**3GPP TSG RAN meeting #100 RP-230xxx**

**Taipei, June 12-14, 2023**

## Status Report to TSG

**Agenda item:** 9.3.3.5

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| --- | --- |
| **WI / SI Name** | NR Timing Resiliency and URLLC enhancements |
| included in this status report | Study Item: No | Core part: Yes | Performance part:No | Testing part:No |
| **Acronym** | TRS\_URLLC-NR-Core |
| **Unique ID** | 991136 |
| **TSG Tdoc of latest approved WI/SI description (if any)** | [RP-230754](http://3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_99/Docs/RP-230754.zip) |
| **Target Completion Date****(indicate if changed)** | Study Item: N/A | Core part: 2023/12 | Performance part: N/A | Testing part: N/A |
| **Overall Completion level** | Study Item: N/A | Core part:25% | Performance Part: N/A | Testing part: N/A |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

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| --- | --- |
| **Leading WG** | RAN3 |
| **Rapporteur** | **Name** | Sean Kelley |
| **Company** | Nokia |
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## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

## 2.1 RAN1

## 2.2 RAN2

#### 2.2.1 Agreements

New agreements from **RAN2#121-bis-e** meeting:

**5GS network timing synchronization status and reporting:**

- RAN2 to confirm that there is no need to support “group of cells across gNBs” for scope of the report ID. The scenario, as per RAN3 will be supported - different cells within gNB that are served by different DUs and different clock quality is possible.

- Confirm the following SA2’s conclusions regarding NG-RAN procedures on 5G clock quality information:

- RRC\_INACTIVE/IDLE UE to be informed of timing synchronization status via an event ID in SIB9 by comparison with the one maintained locally.

- RRC\_CONNECTED UE to be informed of 5G clock quality information via dedicated RRC message

- Postpone the UAC until CT1’s feedback on UAC framework to randomize UE access to network in the time domain

- 5G Clock Quality information is carried in *DLInformationTransfer* message.

- FFS if update of event ID is informed to UE by SI modification procedure

- For Idle/Inactive mode RAN2 assumes that the NAS layer triggers the RRC connection procedure based on inputs from AS.

- The AS layer of the UE determines if there a change of event ID and it indicates a change in the RAN timing synchronization status to NAS layers. FFS to double check for connected mode and inactive

**RAN feedback for low latency communication**

- We will wait for XR to progress and see if we can use the existing mechanism. RAN2 will strive to re-use existing mechanism or rely on gNB to determine the information (i.e. aim to not introduce new UE specific BAT reporting)

New agreements from **RAN2#122** meeting:

**5GS network timing synchronization status and reporting:**

- Update of event ID is informed to UE by normal SI modification procedure.

- Confirm the AS layer of the UE determines if there a change of event ID and/or gNB ID. If there is a change, the AS layer notifies the change in the RAN timing synchronization status to NAS layer. For both IDLE and INACTIVE mode, NAS layer may request the RRC layer to move to RRC\_CONNECTED

- For RRC\_CONNECTED mode UEs, the NW has the necessary information to determine whether to send detailed clock quality information to the UE, (i.e. it may choose to always send update or only when needed) and the details can be left to NW implementation

- Event ID is optional. Under the same gNB, UE considers the change of timing synchronization if event ID field from SIB9 is different. FFS if gNB always broadcasts event ID

- If the UE is in RRC\_INACTIVE, the UE can acquire clock quality information using the SDT procedure, if it supports and/is configured with SDT procedure.

**RAN feedback for low latency communication**

* No new UE report is needed for objective 3 on BAT offset derivation. The XR mechanism can be used if the network configures it, otherwise we can use legacy BSR. We can close the objective in RAN2.

#### 2.2.2 Remaining Open issues

**5GS network timing synchronization status and reporting:**

- Whether the NW always broadcast event ID in SIB9 if it supports 5GS network timing synchronization status and reporting.

- Value range for event ID in SIB9 and connected mode signalling on detailed clock information.

**RAN feedback for low latency communication**

- RAN feedback for low latency communication objective is closed from RAN2 point of view.

