3GPP TSG RAN WG1 Meeting #109e R1-2207689

**Toulouse, France, August 22nd – 26th, 2022**

**Source: Moderator (CATT)**

**Title: FL Summary for mitigating UE/gNB Rx/Tx timing delays**

**Agenda item: 8.5**

**Document for: Discussion and Decision**

# Introduction

This document provides a summary of the issues related to mitigating UE/gNB Rx/Tx timing delays in AI 8.5 for Rel-17 Positioning enhancement.

# Maximum number of Tx TEG per measurement instance

Background

Agreement (RAN1#109-e):

Include the following in the reply LS to RAN4, RAN2, RAN3:

* In RAN1’s understanding, each measurement instance may allow up to 8 reports (or changes) of the TEG-SRS association information for each TEG ID.
* RAN1 kindly requests RAN4 for the confirmation of the understanding.

Agreement (RAN1#109-e):

* Support up to 32 measurement instances in a single measurement report.
* Inform RAN2/RAN3 on RAN1’s decision

In RRC parameters to RAN2 (R1-2205539), it has:

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter name in the spec** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** |
| maxNumOfUE-TxTEG | The maximum number of UE-TxTEG per UE | 8 | Per UE |

Submitted Proposal

* ***(ZTE, R1-2205912 [2]) Proposal 1:*** *The maximum number of TEG-SRS association information per measurement instance should be up to 8\*8=64.*
  + An LS is needed to RAN2 to correct TS 37.355

FL Comment

It seems the LS from RAN1 to RAN2 provides the clear information that the maximum number of Tx TEG per UE is 8, and there each measurement instance allows up to 8 reports (or changes) of the Tx TEG association for each TEG ID. It will be up to RAN2 on how to define the LPP message to support RAN1’s agreement. Thus, in FL’s view there is no need for RAN1 to send another LS to RAN2 on the maximum number of TEG-SRS association information per measurement instance. The proponent may bring their proposal directly to RAN2.

Comments

|  |  |
| --- | --- |
| **Company** | **comments** |
| vivo | The same view as FL |
| ZTE | If RAN1 can confirm RAN2 spec is not aligned with RAN1’s previous agreement, an LS or even a conclusion in RAN1 would be beneficial as we did before. |
| Qualcomm | Same view as the FL |
| CATT | The issue may be related how how RAN2 consider the 8 reports (or changes) of the Tx TEG association within an each measurement instance, since in current structure of LPP message, there are multiple timestamps within one an IE that may corresponds to one measurement instance in RAN1’s agreement. Thus, we have the same view as FL that to RAN2 to decide how to implement RAN1’s agreement in RAN2’s specification. |
| FL | In FL’s understanding, RAN2 is als discussing the same issue. |
| Huawei, HiSilicon | This is not necessary as it results in NBC change of ASN.1.  Anyway from RAN1 perspective, up to 64 associations can be reported per instance, and having a number of 256 associations is considered future proof from RAN2 perspective. |

# UE Tx TEG Reporting (TEG changes/updates/Reset)

Submitted Proposals

* ***(Nokia,*** ***R1- 2206486[6]) Proposal 8: Proposal 8: If UE supports that multiple Tx TEGs and different Tx antenna panels transmit different SRS resources which are associated with the same Tx TEG, it needs to report additional information (e.g., consistency information) to help LMF calculate differential measurement using measurements containing the same timing error.***

FL Comments

The intention of the proposal, in FL’s undersatdning, is to further separate the SRS resources within a Tx TEG which have smaller TX timing differences between them (e.g., the SRS resources transmitted from the one antenna panel from the SRS resources transmitted from the one antenna panel). In FL’s view, it may not be necessary to do so, since the TEG-SRS association and the error margin is up to UE to define. It allows the UE to associate the SRS resources transmitted from the same antenna panel into one Tx TEG with possibly smaller error margin, or SRS resources transmitted from more than one antenna panel into one Tx TEG with the same or a larger error margin. It is all up to UE implementation to select the best way to group the SRS resources into the Tx ETGs.

