**3GPP TSG-RAN WG4 Meeting # 104-e R4-22XXXXX**

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

**Agenda item: 9.19.3**

**Source:** Moderator (CATT)

**Title:** Email discussion summary for [104-e][226] NR\_pos\_enh\_2

**Document for:** Information

# Introduction

This email discussion summary contains the discussions in agenda 9.19.1.1, 9.19.1.3, 9.19.1.5 and 9.19.1.6 which include the following topics:

* Topic #1: R17 ePOS core requirements maintenance
  + Sub-topic #1-1: UE Rx/Tx and/or gNB Rx/Tx timing delay mitigation
  + Sub-topic #1-2: Measurement in RRC\_INACTIVE state
  + Sub-topic #1-3: Enhancements of A-GNSS positioning (*No documents submitted*)
  + Sub-topic #1-4: Others
* Topic #2: R17 ePOS performance requirements related to TEG
  + Sub-topic #1-1: Timing error margin
  + Sub-topic #1-2: Performance requirements with TEG

Please note that TEG related aspects in the following tdocs are included in topic #2 and other aspects in these tdocs are included in email thread #225.

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| [**R4-2211728**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211728.zip) | Discussion on performance requirements for PRS measurement | CATT |
| [**R4-2213540**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213540.zip) | Discussion on remaining issues for accuracy and test for ePOS | Huawei, HiSilicon |
| [**R4-2213750**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213750.zip) | Open issues in the performance part of NR positioning - Rx/Tx TEG | MediaTek inc. |
| [**R4-2213262**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213262.zip) | Remaining issues on Rx/Tx delay mitigation (performance part) | Ericsson |
| [**R4-2212197**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212197.zip) | On performance requirements for  Rx/Tx timing error mitigation | Qualcomm Incorporated |
| [**R4-2213032**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213032.zip) | Discussion on performance requirements for UE Rx-Tx time difference | vivo |

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: R17 ePOS core requirements maintenance

## Companies’ contributions summary

|  |  |  |
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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211724 | CATT | **Proposal 1: RAN1’s understanding on applicability of reported TEG (issue #2) is correct.**  **Proposal 2: There is no issue identified from RAN4 perspective for RAN1’s understanding on TEG-SRS association (issue #5).**  **Proposal 3: RAN1’s understanding on difference of timing error margin for Rx TEG and RxTx TEG (issue #7) is correct.**  **Proposal 4: The timing error margins are provided as LPP/NRPPa signalling parameters and out of UE capability signal for UE.**  **Proposal 5: A single timing error margin value is provided per Rx TEG/RxTx TEG type per measurement instance in a single LPP message, if it has multiple measurement instances.**  **Proposal 6: The timing error margin values for an Rx TEG/RxTx TEG type in different LPP messages can be different.** |
| R4-2211727 | CATT | **CR on measurement in RRC\_INACTIVE** |
| R4-2211946 | CMCC | ***Observation 1: in inactive state, droping PDSCH means paging may be dropped, results that the UE cannot be paged, which is not preferred.***  ***Proposal 1: for PRS collision with PDSCH in RRC inactive state, in order not to miss paging, it is proposed that UE wait for receiving the PDSCH symbols other than retuning to PRS resources even the DCI is too close to the PRS symbols, and the PRS measurement period can be extended when there is collision with PDSCH.*** |
| R4-2212046 | OPPO | CR to pre-configured Pos gap activation limitation  [Moved to email thread#225] |
| R4-2212202 | Qualcomm Incorporated | **Proposal 1: When the UE is performing positioning measurements in inactive state, if the UE determines that other higher priority DL signals/channels collide with PRS (as defined previously by RAN4) later than [N symbol/T ms] before the collision starts, the UE is not required to receive the other higher priority DL signals/channels and may receive the PRS resources.**  **Proposal 2: Requirements for PRS measurement in INACTIVE apply provided that all PRS resources within a PFL are configured within up to [2] separate windows within TPRS, where each window is up to [5] ms.** |
| R4-2213029 | vivo | **Proposal 1: For Issue #2, Issue #5 and Issue #7, RAN4 has the same understanding with RAN1.**  **Proposal 2: Reply RAN1 that UE Rx/RxTx TEG margins are provided to LMF as LPP signalling parameters.**  **Proposal 3: Reply RAN1 that a single timing error margin value is provided per Rx TEG/RxTx TEG type in a single LPP message, even if it has multiple measurement instances.**  **Proposal 4: Reply RAN1 that the timing error margin values for an Rx TEG/RxTx TEG type in different LPP messages can be different.** |
| R4-2213030 | vivo | **Proposal 1:**  **If a PRS resource is within the initial DL BWP, when the time T between DCI and PRS resource is less than the DCI processing time, UE may receive the DL PRS symbols.**  **If a PRS resource is outside the initial DL BWP, when the time T between DCI and PRS resource is larger than the sum of DCI decoding time and RF retuning time, and scheduled PDSCH symbols do not collide with PRS, UE may receive the DL PRS symbols.**  **Proposal 2: For the number of PRS measurement windows in RRC\_INACTIVE state, M = 2 should be considered from the perspective of both UE power consumption and PRS resources configuration flexibility.**  **Proposal 3: For the PRS measurement window in RRC\_INACTIVE state, the location of windows shall be close to paging occasion (i.e., after the paging occasion or before the paging occasion).** |
| R4-2213253 | Ericsson | **Proposal 1**: The applicability of reported UE Rx/RxTx TEG is limited to the measurements contained within the single measurement instance ~~report~~ in which the Rx/RxTx TEG information is provided, and only to measurements that are tagged with the corresponding TEG ID.  **Proposal 2**: Respond to RAN1 LS as following:  Defining whether UE Rx/RxTx TEG margins are provided to LMF as UE capability, or as LPP signalling parameters outside of UE capability signaling is out of RAN4 scope. It is up to RAN2 to decide on the appropriate signalling for TEG margin value reporting. |
| R4-2213259 | Ericsson | **CR to 38.133 clarification on measurement period requirement in RRC\_INACTIVE state** |
| R4-2213260 | Ericsson | **Proposal 1**: Depending on collision timeline a UE may continue receiving PRS over PDSCH or drop PRS over PDSCH on symbols carrying PRS in RRC\_INACTIVE state.  **Proposal 2**: Collision detection time line similar to gapless PRS measurement in RRC\_CONNECTED state may be adopted for PRS measurement in RRC\_INACTIVE state for symbols where collision between PDSCH and PRS occurs. Details can be FFS.  **Proposal 3**: Do not define PRS measurement window in RRC\_INACTIVE state. |
| R4-2213261 | Ericsson | Response to reply LS on the UE/TRP TEG framework |
| R4-2213529 | Huawei, HiSilicon | **Proposal 1: Confirm that 8 reports (or changes) of the TEG-SRS association information for each TEG ID is sufficient.**  **Proposal 2: Inform RAN1 and RAN2 that UE should be allowed to report a Tx TEG ID not associated to any SRS resource.**  **Proposal 3: Inform RAN1 and RAN2 that UE Rx/RxTx TEG margins are provided to LMF as LPP signalling parameters outside of UE capability signaling**   * **Rx/RxTx TEG margins can be different for different measurement instances in a single LPP message** * **UE Rx/RxTx TEG margins can be different in different LPP messages**   **Proposal 4: Confirm that if a UE/TRP supports both Rx TEG(s) and RxTx TEG(s), the UE/TRP may select different timing error margin values for the Rx TEG(s) and RxTx TEG(s).**  **Proposal 5: When LMF indicates ‘n0’ when requesting UE to measure same DL PRS resource with multiple Rx TEGs, the scaling factor is the number of Rx TEGs UE can support for measurement of same DL PRS resource.** |
| R4-2213530 | Huawei, HiSilicon | **CR on measurement period requirements with multiple Rx TEGs** |
| R4-2213534 | Huawei, HiSilicon | **Proposal 1: Adopt option 1 for PRS collision with PDSCH**   * **UE shall wait for receiving the PDSCH symbols other than retuning to PRS resources even the DCI is too close to the PRS symbols.** * **And the PRS measurement period can be extended when there is collision with PDSCH.**   **Proposal 2: Requirements for PRS measurement in INACTIVE apply provided that all PRS resources on the same PFL are configured within [M] separate windows within Tavailable, where each window is up to [L] ms. FFS for M, L and the location of the windows.** |
| R4-2213535 | Huawei, HiSilicon | **CR on PRS measurement requirements in INACTIVE** |
| R4-2213539 | Huawei, HiSilicon | CR on starting point of meausurement period for scheduled location  [Moved to email thread#225] |
| R4-2213751 | MediaTek inc. | Not available |

