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:**

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**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 to support broadcasting the following parameters: 1) ~~that~~ serving satellite ephemeris ~~is broadcasted for TA pre-compensation~~, where the satellite ephemeris format supports both Set 1 and Set 2; 2) common TA related parameters, ~~In addition, a network controlled common TA may be broadcasted~~ which contains information for deriving/calculating the common TA. The content of the common TA related parameters are still under RAN1 discussion; 3) a fixed offset $N\_{TA,offset}$used to calculate the timing advance.

**RAN1 answer to Q1-(ii):** RAN1 has agreed to have a validity duration for satellite ephemeris data. The duration is configured by the network and it indicates the maximum time duration in which the UE can apply the satellite ephemeris without having acquired new satellite ephemeris. Whether this validity duration can be applied for common TA related parameters is still under RAN1 discussion.

Relevant RAN1 agreements ~~can be found~~ are attached 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.

Agreement:

* A validity duration configured by the network for satellite ephemeris data indicates the maximum time during which the UE can apply the satellite ephemeris without having acquired new satellite ephemeris.
	+ FFS: Associated UE behaviour if the UE does not read the ephemeris within the validity duration.
* FFS: Whether the same validity duration can be applied for Common TA.

**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