Thus, in FL’s view, no change is needed. How to define the association of Tx TEGs and provide the corresponding error margins properly can/should be handled by UE/TRP implementation.

Comments

|  |  |
| --- | --- |
| **Company** | **comments** |
| vivo | The same view as FL |
| ZTE | The same view as FL. As we discussed in last meeting, when TEG-SRS association is changed, the assoiciation mapping will be updated with a time stamp, nothing is unclear based on current RAN2 spec. |
| Qualcomm | Same view as FL |
| CATT | Same view as FL |
| Huawei, HiSilicon | We think that such consistent information is inherent in a single report, i.e. the same TEG ID is consistent with specific group delay within a report, regardless of whenever or whichever SRS is associated with it, and the same TEG ID is not consistent across different reports. |
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|  |  |

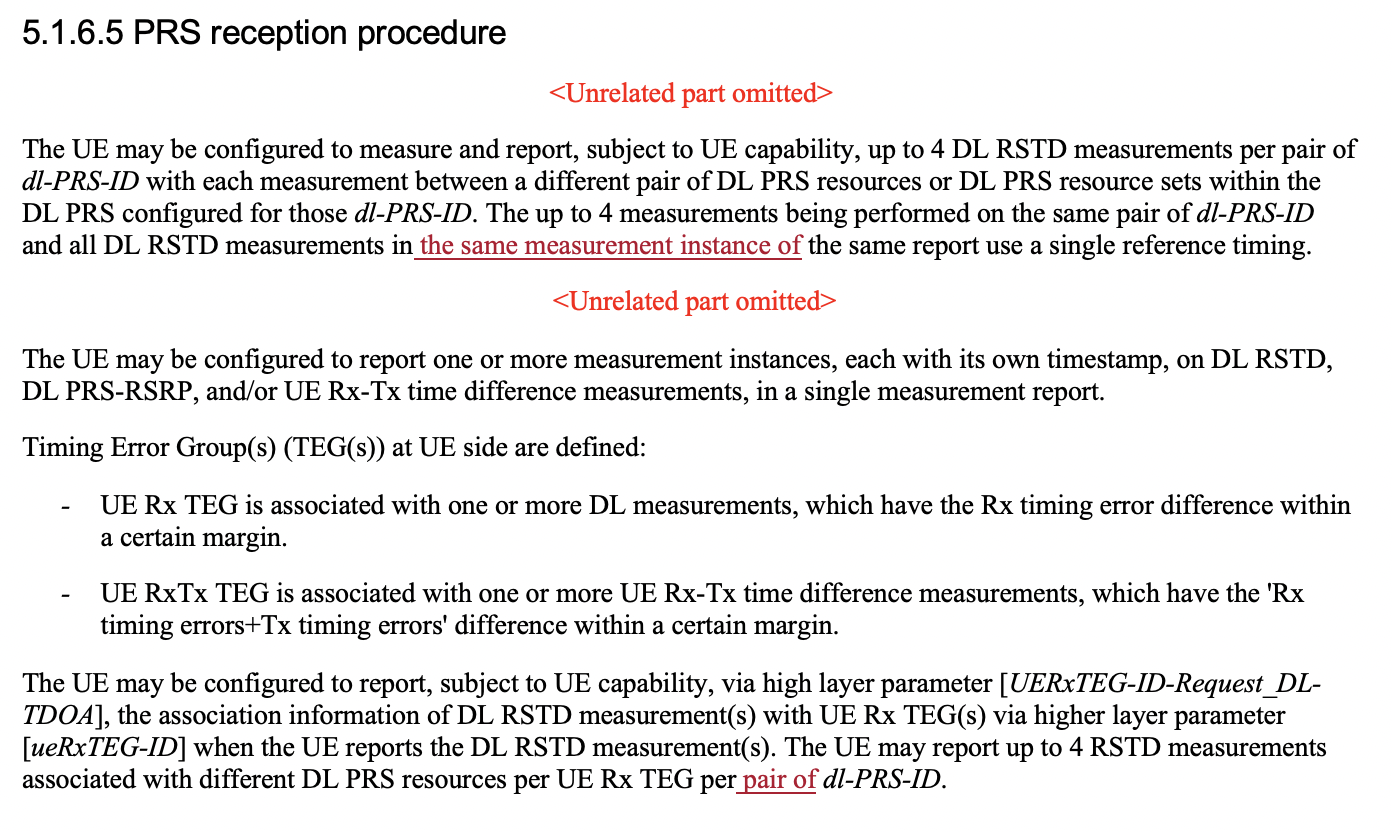
# CRs

### Issue 4-1: Draft CR on RSTD measurement for 38.214 (ZTE, R1-2205908[1])

Summary of changes

(1) The maximum number of reported RSTD measurements is defined per measurement instance.

(2) Use “per pair of dl-PRS-ID” to replace “dl-PRS-ID” for DL RSTD measurements.



FL Comments

Suggest adopting the proposed changes.

(Round 1) Proposal 4-1

Adopt the changes proposed in R1-2205908 for TS 38.214.

Comments

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| --- | --- | --- | --- |
| **Company** | **yes** | **NO** | **Additional comments** |
| vivo |  |  | We agree with the motivation, but Rel-16 UE may not understand the meaning of the measurement instance.  So, we propose  <Unrelated part omitted>  The UE may be configured to measure and report, subject to UE capability, up to 4 DL RSTD measurements per pair of *dl-PRS-ID* with each measurement between a different pair of DL PRS resources or DL PRS resource sets within the DL PRS configured for those *dl-PRS-ID*. If the UE is not configured to report with *multiMeasInSameReport-r17*, t~~T~~he up