## 2.3 RAN3

#### 2.3.1 Agreements

New agreements from **RAN2#119-bis-e** meeting:

**5GS network timing synchronization status and reporting:**

- Include a new *Clock Quality Reporting Control Information* IE in the Rel-17 *Time Synchronisation Assistance Information* IE. It contains a *Clock Quality Detail Level* IE that can be set to “clock quality metrics” or “acceptance indication”. If set to “acceptance indication”, then *Clock Quality Acceptance Criteria* IE is included.

- A new *RAN Timing Synchronisation Status Information* IE can be signalled to the AMF containing Synchronisation State, Traceable to UTC, Traceable to GNSS, Clock Frequency Stability, Clock Accuracy, and Parent Time Source IEs

- The encoding of Synchronisation State, Traceable to UTC, Traceable to GNSS, and Parent Time Source are ENUMERATED with codepoints aligned with TS 23.501.

**RAN feedback for low latency communication:**

- In the existing *TSC Assistance Information* IE, include a CHOICE between feedback type “proactive” and “reactive”. If set to “proactive”, then *Burst Arrival Time Window* IE and optionally *Periodicity Range* IE are included. If set to “reactive”, then *Capability for BAT Adaptation* IE is included.

- For proactive feedback, TSC Feedback Information (Burst Arrival Time Offset and optionally Adjusted Periodicity) can be provided for downlink (FFS for uplink) in the *PDU Session Resource Setup Response Transfer* IE of the PDU SESSION RESOURCE SETUP RESPONSE message, and the *PDU Session Resource Modify Response Transfer* IE of the PDU SESSION RESOURCE MODIFICATION RESPONSE message.

- For reactive feedback, TSC Feedback Information (Burst Arrival Time Offset) can be provided for downlink and/or uplink (support for uplink is FFS pending RAN2) in the *PDU Session Resource Notify Transfer* IE of the PDU SESSION RESOURCE NOTIFY message.

Baseline CRs for NGAP (R3-231998), XnAP (R3-232152), and F1AP (R3-232109) were endorsed, reflecting the above agreements.

New agreements from **RAN2#120** meeting:

**5GS network timing synchronization status and reporting:**

- In NGAP, introduce a new Timing Synchronisation Report procedure (class 2) to enable the gNB to report RAN TSS to the AMF.

- In F1AP, introduce a new Timing Synchronisation Report procedure (class 2) to enable the gNB-DU to report RAN TSS to the gNB-CU.

- Working Assumption: When *Clock Quality Detail Level* IE has value “clock quality metrics”, all clock quality metrics supported by the gNB implementation are delivered to the UE (may be revisited based on SA2 agreements).

- The encoding of *Clock Frequency Stability* IE is BIT STRING (SIZE (16)), indicating the offsetScaledLogVariance as specified in TS 23.501.

**RAN feedback for low latency communication:**

- The encoding of *Periodicity Range* IE is a choice between a periodicity lower bound and upper bound, and a list of up to 8 [FFS] allowed periodicities.

- The existing Editor’s Note “Whether uplink is supported for reactive feedback is FFS pending RAN2” was deleted (i.e., it is supported).

Text proposals for NGAP (R3-233477), XnAP (R3-233489), and F1AP (R3-233525) were agreed, reflecting the above agreements.

#### 2.3.2 Open Issues

All objectives of the work item remain open.

Is proactive RAN feedback applicable/relevant after the initial establishment of the TSC QoS flow?

## 2.4 RAN4

## 3. Detailed progress in SA WGs since last TSG meeting (for all involved WGs)

## 4. References

New references from the last RAN WG meetings.

