3GPP TSG-RAN WG2 Meeting #123 R2-230xxxx

Toulouse, France, 21– 25 August 2023

**Agenda item:** **7.23.1**

**Source:** **Ericsson (Rapporteur)**

**Title:** **Summary of [Post123][xxx]**

**WID/SID:** **xxx**

**Document for:** **Discussion and Decision**

# 1 Introduction

This document is the report of the following email discussion:

* [POST123][309][R18 URLLC] Running 38.331 (Ericsson)

Scope : Discuss stage-3 signaling details

Review running CR

Outcome: CR to be submitted to next meeting

Deadline: long

Email discussion deadlines:

Company comments for preliminary conclusion 2023-09-21 10:00 UTC

Based on these comments Rapporteur will produce a new version of the running CR for a final (short) check before submission.

# 2 Contacts

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson (Rapporteur) |  |  |
| Huawei, HiSilicon | Tao Cai | tao.cai@huawei.com |
| Xiaomi | Yujian Zhang | zhangyujian@xiaomi.com |
| Nokia | Chunli Wu | Chunli.wu@nokia-sbell.com |
| CATT | Pierre Bertrand | pierrebertrand@catt.cn |
| Samsung | Sangkyu Baek | sangkyu.baek@samsung.com |
| vivo | Yitao Mo (Stephen) | yitao.mo@vivo.com |
| Qualcomm | Sherif ElAzzouni | Selazzou@qti.qualcomm.com |
| ZTE | Lu Ting | lu.ting@zte.com.cn |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# 3 Background

Below are the agreements captured for the RAN2 discussion:

|  |
| --- |
| **RAN2#123 Agreements**  1 Confirm in RAN2 that no AS capability is needed for the UE to support clock quality information mechanisms.  2 Confirm the gNB is always broadcasting Event ID in SIB9 if it supports the feature. Send LS to SA2 to information.  3 DLInformationTransfer message is extended to include clock quality information reporting towards the UE (i.e., clock quality metrics or clock quality indication). FFS if event ID is included to be discussed in email discussion for 331  => As a baseline no change to SDT will be support  **RAN2#122 Agreements**  1. Update of event ID is informed to UE by normal SI modification procedure.  2. 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 requests the RRC layer to move to RRC\_CONNECTED  3. 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  4. 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  5. 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.  **RAN2#121 Agreements**   1. 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. 2. Confirm the following SA2’s conclusions regarding NG-RAN procedures on 5G clock quality information:    1. RRC\_INACTIVE/IDLE UE to be informed of timing synchronization status via **an event ID** in SIB9 by comparison with the one maintained locally.    2. RRC\_CONNECTED UE to be informed of 5G clock quality information via dedicated RRC message 3. Postpone the UAC until CT1’s feedback on UAC framework to randomize UE access to network in the time domain 4. 5G Clock Quality information is carried in DLInformationTransfer message. 5. FFS if update of event ID is informed to UE by SI modification procedure 6. For Idle/Inactive mode RAN2 assumes that the NAS layer triggers the RRC connection procedure based on inputs from AS. 7. 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 |

Additionally RAN2 expects to discuss the use of a UE variable for storing the current synchronization status( R2-2307114[2])

**RAN3 Status**

In RAN3 the work on 5GS network timing synchronization status and reporting are captured in an F1AP baseline CR. The current outcome there for reference is currently captured in the RAN3 running CR (here excluding later updates not yet communicated to RAN2, if any):

|  |  |  |
| --- | --- | --- |
| R3-233755 | (BLCR to 38.413) Introduction of 5G Timing Resiliency and URLLC enhancements (Huawei, China Unicom, Nokia, Nokia Shanghai Bell, Samsung, Ericsson, ZTE, CATT) | CR0972r4, TS 38.413 v17.5.0, Rel-18, Cat. B  **Endorsed as BL CR** |

For the relevant part to RAN2:

**9.3.1.x3 RAN Timing Synchronisation Status Information**

This IE indicates the RAN timing synchronisation status information provided towards the AMF as defined in TS 23.501 [9].

