in addition to the *nr-DL-PRS-Info*, provides the possible DL-PRS configuration. The UE shall ignore the *dl-PRS-SubcarrierSpacing*, *dl-PRS-StartPRB*, *dl-PRS-PointA* and *dl-PRS-CyclicPrefix* in this field. |
| ***nr-DL-PRS-Info***  This field, in addition to the *nr-DL-PRS-PositioningFrequencyLayer*, provides the possible DL-PRS configuration. The UE shall ignore the *nr-DL-PRS-ResourceSetID*,Resource Set Slot Offset of *dl-PRS-Periodicity-and-ResourceSetSlotOffset*, *dl-PRS-ResourceTimeGap*, *dl-PRS-MutingOption1*, *dl-PRS-MutingOption2*, *dl-PRS-ResourcePower*, *nr-DL-PRS-ResourceIDand*, *dl-PRS-SequenceID* and Resource offset of *dl-PRS-CombSizeN-AndReOffset* in this field. |

The elements the UE shall ignore are indicated with "NA" in the Table below.

Please replace "Company X" in the Table below with your company name and indicate which elements shall be ignored when included in IE *On-Demand-DL-PRS-Configuration-r17.*

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|  | Presence | R2-2208493  (Option 3) | Moderator's Understanding | CATT | Huawei, HiSilicon | Company D | Company E | Company F | Company G | Company H | Company I | Company J | Company K |
| **NR-DL-PRS-PositioningFrequencyLayer-r16** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| dl-PRS-SubcarrierSpacing-r16 | M | NA |  |  |  |  |  |  |  |  |  |  |  |
| dl-PRS-ResourceBandwidth-r16 | M |  |  |  |  |  |  |  |  |  |  |  |  |
| dl-PRS-StartPRB-r16 | M | NA | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-PointA-r16 | M | NA | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-CombSizeN-r16 | M |  |  |  |  |  |  |  |  |  |  |  |  |
| dl-PRS-CyclicPrefix-r16 | M | NA |  |  |  |  |  |  |  |  |  |  |  |
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| **NR-DL-PRS-Info-r16** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| nr-DL-PRS-ResourceSetList-r16 (1..nrMaxSetsPerTrpPerFreqLayer-r16) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| nr-DL-PRS-ResourceSetID-r16 | M | NA | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-Periodicity-and-ResourceSetSlotOffset-r16 | M | ResourceSetSlotOffset part | ResourceSetSlotOffset part |  | Slot offset |  |  |  |  |  |  |  |  |
| dl-PRS-ResourceRepetitionFactor-r16 | O |  |  |  |  |  |  |  |  |  |  |  |  |
| dl-PRS-ResourceTimeGap-r16 | O | NA | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-NumSymbols-r16 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| dl-PRS-MutingOption1-r16 | O | NA | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-MutingOption2-r16 | O | NA | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-ResourcePower-r16 | M | NA |  |  |  |  |  |  |  |  |  |  |  |
| dl-PRS-ResourceList-r16 (1..nrMaxResourcesPerSet-r16) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| nr-DL-PRS-ResourceID-r16 | M | NA | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-SequenceID-r16 | M | NA | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-CombSizeN-AndReOffset-r16 | M | AndReOffset part | AndReOffset part |  | Offset |  |  |  |  |  |  |  |  |
| dl-PRS-ResourceSlotOffset-r16 | M |  | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-ResourceSymbolOffset-r16 | M |  | NA | NA | NA |  |  |  |  |  |  |  |  |
| dl-PRS-QCL-Info-r16 | O |  |  |  |  |  |  |  |  |  |  |  |  |
| dl-PRS-ResourcePrioritySubset-r17 | O |  | NA | NA | NA |  |  |  |  |  |  |  |  |
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Agreement:

CR in R2-2207419 to be captured in the LPP email discussion [424]; details can be discussed.

The CR in R2-2207419 has been captured in IE *NR-On-Demand-DL-PRS-Information-r17* in **R2\_22xxxxx\_(CR 37355)\_v01.docx** provided in the same folder as this discussion document.

