**3GPP TSG RAN WG1 #108-e R1-220xxxx**

**e-Meeting, February 21 – March 3, 2022**

**Title: [DRAFT]** Reply LS on positioning issues needing further input

**Response to:** R1-2202620(R2-2203597) LS on positioning issues needing further input

**Release:** Rel-17

**Work Item:** NR\_pos\_enh-Core

**Source:** Moderator (CATT, Intel) [RAN1]

**To:** RAN2

**Cc:** RAN3

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**Attachments:** None

**1. Overall Description:**

RAN1 thanks RAN2 LS (R1-2202620/R2-2203597), which requests RAN1 inputs for a number of issues. In this reply LS, RAN1 would like to provide the following feedbacks for the issues in the RAN2 LS.

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| **Topic (Issue #)** | **Issues** | **Required RAN1 work** |
| **Mitigation of UE/TRP Rx/Tx timing delays**  **(Issue #1)** | **The definition of TEG is captured in the running CR of TS38.305 as**  ***UE Rx Timing Error Group (UE Rx TEG)****: A UE Rx TEG is associated with one or more DL timing measurements, which have the Rx timing error difference within a certain margin.*  ***UE RxTx Timing Error Group (UE RxTx TEG):*** *A 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.*  ***UE Tx Timing Error Group (UE Tx TEG)****: A UE Tx 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.*  ***TRP Rx Timing Error Group (TRP Rx TEG):*** *A TRP Rx TEG is associated with one or more UL timing measurements, which have the Rx timing error difference within a certain margin.*  ***TRP RxTx Timing Error Group (TRP RxTx TEG):*** *A TRP RxTx TEG is associated with one or more gNB Rx-Tx time difference measurements, which have the ‘Rx timing errors+Tx timing errors’ difference within a certain margin.*  ***TRP Tx Timing Error Group (TRP Tx TEG):*** *A TRP Tx TEG is associated with the transmissions of one or more DL PRS resources, which have the Tx timing error difference within a certain margin.*  **Issue:** companies in RAN2 commented that the definitions for the different TEG are unclear. The emphasis seems to be about the association with certain measurement but still does not explain the relation to the resources involved and what reference is for the “error difference”. It is also not intuitive what the “group” in TEG refers to;  RAN2 plan to use RAN1 agreements as baseline for the definition of TEGs, i.e.  **Tx timing error**: Result of Tx time delay (defined below) involved in the transmission of a signal. It is the uncalibrated Tx time delay, or the remaining delay after the TRP/UE internal calibration/compensation of the Tx time delay, involved in the transmission of the DL PRS/UL SRS signals. The calibration/compensation may also include the calibration/compensation of the relative time delay between different RF chains in the same TRP/UE and may also possibly consider the offset of the Tx antenna phase centre to the physical antenna centre  **Tx time delay**: From a signal transmission perspective, the time delay from the time when the digital signal is generated at baseband to the time when the RF signal is transmitted from the Tx antenna  **Rx timing error**: Result of Rx time delay (defined below) involved in the reception of a signal before reporting measurements that are obtained from the signal. It is the uncalibrated Rx time delay, or the remaining delay after the UE/TRP internal calibration/compensation of the Rx time delay, involved in the reception of the DL PRS/UL SRS signals. The calibration/compensation may also include the calibration/compensation of the relative time delay between different RF chains in the same UE/TRP and may also possibly consider the offset of the Rx antenna phase centre to the physical antenna centre  **Rx time delay**: From a signal reception perspective, there will be a time delay from the time when the RF signal arrives at the Rx antenna to the time when the signal is digitized and time-stamped at the baseband  **UE Tx ‘timing error group’ (UE Tx TEG)**: Tx timing errors, associated with UE transmissions on one or more UL SRS resources for positioning purpose, that