to 4 measurements being performed on the same pair of *dl-PRS-ID* and all DL RSTD measurements in the same report use a single reference timing. If the UE is configured to report with *multiMeasInSameReport-r17*, t~~T~~he up to 4 measurements being performed on the same pair of *dl-PRS-ID* and all DL RSTD measurements in the same measurement instance of the same report use a single reference timing.  <Unrelated part omitted>   |  | | --- | | 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  ]]  } | |
| ZTE | Yes |  | The spec change is needed at least. We are also fine with vivo’s revision because it is not clear that the above paragraph is only applicable for Rel-16 UEs. It should be noted that this is for Rel-17 spec. |
| Qualcomm | Yes |  | OK with vivo’s change. Agree with ZTE that thic change is for Rel-17 only. |
| CATT | Yes |  | OK with vivo’s change |
| Huawei, HiSilicon | Yes |  | We agree with ZTE that this is Rel-17 spec, and a Rel-16 spec should be implemented according Rel-16 spec.  First change should be OK.  For the second change, in general we are not against the change, but it should be clear that for the reference TRP, there may also be multiple “intra-TRP RSTD” measurement, but such a pair of *dl-PRS-ID* are the same. |

### Issue 4-2: Corrections for TEG-based DL positioning methods (OPPO, 2206271[3])

Summary of changes

1. Change “RSTD reference time” to “RSTD reference”

2. Add the case with the reporting of RxTx TEG and Tx TEG

3. Change the corresponding RRC parameters according to the the latest version of TS 37.355.



FL Comments

The proposed changes can be further discussed in this meeting.

For 1st proposed change: “a RSTD reference time” to “a RSTD reference”, although RAN2 does not explicitly define a parameter named as a *RSTD reference time*, all reported RSTD measurements are relative to the RSTD reference time.

For 2nd proposed change: It is good to further clarify a UE Rx-Tx time difference measurement may also be associated with a Tx TEG optionally.