DL-PRS-QCL-InfoReq-r17 ::= SEQUENCE {

nr-DL-PRS-ResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16,

dl-prs-QCL-InformationReq-r17 CHOICE {

nr-DL-PRS-QCL-Source-r17 DL-PRS-QCL-Info-r16,

dl-prs-QCL-Info-requested-r17 NULL

},

...,

[[

dl-prs-QCL-InformationExt-r17 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16) OF

DL-PRS-QCL-Info-r16 OPTIONAL

]]

}

Please provide your comments (if any) on the changes for IE *NR-On-Demand-DL-PRS-Information-r17* in "**R2\_22xxxxx\_(CR 37355)\_v01.docx**" located in the same folder as this discussion document in the Table below.

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| Company | Comments |
| CATT | Agree |
| Huawei, HiSIlicon | DL-PRS-QCL-InfoReq-r17 ::= SEQUENCE {  nr-DL-PRS-ResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16,  dl-prs-QCL-InformationReq-r17 CHOICE {  nr-DL-PRS-QCL-Source-r17 DL-PRS-QCL-Info-r16,  dl-prs-QCL-Info-requested-r17 NULL  },  ...,  [[  dl-prs-QCL-InformationExt-r17 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16) OF  DL-PRS-QCL-Info-r16 OPTIONAL  ]]  }  Suggest to make the following changes on top of the change above  1/ dummyfy the field dl-prs-QCL-Info-requested-r17  2/ change the field name dl-prs-QCL-InformationReq-r17 to dl-prs-QCL-InformationReqPerResourceSet  3/ change the field name dl-prs-QCL-InformationExt-r17 to dl-prs-QCL-InformationReqPerResource-r17 |
| Ericsson | Agree; also agree with Huawei’s suggestion for 2 and 3. However do not see the need to dummify as such (i.e donot agrere with 1). For on demand the information does not need to be very granular. It is ok for UE to request even preferred QCL at resource set level. It is just an indication for NW to know which QCL as such is preferred; does not necessarily have to be at beam level. |
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## 2.3 Agreements – Accuracy Enhancements

Agreements:

Introduce the timing error margin values for the Tx TEG case, using a BC change. Rx and RxTx (in LPP) will be introduced if/when RAN4 provide final values.

Change for Tx to be taken into account in the RRC email discussion [411].

Agreement:

For UE-based positioning, the selected Tx-TEG margin for TRP is added in NR-DL-PRS-TRP-TEG-Info.

The above will be implemented based on the conclusions in "[AT119-e][426][POS] TEG timing error margin in RRC and LPP (CATT)" when available.

## 2.4 Open Proposals from R2-2208794

**R2-2208794**, "[Pre119-e][402] Summary of agenda item 6.11.2.6 on positioning accuracy enhancements (CATT)".

Please see R2-2208794 for further background on the Proposals.

Agreement:

P5/P6/P7/P8/P9 of R2-2208794 to be discussed in the LPP email discussion [424].

### 2.4.1 Proposal 5 in R2-2208794

**Proposal 5: RAN2 to agree removing the condition presence tag and need code for nr-DL-PRS-RSRP-ResultDiff and nr-DL-PRS-FirstPathRSRP-ResultDiff in CR [R2-2207884].**

**Moderator's Comments:**

- In LPP, Need codes/Cond tags are also used in UL. Therefore, this seems not an essential correction.

**Question 1:** Do you agree with the following Proposal:  
**Remove the condition presence tag and need code for nr-DL-PRS-RSRP-ResultDiff and nr-DL-PRS-FirstPathRSRP-ResultDiff as proposed in CR [R2-2207884].**

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| Company | Yes/No | Comments |
| CATT | No | There is a sentence in 6.1 General  “The use of these tags in the uplink (target to server) direction does not impose any requirements on the server.” |
| Huawei,Hillicon | Yes | Not needed. Need code is used for specifying UE behaviour when the field is absent. |
| Ericsson | No | Agree with CATT |
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### 2.4.2 Proposal 6 in R2-2208794

**Proposal 6: RAN2 to discuss if it is an essential correction: modify the condition of Rx beam index reporting so that RSRPP reporting is considered and the number of RSRP/RSRPP are counted across multiple resource sets in CR[R2-2207884].**

**Moderator's Comments:**

- I believe the wording for the Beam Index field description has been extensively discussed in RAN1/2 during Rel-16.

