3GPP TSG-RAN WG2 Meeting #119 Electronic R2-220xxxx

Online Meeting, Aug 17th – 26th, 2022

**Agenda item: 6.11.2.6**

**Source: CATT**

**Title:**  **[AT119-e][426][POS] TEG timing error margin in RRC and LPP (CATT)**

**WID/SID: NR\_pos\_enh-Core**

**Document for: Discussion and Agreement**

# 1 Introduction

This document is to kick off the following email discussion:

* [AT119-e][426][POS] TEG timing error margin in RRC and LPP (CATT)

 Scope: Discuss the handling of the TEG timing error margins in RRC and LPP and conclude on an agreeable implementation approach. RAN4 agreements should be taken into account.

 Intended outcome: Report to CB session

 Deadline: Tuesday 2022-08-23 1200 UTC

This email discussion will discuss TEG timing error margins in RRC and LPP and conclude on an agreeable implementation approach based on RAN4 agreement.

# 2 Contact Information

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| ZTE | Yu Pan(pan.yu24@zte.com.cn) |
| CATT | Jianxiang Li (lijianxiang@catt.cn) |
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# 3 References

1. R2-2206914 Reply LS on the UE/TRP TEG framework (R1-2205382; contact: CATT) RAN1 LS in Rel-17 NR\_pos\_enh-Core To:RAN4, RAN2, RAN3
2. R2-2206946 LS on Tx TEG framework (R4-2210603; contact: CATT) RAN4 LS in Rel-17 NR\_pos\_enh-Core To:RAN1, RAN2, RAN3
3. R2-2207099 Corrections on the RxTEG,TxTEG and RxTxTEG report in TS 37.355 CATT CR Rel-17 37.355 17.1.0 0352 - F NR\_pos\_enh-Core
4. R[2-2207100](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2207100.zip) Corrections on the UE TxTEG report in TS 38.331 CATT CR Rel-17 38.331 17.1.0 3217 - F NR\_pos\_enh-Core
5. R2-2207087 37.355 CR for clarification of number of UE Rx TEGs OPPO CR Rel-17 37.355 17.1.0 0350 - F NR\_pos\_enh-Core
6. R[2-2207088](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2207088.zip) 37.355 CR for introduction of UE Rx TEG error margin and Tx TEG error margin OPPO CR Rel-17 37.355 17.1.0 0351 - F NR\_pos\_enh-Core
7. R[2-2207581](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2207581.zip) Correction on UE Rx Tx RxTx TEG and TRP Tx TEG timing error margin in 37.355 ZTE, Sanechips CR Rel-17 37.355 17.1.0 0364 - B NR\_pos\_enh-Core
8. R[2-2207582](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2207582.zip) Correction on UE Tx TEG timing error margin in 38.331 ZTE, Sanechips CR Rel-17 38.331 17.1.0 3286 - B NR\_pos\_enh-Core
9. R[2-2207583](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2207583.zip) Discussion on the framework of TEG timing error margin ZTE, Sanechips discussion Rel-17 NR\_pos\_enh-Core
10. R2-2207882 Correction to measurment with mutliple TEGs Huawei, HiSilicon, VIVO CR Rel-17 37.355 17.1.0 0369 - F NR\_pos\_enh-Core
11. R[2-2208073](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2208073.zip) On Mitigation of UE/TRP Rx/Tx timing delays Ericsson discussion Rel-17

# 4 Discussion

## 4.1 Timing error margin of UE/TRP Tx TEG

### 4.1.1 Analysis on UE/TRP Tx TEG

**RAN4 LS:** RAN4 is working on the UE Rx/Tx and/or gNB Rx/Tx timing delay mitigation in R17 ePOS WI and informed RAN1/2 about the UE/TRP Rx/RxTx TEG framework in last meeting. In RAN4#103e meeting, RAN4 discussed the UE/TRP Tx TEG framework, and the following agreements are made:

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| * The framework of UE/TRP Tx TEG is defined as below:
	+ Define multiple candidate timing error margin values {TE1, TE2, …, TEN} in the spec.
		- The number of candidate values (i.e. N) and the exact values of {TE1, TE2, …, TEN} will be decided in Perf part.
	+ UE/TRP selects one value M from {TE1, TE2, …, TEN} based on its implementation and indicate to gNB or LMF.
	+ For UE that supports multiple Tx TEGs (TEG#1, TEG#2, …), the associated timing error margin value of each Tx TEG is M, which means the timing error difference between the transmission occasions of same or different SRS resources within the same Tx TEG is within the margin M.
	+ The applicability of reported UE Tx TEG is limited to the transmission occasions of same or different SRS resources within the validity time defined by RAN2 e.g. based on the time stamp information.
 |

In RAN4#103e meeting, RAN4 also discussed the timing error margins of UE/TRP Tx/Rx/RxTx TEG , and the following agreements are made:

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| * Candidate timing error margins for UE/TRP Rx TEGs:
	+ 0Tc, 2 Tc, 4 Tc, 6 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 56 Tc, 64 Tc, 72 Tc, 80 Tc.
* For UE/TRP Tx TEGs, Use the same candidate timing error margins as UE/TRP Rx TEG.
* The reported value for Tx TEGs, Rx TEGs and RxTx TEGs can be different.
* The reported value for Tx/Rx/RxTx TEGs can be different at different times.
 |

**Definition in TS 38.305 (V17.1.0):**

**UE Tx 'Timing Error Group' (UE Tx TEG):** Tx timing errors, associated with UE transmissions on one or more UL SRS resources for positioning purpose, that are within a certain margin.

**Background of UE/TRP Tx TEG in RAN1:**

For mitigating UE/gNB Rx/Tx/RxTx timing delay errors, RAN1 introduced the concept of the Timing Error Groups (TEGs). **A Tx TEG** is associated with transmissions on a group of reference signals, whose Tx timing error differences are within a certain margin. For example, when two DL PRS signals from a TRP are transmitted from the same antenna panel simultaneously, the Tx timing error difference between the two DL PRS signals is expected to be very small, and thus, the two DL PRS signals can be in the same TRP Tx TEG. However, if two DL PRS signals from a TRP are transmitted from different antenna panels, the Tx timing error differences between the two DL PRS signals may exceed a certain margin. In this case, the two DL PRS signals may belong to different Tx TEGs.

It is concluded from RAN4 LS:

* The candidate timing error margins for UE/TRP Tx TEGs is: 0Tc, 2 Tc, 4 Tc, 6 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 56 Tc, 64 Tc, 72 Tc, 80 Tc.
* The reported timing error margins for UE Tx TEGs can be different at different times, i.e. reported M per timestamp.
* The timing error margin can be different for different times (instances). But, at any given instance (at timestamp), there is only one value for all Tx TEGs, one value for all Rx TEGs, and one value for RxTx TEGs for a UE or for a TRP.

**Question 1: Do you agree that the timing error margins of UE Tx TEGs can be different at different timestamps? Please also provide views in the table.**

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| --- | --- | --- |
| Company |  Yes/ No | Comments |
| ZTE | No | we don’t think that means UE Tx TEG timing error margin value should be compulsively associated with each timestamp. 1. Note that R4’s LS does not say timing error margin value should be different at different timestamps, but different times. The time can be time period since timing error margins may vary due to hardware/environment in different time period.