For 3rd proposed changes: the RRC parameters in brackets needs to be changed according to the the latest version of TS 37.355.

(Round 1) Proposal 4-2

Adopt the following changes for TS 38.214:

5.1.6.5 PRS reception procedure

< Unchanged parts are omitted >

Timing Error Group(s) (TEG(s)) at UE side are defined:

*-* UE Rx TEG is associated with one or more DL measurements, which have the Rx timing error difference within a certain margin.

*-* UE RxTx TEG is associated with one or more UE Rx-Tx time difference measurements, which have the 'Rx timing errors+Tx timing errors' difference within a certain margin.

The UE may be configured to report, subject to UE capability, via high layer parameter *nr-UE-RxTEG-Request*, the association information of DL RSTD measurement(s) with UE Rx TEG(s) via higher layer parameter *nr-UE-Rx-TEG-ID* when the UE reports the DL RSTD measurement(s). The UE may report up to 4 RSTD measurements associated with different DL PRS resources per UE Rx TEG per *dl-PRS-ID*.

The UE may report a UE Rx TEG ID via higher layer parameter *nr-UE-Rx-TEG-ID* for a RSTD reference time *dl-PRS-ReferenceInfo* and a UE Rx TEG ID for each DL RSTD measurement, where the DL RSTD can be DL RSTD measurement in *NR-DL-TDOA-MeasElement* and/or *NR-DL-TDOA-AdditionalMeasurementElement*.

The UE may be configured to measure and report, via high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTEGs* subject to UE capability, RSTD measurements on a PRS resource associated with a *dl-PRS-ID* using up to 8 different UE Rx TEGs with the same *dl-PRS-ReferenceInfo.* The higher layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTEGs* applies to all DL PRS positioning frequency layers.

The UE may be provided with association information of DL PRS resource(s) with Tx TEGs via higher layer parameter *dl-prs-trp-Tx-TEG-ID* for a *dl-PRS-ID*.

The UE may be configured to report, via high layer parameter *nr-UE-RxTxTEG-Request*, subject to UE capability, the association information of UE Rx-Tx time difference measurement(s) with UE RxTx TEG(s) via higher layer parameter *nr-UE-RxTx-TEG-ID*, and optionally UE Tx TEG(s) via higher layer parameter *nr-UE-Tx-TEG-Index*. The UE may report up to 4 UE Rx-Tx time difference measurements associated with different DL PRS resources per UE RxTx TEG per *dl-PRS-ID*.

The UE may be configured to report, via high layer parameter *nr-UE-RxTxTEG-Request*, subject to UE capability, the association information of UE Rx-Tx time difference measurement(s) with the UE Rx TEG(s) and UE Tx TEG(s) via the higher layer parameters of *nr-UE-Rx-TEG-ID*, and *nr-UE-Tx-TEG-Index*. The UE may report up to 4 UE Rx-Tx time difference measurements associated with different DL PRS resources per UE Rx TEG per *dl-PRS-ID*.

The UE may be configured to measure and report, via high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTEGs* subject to UE capability, UE Rx-Tx time difference measurements on a PRS resource associated with a *dl-PRS-ID* using up to 8 different UE Rx TEGs The high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTEGs* applies to all DL PRS positioning frequency layers.

The UE may be configured to measure and report, via high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs* subject to UE capability, UE Rx-Tx time difference measurements with the same UE Tx TEG using up to 8 different UE RxTx TEGs*.* The high layer parameter  *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs* applies to all DL PRS positioning frequency layers.