## Open issues summary

### Sub-topic 1-1 UE Rx/Tx and/or gNB Rx/Tx timing delay mitigation

*Moderator: Issue 1-1-1 to 1-1-6 are related to RAN1 LS R4-2211503 (R1-2205382).*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Issue #2: Applicability of an Rx/RxTx TEG**  In RAN1#109-e, RAN1 has made the following agreement related to the applicability of a reported UE/TRP Rx/RxTx TEG. The agreement implies the applicability of a reported UE/TRP Rx/RxTx TEG is limited to the measurements contained within the single measurement instance, regardless of how many measurements are included in the measurement instance.   |  | | --- | | **Agreement**   * It is RAN1’s understanding that when the TEG feature is combined with the reporting of multiple measurement instances as liaised in R1-2202922, the applicability of a reported UE/TRP Rx/RxTx TEG is limited to the measurements contained within the single measurement instance of a measurement report in which the Rx/RxTx TEG information is provided, and only to measurements that are tagged with the corresponding Rx/RxTx TEG ID. * Include above statement in reply LS to RAN2, RAN3, RAN4 |   **Issue #5: Maximum number of changes of reports (or changes) of the TEG-SRS association**  RAN1 made the following agreement related to the maximum number of reports (changes) of the TEG-SRS association information for each Tx TEG ID in an LPP multi-RTT report.   |  | | --- | | **Agreement**  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. |   **Issue #6: Questions on UE Rx/RxTx TEG margins**  In the following agreement, RAN1 asks 2 questions related to UE Rx/RxTx TEG margins.   |  | | --- | | **Agreement**  In the reply LS to RAN4 (cc RAN2/RAN3),   * Ask RAN4 whether UE Rx/RxTx TEG margins are provided to LMF as UE capability, or as LPP signalling parameters outside of UE capability signaling. If RAN4 considers UE Rx/RxTx TEG margins are provided to LMF as LPP signalling parameters outside of UE capability signaling, further ask RAN4 the following questions:   + - Whether a single timing error margin value is provided per Rx TEG/RxTx TEG type in a single LPP message, even if it has multiple measurement instances;     - Whether the timing error margin values for an Rx TEG/RxTx TEG type in different LPP messages can be different; * RAN1 understands the TRP Rx/RxTx TEG margins are provided to the LMF via an NRPPa message and which message to contain the TEG margins is up to RAN3 |   **Issue #7: Difference of timing error margin values for Rx TEG and RxTx TEG**  The following agreement presents RAN1’s understanding related to the different timing error margin values for the Rx TEG(s) and RxTx TEG(s).   |  | | --- | | **Agreement**  In the reply LS to RAN4 (cc RAN2/RAN3), request RAN4 to confirm the following RAN1’s understanding:   * If a UE/TRP supports both Rx TEG(s) and RxTx TEG(s), the UE/TRP may select different timing error margin values for the Rx TEG(s) and RxTx TEG(s). | |

#### Issue 1-1-1 RAN1’s understanding on issue #2 is correct?

Proposals

* Option 1: (CATT, vivo, Ericsson)
  + Yes
    - Capture the agreement in the WF: The applicability of a reported UE/TRP Rx/RxTx TEG is limited to the measurements contained within the single measurement instance of a measurement report in which the Rx/RxTx TEG information is provided, and only to measurements that are tagged with the corresponding Rx/RxTx TEG ID.
* Recommended WF
  + *Agree on option 1.*

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| **Issue 1-1-1 RAN1’s understanding on issue #2 is correct?** | |
| **Company** | **Comments** |
| CATT | Support option 1 and fine to capture it in the WF as agreement. |
| Qualcomm | Support the recommended WF. |
| Intel | Support the recommended WF. |
| Huawei | Support Option 1 and the recommended WF. |
| Ericsson | Support the recommended WF. |
| OPPO | Support the recommended WF. |
| vivo | Support Option 1. |
| MTK | Support the recommended WF. |
| Nokia | We support the recommended WF. |

#### Issue 1-1-2 RAN1’s understanding on issue #5 is correct?

Proposals

* Option 1: (vivo, Huawei)
  + Response to RAN1: RAN4 has the same understanding.
* Option 1a: (Huawei)
  + Inform RAN1 and RAN2: UE should be allowed to report a Tx TEG ID not associated to any SRS resource.
* Option 2: (CATT, Ericsson)
  + Response to RAN1: Tx TEG association is up to RAN2 and no further actions in RAN4.
* Recommended WF
  + *Need more discussion*

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| **Issue 1-1-2 RAN1’s understanding on issue #5 is correct?** | |
| **Company** | **Comments** |
| CATT | Support option 2. RAN4 has agreed that the TEG association is up to RAN2 and how may reports (changes) are allowed can be decided by RAN1/2. And we are also fine to respond that RAN4 don’t identify any issue on this understanding.  For option 1a, we are fine to inform RAN2 about this understanding but should also inform that each SRS resource should be associated with the Tx TEG ID if UE supporting this feature and is requested to report. |
| Qualcomm | Option 1 |
| Huawei | Support Option 1 and 1a.  On option 2, we understand that the number of changes of the TEG-SRS association is up to RAN4 to decide, i.e. whether 8 reports for each TEG ID is sufficient during a measurement period.  In addition, we think the current signaling requires a TEG ID must be associated with one or more SRS resources which is limiting UE implementation, and hence we have proposed option 1a. |
| Ericsson | Support option 2.  RAN4#103e agreed on the following:  *Issue 1-1-2 The temporal validity of UE/TRP Tx TEGs*  *Agreements:*  *Tx TEG association report is discussed in RAN2 and there is no need to further define temporal validity of Tx TEG in RAN4.* |
| OPPO | Support option 1 and 2. |
| vivo | Support Option 1. RAN 1’s LS implies that there may exist up to 8 TEG-SRS association changes during a measurement instance. We also believe 8 is enough for UE to consider the multiple TEG-SRS association changes in practice.  We are also fine with Option2 because we understand there is no corresponding RRM impact. |
| MTK | Support Option 1. |
| Nokia | We support options 1 and 2. |

#### Issue 1-1-3 RAN1’s understanding on issue #7 is correct?

Proposals

* Option 1: (CATT, vivo, Ericsson, Huawei)
  + Yes
* Recommended WF
  + *Agree on option 1.*

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| **Issue 1-1-3 RAN1’s understanding on issue #7 is correct?** | |
| **Company** | **Comments** |
| CATT | Support option 1 which is already informed to RAN1 in the LS in last meeting |
| Qualcomm | Support the recommended WF |
| Intel | Support the recommended WF. |
| Huawei | Support the Recommended WF. |
| Ericsson | Option 1 |
| OPPO | Support the recommended WF. |
| vivo | Support Option 1. |
| MTK | Support the Recommended WF. |
| Nokia | We support the recommended WF. |

#### Issue 1-1-4 Whether UE Rx/RxTx TEG margins are provided to LMF as UE capability, or as LPP signalling parameters outside of UE capability signaling (issue #6)?