**RAN2#121-bis-e**

1. R2-2303864, Timing Resiliency and URLLC enh Workplan, Nokia, Nokia Shanghai Bell
2. R2-2302689, Discussion on 5GS Clock quality information delivery to UE, Huawei, HiSilicon
3. R2-2302690, Discussion on UL reactive RAN feedback for burst sending time adjustment, Huawei, HiSilicon
4. R2-2302722, Discussion on RAN Feedback for Low Latency Communication, vivo
5. R2-2302723, Discussion on 5GS Network Timing Synchronization Status and Reporting, vivo
6. R2-2302761, RAN2 Impact of timing synchronization status information delivery in CONNECTED mode, CATT
7. R2-2302762, Impact of timing synchronization status and reporting in IDLE/INACTIVE mode, CATT
8. R2-2302833, Considerations on BAT offset ZTE Corporation, Sanechips
9. R2-2302834, Considerations on time synchronization status and reporting, ZTE Corporation, Sanechips
10. R2-2302932, Timing Synchronization Reporting, Qualcomm Incorporated
11. R2-2302933, UL BAT Reporting and Adjustment, Qualcomm Incorporated
12. R2-2303382, Views on RAN feedback for burst sending time adjustment, Apple
13. R2-2303723, Discussion on NR Timing Resiliency, Ericsson
14. R2-2303733, RAN2 impact of DL and UL scheduling adaptation and BAT offset deviation, Ericsson
15. R2-2303777, Discussion on timing resiliency and URLLC enhancements, China Telecom
16. R2-2303816, 5GS network timing synchronization status and reporting, Intel Corporation
17. R2-2303817, RAN reactive UL feedback for burst sending time adjustment, Intel Corporation
18. R2-2303865, 5GS network timing synchronization status and reporting, Nokia, Nokia Shanghai Bell
19. R2-2303866, Reactive RAN feedback for upstream scheduling, Nokia, Nokia Shanghai Bell
20. R2-2304152, Delivery of 5G Clock Quality Information, Samsung
21. R2-2304153, Adaptive Upstream Scheduling Based on RAN Feedback, Samsung

**RAN2#122**

1. R2-2304605, Response to Reply LS on Proposed method for Time Synchronization status reporting to UE(s) (C1-232942; contact: Nokia) CT1 LS in Rel-18 TRS\_URLLC To:RAN2, SA1 Cc:SA2, RAN3
2. R2-2304621, Reply LS on proposed method for time synchronization status reporting to UE(s) (R3-230811; contact: Nokia) RAN3 LS in Rel-18 FS\_5TRS\_URLLC To:SA2, RAN2
3. R2-2305655, Stage 2 running CR on timing resiliency and URLLC, Nokia, Nokia Shanghai Bell
4. R2-2304704, Further Discussion on 5G Clock Quality Information Reporting, vivo Mobile Com. (Chongqing)
5. R2-2304705, Discussion on RAN feedback for Upstream Scheduling, vivo Mobile Com. (Chongqing)
6. R2-2304841, Discussion on TSS change notification procedure, Huawei, HiSilicon
7. R2-2304842, Discussion on the update of event ID, Huawei, HiSilicon
8. R2-2304972, RAN2 Impact of 5GS network timing synchronization status and reporting, CATT
9. R2-2304973, Discussion on RAN feedback , CATT
10. R2-2305079, RAN feedback for burst sending time adjustment , Apple
11. R2-2305080, 5GS Network Timing Synchronization in RRC\_INACTIVE, Apple
12. R2-2305129, Clock Quality Report Delivery, Qualcomm Incorporated
13. R2-2305130, UL BAT Derivation at RAN, Qualcomm Incorporated
14. R2-2305627, Discussion on the network timing synchronization status monitoring, CMCC
15. R2-2305656, 5GS network timing synchronization status and reporting, Nokia, Nokia Shanghai Bell
16. R2-2305657, Reactive RAN feedback for upstream scheduling, Nokia, Nokia Shanghai Bell
17. R2-2305738, Signaling of 5G Clock Quality Information, Samsung
18. R2-2305739, Time Synchronization Status Update via EventID, Samsung
19. R2-2305966, Further discussion on time synchronization status and reporting, ZTE Corporation, Sanechips
20. R2-2305967, Discussion on the issue of RACH congestion, ZTE Corporation, Sanechips
21. R2-2306343, Discussion on 5G network timing synchronization status and reporting, China Telecom Corporation Ltd. discussion
22. R2-2306464, Burst Arrival Time (BAT) offset derivation, Ericsson
23. R2-2306473, Discussion on NR timing resiliency, Ericsson