In RRC, UE can send *UEPositioningAssistanceInfo*at different times, that is also called ‘the timing error margins of UE Tx TEGs can be different at different times’.In LPP, UE can send different measurement instanceat different times, that is also called ‘the timing error margins of UE Tx TEGs can be different at different times’.1. If UE Tx TEG margin is associated with different timestamps, UE Tx TEG margin will also be associated with different UE Tx TEG IDs. Then for different UE Tx TEG IDs in a single report, UE may report multiple Tx TEG margin values---this is not aligned with R4’s LS-----they indicates if UE support multiple TEGs UE should choose one margin value.
 |
| CATT | Yes | “The **reported value** for Tx/Rx/RxTx TEGs can be different at different times.” in RAN4 LS means “The **reported value** can be different at different timestamps in LPP” from RAN2’s perspective. Let’s stick to the question: **the reported timing error margins of UE Tx TEGs can be different at different timestamps.**The reported value is associated with timestamp, not associated with TEG ID. All TEGs share the same value at the same timestamp. UE can report changes of values for UE TxTEGs at different timestamps in ONE RRC message. It will bring disaster to network that UE report multiple RRC messages if only one value at one timestamp can be reported in one RRC message. |
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**Summary:**

### 4.1.2 Corrections on asn.1 in RRC for UE TxTEG

CRs on the timing error margin value of reported UE TxTEG in RRC are proposed:

R[2-2207100](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2207100.zip) Corrections on the UE TxTEG report in TS 38.331 CATT CR Rel-17 38.331 17.1.0 3217 - F NR\_pos\_enh-Core

R[2-2207582](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2207582.zip) Correction on UE Tx TEG timing error margin in 38.331 ZTE, Sanechips CR Rel-17 38.331 17.1.0 3286 - B NR\_pos\_enh-Core

There are multiple timestamp in existing RRC UEPositioningAssistanceInfo message. So multiple instances will be reported in one RRC message.

The corrections on TxTEG associated with timestamp in RRC asn.1 as option#1:

***UEPositioningAssistanceInfo message***

-- ASN1START

-- TAG-UEPOSITIONINGASSISTANCEINFO-START

UEPositioningAssistanceInfo-r17 ::= SEQUENCE {

 criticalExtensions CHOICE {

 uePositioningAssistanceInfo-r17 UEPositioningAssistanceInfo-r17-IEs,

 criticalExtensionsFuture SEQUENCE {}

 }

}

UEPositioningAssistanceInfo-r17-IEs ::= SEQUENCE {

 ue-TxTEG-AssociationList-r17 UE-TxTEG-AssociationList-r17 OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension UEPositioningAssistanceInfo-v17xy-IEs OPTIONAL

}

UEPositioningAssistanceInfo-v17xy-IEs ::= SEQUENCE {

ue-Tx-TEG-AssociationListExt-v17xy UE-TxTEG-AssociationListExt-v17xy OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

UE-TxTEG-AssociationList-r17 ::= SEQUENCE (SIZE (1..maxNrOfTxTEGReport-r17)) OF UE-TxTEG-Association-r17

UE-TxTEG-AssociationListExt-v17xy ::= SEQUENCE (SIZE (1..maxNrOfTxTEGReport-r17)) OF UE-TxTEG-AssociationExt-v17xy

UE-TxTEG-Association-r17 ::= SEQUENCE {

 ue-TxTEG-ID-r17 INTEGER (0..maxNrOfTxTEG-ID-1-r17),

 nr-TimeStamp-r17 NR-TimeStamp-r17,

 associatedSRS-PosResourceIdList-r17 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResourceId-r16,

 servCellId-r17 ServCellIndex OPTIONAL,

}

UE-TxTEG-AssociationExt-v17xy ::= SEQUENCE {

 ue-TxTEG-TimingErrorMarginValue-r17 ENUMERATED { tc0, tc2, tc4, tc6, tc8, tc12, tc16, tc20, tc24, tc32, tc40, tc48, tc56, tc64, tc72, tc80} OPTIONAL,

 ...

}

NR-TimeStamp-r17 ::= SEQUENCE {

 nr-SFN-r17 INTEGER (0..1023),

 nr-Slot-r17 CHOICE {

 scs15-r17 INTEGER (0..9),

 scs30-r17 INTEGER (0..19),

 scs60-r17 INTEGER (0..39),

 scs120-r17 INTEGER (0..79)

 },

 ...

}

-- TAG-UEPOSITIONINGASSISTANCEINFO-STOP

-- ASN1STOP

|  |
| --- |
| *UEPositioningAssistanceInfo* field descriptions |
| ***nr-TimeStamp***This field specifies the latest time instance at which the association is valid prior to the reporting. |
| ***servCellID***This field indicates the serving cell information of SRS for positioning resources associated to the UE Tx TEG report. |
| ***ue-TxTEG-ID***Identifies the ID of UE Tx TEG. |
| ***ue-TxTEG-TimingErrorMarginValue*** This field indicates the timing error margin value *at nr-TimeStamp* indicated in *UE-TxTEG-Association*. Value *tc0* corresponds to 0 Tc, value *tc2* corresponds to 2 Tc and so on. "Tc” is defined in TS 38.211 clause 4.1. |

#option 1 is BC and reports the timing error margin values at timestamps.

ZTE proposed the corrections on UE TxTEG as option #2: One value in one report within multiple timestamps in UE-TxTEG-AssociationList:

***UEPositioningAssistanceInfo message***

-- ASN1START

-- TAG-UEPOSITIONINGASSISTANCEINFO-START

UEPositioningAssistanceInfo-r17 ::= SEQUENCE {

 criticalExtensions CHOICE {

 uePositioningAssistanceInfo-r17 UEPositioningAssistanceInfo-r17-IEs,

 criticalExtensionsFuture SEQUENCE {}

 }

}

UEPositioningAssistanceInfo-r17-IEs ::= SEQUENCE {

 ue-TxTEG-AssociationList-r17 UE-TxTEG-AssociationList-r17 OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension UE-TxTEG-TimingErrorMargin-v17xx-IEs OPTIONAL

}

UE-TxTEG-TimingErrorMargin-v17xx-IEs ::= SEQUENCE {

UE-TxTEG-TimingErrorMarginValue-v17xx-IEs ENUMERATED {tc0, tc2, tc4, tc6, tc8, tc12, tc16, tc20, tc24, tc32, tc40, tc48, tc56, tc64, tc72, tc80} OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL,

}

UE-TxTEG-AssociationList-r17 ::= SEQUENCE (SIZE (1..maxNrOfTxTEGReport-r17)) OF UE-TxTEG-Association-r17

UE-TxTEG-Association-r17 ::= SEQUENCE {

 ue-TxTEG-ID-r17 INTEGER (0..maxNrOfTxTEG-ID-1-r17),

 nr-TimeStamp-r17 NR-TimeStamp-r17,

 associatedSRS-PosResourceIdList-r17 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResourceId-r16,

 servCellId-r17 ServCellIndex OPTIONAL

}

NR-TimeStamp-r17 ::= SEQUENCE {

 nr-SFN-r17 INTEGER (0..1023),

 nr-Slot-r17 CHOICE {

 scs15-r17 INTEGER (0..9),

 scs30-r17 INTEGER (0..19),

 scs60-r17 INTEGER (0..39),

 scs120-r17 INTEGER (0..79)

 },

 ...