Proposals

* Option 1: (CATT, vivo, Huawei)
  + As LPP signalling parameters outside of UE capability signaling
* Option 2: (Ericsson)
  + Up to RAN2
* Recommended WF
  + *Need more discussion*

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| **Issue 1-1-4 Whether UE Rx/RxTx TEG margins are provided to LMF as UE capability, or as LPP signalling parameters outside of UE capability signaling (issue #6)?** | |
| **Company** | **Comments** |
| CATT | Support option 1. |
| Qualcomm | Option 1 |
| Intel | Option 1. Such indication is not for UE capability. |
| Huawei | Support option 1.  We understand it is a RAN4 issue because it is RAN4 who decided the UE Rx/RxTx TEG margins. |
| Ericsson | In principle we agree what is proposed in option 1. Margins shall be reported outside of UE capability. The only concern is if we should work on the signalling aspects? RAN4 shall provide input and let RAN2 decide the best signalling approach. |
| OPPO | Support option 1. |
| vivo | Support Option 1. If the TEG margin is provided as UE capability, it may be impossible that different margins are used for different measurement reports which has been agreed in the previous RAN4 discussion. |
| MTK | Support option1. |
| Nokia | We support option 1. RAN4’s understanding can be liaised to RAN1 and RAN2. |

#### Issue 1-1-5 If option 1 is agreed in issue 1-1-4, whether a single timing error margin value is provided per Rx TEG/RxTx TEG type in a single LPP message, even if it has multiple measurement instances (issue #6)?

Proposals

* Option 1: (vivo)
  + Yes
    - A single timing error margin value is provided per Rx TEG/RxTx TEG type in a single LPP message, even if it has multiple measurement instances
* Option 2: (CATT, Huawei)
  + No
    - A single timing error margin value is provided per Rx TEG/RxTx TEG type per measurement instance in a single LPP message, if it has multiple measurement instances
* Recommended WF
  + *Need more discussion*

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| **Issue 1-1-5 If option 1 is agreed in issue 1-1-4, whether a single timing error margin value is provided per Rx TEG/RxTx TEG type in a single LPP message, even if it has multiple measurement instances (issue #6)?** | |
| **Company** | **Comments** |
| CATT | Support option 2. If multiple instances are reported in a LPP message, the interval between different measurement instances can be large and the timing error margin can be different. |
| Qualcomm | Option 2. |
| Intel | Option 2. TEG margin depends on the measurement instance itself. |
| Huawei | Option 2.  We have no strong view, but option 2 provides more flexibility than option 1. |
| Ericsson | Based on our comment on issue 1-1-1 we support option 2. |
| OPPO | Support option 2. |
| vivo | Support Option 1. First of all, we understand in the location calculation, we need to use the measurement results with the same TEG to eliminate the time error. If different timing error margins are provided for different measurement instances, it may cause that there is no way to combine any measurement instances Then how can we use the TEG feature?  In addition, the motivation of TEG margins per report is to consider the TEG may change over time. The interval between two instances in a single measurement report is short and it is enough to consider the TEG per report instead of per instance. |
| MTK | Option 2. |
| Nokia | We support option 2. |

#### Issue 1-1-6 If option 1 is agreed in issue 1-1-4, whether the timing error margin values for an Rx TEG/RxTx TEG type in different LPP messages can be different (issue #6)?

Proposals

* Option 1: (CATT, vivo, Huawei)
  + Yes
* Recommended WF
  + *Need more discussion*

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| **Issue 1-1-6 If option 1 is agreed in issue 1-1-4, whether the timing error margin values for an Rx TEG/RxTx TEG type in different LPP messages can be different (issue #6)?** | |
| **Company** | **Comments** |
| CATT | Support option 1. |
| Qualcomm | Option 1 |
| Intel | Option 1. |
| Huawei | Option 1. |
| Ericsson | Support option 1. |
| OPPO | Support option 1. |
| vivo | Support Option 1. |
| MTK | Option 1. |
| Nokia | We support option 1. |

#### Issue 1-1-7 PRS measurement period related to TEG indication (when LMF indicates ‘n0’ in *measureSameDL-PRS-ResourceWithDifferentRxTEGs*)?

Proposals

* Option 1: (Huawei)
  + When LMF indicates ‘n0’ when requesting UE to measure same DL PRS resource with multiple Rx TEGs, the scaling factor is the number of Rx TEGs UE can support for measurement of same DL PRS resource
* Recommended WF
  + *Need more discussion*

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| **Issue 1-1-7 PRS measurement period related to TEG indication (when LMF indicates ‘n0’ in measureSameDL-PRS-ResourceWithDifferentRxTEGs)?** | |
| **Company** | **Comments** |
| CATT | The intention is understandable, but the description in option 1 is not clear. Suggest following the wording in CR R4-2213530 that is the number of Rx TEGs with which UE can support to measure the same PRS resource. Because if *measureSameDL-PRS-ResourceWithDifferentRxTEGs* and *measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul* in *NR-UE-TEG-Capability* exist simultaneously, the scaling factor should be still |
| Qualcomm | According to 37.355: “Enumerated value '*n0*' indicates that the number *N* of different UE Rx TEGs to measure the same DL PRS Resource can be determined by the target device.”  Therefore the UE can choose the number of different Rx TEGs; any number up to its capability. It is up to UE implementation.  The measurement period requirement (scaling factor) can be based on the number of Rx TEGs reported in FG 27-1-4. And that value would also be used for the scaling factor that applies if the UE supports FG 27-1-4a. If this is the intention of proposal 1, we can support it. It would be good to clarify. |
| Intel | The scaling factor can depend on the number of Rx TEGs UE can support for measurement. But how to formulate the exact measurement period can be FFS (e.g. Option 1 or CATT’s proposal above) |
| Huawei | Option 1.  As mentioned in our paper, LMF can indicate ‘n0’ in the location info request which means the number of Rx TEGs used to measure the same DL PRS resource is up to UE implementation. In our view, the most reasonable approach is to define N\_TEG as the number of Rx TEGs UE can support for measurement of same DL PRS resource, which is reported in *NR-UE-TEG-Capability*. In any case, UE cannot measure a DL PRS resource with more Rx TEGs than the number is supports.  To CATT and QC: the intention of option 1 is to consider the following two cases:   * Case 1: LMF indicates other values than ‘n0’ in the location info request. In this case, is equal to the number as LMF indicated in the location info request (as already in the spec). * Case 2: LMF indicates values ‘n0’ in the location info request. In this case, is equal to the number as UE reported in 27-1-4 (as suggested in option 1). As QC mentioned, UE can choose the number of different Rx TEGs; any number up to its capability.   We also confirm that option 1 is only concerned with but not in the requirements, and we understand this is same as what CATT and QC commented. |
| Ericsson | Option 1 is fine. |
| vivo | Support Option 1. Based on the 37.355, when the value ‘n0’ is indicated, it is up to UE decision for the number of multiple Rx TEGs. |
| MTK | Fine with option 1. |
| Nokia | We support the principle of option 1. We also think a clarification of the meaning “the number of Rx TEGs UE can support for measurement of same DL PRS resource” is needed. Is it according to the reported UE capability or is the UE deriving this capability based on current SNR/measurement conditions? |

