**3GPP TSG-RAN WG2 Meeting #118-e *draft* R2-2206259**

**Electronic meeting, May 9th – May 20th, 2022**

**Agenda item: 6**.11.2.6

**Source:** CATT

**Title:** [AT118-e][638][POS] Tx TEG and LOS/NLOS aspects (CATT)

**Document for:** Discussion and Agreement

# 1 Introduction

This is the report of following offline discussion:

* [AT118-e][638][POS] Tx TEG and LOS/NLOS aspects (CATT)

 Scope: Discuss P1a-P1e and P3a/P3b of R2-2206333.

 Intended outcome: Report to CB session in R2-2206259

 Deadline: Tuesday 2022-05-17 1800 UTC

The discussion will continue to discuss the remaining proposals P1a-P1e and P3a/P3b of R2-2206333:

R2-2206333 [Pre118-e][607][POS] Summary of AI 6.11.2.6 on accuracy (CATT) CATT discussion Rel-17

* TxTEG report mechanism in RRC aspect: P1a/ P1b;
* TxTEG report of asn.1 issues in RRC and LPP: P1c/P1d;
* Failure report mechanism of Tx/Rx TEG in RRC and LPP: P1e;
* LOS/NLOS related enhancement: P3a/P3b.

# 2 Contact Information

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

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| Huawei, HiSilicon | yinghaoguo@huawei.com |
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# 3 Discussion

## 3.1 TxTEG report mechanism in RRC aspect

Event-triggered report or periodic report were discussed in[Pre117-e][611][POS] Open issues on positioning accuracy enhancements (CATT) but the periodic report gets more support. LMF actually may update the periodicRreporting Interval if there is no TxTEG change during the reporting, so there is no big signalling issue observed in the existing periodic reporting.

However two companies still suggested supporting event-triggered report in R2-2205654 and R2-2205730. Apple proposed to remove the periodic UE Tx TEG association reporting and to introduce change-triggered reporting instead. The proposal 1a in R2-2206333 says:

**Proposal 1a: RAN2 to agree configuring event triggered reporting for UL-TDOA to enable reporting of the association between UE TxTEG ID and SRSp resources when a change in the association is identified.**

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| AppleR2-2205654 | Observation 1: periodic UE Tx TEG association reporting signalling design is extremely inefficient. Observation 1: in their LS [1], RAN1 have confirmed that there is no need for periodic UE Tx TEG association reporting.Proposal 1: to remove the periodic UE Tx TEG association reporting and to introduce change-triggered reporting instead.Proposal 2: to remove timestamp from the UE Tx TEG association report. |
| InterDigitalR2-2205730  | Observation 1: By allowing the UE to report the association between UE Tx TEG and SRSp resources only when an event associated with the change of Tx TEG association is identified, signalling overhead can be reduced significantly Proposal 1: Support configuring event triggered reporting for UL-TDOA to enable reporting of the association between UE Tx TEG ID and SRSp resources when a change in the association is identified Proposal 2: Support configuring of reportAmount of 1 and infinity for event triggered reporting of UE Tx TEG association Observation 2: For event-triggered reporting, it is possible that the UE may report the Tx TEG association too frequently (e.g. due to frequent movement/changes at UE), which may result in difficulty at network for controlling the resources for reportingProposal 3: Support configuring reportInterval for event-triggered reporting of UE Tx TEG association. Proposal 4: The configurable reportInterval values for event-triggered reporting are reused from periodic reporting (e.g. ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240) |

**Q1: Do companies agree that configuring event triggered reporting for UL-TDOA to enable reporting of the association between UE Tx TEG ID and SRSp resources when a change in the association is identified, and remove periodic reporting in the existing RRC protocol? Please provide also a brief justification for your answer.**

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | No | periodic reporting with timestamp is enough or oneshot reporting. if event-triggered is indeed needed, need R1 to decide |
| Qualcomm | See comment | This was discussed at previous meetings, and in general we agree that event triggered reporting would have been the correct approach. However, given that we made the periodic agreements at previous meetings, it may be too late to change now. |
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Summary

Furthermore, InterDigital observed it is possible that the UE may report the Tx TEG association too frequently (e.g. due to frequent movement/changes at UE), which may result in difficulty at network for controlling the resources for reporting. They proposed the configurable reportInterval values for event-triggered reporting are reused from periodic reporting (e.g. ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240).