}

-- TAG-UEPOSITIONINGASSISTANCEINFO-STOP

-- ASN1STOP

|  |
| --- |
| ***UEPositioningAssistanceInfo* field descriptions** |
| ***nr-TimeStamp***This field specifies the latest time instance at which the association is valid prior to the reporting. |
| ***servCellID***This field indicates the serving cell information of SRS for positioning resources associated to the UE Tx TEG report. |
| ***ue-TxTEG-ID***Identifies the ID of UE Tx TEG. |
| ***UE-TxTEG-TimingErrorMarginValue***This field specifies the UE Tx TEG timing error margin value of all the UE Tx TEGs within one *UEPositioningAssistanceInfo*. Value tc0 corresponds to 0 Tc, tc2 corresponds to 2 Tc and so on (see TS 37.355[49]). |

 It seems that:

* Option #1 is BC and takes the timing error margin value associated with timestamp. The timing error margin value can be different at different timestamps.
* Option #2 is BC and only report only one timing error margin value for all timestamps in one UEPositioningAssistanceInfo message.

According to RAN4 LS, the reported value for Tx/Rx/RxTx TEGs can be different at different times. Option#2 doesn’t capture the changes at different times.

**Question 2: Which option is preferred as corrections of reported timing error margin in RRC asn.1? Please also provide views in the table.**

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| --- | --- | --- |
| Company |  Option 1/ 2/ Other | Comments |
| ZTE | Option 2 | 1. Firstly, to associate the timing error margin with all the Tx TEGs in one report is what RAN4 has specified:
	* UE/TRP selects one value M from {TE1, TE2, …, TEN} based on its implementation and indicate to gNB or LMF.
	* For UE that supports multiple Tx TEGs (TEG#1, TEG#2, …), the associated timing error margin value of each Tx TEG is M, which means the timing error difference between the transmission occasions of same or different SRS resources within the same Tx TEG is within the margin M.

For option 1, each Tx TEG timing error margin is not only associated with each timestamp, but also associate with each Tx TEG ID. That means if UE supports multiple Tx TEG IDs, there will be multiple Tx TEG timing error margin(more than one value M). That is not aligned with the RAN4’s LS.1. Secondly we think option 2 does not break the R4’s rule, i.e., reporting one timing error margin for all Tx TEGs in a UEPositioningAssistanceInfo, and UE can report other timing error margin values in next UEPositioningAssistanceInfo. That is also called ‘the reported value for Tx/Rx/RxTx TEGs can be different at different times’.
 |
| CATT | Option 1 | Option #1 is BC and takes the timing error margin value associated with timestamp. The timing error margin values can be different at different timestamps. Comments on ZTE:It is natural that the values of associated Tx TEGs are the same when the associated timestamp are the same. The ue-TxTEG-TimingErrorMarginValue is optional so it can be reported only once associated with the timestamp and only one TxTEG ID. Values of other TxTEG IDs at the same timestamp can be absent, since all TxTEGs share the same value at the same timestamp.The observed issue in Option #2 is that too many RRC messages will be reported to network when the values change at different times, because option#2 report only one value in one RRC message at one timestamp.  |
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**Summary:**

### 4.1.3 Corrections on procedure descriptions in RRC for UE TxTEG

Here are the corrections on procedure description in RRC for TxTEG as option#1based on asn.1 corrections above:

------------------------------------------ Start of option#1:-------------------------------------------------------------------------------

### 5.7.14 UE Positioning Assistance Information

#### 5.7.14.1 General



Figure 5.7.14.1-1: UE Positioning Assistance Information procedure

The UE Positioning Assistance Information procedure is used by UE to report the UE Positioning Assistance Information. The UE reports the association between UL-SRS resources for positioning, the UE Tx TEG ID and the timing error margin values at different timestamps.

#### 5.7.14.2 Initiation

A UE capable of providing the association between UL SRS Resource for positioning, UE Tx TEG ID and the timing error margin values at different timestamps in RRC\_CONNECTED may initiate the procedure upon being configured to provide this association information.

Upon initiation of the procedure, the UE shall:

1> initiate transmission of the *UEPositioningAssistanceInfo* message in accordance with 5.7.14.3 to provide the association.

------------------------------------------ End of option#1:-------------------------------------------------------------------------------

ZTE proposed the corrections on UE TxTEG as option #2:

 ------------------------------------------ Start of option#2:-------------------------------------------------------------------------------

#### **5.7.14.3 Actions related to transmission of *UEPositioningAssistanceInfo* message**

The UE shall set the contents of the *UEPositioningAssistanceInfo* message as follows:

1> if *ue-TxTEG-RequestUL-TDOA-Config* in *RRCReconfiguration* message is configured with *periodicReporting*;

2> for all the association changes store *ue-TxTEG-Association* corresponding to each *ue-TxTEG-ID* with *nr-TimeStamp*;

2> include the results in *ue-TxTEG-AssociationList* in the *UEPositioningAssistanceInfo* message on expiry of each configured period;

2> include one timing error margin value for all the UE Tx TEGs containing in *ue-TxTEG-AssociationList* in the *UEPositioningAssistanceInfo* message.

1> else if *ue-TxTEG-RequestUL-TDOA-Config* in *RRCReconfiguration* message is configured with *oneShot*:

2> identify the *ue-TxTEG-Association* corresponding to each *ue-TxTEG-ID* with *nr-TimeStamp*;

2> include the results in *ue-TxTEG-AssociationList* in the *UEPositioningAssistanceInfo* message only one time.

2> include one timing error margin value for all the UE Tx TEGs containing in *ue-TxTEG-AssociationList* in the *UEPositioningAssistanceInfo* message.

The UE shall submit the *UEPositioningAssistanceInfo* message to lower layers for transmission.

------------------------------------------ End of option#2:-------------------------------------------------------------------------------

**Question 3: Which option is preferred as corrections of procedure description for timing error margin report in RRC? Please also provide views in the table.**

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| --- | --- | --- |
| Company |  Option 1/ 2/ Other | Comments |
| ZTE | Option 2 | Option 2 gives a more specified procedure on how UE set the contents of *UEPositioningAssistanceInfo* message, which follows the rule of RRC spec  |
| CATT | Option 1 | We support to report the timing error margin values at different timestamps in one RRC message. |
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**Summary:**

###  Corrections for TRP TxTEG in LPP

There is no timestamp of TRP TxTEGs in UE-based in the existing LPP protocol. So there will be only one timing error margin value for all the TRP Tx TEGs.