### Sub-topic 1-2 Measurement in RRC\_INACTIVE state

#### Issue 1-2-1 PRS collision with PDSCH in RRC\_INACTIVE state

Proposals

* Option 1: (CMCC, Huawei)
  + For PRS collision with PDSCH in RRC inactive state, in order not to miss paging, UE shall wait for receiving the PDSCH symbols other than retuning to PRS resources even the DCI is too close to the PRS symbols,
  + and the PRS measurement period can be extended when there is collision with PDSCH
* Option 2: (Qualcomm)
  + When the UE is performing positioning measurements in inactive state, if the UE determines that other higher priority DL signals/channels collide with PRS (as defined previously by RAN4) later than [N symbol/T ms] before the collision starts, the UE is not required to receive the other higher priority DL signals/channels and may receive the PRS resources (RAN1 conclusion)
* Option 3: (vivo)
  + If a PRS resource is within the initial DL BWP, when the time T between DCI and PRS resource is less than the DCI processing time, UE may receive the DL PRS symbols.
  + If a PRS resource is outside the initial DL BWP, when the time T between DCI and PRS resource is larger than the sum of DCI decoding time and RF retuning time, and scheduled PDSCH symbols do not collide with PRS, UE may receive the DL PRS symbols.
* Option 4: (Ericsson)
  + Depending on collision timeline (similar to gapless PRS measurement), a UE may continue receiving PRS over PDSCH or drop PRS over PDSCH on symbols carrying PRS in RRC\_INACTIVE state.
* Recommended WF
  + *Need more discussion*

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| **Issue 1-2-1 PRS collision with PDSCH in RRC\_INACTIVE state** | |
| **Company** | **Comments** |
| CMCC | Option 1. Different from connected state, PDSCH in inactive state is mainly about paging, droping PDSCH in inactive state means that paging may be dropped, we are not sure whether it is good way to drop paging. A UE is paged means it is expected that this UE could recover to connected mode as soon as possible. Drop paging may result that the UE cannot be paged, which is not good for system performance. We would like hear companies’ views on this issue. |
| CATT | We can support option 1. We understand all other three options are based on RAN1 conclusion, but considering the UE behavior in RRC\_INACTIVE, paging is more important and option 1 seems more reasonable. |
| Qualcomm | It seems Options 2, 3 and 4 have significant commonality.  Option 2 is our proposal and the intention is to leverage the RAN1 conclusion for scheduling restrictions associated with PPWs. RAN1 has not yet agreed on the value ‘N.’  Option 4 seems to be the same as Option 2. Option 3 is equivalent to Option 2 if ‘N’ is equal to the DCI processing time. |
| Intel | Option 1 is fine for us. In principle, in RRC\_INACTIVE, paging message instead of other PDSCH shall be higher priority.  Option 2 can be FFS on how to define the restriction window length. |
| Huawei | Option 1.  In INACTIVE, the PDSCH scheduling is mainly for paging which is important for UE experience, thus it should be prioritized over positioning in INACTIVE. Also, compared to CONNECTED there will be much less PDSCH scheduling in INACTIVE, so the actual impact to PRS measurement period should be tolerable.  Another reason is that the spec impact with option 2 will be large. For option 2, RAN4 needs to define scheduling restriction due to PRS measurement in INACTIVE for the case where scheduling DCI is close to PRS symbols. Such requirements are not defined for CONNECTED, so extra work is needed. |
| Ericsson | Preference is option 4. But we are fine to compromise to option 1. |
| OPPO | We can support option 1. |
| vivo | Support Option 3.  For the first bullet, we understand Option 3 is aligned with Option 2 and Option 4 which follow the RAN1 conclusion. When a PRS resource is within the initial DL BWP, there is no need to consider the RF retuning time, if the time T between DCI and PRS resource is less than the DCI processing time, it is feasible for UE to receive the DL PRS resources.  For the second bullet, we need to update the proposal:  If a PRS resource is outside the initial DL BWP, when the time T between DCI and PRS resource is larger than the sum of DCI decoding time and RF retuning time, there is no scheduled PDSCH symbols ~~do not collide with PRS~~, in that case, UE may receive the DL PRS symbols.  In the last meeting, we prefer Option 1. However, for some cases which are described as above, it is beneficial for avoiding to waste the PRS resources. |
| Nokia | There is overlapping between all options. We support combining options 1 and 2. |

#### Issue 1-2-2 PRS measurement window in RRC\_INACTIVE state

Proposals

* Option 1: (Qualcomm, vivo, Huawei)
  + Requirements for PRS measurement in INACTIVE apply provided that all PRS resources within a PFL are configured within up to [2] separate windows within TPRS, where each window is up to [5] ms.
* Option 1a: (vivo)
  + For the PRS measurement window in RRC\_INACTIVE state, the location of windows shall be close to paging occasion (i.e., after the paging occasion or before the paging occasion).
* Option 2: (Ericsson)
  + Do not define PRS measurement window in RRC\_INACTIVE state in Rel-17
* Recommended WF
  + *Need more discussion*