- According to TS 38.214, section 5.1.6.5:

"The UE may be configured to measure and report, subject to UE capability, up to 24 DL PRS-RSRP measurements on different DL PRS resources associated with the same *dl-PRS-ID*. When the UE reports DL PRS-RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS-RSRP measurements associated with the same higher layer parameter *nr-DL-PRS-RxBeamIndex* [17, TS 37.355] have been performed using the same spatial domain filter for reception if for each *nr-DL-PRS-RxBeamIndex* reported there are at least 2 DL PRS-RSRP measurements associated with it within the DL PRS resource set. The UE may be configured to measure and optionally report via higher layer signaling *nr-DL-PRS-FirstPathRSRP-Result*, subject to UE capability, up to 24 DL PRS RSRPP for the first detected path on different DL PRS resources associated with the same *dl-PRS-ID*."

- The proposed change seems not compatible with Rel-16.

**Question 2:** Do you agree with the following Proposal:  
**Modify the condition of Rx beam index reporting so that RSRPP reporting is considered and the number of RSRP/RSRPP are counted across multiple resource sets as proposed in CR[R2-2207884]**?

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| Company | Yes/No | Comments |
| CATT | No | The intention of Rx beam index reporting only works for RSRP, but not RSRPP. So the CR seems an enhancement, not an essential correction. |
| Huawei, HiSIlicon | Yes |  |
| Ericsson | Yes | Agree with Huawei’s intention that it can be too restrictive. But may be RAN1 should decide. We are fine if there is consensus in RAN2 to change it. |
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### 2.4.3 Proposal 7 in R2-2208794

**Proposal 7: RAN2 to agree to take CR [R2-2207882] as a baseline and merge CR [R2-2207578] via offline.**

**Moderator's Comments:**

- It seems the content of R2-2207578 is mostly covered by R2-2207882. R2-2207578 provides in addition a field description for *NR-DL-AoD-AdditionalMeasurementsExt*.

**Question 3:** Do you agree with the below field descriptions for *nr-DL-TDOA-AdditionalMeasurementsExt*, *NR-DL-AoD-AdditionalMeasurementsExt*, and *nr-Multi-RTT-AdditionalMeasurementsExt*:

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| ***nr-DL-TDOA-AdditionalMeasurementsExt***  This field, in addition to the measurements provided in *NR-DL-TDOA-MeasElement*, provides TOA measurements of up to 4 DL-PRS Resources of a TRP with different UE Rx TEGs. For a certain DL-PRS Resource, there can be up to 8 TOA measurement results with respect to different Rx TEGs.  If this field is present, the field *nr-DL-TDOA-AdditionalMeasurements* should not be present. |

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| ***nr-DL-AoD-AdditionalMeasurementsExt***  This field specifies a list of additional PRS RSRP measurements of different DL-PRS resources for the same TRP.  If this field is present, the field *nr-DL-AoD-AdditionalMeasurements* should not be present. |

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| ***nr-Multi-RTT-AdditionalMeasurementsExt***  This field, in addition to the measurements provided in *NR-Multi-RTT-MeasElement*, provides UE Rx-Tx time difference measurements of up to 4 DL-PRS Resources of a TRP with different UE RxTx TEGs. For a certain DL-PRS Resource, there can be up to 8 measurement results with respect to different UE RxTx TEGs.  If this field is present, the field *nr-Multi-RTT-AdditionalMeasurements* should not be present. |

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| Company | Yes/No | Comments |
| CATT | Yes |  |
| Huawei, HiSIlicon | Yes |  |
| Ericsson | Yes |  |
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### 2.4.4 Proposal 8 in R2-2208794