Below please find the corrections in R-2207581.

----------------------------------------------------- Start of Corrections in R-2207581-------------------------------------------------

### **6.4.3 Common NR Positioning Information Elements**

#### ***–*** *TEGTimingErrorMargin*

The IE *TEGTimingErrorMargin* defines the timing error margin value of TEG(s). Value tc0 corresponds to 0 Tc, tc2 corresponds to 2 Tc and so on.

-- ASN1START

TEGTimingErrorMargin-r17 ::= ENUMERATED {tc0, tc2, tc4, tc6, tc8, tc12, tc16, tc20, tc24, tc32, tc40, tc48, tc56, tc64, tc72, tc80}

-- ASN1STOP

### **6.4.3 Common NR Positioning Information Elements**

#### **– *NR-DL-PRS-TRP-TEG-Info***

The IE *NR-DL-PRS-TRP-TEG-Info* is used by the location server to provide the association information of DL-PRS Resources with TRP Tx TEGs.

-- ASN1START

NR-DL-PRS-TRP-TEG-Info-r17 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

 NR-DL-PRS-TRP-TEG-InfoPerFreqLayer-r17

NR-DL-PRS-TRP-TEG-InfoPerFreqLayer-r17 ::= SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

 NR-DL-PRS-TRP-TEG-InfoPerTRP-r17

NR-DL-PRS-TRP-TEG-InfoPerTRP-r17 ::= SEQUENCE {

 dl-PRS-ID-r17 INTEGER (0..255),

 nr-PhysCellID-r17 NR-PhysCellID-r16 OPTIONAL, -- Need ON

 nr-CellGlobalID-r17 NCGI-r15 OPTIONAL, -- Need ON

 nr-ARFCN-r17 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON

 dl-PRS-TEG-InfoSet-r17 SEQUENCE (SIZE(1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF

 DL-PRS-TEG-InfoPerResourceSet-r17,

 ...,

[[

nr-TRP-TxTEG-TimingErrorMargin-r17 TEGTimingErrorMargin-r17 OPTIONAL, -- Need ON

]]

}

DL-PRS-TEG-InfoPerResourceSet-r17 ::= SEQUENCE (SIZE(1..nrMaxResourcesPerSet-r16)) OF

 DL-PRS-TEG-InfoElement-r17

DL-PRS-TEG-InfoElement-r17 ::= SEQUENCE {

 dl-prs-trp-Tx-TEG-ID-r17 INTEGER (0..maxNumOfTRP-TxTEGs-1-r17),

 ...

}

-- ASN1STOP

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| --- |
| *NR-DL-PRS-TRP-TEG-Info* field descriptions |
| ***dl-PRS-ID***This field specifies the DL-PRS ID of the TRP for which the TRP Tx TEG information is provided. |
| ***nr-PhysCellID***This field specifies the physical Cell-ID of the TRP for which the TRP Tx TEG information is provided, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***This field specifies the NCGI, the globally unique identity of a cell in NR, of the TRP for which the TRP Tx TEG information is provided, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***dl-PRS-TEG-InfoSet***This field specifies the TRP Tx TEG ID associated with the transmissions of each DL-PRS Resource of the TRP. The *dl-prs-trp-Tx-TEG-ID* in *dl-PRS-TEG-InfoSet* is associated with the *nr-DL-PRS-ResourceID* of *NR-DL-PRS-Info* using the same structure and order. |
| ***nr-TRP-TxTEG-TimingErrorMargin*** This field specifies the timing error margin value for all the TRP Tx TEGs contained within one *NR-DL-PRS-TRP-TEG-InfoPerTRP*. |

----------------------------------------------------- End of Corrections in R-2207581--------------------------------------------------

**Question 4: Do you agree the corrections for TRP TxTEG in LPP? Please also provide views in the table.**

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| --- | --- | --- |
| Company |  Yes/ No | Comments |
| ZTE | Yes | For this TRP Tx TEG timing error margin, it is also different at different times when there is no timestamp at all. |
| CATT | Yes |  |
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**Summary:**

## 4.2 Timing error margin of UE Rx/RxTx TEG

### 4.2.1 Analysis on UE Rx/RxTx TEG framework LS from RAN4

Here is the definition in TS 38.305 V17.1.0:

**UE Rx 'Timing Error Group' (UE Rx TEG):** Rx timing errors, associated with UE reporting of one or more DL measurements (RSTD), that are within a certain margin.

**UE RxTx 'Timing Error Group' (UE RxTx TEG):** Rx timing errors and Tx timing errors, associated with UE reporting of one or more UE Rx-Tx time difference measurements, which have the 'Rx timing errors+Tx timing errors' differences within a certain margin.

**An Rx TEG** is associated with the reporting of a group of timing measurements, whose Rx timing error differences are within a certain margin. For an Rx-Tx time difference measurement, it can be impacted by both Rx and Tx timing errors. Thus, an RxTx TEG is defined to be associated with the reporting of one or more Rx-Tx time difference measurements, whose 'Rx timing error + Tx timing error' differences are within a certain margin.

**The usage of the TEG ID** tagged with either the transmission of reference signals or the timing measurements from the reception of reference signals would be helpful to support the differential operation of the timing measurement associated with the same TEG for canceling or reducing the timing error to the margin associated with the TEG ID. For example, if two UL SRS transmissions are associated with the same UE Tx TEG ID, the LMF may perform the differential operation on the UL RTOA measurements obtained from the two UL SRS reception, so that the remaining UE Tx timing error can be reduced to the margin associated with the UE Tx TEG ID.

In RAN4#103e meeting, RAN4 also discussed the timing error margins of UE/TRP Tx/Rx/RxTx TEG , and the following agreements are made:

|  |
| --- |
| * Candidate timing error margins for UE/TRP Rx TEGs:
	+ 0Tc, 2 Tc, 4 Tc, 6 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 56 Tc, 64 Tc, 72 Tc, 80 Tc.
* For UE/TRP Tx TEGs, Use the same candidate timing error margins as UE/TRP Rx TEG.
* The reported value for Tx TEGs, Rx TEGs and RxTx TEGs can be different.
* The reported value for Tx/Rx/RxTx TEGs can be different at different times.
 |

So we can conclude that:

* The candidate timing error margins for UE Rx TEGs is: 0Tc, 2 Tc, 4 Tc, 6 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 56 Tc, 64 Tc, 72 Tc, 80 Tc.
* The reported timing error margins for UE Rx TEGs can be different at different times, i.e. reported M per timestamp.
* The error margin can be different for different times (instances). At any given instance (at timestamp), there is only one value for all Tx TEGs, one value for all Rx TEGs, and one value for RxTx TEGs for a UE or for a TRP.
* There is no candidate timing error margins for UE RxTx TEGs yet in RAN4 LS.

**Question 5: Do you agree that the timing error margins of UE Rx/RxTx TEGs can be different at different timestamps? Please also provide views in the table.**

|  |  |  |
| --- | --- | --- |
| Company |  Yes/ No | Comments |
| ZTE | No (if the Q5 is the same as Q1 to change ‘times’ to ‘timestamp’) | we don’t think that means UE Rx/RxTx TEG timing error margin value should be compulsively associated with each timestamp. 1. Note that R4’s LS does not say timing error margin value should be different at different timestamps, but different times. The time can be time period since timing error margins may vary due to hardware/environment in different time period.