**Q2: Do companies agree to update the asn.1 of *UE-TxTEG-RequestUL-TDOA-Config-r17* as event triggered reporting in RRC below? Please provide also a brief justification for your answer.**

EventTriggerConfig-r17::= SEQUENCE {

 reportInterval-r7 ENUMERATED {ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240}

 reportAmount-r17 ENUMERATED {1, infinity},

 ...

}

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes | In terms of future extensibility it is better. but needs to have restriction in reportInterval that it is only present when the value of report Amount is set to infinity |
| Qualcomm |  | See comment in our reply to Question 1. |
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Summary

## 3.2 TxTEG report of asn.1 issues in RRC and LPP

There are few issues of asn.1 in RRC and LPP are observed in R2-2204706, R2-2204707 and R2-2204708. Most of these issues are captured in the RRC update in R2-2205859 and R2-2205829:

* R2-2205859 Correction based upon Positioning RILs Ericsson CR Rel-17 38.331 17.0.0 3121 - F NR\_pos\_enh-Core Late
* R2-2205829 LPP Updates Qualcomm Incorporated draftCR Rel-17 37.355 17.0.0 F NR\_pos\_enh-Core

**Issue #1:**

The maximum number reported UE TxTEG ID which is defined in *UE-TxTEG-AssociationList-r17* in RRC means that how many changes of TxTEG-ID will be reported in one RRC message.

* The maxi number reported UE TxTEG ID in the existing LPP is 64, but it is 8 in the existing RRC.
* The maximum numbers of TxTEG-IDs in one change is 8 according to RAN1 LS.

It seems that the volume of reported TxTEG-IDs in one RRC message is not proper if it is only 8.

Existing RRC in R2-2205859 is 8:

maxNrOfTEG-ID-r17 INTEGER ::= 8 -- Maximum number of UE Tx Timing Error Group ID

Existing LPP in R2-2205829 is 64:

maxTxTEG-Sets-r17 INTEGER ::= 64 -- FFS 8 TxTEGs and max 8 time stamps

So CATT propose to update the volume of UE TxTEG IDs report in RRC as 64 which is aligned with LPP, because 64 is well considered based on the possible times of the change and the number of TxTEG IDs in one change.

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

maxNrOfTEG-ID-r17 INTEGER ::= 64 -- Maximum reported number of UE Tx Timing Error Group ID

Considering the *maxNrOfTEG-ID-r17* in LPP is still FFS, companies may discuss the maximum numbers of reported UE TxTEG IDs in both LPP and RRC here. Since RAN4 doesn't conclude the changes of TxTEG mentioned in R2-2202165, it is necessary to send RAN2 agreement on the volume of changes of TxTEG-IDs in one report to RAN1 and RAN4 for confirming.

* R[2-2202165](file:///E%3A%5CWORK%5C1%203GPP%5CMeeting%5CRAN2%20117-e%5C2%20During%5CDocs%5CR2-2202165.zip) Reply LS on reporting of the Tx TEG association information (R4-2202685; contact: Huawei) RAN4 LS in Rel-17 To:RAN1, RAN2 Cc:RAN3

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| --- |
| The UE Tx TEG association between UE Tx TEG IDs and SRS resources for positioning is up to UE implementation, so it is not necessary nor practical to define the condition when the TEG association is changed.  |

**Q3: Do companies agree that the maximum numbers of reported TxTEG-IDs in one RRC message and *maxTxTEG-Sets-r17* in LPP message is 64? If No, please provide your preferred value of the max numbers.** **Please provide also a brief justification for your answer.**

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| **Company** | **Yes/No for RRC**  | **Yes/No** **for LPP** | **Comments** |
| Huawei, HiSilicon | Yes | Yes | OK with 8 timestamps. but the name is a bit ambiguous. prefer to change the name to something like maxTEG-ReportsPerPeriod |
| Qualcomm | Not sure | Yes | For RRC, my understanding from previous discussions is that the UE reports the last SRS/TEG association when the (periodic) report is triggered. SRS/TEG changes between periodic reports seem not supported with the current RRC signalling structure.  |
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**Q4: Do companies agree to send the agreement to RAN1 and RAN4 for conforming if there is? Please provide also a brief justification for your answer.**

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | depends | If we can not resolve the issues in RAN2, asking RAN1/4 for guidance would be required. TEG turned out to be rather confusing, and the RAN1 input is often not that clear as it could be. However, we need then consider that a response from RAN1/4 may not be received before the next meeting. |
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Summary

**Issue #2: the usage of nr-SRS-TxTEG-Set-r17**

CATT believes that the TxTEG-IDs from UE to LMF are not only for UE Rx-Tx measurement in LMF, but also for gNB Rx-Tx measurement in LMF. So this IE *nr-SRS-TxTEG-Set-r17* should not be reported only within Cond Case2-3. The IE *nr-SRS-TxTEG-Set-r17* is something like the UE TxTEG report via RRC in UL-TDOA.