**RAN3#119-bis-e**

1. R3-231115, Reply LS on Proposed method for Time Synchronization status reporting to UE(s) (RAN2, Nokia)
2. R3-231194, Work plan for Timing Resiliency and URLLC enhancements (Nokia (rapporteur))
3. R3-231195, (TP for TS 38.413 BL CR) 5GS network timing synchronization status and reporting (Nokia, Nokia Shanghai Bell)
4. R3-231196, (TP for TS 38.413 BL CR) RAN feedback for low latency communication (Nokia, Nokia Shanghai Bell)
5. R3-231264, Discussion on Time Synchronisation Status and Reporting (Qualcomm Incorporated)
6. R3-231265, Discussion on Adaptive UL and DL Scheduling (Qualcomm Incorporated)
7. R3-231274, Discussion on NR Timing Resiliency and URLLC enhancements (Ericsson)
8. R3-231324, Discussion on Network timing synchronization status and reporting (CATT)
9. R3-231325, Discussion on Adapting downstream and upstream scheduling (CATT)
10. R3-231409, Support NR Timing Resiliency and URLLC enhancements (Ericsson)
11. R3-231412, (TP to TS 38.423 and 38.473) Support of Timing Resiliency and URLLC (Huawei, China Unicom)
12. R3-231413, Support of Timing Resiliency and URLLC (Huawei, China Unicom)
13. R3-231661, Discussion on network timing synchronization status and reporting (Samsung)
14. R3-231662, Discussion on adapting downstream and upstream scheduling based on RAN feedback (Samsung)
15. R3-231783, Discussion on timing synchronization status and reporting (ZTE)
16. R3-231784, Discussion on RAN feedback for downstream scheduling (ZTE)
17. R3-231811, Discussion on RAN3 Impact of Timing Resiliency and URLLC Enhancements (China Telecom)

**RAN3#120**

1. R3-232504, Response to Reply LS on Proposed method for Time Synchronization status reporting to UE(s) (CT1(Nokia))
2. R3-232551, (BLCR to 38.413) Introduction of 5G Timing Resiliency and URLLC enhancements (Huawei, China Unicom, Nokia, Nokia Shanghai Bell, Samsung, Ericsson, ZTE, CATT)
3. R3-233288, (BLCR to 38.423) Introduction of 5G Timing Resiliency and URLLC enhancements (Ericsson, Huawei, Nokia, Nokia Shanghai Bell, Samsung, ZTE, CATT)
4. R3-232553, (BLCR to 38.473) Introduction of 5G Timing Resiliency and URLLC enhancements (ZTE, Huawei, Ericsson, Nokia, Nokia Shanghai Bell, Samsung)
5. R3-232722, (TP for TS 38.413 BL CR) Further details on timing resiliency (Nokia, Nokia Shanghai Bell)
6. R3-232791, Discussion on Time Synchronization Status and Reporting (Qualcomm Incorporated)
7. R3-233286, Discussion and TPs for timing synchronization status and reporting (ZTE)
8. R3-233175, (TP to TRS\_URLLC BLCR for TS 38.413, TS 38.423 and TS 38.473) Support of 5G Timing Resiliency enhancements (Huawei, China Unicom)
9. R3-232723, (TP for TS 38.413 BL CR) Further details on RAN feedback for low latency communication (Nokia, Nokia Shanghai Bell)
10. R3-233176, (TP to TRS\_URLLC BLCR for TS 38.413, TS 38.423 and TS 38.473) Support of RAN feedback enhancements (Huawei, China Unicom)
11. R3-232781, TP for BLCR to TS38.413 Adapting downstream and upstream scheduling (CATT)
12. R3-232780, Discussion on Network timing synchronization status and reporting (CATT)
13. R3-232938, Text Proposals on Support NR Timing Resiliency and URLLC enhancements (Ericsson)
14. R3-232970, Discussion on NR Timing Resiliency and URLLC enhancements (Ericsson)
15. R3-233142, Discussion on open issues for network timing synchronization status and reporting (Samsung)
16. R3-233143, (TP for TRS\_URLLC-NR for TS 38.473) Supporting network timing synchronization status and reporting over F1 (Samsung)
17. R3-233287, (TP to BL CR of 38.413) RAN feedback for downlink scheduling (ZTE)