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IE/Group Name** | **Presence** | **Range** | **IE type and reference** | **Semantics description** |
| Synchronisation State | O |  | ENUMERATED (locked, holdover, freeRun, …) |  |
| Traceable to UTC | O |  | ENUMERATED (true, false, …) |  |
| Traceable to GNSS | O |  | ENUMERATED (true, false, …) |  |
| Clock Frequency Stability | O |  | BIT STRING (SIZE (16)) | Indicates the offsetScaledLogVariance as specified in TS 23.501 [9]. |
| Clock Accuracy | O |  | 9.3.1.x5 |  |
| Parent Time Source | O |  | ENUMERATED (syncE, pTP, gNSS, atomicClock, terrestrialRadio, serialTimeCode, nTP, handSet, other, …) |  |

In RAN2 #123 document R2-2307792 **[1]** was discussed and specifically if “*: DLInformationTransfer message is extended to include clock quality information reporting towards the UE (i.e., event ID, clock quality metrics or clock quality indication).*”

Additionally, in R2-2307114 **[2]** discussed if it is useful to distinguish the access attempt to retrieve the latest available clock quality information.

In R2-2308531 **[3]** a draft running CR was provided for which details are open for discussion in this email discussion based on current agreements and later agreements from this email discussion.

## 3.1 Inclusion of eventID in dedicated signaling

In [1] it was proposed that “the RRC message should include the clock quality information the UE requires (i.e., metrics or acceptable/not acceptable indication) and the Event ID the clock quality information can be associated to. This way the UE can locally associate an Event ID with its own clock quality information. The same RRC messages that include *ReferenceTimeInformation* IE can be extended to include the new IEs, i.e., *DLInformationTransfer* message.”

In the above, the IEs in the RRC message have been agreed, however the discussion did not conclude if the eventID is needed for UEs in CONNECTED mode. In this discussion, RAN2 should consider if the eventID is possible to include in dedicated signalling (e.g. in *DLInformationTransfer*), how this may be achieved otherwise and if this can be provided at state transition from RRC CONNECTED to RRC INACTIVE.