So CATT proposed to delete the condition of TxTEG as below. Similarly the time stamp in *NR-SRS-TxTEG-Element-r17* is needed here to help LMF figure out which UE-TxTEG-ID is selected for the gNB Rx-Tx measurement in LMF. However the LPP rapporteur has difference understanding, i.e. for case-1, no Tx TEG is needed. In case of doubt, RAN2 may need to ask RAN1 on the usage of nr-SRS-TxTEG-Set-r17 in Multi-RTT report.

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

 NR-SRS-TxTEG-Element-r17 OPTIONAL

 ]]

**Q5: Do companies agree to delete the condition of TxTEG report in Multi-RTT? Do company agree to send the doubt to RAN1 that if TxTEG IDs are still required when TxTEG is not required in case 2-3 in *NR-UE-RxTx-TEG-Info-r17*? Please provide also a brief justification for your answer.**

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| **Company** | **Yes/No** **(to delete the condition)** | **Yes/No (LS to RAN1)** | **Comments** |
| Huawei, HiSilicon | No | No | This condition is just for restricting when the field can be configured and when it cannot be configured, i.e., it is only needed when case2-3 report is sent to the LMF. it is not a restriction on how it should be used.  |
| Qualcomm | No | See Q4 | Tx TEG and RxTx TEG are different concepts. There is no Tx TEG involved in RxTx TEG (in my understanding, this is the advantage of the definition of a RxTx TEG) and the RAN4 LS cited before Question 3 mentions only Tx TEG association change.  |
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Summary

The updated LPP in R2-2205829 is FFS on CHOICE in NR-UE-RxTx-TEG-Info-r17 as below:

NR-UE-RxTx-TEG-Info-r17 ::= CHOICE { -- FFS if the CHOICE structure is needed

 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)

 },

 ...

} -- FFS the nr-UE-Tx-TEG-ID-r17 in case2 and case3 (pending RAN1)

CATT proposed to change the structure of *NR-UE-RxTx-TEG-Info-r17* from choice to sequence which is more flexible in the LPP as below:

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

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

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

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

}

**Q6: Do companies agree to modify the IE *NR-UE-RxTx-TEG-Info-r17* from CHOICE to SEQUENCE? Please provide also a brief justification for your answer.**

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | No | CHOICE is clear from the readability point of view. from signalling overhead point of view, it also seems to be more or less the same.  |
| Qualcomm | No | The SEQUENCE definition would allow all possible combinations between the 3 fields, which however, seems not the RAN1 intention. I.e., only the current 3 CHOICEs are supported by RAN1. The proposal would also make the corresponding request and capability definition more difficult. I.e., the *nr-UE-RxTxTEG-Request* and *nr-UE-RxTx-TEG-ID-ReportingSupport* can simply refer to the 3 choices. With the removal of the CHOICE, more field description would be needed on which combinations are allowed/supported/requested (without any functional difference).However, the additional SEQUENCE for *case-1* above is not needed. |
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Summary

## 3.3 Failure report mechanism Tx/Rx TEG in RRC and LPP

Ericsson introduces the failure report mechanism on the corresponding Rx/Tx TEG association in LPP and RRC.

Currently there is no provision for failure handling for the above reports, if UE is unable to report the TEG association how should that be handled. UE should be able to handle the failure; i.e provide failure report on the TEG association report and continue transmitting UL-SRS.

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| EricssonR2-2205806 | Proposal 1 Failure to provide (periodic) Rx/Tx TEG association does not result in termination of UL SRS Tx or DL-PRS MeasurementsProposal 2 UE provides the failure report on the corresponding Rx/Tx TEG association and continue with the positioning procedureProposal 3 Below TP on ASN.1 for RRC and LPP is agreed for TEG failure ReportingfailureIndication-r17 ENUMERATED {state-transition, lowpowerstate, unknown, spare1} OPTIONAL, |

So Ericsson proposed to support the failure report in both LPP and RRC as below.