|  |  |
| --- | --- |
| **Issue 1-2-2 PRS measurement window in RRC\_INACTIVE state** | |
| **Company** | **Comments** |
| CATT | Prefer option 2. And actually we think this may be related to the DRX-on duration. If the duration is small, it is not necessary to have this limitation. |
| Qualcomm | Option 1 |
| Intel | In our views, in RRC\_INACIVE state, the available measurement PRS is also up to DRX cycle. That is when DRX cycle is larger than PRS period (e.g. 1280ms), there is no any PRS resource available per PRS period (e.g. “up to [2] separate windows within TPRS”) . Will RAN4 define any requirements under such case according to Option 1? |
| Huawei | Option 1, and we are open to option 1a.  On option 2, it is noted that PRS resource occasions are not necessarily available in the DRX ON period, so UE needs to wake up outside DRX ON period to receive PRS, and the intention of option 1 is to make sure UE does not need to wake up too many times during DRX OFF period. Hope this clarifies. |
| Ericsson | Prefer option 2. In addition to sharing CATT view on this issue, objective of Rel. 17 WI is to enhance accuracy. Energy saving aspects can be discussed in Rel. 18. |
| OPPO | Support option 2. For option 1 and 1a, the location of PRS window is configured by network, or chosen by UE implementation? |
| vivo | Support Option 1 and Option 1a. It is helpful for UE power consumption when defining PRS measurement window in RRC\_INACTIVE. In addition, we suggest the window location shall be close to paging occasion. In that case, UE can weak up to receive the PRS resources and paging signals sequentially. |
| Nokia | We support option 2. Collisions with other DL signals/channels need to be taken into account though as discussed in previous issues. |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2211727 (CATT)  CR on RRC\_INACTIVE | Qualcomm:  Suggested wording; “ = 8 if positioning frequency layer *i* is in FR2 and the LMF does not request that the UE perform PRS measurement with reduced number of Rx beam sweeping factor.”  Applicability of Nsample = 2 is still being discussed in thread 225.  It would be good to keep this statement: The description of for UE Rx-Tx needs revisions |
| Huawei:  OK, but the CR is partially overlapping with 3259 and 3535, suggest to have work split among 3 CRs for INACTIVE requirements, e.g. each CR is focused on one clause, and it can be up to the moderator to decide. |
| Ericsson: It shall be noted that IE *lowerRxBeamSweepingThan8-FR2* is used for both, UE to report its Rx beam sweeping capability and LMF to configure UE with Rx beam sweeping factor. Depending on the outcome of RAN2 discussion on this issue separate IEs may be defined. It shall therefore be preferred to use propose IE or a placeholder for IE so that further CRs for the same issue are not needed. |
| R4-2213259 (Ericsson)  CR on RRC\_INACTIVE | CATT: 1) the changes in 4.2.2.4 and 4.2.2.7 are not needed since they are already reflected in 5.1.2.4 and 5.1.2.7  2) the sentences “The UE shall meet the UE Rx-Tx time difference measurement accuracy requirements in clause 10.1.25.” in change #3 and “The UE shall meet the PRS-RSRPP measurement accuracy requirements in clause 10.1.X.” in change #4 are not needed. These are included in the reporting requirements and are not needed to add in the period requirements. |
| Qualcomm:  Changes to sections 4.2.2.4 and 4.2.2.7 (for IDLE mode) are not correct. We recall this was clarified in the previous meeting.  Many of the changes overlap with R4-2211727. |
| Huawei:  The changes to clause 4.2.2.4 and 4.2.2.7 are not needed. They are for IDLE, while the INACTIVE requirements in clause 5.1.2.4 and 5.1.2.7 have already considered PRS measurement.  The other changes are OK, but the CR is partially overlapping with 1727 and 3535, suggest to have work split among 3 CRs for INACTIVE requirements, e.g. each CR is focused on one clause, and it can be up to the moderator to decide. |
| Ericsson:  To CATT: on 2) the intention is to have consistency among sections. For example, R4-2211727 has the following sentence in change #1.  *“The UE shall meet the RSTD measurement accuracy requirements in clause 10.1.23.”* |
| R4-2213530 (Huawei)  CR on measurement period with TEG | CATT: fine. |
| Qualcomm: Pending issue 1-1-7. |
| Ericsson: Fine. Depending on the outcome of the discussion on issue 1-1-7, corresponding text in CR might need to be updated. |
| R4-2213535 (Huawei)  CR on RRC\_INACTIVE | CATT: there is no agreement to update to for calculating |
| Qualcomm: OK |
| Huawei:  The CR is partially overlapping with 1727 and 3259, suggest to have work split among 3 CRs for INACTIVE requirements, e.g. each CR is focused on one clause, and it can be up to the moderator to decide.  To CATT: we understand this was agreed for Issue 1-2-5 in R4-2210602, could you please double check? |
| Ericsson:  It shall be noted that IE *lowerRxBeamSweepingThan8-FR2* is used for both, UE to report its Rx beam sweeping capability and LMF to configure UE with Rx beam sweeping factor. Depending on the outcome of RAN2 discussion on this issue separate IEs may be defined. It shall therefore be preferred to use propose IE or a placeholder for IE so that further CRs for the same issue are not needed.  Agree with CATT. There is no agreement on what has been proposed for Lavailable in the CR. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

Sub-topic 1-1 UE Rx/Tx and/or gNB Rx/Tx timing delay mitigation

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 1-1-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 1-1-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 1-1-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 1-1-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 1-1-5** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 1-1-6** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 1-1-7** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

Sub-topic 1-2 PRS measurement in RRC\_INACTIVE state

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|  | **Status summary** |
| **Issue 1-2-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 1-2-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