**Proposal 8: RAN2 to** **agree CR [R2-2207087] and CR [R2-2207102] separately.**

**R2-2207087** proposes thatthe number of UE Rx TEGs for measuring the same DL-PRS Resource should be a flexible integer number between 1 and the one indicated by *measureSameDL-PRS-ResourceWithDifferentRxTEGs* in the *LocationInformationRequest* message such as *NR-DL-TDOA-RequestLocationInformation*:

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| --- |
| ***measureSameDL-PRS-ResourceWithDifferentRxTEGs***  This field, if present, indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with up to *N* different UE Rx TEGs. Enumerated value '*n0*' indicates that the number *N* of different UE Rx TEGs to measure the same DL PRS Resource can be determined by the target device, value '*n2*' indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with up to 2 different UE Rx TEGs, value '*n3*' indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with up to 3 different UE Rx TEGs, and so on.  If this field is present, the field *nr-UE-TxTEG-Request* should also be present. |

Similar for the other methods.

**Moderator's Comments:**

- It seems this is the intention.

- However, the same change is then also needed in *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs.*

**Question 4:** Do you agree with the CR in R2-2207087?

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| Company | Yes/No | Comments |
| CATT | Yes |  |
| Huawei, HiSilicon | No | Not essential |
| Ericsson |  | Editorial; can go with Rapporteur’s view. |
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**R2-2207102 proposes:**

(1) RSTD or UE Rx–Tx time difference should be associated in NR-AdditionalPathList, instead of the TOA measurement, according to TS38.214:

"The UE may be configured to measure and report via higher layer parameter [AdditionalPath-relativeTiming-Request], subject to UE capability, the timing and the quality metrics of up to 8 additional detected paths, that are associated with each RSTD or UE Rx – Tx time difference. The timing of each additional path is reported relative to the path timing used for determining nr-RSTD or nr-UE-RxTxTimeDiff."

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| *– NR-AdditionalPathList* The IE *NR-AdditionalPathList* is used by the target device to provide information about additional paths in association with each RSTD or UE Rx – Tx time difference measurements associated to NR positioning in the form of a relative time difference and a quality value. The additional path *nr-RelativeTimeDifference* is the detected path timing relative to the detected path timing used for the TOA value, and each additional path can be associated with a quality value *nr-PathQuality.* |

(2) Delete the code "Need OP" in *NR-SRS-TxTEG-Element-r17* because this code is not required in UL message.

**Moderator's Comments:**

- On (1), it is unclear what the additional path for a time-difference measurement (RSTD) means. This seems not backwards compatible with Rel-16.

- On (2), "Need OP" is used in LPP also in UL messages.

**Question 5:** Do you agree with the CR in R2-2207102?

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| Company | Yes/No | Comments |
| CATT | Yes with one more correction | The intention of CR is to align with TS 38.214. Please find the alignment between 37.355 and 38.214. The description of IE should have the same understanding in both 37.355 and 38.214. Otherwise it will keep on bringing confusion to readers. This is not about compatible.  355 says:  The IE *NR-AdditionalPathList* is used by the target device to provide information about additional paths in association with each RSTD or UE Rx – Tx time difference measurements associated to NR positioning in the form of a relative time difference and a quality value. The additional path *nr-RelativeTimeDifference* is the detected path timing relative to the detected path timing used for determining nr-RSTD or nr-UE-RxTxTimeDiff, and each additional path can be associated with a quality value *nr-PathQuality.*  214 says:  "The UE may be configured to measure and report via higher layer parameter [AdditionalPath-relativeTiming-Request], subject to UE capability, the timing and the quality metrics of up to 8 additional detected paths, that are associated with each RSTD or UE Rx – Tx time difference. The timing of each additional path is reported relative to the path timing used for determining nr-RSTD or nr-UE-RxTxTimeDiff."  In a summary, all TOA in 355 should be updated to align with 38.214.   1. association with each RSTD or UE Rx – Tx time difference measurements 2. used for determining nr-RSTD or nr-UE-RxTxTimeDiff |
| Huawei, HiSIlicon | No | Same view as rapp that there is no RSTD measurement. |
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### 2.4.5 Proposal 9 in R2-2208794