are within a certain margin  **UE Rx ‘timing error group’ (UE Rx TEG)**: Rx timing errors, associated with UE reporting of one or more DL measurements (RSTD), that are within a certain margin  **UE RxTx ‘timing error group’ (UE RxTx TEG)**: Rx timing errors and Tx timing errors, associated with UE reporting of one or more UE Rx-Tx time difference measurements and one or more UL SRS resources for positioning purpose, that are within a certain margin  **TRP Tx ‘timing error group’ (TRP Tx TEG)**: Tx timing errors, associated with TRP transmissions on one or more DL PRS resources, that are within a certain margin  **TRP Rx ‘timing error group’ (TRP Rx TEG)**: Rx timing errors, associated with TRP reporting of one or more UL measurements, that are within a certain margin  **TRP RxTx ‘timing error group’ (TRP RxTx TEG)**: Rx timing errors and Tx timing errors, associated with TRP reporting of one or more gNB Rx-Tx time difference measurements and one or more DL PRS resources, that are within a certain margin. | **RAN1 provides further clarifications and confirmation on the definition;** |
| ***For Issue#1,*** *RAN1 has made the following agreement in RAN1#108e as the response:*  ***Agreement***  *Provide the following response to RAN2 LS (R1-2202620):*   * *A “Rx TEG” is associated with one or more measurements obtained from one or multiple received RS resources. The Rx timing error differences between any pair of the measurements belonging to the same Rx TEG are within a certain margin.* * *A “Tx TEG” is associated with one or more transmitted RS resources. The Tx timing error differences between any pair of the RS resources belonging to the same Tx TEG are within a certain margin.* * *The “group” means that for a set of multiple measurements or a set of multiple RS resources, if the error difference between any pair within the set is within the margin, the set is intuitively considered as timing error group, and is associated with a TEG ID.* * *The definitions of the Tx/Rx timing delays/errors and Rx/Tx/RxTx TEGs in RAN2’s LS that RAN2 plans on using as a baseline are correct with the following changes.*    + ***UE RxTx ‘timing error group’ (UE RxTx TEG)****: Rx timing errors and Tx timing errors, associated with UE reporting of one or more UE Rx-Tx time difference measurements, which have the 'Rx timing errors+Tx timing errors' differences within a certain margin*   + ***TRP RxTx ‘timing error group’ (TRP RxTx TEG)****: Rx timing errors and Tx timing errors, associated with TRP reporting of one or more gNB Rx-Tx time difference measurements, which have the 'Rx timing errors+Tx timing errors' differences within a certain margin* * *RAN1 is not planning on changing the definitions of UE Rx/Tx/RxTx TEGs specified in TS 38.214* | | |
| **Mitigation of UE/TRP Rx/Tx timing delays**  **(Issue #2)** | **Periodic Tx TEG reporting/TEG change procedure**  According to RAN1 LS in R2-2200092: For UL-TDOA, "   * + *Based on a configured periodicity, a UE may report the UE Tx TEG association for the SRS resources for positioning that have already been transmitted during the configured period*      - *It is up to RAN2 to decide how to indicate the change of the Tx TEG association during the configured period (e.g., using the timestamps)*     - *It is up to RAN4 to decide when the Tx TEG association is changed*   + *The values of the configurable periodicities are up to RAN2*   ". what is needed seems an a-periodic report (i.e., a report when the TEG association has changed).  **Issue:** RAN1 already agreed that periodic reporting for UL-TDOA should be supported, what is the purpose of periodically reporting the same information? Or only a-periodic report is required (i.e., a report when the TEG association has changed)? | **RAN1 provides further clarifications on the issue;** |
| ***For Issue#2,*** *RAN1 have reached the following agreement in RAN1#108e as the response:*  **TBD** | | |
| **PRU**  **(Issue #3)** | RAN2 has agreed that RAN2 will not discuss PRUs further without further guidance from RAN1 (LS or feature list). | **RAN1 to decide whether PRU is supported in Rel-17;** |
| ***For Issue#3,*** *RAN1 have reached the following conclusion in RAN1#108e as the response:*  ***Conclusion***  *From RAN1 perspective, no change to RAN1 specifications is needed in order to support PRU in Rel-17.* | | |
| **Preconfigured MG**  **(Issue #4)** | The gNB may activate the pre-configurated measurement gap upon receiving the request from a UE or LMF."  **Issue:** FFS on whether MG activation/deactivation request from the LMF can also be applicable to R16 MG configuration in addition to positioning MG preconfiguration, i.e. Can LMF ask the gNB to configure the MG (e.g. via RRC) directly? | **RAN1 provides further clarifications on the issue;** |
| ***For Issue#3,*** *RAN1 have reached the following conclusion in RAN1#108e as the response:*  **TBD** | | |
| **PRS processing window**  **(Issue #5)** | **Issues:**  FFS:Whether PRS processing window configuration is provided per BWP or not is up to RAN1 to decide.  FFS: Whether UE can be configured with multiple PRS processing windows should be decided by RAN1.  FFS on the max number of PPW configurations (from Stage 2 discussion)  FFS: whether UE should monitor PDCCH during RAR window/msgB window ot contention resolution timer for the affected symbols by PPW | **RAN1 provides further clarifications on the issue;** |
| ***For Issue#5,*** *RAN1 have reached the following conclusion in RAN1#108e as the response:*  **TBD** | | |
| **DL-AOD**  **(Issue #6)** | **For RAN1 agreements “The requested PRS measurement can be DL PRS RSRP and/or path PRS RSRP. ”, is there a need to request and provide only the RSRPP measurements for the additional measurements (without legacy RSRP)?** | **RAN1 provides further clarifications on the issue** |
|  | | |
| ***For Issue#6,*** *RAN1 have reached the following conclusion in RAN1#108e as the response:*  ***Agreement***  *For the reporting of first path DL-PRS RSRPP in DL AOD,*   * *For the 1st measurement, the report includes DL PRS RSRP and optionally DL PRS RSRPP using absolute reporting* * *For additional measurement, at least one of the two following measurement is reported:*   + *First path DL PRS RSRPP can be optionally reported using differential reporting with the first measurement of DL PRS RSRPP,*   + *DL PRS RSRP can be optionally reported using differential reporting with the first measurement of DL PRS RSRP.* | | |
| **DL-AOD**  **(Issue #7)** | As for the expected angle value and uncertainty information interaction between LMF and UE, RAN2 made the following agreements (RAN2#116bis).   |  | | --- | | * **Proposal 2.1-6: enhance LPP assistance data signalling to allow UE to request and LMF to provide the expected angle value and uncertainty.** |   **RAN2 understand “angle assistance information ” applies for DL-AOD positioning method. It is unclear to RAN2 on whether it also applies for DL-TDOA and Multi-RTT?** | **RAN1 provides further clarifications on the issue** |
|  | | |
| ***For Issue#7,*** *RAN1 have reached the following agreement in RAN1#108e as the response:*  ***Agreement***  *The expected angle value and uncertainty for DL-AoD methods also applies to DL-TDOA and Multi-RTT*   * *Note: This does not imply any restriction on UE measurement* | | |
| **FFS in RAN1 parameter list**  **(Issue #8)** |  | **RAN1 to resolve the FFFs.** |
| ***For Issue#8,*** *RAN1 will provide separate LS to RAN2 on the updated RRC parameter list, which includes the updated RRC parameters for Rel-17 positioning.* | | |
| **FFS in RAN1 UE feature list**  **(Issue #10)** |  | **RAN1 to resolve the FFFs.** |
| ***For Issue#9,*** *RAN1 will provide separate LS to RAN2 on the updated UE feature list, where includes the updated UE features for Rel-17 positioning.* | | |

**2. Actions:**

**To RAN2**

**ACTION:** RAN1 respectfully requests RAN2 to take above feedback on RAN2’s questions into account in their future work.

**3. Date of Next TSG-RAN WG1 Meetings:**

TSG-RAN WG1 Meeting #109-e 16 May – 27 May 2022 E-Meeting

TSG-RAN WG1 Meeting #110 22 Aug – 26 Aug 2022 Toulouse, France