In RRC, UE can send *UEPositioningAssistanceInfo*at different times, that is also called ‘the timing error margins of UE Tx TEGs can be different at different times’.In LPP, UE can send different measurement instanceat different times, that is also called ‘the timing error margins of UE Tx TEGs can be different at different times’.1. If UE Tx TEG margin is associated with different timestamps, UE Tx TEG margin will also be associated with different UE Tx TEG IDs. Then for different UE Tx TEG IDs in a single report, UE may report multiple Tx TEG margin values---this is not aligned with R4’s LS-----they indicates if UE support multiple TEGs UE should choose one margin value.
 |
| CATT | Yes | “**at different times**” in RAN4 means “at different timestamps” in LPP.So we agree the timing error margins of UE Rx/RxTx TEGs can be different at different timestamps. |
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**Question 6: Do you agree at any given instance at one timestamp, there is only one value for all Tx TEGs, one value for all Rx TEGs, and one value for RxTx TEGs for a UE or for a TRP? Please also provide views in the table.**

|  |  |  |
| --- | --- | --- |
| Company |  Yes/ No | Comments |
| ZTE | No | In a valid time period (for example, within the time period of one measurement instance in a measurement report), there is only one value for all Tx TEGs, one value for all Rx TEGs, and one value for RxTx TEGs for a UE |
| CATT | Yes | This is our understanding based on RAN1 and RAN4 LS: at any given instance at one timestamp, there is only one value for all Tx TEGs, one value for all Rx TEGs, and one value for RxTx TEGs for a UE or for a TRP.However there may be different values given different instances at different timestamps because RAN4 says:• The reported value for Tx/Rx/RxTx TEGs can be different at different times. |
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**Summary:**

### 4.2.2 Understanding of instances in measurement report in LPP

‘Timestamp of a UE measurement instance’ is introduced in RRC parameters from RAN1 in R[2-2206916](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2206916.zip).

R[2-2206916](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20119-e%5C2%20During%5CDocs%5CR2-2206916.zip) LS on updates of RRC parameters for Rel-17 positioning enhancements (R1-2205406; contact: CATT) RAN1 LS in Rel-17 NR\_pos\_enh-Core To:RAN2, RAN3 Cc:RAN4

|  |  |  |
| --- | --- | --- |
| Timestamp of a UE measurement instance | The timestamp of a UE measurement instance. One measurement report may contain multiple measurement instances of the same or different types of the measurements. | Agreement:Support enabling• A UE to report one or more measurement instances (of RSTD, DL RSRP, and/or UE Rx-Tx time difference measurements) in a single measurement report to LMF for UE-assisted positioning, and • A TRP to report one or more measurement instances (of RTOA, UL RSRP, and/or gNB Rx-Tx time difference measurements) in a single measurement report to LMF, and• Each measurement instance is reported with its own timestamp• Note 1: A measurement instance refers to one or more measurements, which can either be the same or different types, which are obtained from the same DL PRS resource(s), or the same UL SRS resource(s).• Note 2: This enhancement has no intention to change the mapping of measurement types to Rel-16 positioning techniques and no intention to introduce new positioning techniques either. |

|  |  |  |
| --- | --- | --- |
| maximum measurement instances | The maximum measurement instances in a single measurement report | 32 |

It is clear that one instance defined in RAN1 has its own timestamp, and there are up to 32 measurement instances (of RSTD, DL RSRP, and/or UE Rx-Tx time difference measurements) in a single measurement report with each timestamp. It means that one instance defined in RAN1 has one timestamp.

However there are up to 32 timestamps in one instance report in existing LPP protocols, as below *nr-TimeStamp-r16*:

-- ASN1START

NR-DL-TDOA-ProvideLocationInformation-r16 ::= SEQUENCE {

 nr-DL-TDOA-SignalMeasurementInformation-r16

 NR-DL-TDOA-SignalMeasurementInformation-r16

 OPTIONAL,

 nr-dl-tdoa-LocationInformation-r16 NR-DL-TDOA-LocationInformation-r16

 OPTIONAL,

 nr-DL-TDOA-Error-r16 NR-DL-TDOA-Error-r16 OPTIONAL,

 ...,

 [[

 nr-DL-TDOA-SignalMeasurementInstances-r17

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

 NR-DL-TDOA-SignalMeasurementInformation-r16

 OPTIONAL, -- Cond batchUEA

 nr-DL-TDOA-LocationInformationInstances-r17

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

 NR-DL-TDOA-LocationInformation-r16

 OPTIONAL -- Cond batchUEB

 ]]

}

-- ASN1STOP

-- ASN1START

NR-DL-TDOA-SignalMeasurementInformation-r16 ::= SEQUENCE {

 dl-PRS-ReferenceInfo-r16 DL-PRS-ID-Info-r16,

 nr-DL-TDOA-MeasList-r16 NR-DL-TDOA-MeasList-r16,

 ...

}

NR-DL-TDOA-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-TDOA-MeasElement-r16

NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {

 dl-PRS-ID-r16 INTEGER (0..255),

 nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL,

 nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

 nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL,

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-RSTD-r16 CHOICE {

 k0-r16 INTEGER (0..1970049),

 k1-r16 INTEGER (0..985025),

 k2-r16 INTEGER (0..492513),

 k3-r16 INTEGER (0..246257),

 k4-r16 INTEGER (0..123129),

 k5-r16 INTEGER (0..61565),

 ...

 },

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,

 nr-DL-TDOA-AdditionalMeasurements-r16

 NR-DL-TDOA-AdditionalMeasurements-r16 OPTIONAL,

 ...,

 [[

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-Result-r17 INTEGER (0..126) OPTIONAL,

 nr-los-nlos-Indicator-r17 CHOICE {

 perTRP-r17 LOS-NLOS-Indicator-r17,

 perResource-r17 LOS-NLOS-Indicator-r17

 } OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 nr-DL-TDOA-AdditionalMeasurementsExt-r17

 NR-DL-TDOA-AdditionalMeasurementsExt-r17 OPTIONAL

 ]]

}

NR-DL-TDOA-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

 NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasTDOA-r17)) OF

 NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalMeasurementElement-r16 ::= SEQUENCE {

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-RSTD-ResultDiff-r16 CHOICE {

 k0-r16 INTEGER (0..8191),

 k1-r16 INTEGER (0..4095),

 k2-r16 INTEGER (0..2047),

 k3-r16 INTEGER (0..1023),

 k4-r16 INTEGER (0..511),

 k5-r16 INTEGER (0..255),

 ...