**Proposal 9: RAN2 to** **agree the proposed description without ‘and a maximum of up to 32 measurement instances in a single measurement report is supported.’ in R2-2208073 and merge the modification into CR [R2-2207087].**

**R2-2208073** proposes the following additions:

| ***nr-SRS-TxTEG-Set***  This field provides the SRS for Positioning Resources associated with a particular UE Tx TEG and comprises the following subfields:  - ***nr-TimeStamp*** specifies the start time for which the *NR-SRS-TxTEG-Element* is valid. If this field is absent, the *nr-TimeStamp* of this instance of the *NR-SRS-TxTEG-Element* of the *nr-SRS-TxTEG-Set* is the same as the *nr-TimeStamp* of the previous instance of the *NR-SRS-TxTEG-Element*. If this field is also absent in the first *NR-SRS-TxTEG-Element* of the *nr-SRS-TxTEG-Set*, all *NR-SRS-TxTEG-Element*'s provided are valid for the measurement period of the *NR-Multi-RTT-SignalMeasurementInformation.*  - ***nr-UE-Tx-TEG-ID*** specifies the ID of this UE Tx TEG.  - ***carrierFreq*** specifies the frequency of the SRS for positioning resources.  - ***srs-PosResourceList*** specifies the SRS for Positioning Resources belonging to this UE Tx TEG.  For each UE Tx TEG ID, there may be up to 8 reports for each measurement instance and a maximum of up to 32 measurement instances in a single measurement report is supported |
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**Moderator's Comments:**

- The maximum number of measurement instances seems irrelevant in this context, since each measurement instance is one e.g., *NR-Multi-RTT-SignalMeasurementInformation-r16*:

nr-Multi-RTT-SignalMeasurementInstances-r17

SEQUENCE (SIZE (1..maxMeasInstances-r17)) OF

NR-Multi-RTT-SignalMeasurementInformation-r16

- For each TEG ID, there may be up to 8 changes of the TEG-SRS association information (i.e., up to 8 different time stamps) (as noted in R2-2208073).

- A potential clarification could be:  
  
"For each UE Tx TEG, there may be up to 8 changes of the TEG-SRS association information provided in *nr-SRS-TxTEG-Set.*"

- Regarding: "**and merge the modification into CR [R2-2207087]**" in Proposal 9, R2-2207087 seems to be on a different topic (see section 2.4.4).

**Question 6:** Do you agree with the following addition to *nr-SRS-TxTEG-Set* field description:

| ***nr-SRS-TxTEG-Set***  This field provides the SRS for Positioning Resources associated with a particular UE Tx TEG and comprises the following subfields:  - ***nr-TimeStamp*** specifies the start time for which the *NR-SRS-TxTEG-Element* is valid. If this field is absent, the *nr-TimeStamp* of this instance of the *NR-SRS-TxTEG-Element* of the *nr-SRS-TxTEG-Set* is the same as the *nr-TimeStamp* of the previous instance of the *NR-SRS-TxTEG-Element*. If this field is also absent in the first *NR-SRS-TxTEG-Element* of the *nr-SRS-TxTEG-Set*, all *NR-SRS-TxTEG-Element*'s provided are valid for the measurement period of the *NR-Multi-RTT-SignalMeasurementInformation.*  - ***nr-UE-Tx-TEG-ID*** specifies the ID of this UE Tx TEG.  - ***carrierFreq*** specifies the frequency of the SRS for positioning resources.  - ***srs-PosResourceList*** specifies the SRS for Positioning Resources belonging to this UE Tx TEG.  For each UE Tx TEG, there may be up to 8 changes (different *nr-TimeStamp*) of the TEG-SRS association information provided in *nr-SRS-TxTEG-Set.* |
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| Company | Yes/No | Comments |
| CATT | Yes | “up to 8 changes (different nr-TimeStamp) of the TEG-SRS association information” is good enough, because there is no agreement that 32 measurement instances should be included in one RRC message. |
| Huawei, HiSIlicon | Yes |  |
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