< Unchanged parts are omitted >

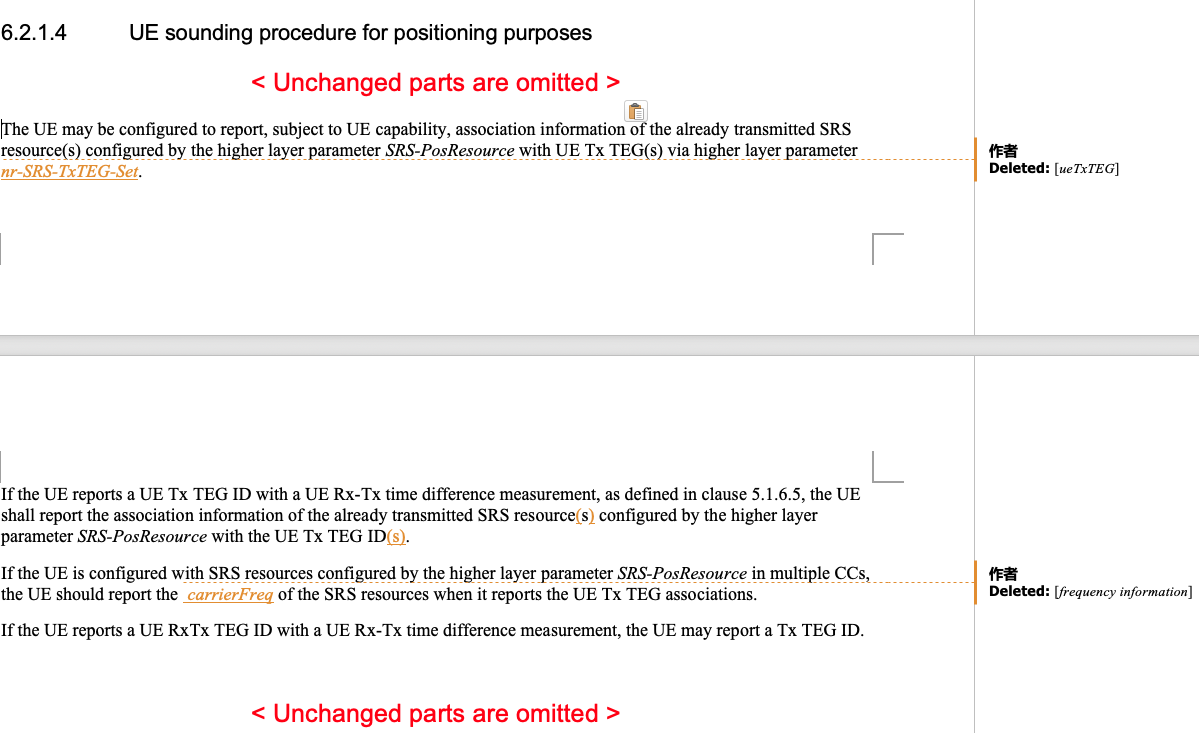
Offline Comments

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| --- | --- | --- | --- |
| **Company** | **yes** | **NO** | **Additional comments** |
| vivo | Yes |  |  |
| ZTE |  |  | We suggest all alignment draft CRs are included in a single CR for simplicity. Otherwise, please also include ZTE’s draft CR R1-2205907(alignment CR including the similar change) to discuss toghether.  In addition, UE TxTEG report is captured in UL section, i.e. 6.2.1.4, we don’t need to repeat it in DL section. |
| CATT | Yes |  | We share the similar view with ZTE that all alignment issue can be captured in one CR. |
| Huawei, HiSilicon | Yes |  | In general OK, but we have the same understanding as ZTE that all parameter alignment CRs should be merged. |
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### Issue 4-3: Corrections for TEG-based UL positioning methods (OPPO, 2206272[4])

Summary of changes

Change the corresponding RRC parameters according to the the latest version of TS 37.355.



FL Comments

The changes proposed in the CR are for the alignment of parameter names.

(Round 1) Proposal 4-3

Adopt the changes proposed in R1-2206272 for TS 38.214.