 },

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 ...,

 [[

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-ResultDiff-r17

 INTEGER (0..61) OPTIONAL,

 nr-los-nlos-IndicatorPerResource-r17

 LOS-NLOS-Indicator-r17 OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL

 ]]

}

-- ASN1STOP

**There are gaps of the understanding on instances in one measurement report between RAN1 and RAN2.**

* RAN1 says Each measurement instance is reported with its own timestamp. The maximum measurement instances in a single measurement report is 32.
* RAN2 designed Each measurement instance is reported with up to 32 timestamps. There are 32 measurement instances(RAN2) in a single measurement report. The total number of timestamps in a single measurement report includes 32x32= 1024 timestamps!

Before we jump into the timing error margin values in measurement report, we need to figure out the understanding of instances between RAN1 and RAN2.

**Question 7: Do you agree RAN2 should follow the LS in RAN1: each measurement instance is reported with its own timestamp, and maximum measurement instance in a single measurement report is 32?**

|  |  |  |
| --- | --- | --- |
| Company |  Yes/ No | Comments |
| ZTE | Yes | We think ‘Each measurement instance is reported with its own timestamp’ does not necessarily mean ‘each measurement instance is associated with one timestamp’. It is just to clarify that measurement instances set the timestamps separately/independently with each other. |
| CATT | Yes | The RRC parameter table (R2-2206916) says: each measurement instance is reported with its own timestamp when Timestamp of a UE measurement instance is introduced.And the maximum measurement instance in a single measurement report is 32 according to the RRC table.So the each measurement instance is reported associated with timestamp in LPP from RAN2’s perspective. |
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**Question 8: Do you agree there is an issue which includes 1024 timestamps more than 32 timestamps required in RAN1 in existing measurement report? Do you agree to fix this issue?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Yes(issue)/No |  Yes(fix) /No | Comments |
| ZTE | NO | NO | If R1’s statement ‘Each measurement instance is reported with its own timestamp’ is just to clarify that measurement instances work separately with each other on the setting of timestamps, then no change is needed |
| CATT | Yes | Yes | It is said in RAN1 LS: Each measurement instance is reported with its own timestamp. The maximum measurement instances in a single measurement report is 32.Each instance report in existing LPP has more than one timestamps. Which timestamp should be for **each measurement instance reported with its own timestamp** in existing LPP? One instance is supposed to be associated with one timestamp in LPP. |
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**Summary:**

### 4.2.3 Corrections for UE RxTEG in LPP

The root cause to different understandings on timing error margin values in measurement report is instance. If companies agree that at any given instance (at timestamp), there is only one value for all Tx TEGs, one value for all Rx TEGs, and one value for RxTx TEGs for a UE or for a TRP, there are two candidate corrections on the timing error margin values of UE RxTEG in LPP:

* Option#1: The timing error margin value for all the UE Rx TEGs is associated with timestamp.
* Option#2: The timing error margin value for all the UE Rx TEGs without timestamp.

Below please find the corrections of option #1 and option #2.

### Option #1:

-------------------------------Start of option #1--------------------------------------------------------------------------------------

#### 6.5.10.4 NR DL-TDOA Location Information Elements

#### – *NR-DL-TDOA-SignalMeasurementInformation*

-- ASN1START

NR-DL-TDOA-SignalMeasurementInformation-r16 ::= SEQUENCE {

 dl-PRS-ReferenceInfo-r16 DL-PRS-ID-Info-r16,

 nr-DL-TDOA-MeasList-r16 NR-DL-TDOA-MeasList-r16,

 ...

}

NR-DL-TDOA-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-TDOA-MeasElement-r16

NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {

 dl-PRS-ID-r16 INTEGER (0..255),

 nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL,

 nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

 nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL,

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-RSTD-r16 CHOICE {

 k0-r16 INTEGER (0..1970049),

 k1-r16 INTEGER (0..985025),

 k2-r16 INTEGER (0..492513),

 k3-r16 INTEGER (0..246257),

 k4-r16 INTEGER (0..123129),

 k5-r16 INTEGER (0..61565),

 ...

 },

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,

 nr-DL-TDOA-AdditionalMeasurements-r16

 NR-DL-TDOA-AdditionalMeasurements-r16 OPTIONAL,

 ...,

 [[

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-Result-r17 INTEGER (0..126) OPTIONAL,

 nr-los-nlos-Indicator-r17 CHOICE {

 perTRP-r17 LOS-NLOS-Indicator-r17,

 perResource-r17 LOS-NLOS-Indicator-r17

 } OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 nr-DL-TDOA-AdditionalMeasurementsExt-r17

 NR-DL-TDOA-AdditionalMeasurementsExt-r17 OPTIONAL,

 ]]

 [[

 nr-UE-Rx-TEG-Value-r17 ENUMERATED {

 tc0, tc2, tc4, tc6, tc8, tc12, tc16, tc20, tc24, tc32,

 tc40, tc48, tc56, tc64, tc72, tc80

 } OPTIONAL

 ]]

}

NR-DL-TDOA-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

 NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasTDOA-r17)) OF

 NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalMeasurementElement-r16 ::= SEQUENCE {

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-RSTD-ResultDiff-r16 CHOICE {

 k0-r16 INTEGER (0..8191),

 k1-r16 INTEGER (0..4095),

 k2-r16 INTEGER (0..2047),

 k3-r16 INTEGER (0..1023),

 k4-r16 INTEGER (0..511),

 k5-r16 INTEGER (0..255),

 ...

 },

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 ...,

 [[

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-ResultDiff-r17

 INTEGER (0..61) OPTIONAL,

 nr-los-nlos-IndicatorPerResource-r17

 LOS-NLOS-Indicator-r17 OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 [[

 nr-UE-Rx-TEG-Value-r17 ENUMERATED {

 tc0, tc2, tc4, tc6, tc8, tc12, tc16, tc20, tc24, tc32,

 tc40, tc48, tc56, tc64, tc72, tc80

 } OPTIONAL

 ]]

}

-- ASN1STOP

| *NR-DL-TDOA-SignalMeasurementInformation* field descriptions |
| --- |
| ***nr-UE-Rx-TEG-Value***This field provides the the associated timing error margin value of *nr-UE-Rx-TEG-ID*. Value ‘*tc0*’ corresponds to 0 Tc, value ‘*tc2*’ corresponds to 2 Tc and so on. "Tc” is defined in TS 38.211 clause 4.1.  |

#### 6.5.12.4 NR Multi-RTT Location Information Elements

#### – *NR-Multi-RTT-SignalMeasurementInformation*

-- ASN1START

NR-Multi-RTT-SignalMeasurementInformation-r16 ::= SEQUENCE {

 nr-Multi-RTT-MeasList-r16 NR-Multi-RTT-MeasList-r16,

 nr-NTA-Offset-r16 ENUMERATED { nTA1, nTA2, nTA3, nTA4, ... } OPTIONAL,

 ...,

 [[

 nr-SRS-TxTEG-Set-r17 SEQUENCE (SIZE(1..maxTxTEG-Sets-r17)) OF

 NR-SRS-TxTEG-Element-r17 OPTIONAL

 -- Cond Case2-3

 ]]

}

NR-Multi-RTT-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-Multi-RTT-MeasElement-r16

NR-Multi-RTT-MeasElement-r16 ::= SEQUENCE {

 dl-PRS-ID-r16 INTEGER (0..255),

 nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL,

 nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

 nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL,

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

 nr-UE-RxTxTimeDiff-r16 CHOICE {

 k0-r16 INTEGER (0..1970049),

 k1-r16 INTEGER (0..985025),

 k2-r16 INTEGER (0..492513),

 k3-r16 INTEGER (0..246257),

 k4-r16 INTEGER (0..123129),

 k5-r16 INTEGER (0..61565),

 ...