## Discussion on 2nd round (if applicable)

# Topic #2: R17 ePOS performance requirements related to TEG

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211728 | CATT | **Proposal 1: The applicability of timing error margin of Rx TEG should be defined, i.e. the timing error margin values that can be selected by the UE are the pre-defined values which are not larger than the Rel-16 group delay margin (dependent on PRS/SRS BW).**  **Proposal 2: It is beneficial to define the R16 accuracy requirements as (baseband error + group delay margin) than to define a total allowed measurement error.**  **Proposal 3: Reuse the candidate timing error margins of Rx TEG to RxTx TEG.**  **Proposal 4: Define relative UE Rx-Tx accuracy requirements and corresponding test cases for the case where two measurements are in same RxTx TEG.**  **Proposal 5: When defining relative UE Rx-Tx accuracy requirements related to RxTx TEG, the simulation results for RSTD measurement in R16 can be reused.**  **Proposal 6: No need to define the reporting condition for RSTD and UE Rx-Tx measurement.**  **Proposal 14: Define applicability for the test cases related to TEG, i.e. the tests apply for the UE supporting TEG feature and reporting the same Rx TEG/RxTx TEG for the two cells.** |
| R4-2213540 | Huawei, HiSilicon | **Proposal 1: Confirm that for Rx TEG, the applicable timing error margin values that can be selected by the UE are the pre-defined values that are not larger than the sum of the Rel-16 group delay margin (dependent on PRS/SRS BW) and frequency drift margin.**  **Proposal 2: For RxTx TEG**   * **Adopt option 1 for candidate timing error margins:**   + **(16 values): 1/2 Tc, 1 Tc, 2 Tc, 4 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 64 Tc, 80 Tc, 96 Tc, 128 Tc.** * **The applicable timing error margin values that can be selected by the UE are the pre-defined values that are not larger than the sum of twice the Rel-16 group delay margin (dependent on PRS/SRS BW) and frequency drift margin.**   **Proposal 3: Do not define relative UE Rx-Tx accuracy requirements and related test cases.**  **Proposal 4: RAN4 not to define restrictions on use of differential reporting based on timing error.**  **Proposal 5: UE should not be mandated to use the same TEG to perform the measurement on both cells during the test.** |
| R4-2213750 | MediaTek inc. | *Proposal 1: Define a larger margin for RxTx TEGs than Rx TEGs and Tx TEGs:*   * *(16 values): 1/2 Tc, 1 Tc, 2 Tc, 4 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 64 Tc, 80 Tc, 96 Tc, 128 Tc.* |
| R4-2213262 | Ericsson | **Observation 1**: Based on its implementation UE selects one margin value from the predefined candidate margin values for Rx TEG and Tx TEG.  **Observation 2**: The margin values for Rx and Tx TEG may or may not be same.  **Observation 3**: The candidate margin values for RxTx TEG shall accommodate the difference between the UE selected margin value for Rx TEG and Tx TEG.  **Observation 4**: Based on observation 3 candidate margin values 1/2Tc, 1Tc, 96Tc, and 128Tc in option 1 may not be needed.  **Observation 5**: Candidate margin values for Rx TEG can be adopted for RxTx TEG such that the magnitude of the difference between Rx TEG and Tx TEG margins for Rx-Tx time difference measurement may be well accommodated.  **Observation 6**: Within a measurement report the measurements in different instances may be associated with different TEGs or the measurements in different instances may be from the same TEG with a different margin value.  **Observation 7**: Measurement reporting condition allows UE capable of Rx TEG based RSTD measurements to decide whether or not to report ∆RSTD defined in clause 10.1.23.3.2 of TS 38.133.  **Observation 8**: Measurement reporting condition allows UE capable of RxTx TEG based Rx-Tx time difference measurement decide whether or not to report ∆TUE Rx-Tx defined in clause 10.1.25.3.2.  following proposals are made:  **Proposal 1**: The applicable timing error margin values for Rx TEG that can be selected by the UE are the pre-defined values that are not larger than the sum of the Rel-16 group delay margin (dependent on PRS BW) and frequency drift margin.  **Proposal 2**: Use the same candidate values as Rx TEG for RxTx TEG.  **Proposal 3**: Define test case for UE Rx-Tx time difference measurement accuracy requirement related to TEG.  **Proposal 4**: Rel. 16 setup can be reused to define test case for TEG based UE Rx-Tx measurement accuracy requirement. Rel.16 setup shall be updated to support UE reported RxTx TEG margin value and UE is expected to meet the accuracy requirement corresponding to the RxTx TEG to pass the test. Applicability rules for RxTx TEG accuracy requirement test case is not precluded.  **Proposal 5**: Define only absolute measurement accuracy requirement for UE Rx-Tx time difference measurement.  **Proposal 6**: Define measurement reporting condition based on margin value for TEG based measurements.  **Proposal 7**: Measurement reporting condition may be based on the magnitude of the difference between two margin values selected by the UE to perform positioning measurements (RSTD and UE Rx-Tx) in different measurement instances is within a threshold. Threshold value is FFS.  **Proposal 8:** The UE capable of Rx TEG, shall report ∆RSTD defined in clause 10.1.23.3.2 provided that the magnitude of difference between timing error margins of the two TEGs used for the two RSTD measurements (RSTD1 and RSTD2) for deriving ∆RSTD is below X Tc; X is TBD. Otherwise, the UE does not report the measurement.  **Proposal 9:** The UE capable of RxTx TEG, shall report ∆TUE Rx-Tx defined in clause 10.1.25.3.2 provided that the magnitude of difference between timing error margins of the two TEGs used for the two UE Rx-Tx time difference measurements (TUE Rx-Tx1 - TUE Rx-Tx2) for deriving ∆TUE Rx-Tx is below X Tc; X is TBD. Otherwise, the UE does not report the measurement. |
| R4-2212197 | Qualcomm Incorporated | **Proposal 1: For RSTD measurements where the reference cell and neighbor cell TOAs belong to the same Rx TEG, absolute measurement accuracy requirements are defined as the sum of the baseband accuracy derived from simulations and the Rx TEG timing error margin.**  **Observation 1: When two UE Rx-Tx measurements belong the same RxTx TEG, there is no implication about the relationship between the UL Tx times of the two measurements.**  **Proposal 2: Frequency drift margin does not need to be added to the relative UE Rx-Tx accuracy requirements on the difference between two UE Rx-Tx measurements that belong to the same RxTx TEG.**  **Proposal 3: New simulations are required to derive UE Rx-Tx relative accuracy requirements for 90th percentile of absolute differential error.**  **Proposal 4: For RSTD measurements where the reference cell and neighbor cell TOAs belong to the same Rx TEG,**   * **the applicable timing error margin values that can be reported by the UE are the candidate values that are not larger than the sum of the Rel-16 group delay margin (dependent on PRS BW) and frequency drift margin.**   **Proposal 5: The candidate timing error margin values for RxTx TEGs are**   * **(16 values): 1/2 Tc, 1 Tc, 2 Tc, 4 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 64 Tc, 80 Tc, 96 Tc, 128 Tc.** |
| R4-2213032 | vivo | **Proposal 1: For the candidate timing error margins for RxTx TEGs, we support Option 1, i.e., 1/2 Tc, 1 Tc, 2 Tc, 4 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 64 Tc, 80 Tc, 96 Tc, 128 Tc.**  **Proposal 2: Define the relative Rx-Tx accuracy requirement when the two measurements are in the same UE Rx-Tx TEG.**  **Proposal 3: Define the test case for UE Rx-Tx time difference measurement accuracy requirements related to TEGs.**  **Proposal 4: For the error from baseband of relative UE Rx-Tx time difference accuracy, the result of (95%-ile of UE Rx errors – 5%-ile of UE Rx errors) can be used.**  **Proposal 5: The relative Rx-Tx accuracy can be defined as the sum of the error from baseband and the timing error margin.** |

## Open issues summary

### Sub-topic 2-1 Timing error margin

#### Issue 2-1-1 Applicability of timing error margin of Rx TEG?

Proposals

* Option 1: (CATT)
  + The applicable timing error margin values that can be selected by the UE are the pre-defined values which are not larger than the Rel-16 group delay margin (dependent on PRS/SRS BW).
* Option 2: (Huawei, Ericsson, Qualcomm)
  + For Rx TEG, the applicable timing error margin values that can be selected by the UE are the pre-defined values that are not larger than the sum of the Rel-16 group delay margin (dependent on PRS/SRS BW) and frequency drift margin.
* Recommended WF
  + *Need more discussion*

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| --- | --- |
| **Issue 2-1-1 Applicability of timing error margin of Rx TEG?** | |
| **Company** | **Comments** |
| CATT | If R17 doesn’t consider frequency drift margin separately, we are also fine with option 2. |
| Qualcomm | Option 2. |
| Intel | Option 2. The frequency drift margin in Rel17 will leverage from that of Rel16. |
| Huawei | Option 2.  We assume frequency drift margin can be also considered when UE selects the TEG margin. |
| Ericsson | Support option 2. |
| OPPO | Option 2. |
| vivo | Agree with Option 2. We understand the frequency drift margin shall be included into timing error margin. |
| MTK | Support option 2. |
| Nokia | We support option 2. |

#### Issue 2-1-2 Candidate timing error margin for RxTx TEG?

Proposals

* Option 1: (CATT, Ericsson)
  + Reuse the candidate timing error margins of Rx TEG
* Option 2: (Huawei, MTK, Qualcomm, vivo)
  + (16 values): 1/2 Tc, 1 Tc, 2 Tc, 4 Tc, 8 Tc, 12 Tc, 16 Tc, 20 Tc, 24 Tc, 32 Tc, 40 Tc, 48 Tc, 64 Tc, 80 Tc, 96 Tc, 128 Tc.
* Option 2a: (Huawei)
  + The applicable timing error margin values that can be selected by the UE are the pre-defined values that are not larger than the sum of twice the Rel-16 group delay margin (dependent on PRS/SRS BW) and frequency drift margin
* Recommended WF
  + *Need more discussion*