- LPP

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),

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

 SRS-PosResources-r17,

 ...,

 [[

 tegTxReportingfailureIndication-r17 ENUMERATED {state-transition, lowpowerstate, unknown, spare1} 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)

 },

 ...,

 failureCase-r17 ENUMERATED {state-transition, lowpowerstate, unknown, spare1} OPTIONAL,

}

- RRC

UEPositioningAssistanceInfo-IEs-r17 ::= SEQUENCE {

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

 failureIndication-r17 ENUMERATED {state-transition, lowpowerstate, unknown, spare1} OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

nonCriticalExtension SEQUENCE {} OPTIONAL

}

**Q7: Do companies agree the TP of Failure report mechanism of Tx/Rx TEG in RRC and LPP? Please provide also a brief justification for your answer.**

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| **Company** | **Yes/No****(TP on RRC)** | **Yes/No****(TP on LPP)** | **Comments** |
| Huawei, HiSIlicon | No | No | Justification is not clear from R2’s perspective. Why the UE may fail to provide TEG association at certain times?This needs to be discussed in R1 if needed |
| Qualcomm | No | No | If TEG is requested, but absent in the report, it obviously means that the TEG is not available. This is not different compared to any other "failure handling" in e.g. LPP (e.g., RSRP etc.). In addition, the proposed failure cases seem all unrelated to TEG. |
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Summary

## 3.4 LOS/NLOS related enhancement

Two companies believe that the current field cannot differentiate whether the report is per TRP or per resource for the main measurement. There are two candidate options on the update:

* #Option 1: Huawei suggest updating to indicate whether the LOS-NLOS report is per TRP or per resource in R2-2205004.

 [[

 nr-LOS-NLOS-Indicator-r17 CHOICE {

 perTRP LOS-NLOS-Indicator-r17,

 perResource LOS-NLOS-Indicator-r17

 } OPTIONAL,

* #Option 2: ZTE propose to modify the indicator as below:

– *LOS-NLOS-Indicator*

The IE *LOS-NLOS-Indicator* provides information on the likelihood of a Line-of-Sight (LOS) propagation path from the source to the receiver.

LOS-NLOS-Indicator-r17 ::= CHOICE{

 per-trp-r17 Indicator-r17,

 per-resource-r17 SEQUENCE (SIZE (1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF

 LOS-NLOS-Indicator-PerResource-r17,

 ...

 },

LOS-NLOS-Indicator-PerResource-r17 ::=

 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF

 Indicator-r17

Indicator-r17 CHOICE {

 soft-r17 INTEGER (0..10),

 hard-r17 BOOLEAN,

 ...

 },

-- ASN1STOP

| *LOS-NLOS-Indicator* field descriptions |
| --- |
| ***LOS-NLOS-Indicator***This field indicates whether the LOS or NLOS indicator is provided per TRP or per PRS resource. |

**Q8-1: Do companies agree to modify the *nr-LOS-NLOS-Indicator-r17* to choice of per TRP or per resource? Please provide also a brief justification for your answer.**

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| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | No | the current LPP CR already handles this. |
| Qualcomm | Yes | Seems according to RAN1 parameter. The CHOICE is simpler, otherwise significant additional field description would be required.  |
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**Q8-2: If yes, which TP do you prefer? Please provide also a brief justification for your answer.**

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| **Company** | **Option 1/2** | **Comments** |
| Qualcomm | Option 1 | Option 2 is unclear. Seems only applicable to the *NR-DL-PRS-ExpectedLOS-NLOS-Assistance*, where the CHOICE is already supported anyhow. |
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Summary

Furthermore, Huawei proposed several corrections to LOS-NLOS indication in R2-2205004 according the RIL:

[H027] UE should be allowed to choose its own reporting mode of per TRP or pre resource report and does not have to follow the LMF’s request. This should be also clarified in the field descritpion or IE description.

[H029]Change the name to nr-LOS-NLOS-IndicatorPerResource to differentiate it with the per TRP/perResource Indication

[H030] Is it possible that the UE chooses a NLOS reference TRP? If that is the case, all the LOS-NLOS indicator will be NLOS and signaling can be optimized. If not, this indication is only for the neighbour TRP indicated by the PRS ID.

