

**Title:** LS on Correction Field update for Transparent Clock  
**Response to:** -  
**Release:** Rel-17  
**Work Item:** Enhanced support of Industrial Internet of Things

**Source:** 3GPP SA WG2  
**To:** IEEE 1588  
**Cc:** IEEE 802.1

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**Attachments:** -

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### 1. Overall Description:

3GPP 5GS can operate as an end-to-end or peer-to-peer Transparent Clock integrated in a TSN network with external PTP GM Clock. In the IEEE Std 1588-2019, the end-to-end or the peer-to-peer Transparent Clock uses the  $\langle \text{residenceTime} \rangle = \langle \text{egress timestamp} \rangle - \langle \text{ingress timestamp} \rangle$  to update the "correction field" in the PTP messages. The  $\langle \text{residenceTime} \rangle$  is based on the Local Transparent Clock time and is not based on the PTP GM time, which will introduce some measurement errors to update the "correction field" which is expressed in PTP GM time. In order to minimize such measurement error, it is described in clause 6.5.3 of IEEE 1588-2019 that the end-to-end Transparent Clock is synchronizing to the PTP GM clock or using a Local PTP Clock.

However, if the 5GS operates as an end-to-end Transparent Clock, the 5GS cannot synchronize its 5GS Clock to the external PTP GM Clock. In such case, using the  $\langle \text{residenceTime} \rangle$  based on Local Transparent Clock to update the "correction field", depending on the frequency difference between the 5GS clock and the external PTP GM, may lead to non-negligible errors.

Q1: When the 5GS operates as an end-to-end Transparent Clock, how to reduce the measurement errors of  $\langle \text{residenceTime} \rangle$  to update the "correction field" in the PTP messages? For example, whether the  $\langle \text{residenceTime} \rangle$  expressed in the Transparent Clock time (i.e. the 5GS time) can be converted into the  $\langle \text{residenceTime} \rangle$  expressed in PTP GM time via cumulative rateRatio or the factor as specified in Equation (6) of clause 12.2.2 in IEEE Std 1588-2019? If neither can be used, how to do the conversion to reduce the measurement errors?

Q2: When the 5GS operates as a peer-to-peer Transparent Clock, how to reduce the measurement errors of the  $\langle \text{residenceTime} \rangle$  to update the "correction field" in the PTP messages? For example, whether the  $\langle \text{residenceTime} \rangle$  expressed in the Transparent Clock time (i.e. the 5GS time) can be converted into the  $\langle \text{residenceTime} \rangle$  expressed in PTP GM time via the cumulative rateRatio? If not, how to do the conversion to reduce the measurement errors?

### 2. Actions:

To IEEE 1588

#### ACTION:

SA WG2 kindly requests to provide answers for the above questions.

### 3. Date of Next TSG SA WG2 Meetings:

TSG-SA2 Meeting #147E	18 – 22 October 2021	e-meeting
TSG-SA2 Meeting #148E	15 – 19 November 2021	e-meeting