 },

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,

 nr-Multi-RTT-AdditionalMeasurements-r16

 NR-Multi-RTT-AdditionalMeasurements-r16 OPTIONAL,

 ...,

 [[

 nr-UE-RxTx-TEG-Info-r17 NR-UE-RxTx-TEG-Info-r17 OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-Result-r17 INTEGER (0..126) OPTIONAL,

 nr-los-nlos-Indicator-r17 CHOICE {

 perTRP-r17 LOS-NLOS-Indicator-r17,

 perResource-r17 LOS-NLOS-Indicator-r17

 } OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 nr-Multi-RTT-AdditionalMeasurementsExt-r17

 NR-Multi-RTT-AdditionalMeasurementsExt-r17 OPTIONAL,

 ]]

 [[

 nr-UE-RxTx-TEG-Value-r17 NR-UE-RxTx-TEG-Value-r17 OPTIONAL

 ]]

}

NR-Multi-RTT-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

 NR-Multi-RTT-AdditionalMeasurementElement-r16

NR-Multi-RTT-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasRTT-r17)) OF

 NR-Multi-RTT-AdditionalMeasurementElement-r16

NR-Multi-RTT-AdditionalMeasurementElement-r16 ::= SEQUENCE {

 nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

 nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,

 nr-UE-RxTxTimeDiffAdditional-r16 CHOICE {

 k0-r16 INTEGER (0..8191),

 k1-r16 INTEGER (0..4095),

 k2-r16 INTEGER (0..2047),

 k3-r16 INTEGER (0..1023),

 k4-r16 INTEGER (0..511),

 k5-r16 INTEGER (0..255),

 ...

 },

 nr-TimingQuality-r16 NR-TimingQuality-r16,

 nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

 nr-TimeStamp-r16 NR-TimeStamp-r16,

 ...,

 [[

 nr-UE-RxTx-TEG-Info-r17 NR-UE-RxTx-TEG-Info-r17 OPTIONAL,

 nr-DL-PRS-FirstPathRSRP-ResultDiff-r17 INTEGER (0..61) OPTIONAL,

 nr-los-nlos-IndicatorPerResource-r17 LOS-NLOS-Indicator-r17 OPTIONAL,

 nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

 ]]

 [[

 nr-UE-RxTx-TEG-Value-r17 NR-UE-RxTx-TEG-Value-r17 OPTIONAL

 ]]

}

NR-SRS-TxTEG-Element-r17 ::= SEQUENCE {

 nr-TimeStamp-r17 NR-TimeStamp-r16 OPTIONAL, -- Need OP

 nr-UE-Tx-TEG-ID-r17 INTEGER (0..maxNumOfTxTEGs-1-r17),

 carrierFreq-r17 SEQUENCE {

 absoluteFrequencyPointA-r17 ARFCN-ValueNR-r15,

 offsetToPointA-r17 INTEGER (0..2199)

 } OPTIONAL,

 srs-PosResourceList-r17 SEQUENCE (SIZE (1..maxNumOfSRS-PosResources-r17)) OF

 INTEGER (0..maxNumOfSRS-PosResources-1-r17),

 ...,

 [[

 nr-UE-Tx-TEG-Value-r17 ENUMERATED {

 tc0, tc2, tc4, tc6, tc8, tc12, tc16, tc20, tc24, tc32,

 tc40, tc48, tc56, tc64, tc72, tc80

 } OPTIONAL

 ]]

}

NR-UE-RxTx-TEG-Info-r17 ::= CHOICE {

 case1-r17 SEQUENCE {

 nr-UE-RxTx-TEG-ID-r17 INTEGER (0..maxNumOfRxTxTEGs-1-r17)

 },

 case2-r17 SEQUENCE {

 nr-UE-RxTx-TEG-ID-r17 INTEGER (0..maxNumOfRxTxTEGs-1-r17),

 nr-UE-Tx-TEG-Index-r17 INTEGER (1..maxTxTEG-Sets-r17)

 },

 case3-r17 SEQUENCE {

 nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17),

 nr-UE-Tx-TEG-Index-r17 INTEGER (1..maxTxTEG-Sets-r17)

 },

 ...

}

NR-UE-RxTx-TEG-Value-r17 ::= CHOICE {

 case1-2-r17 SEQUENCE {

 nr-UE-RxTx-TEG-Value-r17 ENUMERATED { ffs }

 },

 case3-r17 SEQUENCE {

 nr-UE-Rx-TEG-Value-r17 ENUMERATED {

 tc0, tc2, tc4, tc6, tc8, tc12, tc16, tc20, tc24, tc32,

 tc40, tc48, tc56, tc64, tc72, tc80

 }

 },

 ...

}

-- ASN1STOP

|  |
| --- |
| *NR-Multi-RTT-SignalMeasurementInformation* field descriptions |
| ***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.- *nr-UE-Tx-TEG-Value* specifies is the timing error margin value of *nr-UE-Tx-TEG-ID*. Value ‘*tc0*’ corresponds to 0 Tc, value ‘*tc2*’ corresponds to 2 Tc and so on. "Tc” is defined in TS 38.211 clause 4.1. |
| ***NR-UE-RxTx-TEG-Value***It specifies is the timing error margin value of the ID in *nr-UE-RxTx-TEG-Info*.- ***case1-2*** provides the timing error margin value of *nr-UE-RxTx-TEG-ID* in *nr-UE-RxTx-TEG-Info*;- ***case3*** provides the timing error margin value of *nr-UE-Rx-TEG-ID* in *nr-UE-RxTx-TEG-Info*.Value ‘*tc0*’ corresponds to 0 Tc, value ‘*tc2*’ corresponds to 2 Tc and so on. "Tc” is defined in TS 38.211 clause 4.1. |

----------------------------------------------End of option #1-----------------------------------------------------------------------------

Note: If there is no candidate timing error margins for UE RxTx TEGs from RAN4, the nr-UE-RxTx-TEG-Value-r17 will be deleted.

 case1-2-r17 SEQUENCE {

 nr-UE-RxTx-TEG-Value-r17 ENUMERATED { ffs }

### Option #2:

-------------------------------Start of option #2--------------------------------------------------------------------------------------

**6.5.10.4 NR DL-TDOA Location Information Elements**

– NR-DL-TDOA-SignalMeasurementInformation

-- ASN1START

NR-DL-TDOA-SignalMeasurementInformation-r16 ::= SEQUENCE {

 dl-PRS-ReferenceInfo-r16 DL-PRS-ID-Info-r16,

 nr-DL-TDOA-MeasList-r16 NR-DL-TDOA-MeasList-r16,

 ...,

[[

nr-DL-TDOA-UE-RxTEG-TimingErrorMargin-r17 TEGTimingErrorMargin-r17, OPTIONAL, --Cond UERxTEG

]]

}

|  |  |
| --- | --- |
| **Conditional presence** | **Explanation** |
| *UERxTEG* | The field is optionally present if the field *nr-UE-Rx-TEG-ID* is present; otherwise it is not present. |

|  |
| --- |
| *NR-DL-TDOA-SignalMeasurementInformation* field descriptions |
| ***nr-dl-TDOA-UE-RxTEG-TimingErrorMargin***This field specifies the UE Rx TEG timing error margin value for all the Rx TEGs within one *NR-DL-TDOA-SignalMeasurementInformation*. |

#### **6.5.12.4 NR Multi-RTT Location Information Elements**

##### – NR-Multi-RTT-SignalMeasurementInformation

The IE *NR-Multi-RTT-SignalMeasurementInformation* is used by the target device to provide NR Multi-RTT measurements to the location server.

