3GPP TSG-RAN WG1 Meeting #106-e R1- 2xxxxxx

e-Meeting, August 16th – 27th, 2021

**Title: DRAFT** Reply LS on TA pre-compensation

**Reply to:** LS on TA pre-compensation (R2-2104376)

**Release:** Release 17

**Work Item:** NR\_NTN\_solutions-Core

**Source:** Moderator (OPPO), [RAN1]

**To:** RAN2

**Cc:**

**Contact Person:**

**Name:** Hao Lin

**E-mail Address:** lin.hao@oppo.com

**Attachments:** None

**1. Overall Description:**

RAN1 would like to thank RAN2 for sending their LS on TA pre-compensation. RAN1 has discussed the questions asked by RAN2 and RAN1 answer is provided below.

**RAN2 Q1**: 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.

**RAN1 answer to Q1-(i)**: RAN1 has agreed that serving satellite ephemeris is broadcasted for TA pre-compensation, where the satellite ephemeris format supports both Set 1 and Set 2. In addition, a network controlled common TA may be broadcasted, which contains information for deriving/calculating the common TA.

Relevant RAN1 agreements can be found below and RAN1 will inform RAN2 in case any additional parameters are agreed to be broadcasted.

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

Agreement:

Specifications should support delivery of ephemeris information using both ephemeris formats, i.e., state vectors and orbital elements.

**2. Actions:**

**To RAN2 group:**

**ACTION:** RAN1 respectfully asks RAN2 to take the above into account for future work.

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

TSG-RAN WG1 Meeting #106-bis-e 11 – 19 October 2021 Electronic Meeting

TSG-RAN WG1 Meeting #107-e 11 – 19 November 2021 Electronic Meeting