**Question 1**: Please indicate your company view including a motivation for the aspects above.

|  |  |  |
| --- | --- | --- |
| Answers to Question 1 | | |
| Company | A/B | Technical Arguments |
| Huawei, HiSilicon | No need | The gNB will always broadcast eventID in SIB9. On the other hand, a UE can always read the SIB9 and store the latest eventID, no matter the UE is in RRC\_CONNECTED state or INACTIVE/IDLE state.  For a CONNECTED UE, when it transitions to INACTIVE/IDLE state, it will maintain and not release the stored eventID variable. The UE can use the eventID to determine whether it shall transition to CONNECTED mode to acquire the clock quality information, when a different eventID is broadcasted by the gNB.  Thus, we think there is no need whatsoever either to include eventID in dedicated signalling, or to provide the eventID to the UE during state transitioning. |
| Xiaomi | Not needed | Agree with Huawei that UE can acquire eventID in RRC\_CONNECTED, therefore no need to included event ID in dedicated signalling or during state transition. |
| Nokia | Yes | We think eventID should be included in the dedicated signalling to associate the detailed information to that eventID. Update with new eventID and detailed information only needed if update happens during CONNECTED mode.  No further indication needed when transit to INACTIVE/IDLE mode. But if the event ID in SIB9 is different from the one stored in CONNECTED mode, it will reconnect. Otherwise if it is the same then no reconnection needed. |
| CATT | Need for dedicated signalling;  Not need for state transition | To align with the clock quality information, the event ID should be included in the *DLInformationTransfer* message, and be stored in the UE. If the clock quality information changes when UE in RRC\_CONNECTED, the *DLInformationTransfer* message can be used to update the clock quality information associated with a new event ID, and if the clock quality information changes when UE is in RRC\_IDLE or in RRC\_INACTIVE, the UE could compare the event ID UE stored with the event ID from SIB9, and decide whether to enter RRC\_CONNECTED. After UE entering RRC\_CONNECTED, a new *DLInformationTransfer* message including clock quality information and event ID can be received by UE, and no need to relate the event ID in SIB9 to the clock quality information in dedicated signalling by UE.  For state transition from RRC CONNECTED to RRC INACTIVE, we do not think the event ID is needed. Since we assume the gNB is always broadcasting Event ID in SIB9 if it supports the feature, the UE could read it by itself, and compare it with the one UE stored (recorded in the RRC\_CONNECTED before last state transition). |
| Samsung | Yes | A main scenario of timing delivery and clock quality information is that per-UE dedicated timing information (*ReferenceTimeInfo* introduced in Rel-16 IIoT) is delivered by *DLInformationTransfer* and the corresponding clock quality information to be introduced in this WI is delivered together. UE is receiving more accurate timing information by the dedicated *DLInformationTransfer* message. Moreover, UE in RRC\_CONNECTED does not need to monitor SIB9 at all, since *ReferenceTimeInfo* of *DLInformationTransfer* is prioritized over SIB9, It means that SIB9 monitoring only for EventID update in RRC\_CONNECTED is unnecessary and inefficient. Thus we think a dedicated signalling of EventID is useful as commented by Nokia and CATT. |
| vivo | No | When the UE in CONNECTED state, it is not required to have the event ID as the UE doesnot need to compare the change of reference report ID. And the UE do not need to know the association between TSS information and report ID until going back to IDLE/INACTIVE. So we fail to see the motivation to deliver the event ID in the CONNECTED state.  Upon release to IDLE/INACTIVE, the UE can read SIB9 of the Pcell for event ID and store it before perform the cell selection. It works. |
| Qualcomm | Yes | UE needs to know the event ID of the clock report so that it can later (after moving to RRC IDLE/INACTIVE or after moving to another cell and coming back) know if the current clock report is an update of what it has or not. RRC CONNECTED UE would not need to read SIB9 since it is receiving dedicated timing signalling. This is the most straightforward way of having the UE track the event ID properly. Other proposals would touch many parts of the spec to get right and cover all possible cases (UE moves to IDLE, UE moves to inactive, Handover, RLF before reading new clock available report, race conditions between clock change and SIB9 change, etc.) and would be needlessly complicated to support, as we have to ensure the UE always correlates the correct event ID to its associated clock report which can be ensured by including it in the report. |
| ZTE | Yes and see comments | In each time the clock status and event ID are changed, for UEs in connected mode, we assume NW will correspondingly update the clock quality information for these UEs (if UEs support) via *DLInformationTransfer*. So for this aspect, we think event ID doesn’t need to be provided to the UE in connected mode.  However, we agree with Qualcomm that the UE back to idle case is a valid case. We have same understanding that UE would not read SIB9 during connected mode. So we assume the UE only have the old event ID that the UE acquired before entering the connected mode. Even the UE may be updated the clock quality information for several times during connected mode, the UE would not update the stored event ID. Then after the UE back to idle state again and acquire the SIB9, even the UE may already have the latest clock quality information, the UE still think the event ID is changed and then trigger a connection establishment. This connection establishment is obvious useless and undesired. Therefore, we are fine to introduce event ID in dedicated signalling to avoid such issue.  But if companies think the issue of one time unnecessary connection establishment after UE back to idle can be tolerated, it’s also fine without event ID in dedicated signalling. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

3.2 Differentiation of UEs accessing the network for Clock Quality Information

In [2] the usefulness of the network to be informed of the access attempt is discussed. It is also pointed out that currently, there are no requirements to distinguish the access attempt to retrieve the latest available clock quality information from CN. As a suggestion, a new cause value for RRC setup request can be used to indicate UE access for obtaining Clock Quality Information.