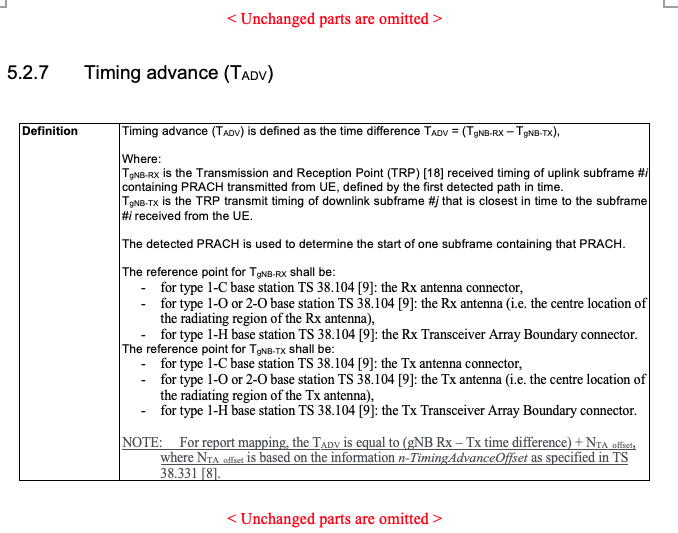
Offline Comments

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **yes** | **NO** | **Additional comments** |
| vivo | YES |  |  |
| ZTE |  |  | We suggest all alignment draft CRs are included in a single CR for simplicity. Otherwise, please also include ZTE’s draft CR R1-2205907(alignment CR including the similar change) to discuss toghether. Please see ZTE’s suggestion in R1-2205907 as follows where UE need to report TEG association by either RRC or LPP signaling.  If the UE is configured with SRS resources configured by the higher layer parameter *SRS-PosResource* in multiple CCs, the UE should report the *carrierFreq* or *servCellId* of the SRS resources when it reports the UE Tx TEG associations. |
| CATT | YES |  |  |
| Huawei, HiSilicon |  |  | This change is imcomplete because it only reflects the LPP part of association. If agreed, RRC part should be added.  In general, we think it should be merged into the editor alignment CR. |
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### Issue 4-4: Corrections on the definition of timing advance (TADV) (CATT, R1-2206367 [5])

Summary of change

Correction on the definition of timing advance (TADV) in clause 5.2.7.



FL Comments

The proposed change to TS 38..215 is based on RAN4 LS (R1-2205712(R4-2211167)).

(Round 1) Proposal 4-4

Adopt the changes proposed in R1-2206367 for TS 38.215.

