**SA WG2 Meeting #S2-143E  *S2-200xxxx***

**24 February – 9 March, 2021, Elbonia**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **23.501** | **CR** | **2261** | **rev** | **-** | **Current version:** | **16.7.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | KI #1-1, Update for supporting UL time sync with gPTP message | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | CATT, Ericsson, Samsung, ETRI?, NTT DOCOMO | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | | 2021-02-24 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
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| ***Reason for change:*** | | Per TR 23.700-20 clause 8.1, it is concluded to support UL time synchronization with gPTP message. | | | | | | | | |
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| ***Summary of change:*** | | Add support for UL time synchronization with gPTP message. | | | | | | | | |
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| ***Consequences if not approved:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.27.1.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* \* 1st change \* \* \* \*

##### 5.27.1.2.2 Distribution of TSN grandmaster clock and time-stamping

The mechanisms for distribution of TSN GM clock and time-stamping described in this clause are according to IEEE Std 802.1AS [104].

NOTE 1: It means Externally-observable behavior of the 5GS bridge needs to comply with IEEE Std 802.1AS [104].

For downlink Time Synchronization for TSN, upon reception of a downlink gPTP message the NW-TT makes an ingress timestamping (TSi) for each gPTP event (Sync) message and uses the cumulative rateRatio received inside the gPTP message payload (carried within Sync message for one-step operation or Follow\_up message for two-step operation) to calculate the link delay from the upstream TSN node (gPTP entity) expressed in TSN GM time as specified in IEEE Std 802.1AS [104]. NW-TT then calculates the new cumulative rateRatio (i.e. the cumulative rateRatio of the 5GS) as specified in IEEE Std 802.1AS [104] and modifies the gPTP message payload (carried within Sync message for one-step operation or Follow\_up message for two-step operation) as follows:

- Adds the link delay from the upstream TSN node in TSN GM time to the correction field.

- Replaces the cumulative rateRatio received from the upstream TSN node with the new cumulative rateRatio.

- Adds TSi in the Suffix field of the gPTP packet as described in Annex H.

UPF/NW-TT then forwards the gPTP message from TSN network to the DS-TT ports in Master state via PDU sessions terminating in this UPF that the UEs have established to the TSN network. All gPTP messages are transmitted on a QoS Flow that complies with the residence time upper bound requirement specified in IEEE Std 802.1AS [104].

NOTE 2: The sum of the UE-DS-TT residence time and the PDB of the QoS Flow needs to be lower than the residence time upper bound requirement for a time-aware system specified in IEEE Std 802.1AS [104].

A UE receives the gPTP messages and forwards them to the DS-TT. The DS-TT then creates egress timestamping (TSe) for the gPTP event (Sync) messages for external TSN working domains. The difference between TSi and TSe is considered as the calculated residence time spent within the 5G system for this gPTP message expressed in 5GS time. The DS-TT then uses the rateRatio contained inside the gPTP message payload (carried within Sync message for one-step operation or Follow\_up message for two-step operation) to convert the residence time spent within the 5GS in TSN GM time and modifies the payload of the gPTP message that it sends towards the downstream TSN node as follows:

- Adds the calculated residence time expressed in TSN GM time to the correction field.

- Removes Suffix field that contains TSi.

For uplink Time Synchronization for TSN, the ingress DS-TT performs the same operations for the received DL gPTP messages as NW-TT performs for the DL gPTP messages as follows:

- Adds the link delay from the upstream TSN node in TSN GM time to the correction field.

- Replaces the cumulative rateRatio received from the downstream TSN node with the new cumulative rateRatio.

- Adds TSi in the Suffix field of the gPTP packet.

The UE forwards the gPTP message from TSN network to the UPF.

In the case of synchronizing end stations behind NW-TT, the egress TT is NW-TT. The UPF/NW-TT performs the same operations as DS-TT performs for the received DL gPTP messages.

In the case of synchronizing TSN end stations behind DS-TT, the egress TT is DS-TT of the other UE, and the UPF/NW-TT forwards the received UL gPTP message transparently to the other UEs/DS-TT ports in Master state.

The Egress TT (NW-TT/DS-TT) performs the operations as follows:

- Adds the calculated residence time to the correction field.

- Removes Suffix field that contains TSi.

\* \* \* \* End of changes \* \* \* \*