**3GPP TSG-WG SA2 Meeting #143E e-meeting  *S2-200XXXX***

**Elbonia, February 24 – March 5, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **23.501** | **CR** | **DRAFT** | **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#1-3, UL Sync including New QoS flow establishment for the gPTP | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Samsung | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | IIoT | | | | |  | ***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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | In Rel-17,Uplink synchornization is supported by 5GS. Current version of TS23.501 specifies only downlink synchronization by 5GS, but not uplink synchornization by 5GS. | | | | | | | | |
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| ***Summary of change:*** | | - Add New Qos flow establishment for the gPTP if follow the IEEE delay recommendation (10ms) for uplink Synchronization both in case that uplink gPTP messages go toward TSN network behind the UPF, and in case that uplink gPTP messages go toward TSN network behind another DS-TT/UE connected to the same UFP. | | | | | | | | |
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| ***Consequences if not approved:*** | | Uplink synchornization is not supported by 5GS. | | | | | | | | |
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| ***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:*** | |  | | | | | | | | |

\*\*\*\*\* BEGIN 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].

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 then forwards the gPTP message from TSN network to the UEs via all 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, all gPTP messages are also transmitted satisfying the residence time upper bound requirement specified in IEEE Std 802.1AS [104].

NOTE 3: In the case of synchronizing TSN end stations behind NW-TT, 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].

NOTE 4: In the case of synchronizing TSN end stations behind DS-TT, the sum of the UE-DS-TT residence time and the PDB of the QoS Flow for the PDU session of the ingress DS-TT port and the UE-DS-TT residence time and the PDB of the QoS Flow for the PDU session of the egress DS-TT port need to be lower than the residence time upper bound requirement for a time-aware system specified in IEEE Std 802.1AS [104].

#### 5.27.1.3 Support for multiple TSN working domains

\*\*\*\*\* END OF CHANGES \*\*\*\*\*