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| --- | --- |
| **Issue 2-1-2 Candidate timing error margin for RxTx TEG?** | |
| **Company** | **Comments** |
| CATT | Prefer option 1.  And don’t support option 2a, TEG feature is aimed at improving accuracy, if the reported timing error margin is twice the Rel-16 margin, why UE report this TEG while it can only get a worse accuracy. |
| Qualcomm | Support Option 2.  Regardng Option 2a, we believe the reason for doubling the group delay margin is that it would be for the difference between two UE Rx-Tx measurements. In general, we could say that if two UE Rx-Tx measurements belong to the same RxTx TEG then the timing error margin of the TEG should be no larger than the sum of the group delay margins for the individual measurements. As we argued in our paper we do not think it is necessary to add frequency drift margin for UE Rx-Tx relative accuracy. |
| Huawei | Option 2 and 2a.  The timing error in UE and gNB Rx-Tx measurement includes both Rx part and Tx part, so it can be larger than Rx alone. This is also reflected in the assumptions for Rel-16 requirements, i.e. the calibration error for UE Rx-Tx is larger than that for RSTD.  In addition, the applicability of RxTx TEG margin values also needs to be discussed. The applicability of Rx TEG margin values can be used as baseline. One difference is that the Rel-16 assumption for RSTD is for relative timing error, so it is directly comparable to Rx TEG margin value. For Rx-Tx the Rel-16 assumption is for absolute timing error, so the upper bound for the RxTx TEG margin value should be twice the Rel-16 assumption plus the frequency drift margin.  To CATT: we understand in Rel-16 we only have absolute accuracy for Rx-Tx, but the RxTx TEG is only useful when LMF is using the differential value between two Rx-Tx measurements, so they are not comparable.  To QC: we are also fine with the suggested wording that “the timing error margin of the TEG should be no larger than the sum of the group delay margins for the individual measurements”. Regarding the frequency drift margin, we assume it is discussed in issue 2-2-3, and we have provided our views there. |
| Ericsson | Prefer option 1. We do not see a need of defining higher margin values.  Do not support option 2a. |
| vivo | Support Option 2 and Option 2a. Based on the rule of Option 2a, the values of Option 2 seem to be reasonable. |
| MTK | Support option 2, The margin for RxTx TEG should be larger to consider both delays in Rx and Tx. |
| Nokia | We support options 2 and 2a. |

#### Issue 2-1-3 How to form the accuracy numbers for RSTD/UE Rx-Tx (i.e. whether to capture timing error margin separately)?

Proposals

* Option 1: (CATT)
  + Define the R16 accuracy requirements as (baseband error + group delay margin).
  + But UE is only required to meet the final accuracy.
* Recommended WF
  + *Need more discussion*

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| --- | --- |
| **Issue 2-1-3 How to form the accuracy numbers for RSTD/UE Rx-Tx (i.e. whether to capture timing error margin separately)?** | |
| **Company** | **Comments** |
| CATT | Support option 1. And this is also included in R16 maintenance through CR discussion in #201, we can follow the discussion and agreement in #201. |
| Qualcomm | For Rel-16 RSTD accuracy requirements there are three components: baseband error, group delay margin, and frequency drift margin. The requirements is the sum of the three components. |
| Intel | Option 1 is fine. There is no separated requirements in terms of baseband and RF impairment. |
| Huawei | We are fine with option 1, but we understand the issue is being discussed in [201], and we suggest to not duplicate the same discussion in [226]. |
| Ericsson | Fine to follow discussion in #201. |
| OPPO | We are fine to either option 1 or to follow the discussion in #201 |
| Nokia | We share Qualcomm’s view. We agree to follow the discussion in #201. |

### Sub-topic 2-2 Performance requirements with TEG

#### Issue 2-2-1 RSTD measurement accuracy requirements with TEG?

Proposals

* Option 1: (Qualcomm)
  + For RSTD measurements where the reference cell and neighbor cell TOAs belong to the same Rx TEG, absolute measurement accuracy requirements are defined as the sum of the baseband accuracy derived from simulations and the Rx TEG timing error margin.
* Recommended WF
  + *Need more discussion*

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| --- | --- |
| **Issue 2-2-1 RSTD measurement accuracy requirements with TEG?** | |
| **Company** | **Comments** |
| CATT | Support option 1. |
| Qualcomm | Support option 1. The Rx TEG timing error margin replaces two components: the group delay margin and the frequency drift margin. |
| Intel | Option 1. |
| Huawei | Option 1 |
| Ericsson | Option 1 is fine. |
| OPPO | Option 1 |
| vivo | Agree with Option 1. R16 simulation results can be reused for the baseband accuracy. |
| Nokia | We support option 1. |

#### Issue 2-2-2 Whether to define UE Rx-Tx accuracy and test case related to TEG?

Proposals

* Option 1: (CATT, vivo)
  + Define relative UE Rx-Tx accuracy requirements and corresponding test cases for the case where two measurements are in same RxTx TEG.
* Option 2: (Huawei)
  + Do not define relative UE Rx-Tx accuracy requirements and related test cases
* Option 3: (Ericsson)
  + Define only absolute measurement accuracy requirement and test case for UE Rx-Tx time difference measurement
* Recommended WF
  + *Need more discussion*

|  |  |
| --- | --- |
| **Issue 2-2-2 Whether to define UE Rx-Tx accuracy and test case related to TEG?** | |
| **Company** | **Comments** |
| CATT | Support option 1. And since the TOA measurement for -3dB and -6dB are almost the same based on R16 simulation, we think the simulation results for RSTD in R16 which is the difference between the TOA measurements of two cells can be reused. |
| Qualcomm | In our view this issue is dependent on 2-2-3. E.g. if new simulations are needed. We should consider the workload and the timeline for completing the requirements.  Regarding option 3, TEGs do not have any impact on UE Rx-Tx absolute measurement accuracy. The timing error margin is a bound on \*relative\* timing error between TOAs or transmissions. For RSTD it does have impact because RSTD is a differential measurement, between two TOAs. |
| Intel | It is up to how to define requirements (issue 2-2-3). For timeline perspective, we slightly prefer Option 2. |
| Huawei | Option 2.  Our main concern in option 1 is the additional baseband simulation work which may delay the completion of the WI perf part. If this is not considered as big issue for other companies, we are also fine to go with option 1.  On option 3, we understand to verify the correct RxTx TEG association, relative accuracy is needed. |
| Ericsson | We are fine to compromise to option 1. |
| OPPO | Prefer option 2. |
| vivo | Support Option 1. First of all, similar to RSTD, when the two measurements are in the same UE Rx-Tx TEG, the relative UE Rx-Tx accuracy requirements can be further tightened. In addition, it is helpful to verify that whether UE can report the correct UE Rx-Tx TEG. For the question related to simulation, we can discuss in the Issue 2-2-3. |
| Nokia | We support option 1. Only relative UE Rx-Tx accuracy for two measurements in same RxTx TEG was debated and included in WF of RAN4#103-e. |

#### Issue 2-2-3 How to define UE Rx-Tx accuracy related to TEG?

Proposals

* Option 1: (CATT)
  + When defining relative UE Rx-Tx accuracy requirements related to RxTx TEG, the simulation results for RSTD measurement in R16 can be reused
* Option 2: (Qualcomm)
  + New simulations are required to derive UE Rx-Tx relative accuracy requirements for 90th percentile of absolute differential error
  + Frequency drift margin does not need to be added to the relative UE Rx-Tx accuracy requirements on the difference between two UE Rx-Tx measurements that belong to the same RxTx TEG
* Option 3: (vivo)
  + For the error from baseband of relative UE Rx-Tx time difference accuracy, the result of (95%-ile of UE Rx errors – 5%-ile of UE Rx errors) can be used.
  + The relative Rx-Tx accuracy can be defined as the sum of the error from baseband and the timing error margin.
* Recommended WF
  + *Need more discussion*