-- ASN1START

NR-Multi-RTT-SignalMeasurementInformation-r16 ::= SEQUENCE {

 nr-Multi-RTT-MeasList-r16 NR-Multi-RTT-MeasList-r16,

 nr-NTA-Offset-r16 ENUMERATED { nTA1, nTA2, nTA3, nTA4, ... } OPTIONAL,

 ...,

 [[

 nr-SRS-TxTEG-Set-r17 SEQUENCE (SIZE(1..maxTxTEG-Sets-r17)) OF

 NR-SRS-TxTEG-Element-r17 OPTIONAL

 -- Cond Case2-3

 ]],

[[

nr-Multi-RTT-UE-TEG-TimingErrorMargin-r17 SEQUENCE {

nr-Multi-RTT-UE-RxTEG-TimingErrorMargin-r17 TEGTimingErrorMargin-r17 OPTIONAL --Cond Case3

nr-Multi-RTT-UE-TxTEG-TimingErrorMargin-r17 TEGTimingErrorMargin-r17 OPTIONAL --Cond Case2-3

nr-Multi-RTT-UE-RxTxTEG-TimingErrorMargin-r17 TEGTimingErrorMargin-r17 OPTIONAL --Cond Case1-2

}

]]

}

|  |  |
| --- | --- |
| Conditional presence | Explanation |
| *Case2-3* | The field is mandatory present if the IE *NR-UE-RxTx-TEG-Info* is provided for choice's *case2* and *case3*. Otherwise it is not present. |
| *Case3* | The field is mandatory present if the IE NR-UE-RxTx-TEG-Info is provided for choice's *case3*. Otherwise it is not present. |
| *Case1-2* | The field is mandatory present if the IE NR-UE-RxTx-TEG-Info is provided for choice's *case1* and *case2*. Otherwise it is not present. |

|  |
| --- |
| *NR-Multi-RTT-SignalMeasurementInformation* field descriptions |
| ***nr-Multi-RTT-UE-TEG-TimingErrorMargin***This field specifies the UE Rx or Tx or RxTx TEG timing error values for all the Rx or Tx or RxTx TEGs within a NR-*Multi-RTT-SignalMeasurementInformation*. This field contains one or more of TEG timing error margin value, UE Tx TEG timing error margin value and UE RxTx TEG timing error margin value according to the reported *nr-UE-RxTx-TEG-Info* case 1, 2 or 3 in the same NR-*Multi-RTT-SignalMeasurementInformation.* |

-------------------------------End of option #2--------------------------------------------------------------------------------------

**Question 9: Which option is preferred as corrections for UE RxTEG in LPP? Please also provide views in the table.**

|  |  |  |
| --- | --- | --- |
| Company |  Option 1/ 2/ Other | Comments |
| ZTE | Option 2 | **In technical:**Take UE Rx TEG for example, RAN4’s LS indicates if UE supports multiple Rx TEGs, UE should only choose one Rx TEG timing error value to apply to these multiple Rx TEGs. That means Rx TEG ID and Rx TEG timing error value should NOT be associated in one measurement report. If option 1 is adopted:Each Rx TEG ID is associated with each timestamp and with each Rx TEG timing error margin value. In the below table if UE supports Rx TEG ID1 and Rx TEG ID 2 in measurement instance 1, UE may report 2 margin values corresponding to Rx TEG1 and Rx TEG ID2, respectively, and it is not align with R4’s LS.

|  |
| --- |
| measurement instance 1 |
| Rx TEG ID 1 | Rx TEG ID 2 |
| Timestamp 1 | Timestamp 2 |
| Margin value 1 | Margin value 2 |

If option 2 is adopted:Each Rx TEG ID is associated with each timestamp, and Rx TEG timing error margin value remains the same within one measurement instance among the reported timestamps. This can surely guarantee that for any Rx TEG IDs that UE supports in a measurement instance, different Rx TEGs can report the same Rx TEG timing error margin value. And this is aligned with RAN4’s LS.

|  |
| --- |
| measurement instance 1 |
| Rx TEG ID 1 | Rx TEG ID 2 |
| Timestamp 1 | Timestamp 2 |
| Margin value 1 |

**In spec writing:**Another advantage of option 2 is that, it introduces a separate margin value IE to be quoted in many other places, which increase the specification readability. Option 2 also introduces the condition tag of timing error margin in multi-RTT case, which is also aligned with current multi-RTT report logic. |
| CATT | Option 1 | The timing error margin value should be associated with timestamps, considering: * At any given instance (at timestamp), there is only one value for all Tx TEGs, one value for all Rx TEGs, and one value for RxTx TEGs for a UE or for a TRP.
* The reported value for Tx/Rx/RxTx TEGs can be different at different times.

There are more than one timestamps in one instance in existing LPP, so the timing error margin value may change at different timestamp. Difference between option #1 and option #2 is the understanding on instance associated with timestamp. There are up to 32 timestamps in one instance in existing LPP:Option #1 thinks each timestamp may be different, so the timing error margin may be different. Comment on ZTE: Margin value can be absent when other TEG IDs is associated at the same timestamp.It seems that option #2 takes one timestamp associated with this ‘instance’. Then question comes out: which timestamp is associated with this instance?  |
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**Summary:**

**Question 10: Do you agree to send an LS to RAN4 and RAN1 for further clarification if we cannot conclude the Timing error margin of TEG and instance?**

|  |  |  |
| --- | --- | --- |
| Company |  Yes/ No | Comments |
| ZTE | Yes | If we can not conclude, we should ask R4:1. Whether the statement ‘The reported value for Tx/Rx/RxTx TEGs can be different at different times’ means timing error margin value should be compulsively associated with each timestamp in the measurement report
 |
| CATT | Yes | A clarification on measurement instance at timestamp, and timing error margin values for all TEGs at different timestamps is required.* + - 1. Is each reported measurement instance associated with its own timestamp?
			2. May timing error margin values for all TEGs be different at different timestamps?
 |
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**Summary:**

# 5 Conclusion

Based on the discussion in section 4 we propose the following:

**TBD**