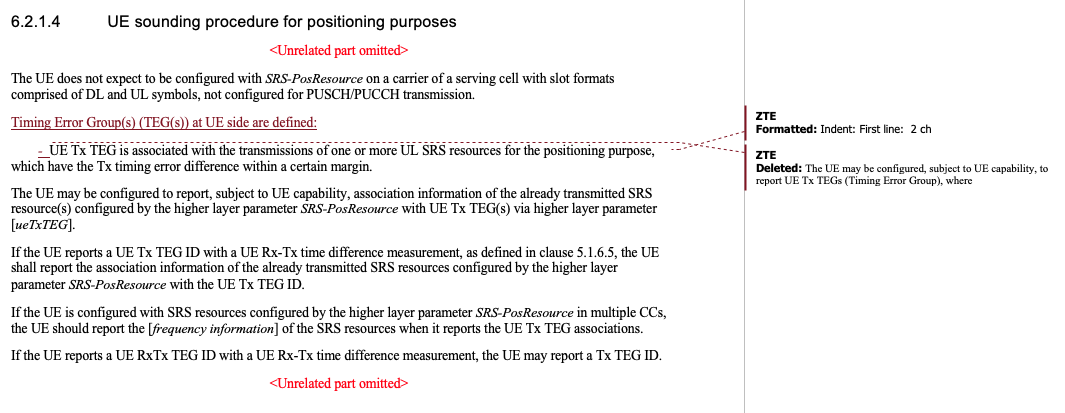
Comments

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **yes** | **NO** | **Additional comments** |
| vivo |  |  | We agree with the motivation, but wonder whether it is necessary to align parameter names, For example  NOTE: For report mapping, the TADV is equal to (TgNB-Rx –TgNB-Tx) + NTA\_offset, where NTA\_offset is based on the information *n-TimingAdvanceOffset* as specified in TS 38.331 [8]. |
| ZTE | Yes |  | vivo’s revision is also OK |
| Qualcomm | OK |  |  |
| CATT | YES |  | vivo’s revision is also fine |
| Huawei, HiSilicon |  |  | This change is related to TEI-17, instead of Positioning enhancement WI, and thus should not be treated here.  We submitted the draft CR R1-2205807 in 8.17. |
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### Issue 4-5: Draft CR on UE TX TEG description for 38.214 ([7], [8], [9])

Summary of change

Clarify the definition of UE Tx TEG in TS 38.214.

FL Comments

The intention of the proposed change seems clear. From editorial point of view, since there is only one type of TEG in UE transmission, we may not need to follow the exact format in Rx side , which has Rx and RxTx TEGs.

(Round 1) Proposal 4-5

Adopt the following changes to TS 38.214.

------- Proposed changes for TS 38.214 -------

6.2.1.4 UE sounding procedure for positioning purposes

**<Unchanged parts omitted>**

For operation on the same carrier, if an SRS configured by the higher parameter *SRS-PosResource* collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.

The UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission.

~~The UE may be configured, subject to UE capability, to report~~ ~~UE Tx TEGs (Timing Error Group), where~~  A UE Tx Timing Error Group (TEG) is associated with the transmissions of one or more UL SRS resources for the positioning purpose, which have the Tx timing error difference within a certain margin.

The UE may be configured to report, subject to UE capability, association information of the already transmitted SRS resource(s) configured by the higher layer parameter *SRS-PosResource* with UE Tx TEG(s) via higher layer parameter [*ueTxTEG*].

**<Unchanged parts omitted>**

Comments

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| --- | --- | --- | --- |
| **Company** | **yes** | **NO** | **Additional comments** |
| Vivo |  |  | We slight prefer the version of ZTE since UE Rx TEG takes a similar definition in section 5.1.6.5   |  | | --- | | *TS 38.214 5.1.6.5*  Timing Error Group(s) (TEG(s)) at UE side are defined:  *-* UE Rx TEG is associated with one or more DL measurements, which have the Rx timing error difference within a certain margin.  *-* UE RxTx TEG is associated with one or more UE Rx-Tx time difference measurements, which have the 'Rx timing errors+Tx timing errors' difference within a certain margin. | |
| ZTE |  |  | Same view as vivo. Our suggested change is more preferable as it is symmetrical as DL description in 38.214. |
| Qualcomm | OK |  |  |
| CATT | OK |  |  |
| Huawei, HiSilicon | Yes |  | Fine with ZTE’s version. |
|  |  |  |  |
|  |  |  |  |

# References

1. R1-2205908 Draft CR on RSTD measurement for 38.214 ZTE
2. [R1-2205912](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205912.zip) Discussion on some remaining issues for NR positioning ZTE
3. [R1-2206271](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206271.zip) Correction for TEG-based DL positioning methods OPPO
4. [R1-2206272](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206272.zip) Correction for TEG-based UL positioning methods OPPO
5. [R1-2206367](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206367.zip) Correction on the definition of timing advance (TADV) CATT
6. [R1-2206486](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206486.zip) Maintenance of NR Positioning Enhancements Nokia, Nokia Shanghai Bell
7. [R1-2206662](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206662.zip) Draft CR on UE TX TEG description for 38.214 ZTE
8. [R1-2206742](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206742.zip) Correction on accuracy improvements for NR positioning vivo
9. [R1-2206744](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206744.zip) Discussion on accuracy improvements for NR positioning vivo