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| --- | --- |
| **Issue 2-2-3 How to define UE Rx-Tx accuracy related to TEG?** | |
| **Company** | **Comments** |
| CATT | Support option 1 and the second bullet of option 3. As commented in issue 2-2-3, since the TOA measurement for -3dB and -6dB are almost the same based on R16 simulation, we think the simulation results for RSTD in R16 which is the difference between the TOA measurements of two cells can be reused. |
| Qualcomm | Regarding option 1, can the proponent explain how the Rel-16 simulations can be reused?  Regarding option 3, the error metric for UE Rx-Tx baseband accuracy in Rel-16 was 90% of absolute error.  We would prefer to leverage the existing requirements to try to come up with the new requirement in Rel-17, even if the new requirement is defined with a lower error percentile (e.g. 80%). Would other companies consider this option? |
| Intel | In our view, Option 1 may be feasible because TEG are root from the RF impairment margin instead of baseband performance estimation error. |
| Huawei | We support the first bullet of option 2.  On option 1, as the Es/Iot condition is different, we are not sure if Rel-16 RSTD simulations can be re-used.  On the second bullet of option 2, we agree that for a single Rx-Tx measurement there is no need to consider frequency drift as the UL and DL are close, but the relative Rx-Tx accuracy is between two Rx-Tx measurements, and they may be taken at different time points. This is in our view as same as RSTD with reference and neighbor resource measured at different time points.  On option 3, we think RSTD simulation is more relevant to the relative error. |
| Ericsson | Option 1: Not sure what is meant by reuse Rel. 16 RSTD simulations.  Option 2: In principle we are fine. Work load shall be taken into account. |
| vivo | Support Option 1 and Option 3.  For the first bullet of Option 2, we understand R16 simulation result can be reused as mentioned in Option 1. When defining the UE Rx-Tx baseband error in Rel-16, 90% of absolute error is based on the maximum value of 95% of absolute UE Rx error and 5% of absolute UE Rx error. In our knowledge, when defining the relative PRS-RSRP accuracy requirement, the following rule is used:  The relative RSRP accuracy should be (RSRP95 – RSRP05), which was agreed in R4#98bis-e.  So we can follow the same rule for relative UE Rx error, i.e., the 90% of relative UE Rx error is based on the error of 95%-ile of absolute UE Rx error and 5%-ile of absolute UE Rx error. Then we do not need more simulation.  For the second bullet of Option 2, in our view, the frequency margin has been included into the timing error margin which is discussed in Issue 2-1-2. The total relative Rx-Tx accuracy can be defined as the sum of the error from baseband and the timing error margin. |
| Nokia | We support option 2. |

#### Issue 2-2-4 Reporting condition for RSTD/UE Rx-Tx measurement?

Proposals

* Option 1: (CATT, Huawei)
  + No need to define the reporting condition for RSTD and UE Rx-Tx measurement
* Option 2: (Ericsson)
  + Define measurement reporting condition based on margin value for TEG based measurements
  + Measurement reporting condition may be based on the magnitude of the difference between two margin values selected by the UE to perform positioning measurements (RSTD and UE Rx-Tx) in different measurement instances is within a threshold. Threshold value is FFS.
    - The UE capable of Rx TEG, shall report ∆RSTD defined in clause 10.1.23.3.2 provided that the magnitude of difference between timing error margins of the two TEGs used for the two RSTD measurements (RSTD1 and RSTD2) for deriving ∆RSTD is below X Tc; X is TBD. Otherwise, the UE does not report the measurement
    - The UE capable of RxTx TEG, shall report ∆TUE Rx-Tx defined in clause 10.1.25.3.2 provided that the magnitude of difference between timing error margins of the two TEGs used for the two UE Rx-Tx time difference measurements (TUE Rx-Tx1 - TUE Rx-Tx2) for deriving ∆TUE Rx-Tx is below X Tc; X is TBD. Otherwise, the UE does not report the measurement.
* Recommended WF
  + *Need more discussion*

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| **Issue 2-2-4 Reporting condition for RSTD/UE Rx-Tx measurement?** | |
| **Company** | **Comments** |
| CATT | Support option 1. UE can report the RSTD/UE Rx-Tx as long as the accuracy requirements are met. If we want to have this differential limitation, it should be through the relative accuracy requirements. |
| Qualcomm | Support Option 1. By specifying applicability for the timing error margins (issues 2-1-1 and 2-1-2) we ensure that performance would not be worse than in Rel-16. |
| Huawei | Option 1.  On option 2, it could happen that UE is not allowed to report measurement results for additional PRS resources within the same TRP just because e.g. UE is using a different Rx path than the main resource of the TRP. |
| Ericsson | As commented in issue 1-1-1 and based on latest agreement in RAN1, the applicability of a reported UE/TRP Rx/RxTx TEG is limited to the measurements contained within the single measurement instance of a measurement report. Within a measurement report there will be measurements with different margin values. Since different margin values result into measurements with different accuracies, there shall be a condition based on which UE decides whether or not to report the measurement.  To Huawei: the threshold value can be discussed. As proposed it is FFS. |
| Nokia | We support option 1 and share CATT’s and Qualcomm’s views. |

#### Issue 2-2-5 How to define the test case related to TEG?

Proposals

* Option 1: (CATT)
  + Define applicability for the test cases related to TEG, i.e. the tests apply for the UE supporting TEG feature and reporting the same Rx TEG/RxTx TEG for the two cells.
* Option 2: (Huawei)
  + UE should not be mandated to use the same TEG to perform the measurement on both cells during the test.
* Option 3: (Ericsson)
  + Rel. 16 setup can be reused to define test case for TEG based UE Rx-Tx measurement accuracy requirement.
  + Rel.16 setup shall be updated to support UE reported RxTx TEG margin value and UE is expected to meet the accuracy requirement corresponding to the RxTx TEG to pass the test.
  + Applicability rules for RxTx TEG accuracy requirement test case are not precluded.
* Recommended WF
  + *Need more discussion*

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| **Issue 2-2-5 How to define the test case related to TEG?** | |
| **Company** | **Comments** |
| CATT | Support option 1 and the second bullet of option 3.  For the test case with TEG, UE should meet the accuracy requirements corresponding to the Rx TEG (for RSTD) or RxTx TEG (for UE Rx-Tx). Actually we think in the test, UE is configured by LMF to report TEG, in this case, it is strange that UE doesn’t report TEG while it supports this feature.  And we think if UE doesn’t report TEG or doesn’t meet the accuracy requirements with TEG, it means UE doesn’t pass the test. |
| Qualcomm | The options are not mutually exclusive.  Support Option 2. Reporting is optional even if the UE supports the feature; it is up to UE implementation.  In principle, we would reuse existing accuracy test cases and just update applicable requirements. This could be done for all new test cases introduced in Rel-17. For Rel-16 test cases, it should also be OK since we would not be changing the test configuration or procedure. We understand this is what Option 3 proposes to do. If that’s the case, we would support it. |
| Intel | Option 1 needs more clarifications on the applicability.  Option 2, Option 3 1st bullet can be agreed in principle. |
| Huawei | Option 1 and option 2.  On option 3, it depends on the outcome of issue 2-2-3. |
| Ericsson | We agree that test case related to TEG shall be defined. The applicability rule proposed in option 1 is not clear. For the test purpose, we are open to discuss the possibility of UE using the same TEG to measure both cells. |
| vivo | In general, we agree with Option 1 and 2.  Only when the same Rx TRG/RxTx TEG is reported for the two cells, UE is required to meet the accuracy requirement related to TEG. |
| Nokia | Can be FFS until above performance part related issues are resolved. |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
|  | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

Sub-topic 2-1 Timing error margin

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 2-1-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-1-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-1-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

Sub-topic 2-2 Performance requirements with TEG

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| --- | --- |
|  | **Status summary** |
| **Issue 2-2-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 2-2-5** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

## Discussion on 2nd round (if applicable)

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
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Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
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Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents