3GPP TSG RAN WG1 Meeting #106e R1-xxxxxx

**e-Meeting, August 16th – 27th, 2021**

Agenda Item: 8.4.2

Source: Moderator (OPPO)

Title: summary of discussion/approval of reply LS for R1-2104230

Document for: Discussion and Decision

# Introduction

In RAN1#105-e meeting, RAN1 received an LS (R1-2104230) [1] from RAN2 and the following questions are raised by RAN2, seeking for answers from RAN1.

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| **1)** RAN2 respectfully requests RAN1 to prioritize the TA pre-compensation work on: (i) whether and/or what parameters to broadcast for TA pre-compensation, and (ii) when broadcasted, how often the broadcasted parameters are expected to change over time. **2)** RAN2 respectfully requests RAN1 to provide input on: (i) how UE determines UE-gNB RTT, and (ii) what additional information needs to be broadcasted other than that for TA pre-compensation, if any.**3)** RAN2 respectfully requests RAN1 to provide input on the exact content and frequency of UE reporting of information about the UE specific TA pre-compensation at least for uplink scheduling adaptation. |

In RAN1#105-e meeting, we have responded to RAN2 with a reply LS R1-2106341, where we provided our answer to Q2

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| **RAN2 Q2**: RAN2 respectfully requests RAN1 to provide input on: (i) how UE determines UE-gNB RTT, and (ii) what additional information needs to be broadcasted other than that for TA pre-compensation, if any.**RAN1 answer**: In RAN1#105-e meeting, RAN1 reached the following agreement on UE-gNB RTT determination, which is used to delay the starts of ra-ResponseWindow and msgB-ResponseWindow. The UE-gNB RTT is estimated according to the UE's TA and K\_mac. RAN2 may take this information into account for future discussion. Agreement:The starts of ra-ResponseWindow and msgB-ResponseWindow are delayed by an estimate of UE-gNB RTT. * The estimate of UE-gNB RTT is equal to the sum of UE’s TA and K\_mac.

Note 1: The UE’s TA is based on the RAN1#104bis-e agreement on Timing Advance applied by an NR NTN UE given by  $N\_{TA}=\left(N\_{TA}+N\_{TA, UE-specific}+N\_{TA,common}+N\_{TA,offset}\right)×T\_{c}$$T\_{TA}=\left(N\_{TA}+N\_{TA, UE-specific}+N\_{TA,common}+N\_{TA,offset}\right)×T\_{c}$. The estimate of gNB-satellite RTT is equal to the sum of $N\_{TA,common}×T\_{c}$ and K\_mac.  How to treat $N\_{TA}$ and $N\_{TA,offset}$ can be further discussed.Note 2: According to the RAN1#104bis-e agreement: When UE is not provided by network with a K\_mac value, UE assumes K\_mac = 0.Note 3: The accuracy of the estimated UE-gNB RTT with respect to the true UE-gNB RTT can be further discussed.Note 4: Other options of determining the estimate of UE-gNB RTT can be further discussed. |

In this document, we continue discussing whether RAN1 can provide answers to the rest of the questions.

# Discussions

In this section, we discuss the possible answers to the RAN2’s answers.

## Answers to Q1

The first questions asked by RAN2 are the following

1. whether and/or what parameters to broadcast for TA pre-compensation,
2. when broadcasted, how often the broadcasted parameters are expected to change over time.

For Q1(i), so far RAN1 has made the following agreements

Agreement:

The Timing Advance applied by an NR NTN UE in RRC\_IDLE/INACTIVE and RRC\_CONNECTED is given by:

$$T\_{TA}=\left(N\_{TA}+N\_{TA,UE-specific}+N\_{TA,common}+N\_{TA,offset}\right)×T\_{c}$$

Where:

* $N\_{TA}$ is defined as 0 for PRACH and updated based on TA Command field in msg2/msgB and MAC CE TA command.
	+ FFS: details of NTA update/accumulation.
* $N\_{TA,UE-specific}$  is UE self-estimated TA to pre-compensate for the service link delay.
* $N\_{TA,common}$ is network-controlled common TA, and may include any timing offset considered necessary by the network.
* $N\_{TA,common}$ with value of 0 is supported.
	+ FFS:  details of signaling including granularity.
* $N\_{TA,offset}$ is a fixed offset used to calculate the timing advance.

Note-1: Definition of $N\_{TA}$ is different from that in RAN1#103-e agreement.

Note-2: UE might not assume that the RTT between UE and gNB is equal to the calculated TA for Msg1/Msg A.

Note-3: $N\_{TA,common}$ is the common timing offset X as agreed in RAN1 #103-e.

Agreement:

Support serving-satellite ephemeris broadcast based on one or more of the following:

* Set 1: Satellite position and velocity state vectors:
	+ position X,Y,Z in ECEF (m)
	+ velocity VX,VY,VZ in ECEF (m/s)
* Set 2: At least the following parameters in orbital parameter ephemeris format:
	+ Semi-major axis α [m]
	+ Eccentricity e
	+ Argument of periapsis ω [rad]
	+ Longitude of ascending node Ω [rad]
	+ Inclination i [rad]
	+ Mean anomaly M [rad] at epoch time to
* FFS: Whether pre-provisioned ephemeris based on orbital elements can be used as reference. Thereby, only delta corrections can be broadcast in order to reduce the overhead
* FFS: The field size for each parameter
* FFS: The impact on signaling due to the required accuracy of serving-satellite ephemeris
* FFS: Whether down-selection is needed or both sets are supported

Based on the latest RAN1 agreements, RAN1 has agreed that at least the following parameters are to be broadcasted for TA pre-compensation

* Serving satellite ephemeris
* Common TA

Additional possible parameters are still in RAN1 discussion. Therefore, RAN1 may provide the answer to RAN2 with this information.

**Moderator proposal:**

For RAN2 question (i): Capture the above RAN1 agreements in the reply LS and indicate to RAN2 that at least the following parameters are to be broadcasted for TA pre-compensation

* Serving satellite ephemeris
* Common TA

For RAN2’s question (ii): no answer can be given in the reply LS.

**Company’s view**

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| Company name | Comments and views |
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## Answers to Q3

Wait until RAN1 agreement, no answer at the moment to be provided to RAN2.

**Company’s view**

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| Company name | Comments and views |
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# References

R1-2104230 LS on TA pre-compensation RAN2, OPPO

R1-2106341 Reply LS on TA pre-compensation RAN1, OPPO

R1-2107706 Discussion on RAN2 LS on TA Pre-compensation, Apple