**Correction[R2-2205004] #2** / Add in the field description that in spite of the request from the network in RLI, the UE can choose its LOS-NLOS reporting by TRP or by resource.

***nr-los-nlos-Indicator***

This field specifies the target device's best estimate of the LOS or NLOS of the TOA measurement for the TRP or resource. Note, the TOA measurement refers to the TOA of this neighbour TRP, as applicable, used to determine the *nr-RSTD* or *nr-RSTD-ResultDiff*. In spite of the request from the network in *requestLocationInformation*, the UE can choose its resourcetype and ganularity for LOS-NLOS reporting.

**Correction [R2-2205004] #3/** Change the name to nr-LOS-NLOS-IndicatorPerResource to differentiate it with the per TRP/perResource Indication

 nr-los-nlos-IndicatorPerResource-r17

 LOS-NLOS-Indicator-r17 OPTIONAL,

***nr-LOS-NLOS-IndicatorPerResource***

This field specifies the target device's best estimate of the LOS or NLOS of the TOA measurement for the resource. The field is only present when the field *nr-LOS-NLOS-Indicator* adopts the field *perResource*.

**Correction[R2-2205004] #4/** Remove the reference TRP in the field description. If clarification is needed from R1, send an LS.

***nr-los-nlos-Indicator***

This field specifies the target device's best estimate of the LOS or NLOS of the TOA measurement for the TRP or resource. Note, the TOA measurement refers to the TOA of this neighbour TRP, as applicable, used to determine the *nr-RSTD* or *nr-RSTD-ResultDiff*.

However it seems that correction #4 is not essential because the agreement in RAN1 parameter [R1-2202759] says:

• For DL-TDOA one LoS/NLoS indicator can be associated with each RSTD measurement performed with a target TRP and one LoS/NLoS indicator is associated with the RSTD measurement performed with a reference TRP

• For DL-TDOA one LoS/NLoS indicator can be associated with each target TRP and one LoS/NLoS indicator can be associated with the reference TRP in the measurement report

So companies will review these corrections #2, #3, #4 in R2-2205004 one by one.

**Q9: Which correction #2/#3/#4/None do you agree? Please provide also a brief justification for your answer.**

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| **Company** | **Modification #2/ #3/ #4/ None** | **Comments** |
| Huawei, HiSilicon | Yes | OK, but these issues seem to have already been captured by the LPP CR.  |
| Qualcomm | #2 / #3 | #2 depends on the current UE situation/location and the request may not always be possible to fulfil.#3 needs to go together with Question 8/Option1, otherwise it will be inconsistent.#4 seems not correct, since the indicator is per TOA measurement, not per RSTD.  |
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Summary

# 4 Conclusion

TBD

# 5 Reference

1. R2-2206333 [Pre118-e][607][POS] Summary of AI 6.11.2.6 on accuracy (CATT) CATT discussion Rel-17
2. R2-2205654 On periodic UE Tx TEG reporting Apple discussion Rel-17 NR\_pos\_enh-Core
3. R2-2205730 Discussion on UE TX TEG association reporting InterDigital, Inc. discussion Rel-17
4. R2-2205859 Correction based upon Positioning RILs Ericsson CR Rel-17 38.331 17.0.0 3121 - F NR\_pos\_enh-Core Late
5. R2-2205829 LPP Updates Qualcomm Incorporated draftCR Rel-17 37.355 17.0.0 F NR\_pos\_enh-Core
6. R2-2204706 Discussion on the left issues on UE TxTEG report in RRC and LPP protocols CATT discussion
7. R2-2204707 [C243] Correction on the UE TxTEG report in TS 38.331 CATT CR Rel-17 38.331 17.0.0 2994 - F NR\_pos\_enh-Core
8. R2-2204708 [C013][C014][C015][C016][C017]Corrections on the UE TxTEG report in TS 37.355 CATT CR Rel-17 37.355 17.0.0 0335 - F NR\_pos\_enh-Core
9. R2-2202165 Reply LS on reporting of the Tx TEG association information (R4-2202685; contact: Huawei) RAN4 LS in Rel-17 To:RAN1, RAN2 Cc:RAN3
10. R2-2205004 [H026][H027][H029][H030] Correction to LOS-NLOS indication Huawei, HiSilicon CR Rel-17 37.355 17.0.0 0339 - F NR\_pos\_enh-Core
11. R2-2205806 Remaining Issues on TEG reporting; failure Handling Ericsson discussion Rel-17