**Question 2**: Indicate your company view including a motivation whether differentiation of access attempts is needed for the purpose of obtaining Clock Quality Information. If you prefer differentiation, indicate how a solution could be introduced (e.g. new Cause Value, etc)

|  |  |  |
| --- | --- | --- |
| Answers to Question 1 | | |
| Company | Needed/Not needed | Technical Arguments |
| Huawei, HiSilicon | Not needed | The network implementation can handle this.  When the UE connects to the network, the gNB will obtain the information about whether the UE is interested in the clock quality information from the core network, i.e. the per UE level clock quality reporting criteria information from the 5GC. Based on the information, the gNB can decide whether to provide the latest clock quality information to the UE.  Thus, there is no need to introduce a new cause value for RRC setup request. |
| Xiaomi | Not needed | As from CT1 and SA1’s reply that existing access category 3 (MO\_sig) can be reused, we think corresponding cause value *mo-Signalling* can be used. Also agree with Huawei that gNB can know from core network whether UE is interested in clock quality information. In summary, there is no need to introduce new cause value. |
| Nokia | Not needed | As discussed in the previous RAN2 meeting. SA1 agreed existing MO signalling can be used, existing cause value can be used as well. The gNB will have the context of the UE after the connection is setup. |
| CATT | Not needed | Agree with above. |
| Samsung | Not needed. | Agree with above |
| vivo | No | Same view with Huawei and Nokia. |
| Qualcomm | Not needed | SA1 and CT1 has concluded no new access requirements to current existing access category 3 should be sufficient. |
| ZTE | Yes | This new cause is not for NW to determine whether to provide clock quality information to the UE, but mainly for NW to decide whether to release the UE in time.  In the case that many idle UEs in a cell initiate the connection establishment just due to the change of event ID, it’s important and beneficial to facilitate the NW release the UEs timely and correctly, e.g., after providing the quality information to the UEs. Without such scheme, the UEs may stay in the connected mode for some time but do nothing, which is bad to UE power saving and NW resources efficiency. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## 3.3 Running CR, expanded comments.

In [3] above, a running CR for 38.331 was provided into RAN2 #123. In there, a draft structure for introducing timing synchronization status update etc.

The CR includes:

- in 5.2.2.4.10 (Actions upon reception of SIB9), a procedure for obtaining eventide with the use of a new UE variable (with the variable in *VarEventID)*

- procedure for notifying higher layers

- Draft ASN. 1 extension that include new IEs expanding the *DLInformationTransfer* message for clock quality information reporting. This includes a choice for when the Clock Quality Detail Level equals “*clock quality metrics*” and "*acceptable/not acceptable indication*", where in the latter the gNB is expected to only provide the Clock Quality Acceptance Criteria (currently FFS)

- new SIB9 IE for providing evenID

**Note** *that the CR currently only has a structure aligning to the status of Clock Quality Metric as defined in RAN3 for where the actual values are FFS, as was the status from the previous meeting rounds. The Rapporteur intends to update the ASN.1 extensions according to the most recent agreements in RAN3 (IE type and references etc)*

**Expanded Input**: Please use bubble comments in the CR for basic CR comments and suggestions. Below companies may optionally provide more expanded input or suggestions with sample code as convenience to the reader.

🡪 Please consider the **Note** and info. above when providing comments and limit to where additions or changes to this general direction is proposed or for significant changes to the current suggested CR structure.

|  |  |
| --- | --- |
| Company | Expanded CR Comments w text/code examples |
| Xiaomi | In clause 5.2.2.4.10, only *eventID* is considered. However as agreed by RAN2 before: “*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*.” Similarly, SA2 TS 23.501 specifies that “*Uniqueness of the event ID is ensured by combining with a gNB ID*.”  Therefore both gNB ID and event ID should be considered. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

3.4 Other

Below companies can add other details or discussion points if needed.

|  |  |
| --- | --- |
| Company | Comment |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# 4 Summary and proposal

CR will be updated from the resulting agreements in this discussion.

# 5 References

[1] R2-2307792 5GS network timing synchronization status and reporting, Nokia, Nokia Shanghai Bell

[2] R2-2307114 Discussion on Timing Synchronization Status Monitoring, vivo

[3] R2-2308531 Introduction of URLLC and Timing Resiliency, Ericsson, CR 38.331